DIGBY WELLS
ENVIRONMENTAL

ORLIGHT SA (PTY) LTD

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR THE

PROPOSED DEVELOPMENT OF THE AGGENEYS SOLAR PHOTOVOLTAIC POWER PLANT IN THE NORTHERN CAPE PROVINCE

APPLICANT:

ORLIGHT SA (PTY) LTD

ORLIGHTSA
RENEWABLE ENERGY

JULY 2012

DEA REFERENCE NO: 12/12/20/2630

NEAS REFERENCE NO: DEA/EIA/0000818/2011

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by **Digby Wells Environmental**.

Report title: Orlight SA (Pty) Ltd – Final EIA Report for the proposed development of the Aggeneys Solar PV Power Plant in the Northern Cape Province

Project number: BSG1384

NAME	RESPONSIBILITY	SIGNATURE	DATE
Marike de Klerk	Project administrator and report compiler		26 April 2012
Mia Ackermann	Project manager and report compiler		02 July 2012
Grant Beringer	Project sponsor and report review		28 March 2012
Graham Trusler	Report review		02 May 2012

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

A. INSTRUCTIONS ON ACCEPTANCE OF THE FINAL SCOPING REPORT

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
1	The final Scoping Report and Plan of Study for EIA dated April 2012 and received by the DEA in April refer.	N/A
2	The DEA has evaluated the submitted final Scoping Report and the Plan of Study for EIA dated April 2012 and is satisfied that the documents comply with the minimum requirements of the EIA Regulations, 2010. The final Scoping Report is hereby accepted by the DEA in terms of regulation 30(1) of the EIA Regulations, 2010.	N/A
3	You may proceed with the EIA process in accordance with the tasks Contemplated in the Plan of Study as required in terms of the EIA Regulations, 2010. All comments and recommendations made by all stakeholders and I&APs in the draft Scoping Report and submitted as part of the final Scoping Report must be taken into consideration when preparing an EIA report in respect of the proposed development.	Refer to Section 1.4.3 – Scoping phase and Section 6.1 – Findings of the PPP
4	Please ensure that comments from all relevant stakeholders are submitted to the DEA with the final EIA Report. This includes but is not limited to the local municipality, district municipality, SAHRA, Eskom Holdings SOC Limited, CAA, SANRAL, provincial environmental department and the DAFF.	Refer to Section 6.1 – Findings of the PPP
5	Proof of correspondence with the various stakeholders must be included in the final EIA Report.	Refer to Appendix D – PPP Report
6	The EAP must, in order to give effect to Regulation 56(2), give registered I&APs access to, and an opportunity to comment on the report in writing within 21 days before submitting the Final EIA report to the DEA.	Refer to Section 2.3 – Public review of reports **All I&APs have been awarded 40 days to comment on the draft EIA report. Another 21 days will be provided for I&APs to review the final EIA Report.*
7	The following amendments and additional information are required for the EIA Report:	N/A
7.1	Details of the future plans for the site and infrastructure after decommissioning in 20 – 30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Refer to Section 4.3.6 – Assessment of alternative post-project land uses **The approach to the decommissioning phase is discussed in Section 6.4 of the draft EMP (Appendix K).*
7.2	The total footprint of the proposed development should be indicated. Exact locations of the PV panels, power lines, roads and other associated infrastructure should be mapped at an appropriate scale.	Refer to Plan 3a
7.3	Should a WULA be required, proof of application for a license needs to be submitted.	Refer to Section 6.1 – Findings of the PPP

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
		**The Department of Water Affairs (DWA) has confirmed that Water Use License Applications (WULAs) will only be processed once proof has been submitted that the proposed solar PV project has been successful in the Independent Power Producer (IPP) bidding process for the Department of Energy (DoE).* **A per the Relevant Qualification Criteria from DoE and the Guideline on Non-binding letters from the DWA, it has been determined that there is no requirement for the submission of a WULA from the DWA or DoE for solar PV projects in the bidding phase of the IPP bidding process.*
7.4	Possible impacts and effects of the development on the agricultural potential of the area.	Refer to Section 6.3.2 – Potential impacts on soil and agricultural potential
7.5	The EIA Report should include information on the following:	N/A
	• Environmental costs versus benefits of the solar farm facility.	Refer to Section 4.2 – Need and desirability
	• Financial implications to tourism in the area.	Refer to Section 6.4.5 – Cumulative impacts on tourism **A detailed economical assessment of impacts to the tourism industry could not be conducted, due to time constraints. From a holistic tourism and sustainability point of view, this limitation does not affect the outcomes of this assessment.*
	• Economic viability of the facility to the surrounding area and how the local community will benefit.	Refer to Section 3.3 – Local socio-economic planning context Refer to Section 4.2.1 – Project benefits Refer to Section 6.3.7 –

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
		Potential impacts on the socio-economic environment
7.6	Information on services required on the site, e.g. sewage, refuse removal, water and electricity.	Refer to Section 4.5 – Availability of services
7.7	A copy of the final site layout plan, including:	Refer to Plan 3a.
	• PV positions and its associated infrastructure;	
	• Foundation footprint;	
	• Permanent laydown area footprint;	
	• Construction period laydown footprint;	
	• Internal roads indicating width;	
	• Water crossings of roads and cables indicating the type of bridging structure that will be used;	
	• Location of heritage sites affected by the facility;	
	• Substations and/or transformer sites including their entire footprint;	
	• Cable routes and trench dimensions (where they are not along internal roads);	
	• Connection routes (include pylon positions) to the transmission network;	
	• Cut and fill areas at panel sites, along roads and at sub-station/transformer sites indicating the expected volume of each cut and fill;	
	• Borrow pits;	
	• Spoil heaps (temporary for topsoil and sub-soils and permanently for excess material);	
	• Environmental sensitive feature and buffer areas;	
	• Buildings, including accommodation;	
	• No-go areas.	
7.8	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Plan 6a and Plan 7a
7.9	A map combining the final layout plan superimposed on the environmental sensitivity map.	Refer to Plan 3a
8	Environmental Management Programme requirements.	Refer to Appendix K – Draft EMP
9	Please ensure that all the relevant Listing notice activities are applied for, that the Listing notice activities that are applied for are specific and can be linked to the	Refer to Table 1-2: Listed activities applicable to the

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
	development activity or infrastructure in the project description.	proposed project
10	Please ensure that the final EIA Report includes at least one A3 regional map of the area and the locality maps included in the final EIA Report illustrate the PV positions, its associated infrastructure, different proposed alignments and above ground storage of fuel.	Refer to Plan 1 and Plan 3a
12	Should an application for Environmental Authorisation be subject to the provision of Chapter II, Section 38 of the NHRA, then the DEA will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority.	**The Heritage Impact Assessment (HIA) report has been submitted to SAHRA for evaluation. No feedback has been received yet.*

B. EIA INFORMATION REQUIRED FOR SOLAR ENERGY FACILITIES

REQUIREMENTS	COMMENTS OR REFERENCE
1. GENERAL SITE INFORMATION	
Descriptions of all affected farm portions.	Refer to Section 1.1 – Portion 1 of the farm Aroams 57 RD Section 5 – Status of baseline environment
21 digit Surveyor General codes of all affected farm portions	Refer to Section 1.1 – SG code C053-000-000-000-057-00001
Copies of deeds of all affected farm portions	Refer to Appendix B – Title deeds
Photos of areas that give a visual perspective of all parts of the site	Refer to Figure 1-1: General site characteristics of the proposed Aggeneys Solar PV Power Plant
Photos from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Refer to Figure 1-1: General site characteristics of the proposed Aggeneys Solar PV Power Plant Refer to Figure 5-8: View of project site from main tourist route
Solar Plant design specifications including: • Type of technology • Structure height • Surface area to be covered (including associate infrastructure such as roads) • Structure orientation • Laydown area dimensions	Refer to Section 1.1 – Project overview Refer to Section 4.1 – Description of the proposed project
Generation capacity of the facility as a whole at delivery points.	Refer to Section 1.1 – Project overview Refer to Section 4.1 – Description of the proposed project
2. SITE MAPS AND GIS INFORMATION	
All maps/information layers must also be provided in ESRI Shapefile format	Refer to Compact Disc submitted as part of this report.
All affected farm portions must be indicated	Refer to Plan 2a – Land tenure
The exact site of the application must be indicated (the areas that will be occupied by the application)	Refer to Plan 3a – Site layout
A status quo map/layer must be provided that includes the following:	Refer to Plan 4a – Land use

REQUIREMENTS	COMMENTS OR REFERENCE
• Current use of land on the site including: ○ Buildings and other structure ○ Agricultural fields ○ Grazing areas ○ Natural vegetation areas with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas ○ Critically endangered and endangered vegetation areas that occur on the site ○ Bare areas which may be susceptible to soil erosion ○ Cultural historical sites and elements • Rivers, streams and water courses • Ridgelines and 20 m continuous contours with height reference in the GIS database • Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs • High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries • Buffer zones (also where it is dictated by elements outside the site); ○ 500 m from any irrigated agricultural land ○ 1 km from residential areas • Indicate isolated residential, tourism facilities on or within 1 km of the site	Refer to Plan 12a – Vegetation types Refer to Plan 13a – Ecological sensitivity Refer to Plan 16a – Heritage aspects
A slope analysis map/layer that include the following slope ranges: • Less than 8% slope • Between 8% and 12% slope • Between 12% and 14% slope • Steeper than 18% slope	Refer to Plan 10a – Slope analysis **The slopes are generally less than 8% and therefore, further categories have been mapped.*
A map/layer that indicate locations of birds and bats including, roosting and foraging areas.	Refer to Plan 14a – Important birding areas
A site development proposal map(s)/layers(s) that indicate: • Positions of solar facilities • Foundation footprint • Permanent laydown area footprint • Construction period laydown footprint • Internal roads indicating width and with numbered sections between the other site elements which they serve • River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used **Not applicable* • Substation(s) and/or transformer(s) sites including their entire footprint. • Cable routes and trench dimensions (where they are not along internal roads)	Refer to Plan 3a – Site layout

REQUIREMENTS	COMMENTS OR REFERENCE
• Connection routes to the distribution/transmission network • Cut and fill areas along roads and at substation/transformer sites indicating the expected volume of each cut and fill **Not applicable* • Borrow pits **To be confirmed* • Spoil heaps **To be confirmed* • Buildings including accommodation. **Within construction laydown yard footprint.*	
3. REGIONAL MAP AND GIS INFORMATION	
All maps/information layers must also be provided in ESRI Shapefile format	Refer to Compact Disc.
Indicate the following: • Roads including their types (tarred or gravel) and category (national, provincial, local or private) • Railway lines and stations • Industrial area • Harbours and airports • Electricity transmission and distribution lines and substations • Pipelines • Water sources to be utilised during the construction and operational phases • A visibility assessment of the areas from where the facility will be visible • Critical Biodiversity Areas and Ecological Support Areas • Critically Endangered and Endangered vegetation areas • Agricultural fields • Irrigated areas • An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams.	Refer to Plan 8a – Land use Refer to Plan 12a – Vegetation types Refer to Plan 13a – Ecological sensitivity Refer to Plan 15a – Viewshed Refer to Plan 16a – Heritage aspects
4. IMPORTANT STAKEHOLDERS	
Amongst other important stakeholders, comments from the National Department of Agriculture, Forestry and Fisheries must be obtained and submitted to the Department. Any application, documentation, notification etc. should be forwarded to the following officials: Ms Mashudu Marubini Delegate of the Minister (Acct 70 of 1970) Email: MashuduMa@daff.gov.za Tel: 012 319 7619 Ms Thoko Buthelezi AgriLand Liaison office Email: ThokoB@daff.gov.za Tel: 012 319 7634	Please refer to Appendix D – PPP Report

REQUIREMENTS	COMMENTS OR REFERENCE
In addition, comments must be requested from Eskom regarding grid connectivity and capacity. Request for comment must be submitted to: Mr John Geeringh Eskom Transmission Megawatt Park D1Y38 PO Box 1091 Johannesburg 2000 Tel: 011 516 7233 Fax: 086 661 4064 John.geerngh@eskom.co.za	Please refer to Appendix D – PPP Report

C. AGRICULTURE STUDY REQUIREMENTS

REQUIREMENTS	COMMENTS OR REFERENCE
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:	Refer to Appendix E – Soil and agricultural survey report
• Identification of the soil forms present on site.	Refer to Section 4.1.3.2 – Soils (Appendix E) **Please note that a soil and land capability assessment was undertaken to identify measures to prevent or mitigate soil erosion for different soil types. During the scoping phase it was confirmed by the soil specialist that the land types present in the study area have restrictive soil properties and inherent low agricultural potential. Therefore, it was recommended that the soil and land capability assessment be undertaken on a reconnaissance level only.*
• 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	
• Size of the site	
Exact locality of the site.	Refer to Plan 2a
Current activities on the site, developments, buildings.	Refer to Section 5.2 – Land use of the site and surrounding area
Surrounding developments/land uses and activities in a radius of 500 m of the site.	
Access routes and the condition thereof.	Refer to Section 5.12 – Traffic
Current status of the land (including erosion, vegetation and a degradation assessment)	Refer to Section 5.5 – Soils and Section 5.6 – Land capability
Possible land use options for the site.	Refer to Section 5.6 – Land capability Refer to Chapter 7 – Environmental Impact Statement *"Tourism and alternative land uses"*
Water availability, source and quality (if available).	**There are no suitable water sources available on the site or surrounding farms.*
Detailed descriptions of why agriculture should or should not be the land use of choice.	**The grazing capacity of the land is considered too low for large-scale, intensive stock farming and therefore, the use*

REQUIREMENTS	COMMENTS OR REFERENCE
	of the land for generation of renewable energy is considered a suitable alternative land use.
Impact of the change of land use on the surrounding area.	Refer to Section 6.4.2 – Cumulative impacts on agricultural potential and land use
A shape file containing the soil forms and relevant attribute data as depicted on the map.	Refer to Compact Disc.

D. INFORMATION REQUIREMENTS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

REQUIREMENTS	COMMENTS OR REFERENCE
(2) AN EIA REPORT MUST CONTAIN ALL INFORMATION THAT IS NECESSARY FOR THE COMPETENT AUTHORITY TO CONSIDER THE APPLICATION AND TO REACH A DECISION CONTEMPLATED IN REGULATION 35 AND MUST INCLUDE:	
(a) Details of: (i) the EAP who compiled the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Refer to Section 1.3 – Details of the EAP
(b) A detailed description of the proposed activity;	Refer to Section 4 – Project description
(c) A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	Refer to Section 1.1 – Portion 1 of the farm Aroams 57 RD Refer to Plan 2a – Land tenure
(d) A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	Refer to Section 5 – Status of baseline environment
(e) Details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties;	Refer to Section 2.2 – Public participation process Refer to Section 2.3 – Public review of reports Refer to Section 6.1 – Findings of the Public Participation Process Refer to Appendix D – Public Participation Process Report
(f) A description of the need and desirability of the proposed activity;	Refer to Section 4.2 – Need and desirability
(g) A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	Refer to Section 4.3 – Project alternatives and the project design process
(h) An indication of the methodology used in determining the significance of potential environmental impacts;	Refer to Section 6 – Environmental Impact Assessment Refer to Appendix L – Impact assessment methodology
(i) A description and comparative assessment of all alternatives identified during the environmental impact assessment process;	Refer to Section 4.3 – Project alternatives and the project design process
(j) A summary of the findings and recommendations of any specialist report or report on a	Refer to Executive summary

REQUIREMENTS	COMMENTS OR REFERENCE
specialised process;	Refer to Section 7 – Environmental Impact Statement
(k) A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	Refer to Section 6 – Environmental Impact Assessment
(l) An assessment of each identified potentially significant impact, including: (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; (vii) the degree to which the impact can be mitigated;	Refer to Section 6 – Environmental Impact Assessment
(m) A description of any assumptions, uncertainties and gaps in knowledge;	Refer to Section 2.5 – Assumptions and limitations
(n) A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Refer to Executive summary Refer to Section 7 – Environmental Impact Statement
(o) An environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Refer to Executive summary Refer to Section 7 – Environmental Impact Statement
(p) A draft environmental management programme containing the aspects contemplated in regulation 33;	Refer to Appendix K
(q) Copies of any specialist reports and reports on specialised processes complying with regulation 32;	Refer to Appendix D to Appendix J
(3) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 31(2)(g), exist.	Refer to Section 2.5.1 – Assumptions Refer to Section 4.3 – Project alternatives

EXECUTIVE SUMMARY

Orlight SA (Pty) Ltd (Orlight SA) is proposing to develop a Solar Photovoltaic (PV) Power Plant on a site in the vicinity of the town of Aggeneys in the Namakwa District Municipality of the Northern Cape Province. The proposed site for development is located on Portion 1 of the farm Aroams 57 RD.

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Aggeneys Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

A study area of 872.21 ha was considered throughout the EIA process and an available surface area of 322 ha in extent was delineated for the development of the proposed project, based on the avoidance of the following environmentally sensitive and other no-go areas:

- *Drainage line* – The main drainage line and associated system should be avoided, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries;
- *Ecologically sensitive areas* – Consists of the drainage line running through the project area, sensitive habitat on ridges and areas which include protected and red data species;
- *N14 road reserve* – A 30 m buffer zone around the N14 national road has been delineated;
- *Visual sensitivity* – Areas north of the drainage line should be avoided due to their high visual sensitivity and proximity to the Gamsberg; and
- *Eskom transmission line servitudes* – The existing 220 kV line has a servitude width of 47 m, while the existing 66 kV line has a servitude width of 22 m. An additional Eskom servitude was identified following public review of the draft EIA report, which is the proposed Eskom Aggeneys – Paulputs 220 kV transmission line to be constructed within a 47 m wide servitude. No construction will take place within these servitudes.

Based on a conservative estimate of the required surface area (4 ha surface area per MW generation capacity), the optimal generation capacity of the power plant that can be accommodated in the available area was determined to be 80 MW. Site layout plans have been developed for a 70 MW project, which is well within the available area that was delineated to be suitable for infrastructure development.

The proposed power plant will make used of Solar PV technology and will be comprised of the following infrastructure:

- Solar PV panels;
- Support structures;
- Foundations;
- Electrical cabling;
- On-site substation;
- Transmission line;
- Access roads;
- Temporary construction lay-down yard; and
- Access control and fencing of the site.

Development of the project components require environmental authorisation in terms of NEMA and an EIA application for the proposed project was submitted to the Department of Environmental Affairs (DEA) on 24 November 2011.

Reference numbers 12/12/20/2630 (DEA) and DEA/EIA/0000818/2011 (NEAS) were assigned to the application on 8 December 2011.

The objectives of the EIA process for the proposed Aggeneys Solar PV Power Plant were to:

- Undertake a Public Participation Process (PPP) to ensure that Interested and Affected Parties (I&APs) can participate in the EIA process;
- Prepare integrated sensitivity maps for the study area based on the findings of environmental, socio-economic and cultural assessments as input into the project design process;

- Identify and assess the significance of potential impacts associated with the projects; and
- Recommend mitigation and enhancement measures to ensure that the development is undertaken in such a way as to promote the positive impacts and to minimise the negative impacts.

The following potentially significant positive impacts were identified during the EIA process:

- *Employment opportunities* – An estimated 280 employment opportunities will be created during construction of which some will be for unskilled labourers sourced from the local area. The majority of youth in this area have low educational and skills levels, thus many are unemployed and well suited to unskilled labour.
- *Procurement of goods and services* – The project will necessitate procurement of goods and services, many of which could be sourced from local companies, Small, Medium and Micro Enterprises (SMMEs) or entrepreneurs, thereby enhancing the socio-economic benefits associated with the project's construction phase.
- *Skills training and capacity building* – Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building.
- *Tourism* – The Aggeneys town itself is not a major tourist attraction. The tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of solar PV projects in the vicinity of Aggeneys. The development of solar PV power plants in the area may become a unique tourist attraction for this area.

The following potentially significant negative impacts were identified during the EIA process:

- *Ecological impacts* – Ecologically sensitive areas were delineated as no-go areas during the site layout design process and will not be directly impacted by development. The project development footprint consists of indigenous natural vegetation and is still considered significant in terms of regional biodiversity programmes. During site preparation activities, 93% of this vegetation will be removed. There is also a possibility that Red Data or protected plant species that have not been identified in these areas during dry-season surveys could be destroyed. It is also likely that alien invasive and weed species will propagate on disturbed areas. The erection of fences will further prevent naturally occurring fauna species to move freely across the project site. A possible cumulative impact of other renewable energy projects in the area that should be considered is the loss of capacity of the area to perform provisioning, regulating, supporting and cultural ecosystem functions.

Mitigation: The opportunity to maintain or increase the ecological functioning of the study area exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the natural habitat types in the no-go areas and removing the threats (i.e. grazing by livestock and alien species invasion), the ecological functioning of the area will be positively affected, thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonise.

Therefore, it is recommended that a management plan be implemented which will firstly monitor ecological status of the project site and secondly, that the destruction of the sensitive species and landscapes areas such as drainage lines, ridges and plains should be avoided. An alien invasive and weed control programme will be an integral part of the success of efforts to increase the ecological functioning of the study area.

- *Influx of job-seekers* – News of the proposed project and employment opportunities may result in an influx of job-seekers into the area which could results in negative social impacts such as informal settlements, social conflict between the incumbent and migrant populations, an increase in social pathologies, petty crimes and stock theft.

Mitigation: An influx of job-seekers should be proactively discouraged by being transparent about the local employment policy and by requiring employees to verify their local residence status. The establishments of informal housing/ or settlements should be actively prevented by implementing an effective system through which the erection of such structures can be reported and dismantled as soon as possible. Adequate accommodation and ablution facilities for employees should be made available in town. A code of conduct should be developed and the construction workforce should be contractually bound to it.

- *Cumulative impacts on water availability* – There are at least two other solar PV project proposed in the vicinity of Aggeneys. These projects and future expansion of the Black Mountain Mine will place increasing demand on water resources in a water scarce area.

Mitigation: The project area is water scarce and very few water supply alternatives are available. The projects should therefore consider recycling water, or using treated effluent from the municipality for washing the solar PV panels.

- *Cumulative visual impacts* – There are at least two other solar PV project proposed in the vicinity of Aggeneys. These projects will introduce potentially significant cumulative impacts on receptors traveling on the N14 national road. The solar PV development will alter the sense of place and sense of remoteness of the visual landscape, since the solar panels of the proposed parks will be new, industrial and dominant structures within the scenery. They may however be a good symbol for progress as South Africa taps into its natural legacy of solar power and renewable energy production.

Mitigation: Orlight SA may consider the establishment of a visitor's centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

The main issues and concerns that were raised by I&APs and the effect of that addressing of these concerns has had on the project design and environmental management objectives of the project are:

- *Water utilisation and storm water management* – Orlight SA has applied for water provision from the Khai Ma Local Municipality. Water provision has not yet been approved. Objectives for storm water management and design measures have been included in the Environmental Management Programme (EMP);
- *Requirement for a rezoning application for affected land* – The rezoning process for the project site is in process. Consultation with the municipality has been completed;
- *Impacts on existing Eskom transmission line servitudes* – The transmission line servitudes have been delineated as no-go areas. Eskom will retain access to these servitudes during the project life;
- *Visual impacts of infrastructure on motorists using national and district roads* – Due to the nature of the project and its location in terms of the N14 national road, the visual impact cannot be avoided. Some of the areas that have high visual sensitivity have been defined as no-go areas.

To summarise, I&APs generally had no objections regarding the proposed project and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The EAP and specialist team supports the decision for an environmental authorisation.

The following conditions would be required in the environmental authorisation for the proposed project:

- All mitigation measures described in this report and in the EMP (Appendix K) should be implemented to ensure that the negative impacts of the project are mitigated and that positive impacts are enhanced.
- All no-go areas, sensitive areas and prescribed buffer zones that were defined unsuitable for development purposes should be avoided.
- A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species.
- The implementation of the EMP (Appendix K) is considered a key factor to the achievement of the environmental standards and long-term sustainability of the project. For this purposed, the EMP should form part of the contractual agreement with the contractors that are appointed for development and operation of the proposed project.
- The EMP (Appendix K) should be considered a living document and should be updated during the project phases as more information on the significance of impacts and effectiveness of mitigation measures becomes known.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF PLANS

ABBREVIATIONS

AC	Alternating current
AIA	Archaeological Impact Assessment
BA	Basic Assessment
BID	Background Information Document
BSGR	BSG Resources Limited
CAA	Civil Aviation Authority
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CBO	Community Based Organisation
CEPF	Critical Ecosystem Partnership Fund
CITES	Convention on International Trade in Endangered Species
COP15	15th Conference of Parties
CRM	Cultural Resource Management
DAFF	National Department of Agriculture, Forestry and Fisheries
DC	Direct current
DEA	National Department of Environmental Affairs
DEANC	Northern Cape Department of Environmental Affairs and Nature Conservation
Digby Wells	Digby Wells Environmental
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EHS	Environmental, Health and Safety
EIA Regulations	GN Regulations 543 to 546 (18 June 2010)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELC	European Landscape Convention
EMP	Environmental Management Programme
ESA	Ecological Support Area
FEPA	Freshwater Ecological Priority Area
GHG	Greenhouse Gas

GIS	Geographic Information System
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producers
IRP	Integrated Resources Plan
IUCN	International Union for Conservation of Nature and Natural Resources
LED	Local Economic Development
LSA	Later Stone Age
LUPO	Land Use Planning Ordinance, Ordinance 15 of 1985
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID	Notice of Intent to Develop
NWA	National Water Act, 1998 (Act No. 36 of 1998)
Orlight SA	Orlight SA (Pty) Ltd
PPA	Power Purchase Agreement
PPP	Public Participation Process
PV	Photovoltaic
RE	Remaining Extent
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SKA	Square Kilometre Array
SKEP	Succulent Karoo Ecosystem Programme
SMME	Small, Medium and Micro Enterprise
TIA	Traffic Impact Statement
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment

WMA	Water Management Area
WULA	Water Use License Application
WWF	World Wildlife Foundation

1 INTRODUCTION

In line with the growing need for electricity supply and cleaner energy production in South Africa, the Orlight SA (Pty) Ltd (Orlight SA) Solar Photovoltaic (PV) Project was initiated by its holding company, BSG Resources Limited (BSGR). BSGR is an international natural resources company that operates in the fields of mining and energy. BSGR established a new company, Orlight SA, for the construction and operation of five new proposed Solar PV Power Plants in the Western Cape and Northern Cape Provinces (Plan 1 – Appendix A).

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Aggeneys Solar PV Power Plant and the associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

1.1 Project Overview

The proposed project site for development of the Aggeneys Solar PV Power Plants is located on Portion 1 of the farm Aroams 57 RD [SG code C053-000-000-000-057-00001] in the vicinity of the town of Aggeneys in the Namakwa District Municipality of the Northern Cape Province (Plan 2a – Appendix A). Copies of the title deeds of the affected property are attached as Appendix B.

The project site is located in an area characterised by low population density, high solar irradiation and in close proximity to the existing Eskom Aggeneys substation and existing 220 kV and 66 kV transmission lines, which allows for easy integration into the national electricity grid. The general site characteristics are illustrated in Figure 1-1.

Figure 1-1: General site characteristics *(Clockwise from top left: Looking north; looking northwest; looking over a rocky outcrop to existing transmission lines; and looking northeast from the approximate centre of the project site)*

A study area of 872.21 ha was considered throughout the EIA process, although the actual development footprint of the proposed project would be smaller in extent. The objective was to determine the optimal generation capacity that could be accommodated in the study area, by configuring the placement of infrastructure in such a way as to avoid environmentally sensitive and other problematic areas.

The proposed power plant will make use of Solar PV technology and will be comprised of the following infrastructure:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 70 MW will be installed over an area of 116.18 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide;
- *On-site substation* – The substation will occupy a surface area of approximately 0.8 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current (DC) to alternating current (AC);
- *Transmission line* – The proposed power plant will be connected to the Eskom Aggeneys substation with overhead transmission lines;
- *Access roads* – Access to the proposed project site will be from an existing farm road that joins up with the N14 national road. An internal network of roads will be required to access the different components of the proposed project;
- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.93 ha and will include a site office, mobile toilets and bathroom facilities, a car parking yard, water tank and the hydrocarbon management facility; and
- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, fencing will be installed.

<u>The available surface area that was delineated for the development of the proposed project is approximately 322 ha in extent and therefore, the optimal generation capacity of the power plant based on a conservative estimate of the required surface area (4 ha surface area per MW generation capacity) was determined to be 80 MW. The site layout that has been developed by the preferred EPC contractor and illustrated in Plan 3a has been developed over a total footprint area of 126.02 ha for a 70 MW project.</u>

1.2 Objectives of the EIA process

The objectives of the EIA process for the proposed Aggeneys Solar PV Power Plant were to:

- Undertake a comprehensive and fully transparent Public Participation Process (PPP) to ensure that Interested and Affected Parties (I&APs) were afforded the opportunity to participate in the EIA process;
- Prepare integrated sensitivity maps for the study area based on the findings of environmental, socio-economic and cultural assessments undertaken for the project as input into the project design process;

- Identify and assess the significance of potential impacts associated with the projects; and
- Recommend mitigation and enhancement measures that should be implemented to ensure that the development is undertaken in such a way as to promote the positive impacts and to minimise the negative impacts.

1.3 Details of the EAP

Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions for clients in diverse sectors including the energy, minerals and mining industries. The names and expertise of the project team members are provided in Table 1-1. A company profile and the Curricula Vitae (CVs) of the project team have been attached to this report as Appendix C.

Table 1-1: Names and expertise of the project team

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Project sponsor	Grant Beringer	2004 – 2006: MSc Environmental Management –UJ 2002 – 2003: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – RAU 2000 – 2002: BSc Earth Sciences – RAU
Project manager	Mia Ackermann	2008: MSc Geography – UJ 2006: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – UJ 2003 – 2005: BSc Geography and Environmental Management – UJ
Project administrator	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2000 – 2002: BhcS (*Cum Laude*) – UP 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP
Public Participation	Sibongile Bambisa	2010: BA (Honours) Anthropology – UJ 2009: BA Health Psychology – UJ

1.4 Overview of the EIA process

This section provides an overview of the EIA process that was undertaken for the proposed project. The approach to undertaking the EIA process and details of the activities undertaken during each phase of the process is described in Chapter 2 of this report.

1.4.1 Screening phase

An environmental screening assessment was undertaken in December 2011 by a team of environmental and cultural specialists from Digby Wells with the aim of determining the suitability of the study area for development, taking into consideration the general characteristics of the study area and the anticipated impacts of project activities on natural or cultural resources.

<u>The findings of the screening assessment concluded that the proposed project has no fatal flaws, pending further assessment of identified environmental features within the study area.</u>

1.4.2 Application phase

An EIA application for the proposed project was submitted to the relevant competent authority, namely the Department of Environmental Affairs (DEA) on 24 November 2011. The applicable listed activities of the proposed project in terms of the EIA Regulations are detailed in Table 1-2 below.

Table 1-2: Listed activities applicable to the proposed project

GN. R	ACTIVITY	DESCRIPTION
544	10	The construction of transmission lines to connect the proposed Solar PV Power Plant to an existing 66 kV Eskom transmission line[1].
545	1	The construction of a Solar PV Power Plant. The power plant infrastructure will consist of a ground mounting system, solar PV panels, inverters, switchboards and transformer/s.
545	15	The physical alteration an area greater than 20 ha agricultural land for the purposes of constructing a Solar PV Power Plant.
546	12	The clearance of more than 300 m^2 of land consisting of 75% or more indigenous vegetation in a Critical Biodiversity Area (CBA) as identified in the CBA map for the Namakwa District Municipality.
546	14	The clearance of approximately more than 5 ha land consisting of 75% or more indigenous vegetation.

Copies of the EIA application form were sent to the relevant provincial authority, namely the Northern Cape Department of Environmental Affairs and Nature Conservation (DEANC). In view of the urgency of developing renewable energy projects in South Africa and to aid in fulfilling the country's demand for electricity, as well as the stringent timeframes imposed on parties intending to bid as Independent Power Producers (IPPs), the EAP lodged a request with the provincial department that the responsibility for processing and evaluating the application is succeeded to the national DEA.

The request was granted and during the EIA Phase, the provincial department was involved as a stakeholder and they were given the opportunity to comment on all environmental documentation.

<u>Reference numbers 12/12/20/2630 (DEA) and DEA/EIA/0000818/2011 (NEAS) were assigned to the application on 8 December 2011.</u>

[1] In the event that an 80 MW power plant is constructed, a new 66 kV transmission line will be required to connect the Solar PV Power Plant to the Eskom Aggeneys Substation. The Basic Assessment (BA) process for this line is being undertaken as a separate application, but is running concurrent to the EIA process for the PV facility.

1.4.3 Scoping Phase

The objectives of the Scoping Phase for the proposed project were to:

- Consult with stakeholders during the first phases of the project to ensure that they are given an opportunity to comment on the proposed projects;
- Define the scope of the EIA process, based on the main issues identified during stakeholder engagement and a screening of potential impacts;
- Define the methodology for the EIA Phase; and
- Describe a Plan of Study for the EIA Phase.

The Scoping Phase was initiated with the distribution of information sharing documents, including a Background Information Document (BID) and I&AP registration form, newspaper advertisements and site notices to the identified stakeholders. An information sharing meeting was held on 10 January 2012 in the town of Aggeneys with the objective of presenting stakeholders with information regarding the proposed project and the EIA process to undertaken and to provide I&APs with a platform to raise their issues and comments regarding the proposed project.

A draft Scoping Report was subsequently compiled to present the results of the public consultation process and other environmental, social and cultural assessments that were undertaken during this phase and the report was made available to all I&APs for review for a period of 40 days from 26 January 2012 to 06 March 2012.

The draft Scoping Report was updated to address the comments that were received from the public and authorities. The final Scoping Report was submitted to the DEA on 04 April 2012.

<u>The main findings of the Scoping Phase, based on stakeholder engagement and environmental screening, as well as the recommended scope for the EIA phase of the proposed project are summarised below:</u>

- *Drainage lines within the site* – Suitable buffer zones must be established around these drainage lines, within which no construction activities will be allowed. A storm water management plan must be implemented to minimise impacts of the project on drainage lines and water quality in the catchment;
- *Water availability* – The project is located in a water scarce area and alternative options for supply of water during construction and operation must be investigated;
- *Ecological sensitivity* – The project is located in a Critical Biodiversity Area (CBA). Baseline characterisation of the ecological environment is required through comprehensive flora and fauna studies to delineate sensitive areas that should be avoided;
- *Visual impacts on motorists* – The project could have a potentially significant impact on motorists using the N14 highway. A Visual Impact Assessment (VIA) must be conducted to determine the full range of visual impacts that the project will have on the surrounding visual environment and to inform the site layout design process. A 30 m buffer zone around the N14 highway was recommended;
- *Soil erosion and impacts on land capability* – The soils present in the study area have inherent low agricultural potential. A soil and land capability assessment must be undertaken to identify measures to prevent or mitigate soil erosion for different soil types;
- *Tourism* – The tourism industry in the larger project area is mainly dependent on natural and cultural resources such as seasonal flowers, vast open areas and outdoor activities such as hiking and 4x4 routes. A Tourism Screening Assessment is required to assess the potential impacts the project may have on tourist attractions;

- *Socio-economic benefits of the project* – These benefits should be optimised and the negative impacts must be prevented or mitigated through the implementation of effective social management plans and programmes;
- *Heritage resources* – No significant heritage resources were identified during this phase, but it was recommended that a Phase 1 Archaeological Impact Assessment (AIA) and a Paleontological Impact Statement be prepared to assess potential impacts on heritage resources;
- *Transmission line servitudes* – There are existing and proposed future Eskom transmission lines that run across the property. No project infrastructure may be located within the servitudes and Eskom must be assured that access to these transmission lines will be maintained;
- *Rezoning and land use* – The project will require the appropriate rezoning of land in accordance with provincial legislation.

The EIA phase of the proposed project was undertaken in accordance with the main in findings of the Scoping Phase listed above.

<u>The Final Scoping Report for the Aggeneys Solar PV Power Plant was approved on 17 May 2012. All requirements stipulated by the DEA have been addressed in this final EIA Report.</u>

1.4.4 EIA Phase

The objectives of the EIA phase of the proposed project were to:

- Undertake specialist environmental assessments in order to determine the significance (i.e. duration, spatial extent, severity and probability) of potential impacts associated with the construction, operational and decommissioning phases of the proposed project;
- Provide input into the project design process by delineating no-go areas within which no development should be undertaken;
- Address the environmental impacts associated with proposed project as part of an Environmental Management Programme (EMP) that specifies measures to mitigate negative and enhance positive environmental impacts; and
- Provide stakeholders with an opportunity to verify whether all issues and concerns have been captured and adequately addressed in the EIA report.

The findings of the EIA phase for the proposed project are integrated into the relevant chapters of this EIA report. Please refer to the executive summary for a concise description of the main findings of this EIA process.

2 APPROACH TO UNDERTAKING THE EIA PROCESS

This section describes the approach that was followed in undertaking the EIA process for the proposed project and details of the activities undertaken throughout the process, including activities undertaken in support of the PPP.

2.1 Requirements for the EIA process

The proposed development of the proposed project is subject to the requirements of GN Regulations 543 to 546 (18 June 2010) ("EIA Regulations") published in terms of NEMA.

To achieve the objective of cooperative environmental governance and integration of all social, economic and biophysical factors into planning, implementation and decision-making, NEMA makes provision for the use of the EIA process as its main planning and decision-making tool.

The PPP is one of the most important aspects of the EIA process. It involves communication and disclosure of relevant project information and provides those interested in, or affected by, a proposed development with an opportunity to provide input into the decision making process. It is a legislative requirement to undertake PPP for any development that requires environmental authorisation.

Failure to undertake public participation may create significant risks to the project as members of the public could mobilise against the project if they have not been given the opportunity to participate The PPP for the proposed project was undertaken in an effort to ensure that all I&APs were given a platform to raise their issues and comments regarding the proposed project.

Through compliance with the requirements of the EIA Regulations, the decision-maker is given the opportunity to consider the potential environmental impacts associated with a project early in its development process and evaluate whether these impacts can be avoided, mitigated or enhanced to an acceptable level.

<u>The approach that was followed in undertaking the EIA process for the proposed project was in accordance with the EIA Regulations.</u>

2.2 Public Participation Process

A comprehensive PPP Report was compiled to document the activities undertaken as part of the PPP for the proposed project. Please refer to Appendix D for the PPP Report.

2.2.1 Pre-consultation meeting

A pre-consultation meeting was held with DEA on 18 November 2011 at the DEA offices in Pretoria. The purpose of this meeting was to discuss the requirements for the Scoping and EIA process for the proposed projects. The main points raised at the pre-consultation meeting are listed in Table 2-1. A copy of the minutes is included in Appendix D.

Table 2-1: Main points raised at the pre-consultation meeting

ASPECT	NAME AND ORGANISATION	ISSUES/COMMENT	RESPONDER	RESPONSE
Scoping and EIA Reports	Mia Ackermann Digby Wells	Will the DEA require separate Scoping reports and EIA reports for each specific site?	Coenraad Agenbach Deputy director: Special projects (DEA)	All sites can be combined into one comprehensive report, but there must be separate chapters dedicated to each site. Common chapters can be combined, but maps, descriptions of the site and property, applicable listed activities, impacts and mitigation measures must be in separate chapters. The cumulative impacts of the project and other projects in the vicinity must be assessed. There are a significant number of applications for renewable energy projects in the project area.
PPP report	Mia Ackermann Digby Wells	Enquired if the Issues and Response report can be combined for all sites.	Coenraad Agenbach Deputy director: Special projects (DEA)	There might be site specific issues and therefore, it is best to have a separate Issues and Responses reports and tables for each site.
Submission of reports	Mia Ackermann Digby Wells	Enquired on the process to follow when to submitting draft and final reports.	Coenraad Agenbach Deputy director: Special projects (DEA)	Draft reports must be sent to commenting authorities and I&APs on the same day. Final reports should be sent to DEA after the 40 day commenting period. Prior to the lapsing of the DEA's commenting period, the DEA will follow up with the commenting authorities to find out if they have any comments regarding the proposed project. In order to avoid delays in the project, the consultant must ensure that the commenting authorities respond to the draft reports. Suggests that the following organisations should be added as key stakeholders and commenting authorities for the proposed project: • Department of Agriculture, Forestry and Fisheries (DAFF); • Weather South Africa (SA); • Square Kilometre Array (SKA) project;

ASPECT	NAME AND ORGANISATION	ISSUES/COMMENT	RESPONDER	RESPONSE
				• Eskom; • Department of Energy; • South African National Biodiversity Institute (SANBI); • Civil Aviation Authority;
Screening phase	Mia Ackermann Digby Wells	During the screening phase three alternatives sites will be considered for each Orlight SA Solar PV Power Plant. Heritage, Visual and Ecological studies will be undertaken during this phase to assess potential impacts.	Coenraad Agenbach Deputy director: Special projects (DEA)	Indicated that he fully supports the undertaking of a screening phase. The proposed project area is characterised by Succulents, Camel Thorns and Kokerbome, so it important that a Flora and Fauna study is undertaken. Information collected during the screening phase and the determination of preferred site options should be included in the Scoping and EIA reports. Suggested that an environmental sensitivity map indicating no-go areas, alternative sites and buffer areas should be developed. The project infrastructure and project information should be overlaid on the sensitivity map in order to determine the impacts the proposed development will have on the environment.

2.2.2 *Identification of Interested and Affected Parties*

During the initial phase of the project, I&APs were identified by means of land surveyor data gathered by an appointed land surveyor and Windeed searches. Two main stakeholder groups were identified, namely public parties and authorities.

Public

The general public includes the following groups of stakeholders:

- Directly affected land owners;
- Surrounding land owners;
- Environmental groups;
- Non-Governmental Organisations (NGOs); and
- Community Based Organisations (CBOs).

The land owner of the Portion 1 of the farm Aroams 57 RD is Mr Abrie van Niekerk and he was involved during the preliminary identification of sites for the development of the proposed solar PV power plants and on a continuous basis throughout the EIA process.

Authorities

Authorities responsible for governing all aspects of the proposed project and forming part of the decision-making process were identified. The authorities were identified through liaison with different government officials and through considering existing I&AP databases for similar projects and published government databases.

Authorities have been divided into the categories listed in Table 2-2.

2.2.3 *Notification of the EIA process*

This phase of the EIA process commenced in December 2011 with the distribution of information sharing documents to identified stakeholders. A copy of all documentation that was developed for the PPP is included in Appendix D.

The objectives of this phase of the process were to:

- Inform I&APs of the proposed project and the PPP to be followed;
- Ensure that stakeholders receive accurate and sufficient project information;
- Invite I&APs to raise issues of concern and suggest project alternatives; and
- Identify and register additional I&APs for the project in response to newspaper advertisements and site notices.

Background Information Document

A BID and I&AP registration form were developed as part of the PPP. BIDs were distributed to various stakeholders and I&APs from 07 December 2011. Additional BIDs were made available at the local municipal offices and libraries. The BIDs included information regarding the following:

- Description of the project;
- Legal framework to be adhered to;
- Locality and extent of the proposed project;

- Specialist studies to be undertaken;
- Approach to the EIA;
- PPP that will be followed;
- Invitation to an information sharing meeting; and
- I&AP registration form.

Table 2-2: Authorities included in the EIA process

GROUP	AUTHORITY
National	• Department of Environmental Affairs (DEA); • Department of Water Affairs (DWA); • South African National Roads Agency Limited (SANRAL); • Department of Agriculture, Forestry and Fisheries (DAFF); • Civil Aviation Authority (CAA); • Department of Science and Technology; and • South African Heritage Resources Agency (SAHRA).
Provincial	• Department of Agriculture; • Northern Cape Department of Economic Development and Tourism; • Department of Transport and Public Works; • Department of Water Affairs; • Department of Environmental Affairs and Nature Conservation (DEANC); • Economic Development Agency; • Cape Nature; and • Northern Cape Economic Development Agency.
Municipalities	• Namakwa District Municipality; • Khai Ma Local Municipality; • Ward councillors.
Parastatals	• Eskom; and • Transnet

Newspaper adverts

In compliance with the local environmental regulations, newspaper advertisements were published in English and Afrikaans.

Site notices

Site notices were compiled in English and Afrikaans and placed in the vicinity of the study areas and within local towns. The site notices provided I&APs with similar information as contained in the BIDs. Please refer to Appendix D for photographs of site notice placements.

Table 2-3 indicates the publication dates and the newspapers used to advertise the proposed project. Proof of placement of the newspaper advertisements are provided in (Appendix D).

Site notices

Site notices were compiled in English and Afrikaans and placed in the vicinity of the study areas and within local towns. The site notices provided I&APs with similar information as contained in the BIDs. Please refer to Appendix D for photographs of site notice placements.

Table 2-3: Newspaper adverts

NEWSPAPER	DATE OF PUBLICATION
Cape Argus	09 December 2011
Diamond Field Advertiser	09 December 2011
Ons Kontrei	15 December 2011
Gemsbok	15 December 2011

2.2.4 Information sharing meeting

An information sharing meeting was held on 10 January 2012 in the town of Aggeneys. The meeting was conducted in Afrikaans and attendees were encouraged to ask questions in the language of their choice. Details of the information sharing meeting are listed in Table 2-4 below.

Table 2-4: Details of the Information Sharing Meeting

LOCATION	VENUE	DATE	TIME
Aggeneys	Aggeneys Community Hall	10 January 2012	14h00

The purpose of the meeting was to present I&APs with information regarding the proposed project, the process to undertaken and to provide I&APs with a platform to raise their issues and comments regarding the proposed project. Minutes from the information sharing meeting are included in Appendix D.

2.3 Public review of reports

2.3.1 Review of draft Scoping Report

The draft Scoping report was made available to all I&APs for review over a period of 40 days from 26 January 2012 to 08 March 2012 at the Black Mountain Recreation Club Black (Boliden Road, Aggeneys).

The report was also made available for download at www.digbywells.com. Information letters were sent to I&APs to inform them about the availability of the draft report. This letter was sent by e-mail, fax and registered post from 26 January 2012.

In accordance with Section 56(7) of GN Regulation 543 of NEMA, the draft Scoping Report was also sent to all identified regulating authorities for comment. Proof of notification of the availability of the draft Scoping Report for review by authorities is included in Appendix D.

2.3.2 Review of final Scoping Report

All I&APs were notified of the submission of the final Scoping Report to the DEA on 04 April 2012 and the availability of this report for review for a further period of 21 days. I&APs were invited to submit their comments to the responsible officer at the DEA.

2.3.3 Review of draft EIA Report

In accordance with Section 56(7) of GN Regulation 543 of NEMA, the draft EIA Report was sent to all identified regulating authorities for comment. Proof of notification of the availability of the draft EIA Report for review by authorities is included in Appendix D to this report.

Hard copies of the draft EIA Report was also made available to I&APs for a period of 40 days between 21 May and 2 July 2012 at the Black Mountain Recreation Club in Aggeneys and an electronic copy could be downloaded at www.digbywells.com. Further hard copies of the draft EIA Report was made available on request.

The main finding following review of the draft EIA Report is the identification of a proposed new Eskom 220 kV transmission line which is being proposed between Aggeneys and Paulputs. Consequently, the site layout of the proposed solar PV power plant was reviewed to locate all infrastructure outside the 47 m servitude.

2.3.4 Review of final EIA Report

Following submission of this final EIA Report to the DEA, the final report will also be made available to all I&APs for a further 21 day public review period. Comments on the final report should be submitted directly to the responsible officer at the DEA in writing, clearly stating the application reference number.

Comments can be sent to:

Contact person: Mpho Morudu	Department of Environmental Affairs
Telephone: +27 12 395 1775	Private Bag X447
Fax: +27 12 320 7539	Pretoria
Email: Mmorudu@environment.gov.za	0001

2.4 Specialist environmental assessments

Upon completion of the scoping phase, it was determined that further specialist investigations would be required during the EIA Phase to assess the environmental impacts associated with the construction, operational and decommissioning phases of the proposed project.

The specialist investigations, as well as the name and expertise of the various specialists involved in undertaking these assessments are provided in Table 2-5. Copies of their CVs have been attached to this report as Appendix C.

Table 2-5: Specialist studies and project team

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Aquatic and wetland ecology	Andrew Husted	2006 – 2007: MSc Aquatic Health – UJ 2005 – 2006: BSc (Honours) Zoology and Aquatic Health –RAU 2005 – 2003: BSc Zoology and Botany – RAU Competent Wetland Delineator, Department of Water Affairs
Visual Impact Assessment	Bradly Thornton	2008: Advanced Analysis with ArcGIS (GIMS) 2008: Flood Hydrology (University of Stellenbosch) 2007: Introduction to ArcGIS (GIMS) 2003: BSc (Honours) Geography and Environmental Management – RAU 2000 – 2002: BSc Geology, Geography & Environmental Management - RAU
	Alice McClure	2009 – 2010: MSc Environmental Sciences 2008: BSc (Honours) Environmental Sciences – Rhodes University 2005 – 2007: BSc Environmental Sciences and Ethnology – Rhodes University
Ecological assessment	Rudi Greffrath	2005: B-tech Nature Conservation – UPE Saasveld Campus 2001 – 2004: Diploma in Nature Conservation – UPE Saasveld Campus
Soils and agricultural potential assessment	Louw Potgieter	2004 – current: SA Council for Natural Scientific Professions – Certificated Natural Scientist (Soil Science) 1989 – 1991: National Diploma in Resource Utilisation – Pretoria Technikon
Tourism and land use assessment	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP 2000 – 2002: BhcS (*Cum Laude*) – UP
Socio-economic impact assessment	Karien Lotter	2007: MA Research Psychology – UP 2006: BSocSci (Honours) – UP 2005: BSocSci Psychology (*Cum Laude)* – UP
Rehabilitation plan	Thomas Wilson	2008 – 2009: BSc (Honours) Geography and Environmental Management – UJ 2005 – 2007: BSc Geography and Environmental Management – UJ
Traffic impact statement	Gerhard de Wet	2011 – 2012: BKS (PTY) LTD, Associate Engineer 2006 – 2011: BKS (PTY) LTD, Chief Engineer 2002 – 2006: BKS (PTY) LTD, Senior Engineer 2001 – 2002: BKS (PTY) LTD, Engineer
Cultural resources pre-assessment	Johan Nel	2012 – Current: MA Archaeology 2002: BA (Honours) Archaeology – UP 2001: BA Anthropology and Archaeology – UP

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Archaeological Impact Assessment	Jayson Orton	1998: MA Archaeology – UCT 1997: BA (Honours) Archaeology – UCT
Paleontological Impact Statement	John Pether	1994. M.Sc. degree awarded with distinction (UCT). 1983. B.Sc. Honours, University of Cape Town SACNASP: Pr.Nat.Sci (Earth Science)

2.5 Assumptions and limitations

This section defines the main assumptions and limitations applicable to the EIA process and this report. Knowledge gaps that were identified during the specialist investigations undertaken for the proposed project are also described.

2.5.1 Assumptions

This report is based on the following assumptions:

- The main factors that were taken into consideration during the selection of a suitable site for development of the proposed Aggeneys Solar PV Power Plant were the identification of available land where long-term lease agreements for development of renewable energy projects by Orlight SA's could be put in place with the land owners and the willingness of the land owner of the identified site to agree to a long-term lease of the property; and
- The objective of the EIA process was to determine the optimal generation capacity that could be accommodated in the identified study area, by configuring the placement of infrastructure in such a way as to avoid environmentally sensitive and other problematic areas. The optimal generation capacity specified in this report is thus based on the maximum amount of solar PV panels and associated infrastructure that could technically be accommodated within the areas that have been delineated as suitable for development. A conservative estimate of the surface area requirement for solar PV infrastructure, namely 4 ha per MW generation capacity, was assumed.

2.5.2 Limitations

2.5.2.1 *Fauna and flora assessment*

The flora and fauna field survey was conducted during the dry season (December) due to constraints imposed by the project timeline. The implication of this was that many of the plant species were dormant during this period and the species that were present were not easily identifiable. Theoretically, sampling of plants should be completed over a full annual cycle. Consequently, the confidence in the data collected for both the flora and the fauna components of the study is medium to low.

In spite of this, regional data from the Succulent Karoo Ecosystem Programme (SKEP) and Critical Biodiversity Area (CBA) plan data that were collected for the study area have a high confidence level and these data sets were used in addition to the findings of the field surveys to delineate sensitive areas. The species composition of the study area, according to the study, could change if the seasonality of plant species is taken into account.

2.5.2.2 *Archaeological surveys*

As with all archaeological surveys, it is not possible to be completely confident that all archaeological sites were identified during the fieldwork. Surface distributions give only a general indication of sub-surface remains. It is always possible that sub-surface archaeological sites may be present which were not identified during the survey.

Morris (2010) has also commented elsewhere in the area on the considerable "background noise" of massively preponderant small nodules of white quartz strewn over most the land surfaces. This may hamper the identification of artefacts, as local assemblages of are dominated by stone artefacts made from such nodules.

2.5.2.3 *Alternatives*

No alternative sites in proximity to Aggeneys was assessed as part of this EIA process for development of the proposed Orlight SA solar PV power plant as the objective of the EIA process was to determine the optimal generation capacity that could be accommodated in the areas identified by Orlight SA as proposed development sites.

3 LEGISLATIVE REQUIREMENTS AND PLANNING CONTEXT

3.1 Background and context

The main energy challenges faced by the world today include addressing climate change considerations, limited water resources and increased demand for electricity. A number of people are demanding sustainable methods of electricity generation. With regards to energy supply in South Africa, Eskom reported that there may be a shortfall in electricity supply in the near future, despite a significantly lower-than-expected recovery in electricity demand. South Africa's energy demand will continue to increase and the shortfall in supply is a major concern.

Simultaneously, South Africa is attempting to move away from the utilisation of carbon intensive, non-renewable fossil fuels for energy production. On international level, the legally binding Kyoto Protocol agreement was established in 1997 soon after the inception of the United Nations Framework Convention on Climate Change (UNFCCC). According to the Kyoto Protocol, developed countries are committed to reducing their greenhouse gas (GHG) emissions by 5.2% from 1990 levels by the year 2012. Classified as a developing country under the Kyoto Protocol, South Africa is not legally bound to reduce its GHG emissions and, therefore, the country's contribution to climate change mitigation has not been framed as an absolute emission reduction target (DEAT, 2004).

The likelihood of GHG emission constraints playing a role in the medium and long-term future of South Africa's economy, whether invoked through the UNFCCC, trade barriers, or other measures not yet contemplated cannot, however, be dismissed. International pressure on industrialised developing countries to formalise their GHG emission reduction target and climate change mitigation strategy is increasing and it is within this context that the Government of South Africa pledged to reduce domestic GHG emissions by 34% by 2020 and 42% by 2025, when compared to business as usual. This pledge was made in agreement with the Copenhagen Accord, a non-binding agreement reached by parties at the 15th Conference of Parties (COP 15) of the UNFCCC held in December 2009 in Copenhagen. The South African economy is, however, still highly dependent on fossil fuels and is considered one of the top 15 countries in terms of absolute GHG emissions. Achievement of the GHG emission reduction target pledge by the South African Government will require a well-planned and co-ordinated response over the long-term.

As outlined by the National Climate Change Response Green Paper (2010), South Africa is subsequently aiming to increase the use of renewable energy and energy efficiency to ensure a sustainable energy future that is in line with the principles of sustainability. This includes the development of future opportunities for the use of renewable energy such as solar power in South Africa that is affordable, environmentally sound and socially acceptable. The Department of Energy (DoE) confirmed the procurement (Request for Proposals) of allocated capacity across various renewables technologies, with 1 850 MW set aside for onshore wind, 200 MW for concentrated solar thermal and a further 1 450 MW for Solar PV solutions.

In response to the macro-economic needs described in this legislative overview, Orlight SA is proposing to construct and operate five new Solar PV Power Plants in the Northern Cape and Western Cape Provinces. The aim is for these projects to participate in the third bidding window of the DoE bidding process, which ends on 20 August 2012.

3.2 Legislative framework

The following legislation and guidelines were considered during the EIA process for the proposed Aggeneys Solar PV Power Plant.

3.2.1 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.

<u>In support of the above rights, the environmental management objectives of proposed project 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.</u>

3.2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

NEMA provides for 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 provides for matters related to sustainable development, which means the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations. To achieve the above objectives, the Act makes provision for the use of the EIA process as a tool for environmentally sound decision-making. The EIA process is regulated in terms of the GN Regulations 543 to 546 (18 June 2010) ("EIA Regulations"). <u>This EIA report is an integrated part of the EIA process.</u>

3.2.3 The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) controls Indigenous Biological Resources. NEMBA provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities.

Within the regional conservation context there are two conservation programmes which are underlain by NEMBA, namely the SKEP and the CBA. The aim of these programmes are to identify and conserve areas of high biodiversity and areas that are in support of these areas through defining conservation outcomes and working towards these. <u>For this report, these programmes were referred to as the basis for conservation planning for the project.</u>

3.2.3.1 <u>*Succulent Karoo Ecosystem Programme*</u>

The SKEP is a long-term, multi-stakeholder bioregional conservation and development programme, with four strategic areas:

- Increasing local and international awareness of the unique biodiversity of the Succulent Karoo;
- Expanding protected areas and improving conservation management;
- Supporting a matrix of harmonious land uses; and
- Improving institutional co-ordination.

The SKEP is a partnership programme with government and non-government partners. The first five years of implementation was funded by the Critical Ecosystem Partnership Fund (CEPF) and focused on catalysing and programme start-up. The next five years will focus on programme consolidation. This will entail integrating the SKEP objectives into national and regional government programmes, and thereby ensuring programme sustainability. The Succulent Karoo biodiversity hotspot extends from the southwest through the north-west areas of South Africa and into southern Namibia.

The Aggeneys site is a geographic priority area, specifically the Bushmanland Inselberg area. This priority area is located on the northeast margin of the Succulent Karoo Hotspot, just south of the Orange River and the border between Namibia and South Africa. SKEP recommends giving priority to conserving those habitats within geographic priority areas that have conservation value and are most vulnerable to increasing land use pressures. Ideally, all untransformed land in these habitats, irrespective of size should enjoy some form of conservation action in order to achieve conservation targets and link reserves by means of natural corridors.

The site is also considered important in terms of amphibian, bird and insect biodiversity, with scattered quartz patches. More information on the importance of the site in terms of biodiversity is provided in Chapter 5 of this report.

3.2.3.2 *Critical Biodiversity Areas*

CBAs are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectorial planning and decision making tools (Figure 3-1).

CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

Ecological support areas (ESAs) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

The purpose of CBAs is simply to spatially indicate the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which we would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process.

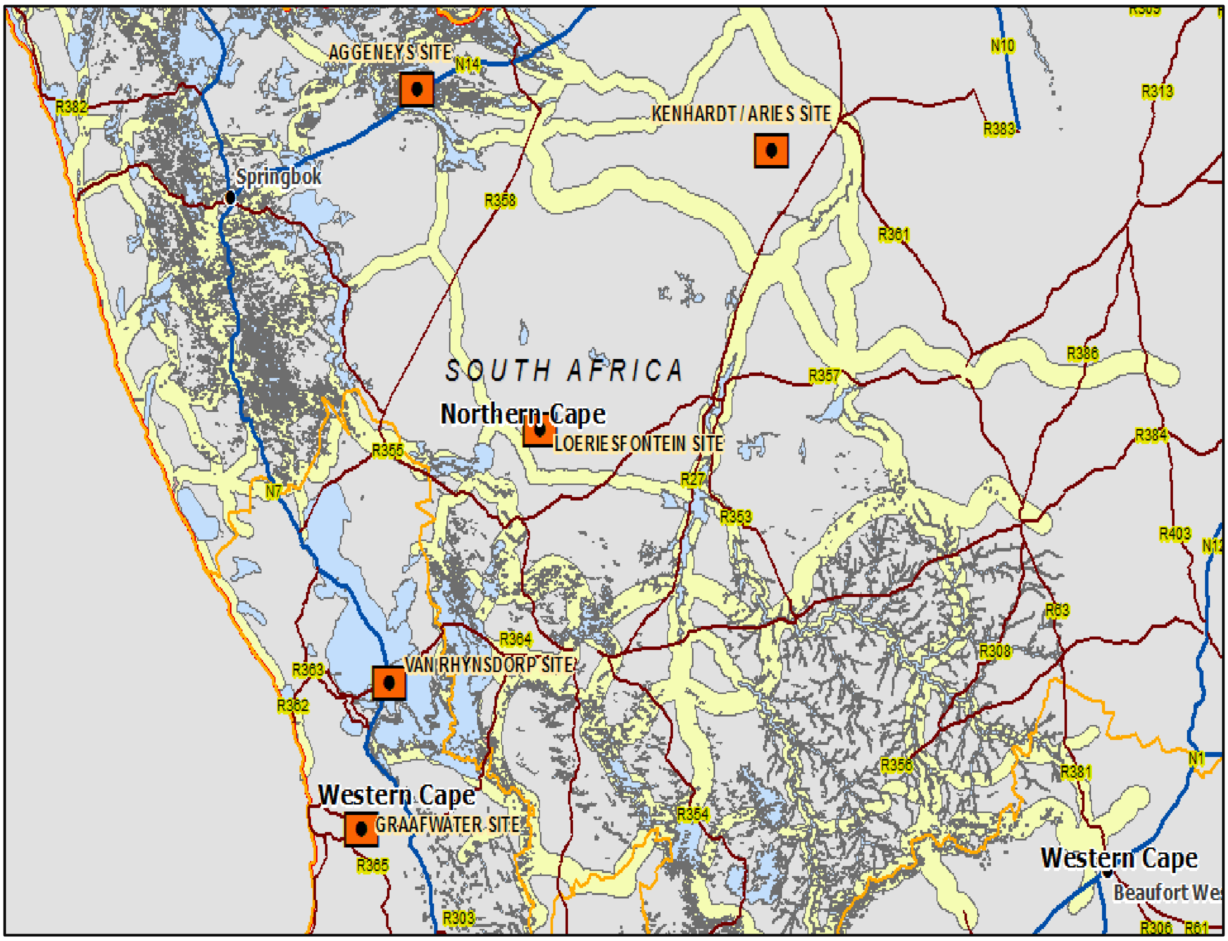


Figure 3-1: Critical Biodiversity Areas (blue) and Ecological Support Areas (yellow) in relation to the Aggeneys project site (Source: CBA database)

3.2.3.3 *Freshwater Ecological Priority Area Programme*

For the aquatic and hydrological assessment of the proposed project, the Freshwater Ecological Priority Area (FEPA) Programme will be considered. This programme provides FEPA maps and supporting information which forms part of a comprehensive approach to sustainable and equitable development of South Africa's scarce water resources (WRC, 2011).

FEPA is a single, nationally consistent information source for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes to support the water resource protection goals of the NWA (WRC, 2011). This programme is directly applicable to the NWA, informing Catchment Management Strategies, classification of water resources, reserve determination, and the setting and monitoring of resource quality objectives. FEPA maps are also directly relevant to the NEMBA, informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act. FEPA maps support the implementation of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) by informing the expansion of the protected area network.

3.2.4 National Water Act, 1998 (Act No. 36 of 1998)

According to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), a water resource is not only considered to be the water that can be extracted from a system and utilised but the entire water cycle. This includes evaporation, precipitation and entire aquatic ecosystem including the physical or structural aquatic habitats, the water, the aquatic biota and the physical, chemical and ecological processes that link water, habitats and biota. The entire ecosystem is acknowledged as a life support system by the NWA.

According to van Wyk *et al*. (2006) the "…*resource is defined to include a water course, surface water, estuary and aquifer, on the understanding that a water course includes rivers and springs, the channels in which the water flows regularly or intermittently, wetlands, lakes and dams into or from which water flows, and where relevant, the banks and bed or the system*."

In terms of the NWA, water courses that were identified in the project area necessitated that establishment of suitable buffer zones around these drainage lines within which no construction activities would be allowed. The Department of Water Affairs (DWA) was consulted in an attempt to determine the suitable widths for these buffer zones, depending on the nature of drainage lines identified. <u>It is not currently anticipated that any activity would be undertaken within these buffer zones and consequently, a Water Use License Application (WULA) for the proposed project is not required in terms of Section 21(d) and 21(i) of the Act.</u>

3.2.5 Environment Conservation Act, 1989 (Act No. 73 of 1989)

The aim of the Environment Conservation Act, 1989 (Act No. 73 of 1989) is to provide for 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; and to provide for matters connected therewith. The Act also includes aspects related to the protection of freshwater systems stating that appropriate environmental investigations are mandatory before approval for the "…*construction or upgrading of dams, levees or weirs affecting the flow of a river*…" will be given by the relevant authority.

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

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) provides for control and conservation of the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, water sources and vegetation and the combating of weeds and invader plants; and for matters connected therewith. Land owners are obliged, by law, to eradicate alien vegetation on their properties.

<u>For the purpose of the proposed Solar PV Power Plant, the relevant soil and agricultural assessments were undertaken in order to minimise potential impacts on the agricultural potential or productivity of the proposed project site. This report also provides a motivation for the use of agricultural land for energy generation in Section 5.6, based on the findings of the assessment undertaken. The motivation will be communicated to DAFF and will be managed as part of the rezoning application for the proposed project.</u>

3.2.7 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) devolves responsibility for the identification of local heritage resources and the inclusion of heritage areas to all municipalities in South Africa. Developers need to incorporate the NHRA and gain approval from the relevant heritage authorities or municipalities before construction may commence.

<u>For the purpose of this project, a cultural resource pre-assessment was undertaken for the study area, which incorporated the submission of a Notice of Intent to Develop (NID) to SAHRA in terms of Section 38 of the NHRA</u>

and the undertaking of a Phase 1 AIA and preparation of a Palaeontological Impact Statement, as stipulated in the feedback received from SAHRA.

The Heritage Impact Assessment (HIA) report has been submitted to SAHRA for evaluation. No feedback has been received yet.

3.2.8 Land Use Planning Ordinance, Ordinance 15 of 1985

The purpose of the Land Use Planning Ordinance (LUPO), Ordinance 15 of 1985, is "*to regulate land use and to provide for matters incidental thereto*". The consultation and rezoning process for the proposed project sites is being undertaken concurrently with the EIA process for the proposed project.

3.3 Local socio-economic planning context

The municipality in which the study area is located is the Khai Ma Local Municipality of the Namakwa District Municipality in the Northern Cape Province.

The local socio-economic planning factors of the province and municipalities that were taken into consideration during the EIA process for the proposed project are discussed below.

3.3.1 Namakwa District Municipality Integrated Development Plan, 2006 – 2011

The Integrated Development Plan (IDP), 2006 – 2011 for the Namakwa District Municipality was assessed as part of the EIA process for the proposed Aggeneys Solar PV Power Plant. The objective of the IDP is to promote the establishment of a sustainable development-orientated and economically viable district.

In terms of local economic development (LED), the municipality has identified a number of LED projects which will have important implications for the proposed Aggeneys Solar PV Power Plant. A description of these LED projects and their relevance to the proposed project is provided in Table 3-1.

3.3.1 Local Economic Development Strategy

During the EIA process, the Local Economic Development (LED) Strategy for the Namakwa District Municipality was taken into consideration in an attempt to identify socio-economic opportunities and constraints for the proposed project. These opportunities and constraints would have to be integrated into the project planning and design process to ensure that the socio-economic benefits of the project are enhanced.

The LED Strategy contains a scan and analysis of potential opportunities for private sector development in the municipality and identifies public sector projects required to create the economic environment in which private sector projects could be implemented. These projects have already been scanned according to their potential for job creation; strategic importance and alignment with national government priorities; feasibility; economic impacts; and development support of small- and medium enterprises. The private sector projects and public sector interventions identified in the LED Strategy that are considered relevant to the proposed Solar PV Power Plant is described in Table 3-2.

.

Table 3-1: LED projects for the Namakwa District Municipality and project implications

PROJECT	OBJECTIVE	RELEVANCE
Project LE02 – Renewable Energy Cluster	To ensure the participation of the municipality in creating synergy between different renewable energy sectors to allow the municipality to enhance their competitive and comparative advantage for renewable energy projects.	The proposed project will directly contribute to the realisation of the municipality's goal to enhance their competitive advantage for renewable energy project, by illustrating that renewable energy projects can be successfully implemented in the district. Orlight SA must endeavour to consult with the municipality to understand how the project can further contribute to the realisation of this goal.
Project LE05 – Small, Medium and Micro Enterprise (SMME) development cluster	To develop a management support system for SMMEs.	The proposed project will necessitate the procurement of goods and services, many of which could be sources from new SMMEs in the district.
Project LE11 – Working for Water (Tourism and Environmental Cluster)	To eradicate Prosopis sp. to protect the underground water resources and eradicate poverty in communities.	Prosopis species were identified in the study area and will have to be eradicated in terms of CARA. The project will implement an alien invasive eradication programme to ensure that impacts on biodiversity and water resources are minimised.
Project LE12 – Tourism and Environment Cluster (Development of Biodiversity in Namakwa)	To promote initiatives such as the Greening Namakwa, Skeppies Fund and Tourism Hub projects, including development of heritage sites.	The project site itself is not located next to a main tourist route and is therefore not considered an integral part of these tourism initiatives. However, the opportunity exists for Orlight SA to promote a new form of tourism in the area, namely "renewable energy tourism".

Table 3-2: Private and public sector projects and interventions relevant to the proposed project

OPPORTUNITY AREA	PRIVATE SECTOR OPPORTUNITY	PUBLIC SECTOR INTERVENTIONS	RELEVANCE
Manufacturing	Supply of machinery and parts for energy sector.	An equipment needs analysis is required with the private sector to identify their supply chain requirements.	If and when available, Orlight SA should promote procurement of locally produced machinery and equipment.
	Recycling depots	A feasibility study is required to identify potential sites for recycling depots.	The solar PV panels are recyclable and therefore the establishment of recycling depots that could accommodate materials from the project would be favourable for both Orlight SA and the municipality. Orlight SA should use local recycling depots if available.
Energy	Solar energy projects	Develop a legal framework for public-private partnerships guiding the establishment of such partnerships.	A legal framework for the establishment of these partnerships has not yet been formulated, but Orlight SA will engage with the public sector to ensure that its operations are aligned with the legal framework once implemented.
		Infrastructure required for the development of projects should be communicated to the relevant provincial departments so that they can take it into consideration during their budget and planning process.	SANRAL was identified as an important stakeholder during the EIA process, as access to the project site will be via the main national highways. Orlight SA will continue to consult SANRAL throughout the development process.
		Skills development programmes will be required for installation, operation and maintenance of renewable energy projects.	Orlight SA will implement their own training and skills development programme to ensure that necessary skills transfer is achieved for local workers that are employed during the construction and operational phases of the project.
Tourism	Techno tours (local space and energy projects) Eco-tourism and flower mapping tours	The Namakwa Tourism information office should package these opportunities and present them at relevant expos and Indabas.	The proposed project will have a negative impact on eco-tourism due to the removal of natural vegetation. Orlight SA should therefore consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

3.3.2 Tourism strategies

There are also a number of tourism development strategies endorsed by the Northern Cape Department of Economic Development and Tourism which should be taken into account during the planning of any future development that might impact on the local and regional tourism industry. These strategies are listed in Table 3-3.

Table 3-3: Strategies endorsed by the Northern Cape Department of Economic Development and Tourism

RELEVANT PRIVATE AND PUBLIC SECTOR PROJECTS AND INTERVENTIONS (DIGBY WELLS, 2012)		
Techno tours (local space and energy projects) Eco-tourism and flower mapping tours	The Namakwa Tourism information office should package these opportunities and present them at relevant expos and Indabas.	Notes: The proposed project may have a negative impact on eco-tourism due to the removal of natural vegetation; however, this impact is not considered to be of great significance due to the geographical remote location of most of the project sites. To compensate for any potential negative impacts. Orlight SA could consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists visiting the area.
National Rural Tourism Strategy implemented by the National Department of Tourism tbloem@tourism.gov.za msimelane@tourism.gov.za	The strategy is aimed at developing rural tourism.	The implementation of the National Rural Tourism Strategy in the proposed project areas can greatly contribute to the alleviation of pressure in areas that are often characterised by poverty and underdevelopment. Rural tourism can be supported by selling local produce and establish tourism services and products in accordance with tourism demand.

3.4 Policies, guidelines and conventions

In addition to the regulations and guidelines discussed in this chapter, the guidelines and policies of the following organisations were also considered during the EIA process:

- Guidelines implemented by the South African National Biodiversity Institute (SANBI), responsible for exploring, revealing, celebrating and championing biodiversity;
- Guidelines of the World Wildlife Foundation (WWF) South Africa, which aims to conserve the biodiversity assets (endangered wildlife, species, habitats and ecosystems) of South Africa and ensure natural ecosystems and their services are appropriately valued and integrated into sustainable development;
- The International Union for Conservation of Nature and Natural Resources (IUCN) Red List, which is based on information from a network of conservation organisations to rate which species are most endangered;
- Convention Concerning the Protection of the World Cultural and Natural Heritage initiated by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Convention aims to protect and conserve the world's natural and cultural heritage. As custodian of unique cultural and natural

heritage, South Africa has the responsibility to ensure the identification, protection, conservation, presentation and transmission of cultural and natural heritage sites for future generations;

- The Convention on Biological Diversity that is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognises that biological diversity is no only centred around plants, animals and ecosystems, but includes people and their need for food security, medical care, fresh air and water, shelter and a clean and healthy environment in which to live;
- The Convention on International Trade in Endangered Species (CITES) which governs international trade in wild animals and plants; and
- The European Landscape Convention of the Council of Europe which focuses exclusively on landscapes with the purpose of promoting effective management and planning of landscapes.

3.5 Equator Principles

The Equator Principles are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Once a bank or financial institution adopt the Equator Principles, they commit to refrain from financing projects that fail to follow the processes defined by the principles. The Equator Principles are modelled on the environmental guidelines of the World Bank Group and social policies of the International Finance Corporation (IFC).

Financing of the proposed Solar PV Power Plant will most likely require that the project applicant demonstrates that all potential environmental and social impacts associated with the project have been considered and that these will be managed and monitored in accordance with the Equator Principles. As listed in Table 3-4 and Table 3-5, the Equator Principles and the IFC performance standards were considered throughout the EIA process for the project.

Table 3-4: The Equator Principles applicable to the proposed Solar PV Power Plants

EQUATOR PRINCIPLES
EP 1: Review and Categorisation A project should be categorised according to the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC. **The proposed Orlight SA Solar Power Plants project does not have the potential to bring about significant adverse social and environmental impacts and has thus been classified as a* ***Category C project.***
EP 2: Social and Environmental Assessment An environmental and social assessment process should be conducted to assess the relevant impacts and risks of the proposed project. Mitigation and management measures relevant and appropriate to the nature and scale of the proposed project should be proposed.
EP 3: Applicable Social and Environmental Standards The assessment should refer to the applicable IFC Performance Standards and the Industry Specific Environmental, Health and Safety (EHS) Guidelines and establish the project's overall compliance with, or justified deviation from, these standards and guidelines. **The IFC Performance Standards applicable to the proposed project are listed* in Table 3-5.
EP 4: Action Plan and Management System Action plans should be prepared that details the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks of the project. **The EMP for the proposed project should hereby be converted into action plans and implemented as part of an Environmental Management System (EMS) for the project.*
EP 5: Consultation and Disclosure Consultation with project affected communities should be undertaken in a structured and culturally appropriate manner. **The PPP for the proposed project will be undertaken in accordance with Government Notice R. No. 543 of NEMA and the IFC Performance Standard 1.*
EP 6: Grievance Mechanism A grievance mechanism should be implemented to ensure that consultation, disclosure and community engagement continues throughout construction and operation of the proposed project.
EP 7: Independent Review An independent social or environmental expert not directly associated with the borrower should review the assessment, action plan and consultation process documentation.

EQUATOR PRINCIPLES
EP 8: Covenants Covenants to comply with all relevant host country social and environmental laws, regulations and permits and project action plans should be made.
EP 9: Independent Monitoring and Reporting An independent environmental and/or social expert should be requested to verify all monitoring information.
EP 10: Equator Principles financial Institution Reporting An annual report on the implementation processes and experience of the project should be supplied to the lender.

Table 3-5: IFC performance standards applicable to the proposed Solar PV Power Projects

APPLICABLE IFC PERFORMANCE STANDARDS
PS 1: Social and Environmental Sustainability Underscores the importance of managing social and environmental performance throughout the life of a project. The objectives of this standard are to: • Identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence; • To avoid, or where avoidance is not possible, minimise, mitigate, or compensate for adverse impacts on workers, affected communities and the environment; • To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and • To promote improved social and environment performance of companies through the effective use of management systems.
PS 2: Labour and Working Conditions Recognises that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. The objectives of this standard are to: • Establish, maintain and improve the worker-management relationship; • Promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws; • Protect the workforce by addressing child labour and forced labour; and • Promote safe and healthy working conditions, and to protect and promote the health of workers.

APPLICABLE IFC PERFORMANCE STANDARDS
PS 3: Pollution Prevention and Abatement Outlines a project approach to pollution prevention and abatement in line with these internationally disseminated technologies and practices. The objectives of this standard are to: • Avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities; and • Promote the reduction of emissions that contribute to climate change.
PS 4: Community Health, Safety and Security Addresses the client's responsibility to avoid or minimise the risks and impacts to community health, safety and security that may arise from project activities. The objectives of this standard are to: • Avoid or minimise risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances; and • Ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimises risks to the community's safety and security.
PS 5: Land Acquisition & Involuntary Resettlement Seeks to protect sellers from a variety of risks of negotiated transactions that occur as a result of expropriation. The objective of this standard for the proposed Orlight SA Solar PV Power Plants is ensure land owners are satisfied with the lease agreements that are negotiated for use of the land to establish the proposed Orlight SA Solar PV Power Plants.
PS 6: Biodiversity Conservation & Sustainable Natural Resource Management Recognises that protecting and conserving biodiversity and its ability to change and evolve is fundamental to sustainable development. The objectives of this standard are to: • Protect and conserve biodiversity; and • Promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
PS 8: Cultural Heritage Aims to protect irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. The objectives of this standard are to: • Protect cultural heritage from the adverse impacts of project activities and support its preservation; and • Promote the equitable sharing of benefits from the use of cultural heritage in business activities.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

4 PROJECT DESCRIPTION

This chapter provides an overview of the proposed Aggeneys Solar PV Power Plant, as well as the findings of assessments undertaken in support of the project design process. A description of the need and desirability of the proposed project in comparison to the no-go project alternative is also provided.

4.1 Description of the proposed project

The proposed project entails the development of a solar PV power plant on Portion 1 of the farm Aroams 57 RD, located approximately 3 km east of the town of Aggeneys in the Northern Cape Province. The land tenure of the project site and directly adjacent properties is illustrated in Plan 2a (Appendix A).

The available surface area that was delineated for the development of the proposed project, based on the avoidance of environmentally sensitive and no-go areas, is approximately 322 ha in extent and therefore, the optimal generation capacity of the power plant based on a conservative estimate of the required surface area (4 ha surface area per MW generation capacity) was determined to be 80 MW. This area includes the surface area requirements for the development of access roads, the construction lay-down yard, site offices and all other project components.

The site layout that has been developed by the preferred contractor and illustrated in Plan 3a has been developed over a total footprint area of 126.02 ha for a 70 MW project.

The proposed solar PV power plant will consist of the following components:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 70 MW will be installed over an area of 116.18 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures. The solar PV panels will be mounted to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide;
- *On-site substation* – The substation will occupy a surface area of approximately 0.8 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current (DC) to alternating current (AC);
- *Transmission line* – The proposed power plant will be connected to the Eskom Aggeneys substation with overhead transmission lines. The alternative transmission line routes are illustrated in Plan 4a and Plan 4b;
- *Access roads* – Access to the proposed project site will be from an existing farm road that joins up with the N14 national road. An internal network of roads will be required to access the different components of the proposed project;
- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.9 ha and will include a site office, mobile toilets and bathroom facilities, a car yard where all vehicles will be parked to reduce oil spillage and the hydrocarbon management facility; and

- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, different types of fencing will be considered, depending on the generation capacities of the proposed project.

The layout of these components within the development footprint is illustrated in Plan 3a (Appendix A). The details of the project design process are provided in Section 4.3 and Section 6.2 of this report.

4.2 Need and desirability

The proposed Aggeneys Solar PV Power Plant is one of five proposed solar PV developments that are being proposed by Orlight SA. The other projects are situated near the towns of Kenhardt and Loeriesfontein in the Northern Cape Province and Vanrhynsdorp and Graafwater in the Western Cape Province (Plan 1).

The proposed solar PV developments are being planned in response to the urgent need for increase electricity supply and cleaner energy production in South Africa. As discussed in Section 3.1 of this report, the development of the proposed solar PV power plants will ensure adherence to the Final Integrated Resources Plan (IRP) (2010 – 2030) which allows for the development of solar PV and other renewable energy technologies in the country. The proposed project is also in alignment with the LED Strategy of the Namakwa District Municipality, as discussed in Section 3.3.

4.2.1 Project benefits

In consultation with local communities and stakeholders, there is a general consensus on the positive impacts that the proposed development may have, which include:

- Potential poverty reduction through economic diversification;
- Job creation/ employment opportunities during the construction and operational phases;
- Effective use of natural resources and sustainable development;
- Creation of opportunities for local youth to be educated in environmental issues;
- Diversification of existing tourism industry/ markets (e.g. business tourism and renewable energy);
- Support and enhance existing tourism establishments (e.g. catering and accommodation); and
- Enhance tourism and investment opportunities (e.g. multiplier effect of increased business).

Other project benefits, including a description of the need and desirability of the proposed project, are described in Table 4-1 below.

Table 4-1: Project benefits

MOTIVATION	DETAILS
Energy demand	The proposed solar PV power plant will assist in addressing the growing need for increased electricity supply and renewable energy production in South Africa.
Adherence to the IRP 2010 – 2030	The development of the proposed solar PV power plant will ensure adherence to Final IRP 2010 – 2030. The IRP is a living document promulgated by the Department of Energy (DoE) on 6 May 2011 (in consultation with Eskom) to guide decisions on the future energy mix in SA. This document allows for a certain MW capacity for Solar PV in SA and guides the programme development.
Solar radiation	The proposed project site is located in an area of high solar irradiation and is considered ideal for solar PV power generation.
Grid accessibility	The proposed project site is located in geographical proximity to the existing Eskom Aggeneys

MOTIVATION	DETAILS
	substation which allows for easy integration into the national electricity grid.
Accessibility	The site is located adjacent to the N14 highway and can therefore be easily accessed during the construction and operational phases.
Optimisation of use of available land	The proposed project site is located in a region characterised by vast tracts of available land. The current grazing capacity of the site is very low and there are no other significant competitive land uses. Use of the land for renewable energy projects is considered a suitable use.
Affordability	PV installations require little maintenance or intervention after their initial set-up (after the initial capital cost of building any solar power plant, operating costs are extremely low compared to existing power technologies).
Future growth	Demand for energy will increase. Although renewable energy is currently still a capital intensive development, technologies will become more cost effective over time, while fossil fuels may become more expensive.
Socio-economic development	The proposed solar PV power plant will stimulate job creation, local content and local manufacturing, rural development and community involvement, education and development of skills, enterprise development and socio-economic development of the Namakwa District Municipality and the Northern Cape Province.
Emission reduction targets	The development of renewable energy projects and solar plants leads to a reduction in additional carbon intensive electricity production, which may in turn reduce the overall GHG emission rates of South Africa.

Orlight SA, along with its fellow shareholders, directors and other stakeholders place an high emphasis on the development of each community where solar parks are to be developed. In line with the criteria as set by the DoE, it is their vision to make a real and sustainable impact with all our social economic development plans. This consists of the following:

Job creation

Orlight SA endeavours to create at least 7 jobs per MW during the construction of the solar PV power plant. They are cognizant that once the construction is completed various jobs will be lost, hence their ambition to create at least one job per MW during the operational phase and over the remaining 20 years of the project. As target, Orlight SA aims to recruit at least 80% of all labour from local communities in order to create new jobs and to develop new skills in the communities that will allow the people to be trained and uplifted for future job opportunities.

All Orlight SA staff will be remunerated in line with the applicable labour laws and minimum wages rules. Where possible, they will aim to remunerate above such minimum wages and also consider ancillary benefits such as medical aid and pension funds. UIF and mandatory minimum holiday provision of 15 days per annum will be standard as part of all permanent staff contracts.

Orlight SA will impose no gender preference. Where possible, they would like to empower women (all ages >18) to be recruited.

Accommodation

In order to limit our environmental footprint, Orlight SA will not look to develop any accommodation on site. Given the close proximity of local town to the proposed project, they endeavour to provide transport to all staff to enter and exit the sites on a daily basis. Orligtht SA and its operational partners will take full responsibility for all transport requirements.

Catering

Orlight SA is cognizant that the site is remote from local sources of food and water supply. Both during the construction and operational phases, they endeavour to appoint a catering supplier to provide staff with the necessary food and beverage supplies as required. They will aim to provide and nutritious food to each one of the staff members. This will all be housed in modern canteens.

The appointment of a catering supplier to the project will be done on a strict local town basis. This means that the local town will have the opportunity to suggest and tender for such work which indirectly allows for the creation of new entrepreneurial SME business opportunities.

Socio-economic development

In line with the economic development requirements as set by the DoE, Orlight SA seeks to empower the local community with the creation and implementation of a unique Orlight SA Solar Academy Education Trust. This trust will have the direct community listed as beneficiaries with a direct shareholding in Orlight SA to the value of 5%. Dividends generated from the project company will pro-rata be distributed to the Education Trust that will allow the appointed Board of Trustees (50% represented by the elected community) to distribute such funds to the benefit of the community as a whole. In addition, 1.5 % of annual turnover will be contributed to the Education Trust as an additional source of revenue income.

Enterprise development

Under the auspice of the Orlight SA Solar Academy Education Trusts, additional enterprise developments as stipulated in the DoE's bid responses will also be developed and implemented once Orlight SA is approved as preferred bidder.

Local content procurement

Orlight SA, under strict legal rules, has instructed their EPC contractor to always first consider to procure the required content from local communities where applicable. Should such content not be available, the EPC will then need to consider the province. If not available, as final procurement option, the EPC will be allowed to source from the entire South Africa or abroad.

4.2.2 Assessment of the no-go alternative

The no-go alternative is the option of not proceeding with the development of the proposed Aggeneys Solar PV Power Plant. The status quo will be maintained and none of the expected negative environmental impacts will occur. In addition, none of the anticipated benefits of the project, as described in Table 4-1 will be realised.

Based on the above motivations, it would be beneficial to pursue projects such as the Aggeneys Solar PV Power Plant that may assist in electricity supply and contribute towards more sustainable and renewable energy. This project also has the potential to provide much needed training and employment opportunities for local communities in the Northern Cape Province. The aspiration and desires to proceed with this sustainable project became apparent during public consultations and site visits to the study area.

4.3 Project alternatives and the project design process

The following alternatives were considered during the EIA process for the proposed development of the solar PV power plant:

- Site alternatives;
- Design and layout alternatives;
- Technology alternatives;
- Operating alternatives; and
- No-go alternative.

It should be noted that the project was not compared to other renewable projects neither is the project compared to the increased production of power from fossil fuels.

4.3.1 Assessment of alternative project sites

The identification of suitable sites for development of proposed solar PV power plants was undertaken prior to the commencement of the EIA process. Sites suitable for the development of solar PV power plants were considered according to the following parameters:

- Areas of high solar irradiation;
- Availability of large tracts of open land for development;
- Easy access to existing roads;
- Diversity in terms of geographical location of the projects proposed by the applicant to ensure that socio-economic benefits of renewable energy projects are not restricted to certain localities;
- Proximity to existing Eskom substations to allow for easy integration of the solar plants with the nearest grid connection points;
- Proximity of sites to load centres where electricity is required;
- Willingness of land owners to agree to long-term leases of their properties; and
- Local need for employment creation and economic development.

Based on an assessment of different areas according to these parameters, the applicant identified the following properties as potential sites for the proposed development of solar PV power plants:

- Portion 1 of the farm Aroams 57 RD near Aggeneys in the Namakwa District Municipality, Northern Cape Province;
- The Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD near Kenhardt in the Siyanda District Municipality. Northern Cape Province;
- Portion 5 of the farm Klein Rooiberg 227 RD near Loeriesfontein in the Namakwa District Municipality, Northern Cape Province;
- The RE of the farm Paddock 257 RD near Vanrhynsdorp in the West Coast District Municipality, Western Cape Province; and
- Portion 1 of the farm Graafwater 97 RD and the RE of the farm Bueroskraal 220 RD near Graafwater in the West Coast District Municipality, Western Cape Province.

All of the above properties were considered suitable for the development of solar PV power plants and therefore, it was decided to submit EIA applications for the development of solar PV power plants on each of the above mentioned properties.

Although the EIA processes for the five proposed Solar PV Power Plants are being undertaken concurrently, this final EIA Report specifically addresses the impacts associated with the development of the Aggeneys Solar PV Power Plant.

4.3.2 Assessment and delineation of study areas

An environmental screening assessment was undertaken in December 2011 with the aim of determining the suitability of the proposed project site for development, taking into consideration the site's environmental sensitivities and the anticipated impacts of project activities on natural or cultural resources.

The study area that would be considered during the EIA process was subsequently delineated. From the onset of the project, the objective was to design the infrastructure layout in such a way to avoid problematic areas. The study area would thus have to be larger than the required footprint areas for the proposed Solar PV Power Plant, to provide adequate space for optimising site layout to avoid ecological and cultural sensitive areas; transmission line, road servitudes; and difficult topographical areas

The delineation of the study area was based on the following factors:

- Preliminary exclusion of areas that would be present challenges to development in terms of topography;
- Preliminary exclusion of areas that are not easily accessible from main roads;
- Optimisation of the extent of study areas to provide sufficient space for site layout alternatives, while minimising the costs and time involved in surveying large areas of land; and
- Willingness of land owners to agree to long-term leases of land included in the delineated study areas.

4.3.3 Assessment of alternative site layouts

Upon completion of the environmental and cultural assessments undertaken in the study area, including important feedback received from stakeholders during the PPP, a number of sensitivity maps were created using a Geographic Information System (GIS), as illustrated in Plan 6a. Details of the approach and process used to delineate environmentally sensitive and no-go areas are provided in Chapter 6 of this report.

The integrated sensitivity map is illustrated in Plan 7a. The proposed site layout for the proposed Aggeneys Solar PV Power Plant, based on the environmental sensitivity analysis is illustrated in Plan 3a (Appendix A).

4.3.4 Assessment of alternative project generation capacities

The optimal generation capacity that can be accommodated in the study area, based on the preliminary assessment of ecological, cultural and socio-economic characteristics and other technical factors are summarised in Table 4-2.

Site layout plans have been developed for a 70 MW project, which is well within the available area that was delineated to be suitable for infrastructure development.

Table 4-2: Optimal generation capacity of the proposed Aggeneys Solar PV Power Plant

SITE	AVAILABLE AREA (LOW SENSITIVITY)	AVAILABLE AREA (TECHNICAL)	OPTIMAL GENERATION CAPACITY[2]
Aggeneys	345.3 ha	322.3 ha	80.00 MW

4.3.5 Assessment of alternative solar technologies

Two main solar PV technologies were considered for the project, namely solar PV and concentrated solar PV (CPV). At this stage, the use of specific technology alternatives is still under investigation by the Orlight SA, but it is foreseen that the two technologies will have similar environmental impacts. It is anticipated that the final decision on preferred technology will depend on both generation efficiency and economic conditions.

4.3.6 Assessment of alternative post-project land uses

Two main alternative post-project land uses have been evaluated. The preferred alternative would be to upgrade the proposed solar PV power plant to the newest available technology of the time.

The proposed solar PV power plant will be built in line with the DoE's proposed Power Purchase Agreements (PPA), which has a 20-year validity period. Research and Development (R&D) have proven that solar PV cells and modules have historically shown long-term robustness and in lieu of this, it is anticipated that solar power generation facilities will continue to make use of solar PV cells as the preferred technology. Advances in terms of solar yields (higher output capacity) produced by solar PV cells are expected as R&D improves. Orlight SA will keep a abreast of any new developments in solar power generation technology and if suitable technologies are available at the time which the 20-year PPA expires, upgrade of the proposed solar PV power plant will be considered.

In the event that there is no need for a solar PV power plant at the end of its 20 year operational life, the objective would be to either remove all infrastructure and rehabilitate the site to its pre-project land use, namely low intensity grazing; or to use some of the remaining facility infrastructure (i.e. buildings, roads and mounting structures) for an agricultural project. Due to the difficulty in predicting the socio-economic conditions in the area in the long-term (20-years), it is not possible to assess the feasibility of projects that could be implemented to utilise existing project infrastructure, while fulfilling the socio-economic needs present at the time.

It is recommended that a closure strategy be developed for the project at least five years before its expected end of life to allow adequate time for stakeholder engagement in an attempt to identify feasible alternative post-project land uses.

The main factors that will have to be taken into account in evaluating the feasibility of these post-project land uses are:

- Potential to re-use existing infrastructure;
- Post-decommissioning and post-rehabilitation land capability to support the post-project land use;

[2] This was based on an approximated requirement of 4 ha per MW peak generation capacity. Includes all power plant infrastructure, construction lay-down areas and internal and access roads.

- Short- to medium term socio-economic needs of local communities; and
- Anticipated environmental impacts associated with the post-project land use and influence on long-term sustainability of the land use.

4.4 Proposed project activities

4.4.1 Construction phase

The duration of the construction phase of the proposed 70 MW solar PV power plant is approximately 16 months.

Employment opportunities and accommodation

In the event that an 70 MW power plant is developed, approximately 490 direct job opportunities will be created during the construction phase.

Construction workers will be sourced from local areas and therefore, minimal additional housing will be required. Accommodation of workers from outside the local area will be provided in the town of Aggeneys.

Establishment of access and internal roads

The site will be accessed from the existing farm road that connects to the N14 national road. This will not require widening of the N14, but the road edges will have to be strengthened with concrete edge beams at the accesses to prevent breaks in the road surface. Two-track gravel roads of approximately 6 m in width will be established to access the construction lay-down yard and development footprint.

Site preparation

Site preparation will consist of the clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure. Topsoil will be removed from the footprint of the substation and car parking yard and stockpiled for use during site remediation. Where the terrain is undulating, the terrain may be levelled. Large boulders and rocks will be removed. No protected tree species will be removed.

Construction lay-down yard

The construction lay-down yard will provide a storage area for construction material and will be used for assembly purposes.

Vehicle hard park and hydrocarbon storage

A vehicle hard park will be established where all construction vehicles and equipment will be parked overnight, serviced and refuelled. The hydrocarbon management area will be bunded for the safe storage of fuel, lubricants and waste oils.

Access control and fencing of site

Adequate systems and procedures will be in place to minimise the risk of unauthorised access to the site. Carefully consideration will also be given to the plant layout to ensure access for day-to-day operations, emergency escape routes and maintenance of the plant and equipment.

Anchoring and installation of solar PV panels

The foundation types used for the solar PV mounting structures will depend on the terrain characteristics defined by the geotechnical studies. The mounting structure will either be hammered into the earth surface, or a shallow concrete foundation will be cast.

Installation of underground cables

Trenches will be excavated wherein underground electrical transmission cables will be laid.

Construction of facility substation

An on-site facility substation will be constructed which will include the casting of foundations, installation of the transformer and inverters and connecting of the conductors.

Construction of transmission lines

In the event that a 40 MW power plant is constructed, a short 66 kV transmission line will be constructed from the facility substation to loop into the existing 66 kV Eskom transmission line that crosses the site. For a 70 MW to 80 MW power plant, a new 66 kV transmission line will be required from the facility substation to the Eskom Aggeneys substation. The transmission line options are illustrated in Plan 4a and Plan 5a.

Upon completion of the preliminary electrical engineering designs and associated consultation with Eskom, it was determined that the project would require the construction of transmission lines to it to the Eskom Aggeneys substation. The properties on which these transmission lines are to be located were not included in the original EIA application. The EAP recommended that a separate Basic Assessment (BA) process be undertaken for the proposed transmission lines. Although considered an "associated activity" to the Solar PV Power Plants, this approach would allow the current EIA process to continue without affecting its planned timeframes.

The proposed approach to the environmental authorisation process for the proposed Solar PV Power Plant and the required transmission lines were discussed with the DEA and it was decided that the potential impacts and required management measures for transmission lines would be addressed during the BA process. Please refer to Appendix D for the correspondence with the DEA.

The final BA Reports will be submitted to the DEA at the same time of submission of this final EIA Report. The preferred transmission line option has been indicated as Option A.

Water use

Water will be used for domestic use and possibly for dust suppression during the construction phase. The total water requirements for the construction phase are estimated at 350 m^3 per month. Orlight SA has applied for water service provision from the local municipality and approval has been granted.

Construction waste management

All construction phase waste will be collected and stored in a temporary waste storage area, where it will be collected by a waste removal contractor for disposal at a licensed waste disposal facility. No on-site burying or burning of wastes will be allowed.

The only chemical toxins on site will be the gas used in welding, the concrete, sulphur hexafluoride housed inside the switchgears and the diesel for the power generators used during the construction. These will be handled with care according to regulatory requirements. Wherever possible, waste materials shall be recycled.

Sewage management

Temporary ablution facilities will be provided and a contractor employed to safely remove sewage from the site to a licensed disposal facility.

Site remediation

Upon completion of the construction phase, the site will be remediated by removing all temporary construction infrastructure, construction waste and construction materials. Topsoil that was removed from the footprint of the substation and car parking yard and stockpiled will be spread over disturbed areas and vegetation re-established.

4.4.2 Operational phase

The typical lifecycle of a PV power plant is generally 20 years, where after it can be considered for upgrade and renewal or decommissioning, depending on the prevalent socio-economic conditions.

Employment opportunities and accommodation

In the event that an 70 MW power plant is developed, approximately 70 direct job opportunities will be created during the operational phase.

Generation and transmission of electricity

The electricity generated by the solar PV panels will be stepped up through the inverters and transformers in the facility substation. The electricity will be evacuated from the facility substation via the overhead transmission lines described above.

Access control and fencing of the facility

The perimeter fence established during the construction phase will be maintained and access to the facility will be through a controlled access point.

Facility maintenance

Facility maintenance will include the replacement of damaged solar PV panels and cleaning of the panels using small amounts of water. Approximately 3 992 m^3 water will be required per month for cleaning purposes of an 70 MW power plant. Orlight SA has applied for water service provision from the local municipality and approval has been granted.

4.4.3 Decommissioning and closure phase

Removal of infrastructure

The facility infrastructure will need to be removed unless a suitable alternative user can be found for the infrastructure. This may include upgrading of the power plant infrastructure to the newest available technology at the time, or the use of buildings and roads for agricultural projects.

Site rehabilitation

Where disturbed during operation and decommissioning, sites will be rehabilitated by returning excess soils removed from the substation footprint and car parking yard to disturbed areas and the re-establishment of vegetation compatible with the surrounding land.

Rehabilitation is the process of returning the land in a given area to some degree of its former state, after some construction or operation activities may have resulted in its damage. The implementation of the EMP will be essential through the construction operational and closure phase.

4.5 Availability of services

Since the propose site located approximately 5 km from the nearest town, Aggeneys, municipal services are not available on site. Services will therefore be kept rudimentary. Since people will not be residing or permanently stationed on site during the operational phase, little if any services will be required. During construction provision will however be made for services on a temporary basis.

4.5.1 Sewerage

During both the construction phase as well as the operational phase the development will be serviced by mobile toilets. Even during the operational phase this will be sufficient since personnel will not be stationed permanently on site. These mobile toilets can be easily maintained by local service providers.

4.5.2 Water

Water will be used during the construction phase of the project for construction purposes and machinery consumption, domestic use and possible for dust suppression, as well as ablution facilities for workers.

During the operational phase a small amount of water will be required for drinking and ablution. The largest contributor to water usage during the operational phase will be for the cleaning of the solar panels.

As state, the developer will contract a water service provider to provide an adequate amount of water to the site which will be stored on site and replenished as necessary. Orlight SA has applied for water service provision from the local municipality and approval has been granted

4.5.3 Electricity

Electricity for use during the construction phase will be supplied by diesel generators. During the operational phase, the project's own supply will be generated.

4.5.4 Refuse

During the construction phase refuse will be removed regularly and disposed of in an approved municipal facility. During the operational phase it is not expected that any notable refuse be generated by the activity, since people will not be stationed on site.

5 STATUS OF BASELINE ENVIRONMENT

This chapter provides a description of the current status of the biophysical, socio-economic and cultural characteristics of the study area for the development of the proposed Aggeneys Solar PV Power Plant.

The specialist environmental investigations that were undertaken to in support of the baseline characterisation are attached as Appendix E to Appendix J to this report.

5.1 Climate

Aggeneys receives approximately 75 mm of rain per year, with most rainfall occurring during autumn. It receives the lowest rainfall (0 mm) in January and the highest (15 mm) in March and April. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Aggeneys range from 14°C in June and July to 29°C in January. The region is the coldest during July when the temperature drops to 4°C on average during the night. The region is characterised by fluctuating temperatures, low and unpredictable rainfall and high evaporation rates. The low annual rainfall (average of 170 mm to 240 mm in central and western parts of Northern Cape Province) is significantly lower than the evaporation rate which creates the dry and arid environment. The area experiences high temperatures especially in the summer months, where daily maximums of >42°C are experienced. The annual evaporation in the area is high at average 2 200 mm. In winter, temperatures can drop below 4°C. Frost is rare, but occurs occasionally, although not severe. Winds generally predominate from the west and east-southeast direction, with strongest winds coming from the northeast and north-north easterly sectors.

5.2 Land use of the site and surrounding area

The main land use of the proposed project area near Aggeneys is illustrated in Plan 8a. The primary land use is grazing (Figure 5-1). There are two existing transmission lines constructed on Aggeneys that divide the site in two (Figure 5-2). An additional transmission line is being proposed by Eskom and will run parallel to the N14 and existing transmission lines.

Figure 5-1: Main land use of the Aggeneys site is grazing

Figure 5-2: Existing transmission lines in the study area

The site can be accessed directly from the N14 via the existing farm access road. There is a two track service road that follows the transmission lines, which can be used to access the site. Farm fences are present on the property. No other significant infrastructure was identified in this study area.

5.3 Topography

The topography of the Aggeneys study area is fairly uniform. The area has a change in elevation elevation from 880 metres above mean sea level (mamsl) to 900 mamsl and the landscape is south facing (Plan 9a). The study area is flat with a slope rise of no more than 3%, except for very small, isolated pieces of land near the northern and eastern borders of the study area where a 10% slope rise might be experienced (Plan 10a).

The Inselbergs that are characteristic of the region can also be seen to the north of the study area. The footslopes of these rocky outcrops are located in the northern sections of the study area. There are also a number of outcrops comprising large boulders in the approximate centre of the study area.

The Aggeneys study area contains one major drainage line running in a south-westerly direction from the north-eastern corner to the south-western corner. Smaller streambeds enter the site in the northeast and further to the northwest respectively and converge towards the centre to join this drainage line. This drainage line is up to about 50 m wide in places.

Surfaces littered with rock remnants seemed to be more prominent north of the riverbed towards the foot of the Aggeneys Mountains. South of the river rocky surfaces diminished whilst coverage was of a much smaller order. However very fine (<2 mm) quartzitic fragments were often seen to cover the surface. As illustrated in Figure 5-3, the study area is covered by sandy and rocky sections and low-lying vegetation.

Figure 5-3: Aggeneys study area and landscape

5.4 Catchment characteristics

The project area is situated in the Lower Orange Water Management Area (WMA 14). The major rivers associated with this WMA are the Ongers, Hartbees and Orange rivers. The project site is situated in the quaternary catchments D81G, D82A, D82A and D82C. An ephemeral river system and associated drainage lines were identified and delineated for the project area. The project area is not recognised as a FEPA and this sub-catchment is not considered to be an upper management area.

This ephemeral system and associated drainage lines is recognised as a watercourse in terms of the NWA and is protected from the associated project activities.

5.5 Soils

A soil and agricultural potential assessment was undertaken and a comprehensive report was compiled at this site. This report was attached to the EIA as Appendix E.

Three transects constituted a cross-cut for the Aggeneys study area and enabled the observation the soil at 24 locations. Findings are as follows:

- The soil observations clearly depicted the dominance of shallow (<30 cm) red loamy sands of the Hutton (Hu) soil form;
- A yellow-red alluvial sand to loamy sand was found to cover the riverbed and banks;
- The surface north of the riverbed was littered with rock fragments of various sizes and shapes and often showed up in the soil profile;
- Most of the surface south of the river was found to be only covered with very fine rock remnants;
- A few occurrences of calcrete cover were observed; and
- Minor occurrences of other soils containing lime or which showed significant differences in colour were accommodated in the Augrabies (Ag) and Clovelly (Cv) soil forms.

Table 5-1 describes the main characteristics of the dominant soil types. Due to the scale of the survey, it was not possible to prepare a map delineating the different soil types. A map illustrating the dominant land type of the site is provided in Plan 11a.

Table 5-1: Characteristics of the soils at the Aggeneys site

SOIL TYPE	DEPTH RANGE (CM)	CLAY CONTENT * %	TEXTURE*	EROSION SUSCEPTIBILITY	UNDERLYING MATERIAL
Hu	< 5 – 30	8-15	Sand to loamy sand	High	Consolidated rock
Hu	< 70 – 200**	<10	Sand	High	Consolidated bedrock

*Take note that clay content was based on an in-field estimation and texture was derived from the clay content estimation.

**It must be noted the depth of 200 cm was the exception to the rule and was located on the river embankment in a part where a deeper cutting prevailed.

The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments, implies susceptibility to water and wind erosion respectively, both of a moderate to high rating if no mitigation measures are in place. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected.

5.6 Land Capability

The land capability of the Aggeneys site is described in Table 5-2. The classification of land capability was conducted in terms of the Guidelines for Rehabilitation of Mined Land (Chamber of Mines & Coaltech, 2007). The site is mainly suitable for grazing, with exception of the alluvial deposits found in the main drainage line that runs through the project site. The grazing capacity of the land is considered too low for large-scale, intensive stock farming and therefore, the use of the land for generation of renewable energy is considered a suitable alternative land use.

Table 5-2: Land Capability of the Aggeneys site

TERRAIN	SOILS	LAND CAPABILITY
Crests	Rock outcrop and scattered occurrences of very shallow topsoil (5-10 cm)	Wilderness/ grazing
Midslopes	Red-yellow shallow topsoil in combination with rock remnants in abundance	Grazing
Footslopes	Red-yellow apedal, topsoil, with rock fragments on surface in places	Grazing
Drainage lines	Alluvial deposits (Red-yellow apedal, Ag, other)	Riparian area

5.7 Flora

In relation to the CBA and SKEP data, the Aggeneys study area is of importance for amphibian, bird and insect habitat components. The baseline characterisation of the flora present in the study area was undertaken as part of a comprehensive Flora and Fauna Assessment that was undertaken for the project. Please refer to Appendix F for a copy of the Flora and Fauna Report.

The Aggeneys study area is situated approximately three kilometres east of the town of Aggeneys within the Nama Karoo. As a result the plant species encountered here have evolved to cope with the low amounts of moisture, even during the rainy season. This study site is located within the Bushmanland and West Griqualand and stretches across two vegetation types described by Mucina and Rutherford (2006), namely the Bushmanland Sandy Grassland (NKb 4) and Bushmanland Arid Grassland (NKb 3). A total of 38 plant species were recorded from the Aggeneys study area (Appendix F) and the main vegetation types are illustrated in Plan 12a.

5.7.1 Red Data and protected plant species

During the field surveys only one Red Data species was encountered, namely *Aloe dichotoma* which is designated as Vulnerable (Raimondo et al., 2009) and is also classified as a medicinal plant species (Van Wyk and Van Wyk 1997, Shearing 1997, Esler et. al. 2010). *Boscia albitrunca* is designated as a protected tree species in terms of the National Forest Act of 1998 and would require a permit before removal.

Red Data plant lists were obtained from SANBI (Raimondo et al., 2009), which indicated that although not recorded during the dry-season survey, the Aggeneys study areas could also contain the following Red Data and protected plant species (Raimondo et al., 2009):

- *Conophytum burgeri* (L.Bolus) – Endangered, African endemic, Northern Cape, Aggeneys;
- *Conophytum ratum* (S.A.Hammer) – Vulnerable, Northern Cape, Ghaamsberg near Aggeneys;
- *Eriospermum pusillum* (P.L.Perry) – Rare, Northern Cape, Springbok to Aggeneys; and
- *Lithops olivacea* (L.Bolus) – Vulnerable, African endemic, Northern Cape, Aggeneys to Pofadder.

5.7.2 Medicinal plant species

The results from the field survey further indicate that the Aggeneys study area contains a wide diversity of medicinal species (Table 5-3), further enforcing the argument that this area is sensitive as far as medicinal plant species populations. Medicinal plants are important to many people and are an important part of the South African cultural heritage (Van Wyk et al, 1997). Plants have been used traditionally for centuries to cure many ailments, as well as for cultural uses such as building material and for spiritual uses such as charms.

Table 5-3: Medicinal plant species (Van Wyk and Van Wyk 1997, Shearing 1997, Esler et. al. 2010)

SCIENTIFIC NAME	COMMON NAME	FORM
Aloe dichotoma	Kokerboom	Aloe
Boscia albitrunca	Shepherds tree	Tree
Hoodia gordonii	Ghaap	Succulent
Monsonia spinosa	Spiny Bushman's Candle	Succulent
Peliostomum leucorrhizum	Veld violet	Dwarf shrub
Rhus undulata	-	Tree
Salsola tuberculata	-	Shrub
Sarcostemma viminale	Melktou	Succulent creeper

5.7.3 Landscape sensitivity

The findings of the landscape sensitivity determination have been taken into consideration during the site layout design process which is described in more detail in Section 6.2 of this report. An illustration of the location of ecologically sensitive areas is provided in Plan 13a.

A distinct division is evident between the dominating landscape features of the study area and this also corresponds with the different plant communities that were delineated. The drainage line that flows from the north eastern corner of the project site to the central western boundary displayed the physical characteristics of these landscape types. A drainage line was the concave part of the habitat also called the valley bottom, where the sediment (sand) collects during rain events, creating favourable habitat for certain plants while excluding others (Figure 5-4).

The grass species *Stipagrostis namaquensis* or River Bushman's grass dominated the grass sward of the drainage line, with the tree species *Boscia foetida* subsp. foetida, and *Prosopis glandulosa* occurring exclusively within the drainage line. This vegetation community is designated as a no-go area due to the sensitivity of the vegetation types within the regional biodiversity context.

Figure 5-4: Drainage line at Aggeneys

The higher lying landscapes encountered on Aggeneys consisted of ridges and relatively flat plains (Figure 5-5). The ridge areas are located to the central and northern sections of the study area. The northern ridges are highly sensitive and forming part of the foot slopes of a mountain range.

The grass sward here was dominated by *Stipagrostis obtusa* and *Stipagrostis uniplumis*, the shrub component was dominated by *Rhigozum trichotomum* and *Searsia (Rhus) undulata*. The tree *Boscia albitrunca* was also encountered here.

The plains (Figure 5-6) present on the Aggeneys study area were sparsely covered by grass and shrub species, no tree species were encountered here. The dominant grass species were *Stipagrostis obtusa* and *Stipagrostis uniplumis*, and the shrub component was dominated by *Rhigozum trichotomum*.

Figure 5-5: Ridge area in Aggeneys

Figure 5-6: Aggeneys plains

Within the study area, areas that were not considered to be ecologically sensitive included areas that are adjacent to human disturbances (the N14) and is affected by this disturbance and areas where prior disturbance (overgrazing) has impacted the plant species richness in a negative way, if compared to other areas within this study area. One alien invasive species, namely *Prosopis glandulosa* (Mesquite tree) was encountered here.

5.8 Fauna

The Karoo region, because of its aridity and low shrubby vegetation, never supported the diversity of herbivorous large mammals found in the African savannas (Azef, 2010). Plant eating animals of the Karoo are either small or confined to protected habitats, or are very mobile. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys.

5.8.1 Mammals

During the field survey, the presence of mammal species such as *Rhaphicerus campestris* (Steenbok), *Vulpes chacma* (Blackbacked Jackal), *Suricatta suricatta* (Meerkat), *Lepus capensis* (Cape Hare) and *Xeris inauris* (Cape Ground Squirrel) were confirmed.

5.8.2 Avifauna

The Aggeneys study area displayed low numbers of bird species, however the time of day when the field study was conducted was not conducive to bird spotting as it was exceptionally hot. Birds that were observed include the Namaqua Dove (*Oena capensis*), Pied Crow (*Corvus albus*) and Sociable Weaver (*Philetairus socius*).

Important birding areas near the project site are illustrated in Plan 14a. Birds that occur in the ecoregion include some of the smallest and largest species in South Africa. Among the birds that can be expected to occur in the study area, are the ferruginous lark (*Certhilauda burra*, VU) and Sclater's lark (*Spizocorys sclateri*) which are strictly endemic to this ecoregion. Five near-endemic species are known to occur, including the Karoo chat (*Cercomela schlegelii*), tractrac chat (*Cercomela tractrac*), red lark (*Certhilauda burra*), Karoo scrub robin (*Cercotrichas coryphaeus*), red-headed cisticola (*Cisticola subruficapillus*) and the Namaqua prinia (*Phragmacia substriata*).

Other characteristic species of the Nama Karoo that could be expected and which is regarded as "Vulnerable" in South Africa are tawny (*Aquila rapax*) and martial (*Polemaetus bellicosus*) eagles, African marsh harrier (*Circus ranivorus*), lesser kestrel (*Falco naumanni*), blue crane (*Anthropoides paradiseus*), kori (*Ardeotis kori*) and Ludwig's (*Neotis ludwigii*) bustardsi and the red lark (McCann 2000; Barnes 2000).

5.8.3 Herpetofauna

The herpetofauna of xeric landscapes in general tends to be poor due to a paucity of suitable habitat. This is evident in the fact that reptile species richness within the Nama Karoo, is generally low and there are few endemic species. Furthermore, few of the reptile species that occur in this ecoregion are of conservation concern or classified as threatened (Alexander and Marais 2008). Only two reptile species were observed during the field survey, namely the Namaqua Speckled Padloper (*Homopus signatus*) which has an IUCN "vulnerable" status and the Karoo Girdled Lizard (*Cordylus polyzonus*).

5.9 Biodiversity importance

In relation to the CBA and SKEP data, the Aggeneys study areas is of importance in terms of its amphibian, bird and insect habitat components. As far as vegetation is concerned the plains that occur on study area is of importance because of the presence of quartz gravel patches which are the preferred habitat for *Lithops* spp., or stone plants, demarcated as highly sensitive areas in Plan 13a.

The study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP, 2010). Because of all the reasons mentioned above the no-go areas of the drainage lines was delineated. As far as avifauna is concerned, the area is approximately 3 km away from an area that is described as a unique habitat for birds (SKEP, 2010).

As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects (SKEP, 2010). Furthermore, the study area falls within an area where eastern Bushmanland Quartz and Gravel patches are found.

The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change (BGIS, 2010).

Entire area falls within the Geographic Priority area, specifically the Bushmanland Inselberg area. This priority area is located on the northeast margin of the Succulent Karoo Hotspot, just south of the Orange River and the border between Namibia and South Africa. The area is dominated by a plain of desert grasslands and peppered by Inselbergs, ancient rocky outcrops in irregular patterns. These Inselbergs are important refugia for plants and animals and act as stepping-stones for rock-loving species migrating east west across the sand-covered plains of Bushmanland. Isolation of populations has led to diversification within the dwarf succulent shrublands. In total, the 31 400 ha area includes 429 plant species, of which 67 are found only in this hotspot and 87 are Red List species.

Mining has impacted many of the Inselbergs, and a proposed opencast zinc mine may devastate most of the spectacularly diverse Gamsberg Inselberg, home to two endemics: *Conophytum ratum* and *Lithops dorotheae*. The Red Lark (*Certhilauda albescens*) is also an important endemic species, although severe overgrazing on communal lands in this part of the Bushmanland plateau is impacting its habitat. The study area has a Very High irreplaceability status (BGIS, 2010). Namaqua Speckled Padloper was encountered. According to the IUCN this tortoise is vulnerable.

<u>All of these findings have been integrated into the site layout design process, as discussed in Section 6.2 and illustrated in Plan 3a, Plan 6a and Plan 7a.</u>

5.10 Visual environment

The baseline characterisation of the visual quality of the study area was undertaken as part of the VIA that was undertaken for the project. Please refer to Appendix G for a copy of the VIA report.

With regard to their visual considerations, the outcrops on the northern border of the study area are typical of the regional area in which the study area falls. The dry landscape is somewhat dramatic with its contrasting features and has a rugged and stark beauty. The surrounding landscape is impressive with large, flat open spaces and contrasting large rocky outcrops.

The study area does, however, have a sense of being transformed by people, not only because of the visibility of the town from the border of the study area, but also because a transmission lines runs through the study area and fences on the border of the property (Figure 5-7). The N14 also dissects the study area towards the south-eastern corner which also adds to the aspect of the area being transformed.

The town of Aggeneys itself is very small and only visible from the north-western boundary of the study area. The N14 national road, Aggeneys town and a number of dirt roads were identified as potential receptors within the 5 km radius around the Aggeneys study area. As illustrated in the viewshed that was prepared for the study area (Plan 15a), the large outcrops and inselbergs to the north and east of the study area will shield the visibility of the potential infrastructure anywhere beyond these outcrops.

There are also smaller outcrops that are scattered around the study area which will also decrease visibility of the proposed infrastructure. The proposed infrastructure will therefore likely only be visible from within a 5 km radius of the site itself.

Figure 5-7: Fence lines on the north westerly boundary of the site - Aggeneys town just visible

5.11 Tourism

The baseline characterisation of the existing tourism industry in the study area was undertaken as part of a Tourism and Sustainability Assessment (T&SA) that was undertaken for the project. Please refer to Appendix H for a copy of the T&SA report.

The Northern Cape Province relies on its natural and cultural heritage to satisfy tourist demands. Tourism demands generally refer to the motivation of travellers to visit a destination. The Northern Cape is a vast semi-desert region, renowned for its eco-tourism attractions, adventures, natural and cultural heritage, as well as unique ecological attractions specifically during the flowering season in spring.

In order to promote, support and increase awareness of the tourism industry, there are a number of tourism authorities and campaigns in the Northern Cape Province. Tourism authorities and campaigns that are dedicated to promote and grow tourism in the Northern Cape are listed in Table 5-4.

Table 5-4: Tourism authorities in the Northern Cape Province

TOURISM AUTHORITIES	DESCRIPTION
Northern Cape Tourism Authority (Tel: 054 9510238, northerncapetourism@telkomsa.net) Kimberley	Northern Cape Tourism Authority provides a range of services to tourists. They present tourism information, products and services to potential tourists at tourism events, exhibitions, through marketing and on the internet (website).
Northern Cape Department of Environmental Affairs and Nature Conservation (Tel: +27 53 807 7300) Kimberley http://denc.ncpg.gov.za	The Northern Cape Department of Environmental Affairs and Nature Conservation is committed to ensuring the sustainable management of the environment and nature. The department also aims to promote tourism, ensure effective biodiversity policy, planning, monitoring and

TOURISM AUTHORITIES	DESCRIPTION
	authorisation and provide professional impact management services.
The Northern Cape Economic Development Agency (NCEDA), established through a partnership between the Northern Cape Provincial Government and the Industrial Development Corporation (IDC)	NCEDA focusses on: Agriculture and agro-processing / value adding; Mining and beneficiation and Tourism infrastructure. NCEDA aims to be the catalyst for the acceleration of sustainable economic growth and development in the Northern Cape through efficient and effective use of public sector resources and public/private partnerships.
The Northern Cape Ministry of Tourism, Environment and Conservation and Department of Tourism, Environment and Conservation http://www.northern-cape.gov.za/	The mission of the Northern Cape Government is to provide strategic leadership that will stimulate economic growth to its full potential and ensure high levels of social development, including tourism growth and sustainable development.

Aggeneys falls into the Namakwa tourist district. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. The Aggeneys town itself is not a major tourist attraction, as it mainly accommodates the employees of the mining industry in the area. The main tourist attraction in the regional area is the unique natural and cultural resources found in this area (Figure 5-8). Beyond the edges of town the arid conditions and the unique ecologies on the various inselbergs, peaks, hills and plains, with their varied rocky and shallow soil substrate, support a wide range of plants, animals, birds and insects, including rare and endemic species, as evident from the findings of the fauna and flora assessment. The Quiver tree (*Aloe dichotoma*) is a well-known attraction in this region and was encountered on site during the flora survey.

Figure 5-8: View of project site from main tourist route

In the LED Strategy for the Namakwa District Municipality, the following opportunities have been identified to further develop the tourism industry in the area:

- Eco-tourism: Vast open land, unique natural flora and a number of national parks and conservancies;
- Adventure tourism: Numerous 4x4 trails and hiking;
- Historical and cultural tourism: A rich heritage of the Khoi San/Nama people in the area, as well as mining museums; and
- Technological tourism: Potentially the SKA radio telescope project (if awarded to the Northern Cape) and renewable energy tourism.

Although the town is currently focused mainly on mining, the tourism industry may provide an alternative for sustainable development once minerals have been depleted or when mining ceases in this area through accommodation, catering and leisure activities in the area.

5.12 Traffic

A Traffic Impact Statement (TIA) for the proposed Aggeneys Solar PV Power Plant was prepared by BKS Consulting Engineers. Please refer to Appendix I for a copy of the report.

The N14 is a two-lane road with paved shoulders of approximately 1 m wide. Farm accesses on the N14 currently serve the two sides of the study area and are located approximately 1.5 km north-west of the Namies/Lus gravel road intersection (T-junction). The N14 is straight and flat at the access position and the sight distance along the N14 is more than a kilometre in both directions. The average daily traffic on this section of the N14 is in the order of 1 200 vehicles per day (SANRAL Yearbook 2011). Conflicting traffic flows on the N14 at the access are therefore low and there will be an abundance of safe gaps for turning vehicles.

5.13 Socio-economic context

The study area is located in the Khai-Ma Local Municipality of the Namakwa District Municipality in the Northern Cape Province. The major settlements in Khai-Ma Local Municipality are the towns of Aggeneys, Pella, Pofadder, Onseepkans and Witbank.

5.13.1 Population

The Khai Ma local municipality is one of the least populated in the Namakwa District Municipality. According to the classification system used by Statistics South Africa in census and community surveys, the most numerous population group in the Khai Ma Local Municipality is Coloured. In this regard it is similar to most local municipalities within the Northern Cape. The population composition of the municipality consists of 86% Coloured, 11% White followed by 3 % Black African. The smallest population group is Asian (Stats SA Community Survey, 2007). The dominant language spoken in this region is Afrikaans, followed by English and IsiXhosa, which are spoken to a lesser extent.

5.13.2 Employment and unemployment

In 2007, half the population within Khai-Ma Local Municipality was employed and 35% was regarded as not economically active. Only 13.6% was unemployed and a majority of the unemployed group are young people below the age of 30. The total percentage of the unemployed group and those classified as economically inactive, indicates a high dependency ratio.

In addition, the high proportion of semi-and unskilled workers has implications for the nature and quality of jobs created. To improve on the quality of jobs, household incomes and overall economic status of the area, skills development programmes are needed.

5.13.3 Education levels

A greater portion of the population has a primary school education which indicates that most people are literate. However, most of the population does not have a matric certificate and even less a tertiary qualification. The low education levels in the Khai-Ma Local Municipality could indicate that the area is challenged by shortage of skills which creates a high unemployment rate. Due to shortage of skills, most people in the Khai-Ma Local Municipality have elementary jobs as these jobs require a low skill levels.

From the above, it is evident that there is a need for educational facilities, particularly post-matric training as well as accredited tertiary institutions that offer affordable and appropriate qualifications. A further need is to attract and retain qualified professionals in the municipality.

5.13.4 Economic overview

Agriculture and mining are the main sectors that contribute to employment in the Khai-Ma Local Municipality. The Khai Ma IDP (2004) views the mining sector as a significant potential injection for the local economy. Employment at Black Mountain is contributing towards upliftment in the area and the municipality is looking towards the Gamsberg mining project to do the same.

Other sectors such as transport, manufacturing and construction do play a role in the economy of this region, although their contribution is minimal. This could be attributed to the low productivity in the area which is created by the shortage of skills. The main contributors towards the economy of the Khai-Ma Local Municipality are shown in Figure 5-9. It is evident that the municipality requires a strategy that will further diversify the economy, reducing dependence on the mining sector.

The municipal area is characterised by low-income households, which has serious implications for the financial status of the municipality itself and its ability to implement development programmes. The low household income also has implications for the types of initiatives that would be feasible for the municipality to implement in terms of local market demand.

The majority of the population currently live in small, dispersed settlements and have limited transport capacity to travel the significant distances between urban centres. As many of these households are also living in poverty, the lack of transport adds to the so-called “poverty trap”.

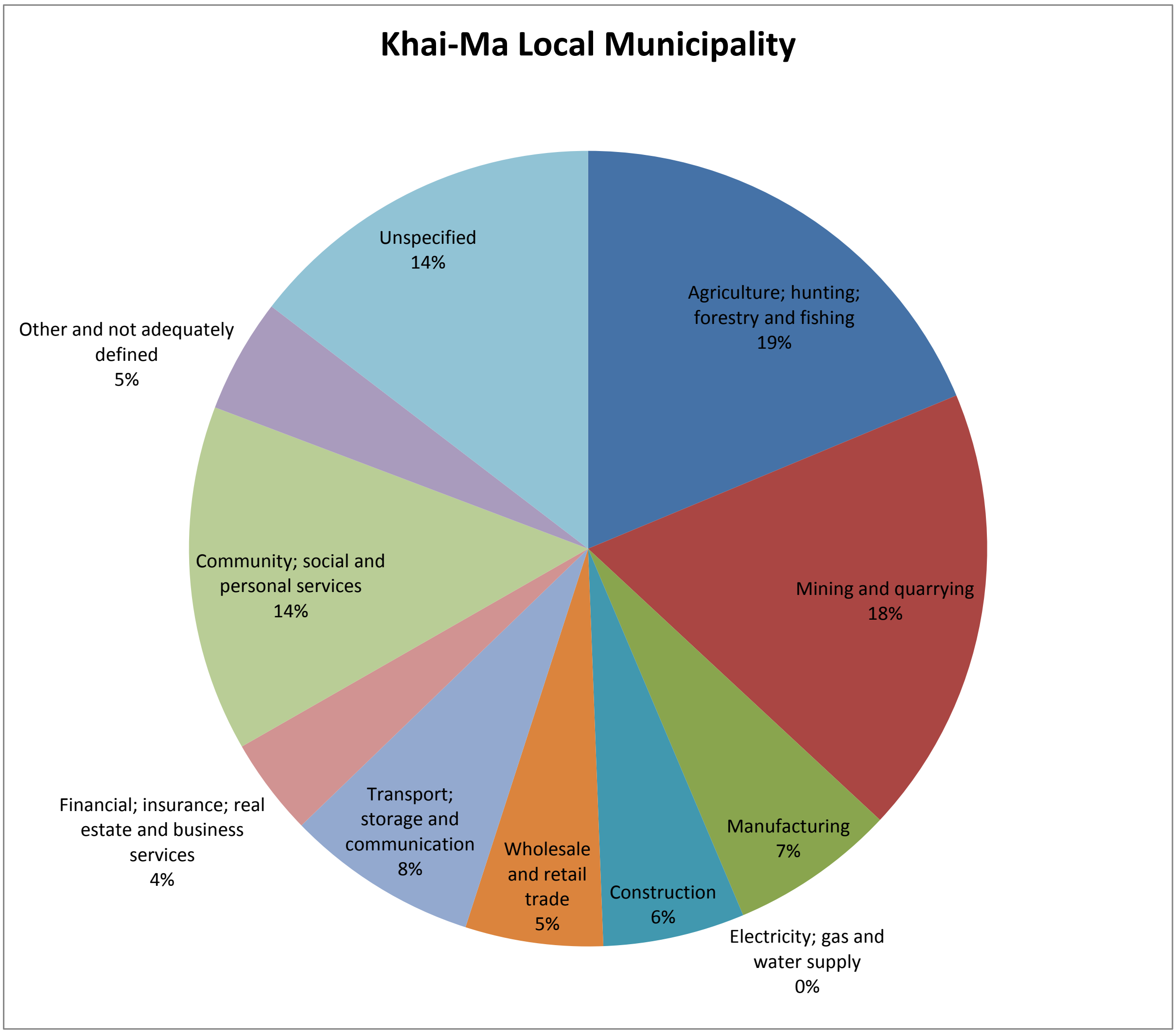


Figure 5-9: Contributions of sectors to local employment in the Khai-Ma Local Municipality *(Source: Adapted Stats SA Community Survey, 2007)*

5.14 Heritage

A Phase 1 AIA was undertaken for the proposed project and a Paleontological Impact Statement prepared. Please refer to Appendix J for a copy of the heritage reports. The location of relevant heritage aspects of the study area is illustrated in Plan 16a.

5.14.1 Palaeontology

The palaeontological landscape is described as bedrock comprising ancient basement rocks of the Bushmanland Terrance of the Namaqua Province. This geology is of negligible palaeontological interest. The Bushmanland Terrance is overlain by Quaternary sand cover – a combination of alluvium in the drainage lines and colluvium closer to the bedrock outcrops.

5.14.2 Archaeology

Background and context

In general, it is stated that archaeological visibility is low around Aggeneys and Pofadder (Morris, 2011). The predominant archaeology consists of widespread, low density lithic artefact scatters of Early Stone Age (ESA) and Middle Stone Age (MSA) material across areas of Bushmanland to the south of the study area. Systematic collections that have been made included a 'fresh component of Middle Stone Age with prepared cores, blades and points and a large aggregate of moderately to heavily weathered Earlier Stone Age' (Beaumont *et al*., 1995).

Cultural Resource Management (CRM) assessments conducted over the past two years in the area around Kenhardt have identified considerable MSA material distributions. Expressions of the Stone Age around Aggeneys and Pofadder is less well known or described. Five 'significant locales' were identified by Morris's (2010) surveys of the northern slopes of the Gamsberg (2.5 km east of the proposed project). These included both ESA and MSA sites.

MSA and Later Stone Age (LSA) material was identified at Paulputs near Pofadder, as well as the presence of ostrich eggshell. It seems that the LSA lithic industries are the predominant 'archaeological trace' seen in CRM surveys in the Aggeneys-Pofadder region. A ceramic LSA site that included lithics manufactured from quartz, glass and porcelain as well as two stone cairns that represent graves was found to the north-west of the Gamberg (Morris, 2010). This may indicate LSA settlements and occur on the plains, near little rocky outcrops, rather than on the slopes of the Gamsberg itself. Additionally, another ceramic LSA site (containing pottery, stone tools, ostrich eggshell and glass) was identified north of the N14 linking Aggeneys to Pofadder where 'boat-shaped grinding grooves in the outcropping bedrock' was found (Morris, 2010). These may represent 'transient settlement by transhumant hunter-gatherers or herders'. Furthermore, it seems that LSA sites are concentrated at the base of small koppies. Rock art (paintings) are also known to occur.

Findings of the field survey

A dense background scatter of quartz flakes was found across the south-western section of the study area. The material is particularly prevalent in those areas where the soil surface is covered in quartz pebbles and cobbles. These quartz "floors" occur in patches between the knee high grasses and are easy to see (Figure 5-10).

The artefacts comprise predominantly quartz flakes, cores and chunks, although quartzite stone artefacts are also present. The size of the artefacts suggests that they are of Middle Stone Age date. The concentrations of stone tools appear to be highest near the drainage channel that runs through the site.

A small koppie to the north of the proposed facility contained a higher concentration of stone artefacts, particularly in quartzite. The koppie is located near a small farm building, and there are fragments of glass in the area, suggesting that livestock may have been kraaled in the shelter of the koppie in the recent past.

Rocky outcrops to the north of the area were also examined for signs of engravings, but the rock was not of a suitable dolerite material for engravings. A slight overhang in one of the rocky outcrops outside the study area was examined for signs of rock paintings, but none were found.

The stone artefact scatters which were recorded during the survey are considered to be of minor significance. They are probably not in original context and not associated with other archaeological material, such as bone, which could provide valuable information on prehistoric life ways. There do not appear to be "archaeological sites" with stone tools left in their original context.

Figure 5-10: Stone artefact scatters are found in these open patches of soil between the vegetation cover

5.14.3 Historical period

The Aggeneys and Gamsberg areas represented a frontier zone during the colonial period where place names were becoming fixed in terms of cadastral terms and farm names. Many current place names have their origins in colonial interpretations or perversions of original San/Khoe names. Aggeneys (alternatively Aggeneis) and Gams are names derived from the Nama language (Morris, 2010).

Of importance is recorded oral history that infers that a 'massacre of Bushmen took place in a kloof at Aggeneys' (Nienaber & Raper, 1977:173). However, there is also a premise that links the San massacre with the Gamsberg rather than Aggeneys. Other interpretations embraces possible meanings of 'place of red clay' or association with reeds. A critical consideration based on the above inference is the possible inclusion of the Gamsberg into a potential /Xam and Khomani Heartland World Heritage Site.

The farm Aroams 57 was surveyed and granted in 1895, suggesting a relatively recent European settlement date of the area. The name Aroams is possibly derived from the Nama terms for *Ziziphus mucronatus* and mouth (‡aro- and am or am-s), translating into 'Wag-'n-bietjiebosfontein' (Nienaber & Raper, 1977).

6 ENVIRONMENTAL IMPACT ASSESSMENT

This section presents the findings of the assessment of potential environmental impacts associated with the proposed development of the Aggeneys Solar PV Power Plant.

The results of the impact assessment are presented as follows:

- *Issues and concerns* – The findings of the PPP undertaken for the proposed project are described;
- *Environmentally sensitive and no-go areas* – The process to delineate these areas and resulting sensitivity maps are presented;
- *Significance assessment* – An assessment of the significance of anticipated positive and negative environmental impacts associated with project activities is provided; and
- *Cumulative impacts* – The results of a qualitative assessment of the potential cumulative impacts of the proposed project, similar projects and other developments in the project area is presented.

Recommended measures to enhance the positive environmental impacts and mitigated negative environmental impacts have been detailed in the EMP for the project attached as Appendix K to this report.

6.1 Findings of the Public Participation Process

Issues and comments raised by I&APs during the EIA process have been recorded and addressed in Table 6-1. The table will be updated throughout the environmental authorisation process to capture all issues identified through on-going consultation and review of public documents and reports.

The main issues and concerns that were raised by I&APs related to:

- Water utilisation and storm water management;
- Requirements for rezoning and consent use applications for affected land;
- Impacts on existing Eskom transmission line servitudes; and
- Visual impacts of infrastructure on motorists using national and district roads.

The significance of the impacts associated with the above mentioned issues and concerns are assessed in Section 6.2 and Section 6.3 that follow.

To summarise, I&APs generally had no objections regarding the proposed Aggeneys Solar PV Power Plant and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Table 6-1: Issues and response table

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
Water provision and management	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental Manager)	Water is a scarce resource in the area. Aggeneys relies on only one source of water from Pella, which has already been exhausted. Requested that a study be undertaken to investigate alternative water sources in the area. Indicated that there are proposed mine developments to be undertaken in the area. This will increase the water demand in the area.	Orlight SA	For the proposed Solar PV Power Project, water will be required for general use by employees during construction and operation, as well as for washing the panels twice a year. **Alternative water sources were considered and it was decided that Orlight SA will utilise a water service provider to bring water to the site during the operational phase for washing the panels. Orlight SA has applied for water service provision from the local municipality and approval has been granted*
	Information sharing meeting (10 January 2012)	Mr France: Farm Aroams 57 RD	Storm water management must be undertaken.	EAP	**A storm water management plan will be implemented as part of the EMP for the proposed project. No activities will be undertaken in the drainage lines and buffer zones that were delineated during the sensitivity mapping process.*
	Fax correspondence (03 April 2012)	Ms N Feni: Northern Cape DWA	The applicant must assess all the potential water uses associated with the proposed development as defined under section 21 of the National Water Act, 1998 (Act 36 of 1998).	EAP	**It is not currently anticipated that the Aggeneys project will require an Integrated Water Use License Application (IWULA), as no Section 21 water uses have been identified.*

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
	Fax correspondence (03 April 2012)	Ms N Feni: Northern Cape DWA	Indicated that energy developments are not part of small industries users and as such cannot be entitled to the water use allowance set aside for small industries users as determined by the General authorisation.	EAP	Comment noted. **Orlight SA will apply to the municipality as water service provider for the provision of water for the construction and operational phases of the project. Orlight SA has applied for water service provision from the local municipality and approval has been granted.*
	Fax correspondence (03 April 2012)	Ms N Feni: Northern Cape DWA	The EMP should include the following management and mitigation measures: Storm water management, waste management, sanitation, sedimentation and erosion and storage of hazardous substances.	EAP	Comment noted. **The EMP (Appendix K) includes management measures for all of these aspects.*
Servitudes	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental Manager)	Concerned that the servitudes running through the project area.	EAP	**The proposed Solar PV Power Plants and associated components were designed in such a way to ensure that Eskom retains access to all existing Eskom servitudes.* *Infrastructure has been kept out of servitudes.*
	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Indicated that Eskom will require access to its existing servitudes for maintenance purposes		
	Email correspondence (22 May 2012)	Mr John Geeringh: Eskom	Indicated that the solar park overlaps with the approved Eskom power line called Aggeneys – Paulputs 220 kV. Requested that a servitude is allowed for in the solar park layout.	EAP	**An alternative site layout for the proposed Solar PV power plant in Aggeneys has been developed to avoid the servitude in question. All I&APs will be awarded an opportunity to comment on the new site layout.*

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
Buffer Zones	Email Correspondence (23 January 2012)	Ms Mia Ackermann: Digby Wells	Enquired on what are the prescribed buffers zones for the N7 at Vanrhynsdorp and the N14 at Aggeneys.	Ms Colene Runkel: SANRAL	SANRAL recommends that there should be a 500 m buffer from the road reserve fence. Requested Digby Wells to send a motivation letter for the relaxation of the buffer zones. The motivation letter should provide mitigation measures that have been put in place. **A motivation letter was sent to SANRAL.*
	Email Correspondence (14 February 2012)	Ms Rene De Kock: SANRAL	Indicated that SANRAL is prepared to approve a 30 m building line, pending the approval of the rezoning of land.	EAP	Comment noted. **The rezoning application is currently being undertaken.*
Grazing land	Information sharing meeting (10 January 2012)	Mr France: Aroams 57 RD	Enquired if the land will still be available for grazing.	Orlight SA	The project site will be fenced-off and therefore, no land will be available for grazing.
Visual Impact Assessment	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental Manager)	The mine does not foresee any visual impact	EAP	Comment noted. **A VIA was undertaken and the Solar PV Power Plant layouts designed in such a way to avoid areas that have a high visual sensitivity rating and to locate infrastructure in areas that have low visual sensitivities. The infrastructure will still be visible from the national road and this impact cannot be avoided.*
	Email Correspondence (23 February 2012)	Ms Rene De Kock: SANRAL	Concerned about the visual impact that will caused by the proposed project. Indicated that proposed project might be a distraction for motorists on the national road		
Socio-economic issues	Information sharing meeting (10	Mr Pieter Venter: Black Mountain Mining	There is a need for a solar power projects in the area as result of increased electricity demands. The mine is also planning to expand in the near	Orlight SA	Suitable accommodation in the town of Aggeneys will have to be identified in

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
	January 2012)	(Environmental Manager)	future, adding to the electricity demand. Housing is a problem, as Black Mountain Mine will be expanding. Indicated that Pieter Clark, the social development consultant from Black Mountain Mine, will be able assist in the identification of community needs.		consultation with the municipality. Suitable community development and/or LED initiatives in which Orlight SA can participate should be identified in consultation with the Black Mountain Mine.
Legislative requirements	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	The Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983. Indicated that the Department does not foresee any problems regarding the proposed development as long as the developer adheres to the articles of Act 43 of 1983.	EAP	Comment noted. **The requirements of this Act will be taken into consideration in the rezoning process that is being undertaken for the project.*
	Email Correspondence (28 February 2012)	Dr Tiplady: South African SKA Project Office (SASPO)	Indicated that the nearest SKA station to the proposed Aggeneys study area is 150 km away and that there is no risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Rezoning	Letter Correspondence (06 February 2012)	Mr/ Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that rezoning will be applicable as the land use will change from the current agricultural status.	EAP	**An application for rezoning is in the process of being undertaken.*

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
Land Owner information	Letter Correspondence (06 February 2012)	Mr/ Ms Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	The current landowner has been identified and has been consulted. The affected farm (Aroams 57 RD) is owned by Mr Abrie van Niekerk.
Lease agreements	Letter Correspondence (06 February 2012)	Mr/ Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner.	Orlight SA	**Long term lease agreements have been reached with the land owner. Land will not be subdivided.*
Environmental Impact Assessment	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom is currently conducting network expansion in some areas which are in close proximity to the proposed sites and possible alternative sites. Indicated that Eskom is planning to construct a 400 kV transmission line from Aggeneys to the Helios substation.	EAP	Comment noted. **The proposed project does not impact on the construction of the transmission line. The proposed project will, however, contribute to the supply of electricity to the area.*
Heritage resources	Email Correspondence (20 March 2012)	Dr M. Galimberti: SAHRA	An AIA should be undertaken for the proposed project. The AIA should assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance. Recommended that the EAP must engage with a Palaeontologist in order to define whether the area is paleontological sensitive and whether paleontological resources will be affected by the proposed project.	EAP	Comment noted. **An AIA was undertaken for the proposed project and a Palaeontological Impact Statement prepared by a palaeontologist. The palaeontological potential of the site was considered to be low.* *The HIA report has been submitted to SAHRA, but no feedback has been received yet.*

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
General	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining Mr France and Mr Arnold: Aroams 57 RD farm	Indicated that they have no objections regarding the proposed project	EAP	Comment noted.
	Email Correspondence 13 October 2011	Mr Christopher Isherwood: CAA	Indicated that the CAA has no objection to the proposed Solar PV facility development, as long as the height of the proposed facility does not exceed a height of 7 m.	Digby Wells	Comment noted. **A restriction of 7 m to solar PV infrastructure will be imposed. Should infrastructure be higher than this, CAA will be engaged to discuss the possibility of exceeding the height restrictions.* *The EAP is currently consulting with the CAA regarding height restrictions for proposed transmission lines.*

6.2 Environmentally sensitive and no-go areas

The project design for the proposed project was finalised after suitable alternatives and necessary assessments were conducted. This was part of an integrated and dynamic process to ensure the most financially viable and environmentally sensitive designs were considered for the project.

Upon completion of the environmental and cultural assessments undertaken for the study area, including important feedback received from stakeholders during the PPP, sensitivity maps were created using a GIS. The approach and methodology used to determine sensitivity of the study areas is described in Table 6-2.

The ecological sensitivity of the study area was assigned a higher weighting than its visual impacts, due to its location in terms of regional biodiversity conservation programmes. Not only does the site fall within a geographic priority area in terms of SKEP, but it is also considered important in terms of its amphibian, bird and insect habitat components. In addition, the study area is classified as a near natural landscape in terms of the CBA, which means that there are options for loss of some components of biodiversity in the landscape without compromising the ability to achieve conservation targets.

Due to the nature of the project and its location in terms of the N14 national road, the visual impact cannot be avoided. Consequently a lower weighting was given to the visual considerations during the site layout design process.

In addition, there do not appear to be "archaeological sites" with stone tools left in their original context and therefore, the stone artefact scatters which were recorded are considered to be of minor significance.

The following sensitive and no-go areas were delineated:

- *Drainage line* – It is recommended that the main drainage line and associated system be avoided during construction and operation, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries;
- *Ecologically sensitive areas* –The no-go area generally describes the drainage line running through the project area. Other areas of high ecological sensitivity include the sensitive habitat of the ridges and areas which include protected and red data species. Least sensitive areas that can be considered for development exist in southern parts of the study area;
- *N14 road reserve* – A 30 m buffer zone around the N14 national road has been included in the site layout;
- *Visual impacts* – Areas north of the drainage line should be avoided due to their high visual sensitivity and proximity to the Gamsberg; and
- *Eskom transmission line servitudes* – The existing 220 kV line has a servitude width of 47 m, while the existing 66 kV line has a servitude width of 22 m. An additional Eskom servitude was identified following public review of the draft EIA report, which is the proposed Eskom Aggeneys – Paulputs 220 kV line to be constructed within a 47 m servitude. No construction will take place within these servitudes.

The site layout design process for the proposed Aggeneys Solar PV Power Plant is illustrated in Plan 6a. The infrastructure layout plan of the proposed project in relation to the environmentally sensitive and no-go areas is presented as Plan 3a.

Table 6-2: Approach and methodology to determining site sensitivity

ASSESSMENT	PHASE	DESCRIPTION
Delineation of drainage lines	EIA phase	Watercourses and drainage areas were delineated in accordance with the DWAF (2005) guidelines, "*A practical field procedure for identification and delineation of wetlands and riparian areas".* A field investigation was conducted in order to delineate these systems. Wetland indicators such as topography, soil and vegetation were considered in order to identify areas of saturation. In addition to this, the riparian indicator referred to as "alluvial soils and deposited material" was also considered in order to delineate the associated drainage areas of the catchment. These indicators were jointly considered to identify and classify areas of the landscape/catchment that are important for the maintenance and functioning of the water resources.
Ecological assessments	EIA Phase: Research	Existing plans and maps were used to gain an understanding of the sites and to determine what to expect once on site. Sites of importance, such as drainage lines can often be determined from these and then investigated in detail during the field work.
	EIA Phase: Field work methodology	The primary objective was to characterise the vegetation in the study areas by conducting an in-depth vegetation survey. The findings were used to identify ecologically sensitive areas, which guided the placement of infrastructure. The presence of the plants with Red Data status; medicinal uses; cultural uses; and declared weeds and invader species were established. An animal survey was conducted in conjunction with the vegetation survey and mammals; avifauna; and herpetofauna known to occur in the area, or observed during surveys were recorded.
	EIA Phase: Sensitivity ratings	The findings from the vegetation and animal studies were used to delineate areas that are sensitive to disturbance from an ecological perspective. The sensitivity categories concentrate on landscapes that perform integral biophysical support and maintenance functions within the study area and surrounding landscapes. In addition to the sensitive landscapes, the protected plant and animal species are also regarded as sensitive and were used in sensitivity mapping. Sensitive areas included areas where Red Data Species (*Boscia albitrunca*) and protected species (*Aloe dichotoma*) occur, Terrestrial CBAs, as well as areas defined in SKEP as Sensitive (Plant priority Areas, Ridge Areas, Buffers, Drainage Lines, Sand Corridors and Quartz Patches). From this information various ratings were developed which defined "No go" areas, which are most sensitive, Highly Sensitive, Sensitive, Minimally Sensitive and Least Sensitive Areas. "No Go' Areas within the study sites are to be avoided at all costs; these areas have a very high potential to support sensitive plant and animal species, but more importantly they are integral for ecosystem functioning within the general area and once removed will have a far reaching effect on the site and surrounding areas. "Highly sensitive" areas are areas that could very possibly provide habitat for sensitive flora and fauna species, and have a role to play in ecosystem functioning but are not integral to this function. Removal or damage to these areas will only affect the habitat present on site and possibly surrounding

ASSESSMENT	PHASE	DESCRIPTION
		habitats. "Sensitive" areas could once again provide habitat for sensitive flora and fauna species and they may contribute to ecosystem functioning within the study area, they are not integral and removal of them will not affect the surrounding ecosystems. "Minimal sensitive" areas have a small chance of containing sensitive flora and fauna species; however these areas have very little ecosystem functioning value on or off the study area. "Least sensitive" areas are considered areas that are most favourable for development due to existing disturbances.
Visual sensitivity analysis	EIA Phase: Identification of visual receptors	Potential receptors were identified using aerial imagery within a 5 km radius of the proposed study area. These receptors included national road users (i.e. those people travelling on the national road); and towns (i.e. those people who reside in or are visiting the town).
	EIA Phase: Viewshed analysis	A model was created in ArcGIS for the viewshed analyses to be run for each of the receptor groups. The results of this model were 12 polygon viewshed layers for each receptor group for each site, denoting which points they would be seen from and, concurrently, which points in the landscape the persons within these receptor groups would be able to see. Values were then assigned for the viewshed polygons based on the receptor group such that the areas visible by more sensitive visual receptors were given a higher value (i.e. the visibility areas for the towns and national roads are likely to be experienced more frequently/by a larger number of people).
	Integration of EIA Phase: viewshed polygons	All of the viewshed polygons for all of the different receptor groups were then merged in order to obtain one comprehensive visual sensitivity layer. This merging process allowed both the number of receptors and the type of receptors to be factored into an all-inclusive visual sensitivity index that ranged from 0 (areas within the study site that are not visible from any of the identified receptors) to 7.25 (areas that are visible from a range of receptors, including the most sensitive receptors – towns and a national road).
	EIA Phase: Visual sensitivity rating	These scores were then grouped into visual sensitivity ratings. Based on the definition of the visual sensitivity scale, areas for potential construction that would lead to lower visual impacts were recommended. *Due to the nature of the project and its location in terms of the N14 national road, the visual impact cannot be avoided. Consequently a lower weighting was given to the visual considerations during the site layout design process.*
Cultural and landscape	Sites of archaeological significance	Findings of the Phase 1 AIA and Palaeontological Impact Statement were integrated into sensitivity maps. For the Aggeneys study area, no areas were delineated as significant in terms of archaeological or palaeontological finds.

ASSESSMENT	PHASE	DESCRIPTION
Technical factors	Eskom servitudes	Consultation with Eskom regarding the prescribed servitude widths of existing transmission lines was undertaken by Aurecon Engineers. The proposed Solar PV Power Plant components were designed in such a way as not to impact on the existing or proposed future Eskom transmission line servitudes.
	Road servitudes	During the initial consultation with SANRAL, it was recommended that a 500 m buffer from the road reserve fence of the N14 should be maintained. The prescribed buffer would significantly reduce the available surface area that could be used for development of the Solar PV Power Plant and thus, Digby Wells sent a motivation letter for the relaxation of the buffer zones. Upon completion of the review of the motivation letter, SANRAL indicated that they are prepared to approve a 30 m building line, pending the approval of the rezoning or consent use of land.
	Integrated design workshop	An integrated design workshop was held between the EAP, the applicant and Aurecon Engineers and NETGroup who were responsible for the preliminary design layouts of the proposed Solar PV Power Plant. The objective of this workshop were to plan the layout of all Solar PV Power Plant components, including the construction lay-down yards and access points, taking into account the environmental sensitivity of the study area, as well as engineering practicality and technical design considerations. The outcomes of this workshop was a site layout plan for each of the Solar PV Power Plant, which could be considered the best-suited option in terms of the project footprint's' environmental and cultural impacts.

6.3 Assessment of potential impacts

Activities associated with the construction, operation and decommissioning of the proposed Aggeneys Solar PV Power Plant will result in impacts on the biophysical, socio-economic and cultural environments. The activities that will trigger an impact during each phase of the project were described in more detail in Section 4.4 of this report.

The physical area that will be disturbed by the proposed project activities and components are summarised in Table 6-3 below.

Table 6-3: Scale of physical disturbances associated with the proposed project

COMPONENT	PHYSICAL DISTURBANCE
Solar panels, roads and cables (ha)	116.18
Area of laydown yard (ha)	8.93
Area of substation (ha)	0.8
Total (ha)	**125.91**
Area suitable for development (ha)	345.3
Portion of area suitable for development (%)	*37%*
Study area (ha)	872.2
Portion of study area (%)	*14%*

In order to assess the significance of these impacts, use was made of a semi-quantitative impact assessment methodology which is based on an assessment of the following parameters:

- *Severity* – The magnitude of change from the current baseline status of the affected environmental, socio-economic or heritage aspect;
- *Spatial scale* – The physical area which is impacted on by the potential impact;
- *Duration* – The expected time period during which a potential impacted will be experienced; and
- *Probability* – The likelihood of occurrence of the impact, based on knowledge of the operating conditions and the type of activities that will be undertaken.

More detail on the quantitative ratings attached to each of the above parameters and the EIA methodology is attached in Appendix L.

6.3.1 Potential impacts on surface water systems

The main impacts on surface water systems will occur during the construction phase of the proposed project. These impacts were assessed to have **low** to **medium-low significance.** Activities that will result in changes to the surface water systems include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation;

- Levelling of the terrain where it is too undulating for installation of panels;
- Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and
- Generation and handling of domestic and industrial wastes.

Tables summarising the significance of the potential impacts on surface water systems during the project phases are presented below.

Nature of impact	**Changes to surface water flow dynamics due to the site preparation activities.**				
Description of impact	The removal of natural vegetation from the project development footprint, levelling of undulating areas and creation of hard and compacted surfaces will alter the natural topography and drainage patterns of the project site. The soil is susceptible to erosion. During rainfall events, disturbed surfaces would be susceptible to erosion and altered surface flow dynamics will aggravate the natural erosion process and sediment transport on-site and off-site. The project site is situated in an arid area which received very little rainfall and therefore, this impact will not occur frequently. However, flash floods could occur and erosion will occur after vegetation removal.				
Mitigation required	• It is recommended that the majority of site preparation activities be undertaken during the dry season; • A storm water management plan (Appendix K) should be implemented during the construction phase and operational phase; • No activities may be allowed with the delineated drainage lines and buffer zones; • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; and • Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan (Appendix K) during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre-Mitigation	Very serious (5)	Limited (2)	Project life (5)	Probable (4)	Medium-low (48)
Post-Mitigation	Limited damage (1)	Very limited (1)	Short-term (2)	Rare or improbable (2)	Low (8)
I&AP concern	Yes, a concern was voiced regarding storm water management of the site and a request made that a management plan be implemented to mitigate its impacts.				
Residual impacts	The surface water dynamics will be altered permanently during the life of the project; however, the resulting impacts (i.e. soil erosion and sediment transport) can be limited through the implementation of a storm water management plan.				

Nature of impact	**Contamination of downstream water resources during surface flow events.**
Description of impact	The main drainage direction of the site is towards the west via the main drainage channel. During surface flow events, increased sediment transported due to aggravated erosion from disturbed areas, as well as other contaminants (i.e. waste products, effluents, construction

Nature of impact	Contamination of downstream water resources during surface flow events.				
	materials) stored on the construction site, may result in contamination of downstream water resources.				
Mitigation required	• It is recommended that the majority of site preparation activities be undertaken during the dry season; • A storm water management plan (Appendix K) should be implemented during the construction phase; • Upslope water should be directed away from cleared areas, • Erosion of cleared areas needs to be prevented e.g. by placing rocks in this area, • Soil and vegetation needs to be replaced at decommissioning, • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; • Site remediation should be undertaken on a concurrent basis during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion; • All waste products must be managed according to a waste management plan (Appendix K); • All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented; • Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase; • The vehicle hard park area should be separated from clean water areas with berms or channels; and • Spillage should be managed through an emergency spill response plan (Appendix K).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre-Mitigation	Moderate (3)	Limited (2)	Short-term (2)	Probable (4)	Low (28)
Post-Mitigation	Limited damage (1)	Very limited (1)	Short-term (2)	Rare or improbable (2)	Low (8)
I&AP concern	No concerns regarding surface water contamination were voiced during the PPP.				
Residual impacts	Some erosion and surface water contamination could still occur during the construction phase and therefore, it is important to monitor water quality during surface water flow events to identify potential sources of contamination.				

6.3.2 *Potential impacts on soil and agricultural potential*

The main impacts on soils and the agricultural potential of the project site will occur during the construction phase of the proposed project. These impacts were assessed to have **low** to **medium-low significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation;
- Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard;

- The installation of solar PV panels and all associated infrastructure; and
- Generation and handling of domestic and industrial wastes.

Tables summarising the significance of the potential impacts on soils and agricultural potential during the project phases are presented below.

Nature of impact	**Loss of the soil resource to support existing land use and land capability.**				
Description of impact	Due to the sizes of the areas impacted upon, the loss of the soil resource as a medium of supporting the grazing capability of the land as well as forming part of a grazing rotational system with a farm management unit will be total for the life of the project. Due to the fact that the land cannot be replaced for the full life of the project, no mitigation is possible.				
Mitigation required	Soil needs to be stockpiled in such a manner that it can be used for rehabilitation after decommissioning.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Serious (4)	Very limited (1)	Project life (5)	Certain (7)	Medium-low (70)
Post- Mitigation	Serious (4)	Very limited (1)	Project life (5)	Certain (7)	Medium-low (70)
I&AP concern	Yes, a query was raised whether the existing use of the land for grazing could continue during the operational phase of the project. This will not be possible as the site will be fenced to protect the project from thefts and vandalism.				
Residual impact	After decommissioning it should be fairly achievable to restore the land to its original natural state, land capability and land use.				

Nature of impact	**Wind and water erosion of soils due to site preparation activities.**
Description of impact	The coarse graded soils that occur on the project site have little cohesion between particles and consequently, these soils are highly susceptible to water erosion, depending on the force applied at the time of impact. The fact that all of the designated sites are situated in low rainfall areas, does not exclude the possibility for potential erosion. One unexpected heavy rainstorm can initiate erosion on a slightly elevated bare patch. The very fine material in-between the fragments will be subjected to wind erosion where exposed and stockpiled. The fine-graded soils of southern part of the site will also be vulnerable to wind erosion when exposed after the removal of vegetation during site preparation and stockpiling for later use. Water erosion can only occur during the rainy season, while wind erosion can occur at any time of the year. Both types of erosion pose a threat to the soil as a support structure for sustaining a grazing land capability.
Mitigation required	• It is recommended that the majority of site preparation activities be undertaken during the dry season; • Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods; • A storm water management plan (Appendix K) should be implemented during the

Nature of impact	**Wind and water erosion of soils due to site preparation activities.**				
	construction phase; • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; • Re-vegetate soil stockpiles to avoid erosion losses; • Ensure stockpiles are placed on a free draining location so as to limit erosion loss; • Minimise the period of exposure of soil surfaces through planning; • Limit stockpile height – a safe height can be regarded as the height at which material can be placed without repeated traffic over already placed material; and • Site remediation should be undertaken on a concurrent basis during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Significant (6)	Limited (2)	Short term (2)	Probable (4)	Medium-low (40)
Post- Mitigation	Very serious (5)	Limited (2)	Short term (2)	Unlikely (3)	Low (27)
I&AP concern	No concerns regarding soil erosion were voiced during the PPP.				
Residual impact	Some erosion could still occur during the construction phase and therefore, it is important to monitor the site and soil stockpiles for visible signs of erosion (i.e. gullies, rills and bare patches).				

Nature of impact	**Soil compaction due to soil handling, stockpiling and vehicles use.**
Description of impact	Site clearance, topsoil removal from the substation and car parking yard footprints and soil stockpiling all have the potential to induce soil compaction in the case where heavy machinery will be used. Soil compaction is a function of the composition of the soil and relates to the grading. Well sorted fine-graded sand and silty soils will compact easier than soils with a coarse or loamy texture. In addition, the establishment of foundations for various construction works may also contribute to compaction. The coarse graded soils that occur on site have little potential for compacting, whilst the fine graded soil south of the riverbed may tend to compact under pressure.
Mitigation required	• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour; • Heavy vehicle movement over soil stockpiles should be prevented; • Traffic over project areas that have not been stripped of topsoil should be minimised; • Stripping operations should only be executed when soil moisture content will minimise the risk of compaction (i.e. during dry season); • During stockpiling, preferably use the 'end-tipping' method to keep stockpiled soils loose; • Limit stockpile height – a safe height can be regarded as the height at which material can be placed without repeated traffic over already placed material.; • Preserve looseness of stockpiled soil by applying fertiliser and seeding by hand; • Where topsoil is partially removed, the soil surface can be loosened via tillage/ripping; and • Soil should be loosened after construction activities, as per rehabilitation plan (Appendix K).

Nature of impact	Soil compaction due to soil handling, stockpiling and vehicles use.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Very significant (7)	Very limited (1)	Project life (5)	Probable (4)	Medium-low (42)
Post- Mitigation	Very serious (5)	Very limited (1)	Long-term (4)	Rare (2)	Low (20)
I&AP concern	No concerns regarding soil compaction were voiced during the PPP.				
Residual impacts	Soil compaction in some areas of the project development footprint will be inevitable. During site remediation and final rehabilitation, all soils will have to be ameliorated as per the rehabilitation plan (Appendix K).				

Nature of impact	Soils contamination due to spillage of hydrocarbons or wastes.				
Description of impacts	The potential for contaminating the soil resource is dependent on the presence of vehicles, machinery and processes involving various types of chemicals. For the planned site use very little of these are anticipated during the life span of the project. The potential impact is thus assumed to be minor and localised if it should occur (i.e. oil leakage from vehicles and earth moving machines).				
Mitigation required	• All waste products must be managed according to a waste management plan (Appendix K); • All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented; • Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase; • The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels; and • Spillage should be managed through an emergency spill response plan (Appendix K).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Significant (6)	Very limited (1)	Long-term (4)	Likely (5)	Medium-low (55)
Post- Mitigation	Moderate (3)	Very limited (1)	Immediate (1)	Rare (2)	Low (10)
I&AP Concern	No concerns regarding soil contamination were voiced during the PPP.				
Residual impact	It is advisable to conduct a soil monitoring plan after construction through collecting and analysis of soil samples at and around the site of potential impact				

6.3.3 Potential impacts on the ecology

The main impacts on the ecology will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-high significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;

- Access control and fencing of site during the construction and operational phases of the proposed project; and
- Site remediation activities.

Tables summarising the significance of the potential impacts on the ecology during the project phases are presented below.

Nature of impact	**Loss of habitat within indigenous natural vegetation types**				
Description of impacts	During the site layout design process, no-go areas along the drainage line running through the project area and other areas of high ecological sensitivity, such as the ridges and areas which include protected and red data species occur were delineated. This area will not be impacted by development. The least sensitive and favourable areas that were delineated and defined as suitable for development consist mostly of indigenous natural vegetation and is still considered significant in terms of SKEP and the CBA. During site preparation activities, 93% of this vegetation will be removed. There is also a possibility that Red Data or protected plant species that have not been identified in these areas during dry-season surveys could be destroyed. During site clearance, it is also likely that alien invasive and weed species will propagate on disturbed areas. Alien invasive species often tend to out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches.				
Mitigation required	• The no-go and high ecologically sensitive areas should be demarcated and avoided at all costs; • A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species; • No vegetation removal should be allowed outside the designated project development footprint; • A representative sample of indigenous plant species should be selected and relocated to an on-site nursery. During site remediation and rehabilitation, these species should be replanted on disturbed areas as per the rehabilitation plan (Appendix K); • Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network); and • An alien invasive and weed control programme should be implemented throughout the project lifetime (Appendix K).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Very significant (7)	Very limited (1)	Permanent (6)	Certain (7)	Medium-high (98)
Post- Mitigation	Significant (6)	Very limited (1)	Project life (5)	Certain (7)	Medium-high (84)
I&AP Concern	No concerns regarding the ecological impacts of the proposed project were voiced during the PPP.				

Residual impact	The destruction of indigenous vegetation in an area which is defined as a near natural landscape in terms of the CBA, in spite of existing disturbances (i.e. due to grazing and transmission line infrastructure) is unavoidable. This impact will continue throughout the project life, although remediation of the site to an ecological state better than the status quo is possible during the decommissioning phase if an alien invasive eradication programme is implemented (Appendix K).

Nature of impact	**Ecological impacts of access control and fencing of the site.**				
Description of impact	The erection of fences during the construction and operational phases of the proposed project will have a dual effect on ecology of the project site. Firstly, animal that graze the project site and contribute to existing pressures on the quality of the vegetation type will be excluded from the property and therefore, natural vegetation outside the project development footprint, but within the fence boundary will be allowed to recover from overgrazing. Secondly, fauna species that currently move freely across the project site will be prevented from doing so.				
Mitigation required	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Serious (4)	Limited (2)	Project life (5)	Certain (7)	Medium-high (77)
Post- Mitigation	Minor effect (2)	Very limited (1)	Project life (5)	Certain (7)	Medium-low (56)
I&AP Concern	Yes, a query was raised whether the existing use of the land for grazing could continue during the operational phase of the project. This will not be possible as the site will be fenced to protect the project from thefts and vandalism.				
Residual impact	The impact on loss of grazing for wild animals cannot be prevented. However, it is likely that positive changes to ecological state of no-go areas and highly sensitive ecological areas will be experienced due to fencing of the site and exclusion of these areas from grazing by livestock.				

6.3.4 Potential impacts on the visual environment

The main impacts on the visual environment will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low significance.** Activities that will result in impacts include:

- Increase in vehicular and other activity levels during the construction phase;
- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Fencing of the project site;
- Installation of the solar PV panels and construction of all related project infrastructure; and
- Generation of electricity from the PV panels during the operational phase of the project.

Tables summarising the significance of the potential impacts on the visual environment during the project phases are presented below.

<table>
<tr><th>Nature of impact</th><th colspan="5">Change to the existing visual character of the project site.</th></tr>
<tr><td>Description of impact</td><td colspan="5">The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur.

The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials. The pre-existing mining activities that are being carried out in the area will lead to some level of absorption capacity of the visual and sense of place landscape as a whole.

The visual impact from vegetation removal will not be severe since the pre-existing vegetation is low-lying and is not a dominant aspect of the dramatic and stark landscape. However, after installation of the solar PV panels, the impact significance will increase.</td></tr>
<tr><td>Mitigation required</td><td colspan="5">• No vegetation removal should be allowed outside the designated project development footprint;
• A representative sample of indigenous plant species should be selected and relocated to an on-site nursery. During site remediation and rehabilitation, these species should be replanted on disturbed areas as per the rehabilitation plan (Appendix K);
• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network); and
• An alien invasive and weed control programme should be implemented throughout the project lifetime (Appendix K);
• The possible tourism aspect of the solar PV power plant should be explored and promoted; and
• Exotic tree species have been introduced in the town of Aggeneys along avenues. Planting of fast-growing species between receptors and the proposed Solar PV Power Plant is an option for visual screening; however it is not advised considering water scarcity and the threat of spreading of alien invasive species.</td></tr>
<tr><td>Parameters</td><td>Severity</td><td>Spatial scale</td><td>Duration</td><td>Probability</td><td>Significant rating</td></tr>
<tr><td>Pre- Mitigation</td><td>Minor (2)</td><td>Local (3)</td><td>Project life (5)</td><td>Certain (7)</td><td>Medium-low (70)</td></tr>
<tr><td>Post- Mitigation</td><td>Minor (2)</td><td>Limited (2)</td><td>Project life (5)</td><td>Certain (7)</td><td>Medium-low (63)</td></tr>
<tr><td>I&AP Concern</td><td colspan="5">SANRAL voiced a concern regarding the visual impact of the infrastructure on motorists using the N14 national road.</td></tr>
<tr><td>Residual impact</td><td colspan="5">The visual impact that the proposed infrastructure will have is dependent on the subject who is viewing it. Visual impacts are rated based on social norms. For some people, the proposed infrastructure may be an indication of urbanisation, new renewable energy and economic upliftment in the area, in which case a positive visual impact will be experienced. For other receptors, the construction of the infrastructure might be a negative factor which could impede tourism in the area. Ideally the perceptions of people residing in each and every household, shop or restaurant that will potentially be affected would be included in the VIA.

For this purpose, the visual specialists attended the public information sharing meeting that was held during the scoping phase. The attendees were shown photos of other solar PV power plants and were made aware of how the potential infrastructure will look once constructed. No comments were made regarding the potential negative visual impact that the proposed infrastructure.</td></tr>
</table>

6.3.5 Potential impacts on the tourism industry

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. **Positive impacts will be experience and was assessed to have medium-high significance.**

Tables summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	**Impacts on the tourism industry.**				
Description of impact	Aggeneys falls into the Namakwa Tourist District. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. The Aggeneys town itself is not a major tourist attraction, as it mainly accommodates the employees of the mining industry in the area. The main tourist attraction in the regional area is the unique natural and cultural resources found in this area and the removal of indigenous vegetation from the project site will have a negative impact on eco-tourism. However, the tourism industry in general will not be negatively affected by the development of the proposed project, as the creation of energy tourism (i.e. renewable energy projects) is possible in the area. The power plant may become a unique tourist attraction for this area. Increased influx of workers may also boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider the establishment of a visitor's centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Probable (4)	Positive medium-low (36)
Post- Mitigation	Serious (4)	Provincial (5)	Project life (5)	Almost certain (6)	Positive medium-high (84)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

6.3.6 Potential impacts on traffic

The main impacts on the visual environment will occur during the construction phase of the proposed project. These impacts were assessed to have **low** to **medium-low significance.** Activities that will result in impacts include:

- Increase in vehicular and other activity levels during the construction phase; and
- Off-site accommodation of employees during the construction phase of the project.

Tables summarising the significance of the potential impacts on traffic during the project phases are presented below.

Nature of impact	**Increased traffic and impact on road surfaces.**				
Description of impact	Even if a 150 MW plant is developed, the construction phase truck trip generation will be less than 10 trucks per day (in and out combined). The total trip generation during the construction phase is not expected to exceed 30 trips per day, and during the operational phase it will be negligible. Vehicle trip generation is therefore of no concern from a traffic capacity point of view. Considering the design strength of national roads such as the N14, the impact on pavement life will be minimal and no mitigation is required.				
Mitigation required	• Considering the low traffic volumes and excellent sight distances at the accesses, no road widening is recommended; • Temporary warning signs should however be erected on the N14 on both sides of the accesses to indicate heavy vehicles turning (sign TW344/5 with appropriate wording); and • Care should however be taken to strengthen the N14 road edges with concrete edge beams at the accesses, each 40 m long, to prevent edge-breaks in the asphalt surface.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Limited (1)	Very limited (1)	Short-term (2)	Likely (5)	Low (20)
Post- Mitigation	Limited (1)	Very limited (1)	Short-term (2)	Probable (4)	Low (16)
I&AP Concern	No concerns regarding increases in traffic were voiced during the PPP.				
Residual impact	None, impacts will only be experienced during the construction phase.				

Nature of impact	**Safety impacts of traffic.**				
Description of impact	The construction phase of the proposed project will necessarily increase the volume of traffic in the vicinity of the project site, as well as change the nature of the traffic (there will be an increased number of heavy motor vehicles). This will likely result in the deterioration of roads (including an increase in potholes), which poses a safety risk for other road users. The mere presence of construction traffic may also result in an increased safety risk, or other roads users may feel as though they are at a greater safety risk, whether this is the actual case or not.				
Mitigation required	• Traffic and transportation rules should be implemented; • Directly affected individuals (including surrounding land owners) should be aware and satisfied with the contractor's traffic-related logistics; • Appropriate warning signs should be erected on the access road to the site; • Access roads should be maintained; and • All construction vehicles should be roadworthy and have the required permits and/ or licenses to carry their load.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (3)	Limited (2)	Short-term (2)	Likely (5)	Medium-low (35)
Post- Mitigation	On-going (3)	Limited (2)	Short-term (2)	Probable (4)	Low (28)
I&AP Concern	No concerns regarding increases in traffic were voiced during the PPP.				
Residual impact	None, impacts will only be experienced during the construction phase.				

6.3.7 Potential impacts on the socio-economic environment

The main impacts on the socio-economic environment will occur due to the creation of employment opportunities during the construction phase of the proposed project. **Positive impacts will be experience and were assessed to have medium-high significance.** Negative impacts were assessed to have a **medium-low** to **medium-high significance**.

Tables summarising the significance of the potential impacts on the socio-economic environment during the project phases are presented below.

Nature of impact	**Procurement of goods and creation of employment opportunities.**				
Description of impact	The construction phase will require a workforce of an estimated 490 individuals. Some of these job opportunities will be for unskilled labourers, which will be sourced from the town of Aggeneys. The majority of youth in this town have low educational and skills levels, thus many are unemployed and well suited to unskilled labour. Additionally, the construction phase will necessitate procurement of goods and services, many of which could be sourced from local companies, SMMEs or entrepreneurs, thereby enhancing the socio-economic benefits associated with the project's construction phase. The operational phase will require a workforce of an estimated 70 individuals. Some of these job opportunities will be for un- and semi-skilled labourers, which will be sourced from the town of Aggeneys. Given the low educational and skills levels in the local municipal area, as well as the high unemployment rate of particularly the youth, the small number of permanent long-term job opportunities constitutes a long-term (albeit small scale) socio-economic benefit for the directly-affected communities. Additionally, the use of local entrepreneurs, SMMEs and businesses further enhance the socio-economic benefit associated with the proposed project. Possible opportunities for local service providers include security, catering and cleaning services, maintenance of the accommodation facilities and operational equipment, as well as the provision of chemical toilets for use on site. Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building.				
Enhancement required	• The employment of locals (particularly women and previously disadvantaged individuals) should be encouraged and contractors should be contractually bound to giving preference to local persons; • Positions should only be filled by outsiders if the required skills are not available in the local study area; • Goods and services should only be sourced from outside the local municipal area if it is not available in this area; and • Orlight SA should create conditions conducive to the involvement of local businesses, entrepreneurs and SMMEs.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Likely (5)	Positive medium-low (45)
Post- Mitigation	On-going (3)	Municipal (4)	Medium-term (3)	Almost certain (6)	Positive medium-low (60)
I&AP Concern	Positive opinions were voiced regarding the potential of the proposed project to create opportunities for employment creation and local socio-economic development.				

Nature of impact	**Capacity building and skills training undertaken in local communities during the operational phase.**				
Description of impact	In addition to the skills training and capacity building for the employees and service providers utilised by the proponent, the proponent has a social responsibility towards the communities in which it operates.				
Enhancement required	• Orlight SA should actively seek to contribute positively to the local municipal area, and to build capacity and strengthen skills in this area; and • Orlight SA should either contribute to existing LED programmes implemented or planned by the local municipality, or initiate programmes of their own that are aligned with the local municipal LED objectives.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Low-level (1)	Local (3)	Medium-term (3)	Probable (4)	Positive low (28)
Post- Mitigation	On-going (3)	Municipal (4)	Permanent (6)	Almost certain (6)	Positive medium-high (78)
I&AP Concern	Positive opinions were voiced regarding the potential of the proposed project to create opportunities for employment creation and local socio-economic development.				

Nature of impact	**Inflow of migrant job-seekers.**
Description of impact	News of the proposed project and employment opportunities may result in an influx of job-seekers into Aggeneys and surrounding towns. This may result in one or more of the following: • The development of informal settlements due to the limited housing available in the area; • Social conflict between the incumbent and migrant populations, due to the incumbent population feeling that the migrants are taking opportunities away from them; • An increase in social pathologies (prostitution, conflict and violence, alcohol abuse, drug use and crime). • Petty crimes and stock theft; • Risks to the security of the project site and equipment or goods. The negative socio-economic impacts could be severe and include health impacts emanating from poor hygiene associated with the lack of basic services such as sanitation and refuse removal and an increase in the prevalence of HIV due to the presence of migrants. Although some of these workers will be from the local and surrounding towns, some migrant job-seekers will be employed. The presence of these individuals may have adverse impacts on the local communities, especially if the well-being of the workforce is not maintained. Disgruntled workers may strike, abuse alcohol, use drugs, engages in sexual relations with local women or come into conflict with others. Should the adverse impacts materialise, the incumbent population may retaliate by mobilising against the project. All of these impacts could have a significant impact on the successful completion of the construction of the proposed project.
Mitigation required	• An influx of job-seekers should be proactively discouraged by being transparent about the local employment policy to be adopted by the project and by requiring verification of local residence status from job applicants; • The establishments of informal housing/ or settlements should be actively prevented by implementing an effective system through which the erection of such structures can be

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Nature of impact	**Inflow of migrant job-seekers.**				
	reported and dismantled as soon as possible; • Adequate accommodation and ablution facilities should be made available to the construction workforce; and • A code of conduct for the construction workforce should be developed and they should be contractually bound to it and their working conditions should be fair.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (4)	Municipal (4)	Project life (5)	Almost certain (6)	Medium-high (78)
Post- Mitigation	Minor (2)	Local (3)	Medium-term (3)	Probable (4)	Low (32)
I&AP Concern	A concern was voiced that the Black Mountain Mine is proposing to expand in the near future and that there is already a shortage of housing in the town of Aggeneys.				
Residual impact	The influx of migrant job-seekers cannot be entirely prevented and this will result in residual impacts, mainly on existing public infrastructure and privately owned land (i.e. in the form of informal settlements).				

Nature of impact	**Project dependence and decommissioning of project infrastructure.**				
Description of impact	It is likely that the proposed project will be decommissioned after an operational lifespan of 20 years, implying that an estimated 70 jobs will be lost at this time. Although this is an inevitable element of such projects, it holds negative socio-economic implications for the town of Aggeneys, the workforce (especially the local unskilled and semi-skilled individuals) and local entrepreneurs, SMMEs and businesses. Additionally, vacated project infrastructure (such as the on-site office, technical service buildings and laydown yard) could potentially be used for inappropriate purposes (shelter), which may give rise to health and safety impacts affecting the local population.				
Mitigation required	• Employment opportunities during the decommissioning phase should go to as many local residents as possible, minimising the adverse effect the inevitable job losses will have on the local population; • Project infrastructure should be decommissioned appropriately and in consultation with the local municipality (Appendix K); • Retrenchments must be aligned with South African labour legislation, and workers should be notified in advance of impending retrenchments; and • Orlight SA should consider providing skills training to employees so as to improve their chances of gainful employment elsewhere.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (4)	Municipal (4)	Long term (4)	Certain (7)	Medium-high (84)
Post- Mitigation	On-going (3)	Municipal (4)	Long term (4)	Likely (5)	Medium-low (55)
I&AP Concern	No concerns regarding dependency on the project were raised during the PPP.				
Residual impact	Loss of jobs after the project has reached its full life time is unavoidable.				

6.3.8 Potential impacts on heritage

The main impacts on heritage of the project site will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation; and
- The installation of solar PV panels and all associated infrastructure.

Tables summarising the significance of the potential impacts on heritage during the project phases are presented below.

Nature of impact	**Impacts to archaeological material.**				
Description of impact	Although some archaeological material will be impacted, the impact is considered Low. Lack of site boundaries or associated organic remains reduces scientific value greatly.				
Mitigation required	• In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation. No mitigation has been suggested.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Negligible (1)	Limited (2)	Permanent (7)	Definite (7)	Medium-low (70)
Post- Mitigation	Negligible (1)	Limited (2)	Permanent (7)	Definite (7)	Medium-low (70)
I&AP Concern	No concerns regarding heritage resources were raised during the PPP.				
Residual impact	The cumulative impact of several such facilities will result in the potential destruction of large scatters of archaeological material.				

Nature of impact	**Impacts to cultural landscape.**				
Description of impact	The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur.				
Mitigation required	• No mitigation is possible.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Moderate (3)	Local (3)	Long term (4)	Definite (7)	Medium-low (70)
Post- Mitigation	Medium (3)	Local (3)	Long term (4)	Definite (7)	Medium-low (70)
I&AP Concern	No concerns regarding heritage resources were raised during the PPP.				
Residual impact	The cumulative impact of several such facilities will result in "industrialization" of the archaeological landscape.				

6.4 Cumulative impacts on the receiving environment surrounding Aggeneys

This section considers and assesses the possible cumulative effects that may occur due to the incremental effects of the proposed Aggeneys Solar PV Power Plant in combination with other projects within the vicinity.

In order to analyse the cumulative impacts associated with a project, the following activities were undertaken:

- The geographic scope of the cumulative impact resource or environmental aspect analysis was defined, based on the potential areas within which impacts from other present or future projects could combine with the project in question; and
- The combined effects of the proposed project in combination with past, present and future projects or activities were analysed in terms of the potential cumulative impacts within the relevant geographical extent.

There has been increased interest by various parties to develop renewable energy facilities throughout South Africa, including the Northern Cape Province with its abundance of solar irradiation and vast open spaces. The cumulative impact assessment therefore mainly focusses on the interaction between proposed renewable energy projects surroundings Aggeneys. Known renewable energy projects that are proposed within the vicinity are illustrated in Plan 17a and include:

- *Solar Capital* – Proposed solar PV development on the farm Blomhoek, located south of the Orlight SA project site; and
- *Aurora Power Solutions* – Two proposed solar PV developments, located 10 km south-west of and 71 km north-east of the Orlight SA project site.

Apart from potential renewable energy developments listed above and the possible expansion of the Black Mountain Mine, no other significant developments have been proposed or are likely to take place in the foreseeable future.

6.4.1 Cumulative impacts on surface water systems

Water is a scarce resource in this area and subsequently the cumulative water use requirements of existing and proposed developments must be taken into consideration. Pressures on surface water systems in the project area include the existing and proposed expansion of mining operations outside the town of Aggeneys, as well as the future solar PV developments described above. The developments fall wholly or partly within the same quaternary catchment as the proposed Orlight SA project (D82C) and cumulative impacts on the catchment could therefore be severe.

All of these developments will result in changes to the natural topography of the area, which will also result in changes to the drainage patterns in the area. Impacts would include increased susceptible to erosion, aggravated erosion processes and sediment transport in the area. However, these impacts will be negligible for all the proposed solar PV developments, especially if major drainage lines are avoided.

<u>Depending on the cumulative water requirements for the projects, there may be an increase in demand for water during the construction and operational phases of the renewable energy projects.</u>

6.4.2 Cumulative impacts on agricultural potential and land use

The area in which the proposed solar PV development will occur occupy a total surface area of approximately 20 465 ha. Even though most of the land within the Khai-Ma Municipality is currently used for grazing of livestock, the cumulative impact on loss of grazing land is considered negligible, due to the inherently low grazing capacity of the land and the fact that alternative land uses are limited.

6.4.3 Cumulative ecological impacts

The significant ecological features known to occur in the region primarily occur in the inselbergs and unique habitats of rocky outcrops. Due to the unsuitability of such terrains for development of solar PV project, these features are unlikely to be impacted.

A possible cumulative impact that should be considered is the loss of capacity of the area to perform provisioning, regulating, supporting and cultural ecosystem functions. The proposed solar PV development sites all fall within SKEP planning domain and areas that have an irreplaceability status of five or higher, which indicates areas that have a high priority in terms of achieving conservation targets. The incremental effects of developing these areas could introduce a cumulative impact that may negatively affect biodiversity targets on a regional scale.

6.4.4 Cumulative visual impacts

One of the proposed Aurora Power Solutions sites and the Solar Capital site are both bordering on, or are most likely within a 5 km radius of the N14 national road. All of the proposed developments are likely to be within a 15 km radius of the town of Aggeneys itself. These projects will introduce potentially significant cumulative impacts on receptors traveling on the N14 national road. The solar PV development will alter the sense of place and sense of remoteness of the visual landscape, since the solar panels of the proposed parks will be new, industrial and dominant structures within the scenery. They may however be a good symbol for progress as South Africa taps into its natural legacy of solar power and renewable energy production.

There is already an existing mining operation within the vicinity of the proposed solar plants/parks and there is a possibility that mining activities will expand, introducing additional negative visual impacts.

6.4.5 Cumulative impacts on tourism

In South Africa, tourism's contribution to the country's gross domestic product (GDP) rose from 2.7% to 7.9% during the period between 2009 and 2010. The tourism sector is relatively labour-intensive, has less barriers to development and has subsequently been identified as vital to ensuring the country achieves its goals set out in the Accelerated and Shared Growth Initiative for South Africa , which aims to halve unemployment and poverty in the country by 2014. Over the new few years, the South African government aims to increase the tourism sector's contribution to 12% of GDP (Media Club South Africa, 2012).

Although the tourism industry is one of the fastest growing industries in South Africa, it is dependent on variable factors, such as fluctuating economies and natural disasters, which cannot be predicted or managed. Even though these variables were not taken into consideration in this assessment, economic and natural variables were considered in totality due to its potential negative impact on a local tourism industry. A detailed economical assessment could not be conducted for the local tourism industries, due to time constraints to the ESIA process. The capital growth and potential financial impact on the economies of the proposed project areas were thus not calculated. From a holistic tourism and sustainability point of view, the aforementioned limitation and knowledge gaps did not affect the objectives and outcomes of this assessment.

The tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of solar PV projects in the vicinity of Aggeneys.

In order to maximise the benefits associate with the establishment of an energy-focused tourism industry, the different proponent of solar PV project in the area should consider the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

6.4.6 Cumulative impacts on traffic

The cumulative impacts on traffic could be potentially significant during construction phase of the proposed projects, if all of these projects are constructed during the same time. A fair amount of traffic will arise on the N14 national road, which is the presumed transport route, if all three of the proposed parks that are within a 15 km radius of one another are constructed simultaneously.

The total trip generation of the sites are likely to be 30 or less trips per day during construction and therefore, the impacts on transport infrastructure is not seen as significant.

6.4.7 Cumulative impacts on the socio-economic environment

The cumulative impacts of the proposed projects on socio-economic development in the Khai-Ma local municipality are likely to have significant positive cumulative impacts. The current unemployment rate (13.6%) is likely to decrease as employment opportunities, prospects for basic skills development and capacity building activities.

6.4.8 Cumulative impacts on archaeology and heritage

The most significant aspect of the archaeological landscape in the area is the Gamsberg, which is located 2.5 km east of the proposed facility. Morris (2010) has discussed the importance of the Gamsberg as a potential "genocide site for the San" and the possibility (albeit unlikely) of its incorporation into a /Xam and Khomani Heartland World Heritage Site. Morris (pers. com.) points to the impact of mining both at Aggeneys Mountain and at Gamsberg and the fact that the area has already been transformed by not only mining, but also by a substation and transmission lines.

7 ENVIRONMENTAL IMPACT STATEMENT

This report presents the findings of the EIA process that was undertaken for the development and operation of the Aggeneys Solar PV Power Plant proposed by Orlight SA.

The following Environmental Impact Statement (EIS) contains a summary of the main findings of the EIA process and recommendations of the EAP.

Public participation process

A comprehensive and fully transparent PPP was undertaken to ensure that I&APs were afforded the opportunity to participate in the EIA process.

I&APs generally had no objections regarding the proposed Aggeneys Solar PV Power Plant and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Integrated sensitivity maps

Integrated sensitivity maps were prepared for the study area, based on the findings of environmental, socio-economic and cultural assessments undertaken for the project as input into the project design process.

It is recommended that the following areas be avoided during project development:

- *Ridges and areas which include protected and red data species;*
- *A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries;*
- *A 30 m buffer zone around the N14 road reserve;*
- *A buffer zone of 47 m around the existing 220 kV Eskom transmission line and 22 m around the existing 66 kV Eskom transmission line that run across the project site. An additional Eskom servitude was identified following public review of the draft EIA report, which is the proposed Eskom Aggeneys – Paulputs 220 kV line to be constructed within a 47 m wide servitude; and*
- *Visually sensitive areas north of the major drainage line.*

Site design process

A study area of 872.21 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 322 ha in extent.

The optimal generation capacity of the power plant, based on a conservative estimate of the required surface area for solar PV infrastructure development (4 ha surface area per MW generation capacity), was determined to be 80 MW.

Site layout plans have been developed for a 70 MW project, which is well within the available area that was delineated to be suitable for infrastructure development.

Soil and agricultural potential

The agricultural potential of the soils present in the study area is very low, with land capability restricted to grazing. Soils in the project area also show high susceptibility to erosion by wind and water.

Despite these factors, the overall impacts on soil resources and land capability of study area can be mitigated to an acceptable level, conditional to the exclusion of the drainage lines from the development footprint.

Ecological sensitivity and biodiversity

During the field assessment, the study area was found to be under pressure from current and previous land use, most notably grazing. Despite these threats it was found that the natural habitat present within the study areas provide an ecological service to the plant and animal species encountered during the field survey and very possibly to the plant and animal species that were identified during the desktop survey. This was evident from the diversity of plant and animal species that were encountered in certain landscapes of the study area.

The vegetation/habitat units identified were all responsible for varied degrees of natural to transformed habitat present; in turn this resulted in the mosaic effect with regards to the vegetation which in turn has an effect on the animal species present.

The opportunity to maintain or increase the ecological functioning of the study area exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the natural habitat types in the no-go areas and removing the threats (i.e. grazing by livestock and alien species invasion), the ecological functioning of the area will be positively affected, thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonise.

Therefore, it is recommended that a management plan be implemented which will firstly monitor ecological status of the project site and secondly, that the destruction of the sensitive species and landscapes areas such as drainage lines, ridges and plains should be avoided. An alien invasive and weed control programme will be an integral part of the success of efforts to increase the ecological functioning of the study area.

Visual sensitivity

The Aggeneys study area is close to the town of Aggeneys town, but the town is a mining town and existing construction related activities contributes to the landscape not being completely pristine. Therefore the landscape type will not be completely transformed by the proposed Solar PV Power Plant.

It is believed that the identified visual impacts associated with the proposed Solar PV Power Plant, should not introduce limitations to the construction of the proposed project based on the current landscape context.

Tourism and alternative land uses

The local area in which the project is located has the potential to improve its existing tourism industries and develop new product and services in their local tourism industry in terms of ecotourism and agricultural tourism, as well as leisure tourism. In consultation with local communities and stakeholders, there is a general consensus on the positive impacts that the proposed development may have, which include:

- Potential poverty reduction through economic diversification;
- Job creation/ employment opportunities during the construction and operational phases;
- Effective use of natural resources and sustainable development;
- Creation of opportunities for local youth to be educated in environmental issues;
- Diversification of existing tourism industry/ markets (e.g. business tourism and renewable energy);
- Support and enhance existing tourism establishments (e.g. catering and accommodation); and
- Enhance tourism and investment opportunities (e.g. multiplier effect of increased business).

Tourism products and services needs to be developed in the context of the provincial and local tourism strategies and local economic development plans. These, amongst others, may include initiatives such as transportation services, travel agencies, accommodation, guided tours and tour guides, renewable energy tourism services and hospitality.

Through integrated marketing opportunities and business development support, the local area should be able to optimise the positive impacts and benefits that increased business (such as renewable energy projects) may bring.

Heritage impacts

The stone artefact scatters which were recorded in the study area are considered to be of minor significance and therefore, although some archaeological material will be impacted, the impact is considered to be low. There are no issues relating to the built environment (e.g. buildings or structures older than 60 years which are protected by the NHRA).

In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation. No other mitigation has been suggested.

Overall recommendation

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The EAP and specialist team supports the decision for an environmental authorisation.

The following conditions would be required in the environmental authorisation for the proposed project:

- All mitigation measures described in this report and in the EMP (Appendix K) should be implemented to ensure that the negative impacts of the project are mitigated and that positive impacts are enhanced;
- All no-go areas, sensitive areas and prescribed buffer zones that were defined unsuitable for development purposes should be avoided;
- A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;
- The implementation of the EMP (Appendix K) is considered a key factor to the achievement of the environmental standards and long-term sustainability of the project. For this purposed, the EMP should form part of the contractual agreement with the contractors that are appointed for development and operation of the proposed project;
- The EMP (Appendix K) should be considered a living document and should be updated during the project phases as more information on the significance of impacts and effectiveness of mitigation measures becomes known.

8 REFERENCES

AZEF, 2010: Arid Zone Ecology Forum, Biomes. Available [online]: at: http://www.azef.co.za/biomes_karoo.htm (Accessed 11 January 2012).

BARNES, K. N., 2000: *The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland.* Johannesburg: Birdlife South Africa.

BEAUMONT, P.B., SMITH, A.B. AND VOGEL, J.C., 1995: Before the Einiqua: The archaeology of the frontier zone. In SMITH, A.B. (Ed.): Einiqualand: *Studies of the Orange River frontier.* Cape Town: UCT Press, 236-64.

BGIS. 2010. Succulent Karoo Ecosystem Programme. Availability [Online] at: http://www.bgis.sanbi.org.za/ (Accessed 11 January 2012).

CHAMBER OF MINES & COALTECH RESEARCH, 2007: Guidelines for the rehabilitation of mines land. Johannesburg: Chamber of Mines.

ESLER, K.J., MILTON, S.J., AND DEAN, W.R.J., (Eds.) 2010: Karoo Veld, Ecology and Management. Pretoria: Briza Publications.

MC CANN, K., 2000: Blue Crane (*Anthropoides paradiseus*). In BARNES, K.N. (Ed.): *The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland,* 92-4. Johannesburg: BirdLife South Africa.

MORRIS, D., 2010: Cultural Heritage Assessment: Gamsberg. Supplementary observations to a previous specialist report on archaeological resources. Unpublished report.

MORRIS, D., 2011: Black Mountain Concentrated Solar Power Facility development at Aggeneys, Northern Cape. Unpublished report for Aurora Power Solutions (Pty) Ltd.

MUCINA, L. AND RUTHERFORD, M.C., 2006: The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia, 19*. Pretoria: SANBI.

NIENABER, G.S. AND RAPER, P.E., 1977: Toponymica Hottentotica. SA Naamkundesentrum. RGN Naamkudesreeks 6.

SHEARING, D., 1997: Karoo. *South African Wildflower Guide, 6*. Cape Town: Botanical Society of South Africa.

SKEP, 2010: Succulent Karoo Ecosystem Program. Available [online] at: http://www.skep.org.za/ (Accessed 12 January 2012).

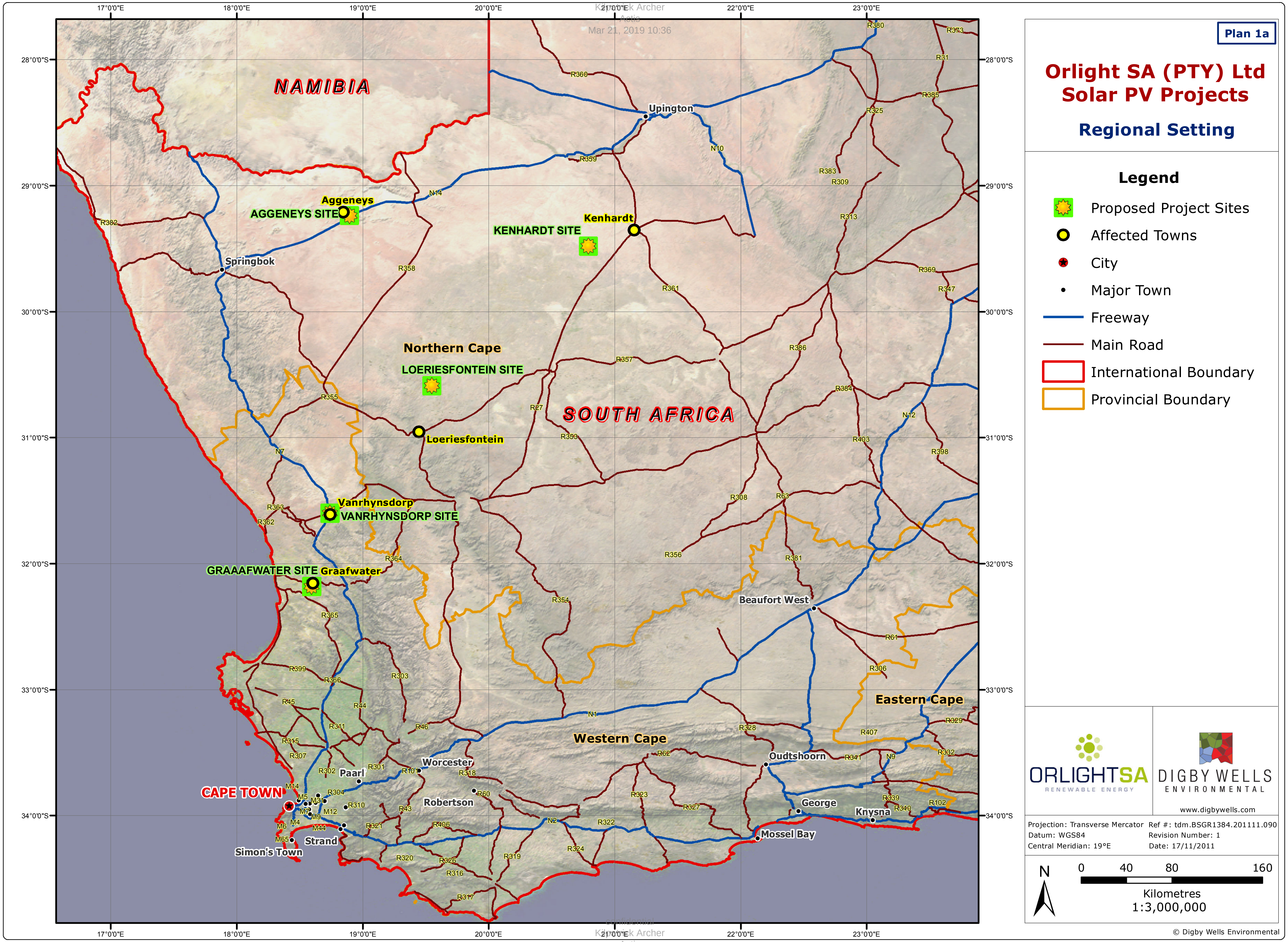
STATS SA, 2007: Community Survey. Pretoria: Statistics South Africa.

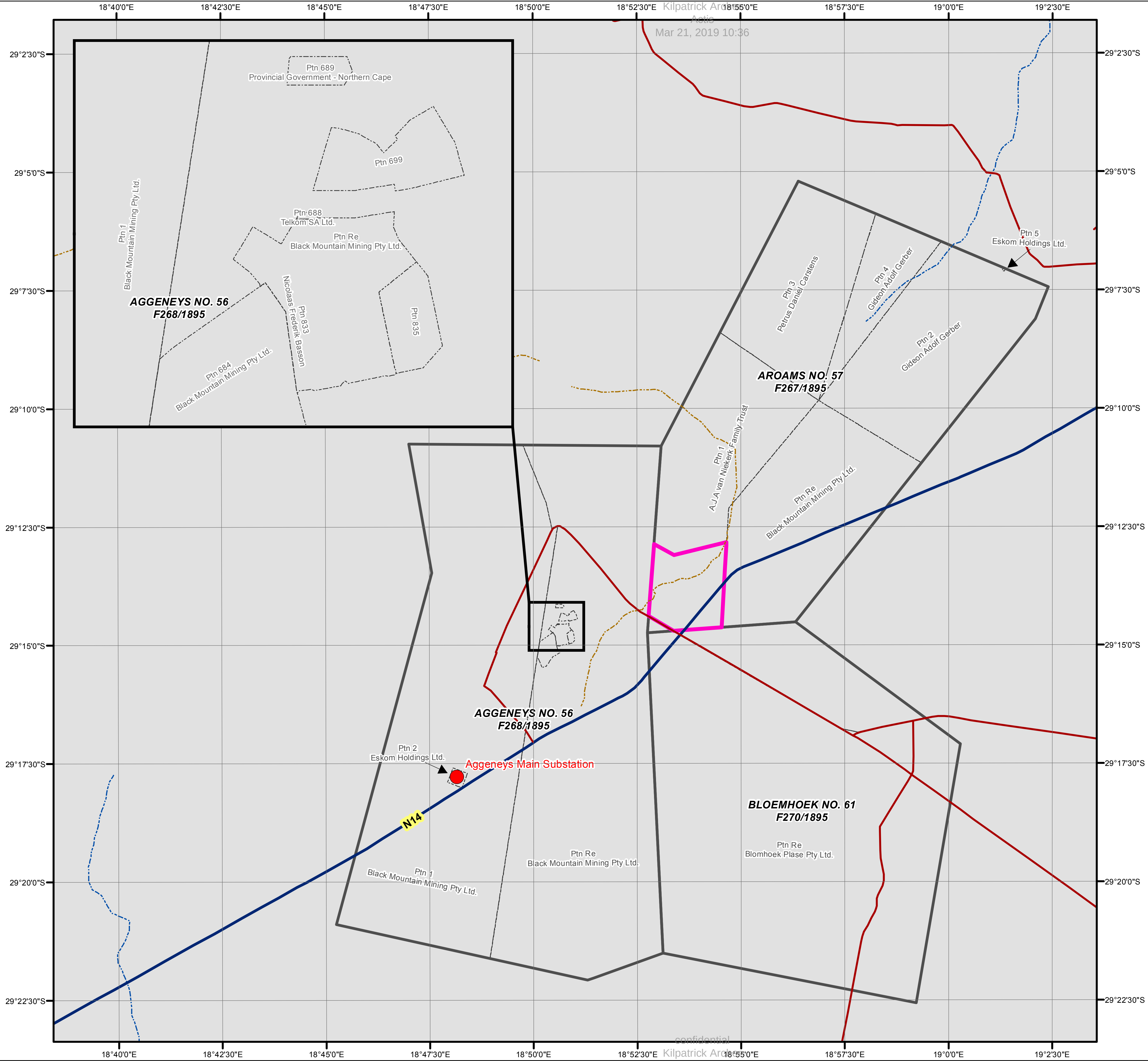
VAN WYK, B., VAN OUDTSHOORN, B. AND GERICKE, N., 1997: Medicinal Plants of Southern Africa. Pretoria: Briza Publications.

VAN WYK, E., BREEN, C.M., ROUX, D.J. ROGERS, K.H., SHERWILL, T. & VAN WILGEN, B.W., 2006: The Ecological Reserve: Towards a common understanding for river management in South Africa. *Water SA, 32(3),* 403-9.

WATER RESEARCH COMMISSION (WRC), 2011: Implementation Manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11.

Appendix A: Plans


Plan 1a
Orlight SA (PTY) Ltd
Solar PV Projects
Regional Setting
Legend
Proposed Project Sites
Affected Towns
City
Major Town
Freeway
Main Road
International Boundary
Provincial Boundary
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: WGS84
Central Meridian: 19°E
Ref #: tdm.BSGR1384.201111.090
Revision Number: 1
Date: 17/11/2011
N
0 40 80 160
Kilometres
1:3,000,000
© Digby Wells Environmental
NAMIBIA
SOUTH AFRICA
Northern Cape
Western Cape
Eastern Cape
AGGENEYS SITE
Aggeneys
KENHARDT SITE
Kenhardt
LOERIESFONTEIN SITE
Loeriesfontein
VANRHYNSDORP SITE
Vanrhynsdorp
GRAAFWATER SITE
Graafwater
CAPE TOWN
Upington
Springbok
Beaufort West
Oudtshoorn
George
Knysna
Mossel Bay
Worcester
Paarl
Robertson
Strand
Simon's Town
17°0'0"E
18°0'0"E
19°0'0"E
20°0'0"E
21°0'0"E
22°0'0"E
23°0'0"E
28°0'0"S
29°0'0"S
30°0'0"S
31°0'0"S
32°0'0"S
33°0'0"S
34°0'0"S



Plan 2a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Land Tenure

Legend

- Study Area
- Substation
- Perennial River
- Non-Perennial River
- Dry river
- Gravel Roads
- National Roads
- Farm Boundaries
- Farm Portions

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

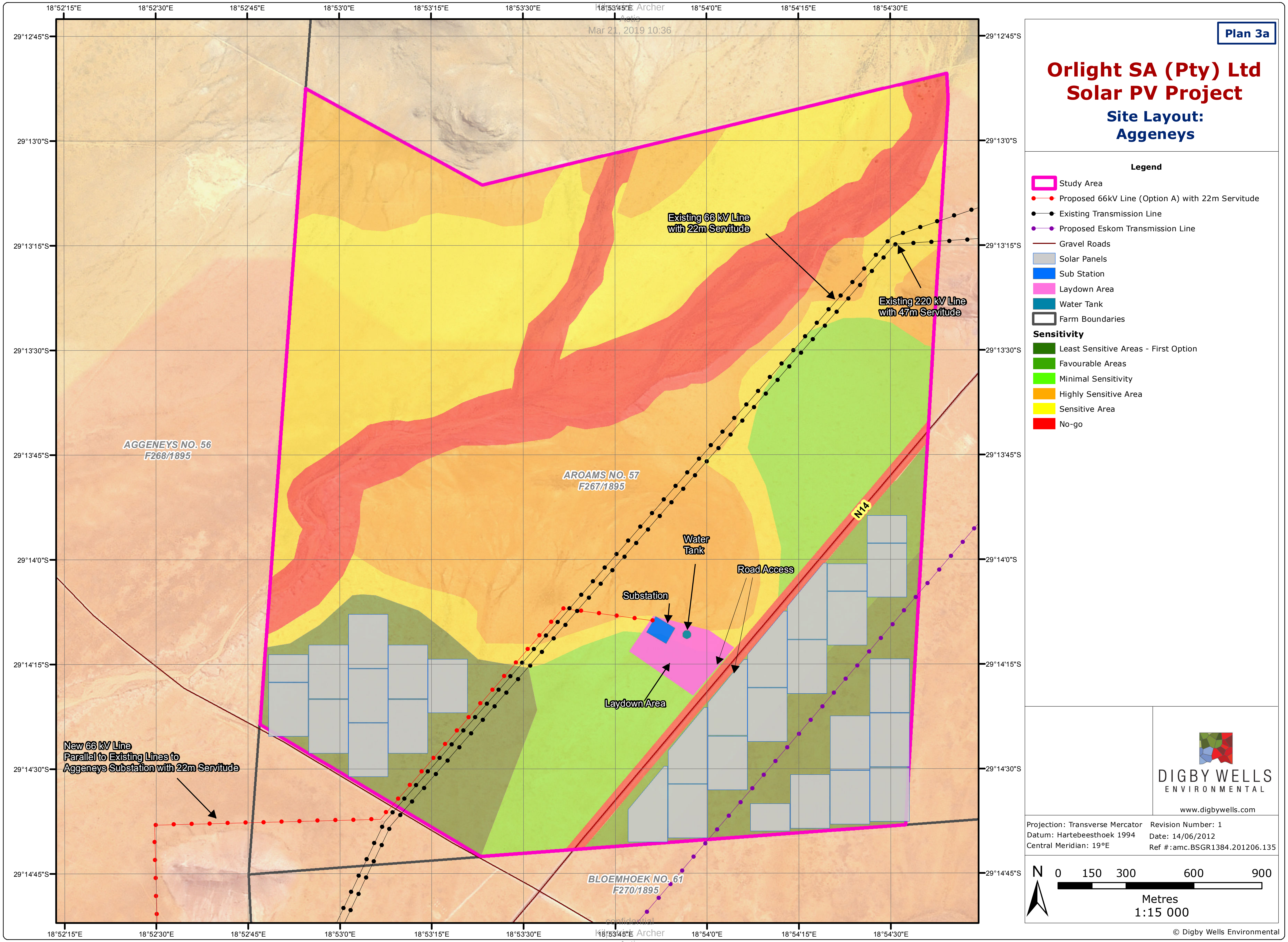
www.digbywells.com

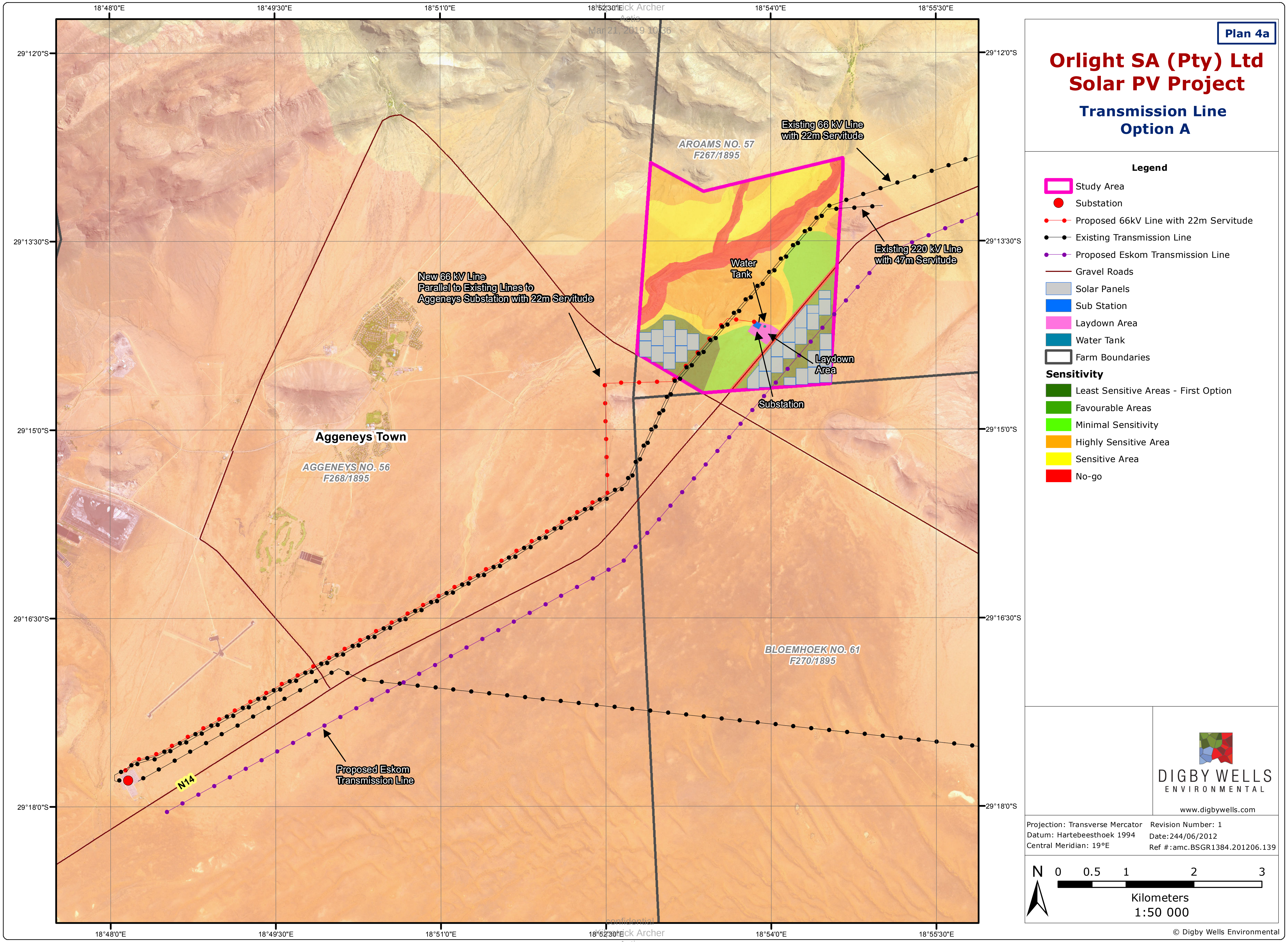
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E

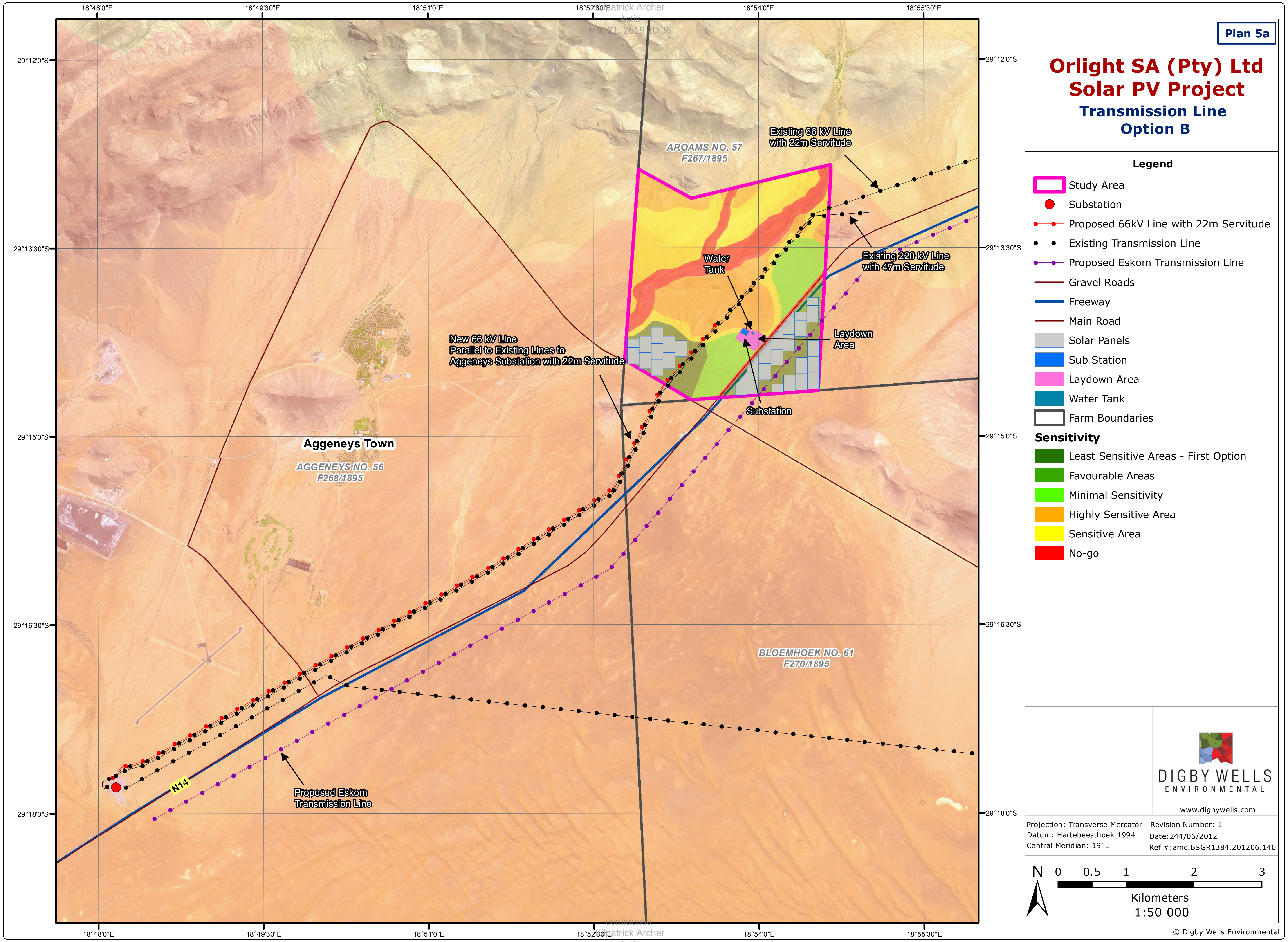
Revision Number: 1
Date: 17/01/2012
Ref #:amc.BSG1384.201201.038

N

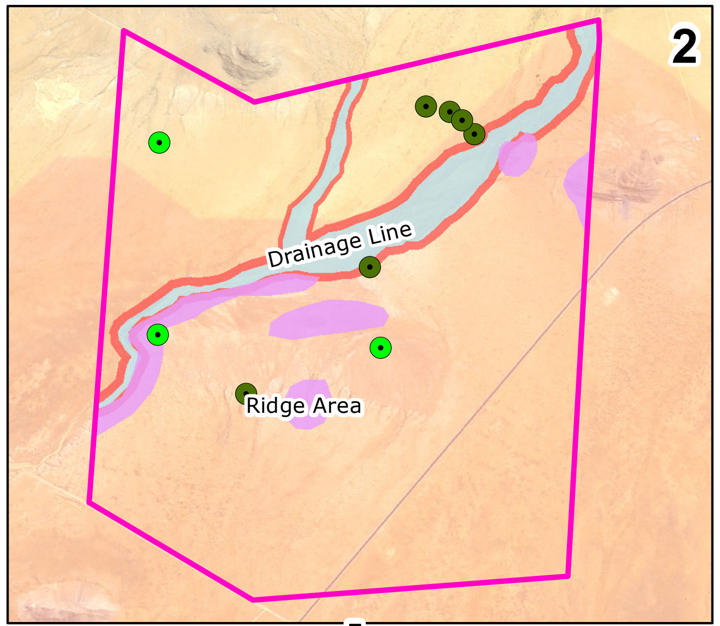
0 2 4 8
Kilometres
1:150,000


Plan 3a
Orlight SA (Pty) Ltd
Solar PV Project
Site Layout:
Aggeneys
Legend
Study Area
Proposed 66kV Line (Option A) with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
Existing 66 kV Line
with 22m Servitude
Existing 220 kV Line
with 47m Servitude
AGGENEYS NO. 56
F268/1895
AROAMS NO. 57
F267/1895
BLOEMHOEK NO. 61
F270/1895
N14
Water
Tank
Road Access
Substation
Laydown Area
New 66 kV Line
Parallel to Existing Lines to
Aggeneys Substation with 22m Servitude
18°52'15"E
18°52'30"E
18°52'45"E
18°53'0"E
18°53'15"E
18°53'30"E
18°53'45"E
18°54'0"E
18°54'15"E
18°54'30"E
29°12'45"S
29°13'0"S
29°13'15"S
29°13'30"S
29°13'45"S
29°14'0"S
29°14'15"S
29°14'30"S
29°14'45"S
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date: 14/06/2012
Ref #:amc.BSGR1384.201206.135
N
0 150 300 600 900
Metres
1:15 000
© Digby Wells Environmental

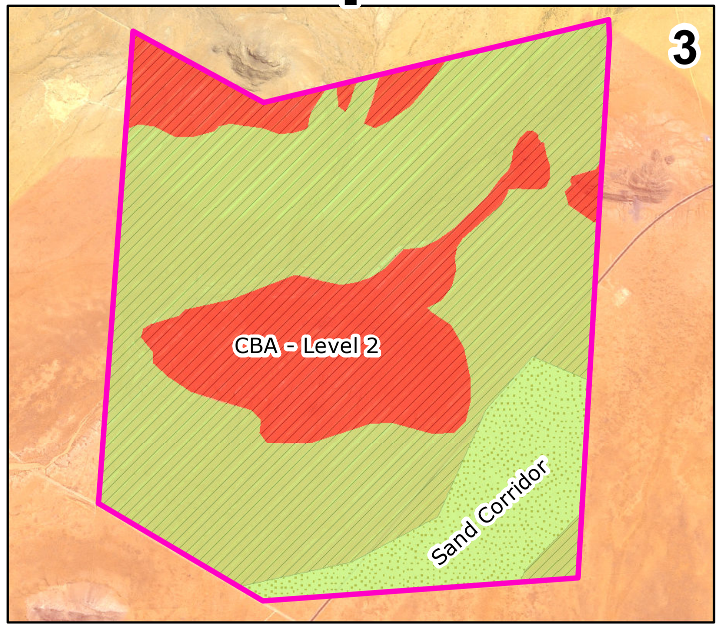

Plan 4a
Orlight SA (Pty) Ltd
Solar PV Project
Transmission Line
Option A
Legend
Study Area
Substation
Proposed 66kV Line with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
Existing 66 kV Line with 22m Servitude
AROAMS NO. 57 F267/1895
Existing 220 kV Line with 47m Servitude
Water Tank
New 66 kV Line Parallel to Existing Lines to Aggeneys Substation with 22m Servitude
Laydown Area
Substation
Aggeneys Town
AGGENEYS NO. 56 F268/1895
BLOEMHOEK NO. 61 F270/1895
Proposed Eskom Transmission Line
N14
18°48'0"E
18°49'30"E
18°51'0"E
18°52'30"E
18°54'0"E
18°55'30"E
29°12'0"S
29°13'30"S
29°15'0"S
29°16'30"S
29°18'0"S
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date:244/06/2012
Ref #:amc.BSGR1384.201206.139
N
0 0.5 1 2 3
Kilometers
1:50 000
© Digby Wells Environmental


Plan 5a
Orlight SA (Pty) Ltd
Solar PV Project
Transmission Line
Option B
Legend
Study Area
Substation
Proposed 66kV Line with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Freeway
Main Road
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date:244/06/2012
Ref #:amc.BSGR1384.201206.140
N
0 0.5 1 2 3
Kilometers
1:50 000
© Digby Wells Environmental
18°48'0"E
18°49'30"E
18°51'0"E
18°52'30"E
18°54'0"E
18°55'30"E
29°12'0"S
29°13'30"S
29°15'0"S
29°16'30"S
29°18'0"S
AROAMS NO. 57
F267/1895
Existing 66 kV Line
with 22m Servitude
Existing 220 kV Line
with 47m Servitude
Water
Tank
Laydown
Area
Substation
New 66 kV Line
Parallel to Existing Lines to
Aggeneys Substation with 22m Servitude
Aggeneys Town
AGGENEYS NO. 56
F268/1895
BLOEMHOEK NO. 61
F270/1895
N14
Proposed Eskom
Transmission Line

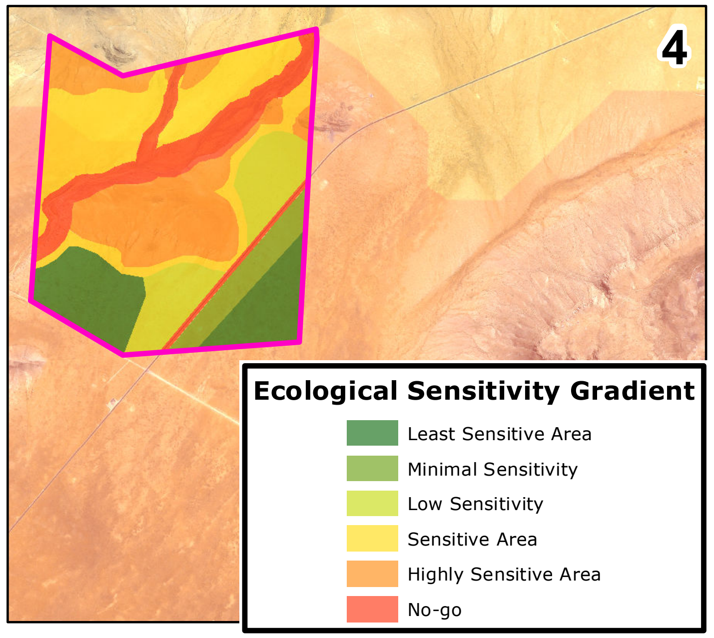
Plan 6a



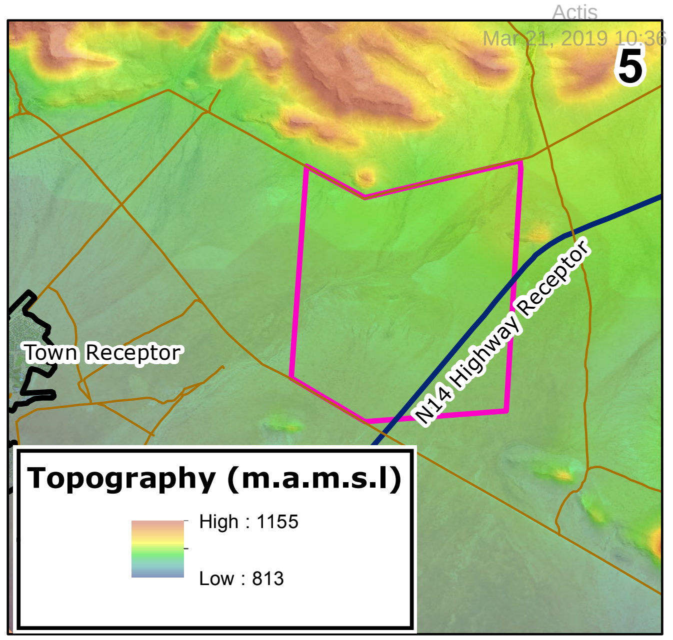
+



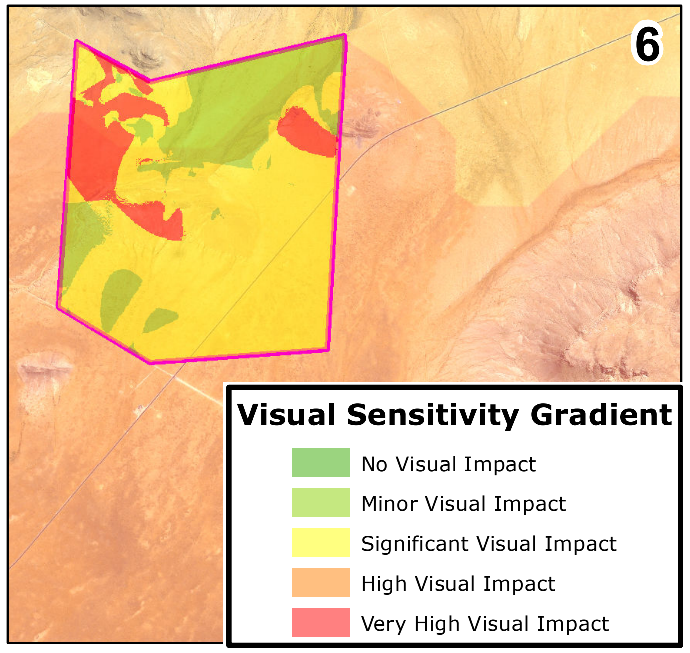
=



+



Viewshed models run for all potential receptors based on 5 km radius Digital Elevation Models. All receptor viewsheds synthesised and weighted



+

Sensitivity Delineation Process

1. Fauna and Flora (F&F) and aquatic specialists collect field information on site

2. Field F&F and aquatic information transformed into GIS data

3. Existing F&F data reasearched, accessed and acquired

4. Field and existing F&F and aquatic data synthsised to create one comprehensive ecological sensitivity gradient GIS layer

5. Viewshed models run for each potential receptor based on the Digital Elevation Model (DEM) for the areas

6. All vieshed results synthesised to create one comprehensive visual sensitivity gradient GIS layer

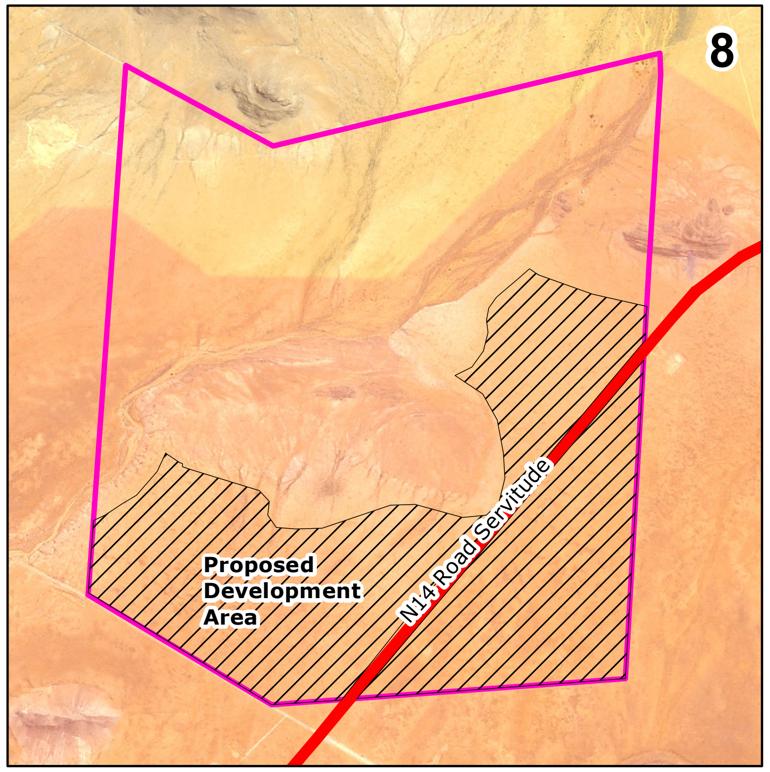
7. Technical considerations taken into account (i.e. road servitudes and Mw output targets of Solar PV Parks)

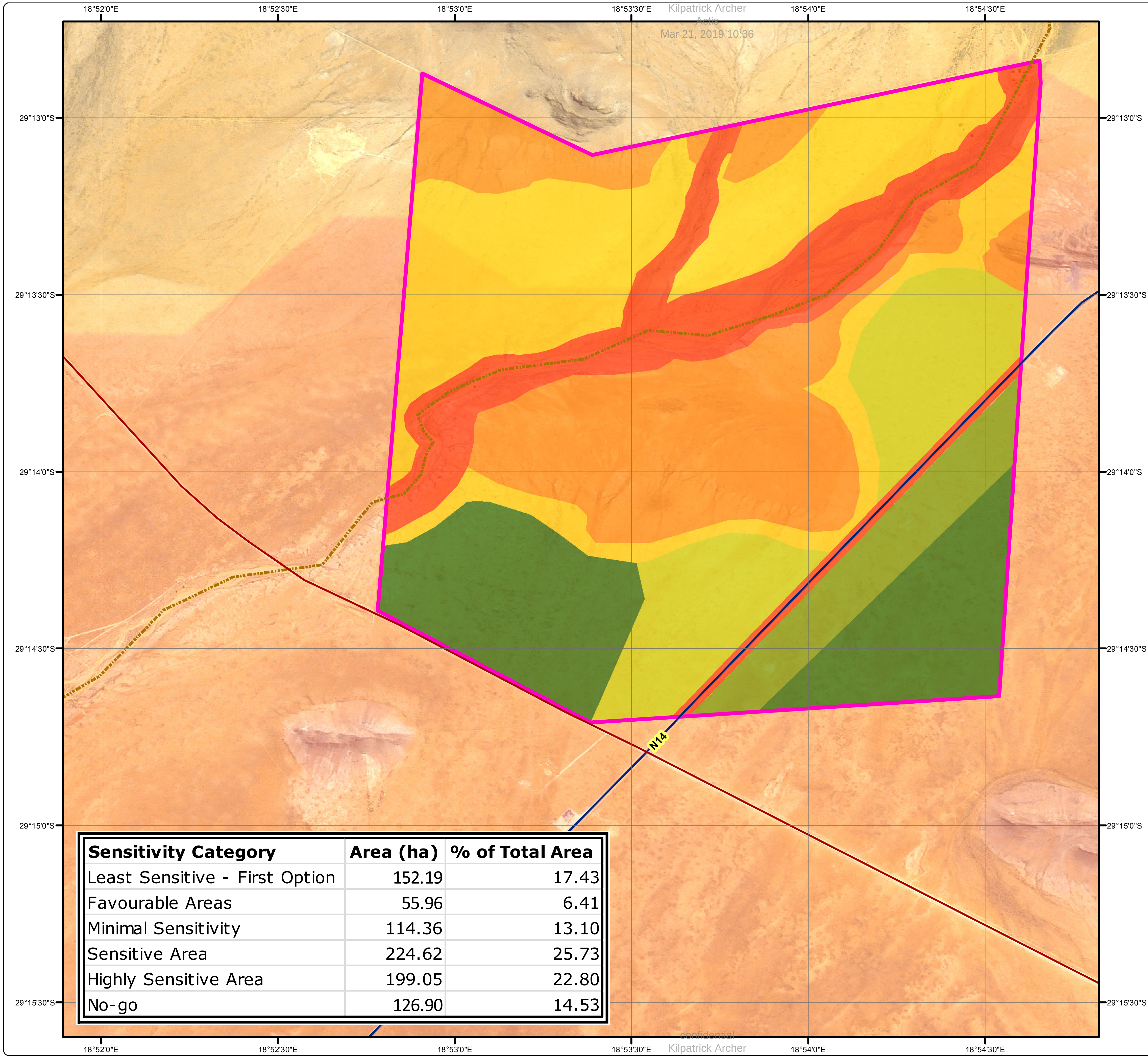
8. Ecological and visual sensitivity GIS layers combined / overlaid, taking technical considerations into account, to delineate areas for potential development

7

Technical considerations (e.g. road servitude and Mw outputs)

=





Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	152.19	17.43
Favourable Areas	55.96	6.41
Minimal Sensitivity	114.36	13.10
Sensitive Area	224.62	25.73
Highly Sensitive Area	199.05	22.80
No-go	126.90	14.53

Plan 7a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Integrated Sensitivity Map

Legend

- Study Area
- Minor Roads
- Main Road
- Dry river

Sensitivity Ratings

- Least Sensitive Areas - First Option
- Favourable Areas
- Minimal Sensitivity
- Sensitive Area
- Highly Sensitive Area
- No-go

NB: Area susceptible to erosion

ORLIGHTSA RENEWABLE ENERGY

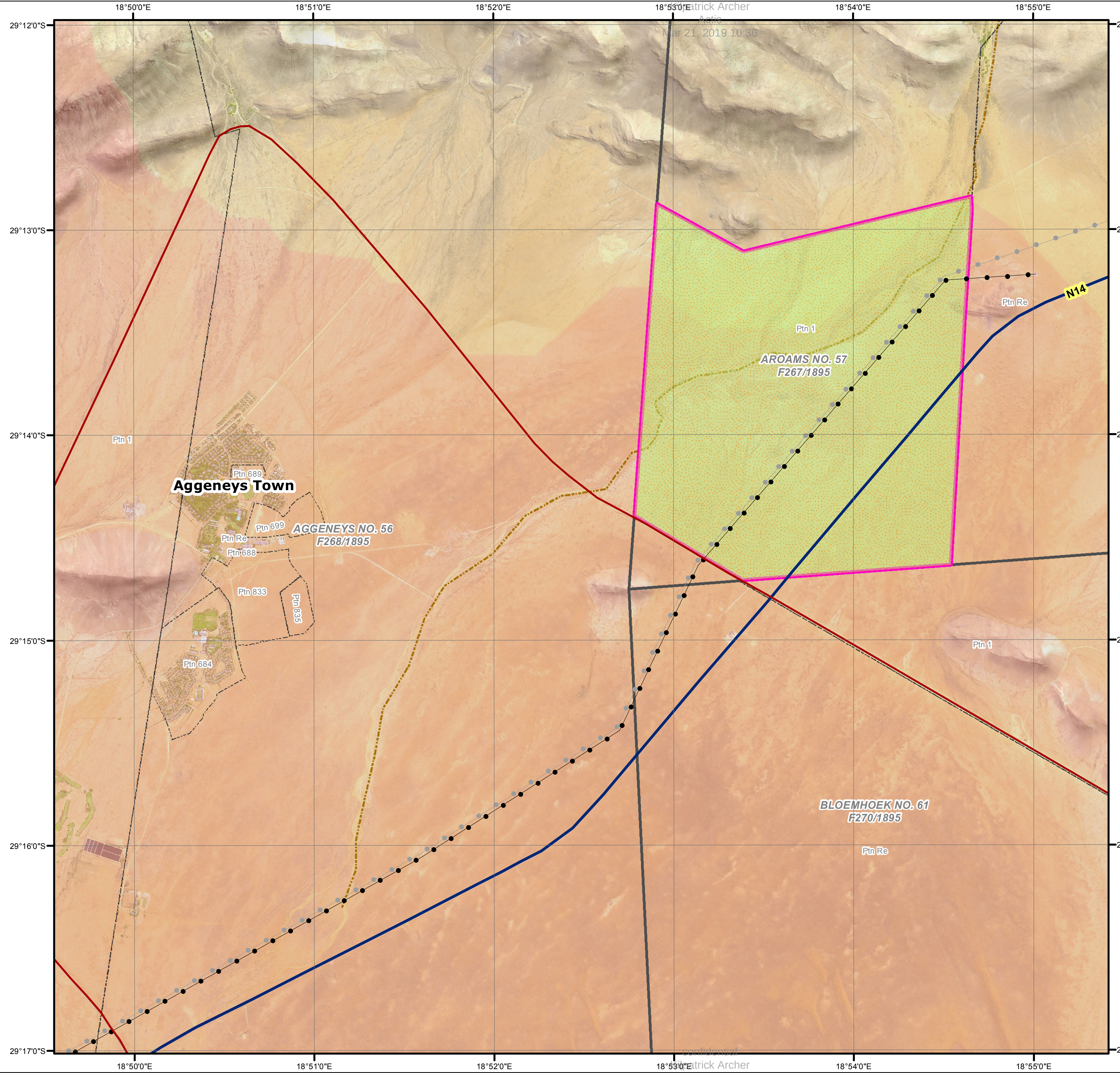
DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201202.065
Revision Number: 2
Date: 13/02/2012

N 0 0.25 0.5 1
Kilometers
1:20 000



Plan 8a

Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Current Land Use

Legend

- Study Area
- Existing 220 kV Line with 47m Servitude
- Existing 66 kV Line with 22m Servitude
- Gravel Roads
- National Roads
- Dry river
- Farm Boundaries
- Farm Portions

Current Study Area Land Use

- Grazing Area

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

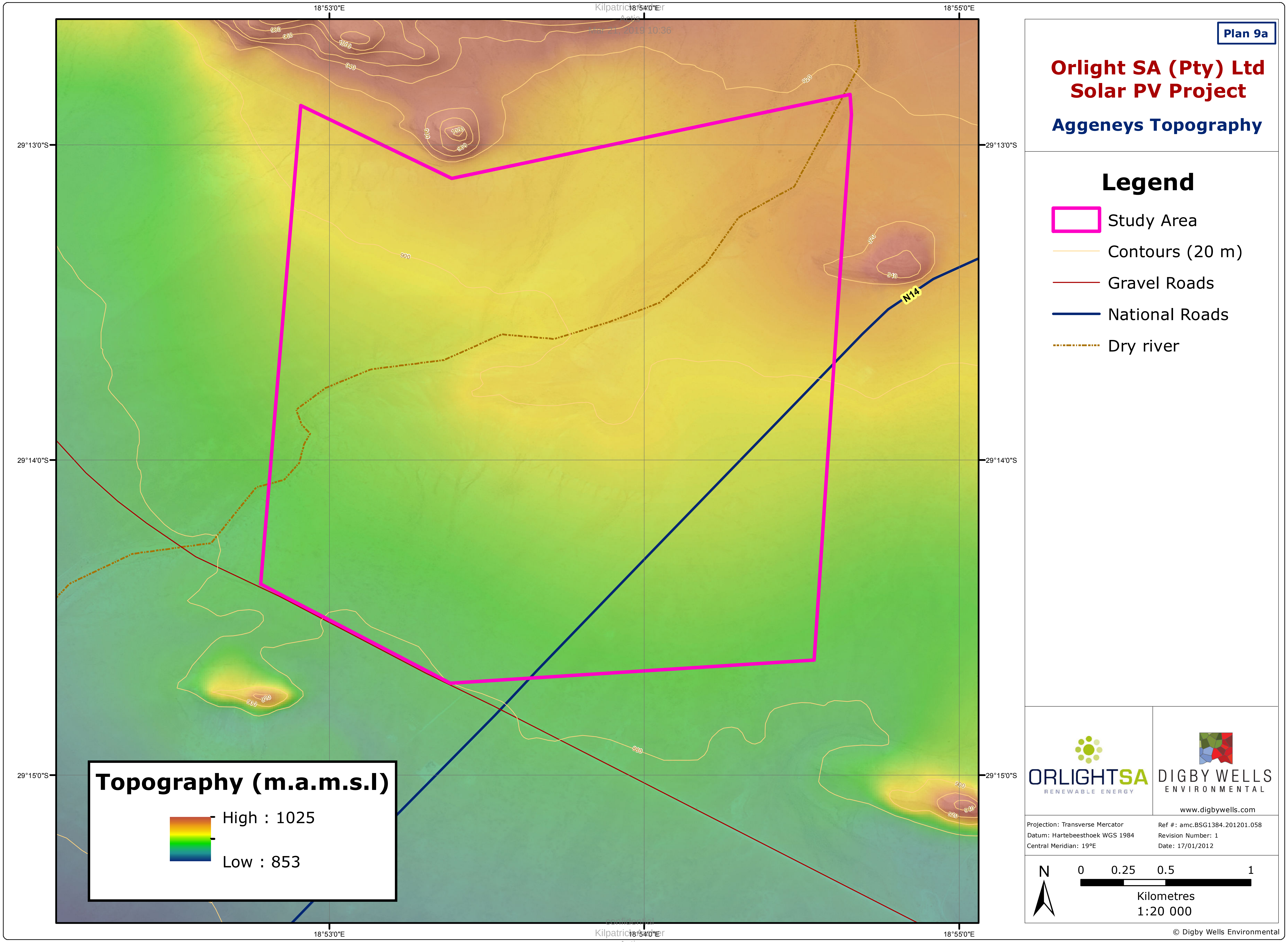
www.digbywells.com

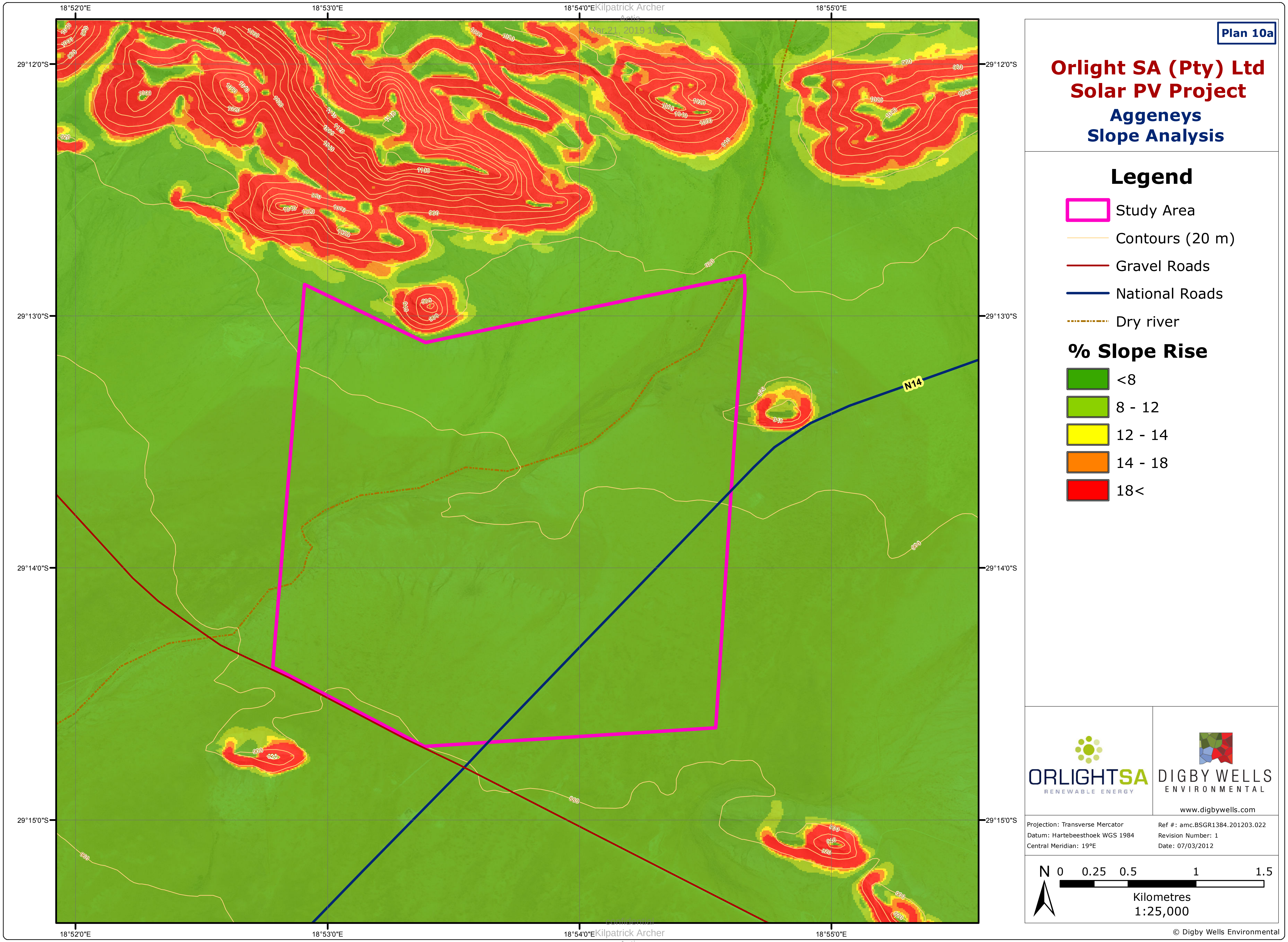
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

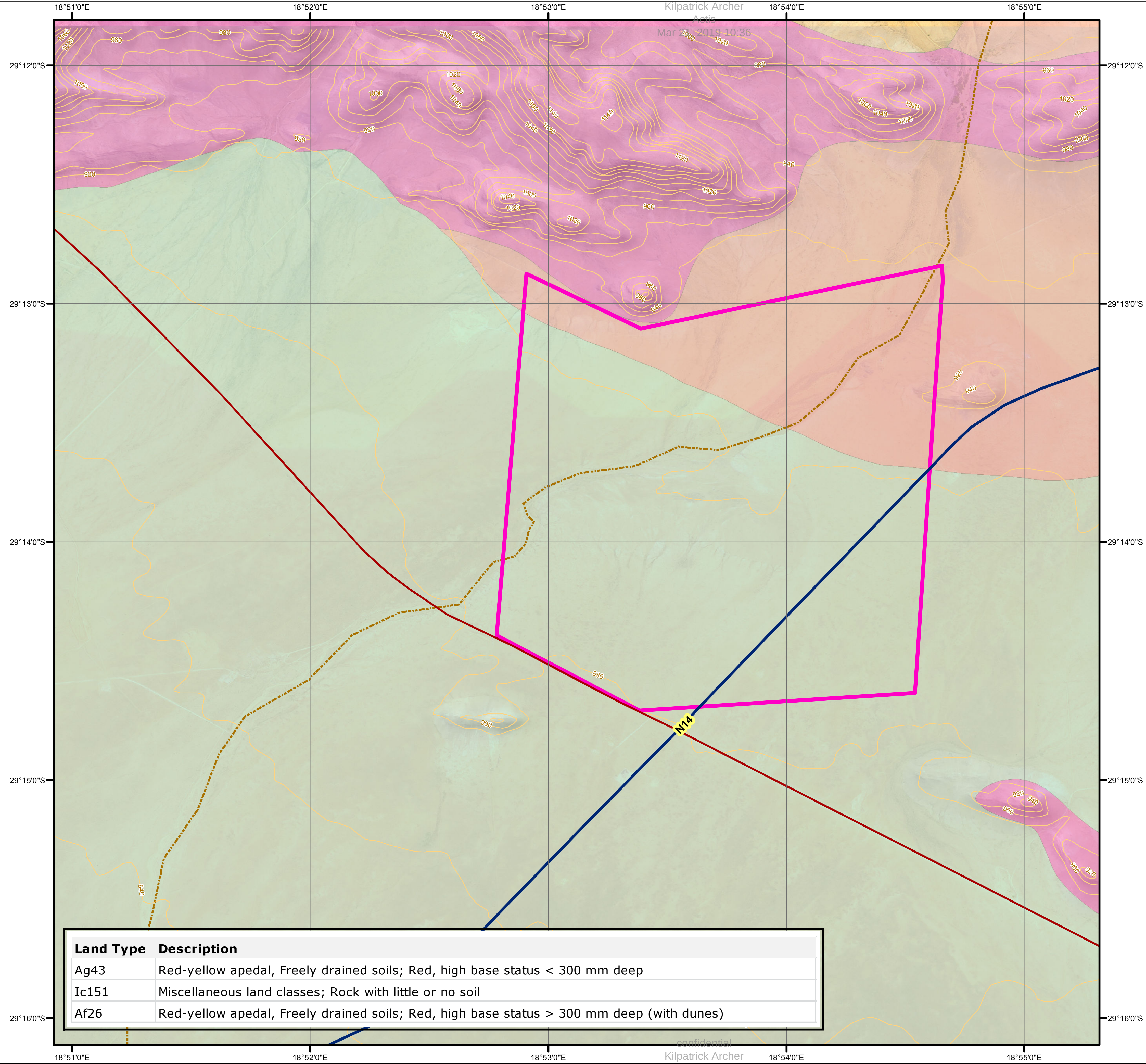
Ref #: amc.BSGR1384.201204.098
Revision Number: 1
Date: 18/01/2012

N

0 0.5 1 2
Kilometres
1:35,000


18°53'0"E
18°54'0"E
18°55'0"E
29°13'0"S
29°14'0"S
29°15'0"S
N14
Topography (m.a.m.s.l)
High : 1025
Low : 853
Plan 9a
Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys Topography
Legend
Study Area
Contours (20 m)
Gravel Roads
National Roads
Dry river
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSG1384.201201.058
Revision Number: 1
Date: 17/01/2012
N
0 0.25 0.5 1
Kilometres
1:20 000
© Digby Wells Environmental


18°52'0"E
18°53'0"E
18°54'0"E
18°55'0"E
29°12'0"S
29°13'0"S
29°14'0"S
29°15'0"S
N14
Plan 10a
Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Slope Analysis
Legend
Study Area
Contours (20 m)
Gravel Roads
National Roads
Dry river
% Slope Rise
<8
8 - 12
12 - 14
14 - 18
18<
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR1384.201203.022
Revision Number: 1
Date: 07/03/2012
N
0 0.25 0.5 1 1.5
Kilometres
1:25,000



Land Type	Description
Ag43	Red-yellow apedal, Freely drained soils; Red, high base status < 300 mm deep
Ic151	Miscellaneous land classes; Rock with little or no soil
Af26	Red-yellow apedal, Freely drained soils; Red, high base status > 300 mm deep (with dunes)

Plan 11a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Land Types

Legend

- Study Area
- Contours (20 m)
- Gravel Roads
- National Roads
- Dry river

Land Types

- Af26
- Ag43
- Ic151

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

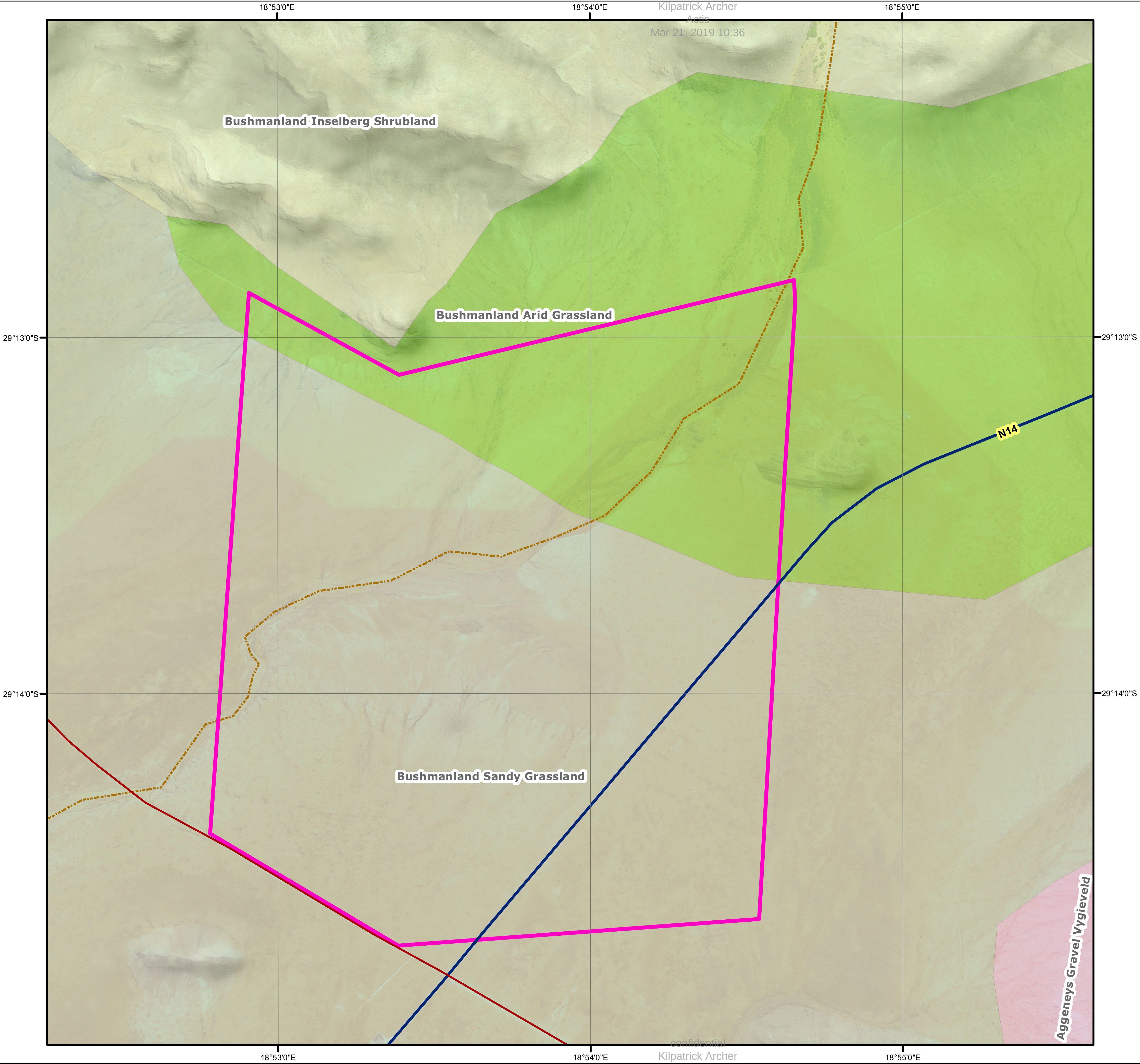
Ref #: amc.BSG1384.201201.071
Revision Number: 1
Date: 18/01/2012

N

0 0.25 0.5 1 1.5

Kilometres

1:30,000



Plan 12a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Vegetation Types

Legend

- Study Area
- Gravel Roads
- National Roads
- Dry river

Surrounding Vegetation Types

- Aggeneys Gravel Vygieveld
- Bushmanland Arid Grassland
- Bushmanland Inselberg Shrubland
- Bushmanland Sandy Grassland

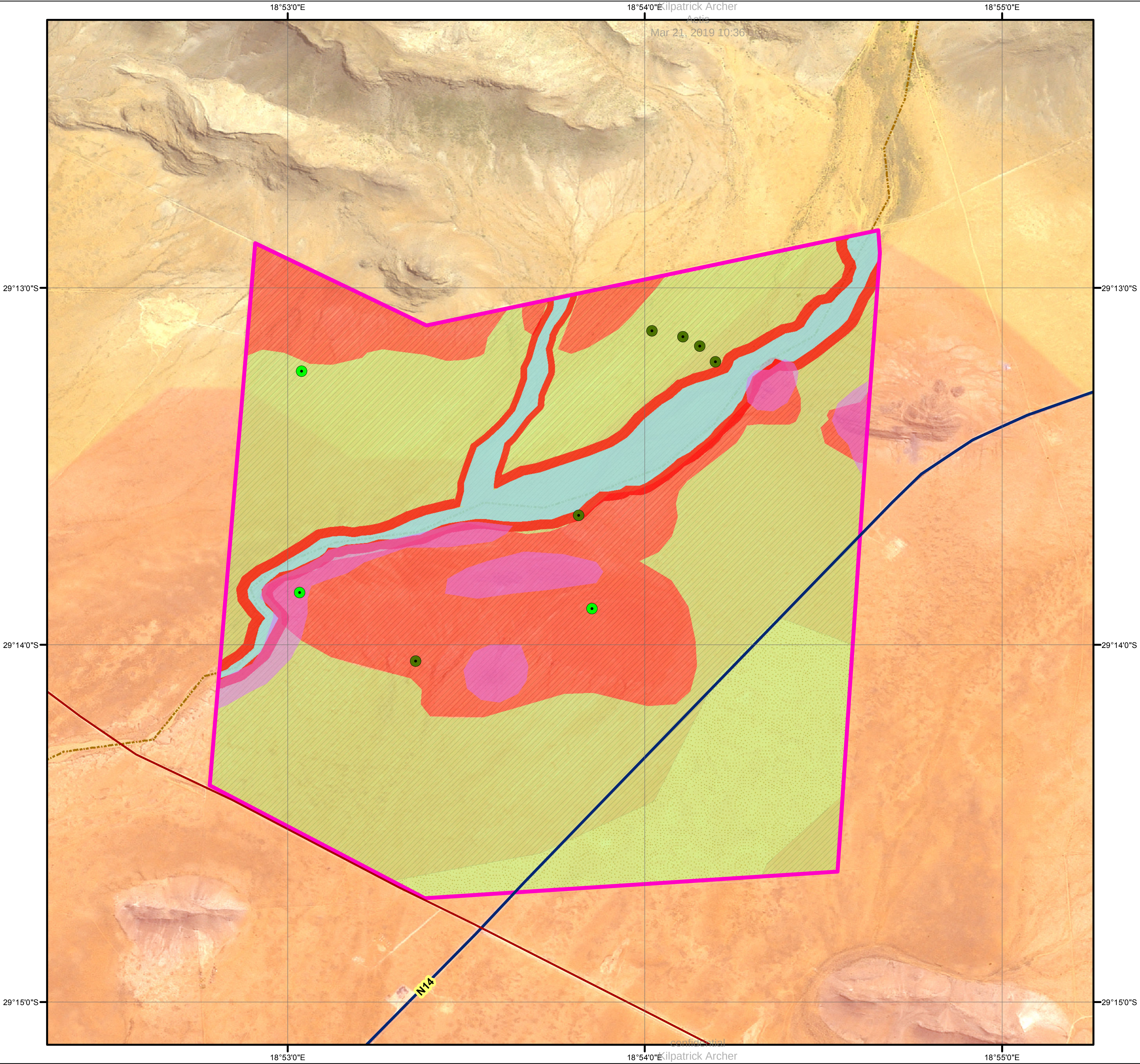
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201204.161
Revision Number: 1
Date: 18/01/2012

N

0 0.25 0.5 1
Kilometres
1:20,000



Plan 13a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Ecological Sensitivity

Legend

- Study Area
- Gravel Roads
- National Roads
- Dry river

Specialist Data

- Aloe dichotoma
- Boscia Species
- Ridge Area
- Drainage Line Area
- Buffers of Drainage Lines (50m and 30m)

SKEP and CBA

- Ecological Support Area
- Terrestrial CBA - Level 2
- Quartz Patches
- Sand Corridor

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

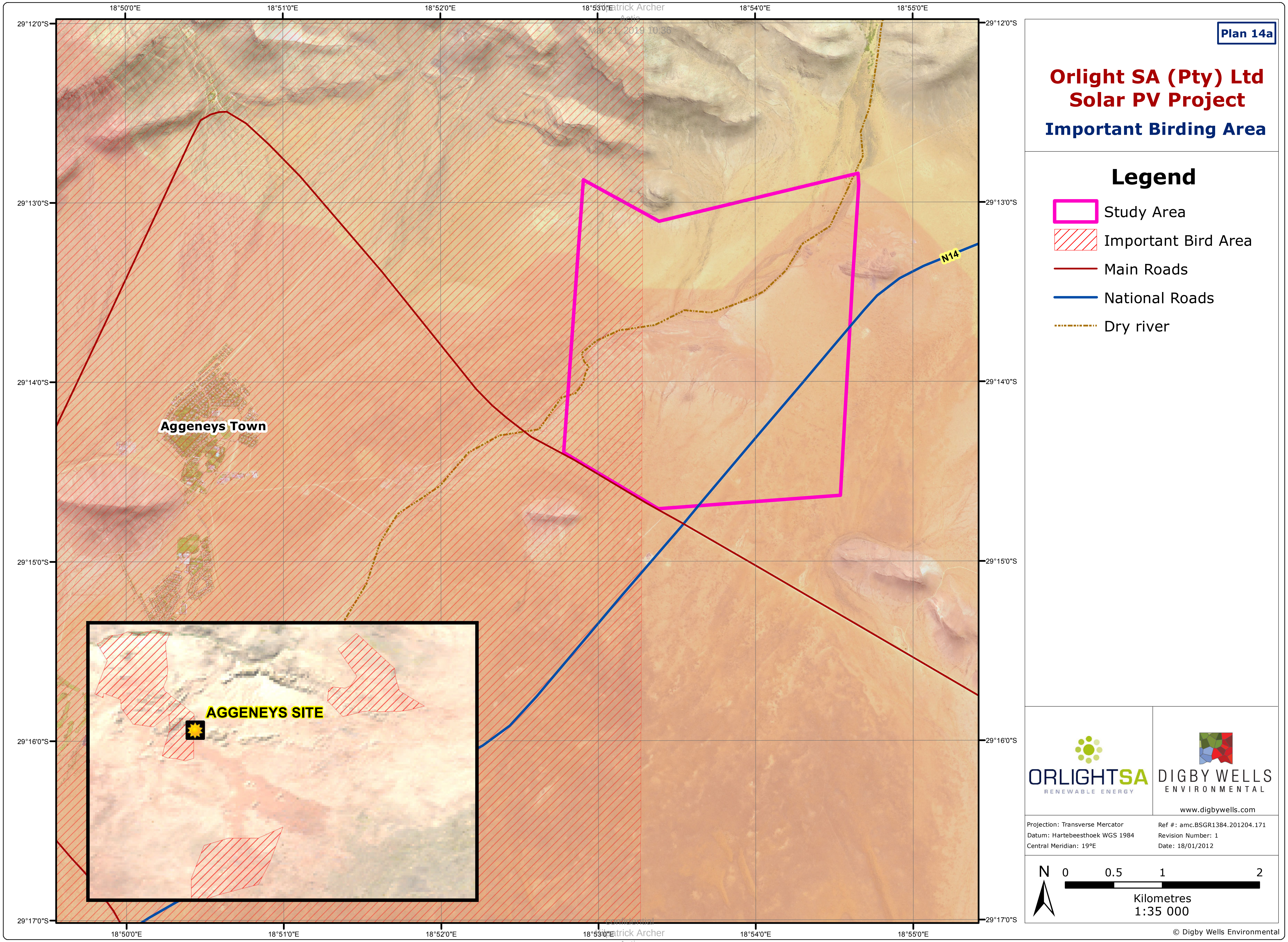
Ref #: amc.BSG1384.201201.071
Revision Number: 1
Date: 18/01/2012

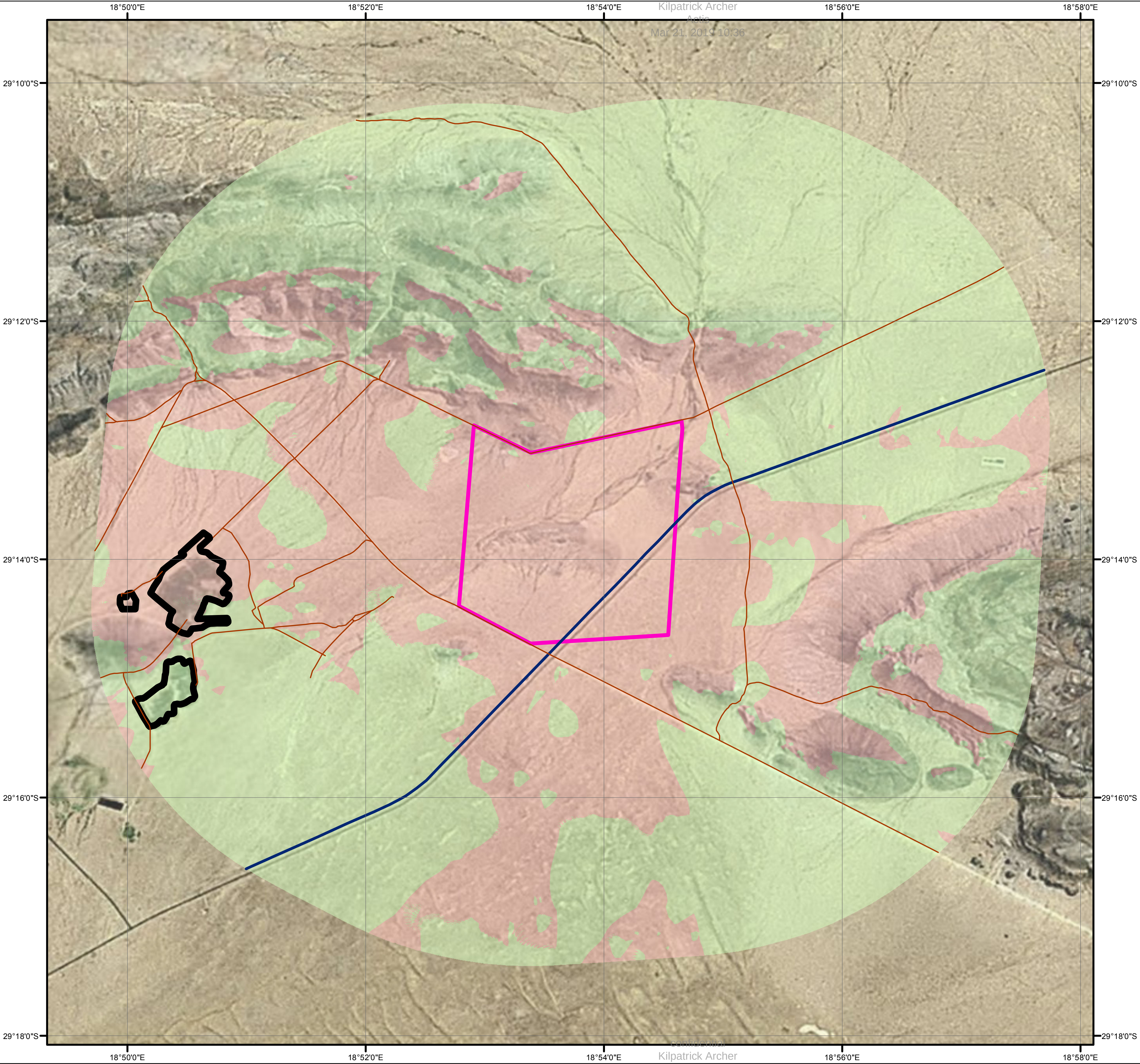
N

0 0.25 0.5 1

Kilometres

1:20 000


Plan 14a
Orlight SA (Pty) Ltd
Solar PV Project
Important Birding Area
Legend
Study Area
Important Bird Area
Main Roads
National Roads
Dry river
Aggeneys Town
N14
AGGENEYS SITE
18°50'0"E
18°51'0"E
18°52'0"E
18°53'0"E
18°54'0"E
18°55'0"E
29°12'0"S
29°13'0"S
29°14'0"S
29°15'0"S
29°16'0"S
29°17'0"S
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR1384.201204.171
Revision Number: 1
Date: 18/01/2012
N
0
0.5
1
2
Kilometres
1:35 000
© Digby Wells Environmental



Plan 15a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Viewshed and Receptors

Legend

Study Area

Receptors

Gavel Roads

Highway

Town

Potential Viewshed

Not Visible

Visible

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

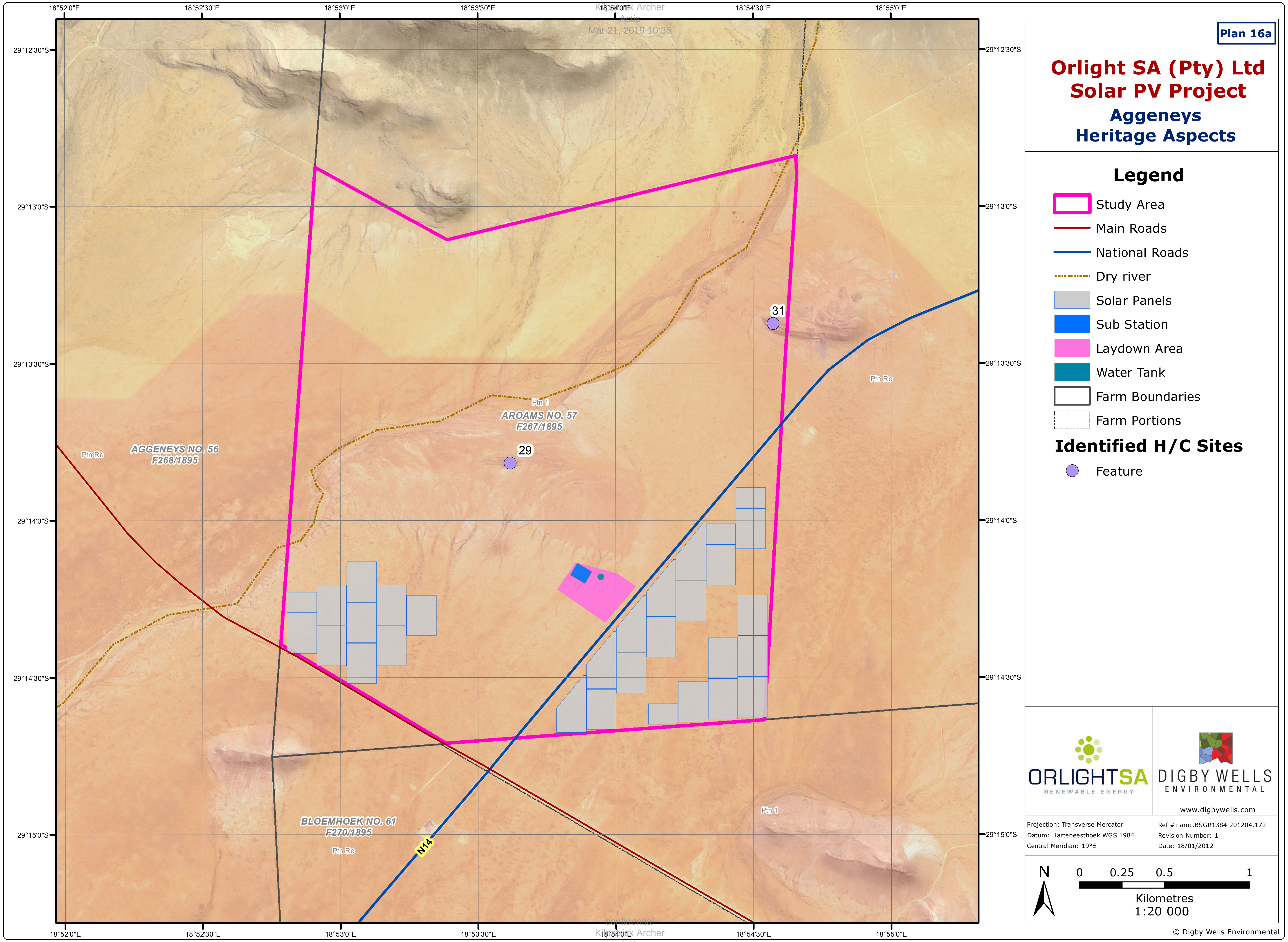
Ref #: amc.BSGR.1384.201203.011
Revision Number: 1
Date: 02/03/2012

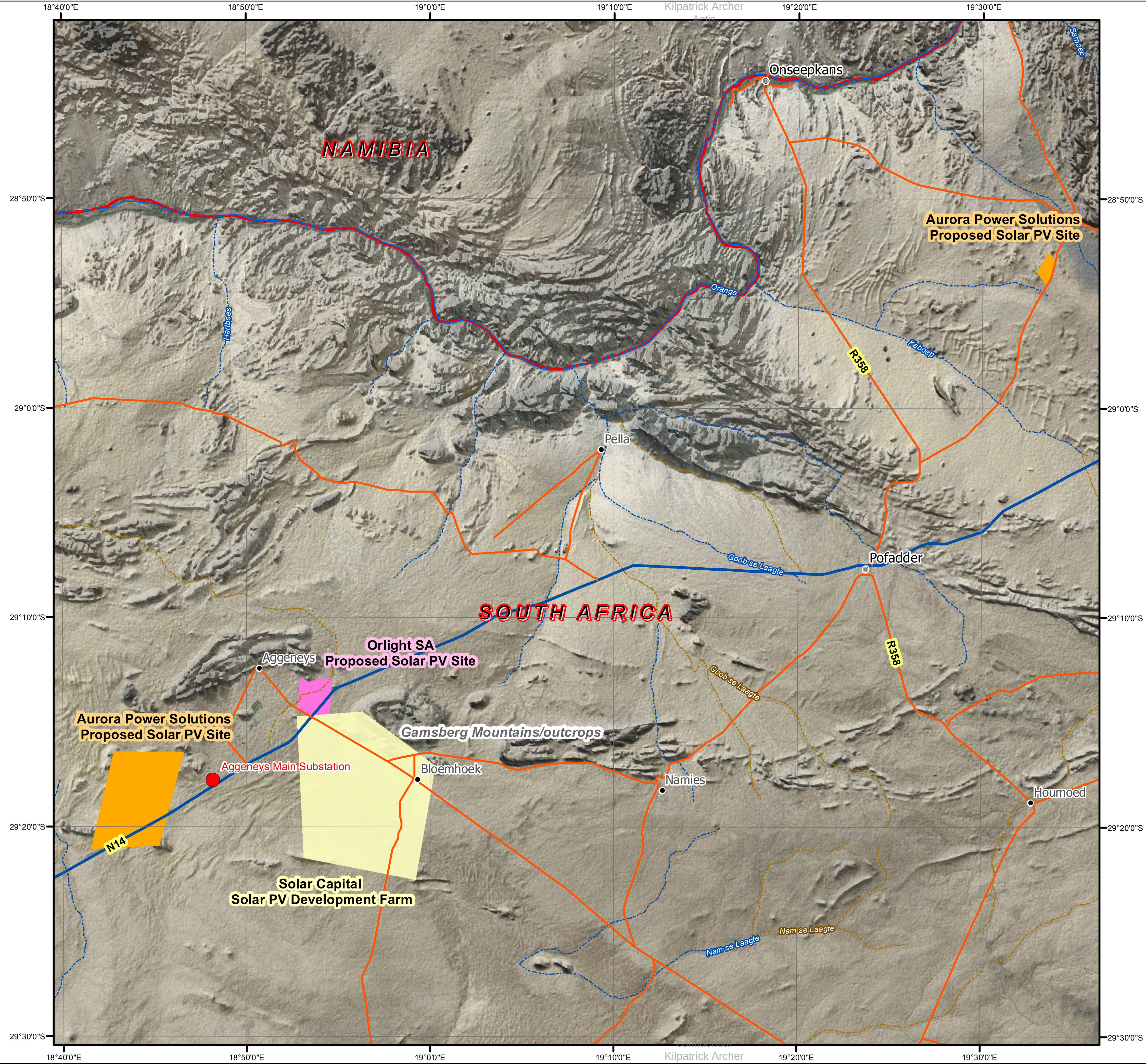
N

0 0.5 1 2 3

Kilometres

1:60,000


Plan 16a
Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Heritage Aspects
Legend
Study Area
Main Roads
National Roads
Dry river
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Farm Portions
Identified H/C Sites
Feature
AGGENEYS NO. 56
F268/1895
AROAMS NO. 57
F267/1895
BLOEMHOEK NO. 61
F270/1895
Ptn Re
Ptn 1
N14
29
31
18°52'0"E
18°52'30"E
18°53'0"E
18°53'30"E
18°54'0"E
18°54'30"E
18°55'0"E
29°12'30"S
29°13'0"S
29°13'30"S
29°14'0"S
29°14'30"S
29°15'0"S
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR1384.201204.172
Revision Number: 1
Date: 18/01/2012
N
0
0.25
0.5
1
Kilometres
1:20 000
© Digby Wells Environmental



Plan 17a

Orlight SA (Pty) Ltd Solar PV Project

Cumulative Impacts

Legend

- Orlight SA Aggeneys Study Area
- Aurora Power Solutions Proposed PV Site
- Solar Capital - Farm on which Proposed Solar PV Site exists
- Substation
- City
- Major Town
- Secondary Town
- Other Town
- Settlement
- Provincial Roads
- National Roads
- Perennial River
- Non-Perennial River
- Dry river
- International Boundary

ORLIGHTSA RENEWABLE ENERGY

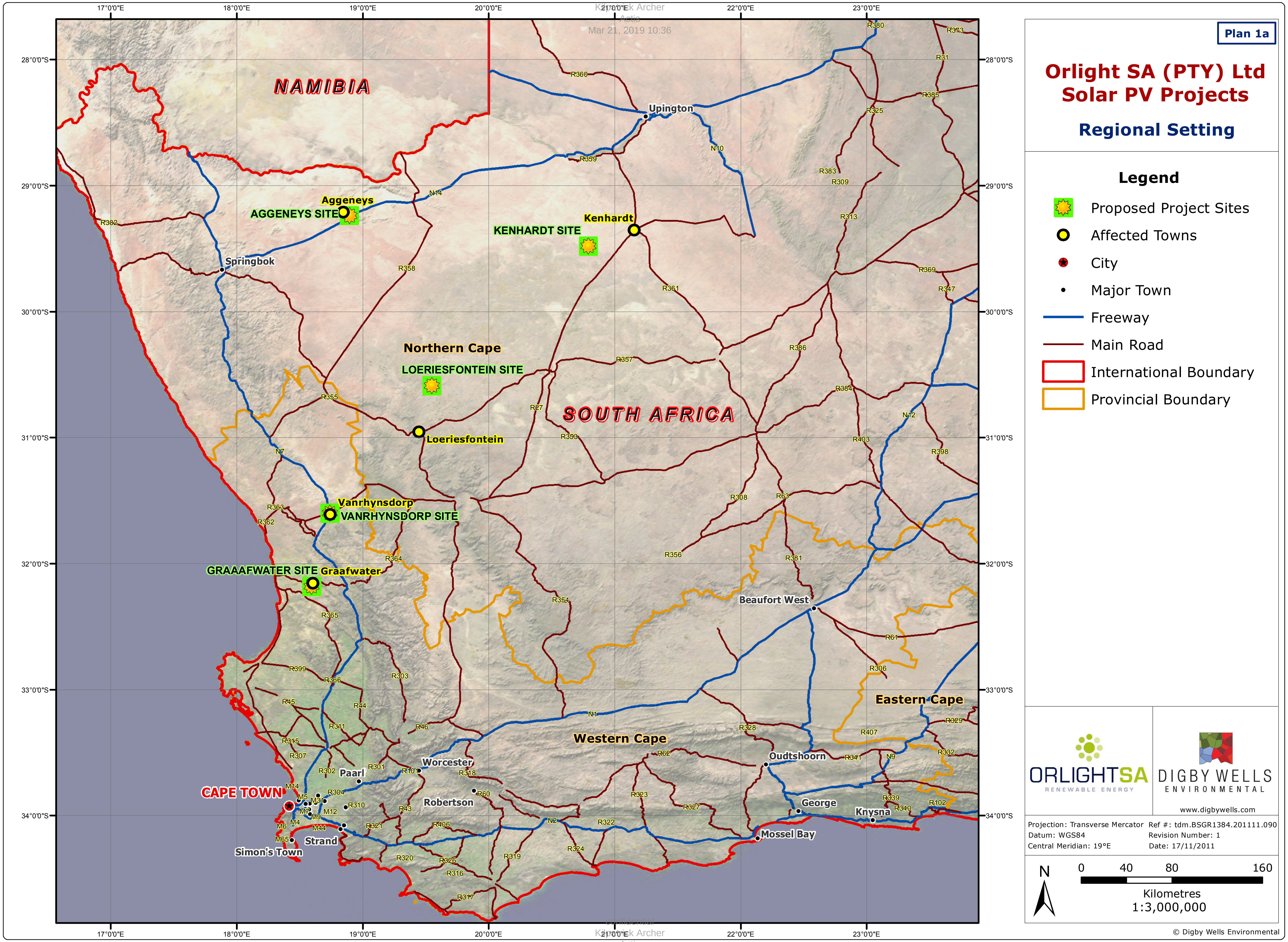
DIGBY WELLS ENVIRONMENTAL

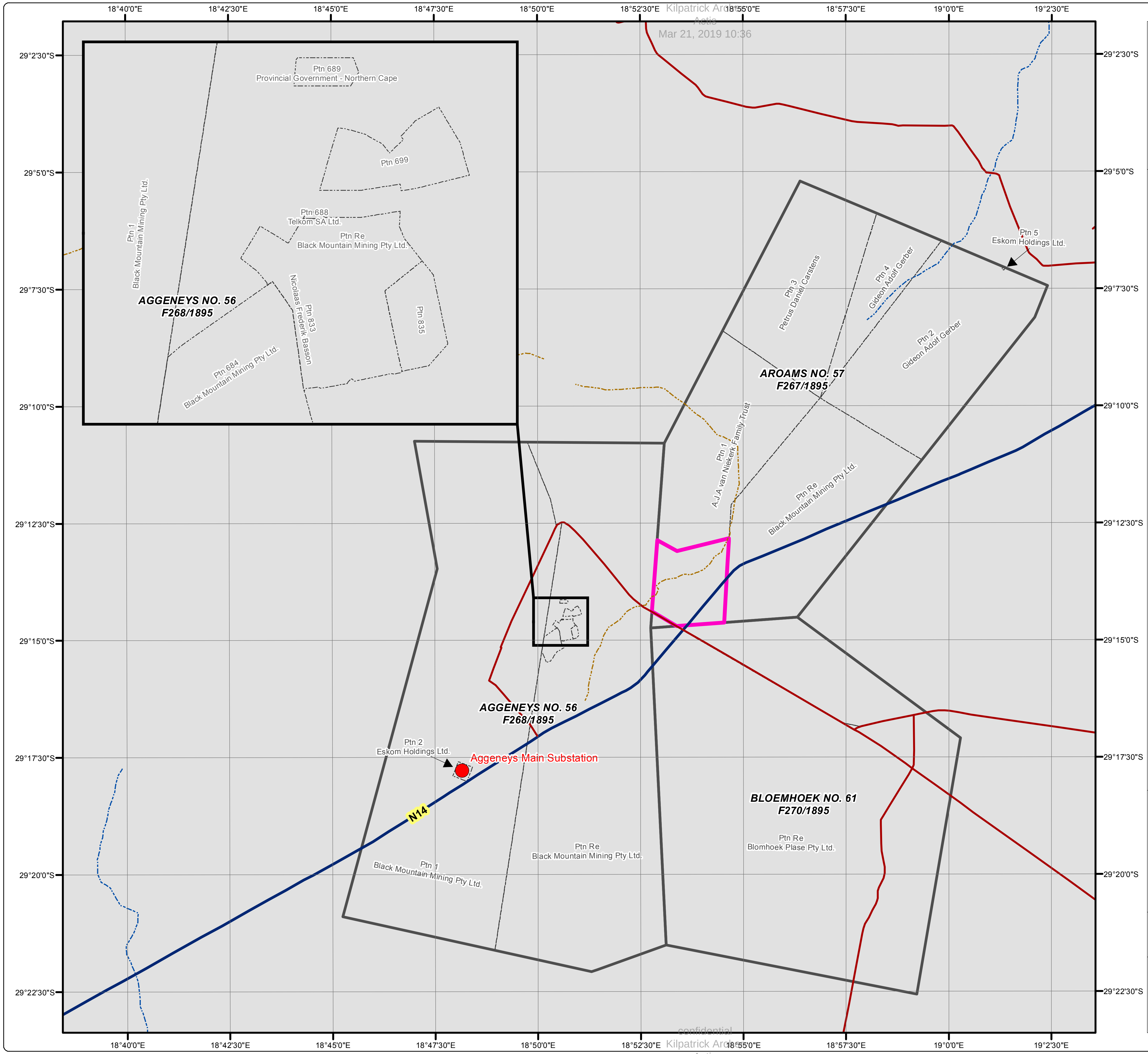
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E

Revision Number: 1
Date: 19/03/2012
Ref #:amc.BSGR1384.201203.081

N 0 5 10 20
Kilometres
1:340 000


Plan 1a
Orlight SA (PTY) Ltd
Solar PV Projects
Regional Setting
Legend
Proposed Project Sites
Affected Towns
City
Major Town
Freeway
Main Road
International Boundary
Provincial Boundary
NAMIBIA
SOUTH AFRICA
Northern Cape
Western Cape
Eastern Cape
AGGENEYS SITE
Aggeneys
KENHARDT SITE
Kenhardt
LOERIESFONTEIN SITE
Loeriesfontein
Vanrhynsdorp
VANRHYNSDORP SITE
GRAAFWATER SITE
Graafwater
Upington
Springbok
Beaufort West
Oudtshoorn
George
Knysna
Mossel Bay
Worcester
Paarl
Robertson
CAPE TOWN
Strand
Simon's Town
N1
N2
N7
N9
N10
N12
N14
17°0'0"E
18°0'0"E
19°0'0"E
20°0'0"E
21°0'0"E
22°0'0"E
23°0'0"E
28°0'0"S
29°0'0"S
30°0'0"S
31°0'0"S
32°0'0"S
33°0'0"S
34°0'0"S
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: WGS84
Central Meridian: 19°E
Ref #: tdm.BSGR1384.201111.090
Revision Number: 1
Date: 17/11/2011
N
0 40 80 160
Kilometres
1:3,000,000
© Digby Wells Environmental



Plan 2a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Land Tenure

Legend

- Study Area
- Substation
- Perennial River
- Non-Perennial River
- Dry river
- Gravel Roads
- National Roads
- Farm Boundaries
- Farm Portions

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

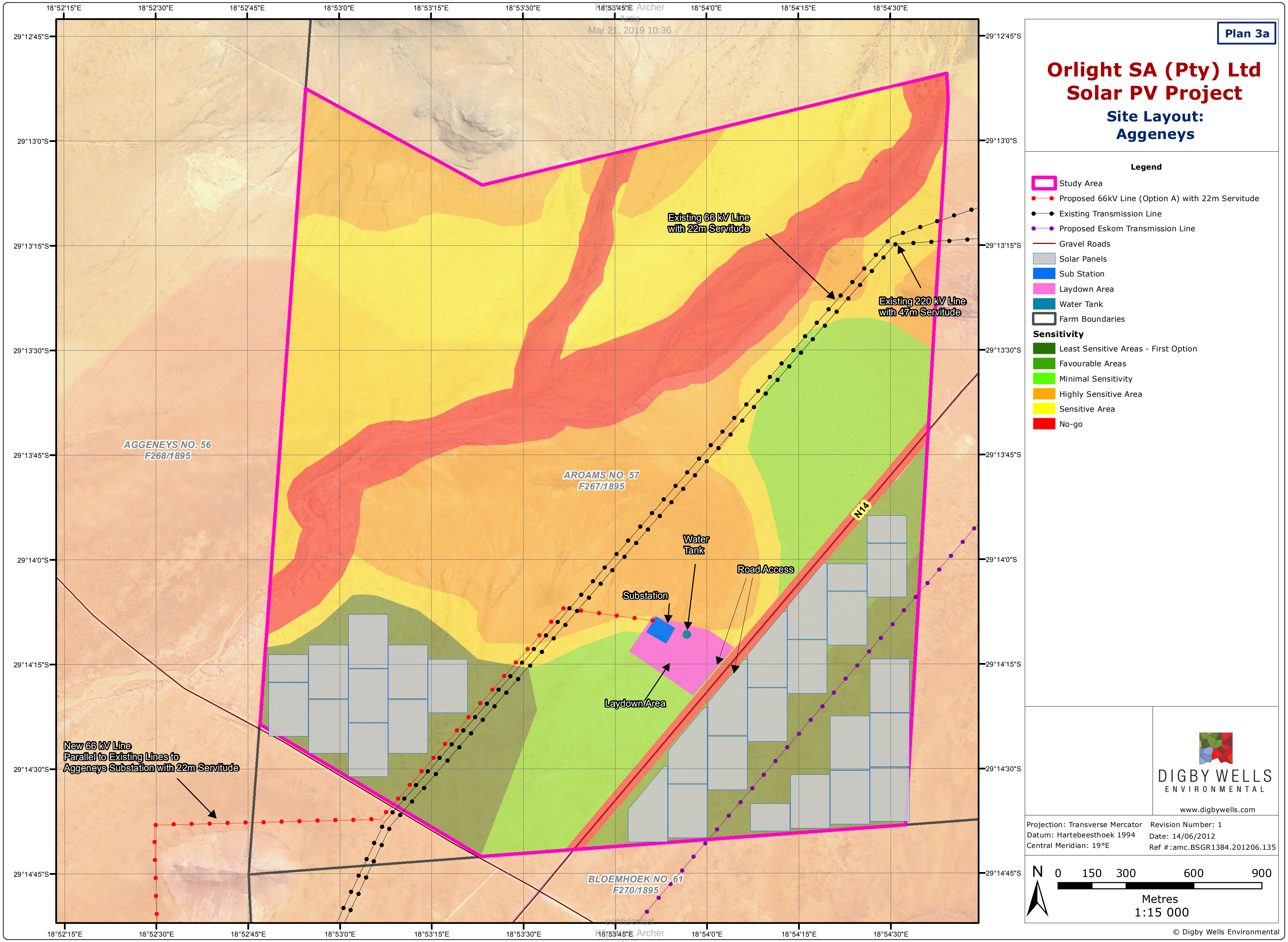
www.digbywells.com

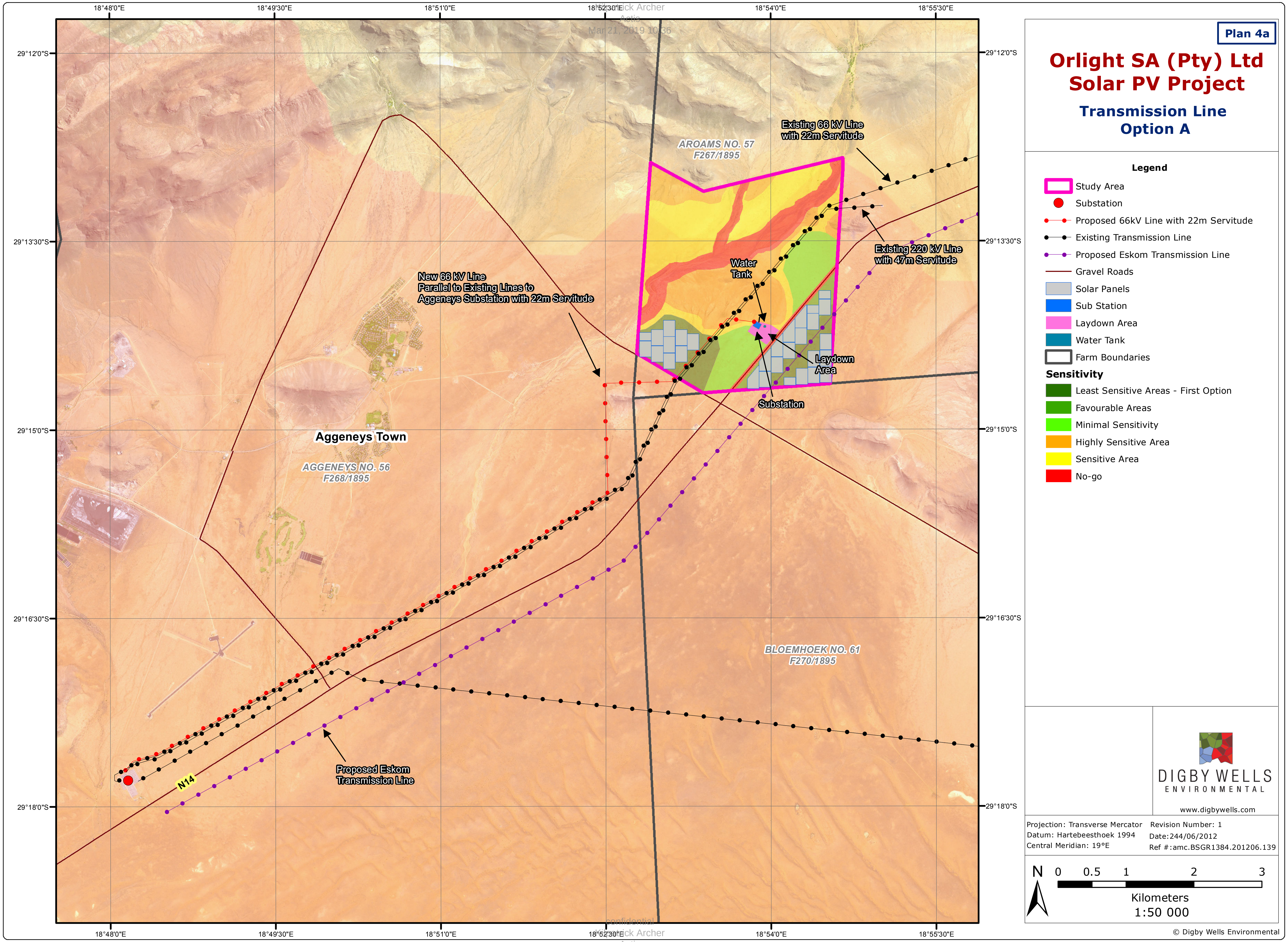
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E

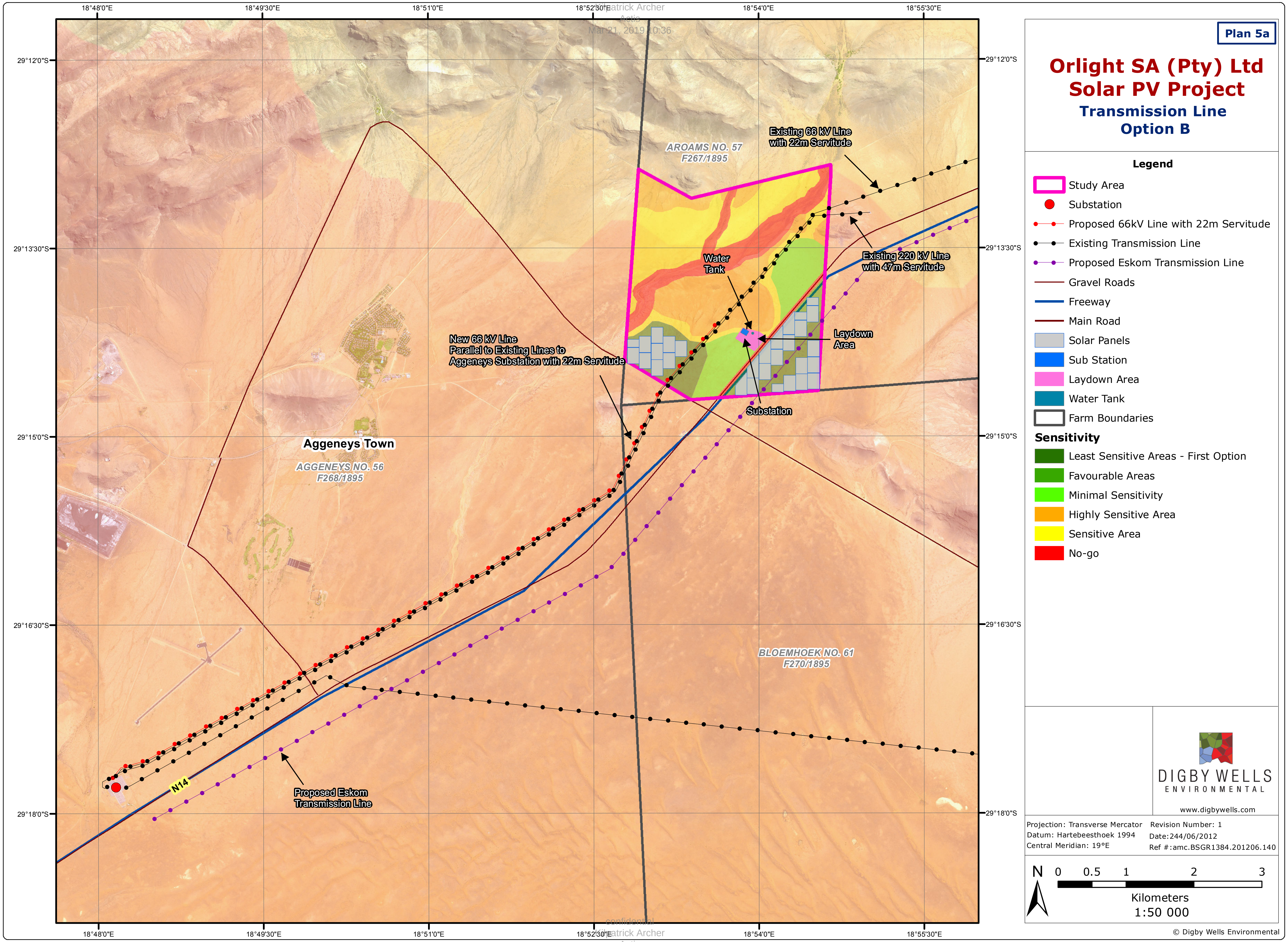
Revision Number: 1
Date: 17/01/2012
Ref #:amc.BSG1384.201201.038

N

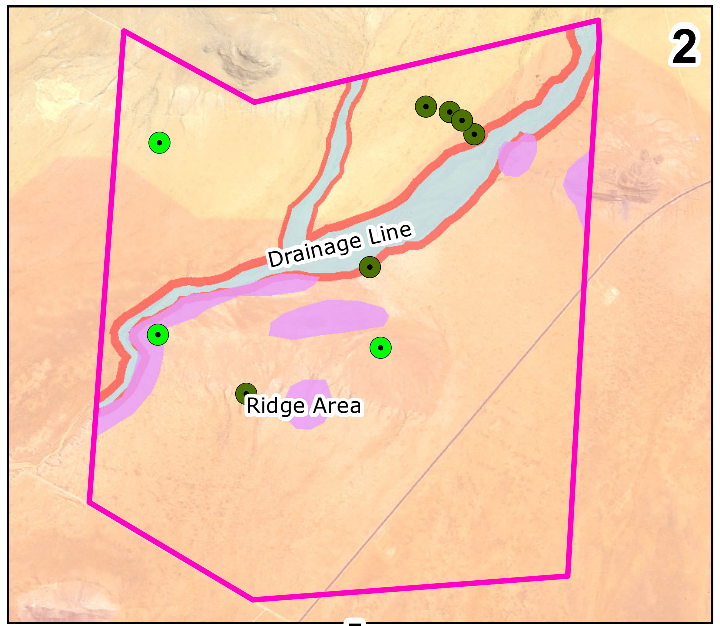
0 2 4 8
Kilometres
1:150,000

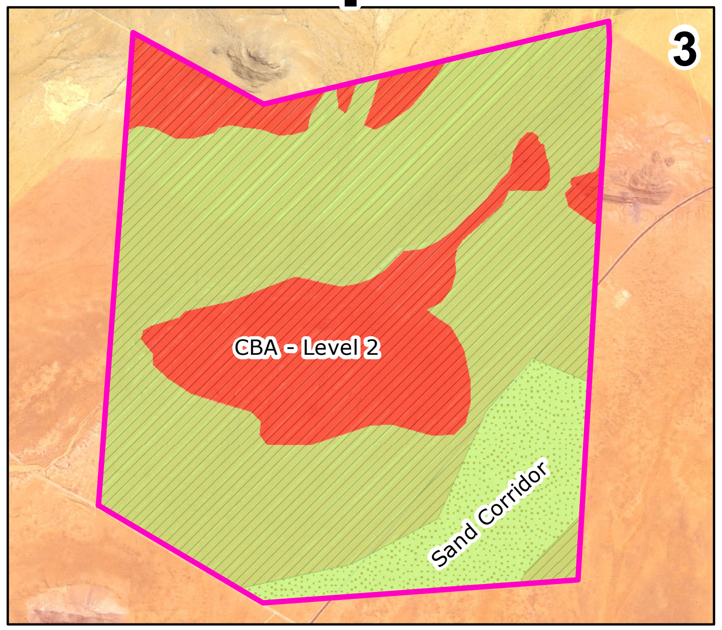

Plan 3a
Orlight SA (Pty) Ltd
Solar PV Project
Site Layout:
Aggeneys
Legend
Study Area
Proposed 66kV Line (Option A) with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
Existing 66 kV Line with 22m Servitude
Existing 220 kV Line with 47m Servitude
AGGENEYS NO. 56 F268/1895
AROAMS NO. 57 F267/1895
BLOEMHOEK NO. 61 F270/1895
N14
Water Tank
Road Access
Substation
Laydown Area
New 66 kV Line Parallel to Existing Lines to Aggeneys Substation with 22m Servitude
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date: 14/06/2012
Ref #:amc.BSGR1384.201206.135
N
0 150 300 600 900
Metres
1:15 000
© Digby Wells Environmental

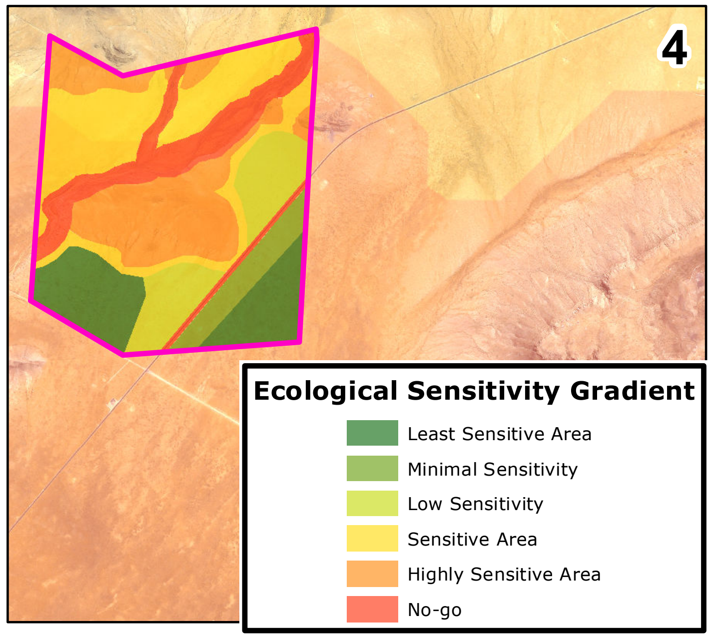

Plan 4a
Orlight SA (Pty) Ltd
Solar PV Project
Transmission Line
Option A
Legend
Study Area
Substation
Proposed 66kV Line with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date:244/06/2012
Ref #:amc.BSGR1384.201206.139
N
0 0.5 1 2 3
Kilometers
1:50 000
© Digby Wells Environmental
18°48'0"E
18°49'30"E
18°51'0"E
18°52'30"E
18°54'0"E
18°55'30"E
29°12'0"S
29°13'30"S
29°15'0"S
29°16'30"S
29°18'0"S
Existing 66 kV Line
with 22m Servitude
AROAMS NO. 57
F267/1895
Existing 220 kV Line
with 47m Servitude
Water
Tank
New 66 kV Line
Parallel to Existing Lines to
Aggeneys Substation with 22m Servitude
Laydown
Area
Substation
Aggeneys Town
AGGENEYS NO. 56
F268/1895
BLOEMHOEK NO. 61
F270/1895
Proposed Eskom
Transmission Line
N14

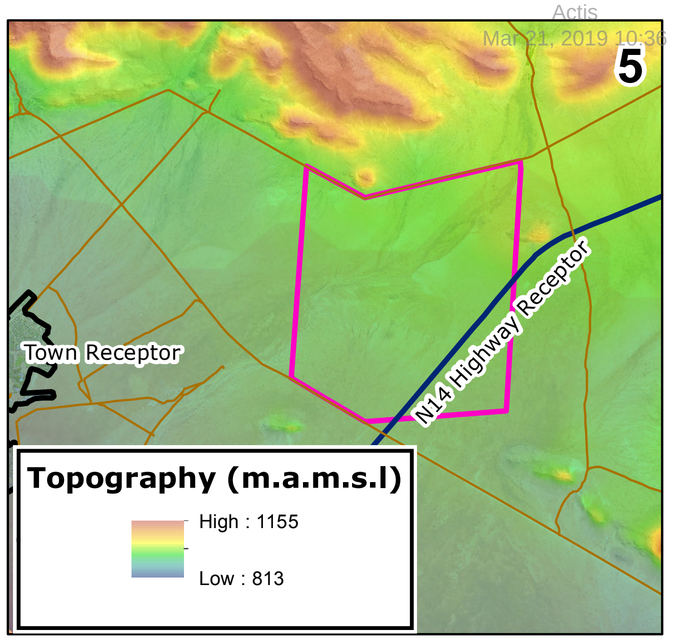

Plan 5a
Orlight SA (Pty) Ltd
Solar PV Project
Transmission Line
Option B
Legend
Study Area
Substation
Proposed 66kV Line with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Freeway
Main Road
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
18°48'0"E
18°49'30"E
18°51'0"E
18°52'30"E
18°54'0"E
18°55'30"E
29°12'0"S
29°13'30"S
29°15'0"S
29°16'30"S
29°18'0"S
AROAMS NO. 57
F267/1895
Existing 66 kV Line
with 22m Servitude
Existing 220 kV Line
with 47m Servitude
Water
Tank
Laydown
Area
Substation
New 66 kV Line
Parallel to Existing Lines to
Aggeneys Substation with 22m Servitude
Aggeneys Town
AGGENEYS NO. 56
F268/1895
BLOEMHOEK NO. 61
F270/1895
N14
Proposed Eskom
Transmission Line
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date:244/06/2012
Ref #:amc.BSGR1384.201206.140
N
0 0.5 1 2 3
Kilometers
1:50 000
© Digby Wells Environmental

Plan 6a

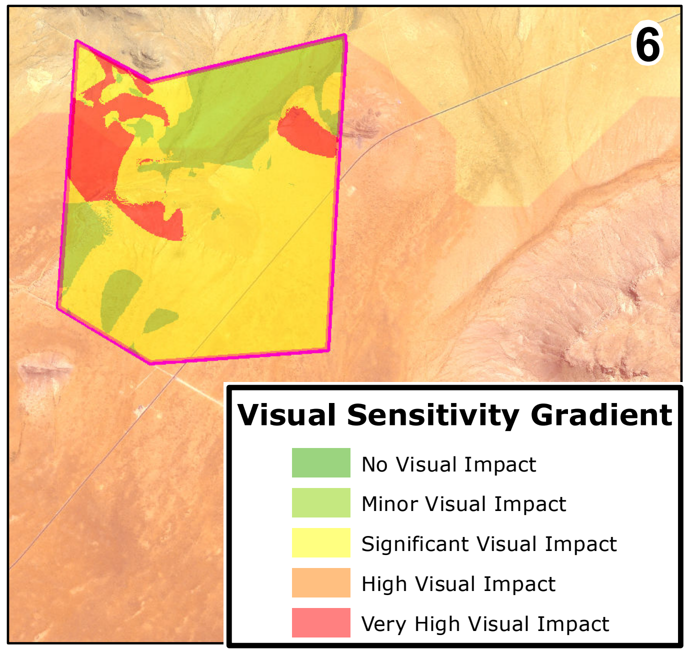








Viewshed models run for all potential receptors based on 5 km radius Digital Elevation Models. All receptor viewsheds synthesised and weighted

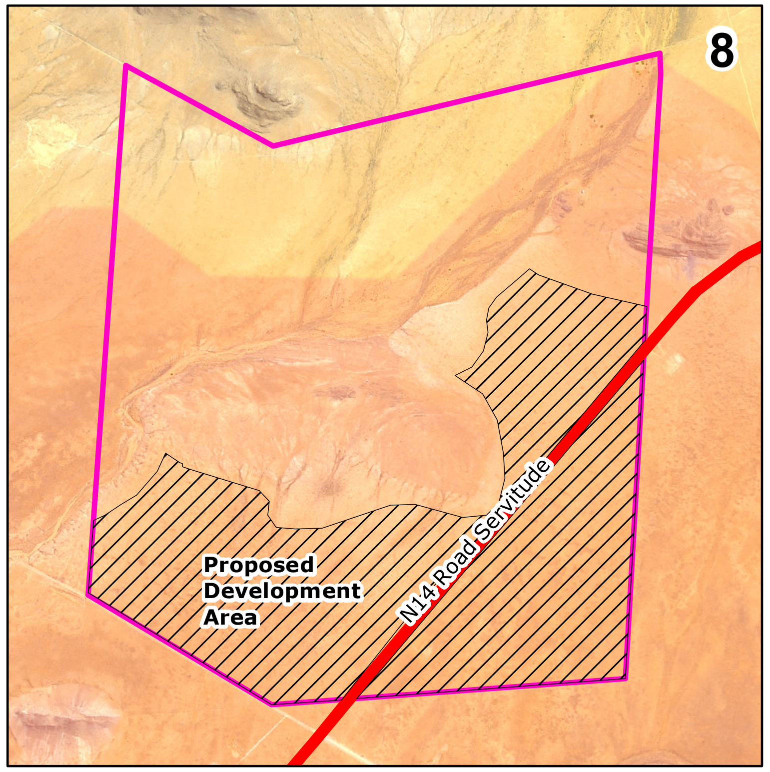


Sensitivity Delineation Process

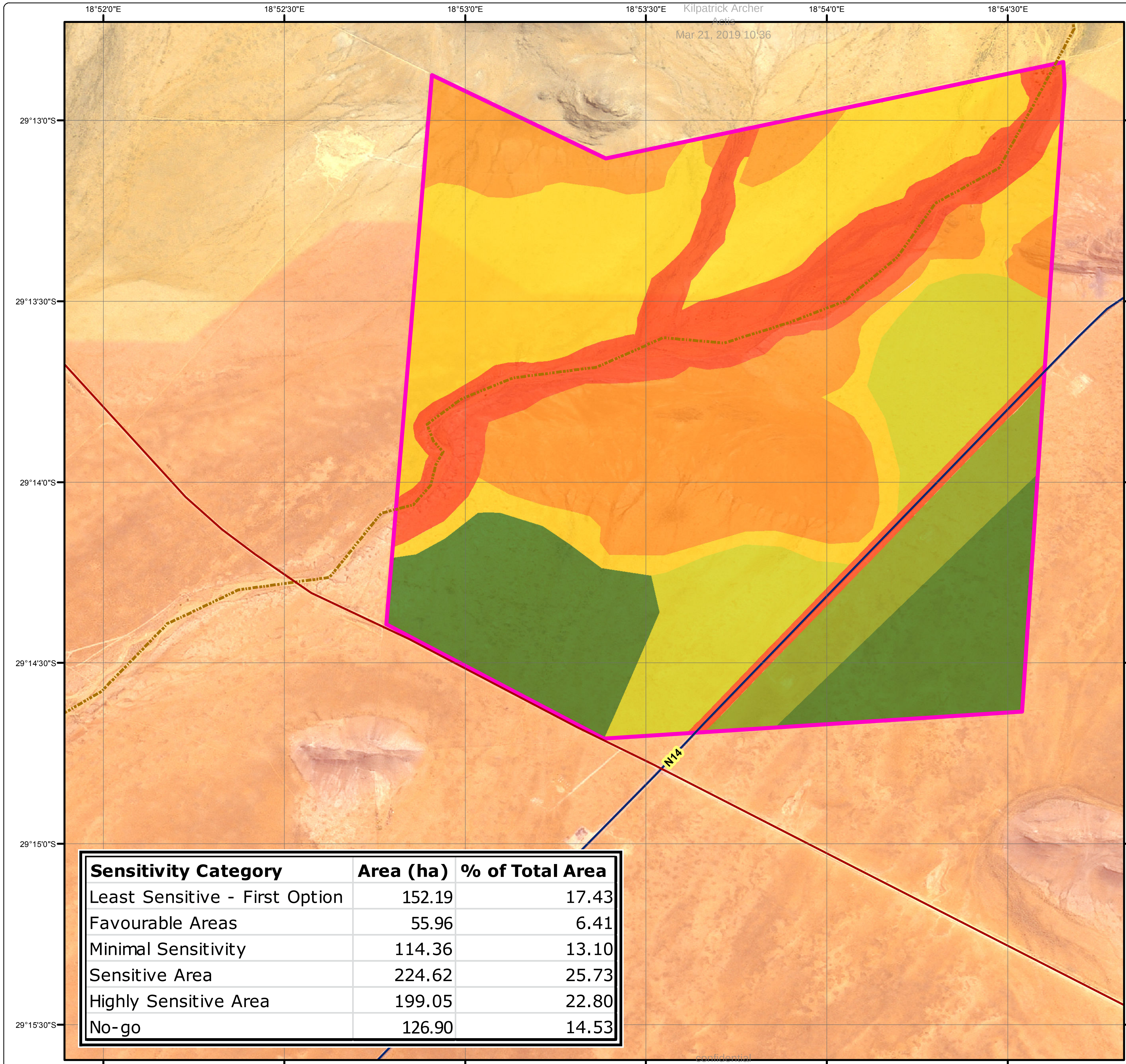
1. Fauna and Flora (F&F) and aquatic specialists collect field information on site
2. Field F&F and aquatic information transformed into GIS data
3. Existing F&F data reasearched, accessed and acquired
4. Field and existing F&F and aquatic data synthsised to create one comprehensive ecological sensitivity gradient GIS layer
5. Viewshed models run for each potential receptor based on the Digital Elevation Model (DEM) for the areas
6. All vieshed results synthesised to create one comprehensive visual sensitivity gradient GIS layer
7. Technical considerations taken into account (i.e. road servitudes and Mw output targets of Solar PV Parks)
8. Ecological and visual sensitivity GIS layers combined / overlaid, taking technical considerations into account, to delineate areas for potential development

7

Technical considerations (e.g. road servitude and Mw outputs)



confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36



Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	152.19	17.43
Favourable Areas	55.96	6.41
Minimal Sensitivity	114.36	13.10
Sensitive Area	224.62	25.73
Highly Sensitive Area	199.05	22.80
No-go	126.90	14.53

Plan 7a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Integrated Sensitivity Map

Legend

- Study Area
- Minor Roads
- Main Road
- Dry river

Sensitivity Ratings

- Least Sensitive Areas - First Option
- Favourable Areas
- Minimal Sensitivity
- Sensitive Area
- Highly Sensitive Area
- No-go

NB: Area susceptible to erosion

ORLIGHTSA RENEWABLE ENERGY

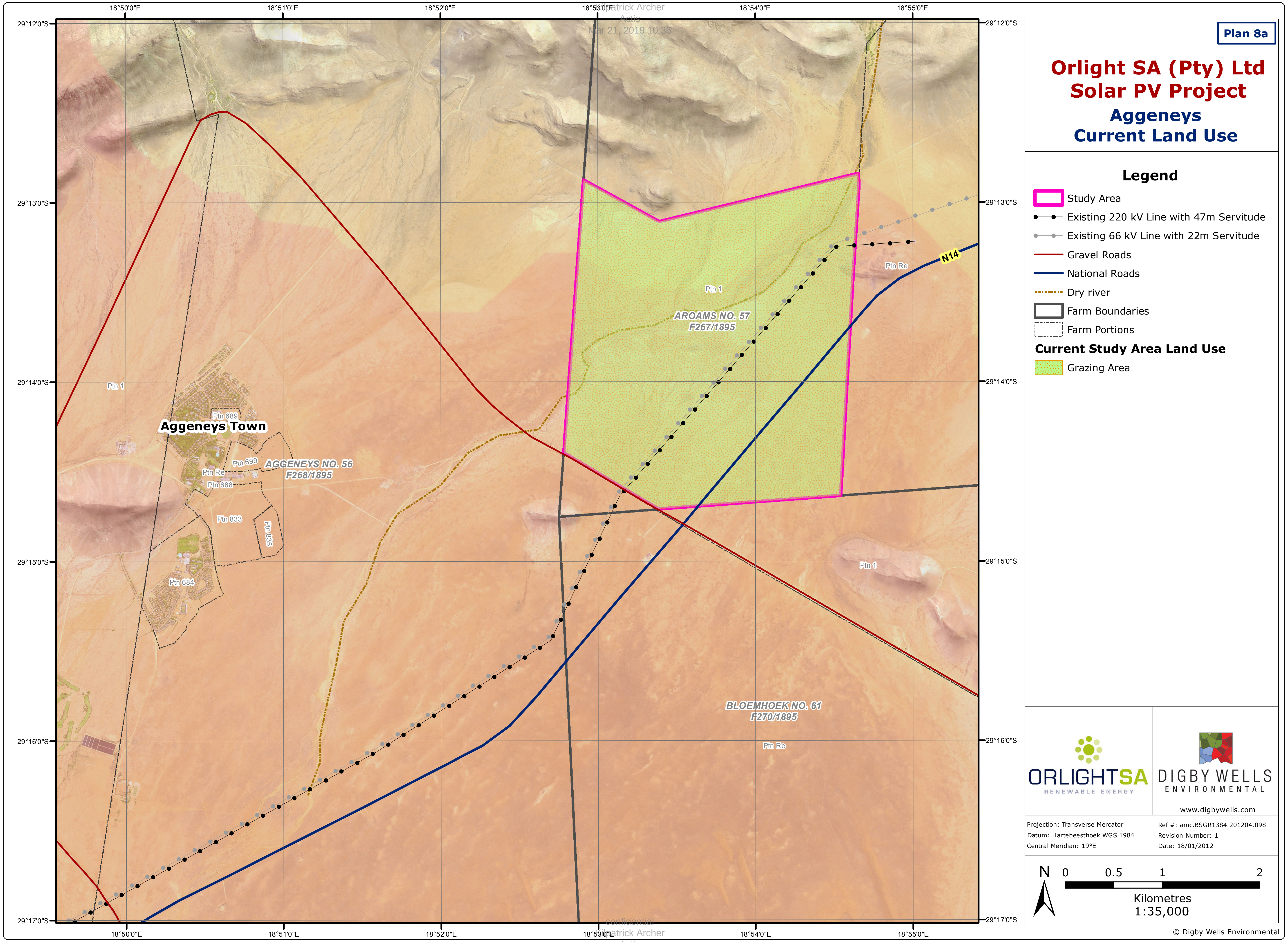
DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

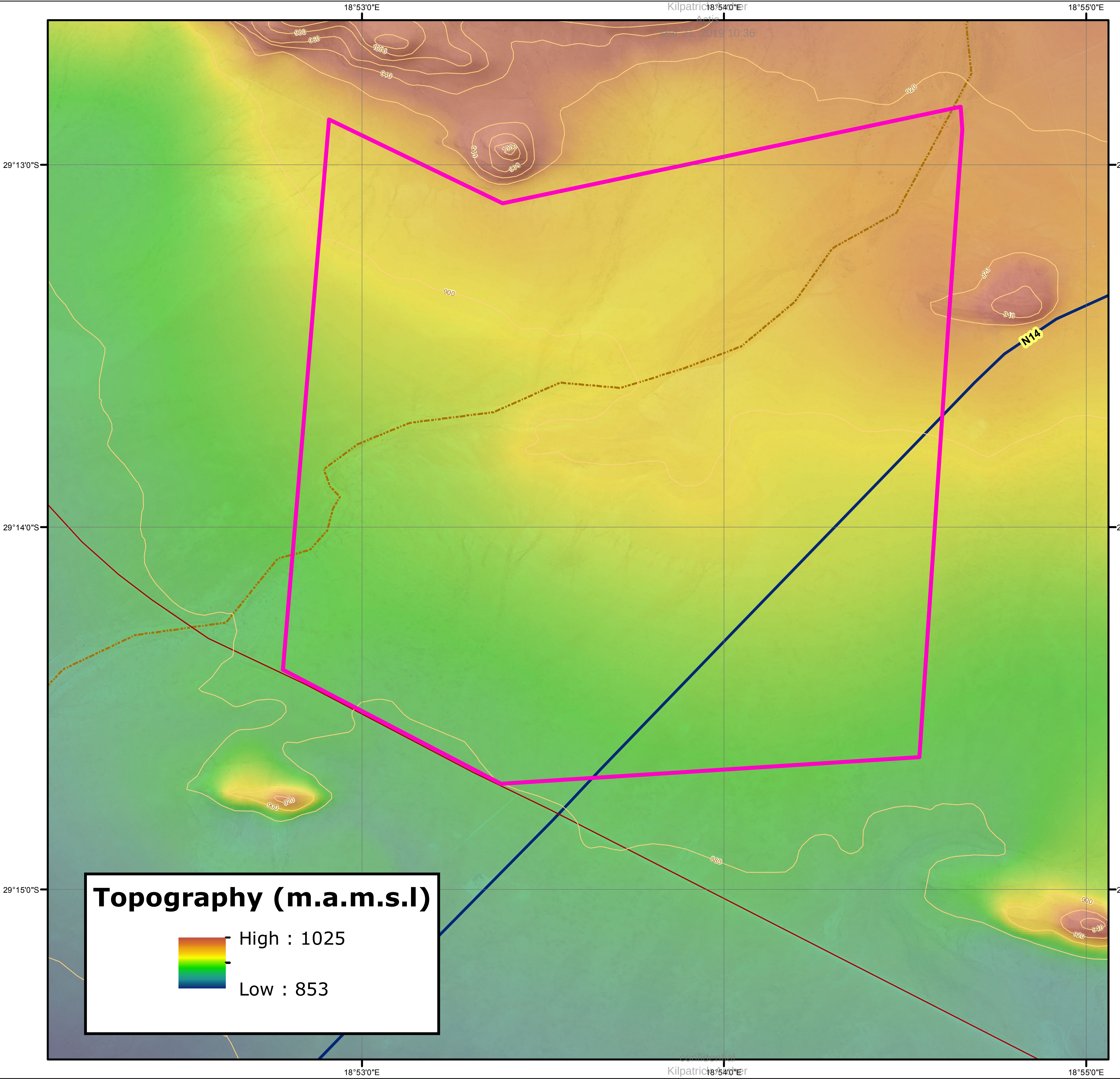
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201202.065
Revision Number: 2
Date: 13/02/2012

N 0 0.25 0.5 1
Kilometers
1:20 000



confidential
Patrick Archer
Actis
Mar 21, 2019 10:36



Plan 9a

Orlight SA (Pty) Ltd
Solar PV Project

Aggeneys Topography

Legend

- Study Area
- Contours (20 m)
- Gravel Roads
- National Roads
- Dry river

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

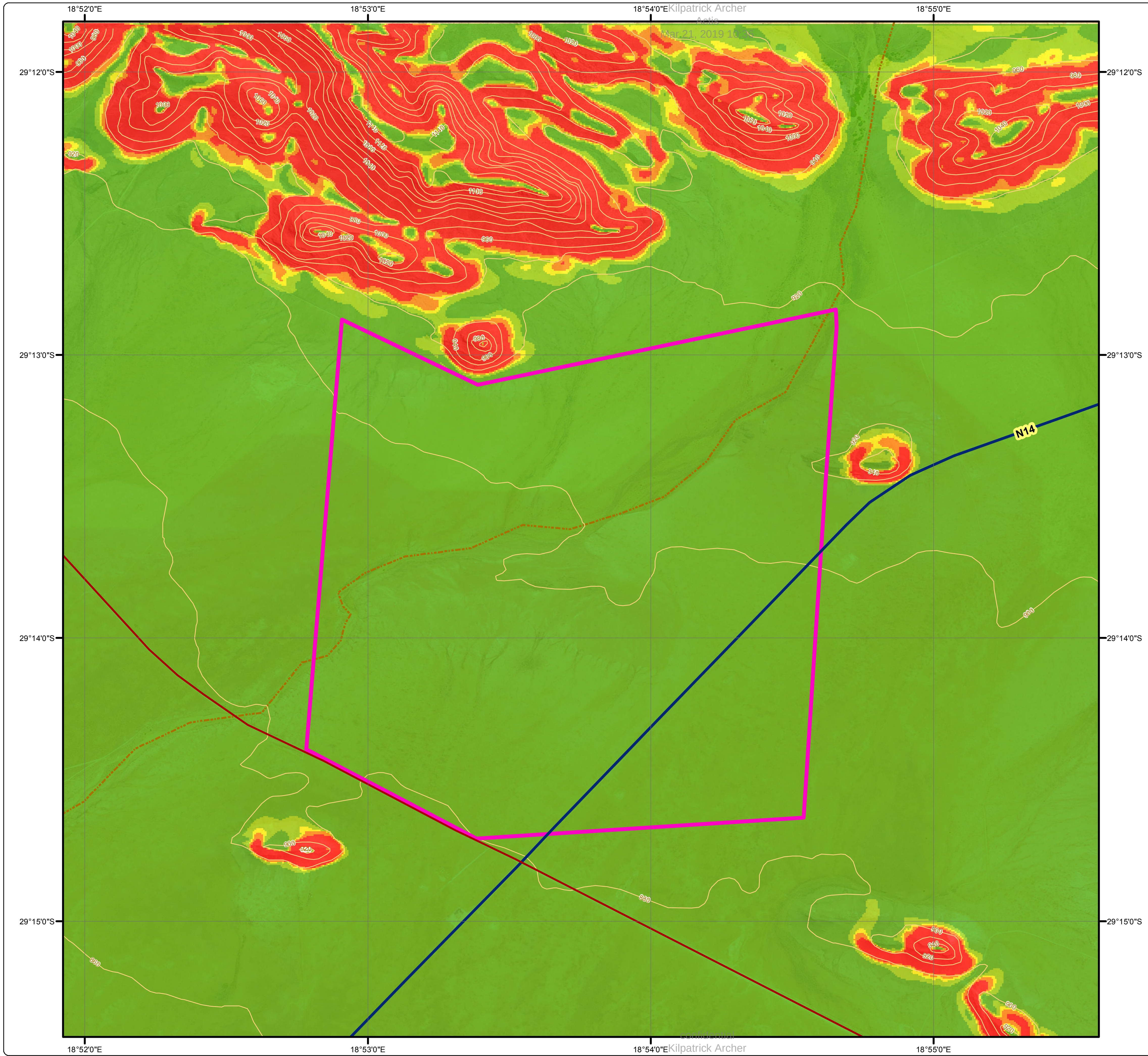
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSG1384.201201.058
Revision Number: 1
Date: 17/01/2012

N

0 0.25 0.5 1
Kilometres
1:20 000



Plan 10a

Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Slope Analysis

Legend

- Study Area
- Contours (20 m)
- Gravel Roads
- National Roads
- Dry river

% Slope Rise

- <8
- 8 - 12
- 12 - 14
- 14 - 18
- 18<

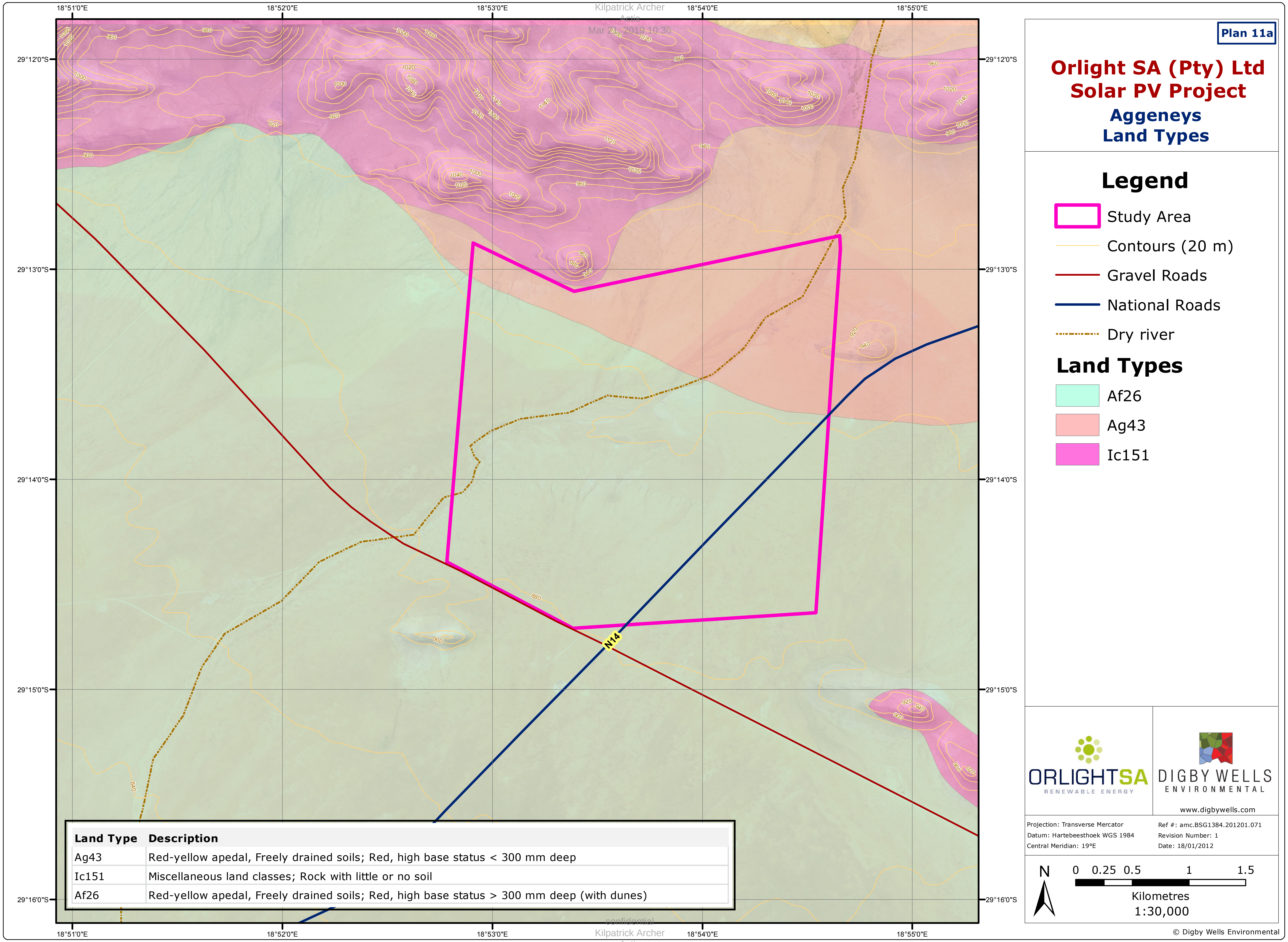
ORLIGHTSA
RENEWABLE ENERGY

DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com

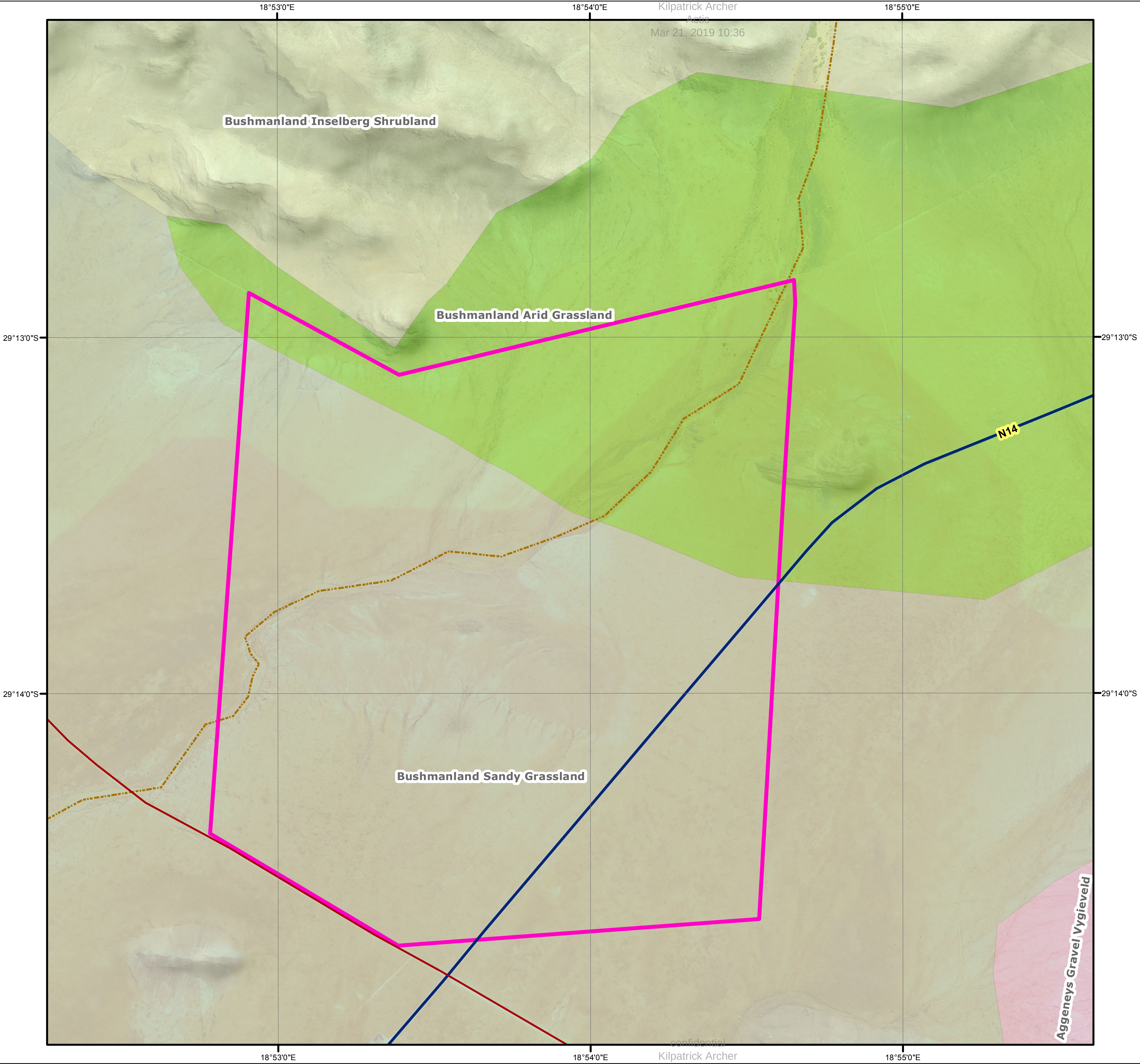
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201203.022
Revision Number: 1
Date: 07/03/2012

N
0 0.25 0.5 1 1.5
Kilometres
1:25,000



Land Type	Description
Ag43	Red-yellow apedal, Freely drained soils; Red, high base status < 300 mm deep
Ic151	Miscellaneous land classes; Rock with little or no soil
Af26	Red-yellow apedal, Freely drained soils; Red, high base status > 300 mm deep (with dunes)



Plan 12a

Orlight SA (Pty) Ltd
Solar PV Project

Aggeneys
Vegetation Types

Legend

- Study Area
- Gravel Roads
- National Roads
- Dry river

Surrounding Vegetation Types

- Aggeneys Gravel Vygieveld
- Bushmanland Arid Grassland
- Bushmanland Inselberg Shrubland
- Bushmanland Sandy Grassland

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

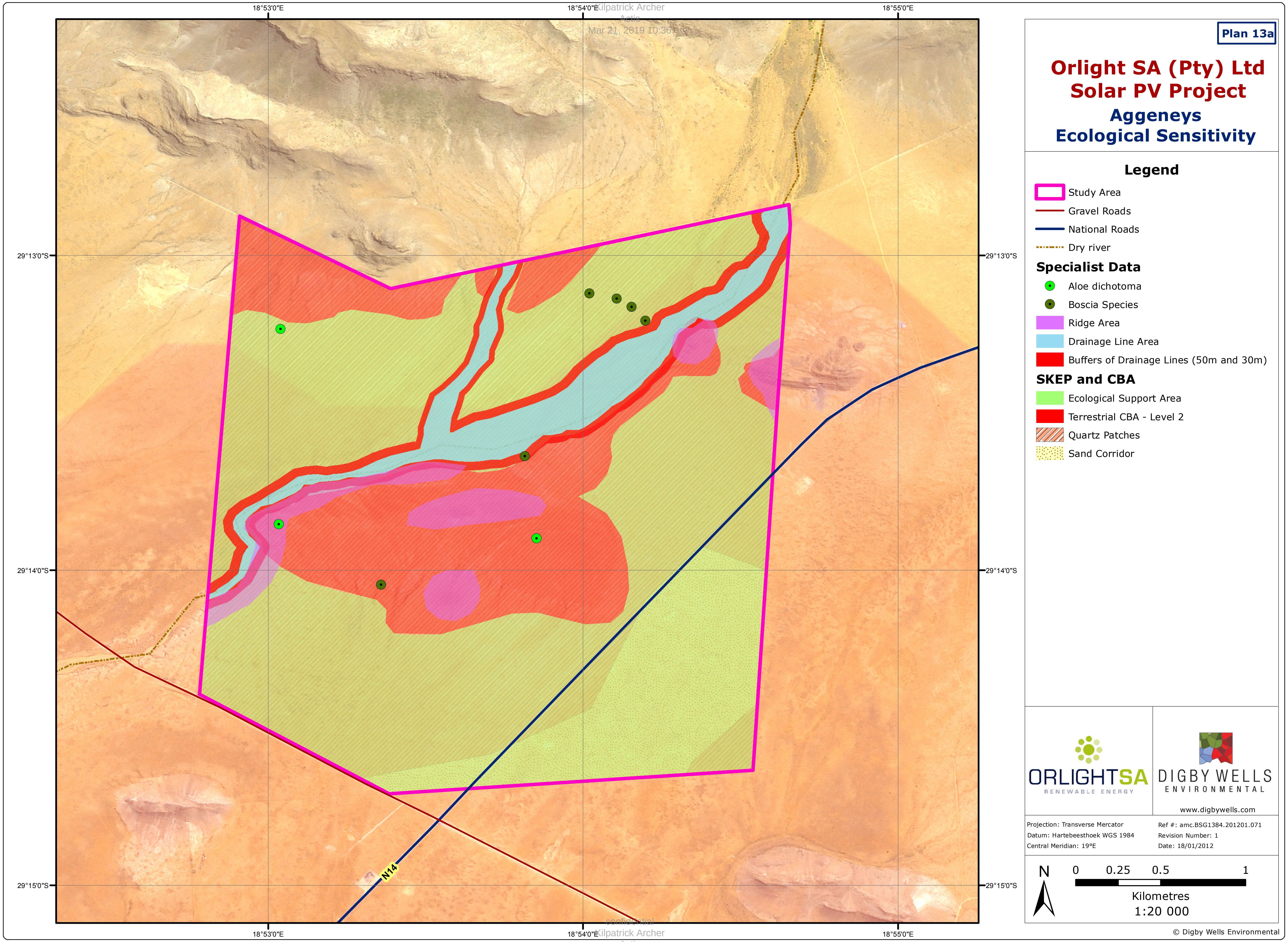
Ref #: amc.BSGR1384.201204.161
Revision Number: 1
Date: 18/01/2012

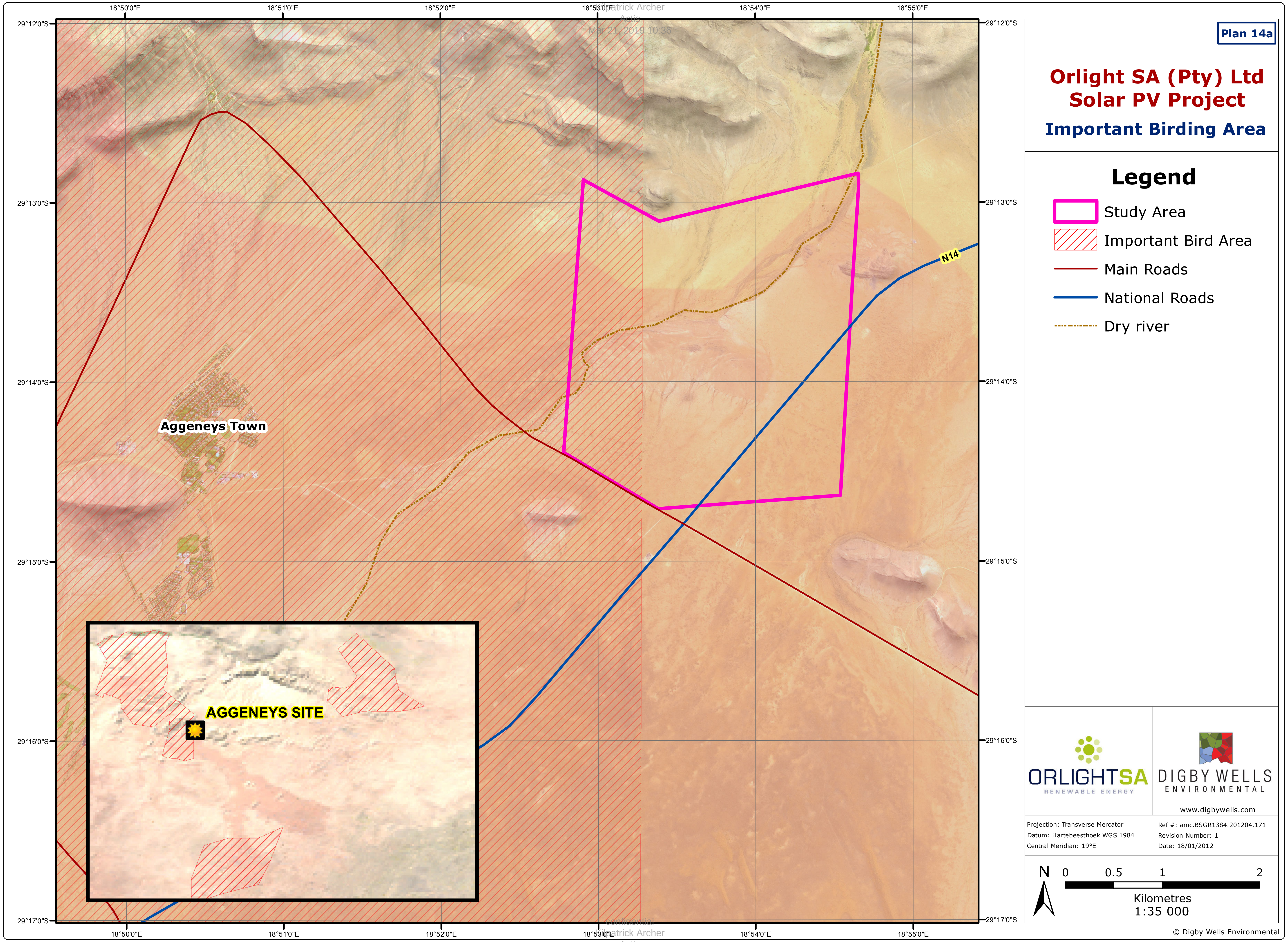
N

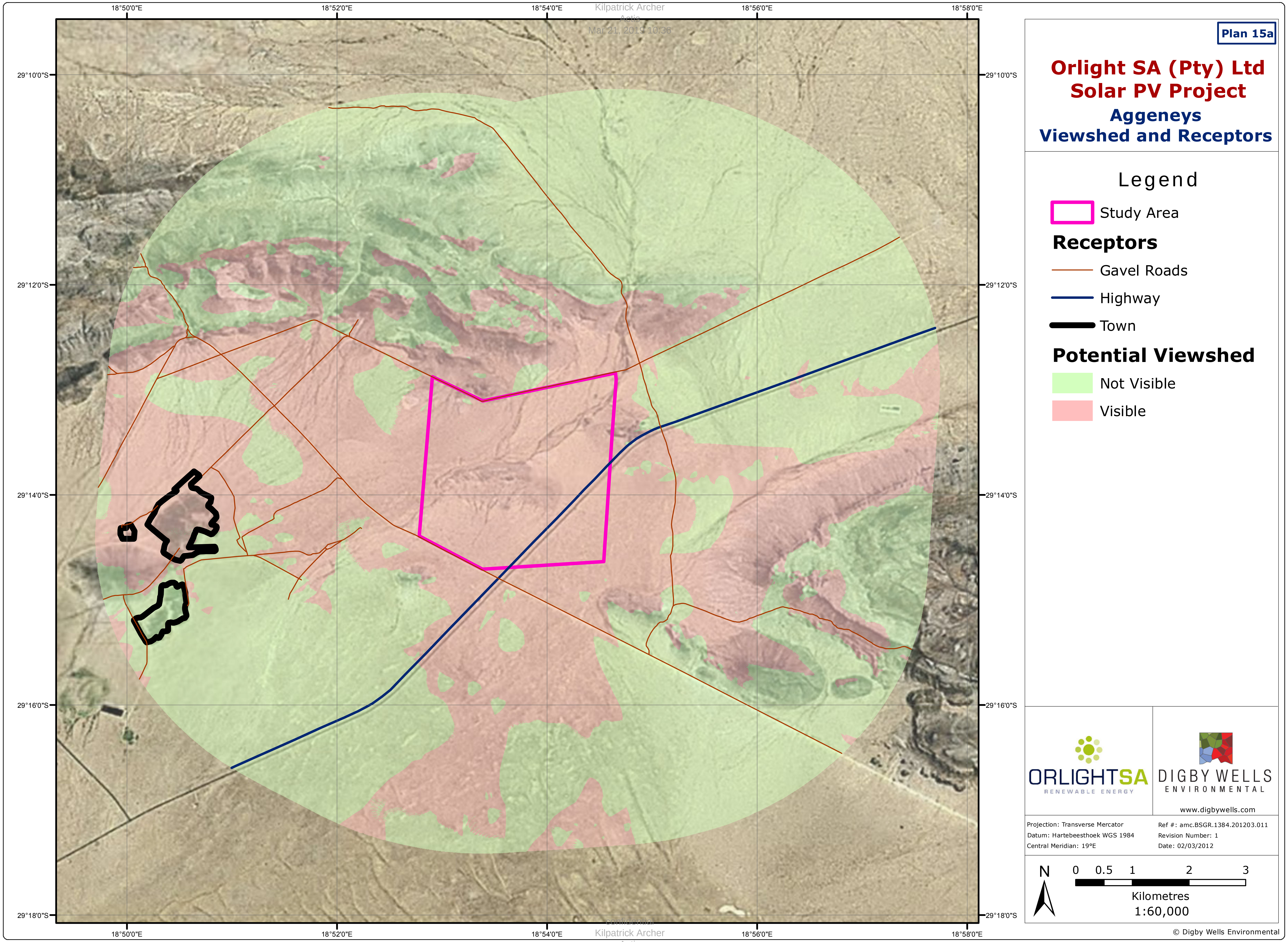
0 0.25 0.5 1

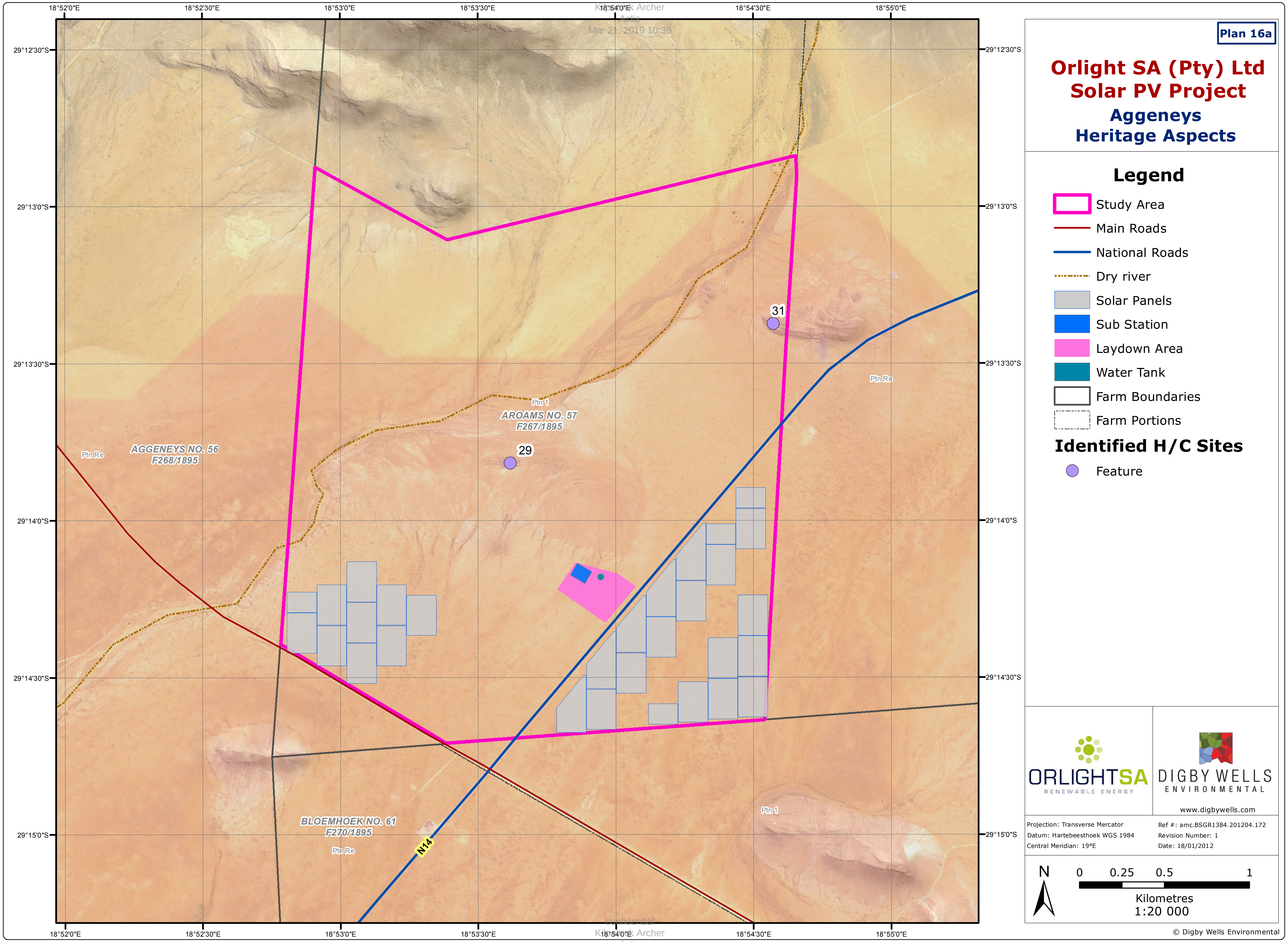
Kilometres

1:20,000

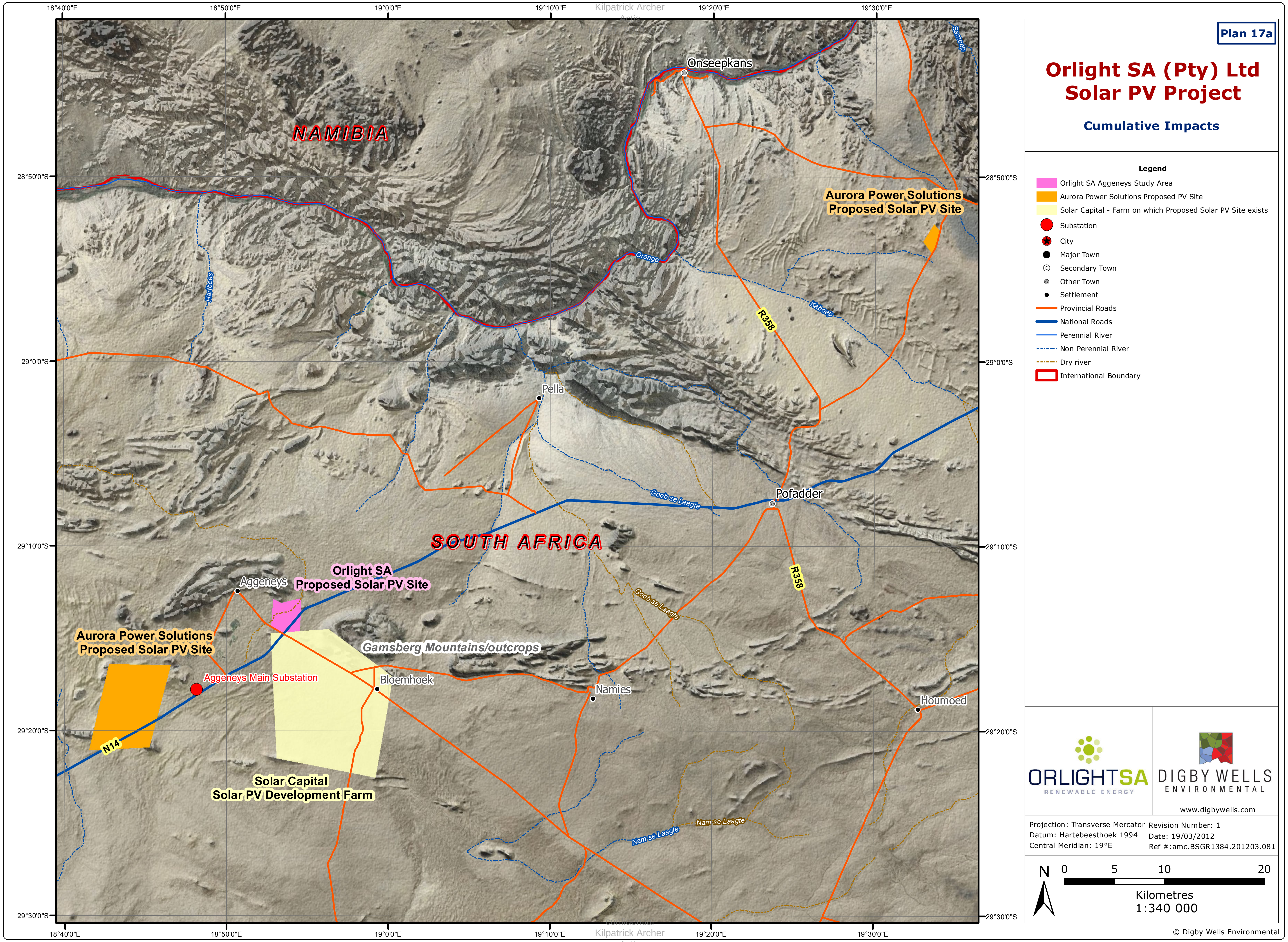

Plan 13a
Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Ecological Sensitivity
Legend
Study Area
Gravel Roads
National Roads
Dry river
Specialist Data
Aloe dichotoma
Boscia Species
Ridge Area
Drainage Line Area
Buffers of Drainage Lines (50m and 30m)
SKEP and CBA
Ecological Support Area
Terrestrial CBA - Level 2
Quartz Patches
Sand Corridor
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSG1384.201201.071
Revision Number: 1
Date: 18/01/2012
N
0 0.25 0.5 1
Kilometres
1:20 000
© Digby Wells Environmental
18°53'0"E
18°54'0"E
18°55'0"E
29°13'0"S
29°14'0"S
29°15'0"S
N14


Plan 14a
Orlight SA (Pty) Ltd
Solar PV Project
Important Birding Area
Legend
Study Area
Important Bird Area
Main Roads
National Roads
Dry river
18°50'0"E
18°51'0"E
18°52'0"E
18°53'0"E
18°54'0"E
18°55'0"E
29°12'0"S
29°13'0"S
29°14'0"S
29°15'0"S
29°16'0"S
29°17'0"S
Aggeneys Town
N14
AGGENEYS SITE
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR1384.201204.171
Revision Number: 1
Date: 18/01/2012
N
0
0.5
1
2
Kilometres
1:35 000
© Digby Wells Environmental


18°50'0"E
18°52'0"E
18°54'0"E
18°56'0"E
18°58'0"E
29°10'0"S
29°12'0"S
29°14'0"S
29°16'0"S
29°18'0"S
Plan 15a
Orlight SA (Pty) Ltd
Solar PV Project
Aggeneys
Viewshed and Receptors
Legend
Study Area
Receptors
Gavel Roads
Highway
Town
Potential Viewshed
Not Visible
Visible
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR.1384.201203.011
Revision Number: 1
Date: 02/03/2012
N
0 0.5 1 2 3
Kilometres
1:60,000
© Digby Wells Environmental



confidential
Kimberly Archer
Actis
Mar 21, 2019 10:36


Plan 17a
Orlight SA (Pty) Ltd
Solar PV Project
Cumulative Impacts
Legend
Orlight SA Aggeneys Study Area
Aurora Power Solutions Proposed PV Site
Solar Capital - Farm on which Proposed Solar PV Site exists
Substation
City
Major Town
Secondary Town
Other Town
Settlement
Provincial Roads
National Roads
Perennial River
Non-Perennial River
Dry river
International Boundary
NAMIBIA
SOUTH AFRICA
Onseepkans
Orange
Harlbees
Kaboep
Samoep
R358
Pella
Pofadder
Goob se Laagte
Aggeneys
Orlight SA
Proposed Solar PV Site
Aurora Power Solutions
Proposed Solar PV Site
Aggeneys Main Substation
Gamsberg Mountains/outcrops
Bloemhoek
Namies
Houmoed
N14
Solar Capital
Solar PV Development Farm
Nam se Laagte
18°40'0"E
18°50'0"E
19°0'0"E
19°10'0"E
19°20'0"E
19°30'0"E
28°50'0"S
29°0'0"S
29°10'0"S
29°20'0"S
29°30'0"S
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date: 19/03/2012
Ref #:amc.BSGR1384.201203.081
N
0 5 10 20
Kilometres
1:340 000
© Digby Wells Environmental

Appendix B: Title deeds

24. FINDLAY & TAIT
St George's Wandellaan 60
KAAPSTAD
8001

Opgestel deur my

TRANSPORTBESORGER
ARL BERTRAND

SEËLREG
DUTY R.........

FOOI
FEE R....500,00

2760

T 005536 / 2002

TRANSPORTAKTE
Kragtens 'n Prokurasie
SY DIT KENNELIK AAN ALMAL WIE DIT MAG AANGAAN

DAT ALBERT ROBERT LOUIS BERTRAND

verskyn het voor my, Registrateur van Aktes te Kaapstad, Hy die gesegde Komparant synde daartoe behoorlik gemagtig deur 'n volmag uitgevoer te KEIMOES op 14 SEPTEMBER 2001, deur

ABRAHAM JOHANNES ALBERTUS VAN NIEKERK
Identiteitsnommer 351124 5003 08 5
Getroud buite gemeenskap van goedere

welke volmag, geteken in die teenwoordigheid van getuies ooreenkomstig die Wet, my hede getoon is;

10

PARA 3 WOP

4

VERBIND MORTGAGED

VIR
FOR R 900 000,00

B 53437/03
2003-09-17

REGISTRATION FEES

3

BC 076281/08
GEKANSELLEER
CANCELLED

REGISTRATEUR/REGISTRAR
18 SEP 2008

EN die Komparant het verklaar dat sy voorsegde Prinsipaal werklik en wettiglik verkoop het op 14 SEPTEMBER 2001 en dat hy, in sy hoedanigheid as voorsegde prokureur, deur hierdie akte, gesedeer en getransporteer het in volle en vrye eiendom aan en ten behoewe van

DIE TRUSTEES INDERTYD VAN DIE AJA VAN NIEKERK FAMILIE TRUST
REGISTRASIE NOMMER IT434/2000

hul Amps Opvolgers of Gemagtigdes

1. **GEDEELTE 1 VAN DIE PLAAS AROAMS NR 57**
Munisipaliteit Khai-Ma, Afdeling van Namakwaland,
Provinsie Noord-Kaap;

GROOT: 3837,7102 (Drieduisend Agthonderd Sewe en Dertig komma sewe een nul two) hektaar.

AANVANKLIK OORGEDRA kragtens Transportakte Nr T12000/1929 met Kaart wat daarop betrekking het en gehou kragtens Transportakte Nr T26930/1987.

A. ONDERHEWIG aan die voorwaardes waarna verwys word in Akte van Transport Nr T3332/1929;

B. ONDERHEWIG aan die voorwaardes vervat in Grondbrief gedateer 14 Julie 1915 (Namakwaland Erfpagte Boekdeel 10, Nr 16), Nrs II tot VII waarvan soos volg lui:-

"II. That all roads and thoroughfares being or existing on the land whether or not described in the plan or diagram of the same, shall remain free and uninterrupted unless the same be closed or altered by competent authority.

III. That if at any time it should appear to the State President upon petition of any adjacent or neighbouring proprietor that such adjacent or neighbouring proprietor requires a way or road of necessity to or from the land of such adjacent or neighbouring proprietor, the owner of the land hereby granted which such road is required, shall be bound to grant such way or road of necessity, and to point out the direction and width thereof: provided that in case of a dispute or difference regarding such road, or its sufficiency, the direction and width of the road shall be decided upon by the Divisional Council of the Division in which the land is situated: provided, further, that the said owner shall not be bound to allow such road or thoroughfare across land which shall at the time be in a state of cultivation or improvement, and that compensation for the right of way and any damage done shall be paid for by the person or persons for whose benefit and upon whose application the said road is made according to determination by arbitration.

B

IV. That the State President shall at all times have the right to make roads, railways, dams, aqueducts, drains and to conduct telegraphs over the land for the benefit of the public, and to take materials for these purposes; also to establish convenient outspans for the use of travellers on payment to the proprietor of such sum of money as compensation as may be determined by arbitration; provided that the arbitrators may set off against he loss of damage caused to the proprietor, the benefit, instant or prospective, which he shall or may derive in consequence of the construction of any of the said works.

V. That the State president shall at all times have the right of resuming the whole or a portion of the land hereby granted, if required for public purposes, on payment to the proprietor of such sum of money in compensation as may be mutually agreed upon by the parties concerned, or failing such agreement as may be determined by arbitration.

VI. That all rights to gold, silver and precious stones found or discovered at any time on or in the said land, shall be reserved to the State, together with a right of ingress and egress from any mines or works undertaken for mining or prospecting purposes by any person or persons authorised by the Minister; but subject always to the provisions of any law for the time being of regulating the prospecting and minings for precious stones and minerals.

VII. That the proprietor shall allow to the public travelling along one or more of the roads running over the land hereby granted the right to pass over and graze their loose cattle, horses, sheep and goats to any extent not exceeding One Hundred and Eighty comma Nine One metres on each side thereof, such roads to be selected for that purpose by the Divisional Council."

C. ONDERHEWIG aan die serwituut waarna verwys word in die Endossement gedateer 31 Julie 1978 op Akte van Transport Nr T22714/1965, welke Endossement as volg lees:-

"By Notarial Deed No K589/1978 dd 14-7-1972 S, the property held hereunder is subject to a right in favour of The Electricity Supply Commission to convey electricity thereover, together with ancillary rights and subject to conditions, as will more fully appear from reference to said Notarial Deed, grosse whereof is annexed hereto."

Soos gewysig deur Notariële Akte Nr K826/1983 S, waarna verwys word in die Endossement gedateer 30 November 1983 op Akte van Transport nr T22714/1965, welke Endossement as volg lees:-

"Kragtens Notariële Akte van Wysiging van Serwituut Nr K826/1983 S gedateer 31-10-83 geregistrer op 30 November 1983 het EVKOM die reg, voorbehou in Notariële Akte Nr K589/1976 S, uitgeoefen om hierdie vroeëre Notariële Akte te wysig deur die Kraglynroetes oor die eiendom meer volledig te beskryf. Soos meer volledig sal blyk uit gesegde Notariële Akte"

D. ONDERHEWIG aan die onteiening waarna verwys word in die Endossement gedateer 28 November 1979 op Akte van Transport Nr T22714/1965, welke Endossement as volg lees:-

"Para 1

ENDOSSEMENT KRAGTENS ARTIKEL 31(6) VAN WET 47 VAN 1937 (SOOS GEWYSIG)

'n Gedeelte van die eiendom hierin vermeld in Para 1, groot ongeveer 7,6726 ha is onteien deur die Prov. Adm. Van die Kaap kragtens Art. 27 van Ord. op paaie 19/1976. Vide Onteieningskennisgewing Nr RD 17/2728 d.d. 25-10-1979 geliasseer as Onteinings Caveat Ex 767/79 planne in tweevoud geliasseer hiermee."

E. ONDERHEWIG aan die serwituut waarna verwys word in die Endossement gedateer 22 Mei 1981 op Akte van Transport Nr T22714/1965, welke Endossement as volg lees:-

"Kragtens Notariële Akte van Serwituut K340/81 S gedateer 29/1/1981 is die ewigdurende reg aan die Pelladrift Waterraad verleen om 'n waterleiding te lê binne 'n serwituutgebied 30 meter wyd wat insluit pypleiding, pompinstallasie en opgaardamme met kleppe en meegaande toebehore met bykomende regte en verpligtings. Soos meer ten volle sal blyk uit gesegde Notariële Akte."

F. Kragtens Notariële Serwituutakte Nr K1053/2000S die binnegemelde eiendom is onderhewig aan 'n kraglynserwituut ten gunste van ESKOM mete bykomende regte.

2. **GEDEELTE 1 VAN DIE PLAAS POORTJE NR 209,** Munisipaliteit Khâi-Ma, **Afdeling Kenhardt, Provinsie Noord-Kaap;**

GROOT: 5774,9447 (Vyfduisend Sewehonderd Vier en Sewentig Komma nege vier vier sewe) Hektaar.

AANVANKLIK OORGEDRA kragtens Verdelingstransportakte Nr T3489/1948 met 'n Kaart Nr 1981/47 wat daarop betrekking het en gehou kragtens Transportakte Nr T12236/1977.

A. ONDERHEWIG aan die voorwaardes waarna verwys word in Grondbrief uitgereik Ingevolge Wet Nr 40 van 1895 op 27 Oktober 1914 (Kenhardt Erfpagte Boek 7 Nr 12) Nrs II, III, IV, V, VI, VII en VIII waarvan as volg lui:

"II. That all roads and thoroughfares being or existing on the land whether or not described in the plan or diagram of the same, shall remain free and uninterrupted unless the same be closed or altered by competent authority.

III. That if at any time it should appear to the Governor General upon petition of any adjacent or neighbouring proprietor that such adjacent or neighbouring proprietor requires a way or road of necessity to or from the land of such adjacent or neighbouring proprietor, the owner of the land hereby granted upon which such road is required, shall be bound to grant such way or road of necessity, and to point out the direction and width thereof: Provided that in case of a dispute or difference regarding such road, or its sufficiency, the direction and width of the road shall be decided upon by the Divisional Council of the Division in which the land is situated: Provided, further, that the said owner shall not be bound to allow such road or thoroughfare across land which shall at the time be in a state of cultivation or improvement, and that compensation for the right of way and any damage done shall be paid for by the person or persons for whose benefit and upon whose application the said road is made according to determination by arbitration.

IV. That the Governor Genral shall at all times have the right to make roads, railways, dams, aqueducts, drains and to conduct telegraphs over the land for the benefit of the public, and to take materials for these purposes; also to establish convenient outspans for the use of travellers on payment to the proprietor of such sum of money as compensation as may be determined by arbitration; Provided that the arbitrators may set off against the loss or damage caused to the proprietor, the benefit, instant or prospective, which he shall or may derive in consequence of the construction of any of the said works.

V. That the Governor General shall at all times have the right of resuming the whole or portion of the land hereby granted, if required for public purposes, on payment to the proprietor of such sum of money in compensation as may be mutually agreed upon by the parties concerned, or failing such agreement as may be determined by arbitration.

4. That the Governor shall at all times have the right of resuming the whole or portion of the said land, if required for public purposes, on payment to the proprietor of such sum of money in compensation as may be mutually agreed upon by the parties concerned, or, failing such agreement, as may be determined by arbitration.

5. That all rights to gold, silver and precious stones found or discovered at any time on or in the said land, shall be reserved to the Crown, together with a right of ingress to and egress from any mines or works undertaken for mining or prospecting purposes by any person or persons authorised by the Minister; but subject always to the provisions of any law for the time being regulating the prospecting and mining for precious stones and minerals.

B. KRAGTENS Notariële Akte Nr. K 28/1976 S, ged 29/10/75, is die binnevermelde eiendom onderhewig aan die reg ten gunste van Elektrisiteitsvoorsieningskommissie om elektrisiteit daaroor te lei, tesame met bykomende regte, en onderhewig aan voorwaardes, soos vollediger sal blyk uit die gesegte Akte, afskrif waarvan hieraan geheg is.

C. KRAGTENS Notariële Akte Nr. K 886/1983 S gedateer 17 November 1983 het EVKOM nou sy reg uitgeoefen soos voorbehou in K 28/76S gedateer 29 Oktober 1975 om die serwituut meer volledig te omskryf. Soos meer volledig sal blyk uit gesegde Notariële Akte met Kaart 3453/83 daaraan aangeheg.

DIE Komparant doen dus hiermee afstand van al die regte, aanspraak en titel wat TRANSPORTGEWER voorheen op genoemde eiendom gehad het, en gevolglik erken die Komparant ook dat TRANSPORTGEWER geheel en al van die besit daarvan onthef en nie meer daarop geregtig is nie, en dat kragtens hierdie akte, bogenoemde DIE AJA VAN NIEKERK FAMILIETRUST hul Opvolgers in Titel of Gemagtigdes tans en voortaan daartoe geregtig is ooreenkomstig plaaslike gebruik behoudens die Regte van die Staat; en ten slotte erken hy dat die hele Koopsom ten bedrae van R1 050 254,00 (EENMILJOEN EN VYFTIGDUISEND TWEEHONDERD VIER EN VYGTIG RAND) behoorlik betaal of verseker is.

TEN BEWYSE waarvan ek, die genoemde Registrateur, tesame met die Komparant, hierdie Akte onderteken en dit met die Ampsel bekragtig het.

ALDUS GEDOEN en verly op die Kantoor van die Registrateur van Aktes, te Kaapstad, op 28 JANUARIE 2002.

TRANSPORTBESORGER q.q.

In my teenwoordigheid

REGISTRATEUR VAN AKTES

Appendix C: Company profile and Curricula Vitae

Appendix – Curricula Vitae of Project Team

SPECIALIST	RESPONBILITY
Alice McClure	Visual Impact Assessment
Andrew Husted	Aquatic and wetland ecology
Bradly Thornton	Visual Impact Assessment
David John Halkett	Archaeological Impact Assessment
Florentien Wijsenbeek	Archaeological Impact Assessment
Gerhard de Wet	Traffic Impact Assessment
Grant Beringer	EIA Report (reviewer)
Hendrik Smith	Soils and agricultural potential assessment (reviewer)
Jayson Orton	Archaeological Impact Assessment
Johan Nel	Cultural resources pre-assessment
John Pether	Paleontological Impact Statement
Karien Lotter	Socio-economic impact assessment
Lita Webley	Archaeological Impact Assessment
Louw Potgieter	Soils and agricultural potential assessment
Marike de Klerk	Tourism and land use assessment , EIA Report
Maria Ackermann	EIA Report
Rudi Greffrath	Ecological assessment
Sibongile Bambisa	Public Participation
Thomas Wilson	Rehabilitation plan

DIGBY WELLS
ENVIRONMENTAL

ALICE MCCLURE

Miss Alice McClure

Specialist: GIS and Air Quality

GIS & Air Quality Department

Digby Wells Environmental

1 EDUCATION

- 2005 – 2007: B.Sc Environmental Sciences: Majored in Environmental Science and Entomology (Rhodes University)
- 2008: B.Sc (Hons) Environmental Sciences: Courses in Conservation Planning, Rehabilitation Ecology, Non-timber Forest Product Uses, Geographic Information Systems (GIS), Environmental Impact Assessment (EIA) and a short course in statistics (Rhodes University)
- 2009 – 2010: M.Sc. Environmental Sciences: Proactive conservation planning with a strong social focus using GIS

2 EMPLOYMENT

March 2011 to present	Digby Wells Environmental
January 2009 – August 2010	Eden to Addo Corridor Initiative

3 EXPERIENCE

GIS specialist in the Geographic Information Systems (GIS) and Air Quality Department. Graduated with a MSc in Environmental Sciences. The research associated with my master's degree was carried out while I was employed at Eden to Addo and was utilised practically to begin the systematic design of a conservation corridor between Addo Elephant National Park and Tsitsikamma National Park. Special consideration was given to the high social sensitivity of the area and the controversy surrounding conservation in the area. I used GIS to explore the effect and outcomes of incorporating social data into systematic conservation planning using least-cost corridor models. Since employment at Digby Wells, my expertise in ArcGIS processes has grown exponentially and techniques to solve spatial, temporal and analytical problems have been refined.

Responsibilities at Digby Wells Environmental currently include but are not limited to:

- Generation of maps for company projects;
- Compilation of Visual Impact Assessments;
- Assist in the completion of Biodiversity Assessments;
- Assist in the completion of Due Diligence Reports;
- Assist in the development of a systematic and efficient tree-relocation plan;
- Assist in the maintenance of the GIS database by storing all electronic files in a well organised structure;
- Assist in the completion of Closure Cost Assessments by solving the spatial and analytical queries involved;
- Assist in the design and completion of Rehabilitation Plans;
- Assist in carrying out air quality assessments;
- Produce spatial information in map format; and
- Application of GPS technology, aerial photo and satellite images.

4 PROJECT EXPERIENCE

Dennilton Transmission Project Basic Assessment Report – PBA International (SA) (Pty) Ltd (for Eskom Holdings)

Date:	2011
Responsibilities:	Assist in the completion of the Biodiversity Assessment

Temo Coal Mine Environmental Impact Assessment and Environmental Management Plan – Temo Coal (Pty) Ltd

Date:	2011
Responsibilities:	Generate spatial data in the form of maps
	Assist in the Closure Costing by solving spatial queries
	Assist in air quality assessment

Boikarabelo Coal Mine and Rail Environmental Impact Assessment, NEMA/NEMWA Application and Waste License Applications – Resource Generation

Date:	2011
Responsibilities	Generate spatial data in the form of maps
	Assist in the formulation and completion of a tree-relocation plan

	Assist in the design of a Landfill Site

Kangala Coal Mine Closure and Rehabilitation Plan – Universal Coal PLC

Date:	2011
Responsibilities	Generate spatial data in the form of maps
	Assist in the Rehabilitation design by solving spatial queries

Continental Coal Due Diligence (Project Kabeljou) – Continental Coal (PTY) LTD.

Date:	2011
Responsibilities	Assist in the completion of the due diligence report
	Assist in the management of the project

5 PROFESSIONAL AFFILIATIONS

Geographic Information Society of South Africa (GISSA)

DIGBY WELLS
ENVIRONMENTAL

ANDREW HUSTED

Mr. Andrew Husted

Aquatic Ecologist

Biophysical Department

Digby Wells Environmental

1 EDUCATION

- 2006 – 2007: BSc Masters in Aquatic Health – University of Johannesburg (UJ)
- 2005 – 2006: BSc Hons. Zoology – Aquatic Health – Rand Afrikaans University (RAU)
- 2005 – 2003: BSc Natural Science – Zoology & Botany (RAU)

2 EMPLOYMENT

August 2007 – Present: Digby Wells Environmental, as an aquatic ecologist

January 2006 – June 2007: Econ@UJ, as an aquatic ecologist

3 EXPERIENCE

Before joining Digby Wells & Associates (DWA) I was employed by Econ@UJ, a consortium based at the University of Johannesburg specializing in aquatic ecology as a researcher and project manager. I was involved in a number of projects at all levels. Through this I gained a wealth of experience in terms of aquatic assessments, which included ecological state assessments as well as biomonitoring programmes. Additional responsibilities included project management as well as co-ordination of specialists and report writing. I was also responsible for the management of other master degree studies, ensuring work was completed correctly and the deliverables were met as well as written articles were correct and accurate.

The River Health Programme is a national programme in which I have had extensive training on both a provincial and national level. I am a registered and recognised user of the programme. In addition to this, I have been involved in the formulation of the programme on an ongoing basis. Through this, I have a good understanding of the benefits and uses of such a programme, as well as the limitations offered by it. I am also an accredited South African Scoring System version 5 (SASS5) practitioner, a requirement of the RHP. I have received training on the RHP and the relevant indices in order to familiarise myself with the latest tools.

I am also currently part of the first group of consultants to be trained by DWAF during a year long training programme (2008). This training will allow me to be recognised by DWAF as a competent wetland delineator. The programme not only allows for wetland areas to be delineated but also for ecological services offered by the wetlands to be identified and described as well as for the integrity (health) of the wetland unit to be established. I also received a certificate of competence from Rhodes University for tools which are considered for wetland delineations as well as the

WET-Management series. An additional area of speciality which is being developed is the design of rehabilitation or conservation strategy for wetland offset areas.

I have also had the opportunity to undergo training with Rivers of Life in the use of the fish community structure to assist with the determination of the ecological state of lotic systems, such as dams and lakes. This training was conducted of a one year period and took place in Selebi-Phikwe, Botswana. In addition to this, I also received training in the application of telemetry to Tigerfish (*Hydrocynus vittatus*) both in Botswana and the Limpopo province. This included the capture of the species, as well as the sedation, transport, tagging and stocking of the species into a different system. In addition to this, the training required the monitoring of tagged individuals throughout the year which included 24 hour surveys. The aim of such a component is to conduct an assessment of the behaviour of the tagged populations.

In an endeavour to continue to improve my skills and specialist knowledge of my areas of interest, continuous training is required. Also considering the environment we live in today and demand for goods and services from our natural systems, there is a growing need to better understand our ecosystems. Owing to complexity of wetlands and the demands and stresses placed on these systems, I was trained in the soil classification of wetlands as well as the rehabilitation methods and techniques widely adopted to better understand this specialist area.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

BRADLY THORNTON

Bradly Thornton

Department Manager: Geographic Information Systems (GIS) & Air Quality

GIS & Air Quality Department

Digby Wells Environmental

1 EDUCATION

- 2000 – 2002: BSc Natural Sciences: Majored in Geology, Geography & Environmental Management (Rand Afrikaans University).
- 2003: BSc (Hons) Geography and Environmental Management: Strong focus on Geographic Information Systems (GIS), Environmental Management and Physical Geography (Rand Afrikaans University).
- 2007: Introduction to ArcGIS (GIMS)
- 2008: Advanced Analysis with ArcGIS (GIMS)
- 2008: Flood Hydrology (University of Stellenbosch)

2 EMPLOYMENT

March 2007 to present	Digby Wells Environmental
May 2003 – April 2006	Fernridge Consulting
April 2006 – February 2007	OPSI Systems

3 EXPERIENCE

Department manager of the Geographic Information Systems (GIS) and Air Quality department. Graduated with a BSc (Hons) in the field of Geography and Environmental Management. Several years of experience in using GIS techniques for solving spatial and temporal problems within the human and natural environments. After inaugurating GIS technology at Digby Wells, expertise has further developed in the areas of Aerial Photographic and Satellite Remote Sensing applications, topographical and three dimensional (3D) data modelling, statistical analytics and digital cartographic applications. Has a keen interest in identifying natural and social relationships which lends itself to a better understanding of the environment and enhancing informed decision making.

Responsibilities at Digby Wells Environmental currently include but are not limited to:

- Management of the GIS & Air Quality Department;
- Technological development of GIS and Remote Sensing solutions;
- Expanding and improving GIS databases by identifying gaps and sources of additional mapping data;
- The production of spatial information in map format;
- Application of GPS technology, Aerial photo and satellite images.

4 PROFESSIONAL AFFILIATIONS

Geographic Information Society of South Africa (GISSA)

David John Halkett:

ACO Associates cc

Director (Principal investigator)

SKILLS BASE AND CORE COMPETENCIES

- David Halkett is a registered professional archaeologist (principal investigator level) with 23 years of working experience in heritage impact assessment, conservation and archaeological research. He has worked in a wide variety of contexts having participated in over 1000 heritage projects ranging from impact assessment to mitigation of archaeological sites in suburban, rural and industrial situations. David Halkett's experience has led to his participation as an advisor to the National Monuments Council before 2000, a member of Heritage Western Cape regulatory committees, SAQUA and recently a forensic consultant to the NPA. He regularly leads field projects on behalf of other research organisations. Having run the Archaeology Contracts Office at the University of Cape Town for 23 years, Dave Halkett is now also a director of the recently established ACO Associates cc. David is a long standing member of the Association of Professional Archaeologists (ASAPA) and an accredited Principal Investigator of the CRM section. David currently serves as a specialist advisor on both the APM and IARCOM committees of Heritage Western Cape.

TERTIARY EDUCATION

MA University of Cape Town 1992
BA hons University of Cape Town 1982
BA University of Cape Town 1980

EMPLOYMENT HISTORY

2008 - present - Director of ACO Associates cc.
1988 - present - Principal Investigator, Archaeology Contracts Office, UCT
2007 - Forensic consultant: Missing Persons Unit: National Prosecuting Authority
1997 - Junior Research Officer, Palaeoanthropology Research Unit, University of the Witwatersrand (p/t appt.)
1984 - Part time research assistant, Spatial Archaeology Research Unit, UCT

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

CURRICULUM VITAE

Personal

Name	Florentien Wijsenbeek
Address	4 Cormorant Close, Imhoff's Gift
Post address	7975 Kommetjie, Cape Town
Phone number	cell: 08-23688153 landline: 0217831914
E-mail address	floor.wijsenbeek@gmail.com
Date of birth	03-05-1973
Marital status	Married having two children. An eight-year-old girl and a four-year-old boy.

Education

1985/1992	Christian Lyceum (V.C.L), The Hague, The Netherlands. A levels: Mathematics, Chemistry, Biology, Dutch, English, History and Geography
1992/1997	Leiden University, The Netherlands MA Archaeology Specialism: Prehistory
1995	University College London, England European Exchange Program (Erasmus) Archaeology Specialism: Prehistory and Physical Anthropology

Additional Training

2010	Website Development Course, University Cape Town
2005/2007	ADC Holding (Major Dutch commercial Archaeology Company (www.archeologie.nl)) Training for Archaeology Policy within country, county and municipal. For this training I did an internship in a large municipal (Leiden)
2008	ADC Holding Training in digital surveying Robotic Total Station (Nikon).

Archaeological Work experience

Organization: **ECRAG**
Date: **2009/2010/2011/2012**
Position: **Archaeological Field worker**
Responsibilities: Recording San rock art and archaeological artefacts on several farms in the Eastern Cederberg. Processing of the data and assisting in Writing Management Plans.

Organization: **Cape Archaeological Survey cc**
Date: **2009**
Position: **Archaeological Project Leader**
Responsibilities: Carried out an Impact Assessment in Paarl: Field survey, collected oral histories, studied building history and wrote the report.

Organization: **ADC Holding, (www.archeologie.nl)**
Date: **2005/2008**
Position: **Archaeological Project Leader**
Responsibilities: I was responsible for the complete process in a small archaeological project, e.g. making the quotation, the organization of the excavation, supervising the staff, writing the scientific reports and maintaining the credit balance. For my reports see list of publications.

Organization: **ADC Holding**
Date: **2005/2008**
Position: **Prehistoric pottery specialist**
Responsibilities: Analyzing pottery and writing scientific reports. Maintaining this pottery project within strict limits of time and money. Pottery came from different Dutch excavations for different archaeological customers. For the reports see list of publications.

Organization: **ADC Holding**
Date: **2004/2005**
Position: **Archaeological GIS assistant**
Responsibilities: Applying the excavation data in a GIS format, and making data ready for the scientific report

Organization: **ADC Holding**
Date: **2003**
Position: **Archaeological Project Leader**
Responsibilities: Monitoring archaeological monuments, with the aim of reevaluating the Archaeology Monument list.

Organization: **RACM, (National Archaeology Institution, www.racm.nl)**
Date: **2002**
Position: **Archaeological assistant Project leader**
Responsibilities: Managing the archaeology within a major road-building project. Contracting archaeological companies for the different projects.

Organization:	**Municipal Archaeology The Haque, (www.denhaag.nl/archeologie)**
Date:	**2000/2001**
Position:	**Archaeological Project Leader**
Responsibilities:	Leading several excavations, processing the field data and writing reports. Furthermore, analyzing prehistoric and Roman pottery, and also writing reports on these data. Also assisting with pollen and seeds analyses.

Organization:	**Municipal Archaeology Breda, (www.breda.nl/archeologie)**
Date:	**1999/2000**
Position:	**Archaeological Project Leader**
Responsibilities:	Leading several excavations, processing the field data and writing reports.

Organization:	**Archol Bv, (www.archol.nl)**
Date:	**1997/1998**
Position:	**Archaeological assistant Project Leader**
Responsibilities:	Leading a team of 25 people at the excavation while working at a major excavation in European prehistoric field; Polderweg en De Bruin at Hardinckveld-Giessendam, Netherlands.

Other work experience

Organization:	**Digitally Dutch, (own company)**
Date:	**2011**
Position:	**Teacher**
Responsibilities:	Organizing and teaching basic Computer skills at home

Organization:	**Fish Hoek Library**
Date:	**2009/2012**
Position:	**Teacher**
Responsibilities:	Organising and teaching a Job Readiness/Career course and organizing and teaching basic skills in computers at Masipumelele library (township Noordhoek).

Organization:	**OPTA (watchdog for phone and mail operators)**
Date:	**1998**
Position:	**Directory Office manager**
Responsibilities:	Managing the office of the director

Organization:	**Archeon, (www.archeon.nl)**
Date:	**1994/1997**
Position:	**Teacher and Entertainer**
Responsibilities:	Representing and teaching on the life style of prehistoric farm- and hunter-gatherers to educate visitors of an Archeological theme park. Alphen aan de Rijn, Netherlands

Referees

- **Janette Deacon**, Project leader Rock Art Recording Group and former Archaeologist at the National Monuments Council, janette@conjunction.co.za
- **Simon Liell-Cock ,** deputy for the DA at Simons Town, simon@artefact.co.za
- **Nicole Daniels**, friend, madamnix@yahoo.com

Skills

- Website development and design
- Access, Word, Excel, Power Point.
- Map-Info, Micro Station 95/97, AutoCAD 2000 and Total Station.
- Driving License
- Bilingual; Dutch and English

Publications

Deacon, J., N. Wiltshire & **F. Wijsenbeek,** 2010**:** Report on an Archaeological Survey, Erf 330, the Krans nature reserve, Mc gregor, langeberg Municipality. Conducted at the Request of the McGregor Heritage Society.

Opbroek, M., **F. Wijsenbeek** & S. Beckerman, 2008: Leek, Leeksterveld. Een Archeologische Begeleiding. Met een bijdrage van: J.W. de Kort (RAAP Archeologisch Advies), L. Kooistra (BIAXConsult), M. Niekus (Rijksuniversiteit Groningen). Amersfoort (ADC Rapport, 918).

Prangsma, N.M. & M.M. Bruineberg, 2007: Venlo Trade Port Noord, deelgebied 7 terrein B t/m I. Een Inventariserend Veldonderzoek in de vorm van proefsleuven. Met bijdragen van: F.S. Zuidhoff, **F. Wijsenbeek**, N.L. Jaspers, H. Kars (Instituut voor Geo- en Bioarcheologie, VU), M.C. Houkes, R. Machiels, S. Baetsen (ACVU HBS). Amersfoort (ADC Rapport, 851).

Veken, B. Van der, 2007: Eijsden Poelveld. Een Inventariserend Veldonderzoek in de vorm van proefsleuven. Met bijdragen van: S. Baetsen, S. Beckerman, S. Bloo, E. Lohof, **F. Wijsenbeek**, F.S. Zuidhoff. Amersfoort (ADC Rapport, 1052).

Verelst, K.F.M. & **F.C. Wijsenbeek**, 2005a: Plangebied Antoniuslaan 74 te Blerick. Een Archeologische Opraving. Met bijdragen van W. van Zijverden en H. van Haaster. Amersfoort (ADC Rapport, 465).

Verelst, K.F.M. & **F.C. Wijsenbeek**, 2005b: Plangebied Antoniuslaan 74 te Blerick: een archeologische opgraving. Amersfoort (ADC-rapport, 465).

Wijsenbeek, F.C., 1998: Voorlopig verslag van het Neolithisch grafveld van Ypenburg. Intern rapport van de Gemeentelijke Archeologische Dienst van Rijswijk.

Wijsenbeek, F.C., 1999: Plangebied Prinsebeek, bewoningssporen uit de Bronstijd, IJzertijd en Romeinse tijd. Intern rapport van de Gemeentelijke archeologische Dienst Breda.

Wijsenbeek, F.C., 2001: Juliana Kinderziekenhuis, Bewoningsporen uit de IJzertijd, Romeinse tijd en vroege middeleeuwen. Intern rapport van de Archeologische Dienst van de Gemeente Den Haag

Wijsenbeek, F.C., 2005a: Archeologisch inventariserend veldonderzoek in het plangebied Praamplein te Aalsmeer. Rasenberg Milieu Techniek bv. VB/82099.

Wijsenbeek, F.C., 2005b: Beverwijk "Meerestein". Een Archeologische Begeleiding. Amersfoort (ADC Rapport, 464).

Wijsenbeek, F.C., 2005c: Ede landgoed de Valouwe, Een Archeologische Begeleiding. Amersfoort (ADC Rapport, 490).

Wijsenbeek, F.C., 2007a: Blerick, Rutgerusgang. Een Inventariserend Veldonderzoek in de vorm van proefsleuven en begeleidingen uitgevoerd in drie deelprojecten in de jaren 2005 en 2006. Amersfoort (ADC Rapporten, 987).

Wijsenbeek, F.C., 2007b: Bodegraven, Oud Bodegraafseweg. Kijkgaatjes in het verleden van Bodegraven. Een Archeologische Opgraving. Amersfoort (ADC Rapport, 545).

Wijsenbeek, F.C., 2007c: Ede, Verlengde Maanderweg 176. Een Inventariserend Veldonderzoek in de vorm van een proefsleuf. Amersfoort (ADC Rapport, 1036).

Wijsenbeek, F.C., 2007d: Aardewerk. In: W. Roessingh: Speuren tussen verstoringen. Bewoningssporen uit de Midden IJzertijd op het PGGM terrein in Zeist. Amersfoort (ADC Rapport, 799), 16-18.

Wijsenbeek, F.C. & S.M. Beckerman, 2007: Mook, het voormalige klooster aan de Bovensteweg 20. Een Archeologische Begeleiding. Amersfoort (ADC Rapport, 1035).

Wijsenbeek, F.C. en W.Jezeer, 2007: Het aardewerk. In: A. van Benthem Zelhem Soerlandt IV (gemeente Bronckhorst) Een archeologische opgraving, Amersfoort (ADC Rapport 880), 21-28.

Wijsenbeek, F.C. & S.M. Beckerman, 2008: Raalte, Sallandse Poort Oost. Een Inventariserend Veldonderzoek in de vorm van proefsleuven. Amersfoort (ADC Rapport, 1090).

Wijsenbeek, F.C., M. Opbroek en S.M. Beckerman, 2009. Wageningen Rooseveltweg. Een Archeologische Begeleiding. Met bijdragen van: N. Jaspers, S.B.C. Bloo & C. van Pruissen. Amersfoort (ADC Rapport, 917).

Wijsenbeek, F.C., in voorbereiding: Het aardewerk uit de Late IJzertijd en Romeinse Tijd. In: E. Blom en W. Roessingh, Aan de rand van het Romeinse Rijk, Archeologisch onderzoek in de Munnnikenpolder te Leiderdorp. Een Archeologische Opgraving, Amersfoort (ADC Rapport 802), 30-40.

Wijsenbeek, F.C., M.Patrick, 2009, Archaeological Impact Assessment: La Grande Roche Hotel Paarl. By Cape Archaeological Survey. Prepared for I.C.@PLAN Town planners, Somerset West.

SUMMARY CV

Gerhard de Wet

Profile

A professional transportation engineer with 11 years of experience in transportation planning and traffic engineering. His work included inter alia numerous traffic impact studies, transportation modelling and planning, toll feasibility studies, traffic signal optimisation and rail passenger flow analysis. Since 2002 he specialised in traffic and pavement loading monitoring with the emphasis on weigh-in-motion technology, data analysis and scrutiny, and technical management of the data collection process.

Experience and skills

BKS (PTY) LTD, Associate Engineer, 2011 – 2012

Management and execution of overloading control projects, transport planning and impact studies, transport modelling and toll related traffic studies.

BKS (PTY) LTD, Chief Engineer, 2006 – 2011

Specialising in calibration and quality management of weigh-in-motion traffic data, performance indicators and auditing load control centres on the N1 North, N4 East, Bakwena and N3 Toll Roads. Member of PRASA rail census steering committee. Headed conceptual design phase of Pretoria Station building. Project management, transport planning and impact studies, transport modelling and toll related traffic studies.

BKS (PTY) LTD, Senior Engineer, 2002 – 2006

Traffic monitoring and overload management systems, toll feasibility studies, traffic impact studies, traffic signal optimisation and design, transport planning and rail passenger monitoring.

BKS (PTY) LTD, Engineer, 2001 – 2002

Traffic counts and origin-destination surveys, traffic impact studies and passenger rail census data analysis.

Selected projects

N3 Overloading Management System, South Africa, *N3 Toll Concession*
On-going monitoring of traffic and loading trends on the N3 Toll Road between Heidelberg and Cedara, including technical analysis and support, contractor management and project management.

N4 Maputo Corridor Overload Control, Mpumalanga, *South African National Roads Agency Ltd*
On-going monitoring of traffic and loading trends on the N4 Corridor, pavement loading data analysis and scrutiny, auditing and reporting on load control centre performance.

Lagos Infrastructure Projects, Lagos, Nigeria, *ARM & Lagos State Government*
Feasibility studies and design input into the Lekki BOT toll road project in Lagos. Manual traffic counts and roadside interviews in Lagos, trip matrices and desire lines, toll strategy and toll plaza queuing modelling.

Toll Feasibility Study: EN1 Maputo – Xai-Xai, Mozambique, *Trans African Concessions*
Investigation of the feasibility of extending the existing EN4 Toll Road to Xai-Xai along the EN1. Traffic surveys, Logit-type route choice model, redistribution of traffic, plaza attraction rates and toll revenue.

Toll Feasibility Studies: Hidcote, Nottingham Road and Warden Ramp Plazas, *N3 Toll Concession*
Origin-destination surveys, Logit choice models, evaluation of toll feasibility and potential financial gain.

Traffic Impact Study: Ilanga Shopping Centre, Nelspruit, Mpumalanga, *Visagie Trust*
Traffic Impact Study (including trip generation, modal split, trip distribution and assignment), road improvements and innovative accessibility solutions to accommodate traffic progression on the N4 through Nelspruit.

Rail Passenger Censuses, South Africa, *PRASA*
Specifications, tender evaluation, data analysis, interpretation and reporting on the Gauteng Rail Passenger Censuses for 2002, 2005, 2007 and 2008, and the Metrorail KZN Rail Passenger Census in 2009. Data analysis for the National Rail Commuter Plan, 2005.

Pretoria Station Upgrade, *PRASA*
Conceptual design of the Pretoria Station building (access, circulation, queuing, control etc.) as part of a general rail capacity upgrade.

Traffic Impact Assessments: KZN and Port Elizabeth Peaking Power Plants, *Environmental Impact Management Services*
Traffic capacity, safety, pavement damage and traffic mitigation measures for the provision of gas turbine peaking power plants in KZN (900 MW) and Coega (500 MW).

Logistics Infrastructure on Road Arrivals, Secunda, South Africa, *SASOL*
Evaluation and optimisation of the access control infrastructure for heavy vehicle deliveries and product collection at SASOL 2 & 3 in Secunda based on an analysis of truck arrival profiles, impact of overflow queues and vehicle queuing and delay modelling.

Supplementary information

Co-author and presenter of paper, "Macroscopic WIM Calibration", at ICWIM Conference, Paris, 2008 (awarded best paper on WIM).
Author of technical paper, "WIM Calibration and Data Quality Management", SAICE Journal, 2010

Position
Associate Engineer: Transportation

Year of birth
1977

Nationality
South African

Language
English and Afrikaans - Excellent

Qualifications
Stellenbosch University, South Africa
MScEng (Civil Engineering), Cum Laude
University of Pretoria, South Africa
BEng (Hons)(Transport), Cum Laude
BEng (Civil)

Memberships
Registered Professional Engineer, ECSA
Member of South African Institution of Civil Engineers

Key skills
Traffic Engineering
Traffic Impact Assessments
Transportation Planning
Overloading Management
Traffic Monitoring
Weigh-in-Motion

engineering a brighter future

DIGBY WELLS
ENVIRONMENTAL

GRANT BERINGER

Grant Beringer

Principal Environmental Consultant and Project Management Coordinator

Corporate Department

Digby Wells Environmental

1 EDUCATION

2004 – 2006:	MSc in Environmental Management – University of Johannesburg (UJ)
2002 – 2003:	BSc Hons. Geography and Environmental Management – Rand Afrikaans University (RAU)
2000 – 2002:	BSc Earth Sciences, Majoring in Geography & Environmental Management and Geology (RAU)

2 EMPLOYMENT

Nov 2010 – Present:	Digby Wells Environmental, as a Principal Environmental Consultant and Project Co-ordinator
Nov 2008 – Nov 2010:	Digby Wells and Associates, as Manager of the Biophysical Department.
March 2007 – Nov 2008:	Digby Wells and Associates, as Unit Manager.
Oct 2003 – March 2007:	Digby Wells and Associates, as an Environmental Scientist.

3 EXPERIENCE

Whilst at Digby Wells I have been extensively involved in the management of the Environmental Impact Assessment (EIA) process as well as with the compilation of Environmental Management Plans (EMP). I have also compiled numerous Prospecting Right Applications, Liability Assessments and Water Use Licenses. In addition I have experience in conducting due diligence investigations throughout Africa; closure costs assessments and EMP compliance auditing. This has included work in Botswana, Namibia, Zambia, The Democratic Republic of Congo (DRC), Zimbabwe, Guinea and

South Africa. The projects I have worked on have covered various minerals, including gold, silver, copper, cobalt, nickel, and coal.

Special areas of interest include Project Management, Closure Liability Assessments and Closure Cost Estimations.

4 PROJECT EXPERIENCE

Harmony Gold Closure Cost Assessment (Project Manager): Completed the closure cost assessment for all Harmony Gold's Operations (for the last 4 years).

Harmony Gold Closure Cost Rate updates (Project Manager): Harmony Gold's rates were updated through investigation into the various industries related to mine closure and rehabilitation.

Sasol Mining Rate update (Project Manager): Sasol's rates for mine closure were reviewed and updated to ensure they were accurate.

Sasol Mining Closure Model review and Update (Project Manager): Sasol's closure cost estimation model was updated to provide ease of use and to make certain that all liabilities were accounted for. The model was also updated to provide summary sheets and allow for cross referencing.

National Manganese Mines (Project Manager): A liability assessment for National Manganese's Morokwa Mine in the Northern Cape was completed. The assessment was conducted to evaluate the current closure methods, provide recommendations for closure and update methodologies adopted by the mine.

Richards Bay Coal Terminal: Completed the liability and closure cost assessment for Richards Bay Coal Terminal.

Closure and Rehabilitation Assessments for prospecting: Numerous prospecting closure and rehabilitation costs have been calculated for operations throughout Southern Africa. The relevant guidelines and standards were used to calculate these costs accurately.

Foskor Zirconia EIA/EMP authorisation (Project Manager): Completion of the EIA and EMP for Foskor Zirconia under the NEMA regulations.

ERGO Mining (Pty) Ltd – Benoni and Elsburg Dump Reclamation Projects (Project Manager): The completion of the EIA/EMPs for the two areas under the MPRDA regulations. The project involved managing the Public Participation Process, Project Meetings and resource allocation and management.

DRD Gold – The overall project management of all DRD Golds reclamation projects. This includes the closure liability assessments.

Xstrata Alloys – Completion of the rehabilitation plan for the proposed Lesedi Power Plant in Mpumalanga.

Randgold Resources – Kibali Gold Project in the DRC. Managed the Environmental studies for the project and currently overseeing the general management of the project which includes the resettlement of people.

A number of due diligences have been completed locally and in Africa, Zambia (2) and Namibia.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

DIGBY WELLS
ENVIRONMENTAL

HENDRIK SMITH

Dr Hendrik Smith

Soil Scientist

Biophysical Department

Digby Wells Environmental

1 EDUCATION

2005 PhD (Interdisciplinary), Commonwealth Open University.

1990 MSc (Agric) Soil Science, University of Pretoria.

1983 BSc (Agric) Hons. SolI Science, University of the Free State.

1978 BSc (Agric) Soil Science and Plant Nutrition, University of Pretoria.

2 EMPLOYMENT

January 1981 – July 1999	Institute for Soil Climate and Water, Agricultural Research Council, Pretoria
July 1999 – September 2003	Freelance soil consultant and franchise owner
September 2003 – January 2008	University of Pretoria, Department Plant Production and Soil Science.
January 2008 – February 2009	Free-lance soil consultant
February 2009 – Present	Digby Wells and Associates as Soil Scientist

3 PROJECT EXPERIENCE

- The effects of soil properties and electrolyte concentration on surface sealing crusting and runoff.
- Reclamation of soil surface sealing and crusting using soil ameliorants.
- The effects of industrial effluents (water quality) on soils.
- Evaluation of organic composted products, lime, gypsum and fertilizers for heavy metals and other health-related micro-elements.

- The influence of heavy metals and other health-related micro-elements on the soil, plant and water system.
- Reclamation of a sacrificial sewage sludge dumping site.
- Reclamation of sodic and saline industrial sites.
- Reclamation of a coarse ash dump site.
- Reclamation of a kimberlite dump site.
- Soil surveys and agricultural potential studies.
- Wetland delineation soil surveys.
- Using wetting front detectors in managing orchard root zone electrical conductivity and fertility.

4 PROFESSIONAL AFFILIATIONS

Registered as a soil scientist with the South African Council for Natural Scientific Professions (Pr.Sci.Nat. Soil Science)

Member of the following relevant bodies:

- Soil Science Society of South Africa since 1981
- South African Soil Surveyors Organization

Curriculum Vitae

Name: Jayson David John Orton

Occupation: Archaeologist

Employer: Archaeology Contracts Office (ACO), University of Cape Town

Date of appointment: Part-time: April 1999 – May 2004
Full-time: June 2004 – September 2008
Part-time: October 2008 - present (while studying)

Education:

Matric	South African College High School	1994
B.A.	University of Cape Town	1997
B.A. (Hons) (Archaeology)*	University of Cape Town	1998
M.A. (Archaeology)	University of Cape Town	2004
D.Phil. (Archaeology)	University of Oxford	current

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

Experience Record:

Research assistant	Spatial Archaeology Research Unit University of Cape Town	1996 - 1998
Field archaeologist	Department of Archaeology University of Cape Town	1998
Field archaeologist	Archaeology Contracts Office University of Cape Town	1999 - 2004
Full-time archaeologist	Archaeology Contracts Office University of Cape Town	2004 -
Undergraduate Tutor	School of Archaeology University of Oxford	2008 - 2009

Other:

South African Archaeological Society Council member	2004 -
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 -
ASAPA Cultural Resources Management Section member	2007 -

ASAPA accreditation (membership number 233):

Principal Investigator (awarded 2007):	Coastal shell middens Stone Age archaeology
Field Director (awarded 2007):	Colonial period archaeology Rock art Grave relocation

Fieldwork and project experience:

Extensive fieldwork as both Field Director and Principle Investigator in the Western and Northern Cape including the following:

Phase 1:

- Clanwilliam Dam & Cederberg surveys
- Central (Sutherland) and southern Karoo
- Southern Namaqualand (coastal and inland areas)
- Northern Namaqualand (coastal and inland areas)
- Numerous small surveys in Cape Town and surrounding suburbs as well as along the West and South Coasts and adjacent interior including the wine lands
- Phase 1 shovel test excavations in historical and prehistoric sites

- Project types include mining, residential, commercial and industrial development, dams, pipe lines, power lines, wind energy facilities, etc

Phase 2:

- Duinefontein (ESA open site)
- Yzerfontein (MSA rock shelter & LSA open shell middens)
- Saldanha Bay (LSA shell midden with burials)
- Cederberg (LSA & MSA rock shelters)
- Richtersveld (LSA open sites)
- Paternoster (LSA open shell midden)
- De Beers Namaqualand Mines (ESA, MSA and LSA open sites and shell middens, occasional burials)
- Knysna (LSA open shell midden with burial)
- Franschhoek (historic farmstead, historic well & LSA open site)
- Chavonnes Battery, V&A Waterfront (historical well, structure & dump)
- Prestwitch Place, Green Point (burial ground)
- Marina Residential, V&A Waterfront (burial ground)
- Many small historical excavations in Cape Town and surrounding suburbs

Academic:
Numerous publications, and several conference presentations and posters all dealing with the Middle and Later Stone Age archaeology of the west coast of South Africa.

DIGBY WELLS
ENVIRONMENTAL

JOHAN NEL

Johan Nel

Archaeologist

Social Sciences Department

Digby Wells Environmental

1 EDUCATION

- 2001 BA Anthropology & Archaeology, University of Pretoria
- 2002 BA Honours Archaeology, University of Pretoria (UP) (2002)
- Current MA Archaeology

2 EMPLOYMENT

2010 – present:	Archaeologist and CRM specialist, Digby Wells Environmental
2005 – 2010:	Co-owner and manager of Archaic Heritage Project Management, Cultural Heritage Resources Management consultancy company;
2004 – 2005:	Resident, professional archaeologist, Rock Art Mapping Project based at Didima / Cathedral Peak, Ukhahlamba-Drakensberg World Heritage Site, Department of Geomatics, University of KwaZulu-Natal;
2003 – 2004:	Freelance, professional archaeologist;
2002 – 2003:	Special Assistant, Physical Anthropology Unit, Department of Anatomy, University of Pretoria;
2000 – 2002:	Technical Assistant, Physical Anthropology Unit, Department of Anatomy, University of Pretoria;
1999 – 2000:	Assistant in Mapungubwe Project, Department of Anthropology and Archaeology, University of Pretoria;
1998 - 1999:	Volunteer at National Cultural History Museum, Pretoria, Writer for BAT ('By About Town) arts section in Perdeby, official University of Pretoria student newspaper.

3 EXPERIENCE

PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENTS:

- Above Ground Storage Tanks survey, SASOL Oil (Pty) Ltd, Free State Province, South Africa
- Access road establishment , AGES-SA, Tzaneen, South Africa
- Boikarabelo Railway Link, Resgen South Africa, Steenbokpan, South Africa
- Conversion of prospecting rights to mining rights, Georock Environmental, Musina, South Africa
- Galaxy Gold Agnes Mine, Barberton, South Africa
- HCI Khusela Palesa Extension, Bronkhorstspruit, South Africa
- Kennedy's Vale township establishment, AGES-SA, Steelpoort, South Africa
- Koidu Diamond Mine, Koidu Holdings, Koidu, Sierra Leone
- Lonmin Platinum Mine water pipeline survey, AGES-SA, Lebowakgomo, South Africa
- Mining right application, DERA Environmental, Hekpoort, South Africa
- Mogalakwena water pipeline survey, AGES-SA, Limpopo Province, South Africa
- Nzoro Hydropower Station, Environmental and Social Impact Assessment, DRC
- Randgold Kibali Gold Project, Environmental and Social Impact Assessment, Kibali, Democratic Republic of the Congo
- Randwater Vlakfontein-Mamelodi water pipeline survey, Archaeology Africa cc, Gauteng, South Africa
- Residential and commercial development, GO Enviroscience, Schoemanskloof, South Africa
- Temo Coal, Limpopo, South Africa
- Transnet Freight Line survey, Eastern Cape and Northern Cape, ERM, South Africa
- Van Reenen Eco-Agri Development Project, GO Enviroscience, South Africa
- Platreef Platinum Mine, Ivanhoe Nickel & Platinum, Mokopane, South Africa

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

MITIGATION PROJECTS:

- Mitigation of Iron Age archaeological site: Kibali Gold Project, DRC
- Mitigation of Iron Age metalworking site: Koidu Diamond Mine, Sierra Leone
- Mitigation of Iron Age sites: Boikarabelo Coal Mine, South Africa
- Exploratory test excavations of alleged mass burial site: Rustenburg, Bigen Africa Consulting Engineers, South Africa
- Mitigation of Old Johannesburg Fort: Johannesburg Development Agency (JDA), South Africa
- Site monitoring and watching brief: Department of Foreign Affairs Head Office, Imbumba-Aganang Design & Construction Joint Venture, South Africa

GRAVE RELOCATION

- Du Preezhoek-Gautrain Construction, Bombela JV, Pretoria, South Africa
- Elawini Lifestyle Estate social consultation, PGS (Pty) Ltd, Nelspruit, South Africa;
- Motaganeng social consultation, PGS (Pty) Ltd Burgersfort, South Africa
- Randgold Kibali Mine, Relocation Action Plan, Kibali, DRC
- Repatriation of Mapungubwe National Park and World Heritage Site, DEAT, South Africa
- Smoky Hills Platinum Mine social consultation, PGS (Pty) Ltd Maandagshoek South Africa
- Southstock Colliery, Doves Funerals, Witbank, South Africa
- Tygervallei. D Georgiades East Farm (Pty) Ltd, Pretoria, South Africa
- Willowbrook Ext. 22, Ruimsig Manor cc, Ruimsig, South Africa
- Zondagskraal social consultation, PGS (Pty) Ltd,Ogies, South Africa
- Zonkezizwe Gautrain, PGS, (Pty) Ltd, Midrand, South Africa

OTHER HERITAGE ASSESSMENTS AND REVIEWS:

- Heritage Scoping Report on historical landscape and buildings in Port Elizabeth: ERM South Africa
- Land claim research Badenhorst family vs Makokwe family regarding Makokskraal, Van

Staden, Vorster & Nysschen Attorneys, Ventersdorp South Africa

- Research report on Cultural Symbols, Ministry for Intelligence Services, Pretoria, South Africa
- Research report on the location of the remains of kings Mampuru I and Nyabela, National Department of Arts and Culture, Pretoria, South Africa
- Review of Archaeological Assessment: Resources Generation, Coal Mine Project in the Waterberg area, Limpopo Province
- Review of CRM study and compilation of Impact Assessment report, Zod Gold Mine, Armenia

ACADEMIC FIELDWORK

Five seasons hosted: survey, mapping and excavation historic / Late Farmer Community sites on farms Bivack 14 MR and Eerstekrans 16 MR for personal MA research, Department of Anthropology and Archaeology, UP.

Ten projects / seasons attended as Teaching Assistant / Member of Staff

Eight projects / field seasons attended on invitation as undergraduate and graduate student

4 PROFESSIONAL AFFILIATIONS

- Association of Southern African Professional Archaeologists (ASAPA): Professional Member
- ASAPA Cultural Resources Management (CRM) section: Accredited member
- International Association of Impact Assessors (South Africa)
- Society for Africanist Archaeologists (SAFA)

5 PUBLICATIONS

Nel, J & Tiley, S. 2004. The Archaeology of Mapungubwe: a World Heritage Site in the Central Limpopo Valley, Republic of South Africa. Archaeology World Report, (1) United Kingdom p.14-22.

Nel, J. 2001. 2001. Cycles of Initiation in Traditional South African Cultures. South African Encyclopaedia (MWEB).

Nel, J. 2001. Social Consultation: Networking Human Remains and a Social Consultation

Case Study. Research poster presentations at the Bi-annual Conference (SA3) Association of Southern African Professional Archaeologists: National Museum, Cape Town.

Nel, J. 2002. Collections policy for the WG de Haas Anatomy museum and associated Collections. Unpublished. Department of Anatomy, School of Medicine: University of Pretoria.

Nel, J. 2004. Research and design of exhibition for Eloff Belting and Equipment CC for the Institute of Quarrying 35th Conference and Exhibition on 24 – 27 March 2004.

Nel, J. 2004. Ritual and Symbolism in Archaeology, Does it exist? Research paper presented at the Bi-annual Conference (SA3) Association of Southern African Professional Archaeologists: Kimberley

Nel, J. 2007. The Railway Code: Gautrain, NZASM and Heritage. Public lecture for the South African Archaeological Society, Transvaal Branch: Roedean School, Parktown.

Nel, J. 2009. Un-archaeologically speaking: the use, abuse and misuse of archaeology in popular culture. The Digging Stick. April 2009. 26(1): 11-13: Johannesburg: The South African Archaeological Society.

Nel, J. 2011. 'Gods, Graves and Scholars' returning Mapungubwe human remains to their resting place.' In: Mapungubwe Remembered. University of Pretoria commemorative publication: Johannesburg: Chris van Rensburg Publishers.

John Pether

January 2010

CURRENT STATUS

Independent Consultant/Researcher.

EXPERTISE

Shallow marine sedimentology.

Coastal plain and shelf stratigraphy (interpretation of open-pit exposures and cores).

Marine macrofossil taxonomy (molluscs, barnacles, brachiopods).

Marine macrofossil taphonomy.

Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones).

Analysis of the shelly macrofauna of modern samples e.g. for environmental surveys.

Is a recognized authority in the field of coastal-plain and continental-shelf palaeoenvironments and is consulted by exploration and mining companies, by the Council for Geoscience, the Geological Survey of Namibia and by colleagues/students in academia pursuing coastal-plain/shelf projects.

Has intimate knowledge of the West Coast geohistorical model w.r.t. exploration for gem diamond resources. Currently a member of the Afri-Can Marine Minerals Corp. exploration team.

Has served as a representative for the interests of palaeontology in early discussions on developing strategies to mitigate loss of data and fossils in coastal mines and developments, in terms of Heritage Resource Management.

At present, an important involvement is in palaeontological impact assessments (PIAs) and mitigation projects in terms of the National Heritage Resources Act 25 (1999).

MEMBERSHIP OF PROFESSIONAL BODIES

South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.

Geological Society of South Africa.

Palaeontological Society of Southern Africa.

Southern African Society for Quaternary Research.

Heritage Western Cape. Member, Permit Committee for Archaeology, Palaeontology and Meteorites.

Accredited member, Association of Professional Heritage Practitioners, Western Cape.

HERITAGE IMPACT ASSESSMENT INVOLVEMENTS

1995. Draft procedures for the mitigation of mining impacts on palaeontological resources at the proposed Anglo-Alpha Saldanha Cement Project. For Mark Wood Consultants, Environmental Management. (Jun)

1995. Specialist Palaeontological Study. Assessment of the potential palaeontological impacts of the shale and limestone mining, Anglo-Alpha Saldanha Cement Project. For Mark Wood Consultants, Environmental Management. (Jun).

1995. The Impact of Mining on Fossiliferous Sediments. Submitted to the Mining Environment Forum, Western Cape Regional office of the Department of Mineral and Energy Affairs. (27 Oct).

2003. Palaeontological Mitigation Report, Development on Velddrif Fossil Shell Bar. Noordhoek Phase 2, Velddrif Housing, Berg River Municipality. For Ninham Shand (Pty) Ltd. (Oct).

2004. Initial Palaeontological Mitigation Report, Last Interglacial Deposits Verlorevlei South Bank. Re-alignment of Main Road Mr 535, Elandsbaai, Provincial Administration Western Cape. For Megan Anderson, Landscape Architect. February 2005. (May).

2004. Palaeontological Mitigation Report, Coastal Marine Deposits Dwarskersbos. Dwarskersbos Erf 276 Housing Development. For BKS (Pty) Ltd. (Sept).

2005. Final Palaeontological Mitigation Report, Last Interglacial Deposits Verlorevlei South Bank. Re-alignment of Main Road Mr 535, Elandsbaai, Provincial Administration Western Cape. For Megan Anderson, Landscape Architect. (Feb).

2005. Brief assessment for palaeontological mitigation, sites on Witteklip, Vredenburg. For Heritage Resources Authority, Western Cape. (2 Sept).

2006. Western Macassar Dunes Eco-trails Project. Heritage specialist input for Draft Scoping Report: Palaeontological assessment of the Western Macassar Dunes. For UCT Environmental Evaluation Unit. (Feb)

2006. Western Macassar Dunes Eco-trails Project. Palaeontological assessment of the Western Macassar Dunes: General Information Document. For UCT Environmental Evaluation Unit. (Feb).

2006. Palaeontological and scientific mitigation of shoreline deposits during works at Dwarskersbos, Erf 149, Dwarskersbos North and Farm 109, Dwarskersbos South. For Western Cape Environmental Consultants (Pty) Ltd, t/a ENVIRO DINAMIK. Mar.

2006. Palaeontological and scientific mitigation of shoreline deposits during works at Erf 470, Velddrif. For Western Cape Environmental Consultants (Pty) Ltd, t/a ENVIRO DINAMIK. Mar.

2006. Palaeontological investigation and mitigatory actions for proposed hazardous waste disposal site, Saldanha Bay municipal area. For Resource Management Services. May.

2006. Palaeontological Mitigatory Actions – Development of Erf 578, Velddrif (Laaiplek). For Western Cape Environmental Consultants (Pty) Ltd, t/a ENVIRO DINAMIK. Aug.

2006. Palaeontological investigation and mitigatory actions for proposed residue dam, Namakwa Sands smelter, Saldanha Bay municipal area. For Resource Management Services. Aug.

2006. Palaeontological Mitigatory Actions – Development of Erf 377, Jacobs Bay. For Matflor (Pty) Ltd. Sept.

2006. Palaeontological Mitigatory Actions – Developments of Portion 7 of Jacobs Baay 108 and Portion 3 of Trekossen Kraal 104. Prepared for Mr Tim Hart, Heritage Assessor, UCT Archaeology Contracts Office (ACO). Sept.

2006. Palaeontological Mitigatory Actions – Development of Erf 460, St. Helena Bay. For CK Rumboll & Partners. Sept.

2006. Palaeontological Mitigation Report, Coastal Marine Deposits, Bloubergstrand. For Cape Archaeology, Dr Mary Patrick. Sept.

2006. Palaeontological Mitigatory Actions – Development of Philipskraal, Centrepoint Development, Saldanha Small Holdings. For BKS (Pty) Ltd Engineering and Management. Dec.

2007. Brief palaeontological impact assessment and proposed mitigatory actions. Construction of a pebble-bed modular reactor, Koeberg. For Archaeology Contracts Office, Dept Archaeology, UCT. (Nov).

2007. Palaeontological Impact Assessment. Desktop scoping report. Developments of Duinekroon 591/ remainder (Still Bay), district Riversdale. For Perception Environmental Planning. (Oct).

2008. EIA Phase 2 expansion of the Saldanha iron ore handling facility. Heritage: Palaeontological Assessment. Stratigraphic review and recommendations for palaeontological mitigation. For PD Naidoo & Associates (Pty) Ltd, consultants to Transnet. (Feb).

2008. Palaeontological Mitigation and Geoheritage: De Beers Namaqualand Mines. Initial Draft Report. 28pp, with 4 maps and 49 images. Unpub. (May).

2008. Palaeontological potential at Baboon Point. A brief palaeontological assessment of erven 65, 66 and Portion 4 of Verlorenvlei Farm no. 8, Baboon Point/Cape Deseada, Elandsbaai. For Agency for Cultural Resource Management. (June).

2008. Palaeontological Impact Assessment. Development Of Erven 231 and 478, Velddrif (Laaiplek). For Robin Ellis, Heritage Impact Assessor. (July).

2009. Draft Palaeontological Impact Assessment. New Borrow Pits for Roadworks, Port Nolloth – Richtersveld Municipality. For Van Zyl Environmental Consultants, Upington. (Jan).

2009. Palaeontological Impact Assessment. Proposed Phosphate Prospecting, Langebaanweg. Langeberg 185 Portions 7 & 12 and Farm 1043, Vredenburg Magisterial District, Saldanha Bay Municipality. For Site Plan Consulting (Pty) Ltd. (Feb).

2009. Palaeontological Impact Assessment (Desktop Scoping Study). Proposed Construction of an Hotel on Ganse Vallei 444/38, Plettenberg Bay, District Knysna, Western Cape. For Perception Environmental Planning. (May).

2009. Palaeontological Impact Assessment (Desktop Scoping Study). Proposed Housing Development on Besters Kraal 38, Portion 37, Vredenburg, Western Cape. For Agency for Cultural Resource Management. (June).

2009. Palaeontological Impact Assessment (Desktop Scoping Study) and Chance Find Management Plan. Establishment of a Metal Recovery Plant At Arcelor Mittal Saldanha Works, Saldanha Bay, Western Cape. For Environmental Resources Management SA (ERM). (June).

2009. Palaeontological Monitoring Report. Establishment Of A Metal Recovery Plant At Arcelor Mittal Saldanha Works, Saldanha Bay, Western Cape. For Environmental Resources Management SA (ERM). (Aug).

2009. Palaeontological Impact Assessment (Desktop Scoping Study). Proposed Construction of an Hotel on Erf 12529, Beacon Island Estate, Plettenberg Bay, District Knysna, Western Cape. For Perception Environmental Planning. (June).

2009. Palaeontological Impact Assessment (Desktop Scoping Study). Proposed New Waste Water Treatment Works, Paternoster. Remainder Besters Kraal 38, Portion 3 and Erf 1519, Vredenburg District, Saldanha Bay Municipality, Western Cape. For Agency for Cultural Resource Management. (July).

2009. Palaeontological Mitigation Procedures. Initial Phase 2a Phosphate Prospecting. Langeberg 185 Ptns 7 & 12 and Farm 1043, Langebaanweg, Vredenburg Magisterial District, Saldanha Bay Municipality. For Site Plan Consulting (Pty) Ltd. (Sept).

2009. Palaeontological Impact Assessment. (Desktop Scoping Study). Protection Of Saldanha-Sishen Iron Ore Railway Line From Beach Erosion Processes Near Elandsbaai. (Aka S.E.F 502330: Elandsbaai Sand Dune Rehabilitation). For Strategic Environmental Focus (Pty) Ltd (Oct).

2009. Palaeontological Impact Assessment (Desktop Study). Proposed Vredelus 132/22 Kv Substation and Verlore-Vredelus 132 Kv Overhead Powerline. With Fossil Find Procedures. Project Reference 0104439, Task 1, Eskom Verlore/Vredelus. For Environmental Resources Management SA (ERM). (Dec).

2009. Palaeontological Mitigation Report. Initial Phase 2a Phosphate Prospecting. Langeberg 185 Ptns 7 & 12 and Farm 1043, Langebaanweg, Vredenburg Magisterial District, Saldanha Bay Municipality. For Site Plan Consulting (Pty) Ltd. (Dec).

2010. Brief Desktop Palaeontological Impact Assessment. Development of Erf 6268, Atlantis Extension 12. For Cape Archaeology (Jan).

RECENT GENERAL CONSULTATION

2005. Note on calcareous tubes etc. from Mossel Bay, sample 46842. For Dr. Curtis W. Marean, Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University. (5 May).

2005. Marine deposits and sea-level history in the Mossel Bay area. With Dave Roberts, CGS. For SACP4 Project led by Dr. Curtis W. Marean, Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University. Ongoing.

2005. Geology of the Velddrif area and desktop assessment of the potential for ****** deposits. For CNdV Africa. (22 Jun).

2005. Notes on a visit to Namakwa Sands, 14 March 2005. For Namakwa Sands (Pty) Ltd. (19 Apr).

2005. Namakwa Sands West Mine: stratigraphy, depositional environments and palaeontology. 1st Report. For Namakwa Sands. (Dec.).

2005. The West Coast – a brief history. For Mr Joss Lean, Exec. Producer, Project Coordination, Our Coast for Life. (Jul).

2005. Initial examination of the macrofaunal fossil content of paraconglomerates from SASA 2C. For De Beers Marine (SA) Pty Ltd. (Aug).

2006. Stratigraphic contexts of palaeoseismicity, Namaqualand coast. Field consultation. For the Council for Geoscience. (Feb).

2006. Namakwa Sands West Mine: stratigraphy, depositional environments and palaeontology. 2nd Phase. For Namakwa Sands. (Oct. – ongoing).

2006. Stratigraphy, depositional environments and palaeontology of Marine EPL 2499, off Namibia. For Afri-Can Marine Minerals Corp. (Nov. – ongoing).

2007. Epl 2499, Namibia. Report On The Vibracores. Features 6, 8, 17 & 18. Voyage Mv Mare Oceano, October-November 2006. Parts I & II. For Afri-Can Marine Minerals Corp. (Aug).

2008. Due Diligence Report. Concession Area EPL 3484, Namibia. For Afri-Can Marine Minerals Corp. Co-authors M. Mittelmeyer, J Pether, L Gardner. (Nov).

PUBLICATIONS

Pether, J. 1983. The lithostratigraphy of Hondeklipbaai – a reconnaissance. Unpub. B.Sc. Honours Project, University of Cape Town , 77 pp.

Kensley, B. & Pether, J. 1986. Late Tertiary and Early Quaternary Mollusca of the Hondeklip area, Cape Province, South Africa. Annals of the South African Museum 97 (6): 141-225.

Pether, J. 1986. Late Tertiary and Early Quaternary marine deposits of the Namaqualand coast, Cape Province: new perspectives. South African Journal of Science 82 (9): 464-470.

Grindley, J.R., Rogers, J., Woodborne, M.W. and Pether, J. 1988. Holocene evolution of Rietvlei, near Cape Town, deduced from the palaeoecology of some mid-Holocene estuarine Mollusca. Palaeoecology of Africa 19: 347-353.

Pether, J. 1990. A new Austromegabalanus (Cirripedia, Balanidae) from the Pliocene of Namaqualand, Cape Province, South Africa. Annals of the South African Museum 99 (1): 1-13.

Rogers, J., Pether, J., Molyneux, R., Hill, R.S., Kilham, J.L.C., Cooper, G. & Corbett, I.B. 1990. Cenozoic geology and mineral deposits along the west coast of South Africa and the Sperrgebiet. Guidebook Geocongress '90. Geological Society of South Africa, PR 1: 1-111.

Pether, J. 1993. Relict shells of Subantarctic Mollusca from the Orange Shelf, Benguela Region, off southwestern Africa. The Veliger 36 (3): 276-284.

Pether, J. 1994. Molluscan evidence for enhanced deglacial advection of Agulhas water in the Benguela Current, off southwestern Africa. Palaeogeography, Palaeoclimatology, Palaeoecology 111: 99-117.

Pether, J. 1994. The sedimentology, palaeontology and stratigraphy of coastal-plain deposits at Hondeklip Bay, Namaqualand, South Africa. Unpub. M.Sc. thesis, University of Cape Town, 313 pp. 5

Pether, J. 1995. Belichnus new ichnogenus, a ballistic trace on mollusc shells from the Holocene of the Benguela region, South Africa. Journal of Paleontology 69: 171-181.

Pether, J, Roberts, D.L. and Ward, J.D. 2000. Deposits of the West Coast (Chapter 3). In: Partridge, T.C. and Maud, R.R. eds. The Cenozoic of Southern Africa. Oxford Monographs on Geology and Geophysics No. 40. Oxford University Press: 33-55.

Roberts, D.L., Botha, G.A., Maud, R.R. and Pether, J. 2006. Coastal Cenozoic Deposits (Chapter 30). In: Johnson, M. R., Anhaeusser, C. R. and Thomas, R. J. (eds.), The Geology of South Africa. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria: 605-628.

CONFERENCE REPORTS/ABSTRACTS

1986. The Late Tertiary and Early Quaternary marine deposits of the coast of Namaqualand, Cape Province. Institute of Coastal Research, University of Port Elisabeth, Report No. 12: 50-60.

1986. Fossil molluscs from Hondeklipbaai. Fourth Conference of the Palaeontological Society of South Africa, Abstracts.

1987. Shallow marine deposition in the Pliocene of Namaqualand. Sixth National Oceanographic Symposium, Stellenbosch. Handbook: B-27.

1989. Relict to Recent Mollusca: a potential for Benguela history. Conference on Geosphere-Biosphere change in Southern Africa, Cape Town, Programme and Abstracts: 35.

1989. Summary of western shelf malacological evidence. Proceedings of the Workshop on later Quaternary fluctuations of sea-level 13th March, 1989, University of Cape Town.

1989. The malacofauna of late Quaternary transgressions. Proceedings of the Workshop on later Quaternary fluctuations of sea-level 13th March, 1989, University of Cape Town.

1995. Molluscan evidence of climatic change from the western shelf. XII Biennial Conference of the Southern African Society for Quaternary Research, Abstracts, 9-10.

POPULAR

1987. Curious conches from bygone beaches. Sagittarius 2 (1): 7-9.

1988. Provinces past and present. Sagittarius 3: 2- 4.

1990. West Coast Excursion. Geobulletin, The Geological Society of South Africa 33(3): 24-26.

SUMMARY HISTORY

1956. Born in Cape Town on the 19th June.

1973. Matriculated First Grade, Westerford High School, Newlands.

1974. Research technical assistant, Division of Sea Fisheries, Walvis Bay. Involved in monitoring of pelagic fishing and in oceanographic and biological research cruises.

1977. B.Sc. student, Geology major, University of Cape Town.

1980. Geologist, Trans-Hex Group (Buffelsbank Diamante, Terra Marina). Diamond exploration onshore and offshore, including ore-body delineation at Hondeklip Bay, prospecting of modern beaches and shoreface, including side-scan sonar mapping. Mapping of south bank Orange River terraces (Baken).

1981. B.Sc., Geology major, University of Cape Town.

1983. B.Sc. Honours, University of Cape Town.

1984. Joined the South African Museum as Professional Officer in the Department of Cenozoic Palaeontology. Researcher of the palaeontology, sedimentology and palaeoenvironments of coastal-plain deposits and deposits of the continental shelf. Duties also involved field collection of invertebrate and vertebrate fossils, their conservation and curation. Honourary curator of the modern Mollusca collection. Participated in educational programmes by giving lectures, courses and preparing displays.

1994. M.Sc. degree awarded with distinction (UCT).

1996. Senior Project Geologist, De Beers Marine. Data acquisition, management, analysis, synthesis and report compilation involving inter alia: field observations, logging and sampling; development of routine field logging criteria, recording procedures and training for operational personnel; sample analysis and interpretation; geological and geophysical interpretation; seabed geotechnical characterization; consultation to peers within the company; project planning; input to local and regional geological models, including within the wider De Beers Group companies.

2004 – Present. Independent Consultant/Researcher.

Currently an independent consultant to Afri-Can Marine Minerals Corp. as a member of the exploration team.

Consultant to EIA/HIA projects, contributing palaeontological impact assessments (PIAs) and mitigation recommendations in terms of the National Heritage Resources Act 25 (1999).

DIGBY WELLS
ENVIRONMENTAL

KARIEN LÖTTER

Ms Karien Lötter

Social Specialist

Social Sciences Department

Digby Wells Environmental

1 EDUCATION

2006	:	BSoc Sci (Honours) (Psychology) cum laude, University of Pretoria, South Africa
2005	:	BSoc Sci (Psychology) cum laude, University of Pretoria, South Africa
0	:	MA (Research Psychology), University of Pretoria, South Africa

2 EMPLOYMENT

02/2012 – Date	Digby Wells Environmental, Social Scientist
09/2009 – 02/2012	Aurecon South Africa (Pty) Ltd, Social Scientist
01/2009 - 09/2009	Golder Associates Africa (Pty) Ltd, Johannesburg, South Africa, Social Scientist
01/2008 - 12/2008	Golder Associates Africa (Pty) Ltd, Johannesburg, South Africa, Intern Social Scientist
01/2007 - 12/2007	Golder Associates Africa (Pty) Ltd, Johannesburg, South Africa, Contract Social Researcher (concurrent with MA directed component)
01/2006 - 12/2006	Crowa Global, Pretoria, South Africa, Criminology Lecturer
01/2006 - 12/2006	University of Pretoria, Pretoria, South Africa, Assistant, Department of Psychology (concurrent with BSoc Sci)

3 EXPERIENCE

Ms Karien Lötter is a social scientist with 4 years' experience. Most of her work is in the field of Social Impact Assessment and Resettlement Planning, although she has experience in other aspects of social research as well. She has been involved in many international projects, including projects in Angola, Central African Republic, Ghana, Malawi, Mozambique, South Africa, Swaziland, Tanzania and Zanzibar.

She has conducted a number of social impact assessments and resettlement plans where her responsibilities included project design and implementation, questionnaire design, management of on-site data collection, qualitative data collection through focus group discussions and individual interviews, management of GIS data, project log frames, drafting public communications and report writing. She recently completed SIAs for Vale in Malawi and the Aga Khan Trust for Culture in Zanzibar.

Ms Lötter has attended courses on topics such as “Geographic Information Systems” and “Resettlement planning and implementation”. She is currently writing her Master's dissertation entitled “Predicted versus actual psych-socio-economic impacts of mining and infrastructure projects”.

4 PROJECT EXPERIENCE

Compilation of a Resettlement Action Plan (RAP) and Implementation of Resettlement for the proposed new Khanyisa Power Station **(Witbank, South Africa). 08/2011 – date.** *Social Specialist.* The proposed construction of a new power station at Kleinkopje Colliery necessitates the relocation of two households. Joint responsibility for all aspects involved in resettlement planning. (Anglo American, South Africa).

Environmental and social impact assessment for the proposed construction of a new Shoprite Checkers branch in Nova Vida, Luanda, Angola **(Angola) 08/2011 - date.** *Social Specialist.* Conducting a Social Impact Assessment for the construction of a new Shoprite Checkers store, and authoring the reports. (Shoprite Checkers, Angola).

Social assessment and stakeholder engagement for the Simandou Project FEL 2 (Liberia). 06/2011 – 07/2011. *Social Specialist.* Assessing the attitudes of the locally-affected communities in order to determine whether they pose a safety risk for the geotechnical teams, and recommending and implementing awareness creation activities and procedures for grievance redress. (Vale, Brazil).

Social input into design criteria for the Ncala Corridor Project FEL 4 (Mozambique and Malawi). 04/2011 – date. *Social Specialist.* Providing input into the Engineering Design Criteria for the construction of a railway from Moatize to Nacala in Mozambique. (Vale, Mozambique).

Environmental impact assessment for the proposed AfriSam Cement Plant, mine and associated infrastructure in Saldanha **(Saldanha, Western Cape, South Africa) 03/2011 - date.** *Social Specialist.* Mining of limestone quarry near Saldanha, transportation of aggregate to a cement mill and production of cement. Conducting a Social Impact Assessment including reconnaissance site visit, focus group discussions and interviews, and authoring the report. (AfriSam, South Africa).

Relocation of Tete International Airport and re-alignment of road N9 **(Mozambique) 01/2011 - 04/2011.** *Social Specialist.* Due to its mining operations in Tete, Mozambique, Riversdale is required to relocate the Tete International Airport and realign a national road in the vicinity of the airport. Identification of fatal flaws and important social considerations during the site selection process. (Riversdale Capital Mozambique, Limitada).

***Environmental impact assessment and environmental management plan for the Mbewu-Isundu 2 x 400kV transmission line project* (Kwa-Zulu Natal, South Africa) 12/2010 - date.** *Social Specialist.* Proposed construction of 2 x 400kV transmission lines from the proposed new Mbewu substation near Pietermaritzburg to the proposed new Isundu substation near Empangeni. Conducting a Social Impact Assessment, including reconnaissance site visit, focus group discussions and interviews, and authoring the report. (Eskom).

***Environmental and social impact assessment for the proposed construction of five new Shoprite Checkers branches in Angola* (Huila, Luanda, Huambo and Benguela - Angola) 07/2010 - 10/2010.** *Social Specialist.* Conducted Social Impact Assessment for each of the five sites where Shoprite Checkers propose to erect stores, and authored the reports. (Shoprite Checkers, Angola).

***Social assessment for road alternatives study for export of coal from Moatize Mine to Beira* (Mozambique) 06/2010 - 10/2010.** *Social Specialist.* Identification of fatal flaws and risks associated with the transport of coal along the proposed route. Co-authored report. (Vale Mozambique).

***Socio-economic baseline and impact assessment for Moatize Mine Expansion and Ncala Corridor Project* (Malawi) 03/2010 - 10/2010.** *Social Specialist.* . Compilation of baseline socio-economic profile based on secondary and primary information collected in the field. Managed and executed fieldwork. Identification and assessment of potential socio-economic impacts resulting from the proposed project. (Vale Mozambique).

***Socio-economic impact assessment for the Zanzibar Urban Services Project* (Zanzibar) 02/2010 - 07/2010.** *Social Specialist.* Compilation of baseline socio-economic profile based on secondary and primary information collected in the field. Managed and executed fieldwork. Identification and assessment of potential socio-economic impacts resulting from the proposed project. Co-authored the Environmental and Social Impact Assessment Report. Provided input from a social perspective into the Environmental and Social Management Plan. (Aga Khan Trust of Culture).

***Olifants River Water Resources Development Project Phase 2* (Limpopo and Mpumalanga, South Africa) 12/2009 - date.** *Social Specialist.* Design and construction of two bulk water transfer pipelines to augment water supply to communities and industries in Limpopo and Mpumalanga Provinces. Conducting and managing an asset and infrastructure baseline using GIS software. Maintaining stakeholder database and conducting stakeholder consultation. Compilation of Resettlement Action Plans for each project phase. (Trans Caledon Tunnel Authority (TCTA)).

***Cronimet Socio-economic Impact Assessment (SIA)* (Limpopo, South Africa) 09/2009 - date.** *Social Specialist.* The project involve a Socio-economic Impact Assessment (SIA) for the development of an opencast mine and ancillary infrastructure. Responsible for assistance with the design and implementation of a Socio-economic Impact Assessment (SIA). Involved for 2 person-months. (Cronimet Mining South Africa).

***Socio-economic Impact Assessment (SIA) survey for the Cradle of Humankind and Dinokeng Projects* (Gauteng, South Africa) 09/2009 - date.** *Social Specialist.* The project involved a Socio-economic Impact Assessment (SIA) survey for the Cradle of Humankind World Heritage Site and Dinokeng Blue IQ Projects. Responsible for assistance with various project components including questionnaire design, management of GIS data, project log frames and the drafting of public communications. Involved for 2 person-months. (Gauteng Provincial Government).

***Construction of Siphofaneni Bridge and upgrading of Siphofaneni-St. Phillips Road* (Siphofaneni Region, Swaziland) 08/2009 - 01/2010.** *Social Specialist.* The project constructed Siphofaneni Bridge and upgraded Siphofeneni-St. Phillips Road in the Siphofaneni Region, Swaziland. Responsible for training, coordinating social surveys and focus group discussions, and also for analysing and reporting results. Also responsible for co-authoring the Social Impact Assessment (SIA) report. Involved for 1 person-month. (Delegation of the European Commission in the Kingdom of Swaziland, Government of Swaziland).

***Social and environmental screening of the Moatize Phase 2 rail corridor alternatives through Malawi* (Malawi and Mozambique) 07/2009 - 12/2009.** *Social Specialist.* This project consisted of the FEL 2 study of alternative routes between Moatize and Nkaya Junction for the export of coal from Moatize Mine to the Port of Nacala. Responsible for conducting fieldwork in order to gather information for the multi-criterion analysis and screening. Involved for 0.5 person-months. (Vale).

***Brits ferrochrome smelter: Environmental Impact Assessment (EIA)* (North West Province, South Africa) 05/2009 - 09/ 2009.** *Social Specialist.* The project included an Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) for a proposed ferrochrome smelter near Brits. Responsible for co-authoring the SIA report and conducting telephonic interviews. Involved for 0.5 person-months. (Beneficiation Company of Southern Africa (BenficoSA)).

***Social Impact Assessment (SIA) for Hillendale Mine* (KwaZulu-Natal, South Africa) 04/2009 - 09/2009.** *Project Manager and Social Specialist.* Exxaro KZN Sands initiated the closure process for the Hillendale Mine operations, situated just southwest of Richards Bay, KwaZulu-Natal. As part of this process, a Social Impact Assessment needed to be conducted to determine the effects of the mine closure on the local communities and employees. Responsible for conducting the SIA, which included a comprehensive baseline profile of the area and an extrapolation of conditions in the foreseeable future; providing an indication of the probable social impacts arising from the mine closure in light of the existing socioeconomic conditions; as well as recommending the most feasible mitigation or enhancement measures. Involved for 2 person-months. (Exxaro KZN Sands).

***Socio-economic baseline study for the new multi-products pipeline* (South Africa) 03/2009 - 04/2009.** *Social Specialist.* In this project, Transnet investigated the feasibility of the new multi-products pipeline running from Durban to an inland terminal at Jameson Park, near Heidelberg, South Africa. Involved in the Jameson Park sector of the pipeline. Responsible for on-site training of eight fieldworkers, including training in the use of Garmin Global Positioning System (GPS) units; conducting a baseline socioeconomic survey; spatially referencing the project area using a

Garmin GPS unit; consolidating and analysing the socioeconomic and spatially referenced data; and compiling a socioeconomic baseline report. Involved for 1 person-month. (Transnet).

Social Impact Assessment (SIA) for Benga coal mining **(Mozambique) 01/2009 - 01/2009.** *Social Specialist.* Located just outside Tete City in the Moatize District, Mozambique, Riversdale Mining proposed mining a concession area of approximately 4 500ha, which was home to over 1 500 households. Riversdale Mining commissioned a Social Impact Assessment (SIA). Responsible for reviewing the SIA report. Involved for 0.5 person-months. (Riversdale Mozambique).

Resettlement Action Plan (RAP) for Riversdale Mining **(Mozambique) 11/2008 - 09/2009.** *Social Specialist.* Located just outside Tete City in Moatize District, Mozambique, Riversdale Mining proposed mining a concession area of approximately 4 500ha, which was home to over 1 500 households. Riversdale Mining commissioned the development of a Resettlement Action Plan (RAP). Responsible for developing and refining a census and socioeconomic questionnaire; on-site training of 18 fieldworkers, including training on how to use Trimble Global Positioning System (GPS) units; supervising and coordinating fieldwork teams during implementation of the survey; daily downloading and consolidation of data using Pathfinder Office software; producing a GPS database and maps using ArcGIS software; and analysing data and presenting a comprehensive baseline profile of affected communities. Also responsible for drafting the initial entitlement framework document, as well as assisting with the establishment of local resettlement working groups. (Riversdale Mozambique).

Macro-economic study for the Benga coal project **(Mozambique) 10/2008 - 10/2008.** *Social Specialist.* In an attempt to determine the local, provincial and national economic benefits of the Benga project, a macro-economic study was conducted. Responsible for compiling the socioeconomic baseline profile using various Mozambican sources and for reviewing the completed study. (Riversdale Mozambique).

Social Impact Assessment (SIA) for Lonmin Akanani **(North West, South Africa) 10/2008 - 10/2008.** *Social Specialist.* Lonmin Platinum investigated the feasibility of developing a platinum ore body close to Mokopane. As part of the Environmental Impact Assessment (EIA) and the Environmental Management Plan (EMP), a Social Impact Assessment (SIA) was required. Responsible for compiling the baseline socio-economic profile for the Social impact Assessment (SIA), using various internet sources including census statistics, Integrated Development Plans (IDPs) and Local Economic Development plans (LEDPs). (Lonmin Platinum).

Social Impact Assessment (SIA) for Samancor Chrome **(Mpumalanga, South Africa) 10/2008 - 10/2008.** *Social Specialist.* In order to carry out an incremental expansion of its Middleburg Ferrochrome Plant, Samancor Chrome required a detailed SIA, the results of which were to be included in the Environmental Impact Assessment (EIA) report. Responsible for conducting the Social Impact Assessment (SIA), which included a comprehensive baseline profile of the area, an indication of the probable social impacts arising from the proposed expansion in light of the existing socio-economic conditions and the likely economic benefits of the expansion, as well as recommending the most feasible mitigation or enhancement measures. (Samancor Chrome).

Social Impact Assessment (SIA) study for the Bakouma project **(Central African Republic) 10/2008 - 11/2008.** *Social Specialist.* UraMin Centrafrique SA (UMCSA), a subsidiary of UraMin

Inc (UraMin), obtained an exploration lease near the town of Bakouma in the Mbomou District in the Central African Republic (CAR). As part of the pre-feasibility study, an SIA was conducted. Responsible for assisting with the development of a socioeconomic and asset questionnaire; on-site training of 13 fieldworkers, including training on how to use Garmin Global Positioning System (GPS) units; supervising and coordinating fieldwork teams during implementation of the survey; daily downloading and consolidation of data; producing a GPS database and maps using ArcGIS software; analysing data and presenting a comprehensive baseline profile of affected communities; and assisting with the compilation of the SIA report. (UraMin Centrafrique SA (UMCSA)).

Social Impact Assessment (SIA) for Harmony Gold Mines **(Free State, South Africa) 09/2008 - 09/2008.** *Social Specialist.* Harmony Gold Mines investigated the feasibility of re-mining their historic tailings dams in the vicinity of Welkom. As part of the Environmental Impact Assessment (EIA) an SIA was required. Responsible for compiling the baseline socioeconomic profile for the SIA using various internet sources including census statistics, Integrated Development Plans (IDPs) and Local Economic Development (LEDs) plans. (Harmony Gold Mines).

Social Reconciliation Plan (SRP) for the Jubilee Field Phase 1 Development **(Ghana) 09/2008 - 09/2008.** *Social Specialist.* Kosmos Energy investigated the feasibility of establishing an oil drilling field off the coast of the city of Sekondi-Takoradi, Ghana. Due to the contentious nature of the proposed project, Kosmos Energy recognised the need to establish a robust, transparent and accessible channel of communication for stakeholders and affected communities. Responsible for the development of a Social Reconciliation Plan (SRP) to define the processes and structures that are deemed necessary to establish a community engagement procedure where reconciliation was required. (Kosmos Energy).

Social Impact Assessment (SIA) for Umbani Power Plant **(KwaZulu Natal, South Africa) 08/2008 - 08/2008.** *Social Specialist.* The Umbani Power Company proposed the development of a 540MW fluidised bed boiler power plant in the KwaMbonambi area of KwaZulu-Natal. As part of the Environmental Impact Assessment (EIA) an SIA was commissioned. Responsible for consolidating previously obtained socioeconomic data with Global Positioning System (GPS) data; conducting a socioeconomic and asset survey to complement previously collected socioeconomic data; producing an integrated spatially referenced database of affected households; and compiling a comprehensive social baseline profile of the affected community. (Umbani Power Company).

Social and Labour Plan (SLP) for Batlhako Mining **(North West, South Africa) 05/2008 - 05/2008.** *Social Specialist.* Batlhako Mining proposed developing an open cast chrome mine in the Bojanala District Municipal Area in the North West Province. For its application to new order mining rights, Batlhako Mining commissioned the development of an SLP. Responsible for compiling the baseline socioeconomic profile for the SLP using various internet sources including census statistics, Integrated Development Plans (IDPs) and Local Economic Development (LEDs) plans. (Batlhako Mining).

Resettlement Action Plan (RAP) and socio-economic study for Arnot Colliery **(Mpumalanga, South Africa) 06/2008 - 06/2008.** *Social Specialist.* Arnot Colliery proposed expanding its operations to a neighbouring farm in Mpumalanga, South Africa. As such, the development of a RAP was commissioned. Responsible for facilitating various meetings and the subsequent drafting of minutes for stakeholders. . (Arnot Colliery).

***Resettlement Action Plan (RAP) for Kabanga Nickel Project* (Tanzania) 03/2008 - 10/2008.** *Social Specialist.* The proposed Kabanga Nickel Project, located in Ngara District, Tanzania, investigated the feasibility of resettling households located on a concession area of approximately 4 000ha. Responsible for developing an integrated database comprising demographic, socioeconomic and Global Information System (GIS) data for 324 households. The database was used to produce a comprehensive baseline profile of affected communities to estimate the resettlement's related impact and suggest possible mitigation measures. Also responsible for analysing and presenting qualitative data obtained through focus group discussions, and identifying and describing Tanzanian laws applicable to involuntary resettlement and its various repercussions. (Kabanga Nickel Project).

***Resettlement Action Plan (RAP) and socioeconomic study for Kriel Colliery* (Mpumalanga, South Africa) 01/2008 - 09/2009.** *Social Specialist.* As a result of subsidence, blasting and other mine-related activities, Kriel Colliery was obliged to resettle adversely affected households around the mining area. Responsible for the facilitation of various meetings and the subsequent drafting of minutes for stakeholders. Also responsible for undertaking a census and socioeconomic survey in the area, keeping photographic and spatial records, and producing a spatially referenced database of the affected households. (Kriel Colliery).

***Social and Labour Plan (SLP) for Hlobane Mine* (KwaZulu Natal, South Africa) 12/2007 - 02/2008.** *Social Specialist.* Hlobane Colliery in KwaZulu-Natal, South Africa commissioned the drafting of closure objects to form part of its SLP. Responsible for drafting these objects, which included an assessment of the existing socioeconomic conditions in the area and projecting the implications of mine closure (Hlobane Mine).

***Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) study for the Bakouma project* (Central African Republic) 10/2007 - 10/2007.** *Contract Social Researcher.* UraMin Centrafrique SA (UMCSA), a subsidiary of UraMin Inc (UraMin), obtained an exploration lease near the town of Bakouma in the Mbomou District, Central African Republic (CAR). As part of the pre-feasibility study, an SIA was conducted. Responsible for the integration and analysis of socioeconomic data and for compiling the baseline socioeconomic profile to be included in the SIA. (UraMin Centrafrique SA (UMCSA)).

CURRICULUM VITAE

Lita Webley

ACADEMIC QUALIFICATIONS:

- Matriculated: 1974, Kloof High School, Kwa-Zulu Natal, South Africa
- BA (Hons) Archaeology, 1978, University of Stellenbosch
- MA (cum laude) Archaeology, 1984, University of Stellenbosch
- PhD Archaeology, 1992, University of Cape Town

PROFESSIONAL CAREER:

- 1979-1980: Junior lecturer, Semitic Languages, University of South Africa
- 1981: Junior Lecturer, Archaeology, University of Stellenbosch
- 1982-1983: Research Assistant, Anthropology, University of Stellenbosch
- 1984: Temporary Lecturer, Archaeology, University of Fort Hare
- 1985-1986: Teaching Assistant, Archaeology, University of Cape Town
- 1988-1990: Archaeologist, Natal Museum Services, Pietermaritzberg
- 1990-1997: Archaeologist, Albany Museum, Grahamstown
- 1997-1998: Assistant Director, Albany Museum, Grahamstown
- 1999-2005: Acting Head (Acting Deputy Director), Albany Museum, Grahamstown.
- 2005-2008: Director: Albany Museum
- 2008-2012: Principle Investigator, Archaeology Contracts Office, University of Cape Town

FIELDS OF SPECIALITY AND COMPETENCE:

- Heritage and Archaeological Impact Assessments
- Accredited as Principal Investigator for Stone Age Archaeology, Shell Midden Archaeology, Colonial Period Archaeology, and as Field Director for Grave Relocations
- Ethno-archaeology (anthropology) and oral history in Northern and Eastern Cape
- Specialised in Archaeology of Northern Cape
- Presentation of Heritage Workshops to communities and government officials
- Excavations at over 50 archaeological sites

PUBLICATIONS:

- Four chapters in books
- Total of 19 articles in refereed journals
- At least 20 popular articles
- Numerous conference presentations in South Africa and abroad (United States and Europe)

COURSES COMPLETED:

- GIS Course at Rhodes University in 2004
- Architectural and Urban Conservation Course (Skills Development) presented by Dr S Townsend in the Faculty of Engineering and the Built Environment, University of Cape Town, 2008.

PROFESSIONAL STATUS:

- Association of Southern African Professional Archaeologists
- Accredited Principle Investigator for CRM

MISCELLANEOUS:

- 1994: Heritage sub-committee responsible for drafting new legislation for the Eastern Cape
- 1997-2001: member of the transitional Eastern Cape Regional Committee of the National Monuments Council.
- 2003-2008: Executive member of Makana Heritage Forum (Makana Municipality) Grahamstown

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Curriculum Vitae

LOUW POTGIETER

PERSONAL INFORMATION

Full Name:	Louwrens Johannes Christoffel Potgieter
ID no.:	6403105165088
Date of Birth:	10 March 1964
Nationality:	South African
Marital Status:	Unmarried partnership
Languages:	Afrikaans/English
Driver's License:	08
Address:	P.O. Box 59412, Karen Park, 0118
Telephone:	+27 83 535 6818 (cell)
Fax:	086 590 4776
Email address:	louwpot@gmail.com

SUMMARY

Dedicated soil surveyor for over 20 years in the field of soil characterization for application in various fields, including mapping and reporting, land capability assessments, impact assessments and rehabilitation purposes. "Hands-on" experience was gained in the agricultural and mining environment during employment at the ARC-ISCW (1991 to 2008) and recently Golder Associates Africa (2008 to 2011). Functions equally well independently or as part of a team.

AREAS OF EXPERTISE

- Soil surveying (mapping) on different scales
- Soil mapping for purposes of EMPR, EIA, irrigation potential, small-farmer development, potential use for rehabilitation
- Soil/vadose zone profiling for flow modeling purposes and pollutant tracking
- Off-site waste sample logging
- Soil chemical status interpretations
- Subsurface interpretation and conceptualization for flow and/or waste modeling and reporting purposes

- Basic map production (basic ArcGIS)
- Computer literacy: proficient in the use of MS Office

Soil characterization experience: 20+ years
Reports on Detail Surveys: Mining (EMPR, EIA) 18, Irrigation 6, Small Farmer Development 2, Other 7.
Reports on Semi Detail Surveys: Small Farmer Development 5, Mining 1.
Reports as first author: 20
Technical memorandums: 8
Publications Coordinator of 17 Land Type Memoirs, forming part of the National Land Type Survey for SA.

CAREER SUMMARY

Dec 08 – Mar 2011: **Golder Associates Africa (Pty.) Ltd**
Senior Soil Science Technician

- Conducting **detail soil surveys** for Environmental Impact Assessments
- **Characterization of soil/vadose zone** for flow modeling purposes and tracking of **pollutant migration**
- **Off-site description** of collected tube or bagged samples of a subsurface in an area of interest
- Evaluation of subsurface material for potential use as **mine waste disposal capping**
- Conducting of double ring water **infiltration tests** to obtain required data for flow modeling purposes

Jul 92 – Nov 08: **Agricultural Research Council (Institute Soil Climate & Water)**
Technician (until '98) to Senior Technician

- Conducting **detail soil surveys** on 1:10 000 scale for EMPR, irrigation and small farmer development purposes
- Conducting **semi-detail soil surveys** on 1:50 000 scale for small farmer development

- Conducting **reconnaissance soil surveys** on 1:250 000 scale for the national land type survey of SA
- **Detailed reporting** on detail and semi detail soil surveys in terms of characteristics, physical and chemical properties, land capability, potential for irrigation and development.
- Served as **project leader** responsible for the publication of the 'Transkei' memoirs and completing various other incomplete memoirs
- Project leader with **sole responsibility** for the survey and production of the land type map of Calvinia.
- **Interpretation** of collected data for verification and quality purposes.
- Application of software (MS Word and ARCGIS) for **reporting** and **map production** according to client specification.

Jan 89 - Dec 91: **Pretoria Technikon**

Student (see Education section for more detail)

Aug 85 - Dec 88: **Anglo American Prospecting Services**

Field Assistant/Senior Field Assistant

- Soil sampling on various scales for various prospecting purposes.
- Establishing of grids to serve as basis for the systematic geological mapping of an identified prospecting area.
- In charge of percussion drilling team.

Jul 83 - Jul 85: **South African Air Force**

Military servant (dog handler: security)

- Part of a security team responsible for securing an Air Force Depot.

Jan 83 – Jun 83: **Department of Posts and Telecommunications**

Switchboard Operator

Curriculum Vitae

LOUW POTGIETER

EDUCATION

Jan 1989 - Dec 1991:	**Pretoria Technikon**
	National Diploma in Resource Utilisation
Main Subjects:	Extension Method, Field Husbandry, Agricultural-Economics, Soil Science [including Soil Classification III]
Secondary subjects:	Pasture Science, Land Use Planning, Soil Conservation, Mechanisation, Physical Science, Milk Production Technology, Beef Production Technology, Small Stock Production Technology, Animal Nutrition
Jan 1986 - Dec 1995:	**University of South Africa (Unisa)**
	1st Year Baccaulaureus Commerci
	Subjects: Economics (1986), Statistics (1986), Business Economics (1992), Farming Management (1992), Commercial Law I (1993), Accounting (1995).
Previous to Dec 1982:	**Willem Pretorius Secondary School, Heilbron**
	Matriculated with exemption
	Subjects: Afrikaans (HG), English (HG), German (HG), Mathematics (SG), Physical Science (HG), Biology (HG).

Curriculum Vitae

LOUW POTGIETER

SUPPLEMENTARY COURSES / CERTIFICATIONS

Sep 2008	ESRI Introduction to ArcGIS II	GIMS
May 2006	ESRI Understanding Projections in GIS	GIMS
Jul 2004	MS Office: Excel [Beginners to Advanced]	Hatfield Business College
Apr 2004	MS Office: Access	Hatfield Business College
Oct 2002	ESRI Introduction to ArcGIS I	GIMS
Mar 2001	A+ Certification	CTU Training Solutions
Jan 1998	MS Office: Word	Training Solutions

PROFESSIONAL AFFILIATIONS

2004 - current — SA Council for Natural Scientific Professions
Certificated Natural Scientist *(Soil Science)*
Reg no. 200031/04

Certificates, publication records and references available on request

DIGBY WELLS
ENVIRONMENTAL

MARIKE DE KLERK

Marike de Klerk

Environmental consultant

Environmental Management Services Department

Digby Wells Environmental

1 EDUCATION

2000 – 2002: BhcS. Degree (Baccalaureas Hereditans Culturaeque Scientea), University of Pretoria (UP)

Specialising in Heritage Tourism Management. Prestige bursary holder for 3 consecutive years; this degree is based on intensive research on heritage resource management and emphasizes sustainable development. It focuses on the practical application of interdisciplinary academic theories. Subjects include: Tourism management, Geography, Computer Information Literacy (CIL), Archaeology, Anthropology, History and Heritage management.

2003 – 2004: Bhcs. (Honours) Degree Cum Laude, University of Pretoria (UP)

Focussed on Environmental Impact Assessment (EIA), sustainable development, African archaeology, Geography and Community development. Research report/Mini-thesis entitled: "Ethno-botanical assessment of the Blouberg region: Its significance for tourism", conducted under leadership of Prof. C.C. Boonzaaier. The report focused on the potential of ethno-botanical tourism development at Blouberg, which is part of the 'African Ivory Route' Tourism Project in the Limpopo Province. (South Africa). Marike conceded her Bhcs (Hon.) degree with distinction.

2005 – 2006: M.A (Magister Artium) Degree, University of Johannesburg (UJ)

Specializing in Sustainable Development and tourism management, focusing primarily on development in the northern regions of the Limpopo Province; Activities include intensive research, implementation of sustainable principles, problem-solving, management evaluation, mission & goal definition, impact assessment, monitoring, strategic management and continuous feedback. Case study: Hananwa region (Blouberg) in the Limpopo Province.

2007 – 2008: Wildlife Campus (Ecolife)

Wildlife Management, Certificate course focusing on the science of wildlife management, habitat management, game management, nutritional physiology of herbivores, nutritional chemistry for herbivores, wildlife nutrition, wildlife diseases, wildlife parasites, toxic plants, soil assessment, carrying capacity, assessing vegetation and integrated game reserve management. The wildlife management course is presented by Ecolife, owned and operated by Professor Wouter Von Hoven at the University of Pretoria's Centre for Wildlife Management (Wildlife campus).

2008 – current: University of Johannesburg (UJ)

Doctoral Degree in Environmental Management in the Science Faculty, Department Geography, Environmental Management and Energy studies, focussing on the systematic analysis of impacts on archaeological and palaeontological resources in the Sterkfontein Caves of the Cradle of Humankind World Heritage Site, as result of groundwater pollution from mining on the West Rand

- Lifetime Membership: Goldenkey International Honorary Society: Membership attained through academic achievement (Honorary Colours) in the BhcS. Degree at University of Pretoria (UP).

2 EMPLOYMENT

2006 – present: Environmental Consultant at Digby Wells Environmental, Randburg;

2005: Lecturer in Sustainable Tourism Development at the University of Johannesburg;

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

2005:	Lecturer in Geography at Abbott's College, Northcliff;
2004:	Researcher for South African Veterinary Association (SAVA): Development of Veterinary Museum at Onderstepoort, Pretoria;
2004:	Administrative Assistant at Financial Services Compensation Scheme (FHCS), London;
2002 – 2003:	Research Assistant at University of Pretoria (UP), Archive Assistant & Part-time Travel Writer for Campus Newspaper

3 EXPERIENCE

Whilst completing a BhcS. (Hon) and Masters Degree, Marike has done intensive research, fieldwork and impact assessments in the Blouberg area, Limpopo Province. The Hananwa community formed an integral part of the Masters Degree in Sustainable Development as well as an Ethno-botanical assessment of the region. As lecturer in Sustainable Development, Tourism development and Geography at University of Johannesburg (UJ) and Abbott's College, she was responsible for the preparation of formal lectures, presentations, practical guidance (excursions) and student evaluation. Other work experiences such as Research assistant for South African Veterinary Association (SAVA) and University of Pretoria (UP) were primarily focussed on resource analysis, literature reviews, compilation of development proposals, data input and constructive recommendations. Current area of expertise at Digby Wells lies in the formulation and implementation of sustainable development initiatives and heritage assessments, as well as the compilation of Environmental Impact Assessments (EIA/ESIA's), Environmental Management Plans (EMP), Scoping Reports and Environmental Audits (EMP review and ISO 14001).

4 COURSES, CONFERENCES AND SEMINARS ATTENDED INCLUDE:

- Qualified Emergency First Aider (Level One) (February 2010, IEFA – Institute of Emergency First Aiders);
- Safety Health and Environment Conference at the Sasol Club, Secunda (January 2010, Coal Conference/ SACEPA)

- Heritage and Development Conference at CSIR in Pretoria (2009, NHC), Presentation of Paper: “Systematic reflection of social and heritage studies in Environmental Impact Assessments (EIAs) and Management Plans (EMPs)”.
- Health and Safety Course (January 2007; Edwilo Risk Consultants);
- Corporate Social Investment (March 2007 at Randfontein Estate).
- Medical Health Seminar (October 2006 , Geosciences MSA Medical);
- Coal Business Seminar (October 2006, Hyatt Hotel, Rosebank)

5 PROJECT EXPERIENCE:

- Orlight SA (Pty) Ltd (Orlight SA), subsidiary of BSG Resources Limited (Scoping Report and EIA/EMP for the proposed Solar PV power plant project in Aggeneys, Kenhardt, Loeriesfontein, Vanrhynsdorp and Graafwater), Northern and Western Cape Provinces;
- Acid Mine Drainage in the Western, Central and Eastern Basins, BKS Pty Ltd (Basic Assessment and EIA/EMP), Gauteng Province, South Africa;
- Koidu Diamond Mine Project (EIA/EMP), Koidu Holdings, Sierra Leone;
- Sadiola Deep Sulphides Project (EIA/EMP, Project Manager), AngloGold Ashanti (AGA), Mali, West Africa;
- Valencia Uranium Project (EIA/EMP, Assistant Project Manager), Forsys Metals, Namibia, Southern Africa;
- Loulo Mine Project (EMP Review, ESIA Amendment Report and ISO 14001 Compatibility Audit), Rand Gold Resources, Mali, West Africa;
- Boikarabelo Project (Sustainability Assessment), Resource Generation, Waterberg, Limpopo Province, South Africa;
- HCI Nokuhle Coal Project, (Archaeological Assessment and Sustainability Assessment), Ogies, Mpumalanga Province, South Africa;
- Resources Generation, Coal Mine Project in the Waterberg area (EIA/EMP, Archaeological Assessment and Tourism Assessment), Limpopo Province, South Africa;

- Universal Coal, Kangala Coal Mine Project in the Delmas area (EIA/EMP, Archaeological Assessment and Tourism Assessment), Mpumalanga;
- Lesedi Power Generation Project (EIA/EMP, heritage assessment, sustainability assessment) in Tweefontein Division, Mpumalanga Province;
- Crown Ergo Mining Operation and related reclamation activities (EIAs/EMPS, Air Quality and Archaeological Management), Gauteng;
- Northern Coal, Weltevreden (EIA/EMP, Archaeological Management), Mpumalanga;
- Etoile (Preliminary Archaeological Investigations), IMC, Democratic Republic of Congo (DRC);
- Khutala Mineral Optimisation Project, EIA/EMPR, Ingwe Colliery, Mpumalanga, South Africa ;
- Cleaner Production (CP) Campaign, Water Research Commission (WRC), South Africa;
- Mmamabula Energy Projects, CIC, Botswana, archaeological and heritage sections for the:
  - Mine & Power station EIA/EMPR,
  - Transmission Lines EIA/EMPR,
  - Railway Link and Service Corridor,
  - Kudumatse Groundwater exploration boreholes and
  - Calcrete Mine.
- ATC Mini Opencast Pits EMPR Addendums, Xstrata Coal, Mpumalanga.
- Mareesburg Platinum Joint Venture, Eastern Platinum, Mpumalanga.
- Bankfontein EIA/EMPR, Vaalsands (Pty) Ltd, Free State
- 3L2 Dump EIA/EMPR, Crown Gold Recoveries, Gauteng
- Lime-Chem EIA/EMPR, Lime-Chem (Pty) Ltd, Limpopo Province

MARIA ACKERMANN

Maria Ackermann

Environmental Management Services

Digby Wells Environmental

1 EDUCATION

2008	M.Sc. Geography (UJ)
2006	B.Sc. Geography Honours (UJ) *Cum Laude*
2003 – 2005	B.Sc. Geography and Environmental Management (UJ)

2 LANGUAGE SKILLS

English – speaking and writing excellent.

French – basic speaking.

Afrikaans – speaking and writing excellent.

3 EMPLOYMENT

September 2008 - present	Environmental Consultant Digby Wells Environmental
July 2008 - September 2008	Environmental Scientist Mills & Otten Environmental Consultants

4 EXPERIENCE

- Support services and data collection frameworks for Corporate Social Responsibility (CSR) Reporting Processes for international gold mining companies in accordance with the Global Reporting Initiative™ (GRI) Sustainability Reporting Guidelines.
- Project management and completion of Environmental and Social Impact Assessments (ESIAs) in line with the International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines and Equator Principles.

- Project management and completion of Greenhouse Gas (GHG) emission footprints and climate change impact analyses for mining companies participating in the Carbon Disclosure Project (CDP) of the World Resource Institute (WRI) and World Business Council for Sustainable Development (WBCSD).
- Project management and completion of *ex ante* GHG emission footprints and reporting frameworks for mining and coal-fires power station projects.
- Project management and completion of Environmental Impact Assessments (EIAs), Basic Assessments and Environmental Management Plans (EMPs) for environmental authorisations in terms of the South African National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).
- Project management and completion of Waste management license applications in terms of the National Environmental Management: Waste Act (NEMWA), 2008 (Act 59 of 2008).
- Project management and completion of Environmental Management Programmes (EMPs) for Mining Right Applications in terms of the South African Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002).
- Assistance with Integrated Water Use License Applications (IWULAs) in terms of the South African National Water Act (NWA), 1998 (Act 36 of 1998).
- Project management and completion of Environmental Impact Statements (EISs) for mining and power plant projects and infrastructure developments in terms of the Botswana Environmental Impact Assessment Act (Act 6 of 2005).
- Development of Environmental Management Systems and ISO14001 implementation procedures.
- Involvement in Public Participation Processes and Public Consultation and Disclosure Plans.
- Compilation of proposals and terms of reference for interdisciplinary investigations as part of EIAs, EMPs and EMPRs.

5 PROJECT EXPERIENCE

- Randgold Resources Limited: Global Reporting Initiative™ (GRI) and Carbon Disclosure Project (CDP) reporting frameworks and data management systems (May 2011 – on-going).
- Koidu Holdings SA: GHG monitoring plan and reporting framework (September 2011).
- CIC Energy Corp: Environmental and Social Impact Assessment for the Mmamabula Energy Project, Central District, Botswana (July 2011 – on-going).

- Xstrata Alloys (Pty) Ltd: *Ex ante* GHG emissions footprint and reporting framework for the proposed Lesedi Power Plant project (August – September 2011).
- Randgold Resources Limited: Carbon Disclosure Project 2011.
- Temo Coal Mining (Pty) Ltd: Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) for the proposed Temo Coal Project, Waterberg District in the Limpopo Province, South Africa (January – August 2011).
- CIC Energy Corp and Golden Concord Holdings Limited: Environmental and Social Impact Assessment for the Mookane Domestic Power Project, Central District, Botswana (August – December 2010).
- CIC Energy Corp, Golden Concord Holdings Limited and Botswana Power Corporation: Environmental and Social Impact Assessment for the 400 kV loop-in transmission line for the Mookane Domestic Power Project, Central District, Botswana (August – September 2010).
- Galaxy Gold Reefs (Pty) Ltd: Environmental Impact Assessment and update of the Environmental Management Programme for the Galaxy Gold Mine (June 2010 – on-going).
- Sasol Mining (Pty) Ltd: Environmental Impact Assessment and update of the Environmental Management Programme for the Syferfontein Colliery, Mpumalanga Province, South Africa (October 2009 – December 2010).
- Nokuhle Coal (Pty) Ltd: Environmental Impact Assessment and Environmental Management Programme for the proposed Nokuhle Colliery, Mpumalanga Province, South Africa (January – July 2010).
- Randgold Resources Limited: Carbon Disclosure Project 2010.
- Xstrata Coal South Africa: Biodiversity and Land Management Plan (October – November 2009).
- Palesa Coal (Pty) Ltd: Basic Assessment and Waste Management License Application for a sewage treatment plant at the Palesa Colliery, Mpumalanga Province, South Africa (June 2009 – September 2010).
- Palesa Coal (Pty) Ltd: Basic Assessment for diesel storage tanks at the Palesa Colliery, Mpumalanga Province, South Africa (June 2009 – March 2010).
- Palesa Coal (Pty) Ltd: Environmental Impact Assessment and update of the Environmental Management Programme for the Palesa Colliery, Mpumalanga Province, South Africa (June 2009 – January 2010).

- Meepong Resources (Pty) Ltd: Environmental Impact Assessment for the upgrade of the Parr's Halt/Stockpoort border post, Limpopo Province (February 2009 – June 2010).
- Randgold Resources Limited: Environmental Awareness and Training Programme for the Loulo Gold Mine, Mali (September 2009).
- BSGR Guinea: Environmental pre-feasibility for the Zogota iron ore project, railway line and port upgrade, Guinea (October 2009).
- CIC Energy Corp: Addendum to the Environmental Impact Statement for the Mmamabula Energy Project: Serorome Mine, Central District, Botswana (March – December 2009).
- Merafe Resources Limited: Environmental Impact Assessment and Environmental Management Programme for the proposed Schoongezicht Colliery, Mpumalanga Province, South Africa (June – August 2009).
- Randgold Resources: Environmental and social investigations for the Morila Gold Mine tailings reclamation project, Mali (March 2009 – on-going).
- Xstrata Coal South Africa: Update of the Environmental Management Programme for the Tavistock Collieries, Mpumalanga Province, South Africa (February 2009 – on-going).
- Gauteng Department of Agriculture, Conservation and Environment (GDACE) Mining and Environmental Impact Guide.

6 PROFESSIONAL AFFILIATIONS

- Member of the International Association of Impact Assessment South Africa (IAIAsa) since March 2009.
- Registration as professional scientist with South African Council for Natural Scientific Professions (SACNASP) in process.
- Registered Carbon footprint assessor with the Carbon Protocol of South Africa.

7 PUBLICATIONS

- Smith, M., 2010: A multiple scenario analysis into the potential for bioethanol production from maize in South Africa. Dissertation submitted in fulfilment of the requirements for the degree Magister Scientiae, Department of Geography, Environmental Management and Energy Studies, Faculty of Science, University of Johannesburg (November 2008).
- Husted, A., M. Ackermann, C. Wells and G. Ovens, 2010: The management of biodiversity in areas associated with mining through the application of a GIS based, integrated Biodiversity Land Management Plan (BLMP). Paper presented at the

IAIAsa 2010 National Conference, CSIR Convention Centre, Pretoria, Gauteng, 23 – 25 August 2010.

- Smith, M., N. Kotze and C. Cooper, 2010: The production of biofuels in South Africa: Policy and availability of energy crops. *Journal of Environmental Science and Engineering, 4(2)*, 70-9.
- Ackermann, M., 2010: Environmental authorisation process for Renewable Energy Projects in South Africa. Presented at the 1st Wits Green Energy Seminar, November 2010.
- Ackermann, M., 2011: Environmental authorisation process for Renewable Energy Projects in South Africa. Presented at the 2nd Wits Green Energy Seminar, May 2011.

8 COURSES ATTENDED

- June, 2009: The use of matrices as an efficient tool in the EIA process. Presented by Dr. P.J. Aucamp (Ptersa).
- July, 2010: GCX Certified Carbon Footprint Analyst Level 1. Presented by Global Carbon Exchange.
- February 2011: GCX Certified Carbon Footprint Analyst Level 2. Presented by Global Carbon Exchange.
- February 2011: GRI Certified Training Programme on Sustainability Reporting Process for South Africa. Presented by Environmental Management Solutions.
- May 2011: Emergency First Aid Level 2. Presented by Institute of Emergency First Aiders.
- May 2011: Microsoft Excel 2010 Advanced. Presented by Executrain.
- July 2011: Mining for Non-Miners. Presented by Snowden Group.

9 ACHIEVEMENTS

2007	South African National Energy Association (SANEA) youth delegate to the World Energy Congress 2007, Rome, Italy
2007 – 2008	South African National Energy Research Institute Bursary for post-graduate research in Energy Studies

DIGBY WELLS
ENVIRONMENTAL

RUDI GREFFRATH

Rudi Greffrath

Environmental Scientist

Biophysical Department

Digby Wells Environmental

1 EDUCATION

2001 – 2004: Diploma in Nature Conservation, UPE Saasveld Campus

2005: B-tech Degree in Nature Conservation, UPE Saasveld Campus

2 EMPLOYMENT

2006 – present: Digby Wells Environmental

2002 – 2003: As part of course work I completed 1 year experiential training at Shamwari private game reserve. Involved with the all daily tasks, including anti-poaching patrols, fence monitoring, alien vegetation control, erosion control, animal husbandry, also the yearly game capture and game relocation, worked at the born free cat sanctuary located on Shamwari, this included feeding and care of all big cats. Annual ecological monitoring of vegetation condition. Annual monitoring of game numbers and general condition. These tasks were performed on Shamwari, Sawubona, and Bushman Sands Game reserves.

1999 – 2001: I was employed by a geotechnical instrumentation company called Kop-Kop, during which time I worked on the Lesotho highlands water project specifically the Mohale dam. I was charged with installing and maintaining the Mohale instruments, as well as taking daily readings, and training personnel before hand over to local authorities. I also worked on the Maguga Dam in Swaziland, where my duties were essentially the same.

3 PROJECT EXPERIENCE

Botswana

Mmamabula Energy Project (MEP). Including:

- MEP Railway siding,
- MEP Strip mining operation

- MEP Calcrete mine
- MEP Transmission lines
- MEP Wellfields
- MEP Serorome mine
- Zoetfontein and Parr's halt

Namibia

Valencia Uranium Project, conducted Fauna and Flora baseline studies.

South Africa

Grassland:

- BHP Billiton, Naudesbank mineral optimisation study, Mpumalanga grasslands
- BHP Billiton Vaalbank, baseline studies, Mpumalanga grasslands
- Xstrata Mpunzi division biodiversity studies, Mpumalanga grasslands
- Kangala, injula baseline studies, Mpumalanga grasslands

Savannah biomes

- Chomdek, Waterberg south, Limpopo river valley
- Chomdek, Waterberg main, Limpopo river valley
- MEP Botswana studies, Botswana

4 PROFESSIONAL AFFILIATIONS

IAIA (International Association for Impact Assessment)

SIBONGILE BAMBISA

Sibongile Bambisa

Social Consultant: Public Participation Practitioner

Digby Wells Environmental

1 EDUCATION

2010: BA Honours (Anthropology) University of Johannesburg

2009: BA (Health Psychology) University of Johannesburg

2 EMPLOYMENT

2010 – present:	Social Consultant: Public Participation Practitoner , Digby Wells Environmental, Johannesburg
2009	Research Assistant: CSIR and the Medical Research Council
2008	Tutor and Student Assistant (University of Johannesburg)

3 EXPERIENCE

Sibongile joined Digby Wells in 2010 as a social consultant. She has experience in the social sciences field and has been actively involved in public participation process and social impact assessment projects. Her expertise involves planning, implementing and managing public participation process. Her duties as public participation practitioner include identifying and consulting with Interested and Affected Parties, liaising with organs of the state and facilitating public meetings.

4 PROJECT EXPERIENCE

- Public Participation Practitioner for the proposed Boikarabelo Power Station in Limpopo Province
- Public Participation Practitioner for Pongola Prospecting
- Public Participation Practitioner for Bethel Prospecting

- Assisting with Social Impact Assessment Consultations for the proposed Kangala Coal Mine
- Compilation of Socio-Economic Assessment data for the Eskom Strengthening Project
- Compiling Socio Economic data for the DRD Gold Social and Labour Plans

5 PROFESSIONAL AFFILIATIONS

IAP2: Member of the International Association for Public Participation

DIGBY WELLS
ENVIRONMENTAL

THOMAS WILSON

Mr Thomas Wilson

Environmental Consultant

Biophysical Department

Digby Wells Environmental

1 EDUCATION

2008 – 2009:	BSc Hons. Geography & Environmental Management – University of Johannesburg (UJ)
2005 – 2007:	BSc Geography & Environmental Management – University of Johannesburg (UJ)
2003:	Matriculated at the Deutsche Schule zu Johannesburg

2 EMPLOYMENT

Feb 2008 – Present:	Digby Wells Environmental as an Environmental Consultant
2004:	Boomkwekeryij vd Starre bv, Boskoop (Netherlands) as a Production Line Assistant

3 EXPERIENCE

My current employment at Digby Wells Environmental (Digby Wells) as an Environmental Consultant requires me to compile various environmental reports in accordance to various regulations. Experience gained at Digby Wells includes the undertaking of various Environmental Impact Assessments (EIA), Environmental Management Plans (EMP) and Basic Assessment applications. In addition I have experience in EIA and EMP document compilation, prospecting rights, closure cost assessments and rehabilitation planning.

4 PROJECT EXPERIENCE

- Ananke Mineral Resources Prospecting Applications: Completed prospecting applications situated in the Limpopo Province;
- Eastern Platinum Limited Closure Cost Assessment (2008 and 2010): Completed a closure cost assessment for all of Eastplat's Operations;
- Harmony Gold Closure Cost Assessment (2009): Completed a closure cost assessment for all Harmony Gold's Operations;
- Harmony Gold Closure Cost Assessment (Project Manager): Completed a closure cost assessment for all Harmony Gold's Operations for 2011;

- Harmony Gold Kalgold Closure Plan (Project Manager): Compiled a closure plan for the closure of a pit at the Kalgold operations in 2011;
- Mashala Resources Closure Cost Assessment (2009): Completed a closure cost assessment for all of Mashala's operations;
- Mashala Resources Closure Cost Assessment (Project Manager): Completed a closure cost assessment for Mashala's Ferreira operations;
- Mashala Resources Closure Plan: Completed a closure plan for mine closure;
- Anglo Platinum Prospecting Performance Assessments: Completed numerous prospecting performance assessments in Limpopo and North West Provinces, South Africa;
- Orange Farm Metals cc Housing Development: Compiled a Basic Assessment Report for a housing development in Orange Farm;
- Shell South Africa Environmental Impact Assessments: Completed numerous EIA's for the upgrade of their service stations; and
- Temo Coal Rehabilitation Plan: Completed a rehabilitation plan for inclusion into the EIA.

document1

Appendix D: PPP Report

PUBLIC PARTICIPATION PROCESS REPORT

FOR

ORLIGHT SA (PTY) LTD – SOLAR PHOTOVOLTAIC POWER PLANTS

ORLIGHT SA (PTY) LTD

July 2012

SITE	*AFFECTED FARM*	*DEA REF. NO.*	*NEAS REF. NO.*
Aggeneys	Portion 1 of Aroams 57 RD	***12/12/20/2630***	***DEA/EIA/0000818/2011***
Kenhardt	Remaining Extent (RE) of Klein Zwart Bast 188 RD	***12/12/20/2631***	***DEA/EIA/0000813/2011***
Loeriesfontein	Portion 5 of Klein Rooiberg 227 RD	***12/12/20/2632***	***DEA/EIA/0000825/2011***
Vanrhynsdorp	Remaining Extent (RE) of Paddock 257 RD	***12/12/20/2633***	***DEA/EIA/0000822/2011***
Graafwater	Portion 1 of Graafwater 97 RD Remaining Extent (RE) of Bueroskraal 220 RD	***12/12/20/2636***	***DEA/EIA/0000828/2011***

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa

Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

DIGBY WELLS
ENVIRONMENTAL

Name	**Responsibility**	**Signature**	**Date**
Sibongile Bambisa	Public Participation Practitioner		02 July 2012
Mia Ackermann	Project manager, 1st Reviewer		02 July 2012

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

100% Recycled Paper

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

ABBREVIATIONS

BEE	Black Economic Empowerment
BID	Background Information Document
CAA	Civil Aviation Authority
CBO	Community Based Organisation
DAFF	Department of Agriculture, Forestry and Fisheries
DoA	Department of Agriculture
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DMR	Department of Mineral resources
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
I&AP	Interested and Affected Party
NGO	Non-governmental Organisation
Orlight SA	Orlight SA (Pty) Ltd
PPP	Public Participation Process
PV	Photovoltaic
RE	Remaining Extent
RoD	Record of Decision
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
ToR	Terms of Reference

1 INTRODUCTION

Orlight SA (Pty) Ltd (Orlight SA), a subsidiary of BSG Resources Limited, is proposing to construct and operate five Solar Photovoltaic (PV) Power Plants, to be located in the Northern Cape and Western Cape Provinces of South Africa.

Digby Wells Environmental (Digby Wells) has been appointed by Orlight SA as the independent Environmental Assessment Practitioner (EAP) responsible for undertaking the Environmental Impact Assessment (EIA) processes for the proposed Solar PV Power Plants.

This report documents the activities and findings of the Public Participation Process (PPP) that has been undertaken during the Scoping and Impact Assessment phases. One integrated PPP was followed for the five different EIA applications. The PPP is one of the most important aspects of any environmental authorisation process. It involves communication and disclosure of relevant project information and provides those interested in, or affected by a proposed development an opportunity to provide input into the decision making process.

It is a legislative requirement to undertake PPP for any development that requires environmental authorisation. Failure to undertake public participation may create significant risks to the project as members of the public could mobilise against the project if they have not been given the opportunity to participate.

2 OBJECTIVES OF THE PUBLIC PARTICIPATION PROCESS

The most important objective of the PPP is to provide sufficient and accessible information to stakeholders in an objective manner to assist them to:

- Raise issues of concern and suggestions for enhanced benefits and commenting on reasonable alternatives;
- Verify that their issues have been recorded and considered in investigations; and
- Contribute relevant local information and traditional knowledge to the process.

3 APPROACH

The approach followed in implementing the PPP for the EIA was based on the following principles:

- Consultation is inclusive (consultation takes place with all sectors of society, and affords a broad range of Interested and Affected Parties (I&APs) the opportunity to become involved).
- Information is sufficient to allow meaningful contributions, and is accessible (in a language that I&APs can understand and written in a non-technical way).
- Information is presented to I&APs in various ways (e.g. by way of discussion documents, meetings, workshops, small-group discussions, printed and broadcast media).
- People are assisted to understand the concepts involved.
- Enough time is allowed for comment, but I&APs' time is not wasted on options that are no longer viable.
- There are various opportunities for comment, at various stages in the process.

- There are various ways for I&APs to comment (written submissions, comment sheets, briefing meetings, stakeholder meetings, personal contact with members of the technical team).
- Stakeholders have opportunities to exchange information and viewpoints (e.g. at stakeholder and other meetings).
- Stakeholders are supplied with information that assists them to understand their roles and responsibilities in the process (e.g. time agreed upon by which comment should be provided, at which points decisions will be made about what aspects and by whom).

The PPP was implemented to adhere to the legislative requirements of the National Environmental Management Act (Act 107 of 2008) (NEMA), Chapter 6 and Sections 54 to 57.

4 METHODOLOGY

The following steps were implemented as part of the methodology to implement the PPP for the EIA:

- Identification of stakeholders and development of a register/database of I&APs;
- Announcement of the proposed project and the opportunity to comment;
- Compilation of an Issues and Response Table which was updated throughout the project;
- Announcement of the availability and public review of the draft and final reports;
- Announcing the submission of the final reports; and
- Announcement of the Environmental Authorisation (EA) and approvals (this will be done on receipt of the EA and the appeal procedure.

Information about each step is provided below.

4.1 Identification of I&APs

I&APs were identified at the beginning of the project by means of Windeed and land surveyor searches. Identification of I&APs also took place through responses to newspaper advertisements and site notices.

Persons and organisations identified as possible I&APs were registered in an electronic database. I&APs who responded to notices and advertisements were also registered, to ensure that they are included in the consultation process. Contact information of all registered I&APs were recorded. The I&AP database was updated throughout the environmental authorisation process.

Two groups of I&APs have been identified, namely regulatory authorities and the public (Appendix 1).

4.1.1 Authorities

Authorities responsible for governing all aspects of the proposed project and forming part of the decision-making process were identified. The authorities were identified through liaison with different government officials, by consulting the I&AP databases for similar projects and by considering published government databases. Authorities have been divided into the following categories:

National

- Department of Environmental Affairs (DEA);
- Department of Water Affairs (DWA);
- South African National Roads Agency Limited (SANRAL);
- Department of Agriculture, Forestry and Fisheries (DAFF);
- Civil Aviation Authority (CAA);
- Council for Geosciences;
- Department of Science and Technology (DST);
- South African Heritage Resources Agency (SAHRA); and
- South African Square Kilometre Array.

Provincial: Western and Northern Cape

- Department of Agriculture (DoA);
- Department of Mineral Resources (DMR);
- Northern Cape Department of Economic Development and Tourism;
- Western Cape Department of Environmental Affairs and Development Planning;
- Western Cape Department of Economic Development and Tourism;
- Heritage Western Cape;
- Department of Transport and Public Works (DTPW);
- Provincial regions of the Department of Water Affairs (DWA);
- Department of Environmental and Spatial Planning;
- Economic Development Agency;
- Cape Nature; and
- Northern Cape Economic Development Agency.

District and Local Municipalities

- Siyanda District Municipality;
    - Kai !Garib Local Municipality;
- Namakwa District Municipality;
    - Khai Ma Local Municipality;
    - Hantam Local Municipality;
- West Coast District Municipality:
    - Matzikama Local Municipality; and
    - Cederberg Local Municipality.
- Ward councillors.

Parastatals

- Eskom; and
- Transnet.

4.1.2 Public

The general public includes the following groups of stakeholders:

- Directly affected and adjacent land owners;
- Environmental groups;
- Non-Governmental Organisations (NGOs); and
- Community Based Organisations (CBOs)

Kindly refer to Table 1 below for registered landowner details of the affected properties. Please refer to Plan 2a to Plan 2e for maps of the land tenure.

Table 1: Directly Affected Landowners

Project site	Farm Name	Portion Number	Name of Landowner
Aggeneys	Aroams 57 RD	Portion 1	Mr Abrie van Niekerk
Kenhardt	Klein Zwart Bast 188 RD	Remaining Extent	Mr Abrie Jordaan
Loeriesfontein	Kleine Rooiberg 227 RD	Portion 5	Mr Herman van Heerden
Vanrhynsdorp	Paddock 257 RD	Remaining Extent	Mr Theunis van Zyl
Graafwater	Graafwater 97 RD	Portion 1	Mr Gert Genis
	Beuroskraal 220 RD	Remaining Extent	Mr Gert Genis

5 PRE-CONSULTATION MEETING WITH DEA

A pre-consultation meeting was held with DEA on 18 November 2011 at the DEA offices in Pretoria. The purpose of this meeting was to discuss the requirements for the Scoping and EIA process for the proposed projects. Refer to **Error! Reference source not found.** for the main oints raised at the pre-consultation meeting. A copy of the minutes is included in Appendix 4.

Table 2: Main points raised at the pre-consultation meeting

Aspect	Name and organisation	Issues/Comment	Responder	Response
Scoping and EIA Reports	Mia Ackermann (MA) EAP	Will the DEA require separate Scoping reports and EIA reports for each specific site?	Coenrad Agenbach (CA) Deputy Director of Special Projects: DEA	All sites can be combined into one comprehensive report, but there must be separate chapters dedicated to each site. Common chapters can be combined, but maps, descriptions of the site and property, applicable listed activities, impacts and mitigation measures must be in separate chapters. The cumulative impacts of the project and other projects in the vicinity must be assessed. There are a significant number of applications for renewable energy projects in the project area.
PPP report	MA EAP	Enquired if the Issues and Response report can be combined for all sites.	CA	There might be site specific issues and therefore, it is best to have a separate Issues and Responses reports and tables for each site.
Submission of reports	MA	Enquired on the process to follow when submitting draft and final reports.	CA	Draft reports must be sent to commenting authorities and I&APs on the same day. Final reports should be sent to DEA after the 40 day commenting period. Prior to the lapsing of the DEA's commenting period, the DEA will follow up with the commenting authorities to find out if they have any comments regarding the proposed project. In order to avoid delays in the project, the consultant must ensure that the commenting authorities respond to the draft reports.

Aspect	Name and organisation	Issues/Comment	Responder	Response
				Suggests that the following organisations should be added as key stakeholders and commenting authorities for the proposed project: • Department of Agriculture, Forestry and Fisheries (DAFF); • Weather South Africa (SA); • Square Kilometre Array (SKA) project; • Eskom; • Department of Energy; • South African Biodiversity Institute; • Civil Aviation Authority (CAA);
Screening phase	MA	During the screening phase three alternatives sites will be considered for each solar PV project. Heritage, Visual and Ecological studies will be undertaken during this phase to assess potential impacts.	CA	Indicated that he fully supports the undertaking of a screening phase. The proposed project area is characterised by Succulents, Camel Thorns and Kokerbome, so it important that a Flora and Fauna study is undertaken. Information collected during the screening phase and the determination of preferred site options should be included in the Scoping and EIA reports. Suggested that an environmental sensitivity map indicating no-go areas, alternative sites and buffer areas should be developed. The project infrastructure and project information should be overlaid on the sensitivity map in order to determine the impacts the proposed development will have on the environment.

6 EIA APPLICATION FORM AND LANDOWNER NOTIFICATIONS

The EIA application form for the proposed project was submitted to the National Department of Environmental Affairs (DEA). A notification letter notifying potentially directly affected land owners and occupiers regarding the proposed project were sent via email and registered mail on 30 November 2011. Proof of the notification letters were attached to the application form which was submitted to the DEA. A copy of the letter is attached as part of Appendix 2.

7 ANNOUNCEMENT OF THE OPPORTUNITY TO BECOME INVOLVED

I&APs were invited to participate in the PPP for the proposed project. Information sharing documents were compiled and distributed to all I&APs via the postal services and email. The documentation that has been developed for the PPP is described below and attached as Appendix 2.

7.1 Background Information Document

A Background Information Document (BID) and an I&AP registration form were developed to announce the EIAs to be undertaken. BIDs were distributed to various stakeholders and I&APs from 07 December 2011. Additional BIDs were made available at the local municipal offices and libraries. The BIDs included information regarding the following:

- Description of the project;
- Legal framework to be adhered to;
- Locality and extent of the proposed project;
- Specialist studies to be undertaken;
- Approach to the EIA;
- PPP that will be followed;
- Invitation to an information sharing meeting; and
- I&AP registration form.

7.2 Newspaper advertisements

In compliance with the environmental regulations, newspaper advertisements were published in English and Afrikaans. Table 2 indicates the publication dates and the newspapers used to advertise the proposed project. Proof of placement of the newspaper advertisements is provided in Appendix 2.

Table 3: Newspaper Advertisements

Newspaper	Date of Publication
Cape Argus	09 December 2011
Diamond Field Advertiser	09 December 2011
Ons Kontrei	15 December 2011
Gemsbok	15 December 2011

7.3 Site notices

Site notices were developed in English and Afrikaans and placed in the vicinity of the study areas and within local towns. The site notices had similar information as contained in the BIDs and were placed prominently to invite stakeholder participation. Please refer to Appendix 3 for photographs of the placement the of site notices.

7.4 Information sharing meetings

Five information sharing meetings were held at each study area. The meetings were conducted in Afrikaans and attendees were encouraged to ask questions in the language of their choice. Please refer to **Error! Reference source not found.** for details of the information sharing meetings.

Table 4: Details of the Information Sharing Meetings

Location	Venue	Date	Time
Aggeneys	Aggeneys Community Hall	10 January 2012	14h00
Kenhardt	Kenhardt Community Hall	11 January 2012	14h00
Loeriesfontein	Loeriesfontein Community Hall	12 January 2012	14h00
Vanrhynsdorp	Vanrhynsdorp Community Hall	13 January 2012	14h00
Graafwater	Graafwater Community Library	14 January 2012	09h00

The purpose of these meetings was to present I&APs with information regarding the proposed project, the process to be undertaken and to provide I&APs with a platform to raise their issues and comments regarding the proposed project. Minutes from the information sharing meetings are included in Appendix 4.

7.5 Obtaining Comment and Contribution

In an effort to obtain comments and contributions from I&APs, the following opportunities were available during the announcement of the EIAs:

- Completing registration forms which was distributed with the BIDs;
- By providing comments by email and telephone correspondence in response to the site notices, adverts and distribution of the BIDs; and
- Attending the information sharing meetings.

8 REVIEW OF PUBLIC DOCUMENTS

8.1 Review of the Draft Scoping Report

A Draft Scoping Report (DSR) was made available to all I&APs for review over a period of 40 days from **26 January 2012** to **06 March 2012**. A notification letter was sent to I&APs from 26 January 2012 to inform them about the availability of the DSR. The DSR was made available for public review and comment at the venues listed in Table 5.

Table 5: Locations for public review of draft environmental reports

Area	Venue	Physical address	Contact details
Aggeneys	Black Mountain Recreation Club	Boliden Road, Aggeneys, 8893	Mr Andre van Zyl (Contact: 054 983 9306)
Kenhardt	Library, Khai !Garib Local Municipality Offices	Park Street, Kenhardt, 8900	Mrs EJ Damon (Contact: 054 431 6300)
Loeriesfontein	Library, Hantam Local Municipality Offices	13 Lang Straat, Loeriesfontein, 8185	Ms E Basson (Contact: 027 341 8500)
Vanrhynsdorp	Matzikama Local Municipality Offices	37 Church Street, Vanrhynsdorp	Mr Robert August (Contact: 027 201 3339)
Graafwater	Graafwater Community Library	25 Hoof Straat, Graafwater	Ms Nathalie Leens (Contact: 027 482 8000)

The DSR was also made available on the Digby Wells website: www.digbywells.com (under public documents).

8.2 Review of the Final Scoping Report

All I&APs were notified of the initial submission of the Final Scoping Report to the DEA for review on 14 March 2012. The final scoping report was resubmitted to DEA on 04 April 2012. I&APs were afforded with an opportunity to review the Final Scoping Report for a period of 21 days from 04 April - 03 May 2012. I&APs were requested to submit all comments directly to the DEA and to send a copy of their comments to Digby Wells Environmental for inclusion into the PPP report.

8.3 Review of the Draft EIA Report

The Draft Environmental Impact Report (DEIR) was made available for a period 40 days from 21 May 2012 to 02 July 2012 for public review and comment. All registered I&APs were notified of the availability of the EIR for public comment by email and post from 21 May 2012. This provided a further opportunity for I&APs to provide inputs into the process, and ensure that their issues, comments and suggestions have been included in the EIA process. The DEIR was made available at the same public places where the Draft Scoping Report was available for public review and comment – see Table 5: Locations for public review of draft environmental reports

9 CONSULTATION DURING THE EIA PHASE

During the EIA phase, on-going consultation was undertaken with all I&APs to provide them with updated project information. No public feedback meetings were undertaken during the impact assessment phase. Although feedback meetings were not conducted, I&APs were still encouraged to raise their issues and comments regarding the proposed project.

10 DISTRIBUTION OF THE ENVIRONMENTAL REPORTS

The DSR and the DEIR for the proposed Orlight SA PV Power Plants was distributed to various National, Provincial and Local Governmental Departments. Table 6: Distribution of the Draft Scoping Report and Draft Environmental Impact Report to authorities and comments received Table 6: Distribution of the Draft Scoping Report and Draft Environmental Impact Report to below provides the information of all Departments which received the DSR and DEIR. Please refer to Appendix 9 for comments received from these Departments.

Table 6: Distribution of the Draft Scoping Report and Draft Environmental Impact Report to authorities and comments received

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
NATIONAL			
Department of Water Affairs	Dr Paul Meulenbeld	CD	The National Department of Water Affairs informed Digby Wells that the review of environmental reports is a regional office competency. As such environmental reports should be sent to the Northern Cape and Western Cape Department of Water Affairs. Digby Wells has sent the environmental reports to the National Department of Water Affairs and the regional departments.
Department of Environmental Affairs	Ms Mpho Morudu	Hard Copy	No comments received
Department of Agriculture: Land Use and Soil Management	Ms Mashudu Marubini & Ms Thoko Buthelezi	Hard Copy	Acknowledgment letters received - Applications were captured in the electronic AgriLand tracking and management system (Refer to Appendix 9).
Department of Agriculture Fisheries and Forestry	Mr Izak van der Merwe	CD	No comments received
South African Heritage Resources Agency	Dr. M. Galimberti	CD	Received comments - An Archaeological Impact Assessment (AIA) should be undertaken for the proposed project. The AIA should assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance. Recommended that the EAP must engage with a Palaeontologist in order to define whether the area is

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
			paleontological sensitive and whether paleontological resources will be affected by the proposed project.
South African Civil Aviation Authority (CAA)	Mr Christopher Isherwood	CD	Received comments – The Aggeneys, Loeriesfontein and Graafwater and Vanrhynsdorp sites have been approved, with a height restriction of 7 m, and the Kenhardt site has been approved with a height restriction of 10m required for solar PV Power Plant infrastructure.
South African Weather Services	Mr Puseletso Mofokeng	CD	No comments received
Square Kilometre Array (SKA) project	Dr. Tiplady	CD	Received Comments - The proposed project poses low risk of detrimental impact on SKA (Refer to Appendix to Appendix 9)
PARASTATALS			
Eskom	Mr John Geeringh	Hard Copy	Eskom is satisfied with the plan of study for the EIA. It should be noted that Eskom is currently conducting network expansion in some areas which are in close proximity to the proposed sites and possible alternative sites. During the public review of the DEIR, Eskom indicated that the proposed Solar PV power plants overlaps with the approved Eskom power line called Aggeneys – Paulputs 220 kV. Requested that servitude is allowed for in the proposed Solar PV layout. The proposed Solar PV power plants in Kenhardt and Loeriesfontein do not have a direct impact on the

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
			existing Eskom Transmission infrastructure. However, Eskom is concerned that the proposed Solar PV plant in Kenhardt is in close proximity to the Aries-Kokerboom 400kV which is an international line serving facilities in Namibia.
TRANSNET Northern Cape and Western Cape	Mr Attie Coetzee & Ms Anel Abrahams	CD	No comments received
WESTERN CAPE			
Cape Nature	Ms Alana Duffell-Canham	CD	Cape Nature provided comments on the proposed development in Vanrhynsdorp and Graafwater. Cape Nature indicated that the proposed site in Vanrhynsdorp is situated on a site that is covered by a Vanrhynsdorp Gannabosveld which is a vulnerable vegetation type. The Northern part of the proposed site has been mapped as a Critical Biodiversity Area; as such Cape Nature recommended that the Solar PV power plants should be placed outside the Critical Biodiversity Area. Cape Nature suggested that the site layout of the proposed project be adjusted. The proposed site layout in Graafwater must undergo revision to avoid sensitive areas.
Department of Agriculture	Ms Joyene Isaacs & Mr Cor van der Walt	Hard Copy	Received comments - The Department of Agriculture objects to the proposed site in Graafwater as the proposed Solar PV plant will be situated in a cultivated land. **The site layout has since been changed – Following*

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
			the public review of the draft EIA report, the sand veld agricultural land was delineated to be highly sensitive in terms of its agricultural importance in the local and regional agricultural context. This type of agricultural land has been designed to make provision for wildlife that traverse the land from time to time. These areas were consequently included as areas that should be avoided in the final site layout plans The Western Cape Department of Agriculture has not objections to the proposed site for the development of the Solar PV power plants in Vanrhynsdorp on condition that the recommendation regarding the soil and agricultural potential are addressed. The DoA will further comment on the proposed development once the Agricultural Impact Assessment is furnished.
Department of Environmental Affairs and Development Planning	Ms C Musemburi	Hard Copy	Received comments - Detailed description of the number of the proposed PV panels and site layout must be included in the report. A no-go alternative needs to be included and must serve as a baseline against which all other alternatives must be measured. A detailed soil and land capability assessment must be undertaken as part of the EIA. Heritage Western Cape should be approached to comment on proposed development. Cumulative impacts should also be considered at a regional and provincial level. The Department of Environmental Affairs and Development Planning confirms its support for further investigation of

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
			renewable energy options in the Western Cape.
Department of Transport and Public Works	Mr Johan Fourie	CD	No comments received.
Heritage Western Cape	Andrew Hall	CD	Comments received - A Heritage Impact Assessment consisting of an Archaeological study, Paleontological study and a visual study needs to be undertaken. **The HIA has been submitted to the HWC. No comments have yet been received.*
Department of Water Affairs	Mr Lesego Lekubu	CD	No comments received
Department of Environmental and Spatial Planning	Ms Dalene Groenewald	Hard Copy	No comments received
Department of Mineral Resources	Mr Vusimuzi Mwelase	Hard Copy	No comments received
NORTHERN CAPE			
Department of Agriculture and Land Reform	Mr NJ Toerien	Hard Copy	Received comments – The Department does not foresee any problems regarding the proposed development as long as the developer adheres to the articles of Act 43 of 1983 (Refer to Appendix 9)
Department of Environment, Nature and Conservation	Ms Adelaide Mokaudi	Hard Copy	No comments received
Department of Economic Development and Tourism	Ms Vanessa Oliver	CD	No comments received
Department of Water Affairs	Magda Ligthelm	CD	Comments received - assess all the potential water uses associated with the proposed development as

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
			defined under section 21 of the National Water Act, 1998 (Act 36 of 1998). Energy developments are not part of small industries users and as such cannot be entitled to the water use allowance set aside for small industries users as determined by the General Authorisation. The Environmental Management Plan should include the following management and mitigation measures: Storm water management, waste management, sanitation, sedimentation and erosion and storage of hazardous substances.
Department of Mineral Resources	Ms Linah Tshikororo	Hard Copy	No comments received
DISTRICT MUNICIPALITIES			
Namakwa District Municipality	Madelein Brandt	CD	No comments received
Siyanda District Municipality	Eric Ngxana	CD	No comments received
West Coast District Municipality	Henry Prins	CD	Received comments - The West Coast District Municipality supports the development of renewable energy facilities, provided that the facilities are appropriately locate. Appropriate mitigation measures to address potential negative impacts should be put in place. (Refer to Appendix 9)
LOCAL MUNICIPALITIES			
Khai Ma Local Municipality	Mr Stanley Basson	CD	No comments received
Kai !Garib Local Municipality	Mr James Styles	CD	No comments received
Hantam Local Municipality	Mr Du Plessis	CD	No comments received

ORGAN OF STATE	CONTACT PERSON	FORMAT	Comments Received
Matzikama Local Municipality	Mr Andreis Siyamba	CD	No comments received
Cederberg Local Municipality	Mr Louis Volschenk	CD	West Coast District Municipality sent comments on behalf of Cederberg Local Municipality.

11 RECORDING OF ISSUES AND COMMENTS

Issues and comments raised by I&APs during the Scoping and Impact Assessment phase have been recorded and addressed in the Issues and Response tables for each proposed project site (Table 6 to Table 9). These issues have been extracted from written submissions of I&AP registration forms, issues raised during the information sharing meetings and comments received during the public review of the DEIR.

11.1 Aggeneys

Table 7: Aggeneys Comments and Response table

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Water provision and management	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental Manager)	Water is a scarce resource in the area. Aggeneys relies on only one source of water from Pella, which has already been exhausted. Requested that a study be undertaken to investigate alternative water sources in the area.	Kevin Anderson	For the proposed Solar PV Power Project, water will be required for general use by employees during construction and operation, as well as for washing the panels twice a year. Orlight SA will utilise a water service provider to bring water to the site during the operational phase for washing the panels.
			Indicated that there are proposed mine developments to be undertaken in the area. This will increase the water demand in the area.	Kevin Anderson	Reiterated that Orlight SA will use its own water service provider for water provision.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	Information sharing meeting (10 January 2012)	Mr France: Farm Aroams 57 RD	Storm water management must be undertaken.	Kevin Anderson	No berms will be created. The natural topography of the sites will be maintained.
			Where will Orlight SA source water from?	Kevin Anderson	A water service provider will be used to supply with water during the construction and the operational phases.
Water provision and management	Fax Correspondence (03 April 2012)	Ms N Feni Northern Cape: DWA	The applicant must assess all the potential water uses associated with the proposed development as defined under section 21 of the National Water Act, 1998 (Act 36 of 1998).	EAP	It is not currently anticipated that the Aggeneys project will require an Integrated Water Use License Application (IWULA), as no Section 21 water uses have been identified.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	Fax Correspondence (03 April 2012)	Ms N Feni Northern Cape: DWA	Indicated that energy developments are not part of small industries users and as such cannot be entitled to the water use allowance set aside for small industries users as determined by the General authorisation.	EAP	Comment noted. Orlight SA will apply to the municipality as water service provider for the provision of water for the construction and operational phases of the project.
	Fax Correspondence (03 April 2012)	Ms N Feni Northern Cape: DWA	The Environmental Management Plan (EMP) should include the following management and mitigation measures: Storm water management, waste management, sanitation, sedimentation and erosion and storage of hazardous substances.	EAP	Comment noted. The EMP includes management measures for all of these aspects.
Servitudes	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental	Concerned that the servitudes of the pipelines are running through the project area.	Kevin Anderson	Noted. All servitudes will remain accessible throughout the project.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
		Manager)			
	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Indicated that Eskom will require access to its existing servitudes for maintenance purposes.	EAP	The proposed Solar PV Power Plants and associated components will be designed in such a way to ensure that Eskom retains access to all existing Eskom servitudes.
	Email correspondence (22 May 2012)	Mr John Geeringh: Eskom	Indicated that the proposed solar park overlaps with the approved Eskom power line called Aggeneys – Paulputs 220 kV. Requested that a servitude is allowed for in the solar park layout.	EAP	An alternative site layout for the proposed Solar PV power plant in Aggeneys has been developed to avoid the servitude in question. All I&APs will be awarded an opportunity to comment on the new site layout.
Buffer Zones	Email Correspondence (23 January 2012)	Ms Mia Ackermann: EAP	Enquired on what are the prescribed buffers zones for the N7 at Vanrhynsdorp and the N14 at Aggeneys.	Ms Colene Runkel: SANRAL	SANRAL recommends that there should be a 500 m buffer from the road reserve fence.
	Email Correspondence (06 February 2012)	Ms Mia Ackermann: EAP	Requested relaxation of the stipulated buffer zones.	Ms Colene Runkel: SANRAL	Requested Digby Wells to send a motivation letter for the relaxation of the buffer zones. The motivation letter should provide mitigation measures that have been put

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					in place.
	Email Correspondence (14 February 2012)	Ms Rene De Kock: SANRAL	Indicated that SANRAL is prepared to approve a 30m building line, pending the approval of the rezoning or consent use of land.	EAP	Comment noted.
Grazing land	Information sharing meeting (10 January 2012)	Mr France: Aroams 57 RD	Enquired if the land will still be available for grazing.	Frank Eager	The project site will be fenced-off and therefore, no land will be available for grazing.
Visual Impact Assessment	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining (Environmental Manager)	The mine does not foresee any visual impact.	Kevin Anderson	Noted.
	Email Correspondence (23 February 2012)	SANRAL	Concerned about the visual impact that will caused by the proposed project. Indicated that proposed project might be a distraction for motorists on the national road.	EAP	Comment noted. A Visual Impact Assessment will be undertaken and the Solar PV Power Plant layouts designed in such a way to avoid areas that will be highly visible from the national roads.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Socio-economic issues	Information sharing meeting (10 January 2012)	Kevin Anderson: Orlight SA (Applicant)	What are the socio-economic needs of the project area?	Pieter Venter	There is a need for a solar power projects in the area as result of increased electricity demands. The mine is also planning to expand in the near future, adding to the electricity demand. Housing is a problem, as Black Mountain Mine will be expanding. Indicated that Pieter Clark, the social development consultant from Black Mountain Mine, will be able assist in the identification of community needs.
Legislative requirements	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	The Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983. Indicated that the Department does not foresee any problems regarding the proposed development as long as the developer adheres to the articles of Act 43 of 1983.		Comment noted.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	Email Correspondence (28 February 2012)	Dr Tiplady South African SKA Project Office (SASPO)	Indicated that the nearest SKA station to the proposed Aggeneys study area is 150 km away and that there is no risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Rezoning	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that rezoning will be applicable as the land use will change from the current agricultural status.	EAP	An application for rezoning is in the process of being undertaken.
Land Owner information	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	The current landowner has been identified and has been consulted. The affected farm (Aroams 57 RD) is owned by Mr Abrie van Niekerk.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Lease agreements	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner.	EAP	Long term lease agreements have been reached with the land owner. Land will not be subdivided.
Heritage Impact Assessment	Email Correspondence (20 March 2012)	Dr. M. Galimberti SAHRA	An AIA should be undertaken for the proposed project. The AIA should assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance. Recommended that the EAP must engage with a Palaeontologist in order to define whether the area is paleontological sensitive and whether paleontological resources will be affected by the proposed project.	EAP	Comment noted. An AIA was undertaken for the proposed project and a Palaeontological Impact Statement prepared by a palaeontologist. The palaeontological potential of the site was considered to be low.
Environmental Impact	Email Correspondence	Mr John Geeringh: Eskom	Eskom takes note of the content of the DSR and is	EAP	Comment noted

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Assessment	(29 February 2012)		satisfied with the plan of study for the EIA. Eskom is currently conducting network expansion in some areas which are in close proximity to the proposed sites and possible alternative sites.		
Additional infrastructure	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Indicated that Eskom is planning to construct a 400 kV transmission line from Aggeneys to the Helios substation.	EAP	Comment noted
Public Participation Process	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Correspondence should be sent to himself instead of Mr Kevin Leask and Ronald Marais.	EAP	Comment noted
General	Information sharing meeting (10 January 2012)	Mr Pieter Venter: Black Mountain Mining Mr France and Mr Arnold: Aroams 57 RD farm	Indicated that they have no objections regarding the proposed project.	Kevin Anderson and Frank Eager	Comment Noted.
	Email	Mr Christopher	The CAA has no objection to	EAP	Comment noted

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	Correspondence 13 October 2011	Isherwood: Civil Aviation Authority (CAA)	the proposed development subject to a height restriction of 7 m.		

11.2 Kenhardt

Table 8: Kenhardt issues and response table

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
Project timeframes	Information sharing meeting (12 January 2012)	Ms Carin Nel: Kenhardt community member	How long will it take to construct the solar power plant?	Kevin Anderson	It will take approximately two years to construct the solar power plant.
	Registration form (13 January 2012)	Ms Carin Nel: Kenhardt community member	Indicated that the proposed Kenhardt Solar PV Power Plant is viable it just needs to be implemented sooner.	EAP	Noted.
Employment	Information sharing meeting (12 January 2012)	Ms Carin Nel: Kenhardt, community member	How many people will be employed?	Kevin Anderson	Approximately 30 people will be employed. One direct employment opportunity per MW generation capacity will be created during the operational phase and four direct job opportunities will be

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
					created per MW generation capacity during the construction phase. During construction and operational phase, accommodation will be required. If feasible, accommodation will be provided in the closest town, namely Kenhardt. It is a requirement of the government to employ local people and Orlight SA supports this policy. The proposed project will have a multiplier effect, which may encourage local entrepreneurs to establish support business such as transport, accommodation or catering services. The procurement of local goods will be preferred.
	Registration form (13 January	Kenhardt community member	Concerned that the proposed project is delaying to employ	EAP	Noted.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	2012)		local people. Enquired on what the salary package entails.		
	Information sharing meeting (12 January 2012)	Ms Maria Daniels: Kenhardt Community Member	Requested that Orlight SA will employ local people and provide skills training for them as the area has many people with matric and tertiary qualifications who are still unemployed.	Kevin Anderson	It is one of the requirements from the government that an area in which the project is situated should be developed and supported in terms of local employment and training opportunities. The proposed solar power project will develop the local area by enhancing local procurement.
	Information sharing meeting (12 January 2012)	Steve Zenani Kenhardt Community Member	Will local people be employed?	Kevin Anderson	Yes, there will be employment opportunities for some local people.
	Information sharing meeting (12 January 2012)	Willie Kooso: Kenhardt Community Member	What kind of skills development will Orlight SA offer?	Kevin Anderson	Engineers will provide a list of the required skills for the proposed project. These requirements will be made public to the community and the I&APs will then have the

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
					opportunity to form part of the skills development programmes and employment opportunities.
	Information sharing meeting (12 January 2012)	Local Community Member	When should the community expect the first employment opportunities to arise?	Kevin Anderson	Employment opportunities will be available during the construction phase, which may only commence in 2013. Encouraged local community members to send CVs and skills to Orlight SA to create a database of available skills and employment opportunities.
	Registration Form (13 January 2012)	Mr Jasper Snyders: Kenhardt Community Member	Indicated that local people should be employed as soon as possible. Requested that the project must be undertaken with integrity.	EAP	Orlight SA intends to employ local people. The process of employing people will start once the environmental authorisation has been approved by DEA.
	Fax Correspondence	Ms Carin Nel: Kenhardt Community	Enquired on what kind of benefits will be offered to people	EAP	At this stage it is not established what benefits

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	(07 February 2012)	Member	employed for the proposed Solar PV project in Kenhardt?		will be offered to employees.
Health	Information sharing meeting (12 January 2012)	Ms Maria Daniels: Kenhardt Community Member	Enquired if there is any health risks associated with solar power plants.	Kevin Anderson	Confirmed that there is no major health risks associated with Solar PV Power Plants.
Environmental studies	Information sharing meeting (12 January 2012)	Ms Carin Nel: Kenhardt Community Member	What kind of environmental studies will be undertaken?	Kevin Anderson	A Visual Impact Assessment, Fauna and Flora assessment, Archaeological and Wetland studies will be undertaken for the proposed project.
Project location	Information sharing meeting (12 January 2012)	Ms Carin Nel: Kenhardt Community Member	Where is the project located?	Frank Eager	The project site is located near the Aries substation, on the Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD.
Project location	Email Correspondence (22 May 2012	Mr John Geeringh: Eskom	The proposed Solar PV power plant does not have a direct impact on the existing Eskom transmission infrastructure. However, it is in close proximity to the Aries-Kokerboom 400kV which is an international line	EAP	Suitable buffer zones will be maintained around the 400 kV Aries- Kokerboom transmission line

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			serving facilities in Namibia.		
Legislative requirements	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that the Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983 as such the Department does not foresee any problems regarding the proposed development as long as the developer adheres to the articles of Act 43 of 1983.	EAP	Comment Noted
	Email Correspondence (28 February 2012)	Dr Tiplady South African SKA Project Office (SASPO)	Indicated that the nearest SKA station to the proposed Kenhardt study area is 28 km away and that there is only low risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Rezoning	Letter Correspondence	Ms Toerien: Department of	Indicated that rezoning will be applicable as the land use will	EAP	An application for rezoning is in the process

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	(06 February 2012)	Agriculture, Land Reform and Rural Development	change from the current agricultural status.		of being undertaken.
Land Owner information	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	The current land owner has been identified and has also been consulted. Mr Abrie Jordaan is the current land owner for Klein Zwart Bast 188 RD.
Lease agreements	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner.	EAP	Long term lease agreements have been reached with the land owner. Land will not be subdivided.
Servitudes	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Indicated that Eskom will require access to its existing servitudes for maintenance purposes.	EAP	Comment noted
Environmental Impact Assessment	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom takes note of the content of the DSR and is satisfied with the plan of study for the EIA. Eskom is currently conducting network expansion in some areas which are in close	EAP	Comment noted

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			proximity to the proposed sites and possible alternative sites.		
Water provision and Management	Email Correspondence (23 March 2012)	Ms N Feni Northern Cape: DWA	The applicant must assess all the potential water uses associated with the proposed development as defined under section 21 of the National Water Act, 1998 (Act 36 of 1998). Indicated that energy developments are not part of small industries users and as such cannot be entitled to the water use allowance set aside for small industries users as determined by the General authorisation. The Environmental Management Plan should include the following management and mitigation measures: Storm water management, waste management, sanitation, sedimentation and erosion and storage of hazardous substances.	EAP	Comment noted. Orlight SA will apply to the municipality as water service provider for the provision of water for the construction and operational phases of the project. Comment noted. The EMP includes management measures for all of these aspects.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
Public Participation Process	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Correspondence should be sent to him instead of Mr Kevin Leask and Ronald Marais.	Digby Wells	Comment noted
General	Email Correspondence (02 May 2012)	Mr Christopher Isherwood: CAA	The CAA has no objection to the proposed development subject to a height restriction of 10 m.	EAP	Comment noted

DIGBY WELLS ENVIRONMENTAL

1.3 Loeriesfontein

Table 9: Loeriesfontein issues and response table

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Water availability	Information sharing meeting (12 January 2012)	Mr Herman van Heerden: Farm owner (Portion 1of Kleine Rooiberg 227 RD)	Indicated that the groundwater at the farm Kleine Rooiberg is of good quality. He recommended that a water reservoir should be constructed in the area to store surface water which can later be used for various activities.	Kevin Anderson	Noted.
Employment	Information sharing meeting (12 January 2012)	Ms Sophia Waterboere: Loeriesfontein Community Member	Enquired if there is a guarantee that local people will be employed.	Kevin Anderson	Confirmed that Orlight intends to employ a certain number of local people. Reiterated that it is a requirement of the government requirement to employ local people and Orlight SA supports this policy. Indicated that the project will cover three aspects and this includes education, small business development and skills development.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
				Frank Eager	If the authorities approve this application, the project will create employment opportunities for local people. One direct employment opportunity per MW generation capacity will be created during the operational phase and four direct job opportunities will be created per MW generation capacity during the construction phase. During construction and operational phase, accommodation will be required. If feasible, accommodation will be provided in the closest town, namely Loeriesfontein.
	Information sharing meeting (12 January 2012)	Ms Sophia Waterboere: Loeriesfontein Community Member	Will candidates who have undergone skills training with Orlight SA receive certificates?	Kevin Anderson	Yes they will receive certificates.
Stock theft	Information	Mr Herman van	Concerned that sheep theft	Kevin	Noted.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	sharing meeting (12 January 2012)	Heerden Farm owner (Portion 1of Kleine Rooiberg 227 RD)	will be common as there will be contractors on site. Previous problems regarding sheep thefts have been experienced with contractors, e.g. contractors responsible for road and transmission construction.	Anderson	
Project consultation	Information sharing meeting (12 January 2012)	Mr David Okhuis: Loeriesfontein Community Member	Suggested that a community representative should be elected.	Frank Eager and Kevin Anderson	Noted.
Project timeframes	Information sharing meeting (12 January 2012)	Mr Wilhelm Stout: Loeriesfontein Community Member	Enquired what the lifespan of the project?	Kevin Anderson	The project has a lifetime of approximately 20 to 22 years, including the construction phase. The contract with the government is for 20 years.
Legislative requirements	Letter Correspondence (06 February	Mr Toerien: Department of Agriculture, Land	Indicated that the Department of Agriculture, Land Reform and Rural	EAP	Comment noted.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	2012)	Reform and Rural Development	development is guided by Act 43 of 1983 as such the Department does not foresee any problems regarding the proposed development as long as the developer must adheres to the articles of Act 43 of 1983.		
	Email Correspondence (28 February 2012)	Dr Tiplady: South African SKA Project Office (SASPO)	Indicated that the nearest SKA station to the proposed Loeriesfontein study area is 32 km away and that there is only low risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Rezoning	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that rezoning will be applicable as the land use will change from the current agricultural status.	EAP	An application for rezoning is in the process of being undertaken.
Land Owner information	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	The current land owner has been identified and has also been consulted. Mr Herman van Heerden is the current land owner of Kleine Rooiberg 227 RD.
Lease agreements	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner	EAP	Long term lease agreements have been reached with the land owner. Land will not be subdivided.
Environmental Impact Assessment	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom takes note of the content of the DSR and is content with the plan of study for the EIA. Eskom is currently conducting network expansion in some areas which are in close proximity	EAP	Comment noted.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			to the proposed sites and possible alternative sites.		
Project Location	Email Correspondence 22 May 2012	Mr John Geeringh: Eskom	The proposed Solar PV power plant in Loeriesfontein which is close to the Helios substation does not have a direct impact on the existing Eskom Transmission infrastructure.	EAP	Comment noted.
Public Participation Process	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Correspondence to should be sent to him instead of Mr Kevin Leask and Ronald Marais.	EAP	Comment noted.
General	Information sharing meeting (12 January 2012)	Mr Herman van Heerden: Farm owner (Portion 1of Kleine Rooiberg 227 RD)	Indicated that there are developers in the area interested in the same project. Enquired on how will Orlight handle competition in the area?	EAP	Noted. Indicated that the question will be directed to the applicant.
				Kevin Anderson	Indicated that Orlight SA is aware of other companies in the area. Explained that the process is part of a national tender for alternative and renewable energy. Various

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					companies are applying in the Northern and Western Cape.
	Registration Form (16 January 2012)	Mr Willem Beukes: Loeriesfontein Community member	Indicated that the proposed project will benefit the whole of South Africa	EAP	Noted
General	Email Correspondence 27 March 2012 13 October 2011	Mr Christopher Isherwood: CAA	The CAA has no objection to the proposed development subject to a height restriction of 7 m.	EAP	Comment noted

11.3 Vanrhynsdorp

Table 10: Vanrhynsdorp issues and response table

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
Employment	Information sharing meeting (13 January 2012)	Cllr. Andreas Siyamba: Ward Councillor	Indicated that the area has a many poor people. It is a privilege to have a solar power project in the area as it will benefit local people. Enquired when will the proposed project be implemented?	Kevin Anderson	Noted. If the project is approved by the DEA, it is anticipated that a Record of Decision (RoD) will be received towards the end of 2012 and construction will commence in 2013. The project may be operational in 2013 or 2014.
			How many people will be employed?	Kevin Anderson	Only few people will be employed in the area as the solar power plant to be constructed in Vanrhynsdorp will only be 20 MW. One direct employment opportunity per MW generation capacity will be created during the operational phase and four direct job opportunities will be created per MW generation capacity during the

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
					construction phase. During construction and operational phase, accommodation will be required. If feasible, accommodation will be provided in Vanrhynsdorp. Confirmed that it is a requirement of the government to employ local people and Orlight SA supports this policy. Orlight SA will also supports small and medium businesses that may be established as a result of the proposed project.
Town development	Information sharing meeting (13 January 2012)	Mr Johan: Vanrhynsdorp Community member	The Matzikama Local Municipality intends to expand the town in Vanrhynsdorp. Recommended that Orlight SA needs to leave some space for the municipality for the expansion of the town.	Kevin Anderson	Noted.
Rezoning	Information	Mr Johan:	Indicated that the project	Kevin	Noted. Confirmed this

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	sharing meeting (13 January 2012)	Vanrhynsdorp Community member	will be rezoned from an agricultural area to an industrial area, therefore all the relevant stakeholders should be involved in the rezoning of the project area.	Anderson	process is underway as part of the project.
	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that rezoning will be applicable as the land use will change from the current agricultural status		An application for consent use of land is in the process of being undertaken, as per the requirements of the provincial legislation.
Environmental Impacts	Registration form (24 January 2012)	Mrs Stephanie Lawler: Vanrhynsdorp Community member	Concerned about soil erosion which will be caused by flooding	EAP	A storm water management plan will be developed for the proposed Solar PV Power Plant site.
Buffer Zones	Email Correspondence (23 January 2012)	Ms Mia Ackermann: EAP	Enquired on what are the prescribed buffers zones for the N7 at Vanrhynsdorp and the N14 at Aggeneys.	Ms Colene Runkel: SANRAL	SANRAL recommends that there should be a 500 m buffer from the road reserve fence.
	Email Correspondence (06 February 2012)	Ms Mia Ackermann: EAP	Requested relaxation of the stipulated buffer zones	Ms Colene Runkel: SANRAL	Requested the EAP to send a motivation letter for the relaxation of the buffer zones. The motivation letter should provide mitigation measures that

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
					have been put in place.
	Email Correspondence (14 February 2012)	Ms Rene De Kock: SANRAL	Indicated that SANRAL is prepared to approve a 30 m building line.	EAP	Comment noted
Legislative requirements	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that the Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983 as such the Department does not foresee any problems regarding the proposed development as long as the developer must adheres to the articles of Act 43 of 1983.		Comment noted.
	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	The provisions of Land Use Planning Ordinance (Ordinance 15 of 1985) must be adhered to prior to any development taking place. The application for consent use must be lodged with Matzikama Local	EAP	EAP is in the process of applying for a consent use application.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			Municipality.		
	Email Correspondence (28 February 2012)	Dr Tiplady: South African SKA Project Office (SASPO)	Indicated that the nearest SKA station is far from the proposed Vanrhynsdorp study area and that there is no risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Land Owner information	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm	EAP	The current land owner has been identified and has also been consulted. Mr Theunis van Zyl is the current land owner of Paddock 257 RD
Lease agreements	Letter Correspondence (06 February	Mr Toerien: Department of Agriculture, Land	Enquired if there will be a subdivision of land or a lease contract between the	EAP	Long term lease agreements have been reached with the land

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	2012)	Reform and Rural Development	developer and the land owner.		owner. Land will not be subdivided.
Environmental Impact Assessment	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom takes note of the content of the DSR and is content with the plan of study for the EIA. Eskom is currently conduction network expansion in some areas which are in close proximity to the proposed sites and possible alternative sites.	EAP	Comment noted.
	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	The Draft Scoping Report indicates that there will be clearance of indigenous vegetation, therefore recommends that Cape Nature should be included as a Commenting Authority in order to give input regarding Biodiversity.	EAP	Cape Nature was not included in the PPP for the Scoping Phase of the project. EAP will send them a Final Scoping Report for comment and will include them in the process further.
	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	A copy of the Record Of Decision (ROD) and the Environmental Management Plan (EMP) must be submitted to the West Coast	EAP	Comment noted.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			District Municipality. Upon receipt of the ROD and the EMP, the West Coast District Municipality's Environmental Health Division will facilitate monitoring during the construction and operational phases.		
Public Consultation	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	Recommended that Heritage Western Cape must be approached for comments on the proposed project.	Digby Well Environmental	Heritage Western Cape has been consulted and comments have been received from them (See Appendix 5).
Heritage Impact Assessment	Email Correspondence (29 February 2012)	Dr Andrew Hall: Heritage Western Cape	Indicated that a HIA is required. The HIA should include a Palaeontological study, an Archaeological Study and a Visual Study with an integrated set of recommendations.	EAP	Comment noted. The HIA will be undertaken accordingly.
Agriculture	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	Indicated that the agricultural potential of the site should not be compromised.	EAP	The Provincial DoA and the DAFF have been included as commenting authorities.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			Recommended that input from the Provincial DoA as well as the DAFF should be obtained.		
	Mail Correspondence (08 May 2012)	Mr Cor van der Walt: Western Cape Department of Agriculture	The Western Cape Department of Agriculture has no objections to the proposed site for the development of the Solar PV power plants on condition that the soil and agricultural potential are addressed. The DoA will further comment on the proposed development once the Agricultural Impact Assessment is furnished.	EAP	The soil and agricultural potential assessment has been completed and the findings indicate that the land capability of the site is classified as grazing. Given the fact that the site is currently only utilised as thoroughfare for passers-by and show signs of degradation, renewable energy generation is considered a suitable alternative land use.
Public Participation Process	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Correspondence should be sent to him instead of Mr Kevin Leask and Ronald Marais.	EAP	Comment noted.
Development of the proposed Solar PV Power	Letter Correspondence (29 February	Ms Dorothea Kotze: West Coast District Municipality	The West Coast District Municipality supports the development of renewable	EAP	Comment noted.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
Plants	2012)		energy facilities, provided that these facilities are appropriately located. Recommended that mitigation measures should be put in place in order to address the potential negative impacts. Indicated that on site housing of workers during the construction phase is not recommended by the West Coast District Municipality.		
Proposed development alternatives	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	A no-go alternative needs to be included in the report and must serve as a baseline against which all other alternatives must be measured. Concerned that there is no comparative assessment regarding the no-go option in the Draft Scoping report. The identified alternatives must consider impacts associated with the	EAP	The assessment of the no-go alternative has been included in the EIA Report.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			construction phase, operational phase, decommissioning phase and the direct and indirect cumulative impacts.		
EIA Reports	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	A detailed description of the number of PV panels must be included in the activity description and the site the Final Scoping report.	EAP	Comment noted. It was not possible to describe the exact number of PV panels that will be installed, as the final technology has not yet been confirmed. The objective of the EIA process was to define the maximum area that would be available for the installation of infrastructure, while avoiding environmentally sensitive areas.
Visual Impact Assessment	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	A Visual Impact Assessment study must be undertaken as the proposed project will be situated directly east of N7. Recommended that SANRAL should be included as a commenting	EAP	The EAP has been in liaison with SANRAL and it has been included as a Commenting Authority.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			authority for the proposed project.		
	Email Correspondence (23 February 2012)	SANRAL	Concerned about the visual impact which will be caused by the proposed project. Indicated that proposed project might be a distraction for motorists on the national road.	EAP	A Visual Impact Assessment will be undertaken and the Solar PV Power Plant layouts designed in such a way to avoid areas that will be highly visible from the national roads.
Water Use and Management	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	Enquired as to where water will be sourced from. Requested information on the amount of water which will be required for cleaning and maintenance of the PV panels. Indicated that the necessary authorisations for water usage should be obtained from the DWA and the Matzikama Local Municipality.	EAP	Water will be sourced from a borehole that is located on the site. More information on the amount of water to be used will be provided in the draft EIA report. The EAP are liaising with the DWA to determine whether a Water Use License will be required.
Specialist Studies	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs	A detailed soil and land capability assessment of the proposed sites must be	EAP	Based on the land type data for the site, the soils of the project site are very

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
		and Development Planning	undertaken.		uniform. A soil and land capability assessment was undertaken and the results confirmed that the land capability of the site is defined as grazing.
Cumulative Impacts	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	Cumulative implications of solar energy facilities must be considered at a regional and provincial level.	EAP	Comment noted. An assessment of the potential cumulative impacts has been included.
Waste Management	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	How will sewage be disposed during the construction and operational phases? Where will the defected photovoltaic parts be disposed during the operational phase? Enquired as to where will the photovoltaic equipment or materials be disposed during decommissioning of the facility? Recommended that	EAP	A detailed waste management plan will be developed for the project in accordance with relevant local, provincial and national legislation.

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
			appropriate measures need to be put in place to ensure that hazardous materials do not pose a threat to the environment.		
Fauna and Flora	Email Correspondence (21 June 2012)	Ms Alana Duffell-Canham: Cape Nature	The proposed site in Vanrhynsdorp is covered by the Vanrhynsdorp Gannabosveld which is considered to be vulnerable vegetation.	Fauna & flora specialist	**The latest infrastructure layout plan indicates that a small percentage of the Vanrhynsdorp Gannabosveld will be disturbed during construction, after which the vegetation will most probably recover. This vegetation type is very well represented outside the project areas boundaries, this coupled with the current condition of the veld which was found to be under severe pressure, and degraded was the basis for the current infrastructure placement.*
Fauna and Flora	Email Correspondence	Ms Alana Duffell-Canham:	The northern part of the proposed project site has	Fauna and flora specialist	**The site layout has been adapted to avoid most of*

Aspect	Reference	Farm/Organisation	Issue	Responder	Response
	(21 June 2012)	Cape Nature	been mapped as a Critical Biodiversity Area (CBA). As such Cape Nature does not support the current proposed layout. Recommended that the Solar PV panels and associated infrastructure be placed outside the CBA.		*the northern parts of the property. It should be noted that due to the visual sensitivity of the southern parts of the study area, an optimal site layout had to be developed, taken into consideration various environmental, socio-economic and heritage factors.*
General	Information sharing meeting (13 January 2012)	Cllr Siyamba: Ward Councillor	On 31 January 2012, there will be council meeting which will be held in Vredendal Hall. It might be worthwhile for Orlight SA to attend the meeting.	Kevin Anderson	Noted. Orlight SA may attend this meeting and appreciates the invitation.

DIGBY WELLS ENVIRONMENTAL

11.4 Graafwater

Table 11: Graafwater issues and response table

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
Public consultation	Information Sharing Meeting (14 January 2012)	(Cllr) Jimmy Barnard: Ward Councillor	Enquired how the landowners were contacted as part of the Public Participation Process (PPP) and to discuss the use of their land for the project.	Kevin Anderson	Landowners were contacted prior the submission of the EIA applications. In consultation with Eskom, the most preferred sites were identified and the relevant land owners were consulted. All interested and affected parties will be consulted during the PPP, which is an on-going process.
	Information Sharing Meeting (14 January 2012)	Mr Boetie Kotze: Local business owner	Requested to be updated on any developments regarding the proposed project.	Kevin Anderson	Noted.
Public Consultation	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western	Recommended that Heritage Western Cape must be approached for comments on the proposed project.	Digby Well Environmental	Heritage Western Cape has been consulted and comments have been received from them (See Appendix 5).

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
		Cape)			
Fauna and flora	Information Sharing Meeting (14 January 2012)	Mr van Zyl: Graafwater Community Member	Will site clearance be undertaken prior construction of the solar power plant?	EAP	Yes, certain areas will be cleared during the construction phase. Certain plants will have to be removed if it is determined that they might affect the efficiency of the solar panels. However, physical disturbance will be minimised and undertaken in accordance with a Fauna and Flora Management Plan and mitigation measures will be implemented. Should protected plant species be found in the study area, they may be relocated to another area where they will not be affected.
	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	The Draft Scoping report indicates that there will be clearance of indigenous vegetation. Concerned that the site where there will be	EAP	Cape Nature was not included in the PPP for the Scoping Phase of the project. The EAP will send them a Final Scoping

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			clearance of indigenous vegetation is situated within a Terrestrial CBA. Recommended that comments from Cape Nature should be obtained.		Report for comment and will include them in the process further.
Avifauna	Registration Form (12 December 2011)	Mrs Tania Anderson: Wildlife and Environment Society of South Africa	Concerned about the impacts the proposed project will have on the birds. A concern was also raised about the loss of endangered species.	EAP	A Fauna and Flora assessment will be undertaken during the EIA phase to assess the potential impact of the projects on biodiversity and to develop suitable management plans.
Employment	Information Sharing Meeting (14 January 2012)	Cllr Jimmy Barnard: Ward Councillor	Will there be employment opportunities for local people?	Kevin Anderson	Yes, employment opportunities will be available to local people. Indicated that Orlight SA intends to employ a certain number of employees from local communities and supports the governments' on-going initiative to enhance local employment and Black Economic Empowerment

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					(BEE). One direct employment opportunity per MW generation capacity will be created during the operational phase and four direct job opportunities will be created per MW generation capacity during the construction phase. During the construction and operational phases, employee accommodation will be required. If feasible, accommodation will be provided in the closest town, which is Graafwater. Orlight SA will also support local businesses that may result from the multiplier effect from this development, such as transport services or hospitality and catering.
	Letter	Ms Dorothea Kotze:	Indicated that on site housing of workers during the	EAP	No workers will be house on-site during the

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	Correspondence (29 February 2012)	West Coast District Municipality	construction phase is not recommended by the West Coast District Municipality.		construction phase.
Heritage Impact Assessment	Email Correspondence (29 February 2012)	Dr Andrew Hall: Heritage Western Cape	Indicated that a HIA is required. The HIA should include a Palaeontological study, an Archaeological Study and a Visual Study with an integrated set of recommendations.	EAP	Comment noted. The HIA will be undertaken accordingly.
Tourism	Information Sharing Meeting (14 January 2012)	Mr Boetie Kotze; Local business owner	The proposed project will be a tourist attraction.	Kevin Anderson	Noted.
Safety and security	Information Sharing Meeting (14 January 2012)	Mr Neethling: Community member	Indicated that safety and security of the project is of concern.	Kevin Anderson	Orlight SA will have security guards on site and the site will be fenced-off.
	Information Sharing Meeting (14 January 2012)	Cllr Jimmy Barnard: Ward Councillor	Indicated that a number of local people have on the railway line that is located adjacent to the project site. Recommended that the safety be taken into	Kevin Anderson	Noted.

DIGBY WELLS ENVIRONMENTAL

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			consideration.		
Development of the proposed Solar PV Power Plants	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	The West Coast District Municipality supports the development of renewable energy facilities, provided that these facilities are appropriately located. Recommended that mitigation measures should be put in place to address the potential negative impacts.	EAP	Mitigation measures will be included in the EMP for the proposed project.
Traffic	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	Concerned that the access roads will be affected during the construction and operation phases. Recommended that the Department of Transport and Public Works should be approached for comment.	EAP	The Department of Transport and Public Works has been consulted. No feedback has been provided, but a Traffic Assessment will be undertaken to assess impacts.
Legislative requirements	Letter Correspondence (06 February 2012)	MrToerien: Department of Agriculture, Land Reform and Rural Development	Indicated that the Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983. The	EAP	Comment noted.

DIGBY WELLS ENVIRONMENTAL

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			Department does not foresee any problems regarding the proposed development as long as the developer adheres to the articles of Act 43 of 1983.		
	Email Correspondence (28 February 2012)	Dr Tiplady: South African SKA Project Office (SASPO)	Indicated that the nearest SKA station is far from the proposed Graafwater study area and that there is no risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Rezoning	Letter Correspondence (29 February	Ms Dorothea Kotze: West Coast District Municipality	The provisions of Land Use Planning Ordinance (Ordinance 15 of 1985) must be adhered to prior to any	EAP	An application for consent use of land is in the process of being undertaken, as per the

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	2012)		development taking place. An application for consent use must be lodged with Matzikama Local Municipality.		requirements of the provincial legislation.
Land Owner information	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	Affected land owners have been identified and have been consulted. Mr Gert Genis is the current land owner for Graafwater 97 RD and Beuroskraal 220 RD.
Lease agreements	Letter Correspondence (06 February 2012)	Mr Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner.	EAP	Long term lease agreements have been reached with the land owner. Land will not be subdivided.
Environmental Impact Assessment	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom takes note of the content of the DSR and is content that the plan of study for the EIA. Eskom is conducting network expansion in some areas which are in close proximity to the proposed sites and	EAP	Comment noted.

DIGBY WELLS ENVIRONMENTAL

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			possible alternative sites.		
		Ms Dorothea Kotze: West Coast District Municipality	A copy of the ROD and EMP must be submitted to the West Coast District Municipality. Upon receipt of the ROD and the EMP, the West Coast District Municipality's Environmental Health Division will facilitate monitoring during the construction and operational phases.	EAP	Comment noted.
Proposed development alternatives	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	A no-go alternative needs to be included in the report and must serve as a baseline against which all other alternatives must be measured. Concerned that there is no comparative assessment regarding the no-go option in the Draft Scoping report. The identified alternatives must consider impacts associated with the construction phase,	EAP	The assessment of the no-go alternative has been included in the EIA Report.

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			operational phase, decommissioning phase and the direct and indirect cumulative impacts.		
EIA Reports	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	A detailed description of the number of PV panels must be included in the activity description and the site layout of the Final Scoping report.	EAP	Comment noted. It was not possible to describe the exact number of PV panels that will be installed, as the final technology has not yet been confirmed. The objective of the EIA process was to define the maximum area that would be available for the installation of infrastructure, while avoiding environmentally sensitive areas.
Public Participation Process	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Correspondence to should be sent to him instead of Mr Kevin Leask and Ronald Marais.	EAP	Comment noted.
	Letter Correspondence	Ms Dorothea Kotze: West Coast District	It should be taken into consideration that there is a	EAP	Transnet has been included in the PPP for the

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
	(29 February 2012)	Municipality	railway line traversing the proposed site, therefore Transnet should be consulted regarding the proposed project.		project, but no comments have yet been received.
Agriculture	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	Indicated that the agricultural potential of the site should not be compromised. Recommended that input from the Provincial DoA as well as the DAFF should be obtained.	EAP	The Provincial DoA and the DAFF have been included as commenting authorities.
	Mail Correspondence (20 May 2012)	Mr Cor van der Walt	The Department of Agriculture objects to the proposed site in Graafwater as the proposed Solar PV plant as it is situated on a cultivated land.	EAP	During consultation with the WC DoA, the sand veld cultivated lands on which solar PV infrastructure would previously have been located were identified highly sensitive in terms of its agricultural importance in the local and regional agricultural context. This type of agricultural land has been designed to make provision for wildlife

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					that traverse the land from time to time. These areas were consequently included as areas that should be avoided in the final site layout plans.
Specialist Studies	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning	A detailed soil and land capability assessment of the proposed sites must be undertaken.	EAP	A detailed soil and land capability assessment was undertaken for the proposed project. Areas with arable land capability were delineated. The results are included in the EIA Report.
Visual Impact Assessment	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	A Visual Impact Assessment study must be undertaken as the proposed project will be situated in close proximity to the developed areas in Graafwater and the R364 as well as the DR2180.	EAP	A Visual Impact Assessment will be undertaken and the Solar PV Power Plant layouts designed in such a way to avoid areas that will be highly visible from the roads.
	Telephone Correspondence (29 June 2012)	Mr Zwelibanzi Shiceka Western Cape	The conventional technique has not been applied in terms of the Visual Impact	EAP	Although the study area is visible from the R364, the visual impact of

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
		Heritage	Assessment study that was undertaken. Requested clarity on the visual impacts associated with the proposed project in Graafwater. What is the visual impact on the cultural landscape in Graafwater.		construction activities and the installation of the Solar PV Power Plant components will be reduced if activities are restricted within the recommended development areas. Graafwater is a farming town and is therefore not an evident tourism town. However, the introduction of the solar PV power plant may evoke positive ideas to passers-by about the town being part of a larger-scale “greener” approach to supplying electricity. The impact is dependent on the person who views the townscape and landscape. Visual impacts are rated based on social norms. For some people, the proposed

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					infrastructure may be an indication of urbanisation and economic upliftment in the area, in which case a positive visual impact will be experienced. For other receptors, the construction of the infrastructure might be a negative factor which could impede tourism in the area. Ideally the perceptions of people residing in each and every household, shop or restaurant that will potentially be affected would be included in the VIA. For this purpose, the visual specialists attended the public information sharing meeting that was held during the scoping phase. The attendees were shown photos of other solar PV power

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					plants and were made aware of how the potential infrastructure will look once constructed. No comments were made regarding the potential negative visual impact that the proposed infrastructure.
Water Use and Management	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	Enquired on where water will be sourced from. Requested information about the amount of water which will be required for cleaning and maintenance of the PV panels. Indicated that the necessary authorisations for water usage should be obtained from the DWA or Matzikama Local Municipality.	EAP	More information on the amount of water to be used will be provided in the draft EIA report. The EAP is liaising with the DWA to determine whether an IWULA will be required.
Waste Management	Letter Correspondence (29 February 2012)	Ms Dorothea Kotze: West Coast District Municipality	How will sewage be disposed during the construction and operational phases?	EAP	A detailed waste management plan will be developed for the project in accordance with

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			Where will the defected photovoltaic parts be disposed during the operational phase? Enquired as to where will the photovoltaic equipment or materials be disposed during the decommissioning of the facility. Recommended that appropriate measures need to be put in place to ensure that hazardous materials do not pose a threat to the environment.		relevant local, provincial and national legislation.
Cumulative Impacts	Fax Correspondence (09 March 2012)	Ms Musemburi: Department of Environmental Affairs and Development Planning (Western Cape)	Cumulative implications of solar energy facilities must be considered at a regional and provincial level.	EAP	Comment noted. An assessment of the potential cumulative impacts has been included.
Fuana and Flora	Email Correspondence (21 June 2012)	Ms Alana Duffell-Canham: Cape Nature	The proposed site contains a mixture of agricultural fields and it is covered by natural vegetation. The vegetation	Fauna and flora specialist	The sensitivity map of the Graafwater site has been updated and now reflects the placement of

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
			on site consists of Graafwater Sandstone Fynbos on the Northern part of the site and Leipoldtville Sand Fynbos on the southern portion of the site. Both the Graafwater Sandstone Fynbos and the Leipoldtville are of high conservation priority. Cape Nature requested that the size and the layout of the proposed Solar PV power plants undergo a major revision to avoid sensitive areas. The construction of the proposed Solar PV power plants and associated infrastructure must be undertaken outside the Critical Biodiversity Areas.		infrastructure as being predominantly over least sensitive areas. More specifically, the site is located in the agricultural area to the north eastern quarter of the study area, which during the time of study was found to be ploughed. Furthermore, the solar park infrastructure falls outside the CBA for this site. The information with regards to site characteristics and possible species present will be updated with the latest possibly information. With regards to the actual layout of infrastructure, the ecological study advises on the layout after considering field work data results, the final decision as taken by the client is

Aspect	Reference	Name and Farm/Organisation	Issue	Responder	Response
					influenced by this data and a compromise must be reached. At this stage with the latest site layout the infrastructure is situated predominantly over least concern agricultural areas, completely avoiding highly sensitive vegetation.
General	Registration form (17 January 2012)	Mrs Retha Coetzee: Graafwater Community member	Concerned about high temperatures.	EAP	The impact of the proposed solar PV power plant on the micro-climate will be investigated during the EIA phase.
	Email Correspondence (28 February 2012)	Mr Christopher Isherwood: CAA	The CAA has no objection to the proposed development subject to a height restriction of 7metres.	EAP	Comment noted.

12 NOTIFICATION OF DECISION

Once a decision has been made by the DEA on whether to grant environmental authorisation for the proposed projects, all registered I&APs will be notified by email, fax and registered post of the decision and appeal procedures.

Appendix E: Soil and agricultural potential study

Avalon Soil Assessment Services

P O Box 59412
Karen Park, 0118
Cell: 083 535 68181
Fax: 086 5904 776
E-mail: louwpot@gmail.com

Date: 13 March 2012 **Report no:** Asas022

REPORT FOR A SOIL ASSESSMENT AS PART OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE DEVELOPMENT OF SOLAR ENERGY FACILITIES AT 5 IDENTIFIED SITES IN THE NORTHERN AND WESTERN CAPE PROVINCE

For

Digby Wells & Associates (Pty) Ltd

(H.J.C SMITH)

Prepared by

L. Potgieter (Cert.Sci.Nat).

Reg No. 200031/04

Contents

List of Tables

List of Figures

GLOSSARY OF TERMS

Alluvium(al) - Refers to detrital deposits resulting from the operation of modern streams and rivers.
Apedal – without structural units

Calcareous - Containing calcium carbonate.
Colluvial material - Unconsolidated deposits of soil and/or rock fragments which accumulates at the bottom of mountain slopes or on nearby land
Concretion – A nodule made up of concentric accretions.
Desert Pavement - a natural residual accumulation of rock fragments which has been polished by wind. It occurs on surface after finer material has been removed through wind erosion.
Erosion – The group of processes whereby soil or rock material is loosened or dissolved and removed from any part of the earth's surface.
Fertilizer – An organic or inorganic material, natural or synthetic, which can supply one or more of the nutrient elements essential for the growth and reproduction of plants.
Fine sand – (1) A soil separate consisting of particles 0.25-0.1 mm in diameter. (2) A soil texture class (see texture) with fine sand plus very fine sand (i.e. 0.25-0.05 mm in diameter) more than 60 % of the sand fraction.
Fine textured soils – Soils with a texture of sandy clay, silty clay or clay.
Fluvial - Fluvial processes comprise the motion of sediment and erosion or deposition (geology) on the river bed
Gleyed – when most of the Iron has been dissolved out of a soil due to prolonged anaerobic conditions the soil matrix is left with a greyish, greenish or bluish colour and is said to be gleyed.
Hydromorphic – refers to soil forming which developed in the presence of an excess of moisture which tends to suppress aerobic factors in soil-building
Land capability – The ability of land to meet the needs of one or more uses under defined conditions of management.

Land type – (1) A class of land with specified characteristics. (2) In South Africa it has been used as a map unit denoting land, mappable at 1:250,000 scale, over which there is a marked uniformity of climate, terrain form and soil pattern.
Measl – mean elevation above sea level
Namib (Nb) soil form – A soil form part classified under the national soil classification system and consisting of a build-up of regic sand layers
Nodule – Units varying in size, shape and colour which comprise a build up of lime or silica and have a assumed a hard object
Pedocrete – comprise of the following: calcrete, ferricrete, silcrete.
Pedological – A study of the soil system and its formation, characteristics and inner workings
Terrain units - see section 3.4
Texture, soil – The relative proportions of the various size separates in the soil as described by the classes of soil texture shown in the soil texture chart (see diagram on next page). The pure sand, sand, loamy sand, sandy loam and sandy clay loam classes are further subdivided (see diagram) according to the relative percentages of the coarse, medium and fine sand sub-separates.

EXECUTIVE SUMMARY

A Pedological and land capability study was undertaken as part of an Environmental Impact Assessment (EIA) for the development of five (5) solar energy facilities located in the Northern and Western Cape Province of South Africa respectively.

The soil and land capability study enables the generation of a baseplan to serve as a reference for baseline conditions when the expected impacts on the soil resource are assessed within the five (5) areas designated for the planned development.

The areas of interest were located near or in close proximity of towns listed in Table 1. Further logistical facts relating to the sizes of the sites, number of soil observations and transects made per site are summarised in Table 1:

Table 1: Summary of logistical facts relating to the study

Nearby Town	Size of the site (Ha)	No. of Observations	No. of Transects
Aggeneys	870	24	3
Kenhardt	900	25	3
Loeriesfontien	1000	30	3
Van Rhynsdorp	185	22	4
Graafwater	300	80	N/A
Total	3255	181	13

The field work was undertaken between 20 February and 3 March 2012 during which a total area of 3 300 ha was visited for investigation. Two approaches for the study were followed. Sites at the first four towns (as listed above) were targeted for a broad scale of investigation. The site at Graafwater was targeted for a semi detail soil investigation due to its location in a more intensively utilised agricultural surround (production of potatoes, partly under irrigation).

For both study approaches soils were identified and classified using the South African Taxonomic Soil Classification System (Mac Vicar et al, 1991). Classification of land capability was assessed in terms of the Guidelines for Rehabilitation of Mined Land; Chamber of Mines of SA, 2007 which employs the following classes: arable, grazing, wetland and wilderness. Assessment of the anticipated impacts on the land capability of the soil resource was based on the impact matrix system (DEAT, 1998).

The broad scale investigation comprised a visit to each site during which a site was transected and observations made along such transects. Sites were further assessed by dividing it into terrain units to establish a relation between terrain and soil occurring on it. However due to aridity of the areas little soil development has taken place, causing the majority of the soils to be shallow on nearly all of the terrain. The exception was found on a few occasions in the dry watercourses, where a mixture of transported soil and rock debris has given rise to a somewhat deeper profile.

Soils of the two sites near Loeriesfontein and Kenhardt were found to have very similar characteristics, including a yellow and red colour, shallowness, infestation with coarse fragments and sandy loam to sandy clay loam texture. Due to the coarse composition a potential impact arising from the proposed development to affect the soil negatively, is the potential to inflict erosion. This will be likely to occur during events where activities such as site clearance, topsoil removal and soil stockpiling may expose the soil to forces of nature.

The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments implied susceptibility to water and wind erosion respectively, both of a moderate to high rating if no mitigation measures are in place. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected. The same reasoning would apply to the soils found at van Rhynsdorp, however would be less vulnerable due to a sandy loam texture, implying better cohesion between particles.

The above-mentioned soils of fine grade will also be susceptible to compaction, where on the opposite the coarse composition of the fragment infested soils will not be easily affected.

Eighty (80) points of investigation was cited on a non-rigid grid format to achieve a semi-detailed level of investigation at Graafwater. Collected information in conjunction with in-field observation resulted in the differentiation of seven (7) soil units. The majority of the units comprised fine to medium sand overlying rock and only varied in depth and somewhat in colour (sMs unit). A land capability inference based on the identified soil units yielded the majority of the study area to be of grazing capability (210+ ha). The only arable capability class was split up and scattered between six (6) units, comprising less than 90 ha in total.

The impacts on the soils identified at Graafwater were found to be similar than those anticipated for the soils identified during the broad scale investigation. Both erosion and compaction will be consequences of moderate significance rating if no mitigation measures were to be employed. With mitigation however, both potential impacts can be reduced to a low significance rating.

Apart from the potential impacts already discussed, the impact of losing the soil resource as a support substrate to grazing and food production for the entire time span of the project, was considered to be of high significance rating with regard to the four sites under discussion. IN the case at Graafwater it was rated to be of moderate significance. The reasoning for this related to the facts that three of the four selected sites are relatively big in relation to grazing units forming part of a grazing rotational system within a farm unit. In addition, the entire site will be lost for the total life of the project.
In the case of the site at Graafwater, the latter mentioned reason will also apply, however it can be reasoned that the area is a smallish unit to be lost to the capability of grazing and a low expectation of production potential in terms of its arable capability. Furthermore, the disturbed land was considered to be able to be restored near to its original capability after the decommissioning stage of the project.

Mitigation measures to minimise or counteract the considered impacts of erosion and compaction relating to the expected activities it may be induced by (site clearance, soil stripping and stockpiling) are listed below.

Erosion:

- Minimising areas of disturbance;
- Plan earthworks in phases so that exposed areas are minimised;
- Stockpiles should be sloped and vegetated to keep potential of erosion as low as possible;
- For the sites comprising coarse graded soils, plan earthworks for the dry season; and
- For the site in the southern half at Aggeneys and the entire site at Van Rhynsdorp, workings can be scheduled for the wet season or surfaces can be lightly sprayed during and after construction activities to keep the exposed surface moistened.

Compaction:

- Minimising areas of disturbance;
- Minimise traffic over the area to be stripped/compacted;
- Plan earthworks for the dry season, damp soil compacts easier; and
- Mechanical loosening of soil after operations should be instigated (where applicable).

In conclusion, it is the meaning of the soil assessor that the overall impacts on the soil resource and land capability of the Solar Energy Facility on the five selected areas for the proposed developments can be mitigated to an acceptable level. The recommendations follows that the planned development should take place away from any natural drainage ways as well as to attempt to avoid the **mY** unit in the centre of the site at Graafwater. With this in mind, the soil assessor supports the decision for the application.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

1. Introduction

Avalon Soil Assessment Services (ASAS was commissioned by Digby Wells & Associates (Pty) Ltd. to undertake a pedological and land capability study as part of an EIA for the development of solar energy facilities in the Northern and Western Cape Province of South Africa.

The report to follow addresses the conducting of the soil and land capability assessment to serve as a baseplan for the evaluation of the expected impacts on the soil resource within the five (5) areas designated for the development (an including their associated infrastructure).

2. Objectives

The objectives of the assessments were as follow:

- To assess the soil resource to derive land capability
- To anticipate significant impacts of the proposed developments in the wider spectrum on the soil resource; and
- To outline mitigation measures in order to manage expected impacts on the soil resource.

3. Study Approach

The scope of work involved assessing the five areas with inclusion of associated infrastructure as listed below:

- Aggeneys
- Kenhardt
- Loeriesfontien
- Van Rhynsdorp
- Graafwater

The field work was undertaken between 20 February and 3 March 2012. A total area of 3 300 ha was investigated. With reference to existing landtype information (Land Type Survey Staff) and from experience through previous projects conducted in the Karoo, it was apparent that four of the five areas could be regarded as having low agricultural potential in terms of cultivation. The relevant land type (including soil profile data) was obtained in order to gain a better understanding and insight of the areas targeted for the assessment. It also had the purpose of serving as an indication of chemical/fertility status of the soils found on site where comparable.
The particular information was made available for use by the Institute for Soil, Climate and Water (ISCW) and is provided as hyperlinks in Appendix C. By using the supplied hyperlinks the information can be freely accessed by anyone using the link correctly.

With regard to the field work approach, two methods of study were employed:

- A broad scale approach was considered for the four areas (first four in above list),
- while a semi-detailed level of investigation was considered for the study site at Graafwater.

3.1 Broad Scale Study Approach

A broad scale of soil investigation was deemed adequate for four of the areas:

- Aggeneys
- Kenhardt
- Loeriesfontien
- Van Rhynsdorp

The broad scale approach constituted the following method of study:

- The identification of terrain types/units (Land Type survey) within the four areas of study;
- The collection of soil information via transecting the identified terrain types to obtain representation of the soil types associated with each terrain type;
- Interpretation of the collected information to derive percentages of identified soil types to represent the various terrain types per study zone;
- The inference of land capability from the above to serve as a baseline for assessing the anticipated impacts; and
- Obtaining soil profile data from the existing land type data base of selected profiles in proximity to each of the sites to compare to the zones of study.

3.2 The Semi-detailed Study Approach

A semi-detail scale for the soil study was considered for the designated area at Graafwater due to its location wthin a more intensely agricultural utilised region. It comprised collecting soil information on a semi-detailed level following the methods as set out below:

- Existing information from the National Land Type Survey was obtained and reviewed;
- A field survey employing a rigid grid pattern was used comprising 200 m intervals in cultivated area whilst a 250 to 300 m interval was applied elsewhere;
- Forthcoming information enabled the delineation of soil mapping units;
- The soil mapping units formed the basis for establishment of land capability units; and
- Hand-drawn maps (soil and land capability) for the Graafwater study zone were compiled and submitted for digitizing.

3.3 Explanation of Classification Systems Applied

For identification and classification purposes of the soil and land in terms of soil type, land capability and terrain three classification systems were applied and each is discussed in the sections to follow.

3.3.1 Soils

For the identification and description of soils, especially where the more detailed level of investigation was applied, the South African Taxonomic Soil Classification System (Mac Vicar et al, 1991) was used.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

3.3.2 Land Capability

The classification of land capability was conducted in terms of the Guidelines for Rehabilitation of Mined Land; Chamber of Mines of SA/Coaltech, 2007 using the following classes: arable, grazing, wetland and wilderness. For application of the term wetland further guidance was seeked and applied as guided by "the practical field guide for the identification and delineation of wetlands and riparian areas", DWAF, 2003. It must be noted that for all watercourses referred to in the areas of study the definition in the guide for riparian areas is more applicable than the term wetlands. Soils in the watercourses of these dry areas are rather of young fluvial processes and hence have no hydromorphic characteristics (DWAF, 2003).

3.3.3 Classification of Terrain Units

Classification of terrain units was based on the methodology followed during the National Land Type Survey by the Institute for Soil Climate and Water (at the time part of the former National Department of Agriculture). A terrain unit is any part of the land surface with homogeneous form and slope. Terrain can be made up of all or some of the following types of terrain units, namely:

- Crest – Terrain unit 1;
- Scarp – Terrain unit 2;
- Midslope- Terrain unit 3;
- Footslope - Terrain unit 4; and
- Valley bottom or flood plain as Terrain unit 5.

A terrain type (adapted after Kruger, 1973; Hammond, 1964; King 1953) in this context denotes an area of land over which there is a marked uniformity of surface form.
Whether a terrain unit is a footslope or a midslope depends on its position (a midslope lies immediately below a crest or scarp) and, to an extent, upon the steepness of the slope. In contrast with a midslope, a scarp is steeper than 100% (45°) and usually steeper than about 70°.

3.4 Impact assessment

An assessment of the impacts of the proposed activities on the soil resource was employed for both studies and was based on the impact matrix system (DEAT, 1998) which included the following aspects:

- Potential impact in terms of the nature of the impact;
- Extent and duration of the impact;
- Probability of the impact occurring;
- Degree to which the impact may cause irreplaceable loss of resources; and
- Degree to which the impact can be mitigated.

Mitigation measures based on the significance rating from the impact evaluation are included, but excluded cost estimations.

4. Findings of the study

The findings of the study were divided into two sections. The first section in the following chapter will address the findings of the broad scale assessment. The second section will disclose the findings of the study applied for the Graafwater study site, which was at semi-detail level. Additional information

4.1 Findings of the broad scale assessment

The findings of the broad scale assessment were sub-divided into sections addressing each of the four study zones assessed via this approach.

4.1.1 Loeriesfontein

The findings of the site near Loeriesfontein will be described in terms of the listed headings in the sections to follow:

- Terrain and Geology
- Soils
- Land Capability

4.1.1.1 Terrain and Geology

The site is situated approximately 40 km north of the town of Loeriesfontein on the Farm Kleine Rooiberg. For the majority of the terrain it comprised a general flat topography with a slight slope at 2 degrees angle from west to east. Drainage starts with narrow rills in the west to transport water in a general easterly direction. The rills transform to larger drainage channels towards the east and transformed into riverbeds (photo 4, Appendix B). The Rooibergriver finally drains the runoff out of the study zone towards the south. A few small loose standing rocky koppies of approximately 5 to 10 m in height were scattered over the area.

Geology: Geology depicts shale rock type of the Ecca Group, Karoo Sequence (Land type survey staff, 1986). Remnants of Shale littered the surface across most of the terrain, covering the surface in a variety of fragment sizes (photo 2, Appendix B).

Using the method as described in Section 3.4 the terrain of the Loeriesfontien site was divided into terrain units and are presented in Table 2

Table 2: Terrain units of the site at Loeriesfontein

Terrain	% of the landscape	Slope (in degrees)	Slope length (m)
1	≤ 2	0-1	50
2	< 1	85-90	2-3
3	5	5-15	100-200
4	65-73	3-6	100-800
5	10–20%	3 - 6	5-50

4.1.1.2 Soils

By establishing three transects across the study site a total of 30 soil observations were established (Figure 1). Findings of importance were as follow:

- The vast presence of the shale rock type gave rise to fragment infested shallow soils (<30cm) for the majority of the site (Photo 2 Appendix B), with the exception of the watercourses where alluvial deposits were dominating (photo 1, Appendix B);
- The colour of the soils when dry, was found to be yellow-brown when compared to colour coding, however when compared after moistening matched a red qualification.
- The yellow-red soil particles between the many rock fragments were found to be structureless (apedal), had significant clay content and overlaid consolidated rock in the majority of the observation points.
- The transported soil deposits found in the watercourses was of similar characteristics. However, fine-graded yellow sandy deposits were also observed at river bends (photo 3, Appendix B) and/or where watercourses were wider. Lime was also detected in places.
- Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to.
- The site formed part of the Land Type with no. Fc467 (Land Type Survey Staff, 1986) and soils of the site was also compared to a soil profile description with No. 2214 (Land Type Survey Staff, 1986) located in close proximity to the site (Appendix C).
- No erosion features of significance were found on this site. Minor sheet erosion seems to occur on Terrain unit 4 in places, (Photo 2, Appendix B) but is a very slow going natural process of this region. It is to some extent, counteracted and limited by the rock fragment cover.
- No erosion features of significance were found on this site. Minor sheet erosion seems to occur on Terrain unit 4 in places, (Photo 2, Appendix B) but is a very slow going natural process of this region. It is to some extent, counteracted and limited by the rock fragment cover.

Characteristics of the soils found on the site are summarised in Table 3.

Table 3: Characteristics of the soils at the Loeriesfontein site

Soil type	Depth range (in cm)	Clay content range (% of volume) *	Texture*	Erosion susceptibility	Underlying material
Yellow-red soils	<5-30	15-25	sandy loam to sandy clay loam	Moderate	consolidated rock
Alluvial deposits	30-50	12-30	loamy sand to loam	Low to moderate	consolidated bedrock

*Take note that clay content was based on an in-field estimation and Texture was derived from the clay content estimation

4.1.1.1 Land Capability

The land capability for the Loeriesfontein site was derived as described under Section 3.2. In conjunction with the factors already established it can be summarised as presented in Table 4.

Table 4: Land Capability for the site at Loeriesfontein

Terrain	Soil type	Land capability
1 (koppie)	Very shallow topsoil with abundant rock outcrop	Wilderness/grazing*
2 (river& embankment)	Rock faces	Wilderness/grazing*
3 (koppie)	Red fragment-infested topsoil on rock including scattered rock outcrops	Grazing
4	Yellow-red, fragment-infested topsoil on rock	Grazing
5	Yellow and red-yellow, fine alluvial deposits on bedrock. Often bedrock was exposed	Riparian area

*A combination of the two is assigned as the terrain unit 1 may proof to be too small to warrant delineation on its own for grazing purposes

Figure 1: Distribution of observation points for the Loeriesfontein site

4.1.2 Kenhardt

The findings of the site near Kenhardt will be described in terms of the listed headings in the sections to follow:

- Terrain and Geology
- Soils
- Land Capability
- Erosion

4.1.2.1 Terrain and Geology

The site is situated approximately 40 km west to the town of Kenhardt on the farm Klein Swartbast. The terrain comprised a gently undulating landscape when viewed from the west towards an easterly direction. The transportation processes of runoff had carved drainage ways towards the west, to eventually collect in a tributary of the Klein Swartbas river from where it is drained out of the study zone. The land slopes gradually towards the west and drainage channels opens up to wider and flatter water pathways. Elevation varies from an approximate of 910 m at the lowest to approximately 950 m above sea level at the highest point in the east.

Geology: Geology of the terrain comprised tillite and shale of the Dwyka Formation, with desert pavement consisting of derivatives from tilite (Land Type Survey Staff). Scattered occurrences of calcrete layers surfaced in places with abundant nodules in the immediate surround.

With regard to terrain type the designation of Kenhardt was divided into four (4) terrain units of application. Table 5 tabulate the differentiation and related information.

Table 5: Terrain units of the Kenhardt site

Terrain	% of the landscape	Slope angle (degrees)	Slope length (m)
1	10-15	1-4	50-100
3	40-55	5-15	150-300
4	5	1-5	50-100
5	30-35	2 - 12	5-40

4.1.2.2 Soils

Findings emanating from the 25 soil observations (Figure 2) and obtained via the establishment of three transects, were as follow:

- Similar to the Loeriesfontein site, yellowish-red coloured soils infested with rock fragments (except in watercourses) were found to be shallow over nearly all of the site, including watercourses (Hu & Cv soil forms – MacVicat, et al, 1991);

- Lime was frequently present in the shallow soil profile and/or on the surface in the form of nodules and were encountered from the crests down to the watercourses (Ag soil form – MacVicat, et al, 1991);
- The surfaces of the crest and slopes were found to be covered with rock fragments of all sizes, occupying between 30% and 90 % of the surface coverage (photo 5, Appendix B).
- Rock (R) with lime nodule and thin calcrete banks on the surface (photo 7, Appendix B) were regularly observed on the crests, whilst infrequently encountered on the slopes.
- Soils in the watercourses comprised transported material, often red to yellow coloured (photo 6 Appenxi B), with little signs of rock fragments within the soil profile or on surface. Furthermore the soils here tended to vary significantly in clay content (<10% to 25%).
- Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed for instance, is considered to be moderate, due to the coarse composition of the soils.
- The site formed part of the Land Type with no. Ah11 (Land Type Survey Staff) and soils of the site was also compared to a soil profile description and analysis with No. 11773 (Land Type Survey Staff) located in close proximity to the site (Appendix 3).
- No erosion features of significance were found on this site. A small gully (photo 8 Appendix B) along the farm track was observed. Some sheet erosion similar to the site at Loeriesfontein was present.

Characteristics of the soil types are summarised in Table 6.

Table 6: Characteristics of the soils at the Kenhardt site

Soil type	Depth range (in cm)	Clay content range (% of volume)*	Texture*	Erosion susceptibility (water)	Underlying material
Yellow red soils	10-25	15-25	sandy loam to sandy clay loam	Moderate	consolidated bedrock
Ag	<10-35	20-25	sandy loam to sandy clay loam	Moderate	consolidated bedrock

*Take note that clay content was based on an in-field estimation
* Texture is derived from the clay content estimation

4.1.2.3 Land capability

In accordance with the description under Section 3.2 the land capability for the Kenhardt site was derived and is summarised in Table 7

Table 7: Land capability of the site at Kenhardt

Terrain	Soils	Land capability
1	Yellow red apedal soils, Ag, R* and other	Wilderness/grazing
3	Red-yellow apedal, Ag, R	Grazing
4	Red-yellow apedal, Ag	Grazing
5	Alluvial deposits (Red-yellow apedal, Ag, other)	Riparian area

- R* indicate very shallow soils (<5cm) in combination with rock outcrop
- Terrain units 1 have high coverage with rock/stone debris as well as flat-type rock outcrop, hence it can be reasoned that a wilderness capability classification may apply. However, in practice it may not be sensible as well as very practical to separate these areas from the rest especially in the context of utilizing the area for grazing-farming purposes.

Figure 2: Distribution of observation points for the Kenhardt site

4.1.3 Aggeneys

The findings of the site near Aggeneys will be described in terms of the listed headings in the sections to follow:

- Terrain and Geology
- Soils
- Land Capability

4.1.3.1 Terrain and Geology

The site is situated approximately 5 km east of Aggeneys on the farm Aroams. The terrain constitutes flat smooth foot slopes (Terrain unit 4) starting from the bottom of the Aggeneys mountains in the north and falls gently towards the south-west. An elevated part (terrain units 1 & 3) estimated to be in the range of 500 to 600 m across and a number of outcrops comprising large boulders, prevailed in the approximate centre of the study zone. A mountain on the east boundary extends partly into the area of study.

A dry riverbed and smaller streambeds entered the site in the northeast and further to the northwest respectively and converge towards the centre to form a wider river which drained south-westwards . Variation in elevation was found to be slight (not accounting for the rock-koppie- type outcrops) and an average height of 900 m above sea level can be reported.

Surfaces littered with rock remnants seemed to be more prominent north of the riverbed towards the foot of the Aggenyes Mountains. South of the river rocky surfaces diminished whilst fragment coverage was of a much smaller order. However very fine (<2mm) quartzitic fragments were often seen to cover the surface south of the riverbed.

Terrain dissection

The site was dominated by Terrain unit 4 stretching from the foot of the Aggenyes mountain range (northern boundary) to the riverbed (Terrain unit 5) and continued from there towards the southern boundary. Terrain unit 5 was also estimated to comprise a significant part of the site. The elevated units towards the centre constituted for terrain unit 1 and 3. Table 7 shows the approximated division that was inferred.

Geology: The geology of the site was obtained from the land type inventory and indicated Gneissic granite of the Namaqualand Metamorphic Complex (Land Type Survey Staff, 1986).

The terrain dissection is presented in Table 8.

Table 8: Terrain units of the site at Aggeneys

Terrain	% of the landscape	Slope (degrees)	Slope length (m)
1	3-5	1-4	50-100
3	2	5-15	150-300
4	85	1-5	200-1800
5	10	2 - 12	5-40

4.1.3.2 Soils

Three (3) transects constituted a cross-cut for the Aggeneys study zone and enabled the obtainment of 24 soil observations (Figure 3). Results of importance were as follow:

- The soil observations clearly depicted the dominance of shallow (<30 cm) red loamy sands of the Hutton (Hu) soil form mostly found on terrain unit 4.
- A more yellow-red alluvial sand to loamy sand was found to cover the riverbed and banks and to deeper extents.
- The surface north of the river was littered with rock fragments of various sizes and shapes and often showed up in the soil profile.
- Most of the surface south of the river was found to be only covered with very fine rock (quartzitic) remnants, except for the part in the centre.
- A few occurrences of calcrete cover (photo 10, Appendix B) were observed.
- Minor occurrences of other soils containing lime or which showed significant differences in colour were accommodated in the Augrabies (Ag) and Clovelly (Cv) soil forms
- Rock outcrop and abundant occurrences of remnants dominated the elevated part in the centre.
- Potential vulnerabilities of the identified soils to anticipated impacts such as erosion induced by wind is expected to be high when the fine sandy soils (especially south of the riverbed) would be disturbed and exposed.
- The site formed part of the Land Type with no. Ag26 (Land Type Survey Staff, 1986) and soils of the site was also compared to a soil profile description and analysis with No. 11773 (Land Type Survey Staff, 1986) located in close proximity to the site (Appendix C).
- No erosion features of significance were found on this site.

Table 9 illustrates the main characteristics of the dominant soil types.

Table 9: Characteristics of the soils at the Agggeneys site

Soil type	Depth range (in cm)	Clay content range (% of volume)*	Texture*	Erosion susceptibility (wind)	Underlying material
Hu	<5-30	8-15	sand to loamy sand	High	consolidated rock
Hu	70-200*	<10	Sand	High	consolidated bedrock

*Take note that clay content was based on an in-field estimation and Texture is derived from the clay content estimation

*Take note that the depth of 200 cm was the exception to the rule and occurred on a river embankment where a deeper cutting prevailed (photo 9 Appendix B)

4.1.3.1 Land Capability

The land capability classification is presented in Table 10 below.

Table 10: Land Capability of the Aggeneys site

Terrain	Soils	Land capability
1	Rock outcrop and scattered occurrences of very shallow topsoil (5-10 cm)	Wilderness/grazing
3	Red-yellow shallow topsoil in combination with rock remnants in abundance	Grazing
4	Red-yellow apedal topsoil, with rock fragments on surface in places	Grazing
5	Alluvial deposits (Red-yellow apedal, Ag, other)	Riparian area

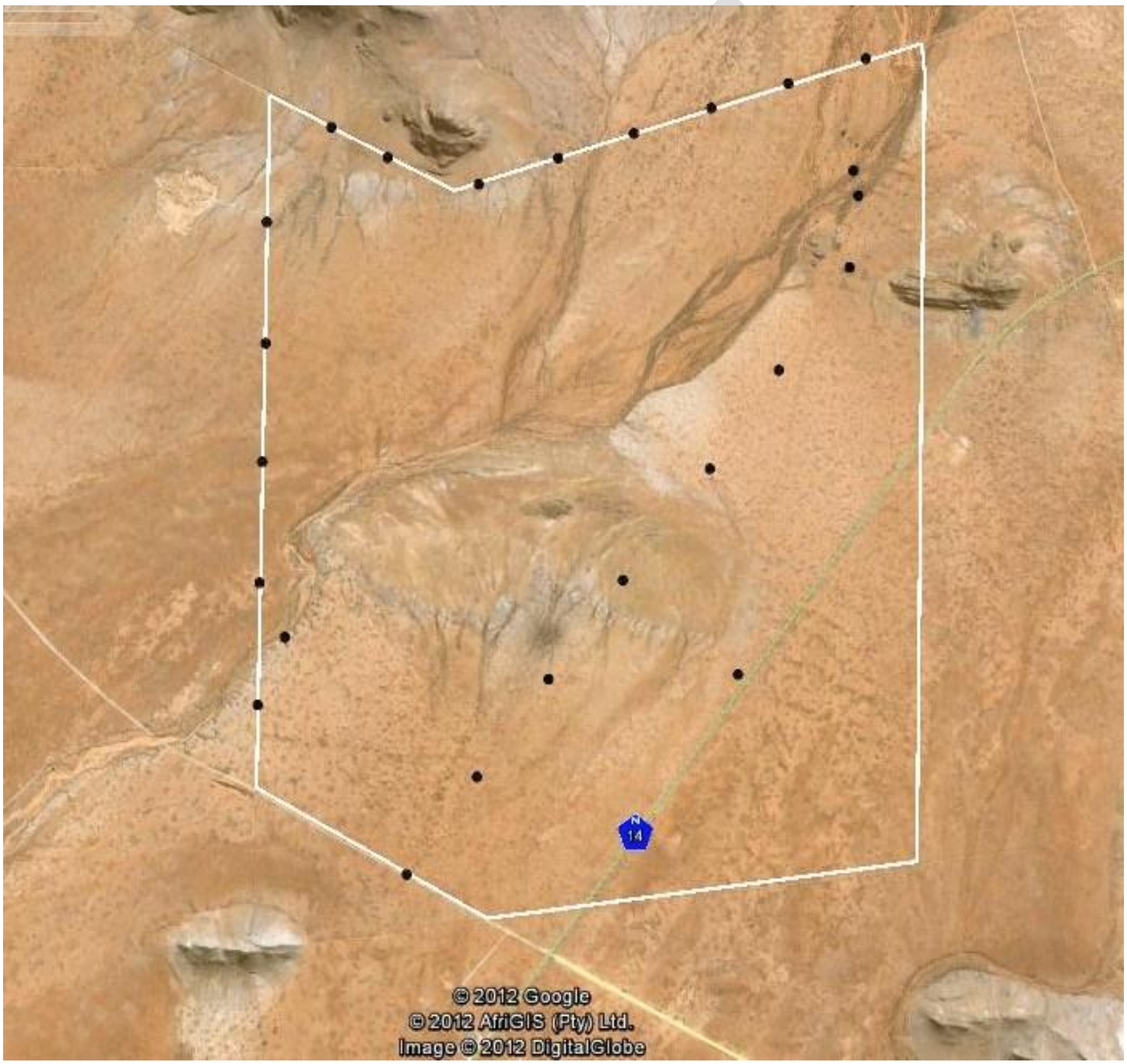


Figure 3: Distribution of observation points for the Aggeneys site

4.1.4 Van Rhynsdorp

The findings of the site adjacent to Van Rhynsdorp will be described in terms of the listed headings in the sections to follow:

- Terrain and Geology
- Soils
- Land Capability

4.1.4.1 Terrain and Geology

The site borders the town of Van Rhynsdorp on the northern side and forms part of the farm Paddock. The terrain constitutes a flat plane between 120 and 140 measl for the majority of the site. Along the southern boundary, the terrain dips at an angle varying between 10 to 15 degrees towards the south. A smallish vale occurred near the south east corner which can be regarded as the start of a drainage way. The flat part was classified as a crest (Terrain unit 1), but may also be seen as a terrain unit 4 when assessed from a wider perspective. The dissection of the terrain into separate units is displayed in Table 11.

Table 11: Terrain units of the site at Van Rhynsdorp

Terrain*	% of the landscape	Slope (in degrees)	Slope length (m)
1	98	1-4	800-1200
3	2	5-15	150-250

*Due to the insignificant size of the only drainage way it was excluded

4.1.4.2 Soils

For this designation existing tracks were mainly used for transecting the study area. Through application of the above mentioned, a number of twenty two observations to represent the soils and terrain units were obtained (Figure 4). The following points of importance can be emphasized:

- The majority of the site was dominated by a shallow (≤30 cm) red sandy loam of the Hutton (Hu) soil form with the absence of stony fragments;
- A strip of approximately 100 m in width and comprising deeper red sand (also of the Hu type) occurred along the eastern boundary; it was estimated to occupied about 10% of the study area;
- Frequent coverage of the surface comprising sub-rounded quartzitic remnants in a variety of sizes occurred (photo 11 Appendix B).
- Sporadic occurrences of calcrete cover were also encountered (photo 13 Appendix B).
- Termite induced raisings, containing lime, was encountered.
- Due to the sandy nature of the soils it will be susceptible to wind erosion if exposed (i.e stockpiled without protective cover). Another impact of consideration is compaction due to the high sand content.
- Soils of the site was compared to soil profile descriptions and analysis with No.'s 10935 and 11056 (Land Type Survey Staff, 1995) located in close proximity to the site (Appendix C).

- No erosion was noticed on the site

Based on physical parameters of depth and texture, the two Hutton soil types were separated. A minority of other soil types found related to the above, but varied due to being lime-containing. A summary of the characteristics of the soils is presented in Table 12.

Table 12: Characteristics of the soils at the Van Rhynsdorp site

Soil type	Depth range (in cm)	Clay content range (% of volume)*	Texture*	Erosion susceptibility (wind)	Underlying material
Hutton	10-30	12-20	loamy sand to sandy loam	moderate	Consolidated rock
Hutton	60-75	<10	sand	high	Unconsolidated material

*Take note that clay content was based on an in-field estimation and Texture is derived from the clay content estimation

●

Figure 4: Distribution of observation points for the site at Van Rhynsdorp

4.1.4.3 Land capability

The land capability classification applied for the site is presented in Table 13.

Table 13: Land Capability for the site at Van Rhynsdorp

Terrain	Soils	Land capability
1	Shallow Huttons	Grazing
1 along east boundary	Moderately deep sandy Huttons	Arable (low)
3 only on south boundary	Shallow Huttons with scattered rock fragments on surface	Grazing

From Table 13 it is evident that most of the terrain has a grazing classification. Only a smallish part has arable potential however was regarded as low due to its very sandy nature.

4.2 Summary of the Land Capability

Land capability for the four study areas can be summarised as depicted in Table 14.

Table 14: Land capability for the assessed four areas

Land capability				
Terrain units	**Loeriesfontein,**	**Kenhardt**	**Aggeneys**	**Van Rhynsdorp**
1	Wilderness/grazing	Wilderness/Grazing	Wilderness/Grazing	Grazing
1 (only at Van Rhynsdorp)	N/A	N/A	N/A	Arable (low)
2	Wilderness/ Grazing	N/A	N/A	N/A
3	Grazing	Grazing	Grazing	Grazing
4	Grazing	Grazing	Grazing	N/A
5	Riparian	Riparian	Riparian	N/A

From Table 14 it is imperative that with the exception of the riparian areas and the eastern strip at the Van Rhysndorp site, the applicable land capability classification can be regarded as grazing for all practical purposes. Where the grazing class is in combination with the wilderness class it involves small rocky terrain located on upland, which in practice will most probably be impractical to separate from the rest of the identified grazing units.

4.3 Findings of the semi-detail scale assessment: Graafwater

The Graafwater study zone was surveyed on semi-detail scale due to its expected higher potential for use and covered approximately 300 hectares. Eighty (80) observations (Figure 5) were cited on a non-rigid grid format that varied between 200 m and 250 m intervals where cultivated land was encountered. Spacing of 250 m to 300 m were applied in natural veld/grazing areas. The findings are discussed in the following sections including:

- Soils
- Land capability

4.3.1 Soils

Findings with regard to the soils encountered on site are summarised below:

- The 80 soil observations enabled the delineation of seven soil units of distinction (Figure 5).
- The largest unit (sMs) occupied nearly 200 ha of the land and was dominated by shallow fine to medium grained sandy soils of the Mispah (Ms) soil form. Sub-dominant soil types included similar sandy versions of the Clovelly (Cv) soil form and shallow versions of the Namib (Nb) soil form.
- The remaining six units was found to be dominated by fine to medium yellow apedal sands of the Cv form overlying either consolidated rock or a streaked/mottled clayey layer (sYw, mYw and dYw), indicating the presence of a temporary saturated zone.
- The yellow sands overlying consolidated rock was further separated based on the variation in depth (mY, dY, vdY).
- Scattered occurrences of rock outcrops and heavy rock cover, occupying slightly elevated parts in the landscape were encountered, but were more concentrated in the sMs unit (photo 15, Appendix B).
- Occurrences of 'desert pavement' were encountered in parts east of the main road. (photos 18, 19, Appendix B)
- A few occurrences of calcrete cover were observed.
- No drainage courses were observed.
- A large excavation, historically exploited for road fill material was located near the centre.
- Near the north east a human induced cutting was noticed.
- Anticipated impacts to negatively affect the soils with their particular characteristics as found here are susceptibility to wind and water erosion and the potential to compact. Reasons can be ascribed to the sandy texture of the soil.
- No erosion features of significance were observed in the study zone.
- Soils of the site was compared to soil profile descriptions and analysis with No.'s 2907 and 2908 (Land Type Survey Staff, 1999) located in close proximity to the site (Appendix C).
- Due to the scale of the survey, it must be noted that any of the units may include a minority of shallower or deeper portions, or, other related soil forms than indicated by the unit description.

All unit codes include a prefix (s, m, d, vd) which served as an indication of a depth range, followed by a one or two letter symbol (Ms, Y) to indicate the dominant colour or name of the dominant soil type (Table15).

Table 15: Explanation of symbols used

Code	Prefix	Explanation	Depth class (mm)	Symbol	Soil name/colour
sMs	s	shallow	0-500	Ms	Ms= Mispah soil form
mY	m	moderately deep	500-1000	Y	Yellow coloured soils
dY	d	deep	1000-1500		
vdY	vd	very deep	>1500		

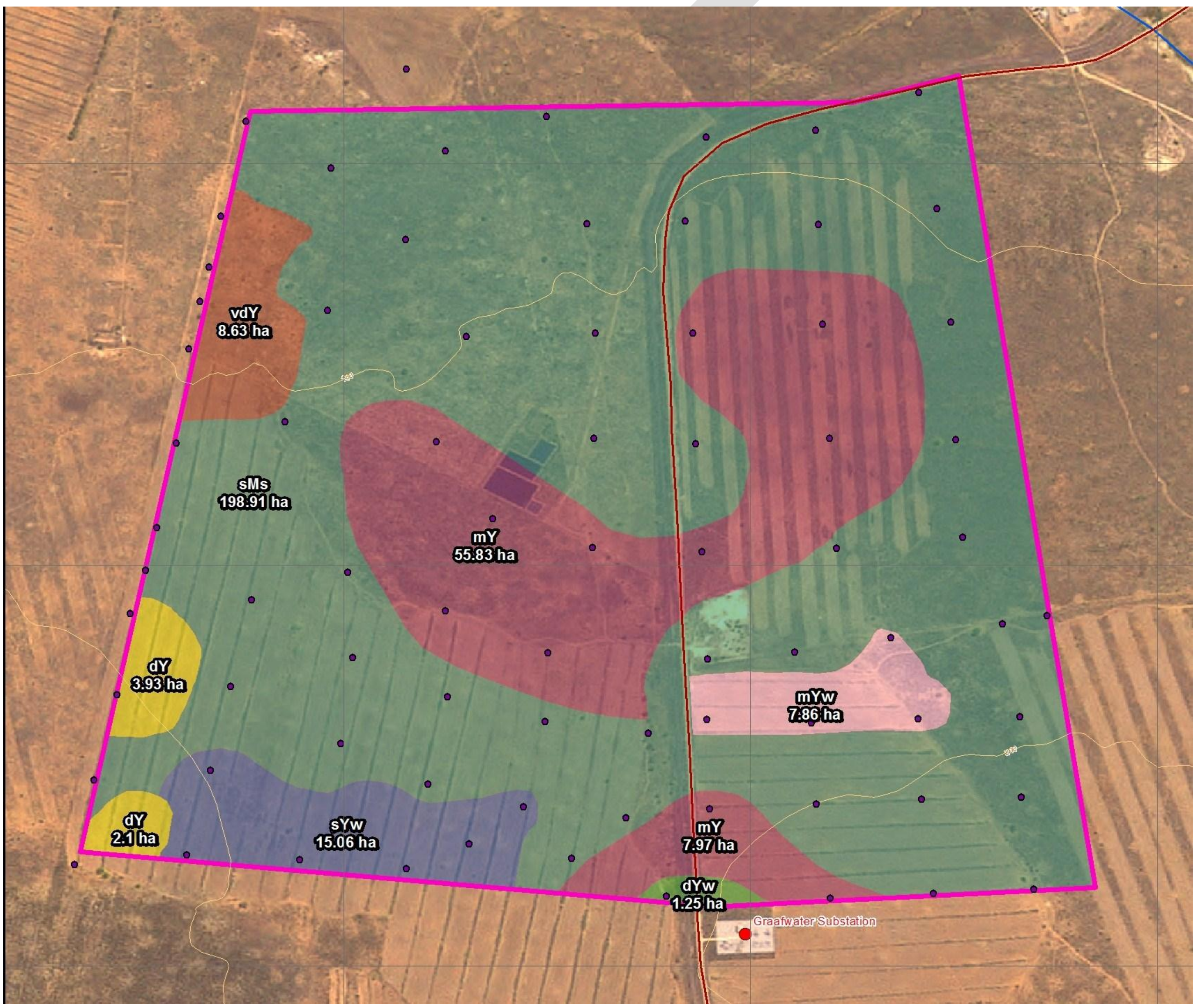


Figure 5: Soil observations and identified soil units for the Graafwater study area

Characteristics of the soils found in each of the identified units are summarised in Table 16.

Table 16 Summary of soils per unit at the Graafwater study zone

Unit	Dominant soil form	Depth range (cm)	Clay %	Texture	Grade	Erosion susceptibility	Area of unit (ha)	% of area
sMs	Mispah (Ms)	10-30	<10	sand	fine to medium	high	198.9	66
mY	Clovelly (Cv)	50-100	<10	sand	fine to medium	high	63.7	21
dY	Clovelly (Cv)	100-150	<10	sand	fine to medium	high	6.0	1.9
vdY	Clovelly (Cv)	>150	10-20	loamy sand to sandy loam	fine to medium	high	8.6	2.8
sYw	Pinedene (Pn)	35-50	<10	sand	fine to medium	high	15.1	5.0
mYw	Pinedene (Pn)	50-100	<10	sand	fine to medium	high	7.8	2.5
dYw	Pinedene (Pn)	100-150	<10	sand	fine to medium	high	1.2	0.4

4.3.2 Land capability

The land capability classification was assessed as explained in Section 3.3.2 and is depicted in Figure 6. Important points emanating from the land capability classification are summarised below:

- Of the seven identified soil units two units (sMs, sYw) were allocated to the grazing capability class due to their depth limitations. The limiting factor for the **sMs** unit is rock while the presence of a periodic (perched) watertable is applicable in the case of the **sYw** unit.
- Although an arable classification was assigned to the rest, it must be noted that it comprised soils with a sandy texture. A sandy texture leads to rapid drainage, which holds negative implications for cultivation, especially in this dry region. Consequently, if the arable class was to be further rated (high, medium, low) one can assume that not more than a low to moderate classification would have applied.

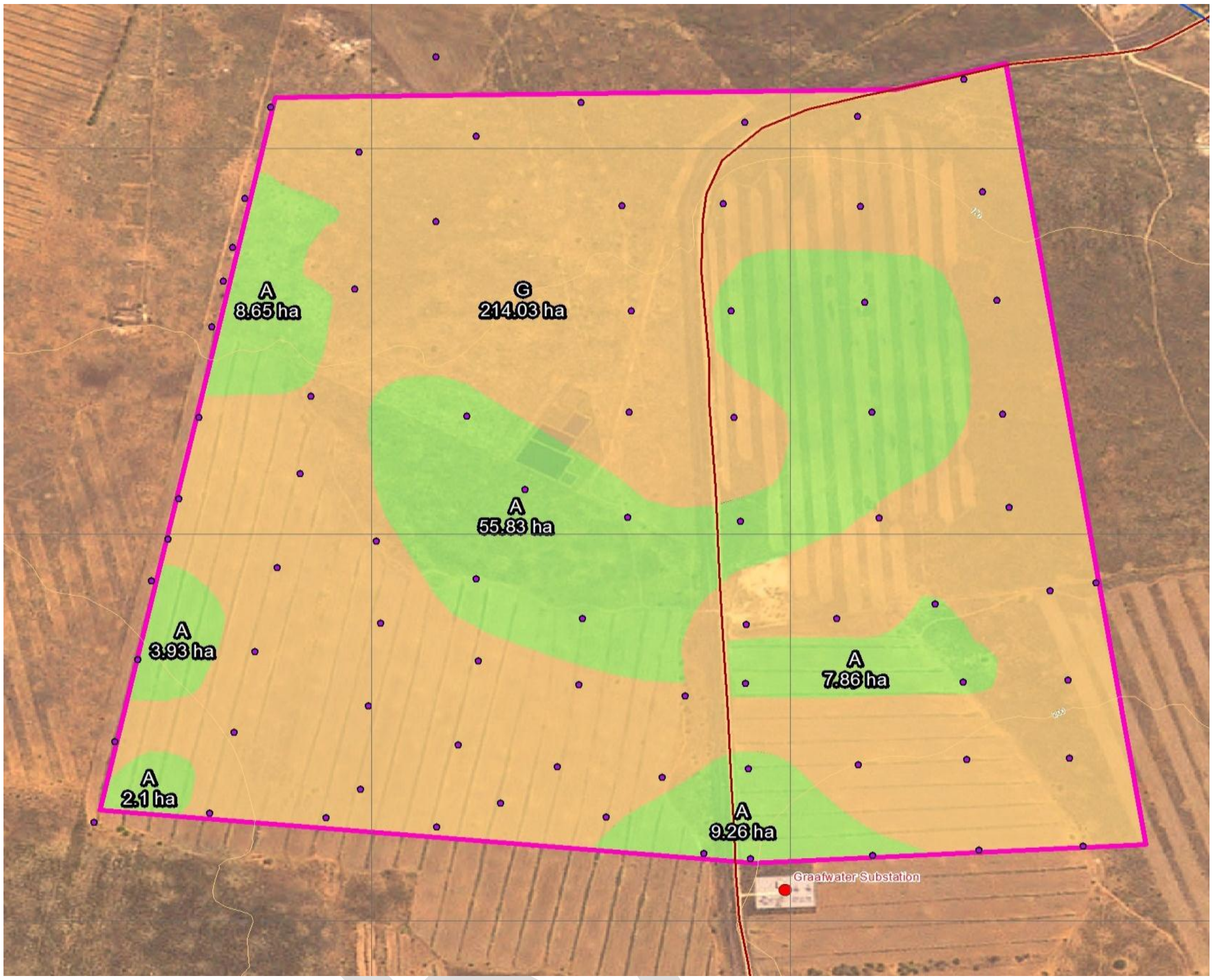


Figure 6: Land Capability units for the Graafwater study area

Table 17 depicts the classification of the study zone in terms of land capability.

Table 17: Land capability classification of the study zone

Soil unit	Land capability	Area of study zone (ha)	Percentage of study zone
sMs	Grazing	199	66
mY	Arable	64	21
dY	Arable	6	1.9
vdY	Arable	8.5	2.8
sYw	Grazing	15	5.0
mYw	Arable	7.8	2.5
dYw	Arable	1.2	0.4

From Table 17 it is obvious that more than 70 % of the study area comprised grazing capability. The remaining 30 % is arable, however scattered into small, nearly impractical, fragments. The larger of the **mY** units (55+ ha) would be the only unit of significance when cultivation for agricultural production is under consideration. However due to the dominating sandy texture of the soils the production potential in the end may be regarded as too poor for utilisation.

5. Impact assessment

The impacts of the proposed activities on the soil resource were assessed in accordance to the method set out under section 3.4 of the report and are presented in the sections to follow.

5.1 Impact assessment for the area investigated at broad scale

For most of the four study areas the following impacts on the soil resource and land capability are of significance:

- Loss of the soil resource
- Degradation of the soil resource/land capability through erosion, compaction and contamination to some extent.

In the sections to follow, the above impacts will be assessed and discussed for each of the phases, with the broad scale areas in mind.

5.1.1 Construction phase

The construction phase will include the preparation of the designated area for establishment of the solar panels and related infrastructure. The following activities are anticipated to impact on the soil resource and related land capability during this phase:

- Site clearance
- Topsoil removal/soil stripping/soil stockpiling
- The presence and movement of vehicles/machinery
- The construction of the planned facilities

Emanating from the above, the following impacts of significance are anticipated:

- Loss of the soil resource;
- Degradation of the soil resource/land capability through erosion, compaction and contamination to some extent.

5.1.1.1 Loss of the soil resource

For the designated sites at Loeriesfontein, Kenhardt and Aggeneys the impact of losing the soil resource due to the planned facilities are assessed and displayed in Table 18.

Table 18: Assessment of the impact: Loss of the soil resource - Construction phase

Impact: Loss of soil resource/land capability		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	High (8)	N/A
Duration	Long term (4)	N/A
Scale	Local (1)	N/A
Probability	Definite (5)	N/A
Significance Score	65	N/A
Significance Rating	high	N/A

5.1.1.1.1 Discussion

Due to the sizes of the areas impacted upon, the loss of the soil resource as a medium of supporting the grazing capability of the land as well as forming part of a grazing rotational system with a farm management unit, will be total for the life of the project, and thus follows the high rating of significance. Due to the fact that the land cannot be replaced for the full life of the project, no mitigation is possible. Nonetheless, after decommissioning it should be fairly achievable to restore the land to its original natural state.

In the case of the site at Van Rhynsdorp the size of the site is in the order of 5 times smaller, and it is thus anticipated that the impact will be of a much lower significance rating.

5.1.1.2 Degradation of the soil resource/land capability

Degradation of the soil resource can occur in a number of forms and is anticipated to emanate from the actions of site clearance, soil stripping, stockpiling and construction of concrete platforms for the planned structures. Due to some differences in the nature of the soils for the four sites associated with the broad scale assessment, different impacts are anticipated.

5.1.1.2.1 Erosion

Water erosion to impact on the coarse graded (due to stony/rock fragment infestation) soils of the Loeriesfontein, Kenhardt and partly at Aggeneys sites respectively, is of significance. Due to the composition the material have little cohesion between particles and thus can be picked up and transported by water, depending on the force applied at the time of impact. The very fine material in-between the fragments will be subjected to wind erosion where exposed.

The fine-graded soils of southern part of the site at Aggeneys site as well as the site at Van Rhynsdorp, will be vulnerable to wind erosion when exposed. An assessment to evaluate the impact of both types of erosion is illustrated in Table 19.

Table 19: Assessment of the impact: Soil degradation - erosion- Construction phase

Impact: Degradation of the soil resource/land capability, due to the potential impact of erosion		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	Moderate (6)	Low to moderate (5)
Duration	Short term (2)	Immediate (2)
Scale	Local (2)	Local (2)
Probability	High (4)	Moderate (3)
Significance Score	40	27
Significance Rating	moderate	low

5.1.1.2.2 Discussion

Both types of erosion pose a thread of disturbance to the soil as a support structure fo sustaining a gazing capability. Water erosion can only occur during the rainy season while wind erosion can occur at any time of the year. However with mitigation measures in place, a low significance score is anticipated. A number of mitigation measures are suggested below to mitigate the potential impacts:

5.1.1.2.3 Mitigation suggestions:

- Minimising areas of disturbance;
- Plan earthworks in phases so that exposed areas are minimised;
- Stockpiles should be sloped and vegetated to keep potential of erosion as low as possible;
- For the sites comprising coarse graded soils, plan earthworks for the dry season; and
- For the site at Aggeneys and Van Rhynsdorp workings can be scheduled for the wet season or surfaces can be lightly sprayed during and after workings to keep the exposed surface moistened.

5.1.1.3 Compaction

Site clearance, topsoil removal and soil stockpiling all have the potential to induce soil compaction in the case where heavy machinery will be used. Soil compaction is a function of the composition of the soil and relates to the grading. Well sorted fine-graded sand and silty soils will compact easier than soils with a coarse or loamy texture. In addition, the establishment of foundations for various construction works may also contribute to compaction.

The coarse graded soils found at the sites at Loeriesfontein, Kenhardt and partially Aggeneys have little potential for compacting, whilst the fine graded soil south of the riverbed at Aggeneys and the soils at Van Rhynsdorp may tend to compact under pressure.

Table 20 presents the potential for compaction where the designated sites will be under construction workings.

Table 20: Assessment of the impact: Soil degradation - compaction - Construction phase

Impact: Degradation of the soil resource/land capability, due to the potential impact of compaction		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	High (8)	Low to moderate (5)
Duration	Permanent (5)	Long term (4)
Scale	Site only (1)	Site only(1)
Probability	High (4)	Low (2)
Significance Score	56	20
Significance Rating	moderate	low

5.1.1.3.1 Discussion

The impact of compaction can be vastly reduced to low via mitigation measures. Some mitigation measures are proposed in the following section.

5.1.1.3.2 Mitigation suggestions:

- Minimising areas of disturbance;
- Minimising the use of heavy machinery for the clearing/stripping activities;
- Minimise traffic over the areas to be cleared/stripped/ or constructed upon; and
- Plan activities to take place in a period where the minimum impact will apply, i.e. dry season when stripping will take place with heavy machinery;
- Limit stockpile heights to below 2 metres;
- Restrict heavy vehicle movement over stockpiles.

5.1.1.4 Contamination

The potential for contaminating the soil resource is dependent on the presence of vehicles, machinery and processes involving various types of chemicals. For the planned site use very little of these are anticipated during the life spa of the project. The potential impact is thus assumed to be minor and localised if it should occur (i.e oil leakage from a earth moving machine). However cleaning apparatus and procedures should be in place to address these kind of incidents if they happens to occur. .

5.1.1.5 Direction of the impacts for the construction phase

Direction of all of the impacts discussed so far will be negative and thus undesirable. Most of them will most likely prevail over the long term if instigated and not mitigated.

5.1.1.6 Cumalative impacts

With the exception of the site at Van Rhynsdorp, the surrounding areas are all undeveloped and used for animal grazing purposes. Furthermore no other development in the near future is planned. Thus the cumulative impacts are considered to be low.

5.1.2 Operational Phase

During the operational phase all of the photovoltaic plants will be in operation and no impacts of significance are expected to affect the soil resource/land capability, apart from the loss of the soil resource /land capability already discussed. However, soil stockpiles should be monitored through sampling to maintain the soil chemical status.

5.1.3 Decommissioning Phase

During the decommissioning phase the plants will be decommissioned involving the disassembling of and removal of the components. No impacts other than already discussed are anticipated. By applying the mitigation measures suggested, impacts should be low. Grazing capability should be restorable by placing back the topsoil and re-establishing vegetation. Compaction if occurred, can be mitigated by mechanically loosening the soil impacted upon.

5.2 Impact assessment for the area investigated at semi-detail scale

In the sections to follow the expected impacts that may affect the soil resource/land capability will be assessed for the site at Graafwater which was assessed on a semi-detail level due to more intense utilisation (partly for crop production). A brief discussion for each of the phases applicable and impacts considered will be addressed in the following sections.

5.2.1 Construction phase

The construction phase will include the preparation of the designated area for establishment of the solar panels and related infrastructure. The following activities are anticipated to impact on the soil resource and related land capability during this phase:

- Site clearance
- Topsoil removal/Soil stripping/Soil stockpiling
- The presence and movement of vehicles
- The construction of the planned facilities

Emanating from the above, the following impacts of significance are anticipated:

- Loss of the soil resource
- Degradation of the soil resource/land capability through the potential impacts of erosion, compaction and contamination to some extent.

5.2.1.1 Loss of the soil resource

For the designated site at Graafwater the impact of losing the soil resource for the life of the project is assessed and displayed in Table 21.

Table 21: Assessment of the impact: Loss of the soil resource -- Construction phase

Impact: Loss of the soil resource/land capability		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	Moderate (6)	N/A
Duration	Long term (4)	N/A
Scale	Local (1)	N/A
Probability	Definite (5)	N/A
Significance Score	55	N/A
Significance Rating	moderate	N/A

5.2.1.1.1 Discussion

It can be reasoned that arable land capability is of higher importance than grazing capability. However it is a fact that the areas rated to be arable at the Graafwater site comprise approximately 30% of the total area to be disturbed. Taking both sides into account the reasoning for a moderate magnitude of impact has been selected. However due to the fact that the land cannot be replaced for the full life of the project, no mitigation is possible. Nonetheless, after decommissioning it should be achieveable to restore the disturbed land near to its original state.

5.2.1.2 Degradation of the soil resource/land capability

Degradation of the soil resource can occur in a number of forms and is anticipated to emanate from the actions of site clearance, soil stripping, soil stockpiling and construction of foundations for the planned structures. The impacts considered are set out in the following sections.

5.2.1.2.1 Erosion

Water and wind erosion to impact on the fine to medium grained sandy soils when exposed during site clearance, soil stripping and soil stockpiling, are of consideration. An assessment is presented in Table 22.

Table 22: Assessment of the impact: Soil degradation - erosion- Construction phase

Impact: Degradation of the soil resource/land capability, due to the potential impact of wind and water erosion		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	Moderate (6)	Low (4)
Duration	Short term (2)	Short term (2)
Scale	Local (2)	Local (2)
Probability	high (4)	medium (3)
Significance Score	40	27
Significance Rating	moderate	low

5.2.1.2.2 Discussion

Both types of erosion pose a risk of impact to the soil as a medium of substrate and production. Water erosion can only occur during the rainy season while wind erosion can occur at any time of the year.

However with mitigation measures in place, a low significance score is anticipated. Where soil stripping will take place, the soil should be stockpiled (especially those from the arable designations). Though the potential for erosion may be limited to this phase where exposed surfaces are concerned, stockpiles must be kept protected against erosion. A number of mitigation measures are suggested below to mitigate the potential impacts:

5.2.1.2.3 Mitigation suggestions:

- Minimising areas of disturbance;
- Plan earthworks in phases so that exposed areas are minimised;
- Where possible workings can be scheduled to coincide with the wet season to limit the effect of wind erosion. However operations during heavy rain should also be avoided to limit the potential for surface runoff and subsequently erosion;
- Soil stockpiles must be effectively sloped to avoid runoff;
- Stockpiles must be vegetated to limit runoff and exposure to wind; and

5.2.1.3 Compaction

Site clearance, topsoil removal and soil stockpiling all have the potential to induce soil compaction in the case where heavy machinery will be used. Soil compaction is a function of the composition of the soil and relates to the grading. Well sorted fine-graded sand and silty soils will compact easier than soils with a coarse texture. In addition, the establishment of foundations for various construction works may also contribute to compaction.

The dominant fine to medium grained sand found at the site of Graafwater has potential for compaction. The impact is assessed in Table 23.

Table 23: Assessment of the impact: Soil degradation - compaction- Construction phase

Impact: Degradation of the soil resource/land capability, due to the potential impact of compaction		
Impact	**Prior to mitigation**	**After mitigation**
Magnitude	Moderate (6)	Minor to low (3)
Duration	Permanent (5)	Long term (4)
Scale	Site only (1)	Site only(1)
Probability	Medium (3)	Low to medium (3)
Significance Score	36	24
Significance Rating	Moderate	Low

5.2.1.3.1 Discussion

The impact of compaction can be much reduced by applying mitigation measures. Some mitigation measures are proposed in the following section.

5.2.1.3.2 Mitigation suggestions:

- Minimising areas of disturbance;

- Minimise traffic over the area to be stripped/compacted;
- Plan earthworks for the dry season, damp soil compacts easier; and
- Mechanical loosening of soil after operations should be instigated (where applicable).

5.2.1.4 Contamination

The potential for contaminating the soil resource is dependent on the presence of vehicles, machinery and processes involving various types of chemicals. For the planned site use very little of these are anticipated during the life span of the project. The potential impact is thus assumed to be minor and localised if it should occur (i.e oil leakage from a earth moving machine). However cleaning apparatus and procedures should be in place to address these kinds of incidents if they happen to occur.

5.2.2 Direction of the impacts for the construction phase

Direction of all of the impacts discussed will be negative and thus undesirable. Most of them will most likely prevail over the long term if instigated and not effectively addressed through mitigation measures.

5.2.3 Cumalative impacts

The immediate surrounding areas are not currently used for crop production, but may be utilised for animal grazing. It is however anticipated that the cumulative impacts should be of low significance.

5.2.4 Operational Phase

During the operational phase all of the photovoltaic plants will be in operation and no impacts of significance are expected to affect the soil resource/land capability, apart from the loss of the soil resource/land capability already discussed. However, soil stockpiles should be monitored through sampling to maintain the soil chemical status.

5.2.5 Decommissioning Phase

During the decommissioning phase the plants will be decommissioned involving the disassembling of and removal of the components. No impacts other than already discussed are anticipated and if adhered to the mitigation measures suggested, impacts should be low.

A number of mitigation measures are suggested to be applied during the decommissioning phase:

- The grazing capability should be restored after decommissioning by placing the soil back or as near as possible to its original position and vegetation should be reinstated.
- Soil could be loosened after placement, ameliorated and a establishment of a proper seedbed is to be ensured.
- Where compaction is suspected to have occurred (or must be investigated , it can be resolved by mechanical loosening through use of an applicable implement.
- During the rehabilitation exercise preliminary soil sampling should be carried out to determine the chemical status and potential shortcomings.

6. Conclusions

It is the meaning of the soil assessor that the overall impacts on the soil resource and land capability of the Solar Energy Facility on the five study areas can be mitigated to an acceptable level. The recommendations however will be that the planned development should take place away from any natural drainage ways as well as to attempt to avoid the **mY** unit in the centre of the site at Graafwater. With this in mind, the soil assessor support the decision for the application.

7. References

Agricultural Research Council 1986. Land type map & Memoir 3018 Loeriesfontein. Pretoria: Institute for Soil, Climate and Water.

Agricultural Research Council 1995. Land type map and Memoir 3118 Calvinia. Pretoria: Institute for Soil, Climate and Water.

Agricultural Research Council 1999. Land type map and Memoir 3218 Clanwilliam. Pretoria: Institute for Soil, Climate and Water.

Chamber of Mines of South Africa, Coaltech Research Association, 2007. Guidelines for the rehabilitation of mined land. Johannesburg.

Department of Environmental Affairs and Tourism, 1998. Environmental impact management. EIA Regulations Implementation of sections 21, 22 and 26 of the Environmental Conservation Act, April 1998, Pretoria: Government Printer (1998).

Department of Mineral and Energy Affairs, 1992**.** Aide-Memoire for the preparation of Environmental Management Programme Reports for prospecting and Mining. Pretoria.

Department of Water Affairs and Forestry, 2003. A practical field procedure for the identification and delineation of wetlands and riparian areas, DWAF, Pretoria.

Soil Classification Working Group, 1991. Soil classification. A taxonomic system for South Africa. Institute for Soil, Climate and Water, Pretoria.

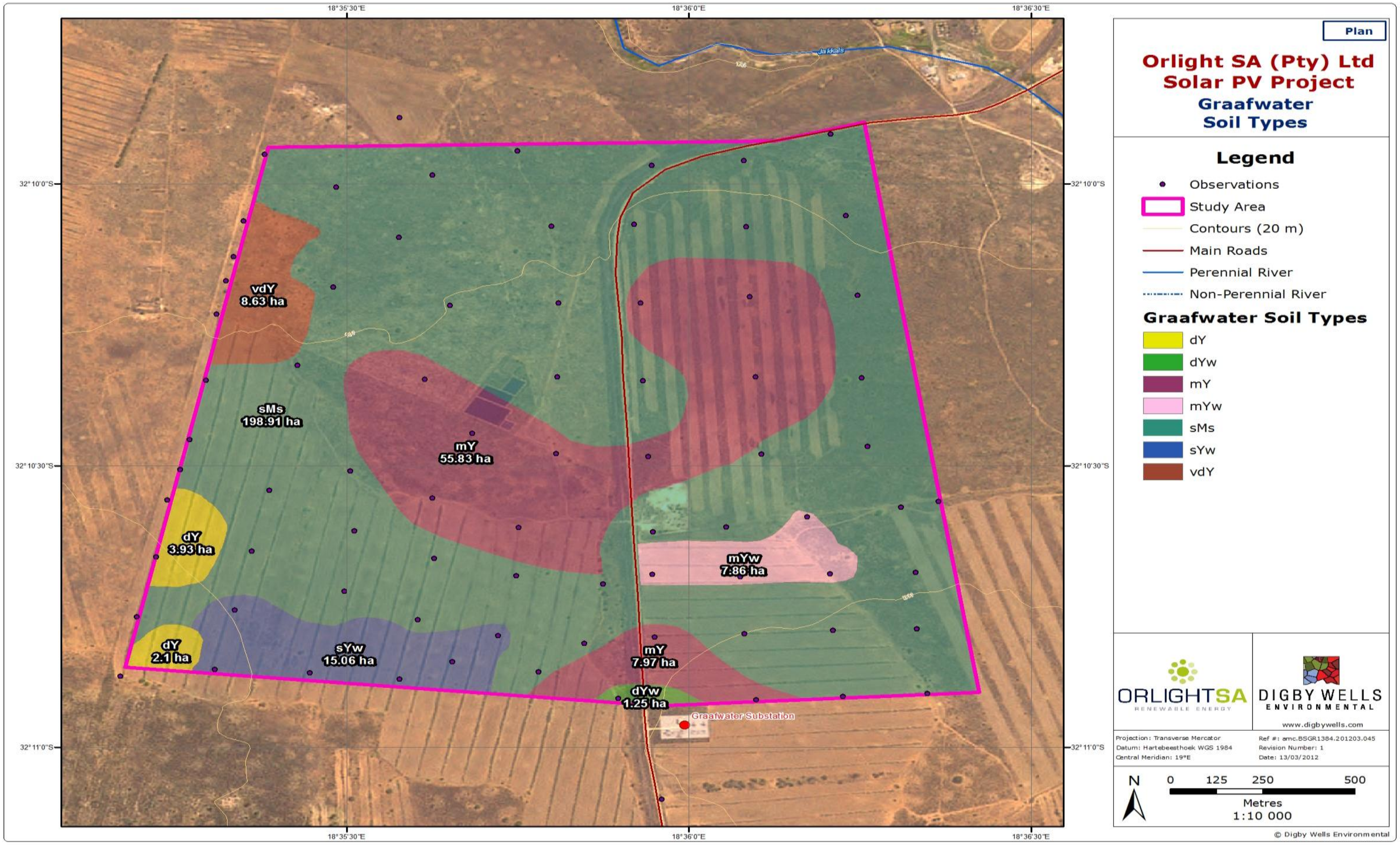
Van der Watt, H.v.H and Van Rooyen T. H, 1990. A glossary of soil science, Pretoria: Soil Science Society of South Africa (1990).

APPENDIX A

Soil and Land Capability maps for the Graafwater study zone

Appendix A: Plans

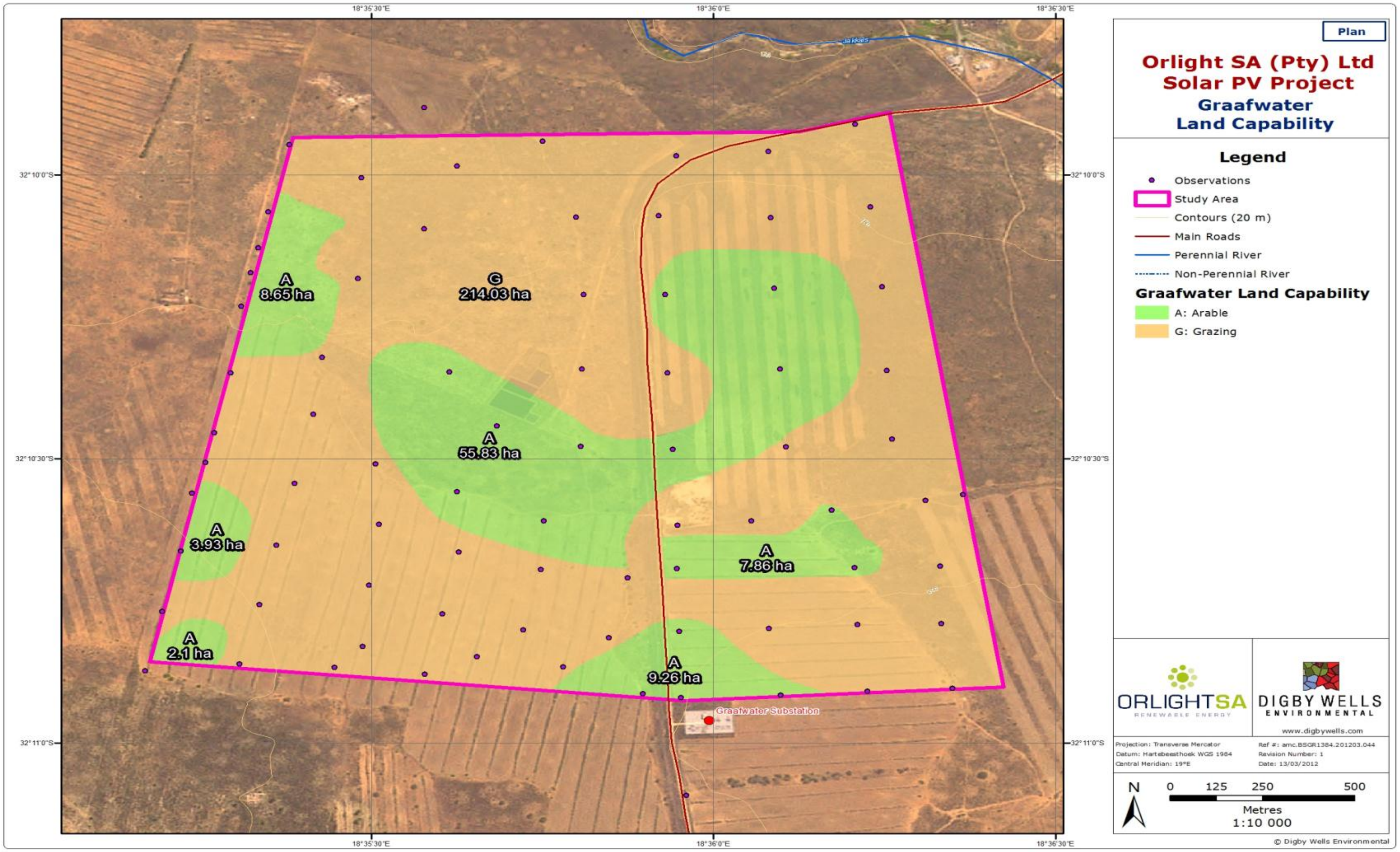
Soil map for the Graafwater site



Legend for the Soil Map

Unit	Dominant soil form	Depth range (cm)*	Clay content range (A & B horizons)	Texture Class	Description of the soil profile	Land capability	Area of unit (ha)	Percentage of unit
sMs	Mispah (Ms)	10-30	<10	sand	A shallow poorly drained sand overlying hard rock	Grazing	199	66
mY	Clovelly (Cv)	50-100	<10	sand	Moderately deep, apedal, yellow coloured fine sand overlying hard rock	Arable	64	21
dY	Clovelly (Cv)	100-150	<10	sand	Deep, apedal, yellow coloured fine sand overlying hard rock	Arable	6	1.9
vdY	Clovelly (Cv)	>150	10-20	loamy sand to sandy loam	Very deep, apedal, yellow coloured, fine loamy sand to sandy loam. Depth of soil profile investigation was limited to 1.5 m	Arable	8.5	2.8
sYw	Pinedene (Pn)	35-50	<10	sand	Shallow, apedal yellow coloured fine sand overlying a yellow and grey streaked, (or often mottled) and weakly or massively structured, sandy clay loam to clay loam*, depicting a temporary saturated zone	Grazing	15	5.0
mYw	Pinedene (Pn)	50-100	<10	sand	Moderately deep, apedal yellow coloured fine sand overlying a yellow and grey streaked and weakly structured, sandy clay loam to clay loam,* depicting a temporary saturated zone	Arable	7.8	2.5
dYw	Pinedene (Pn)	100-150	<10	sand	Deep, apedal yellow coloured fine sand overlying a yellow and grey streaked and weakly structured sandy clay loam*, depicting a temporary saturated zone	Arable	1.2	0.4

Land Capability map of the Graafwater study zone



confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

APPENDIX B

Compilation of the photos taken during the study

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

•

Photo 1: Loeriesfontein Site: Soil profile in river embankment -

Photo 2: Loeriesfontein Site: Rock fragment littered surface as well as visible signs of sheet erosion

Photo 3: Loeriesfontein Site: Yellow alluvial depositing at river bend

Photo 4: Loeriesfontein Site: Bedrock in river bed and rock faces (Terrain unit 2)

Photo 5: Kenhardt site: Rock fragment littered surface

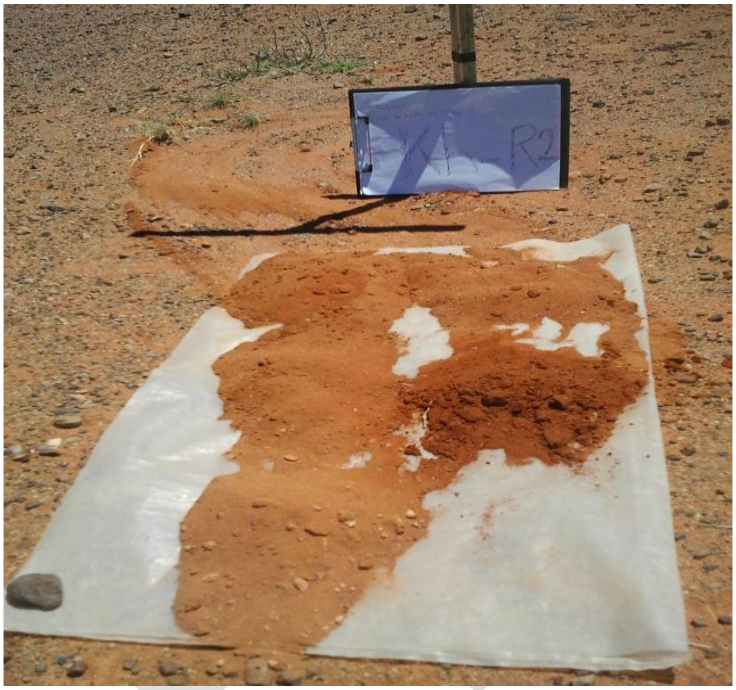


Photo 6: Kenhardt site: A moderately deep, red, sandy loam profile in a riverbed

Photo 7: Kenhardt site: Surface covered with calcrete layers and fragments

Photo 8: Kenhardt site: Small erosion gully next to farm track

Photo 9: Aggeneys site: Sandy riverbed with 2+ m high embankment

Photo 10: Aggeneys site: Calcrete fragments on sandy surface

Photo 11: Van Ryhnsdorp site: Quartzitic fragments on surface

Photo 12: Van Ryhnsdorp site: Typical terrain at the site

Photo 13: Van Ryhnsdorp site: A shallow profile in calcrete surround with a moderately deep red sand profile on the opposite side

Photo 14: Graafwater site: Sandy surface in sMs unit

Photo 15: Graafwater site: Rock outcrop in sMs unit

Photo 16: Graafwater site: A deep sand profile

Photo 17: Graafwater site: Cultivated land, but fallow at the time

Photo 18: Graafwater site: Rocky spot in cultivated land as well as 'desert pavement' on surface

Photo 19: Graafwater site: So- called "desert pavement" on surface

APPENDIX C

Information from the Land Type Database used for purposes of comparison and reference

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

LAND TYPE DATA FOR LOERIESFONTEIN

- https://acrobat.com/#d=WblQd5CA4Pd20NzdknvCRw
- https://acrobat.com/#d=n9yS6zOOIX2ksS3YT2Bo0w

•

LAND TYPE DATA FOR KENHARDT

- https://acrobat.com/#d=04vhzBAz8Vg*ybvTsJJBbA
- https://acrobat.com/#d=EkR-b4XodE7aRi1upuyY4w

•

LAND TYPE DATA FOR AGGENEYS

https://acrobat.com/#d=PuxAKG*irogMxEoQ33OJ4g
https://acrobat.com/#d=d-9eMazu7rUJvTUJB1nGBA
https://acrobat.com/#d=5MCD03sTK*7OQDww4dJm6A

•

LAND TYPE DATA FOR VAN RHYNSDORP

https://acrobat.com/#d=aZi23VvGBiVVucZAm3rhng
https://acrobat.com/#d=R4395lq8v3J0Ef0hlKKx9A

LAND TYPE DATA FOR GRAAFWATER

https://acrobat.com/#d=qrGsBJRpfuR*WBZD-FT12Q
https://acrobat.com/#d=o9cBKCTAioey3rvkzsNaPQ

Appendix F: Fauna and flora report

DIGBY WELLS
ENVIRONMENTAL

FAUNA AND FLORA ASSESSMENT

FOR THE

PROPOSED ORLIGHT SA (PTY) LTD SOLAR PHOTOVOLTAIC POWER PLANTS

REPORT PREPARED FOR:

ORLIGHT SA (PTY) LTD

MAY 2012

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg
Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

Directors: AR Wilke, LF Koeslag, PD Tanner (British)*, J Leaver*, AJ Reynolds (Chairman) (British)*, GE Trusler (C.E.O)
*Non-Executive

This document has been prepared by **Digby Wells & Associates (Pty) Ltd** © 2012

Project Title: Proposed Orlight Solar PV Power Project

Flora and Fauna assessment

Project Number: BSG1384

Name	Responsibility	Signature	Date
Rudi Greffrath	Report compiler		2012/15/03
Barrie Low	1st Reviewer		2012/12/03
Mia Ackermann	2nd Reviewer		2012/18/03

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) was appointed by Orlight SA (Pty) Ltd (Orlight SA) to undertake the flora and fauna assessment in support of the Environmental Impact Assessment (EIA) process for five proposed Solar Photovoltaic (PV) Power Plants to be located in the Northern Cape and Western Cape Provinces, South Africa.

During the field assessment various aspects of the natural environment were recorded. These aspects include a vegetation component, which was conducted by following the Braun-Blanquet sampling technique which gave rise to the various vegetation communities. Within these communities the protected, endemic, exotic, alien invasive and culturally significant species were identified.

The aspects concentrated on during the fauna assessment included the following:

- Mammals;
- Birds;
- Reptiles; and
- Amphibians.

The aim of this survey was to undertake an ecological assessment, whereby the ecological state of the area is investigated by means of the methodologies set forth for the two components, namely flora and fauna, present in the study area as an expression of the habitat present.

The objectives are to establish the sensitivity of the habitats/vegetation types present, followed by determining the significance of the impacts of the construction and operation of the proposed PV power stations on the flora and fauna present within identified habitat types of the five study areas. Within the habitat types all species encountered have been compared to the latest South African National, Red Data list in order to identify species of concern early in the project.

Recommendations have been made for mitigating the actions that may either enhance potential benefits or minimize harmful effects. In order to meet this objective the aforementioned flora and fauna surveys were conducted.

The above mentioned habitat components were discussed in terms of the vegetation units/habitat types in which they were found. These vegetation units/habitat types were differentiated because of the anthropogenic pressure exerted on them in conjunction with natural factors. Nama Karoo, Succulent Karoo and Fynbos were the dominant vegetation types encountered during the field surveys; these were in various conditions depending on anthropogenic pressure.

Areas of specific biodiversity concern was specifically incorporated into this report, they are the SKEP areas, Critical biodiversity areas (CBA'S) and the fine scale critical biodiversity data, specific to certain municipalities. The SKEP (Succulent Karoo Ecosystem Programme) is a long term, multi-stakeholder bioregional conservation and development programme, with four strategic areas: increasing local and international awareness of the unique biodiversity of the Succulent Karoo, expanding protected areas and improving conservation management, supporting a matrix of harmonious land uses and improving institutional co-ordination. The Critical biodiversity areas are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectorial planning and decision making tools.

During field work the Nama Karoo biome exhibited 38 plant species at the Aggeneys study area and 27 plant species on the Kenhardt study area. The Succulent Karoo biome exhibited 41 species at Loeriesfontein study area and 18 at the Vanrhynsdorp study area. The only Fynbos biome study area, Graafwater, exhibited 39 plant species.

The mammal species encountered during the field work within the Nama Karoo biome were eight species at the Kenhardt study area and five species on the Aggeneys study area. The Succulent Karoo biome exhibited four mammal species at Loeriesfontein study area and no species at the Vanrhynsdorp study area. The Graafwater study area exhibited two mammal species.

The avifauna component within the Nama Karoo biome consisted of 13 species at the Kenhardt study area and no species on the Aggeneys study area. The Succulent Karoo biome exhibited eight bird species at Loeriesfontein study area and three species at the Vanrhynsdorp study area. The Graafwater study area exhibited seven bird species.

No amphibian species were encountered on any of the study sites. From a reptile perspective, the Kenhardt and Graafwater sites both exhibited 2 species, Aggeneys one species and Loeriesfontein and Vanrhynsdorp no reptile species.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS

SANBI	South African National Biodiversity Institute
PRECIS	National Herbarium Pretoria (PRE) Computerised Information System
SIBIS	SANBI Integrated Biodiversity Information System
SKEP	Succulent Karoo Ecosystem Program
NEMBA	National Environmental Management Biodiversity Act
IUCN	International Union for Conservation of Nature
EIA	Environmental Impact Assessment
CBA	Critical Biodiversity Areas
CARA	Conservation of Agricultural Resources Act
EMP	Environmental Management Plan
BAR	Basic Assessment Report

GLOSSARY

Fauna	All of the animal life of any particular region or time
Rupicolous	Living or growing on or among rocks
Flora	The plant life occurring in a particular region or time, generally the naturally occurring or indigenous—native plant life.
Ecology	Scientific study of the relations that living organisms have with respect to each other and their natural environment.
Biome	Are climatically and geographically defined as similar climatic conditions on the Earth, such as communities of plants, animals, and soil organisms, and are often referred to as ecosystems.
Plant community (phytocenosis)	Is a collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types.
Exotic	Not endemic
Weeds	Plants that grow where they are unwanted.
Alien invasive	Similar to pioneer plants in that they rapidly colonise disturbed areas, but differ from pioneer plants in having the additional ability to encroach upon undisturbed, pristine areas.
Ecotone	A transition area between two biomes but different patches of the landscape, such as forest and grassland.
Solar Photovoltaic	A system which uses one or more solar panels to convert sunlight into electricity.

1 INTRODUCTION

Digby Wells Environmental (Digby Wells) has been appointed by Orlight SA (Pty) Ltd (Orlight SA) as the independent Environmental Assessment Practitioner (EAP) responsible for undertaking the Environmental Impact Assessment (EIA) process for the proposed construction and operation of five new Solar Photovoltaic (PV) power plants in the Western Cape and Northern Cape Provinces.

After completion of a screening phase for the proposed project, it became evident that, due to the environmentally sensitive nature of the project areas, in-depth ecological assessments of the local flora, plant and faunal communities associated with the study areas were required.

This specialist report serves to document the current ecological state of the five study areas associated with the development footprints for the proposed future Solar PV power plants, based on the findings of a survey undertaken in December 2011.

1.1 Objectives

The overall objectives of the fauna and flora assessment were to:

- Determine and delineate the sensitivity (plant or animal species susceptible or vulnerable to activities or habitat alterations) of plant and animal communities and habitat types that occur in the five study areas;
- To determine if any plant or fauna species or assemblages will be directly impacted upon by the proposed projects and consequently, influence the design and layout of the proposed infrastructure as to have the least impact on the natural sensitive areas present in the study areas;
- Assess the significance of residual impacts that stem from the proposed activities that will be needed for the construction and operation of the proposed Solar PV power plants. These impacts include removal of vegetation and destruction of natural habitat utilised by fauna species; and
- Recommend measures to mitigate impacts on the ecological state of the project sites and surrounding areas.

1.2 Scope of work

An integrated terrestrial biodiversity assessment was conducted within all five study areas and various placement options for the solar PV panels within each investigated. This assessment considered plant life as a feature of the habitat present, as well as numerous fauna components such as mammals, amphibians and reptiles, as an indicator of habitat quality. The diversity and concentrations of the above mentioned flora and fauna components in conjunction with topographic features such as hills, valleys, rivers, streams and anthropogenic activities were used as the basis for delineating habitat types from which the plant communities present was delineated. The plant communities identified on each of the five study areas were assessed to determine the sensitivity of each.

1.3 Approach

The vegetation mapping employed in this report is used to illustrate the differentiation between vegetation assemblages. According to Mucina and Rutherford (2006)… "Vegetation mapping is a frequently used tool in nature. Since successful, scientifically defendable management of conservation areas requires formulation and implementation of spatial management plans, vegetation has often been used to stratify land into management units." The management units are the basis of this report and of any conservation management efforts.

Land management units operate on the assumption that species of plants and animals are supported by and are therefore reliant on features present within these vegetation types. Therefore the presence of a habitat type could indicate the presence of species of plants and animals. The subsequent management prescriptions or objectives for the five study areas will concentrate on the vegetation units and their associated species and not purely on species alone.

Historical and current land use, mostly grazing by sheep farming, in the study areas has led to habitat fragmentation, which in turn has reduced available natural areas frequented by naturally occurring fauna. Animal species are reliant on the available habitat in the area, and are often specific to what type of habitat they will frequent; this is most often determined by the specific benefit an animal species receives from its preferred habitat, such as food, shelter or both. Therefore the prevalence or decline of such habitat will have a similar effect on animal numbers.

Because of this linear relationship, any further loss of natural habitat is viewed as detrimental to this particular region, as the decline of animals will follow.

2 STUDY AREAS

The proposed generation capacities and locations for the development of the Solar PV Power Plants are as follows:

- Proposed 40 MW up to 150 MW generation capacity on Portion 1 of the farm Aroams 57 RD near Aggeneys in the Namakwa District Municipality, Northern Cape Province;
- Proposed 70 MW up to 100 MW generation capacity on the Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD near Kenhardt in the Siyanda District Municipality. Northern Cape Province;
- Proposed 40 MW up to 150 MW generation capacity on Portion 5 of the farm Klein Rooiberg 227 RD near Loeriesfontein in the Namakwa District Municipality, Northern Cape Province;

- Proposed 20 MW up to 45 MW generation capacity on the RE of the farm Paddock 257 RD near Vanrhynsdorp in the West Coast District Municipality, Western Cape Province; and
- Proposed 35 MW up to 75 MW generation capacity on Portion 1 of the farm Graafwater 97 RD and the RE of the farm Bueroskraal 220 RD near Graafwater in the West Coast District Municipality, Western Cape Province.

The study areas are illustrated in Figure 2-1 and area located across three biomes and six vegetation types.

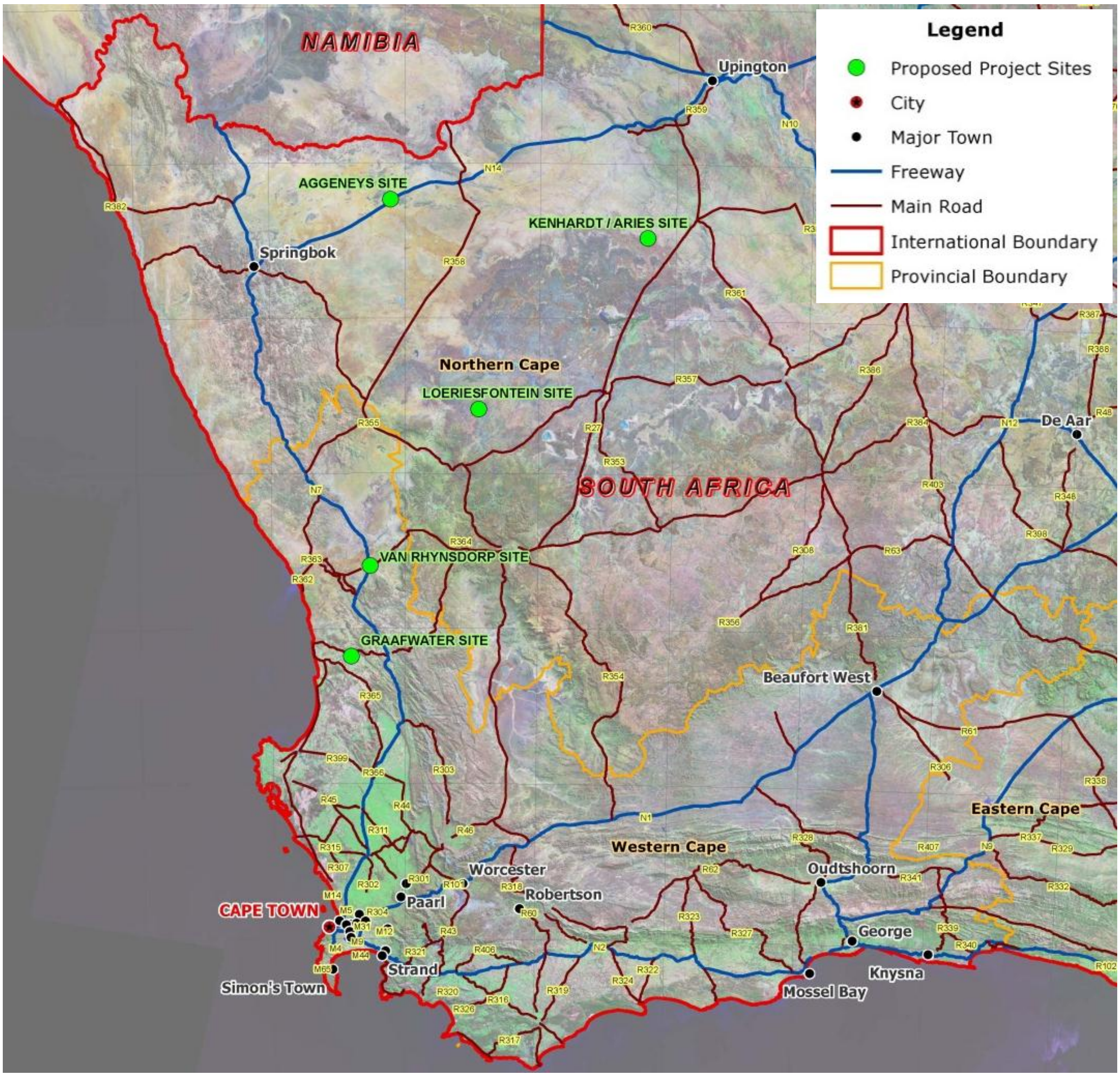


Figure 2-1: Regional setting

3 LEGISLATIVE AND CONSERVATION FRAMEWORK

3.1 Legislative requirements

This assessment was completed in accordance with the requirements of the following legislation:

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

According to the CARA, declared weeds and invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants which are prohibited and must be controlled.
- Category 2 plants (commercially used plants) that may be grown in demarcated areas providing that there is a permit and steps are taken to prevent their spread.
- Category 3 plants (ornamentally used plants) that may no longer be planted and of which existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

This Act is relevant to any weeds or invader plant species encountered on the study areas.

National Environmental Management Act (Act No. 108 of 1998) (NEMA)

The NEMA requires, *inter alia*, that:

- Development must be socially, environmentally, and economically sustainable;
- Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; and
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions.

NEMA states that "…the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

A "risk averse cautious approach" has been taken with the delineation of the sensitive areas on each study area.

National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA)

In terms of NEMBA, a project developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area, such as Critical Biodiversity Areas (CBAs);
- Promoting the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity; and
- Limit further loss of biodiversity and conserve endangered ecosystems.

In terms of Section 57 of the NEMBA a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. The Minister may, by notice in the Gazette, prohibit the carrying out of any activity which is of a nature that may negatively impact on the survival of a listed threatened or protected species.

SKEP and CBA information was extensively used in delineating sensitive areas on each study area.

National Forests Act (Act No. 84 of 1998)

According to this Act, the Minister may declare a tree, group of trees, woodland or a species of tree as protected. The prohibitions provide that no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.

The Act further prohibits the destruction of indigenous trees in any natural forest without a licence.
Any protected trees encountered on the study areas are protected within this Act.

Environment Conservation Act (Act No. 73 of 1989) (ECA)

The ECA states that development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of, *inter alia*, the following factors:

- That pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- That negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

All these factors were taken into account with the compilation of this report.

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

In terms of the Act, boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property. In addition, aquatic habitats may not be destroyed or damaged.

Lastly, the Act stipulates that the owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

This Act was specifically referred to with the delineation and mitigation as far as drainage lines are concerned.

3.2 Regional conservation framework

3.2.1 Succulent Karoo Ecosystem Programme

The Succulent Karoo Ecosystem Programme (SKEP) is a long-term, multi-stakeholder bioregional conservation and development programme, with four strategic areas:

- Increasing local and international awareness of the unique biodiversity of the Succulent Karoo;
- Expanding protected areas and improving conservation management;
- Supporting a matrix of harmonious land uses; and
- Improving institutional co-ordination.

The SKEP is a partnership programme with government and non-government partners. The first five years of implementation was funded by the Critical Ecosystem Partnership Fund (CEPF) and focused on catalysing and programme start-up. The next five years will focus on programme consolidation. This will entail integrating the SKEP objectives into national and regional government programmes, and thereby ensuring programme sustainability. As illustrated in Figure 3-1, the Succulent Karoo biodiversity hotspot extends from the southwest through the north-west areas of South Africa and into southern Namibia.

The data collected and collated by the SKEP for the five study areas, is summarised below in Table 3-1. The Graafwater and Kenhardt sites are of little significance if the SKEP data is seen in isolation, with Vanrhynsdorp and Aggeneys being of geographic priority, data on Loeriesfontein indicates that it is not a geographic priority area.

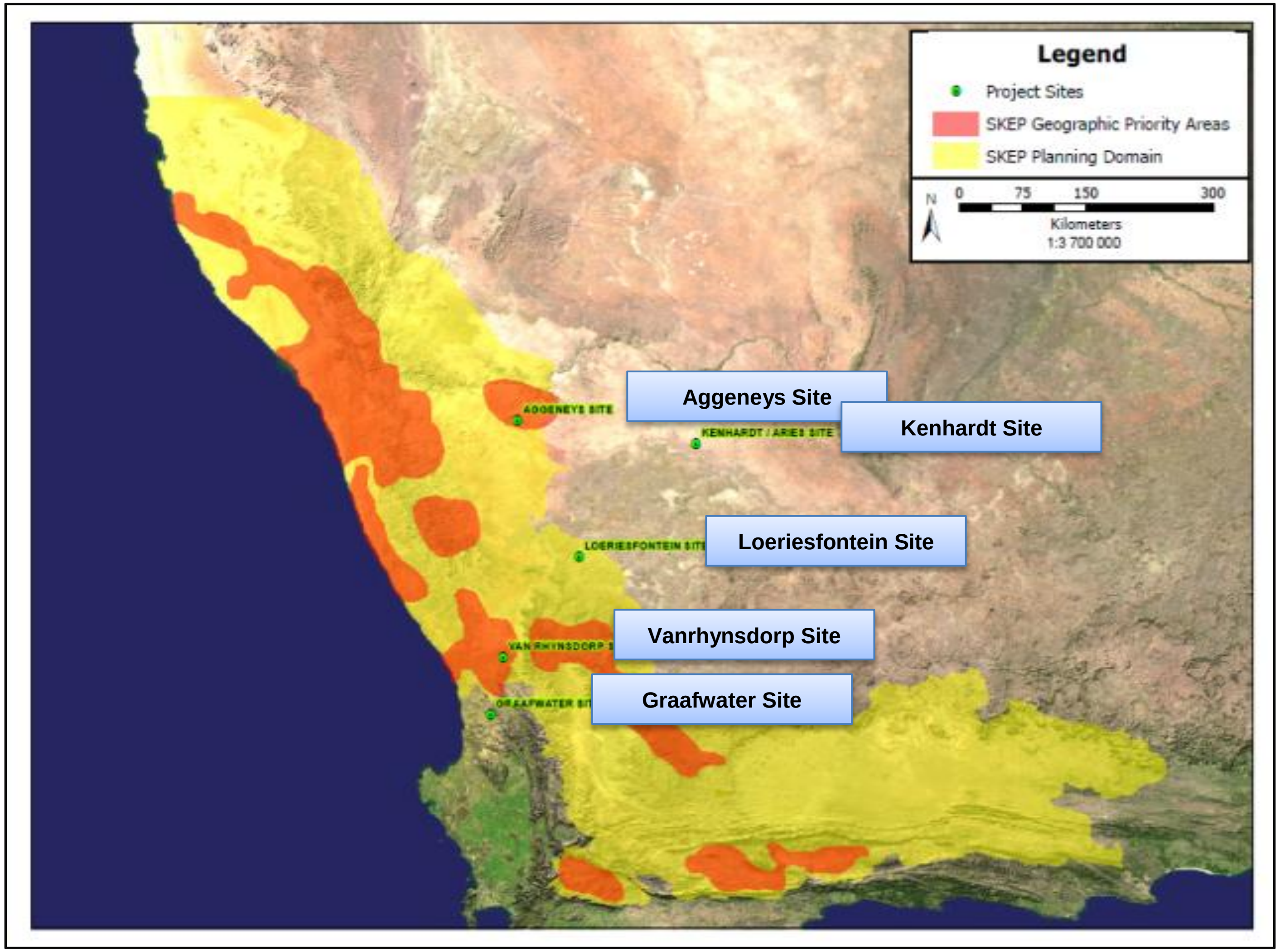


Figure 3-1: The SKEP areas of importance in relation to the project sites (SKEP. 2010)

Table 3-1: SKEP metadata summary (SKEP. 2010)

SITE	GEOGRAPHIC PRIORITY	IRREPLACE-ABILITY	VEGETATION	MAMMALS	AMPHIBIANS	BIRDS	INSECTS	QUARTZ PATCHES
Aggeneys	Yes	1	KGPSK		X	X	X	X
Kenhardt	-							
Loeriesfontein	No	0.28	USK					
Vanrhynsdorp	Yes	0.96	LSK	X			X	
Graafwater	-						X	

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

3.2.2 Critical Biodiversity Areas

This discussion of Critical Biodiversity Areas (CBAs) is adapted from Marsh et al. (2009). CBAs are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectorial planning and decision making tools (Figure 3-2).

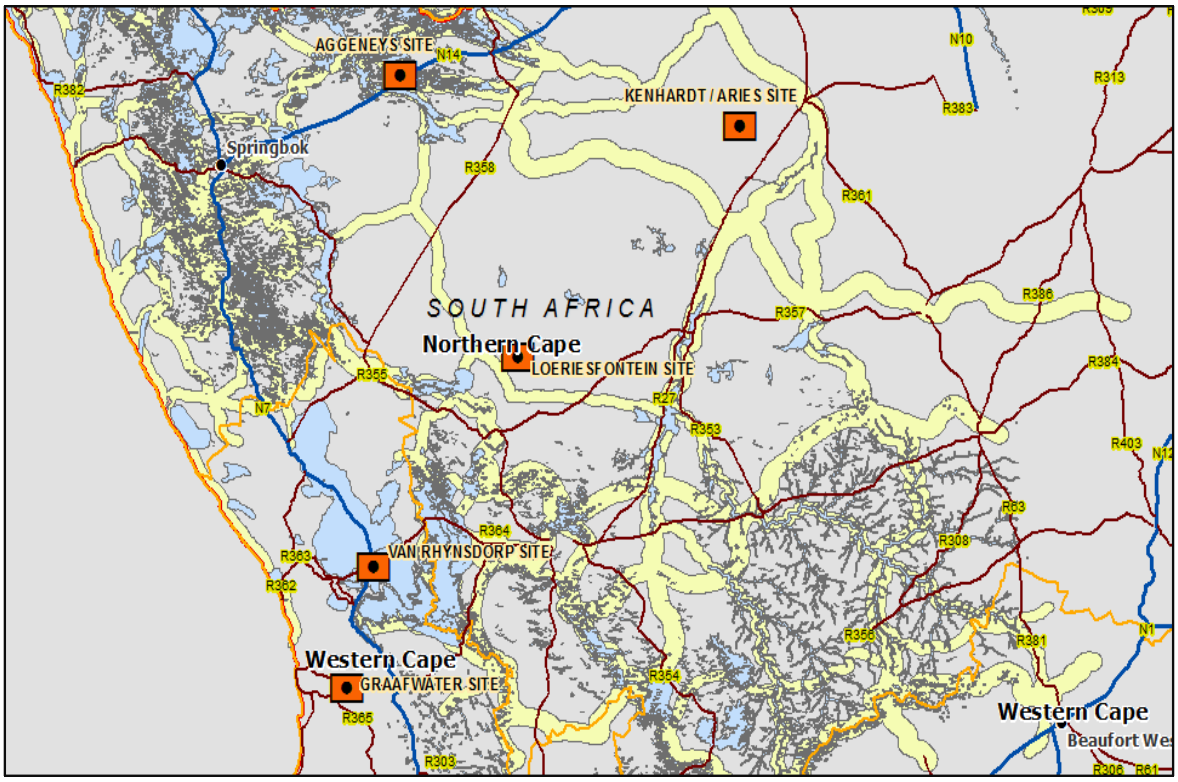


Figure 3-2: Critical Biodiversity Areas (blue) and Ecological Support Areas (yellow) in relation to the proposed project sites

CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. Fine Scale CBA mapping was used in the Graafwater and Vanrhynsdorp study areas.

Ecological Support Areas (ESAs) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

The purpose of CBAs is simply to spatially indicate the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which we would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process.

3.2.3 Freshwater Ecological Priority Area Programme

For the aquatic and hydrological assessment of the proposed project, the Freshwater Ecological Priority Area (FEPA) Programme will be considered. This programme provides FEPA maps and supporting information which forms part of a comprehensive approach to sustainable and equitable development of South Africa’s scarce water resources (WRC, 2011).

FEPA is a single, nationally consistent information source for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes to support the water resource protection goals of the NWA (WRC, 2011). This programme is directly applicable to the NWA, informing Catchment Management Strategies, classification of water resources, reserve determination, and the setting and monitoring of resource quality objectives. FEPA maps are also directly relevant to the NEMBA, informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act.

FEPA maps support the implementation of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) by informing the expansion of the protected area network.

4 EXPERTISE OF THE SPECIALIST

The Biodiversity specialist achieved a National Diploma in Nature Conservation, followed by a Bachelor of technology degree in Biodiversity Conservation at the Nelson Mandela Metropolitan University; and is an environmental consultant specialising in both terrestrial ecology and environmental management. Experience includes predominantly ecology field work such as flora and fauna surveys, biodiversity assessments, Biodiversity Action Plans, species relocation and environmental rehabilitation. Furthermore experience has been acquired in environmental Rehabilitation monitoring, Rehabilitation action plans, EIAs and Environmental Management Plans (EMP). Project experience includes various countries such as Botswana, Sierra Leone, Mali, Mozambique, Ghana, Democratic Republic of the Congo, Namibia and throughout South Africa.

5 METHODOLOGY

5.1 Desktop assessment

Prior to field work, desktop studies of the vegetation (trees, shrubs and forbs as well as exotic and invader species), the biomes and vegetation types were completed in order to collate and assess all available literature and information for the five study areas.

5.2 Fieldwork

The flora, vegetation and fauna studies were conducted together in one field survey completed from 7 to 14 of December 2011 for all study areas. The vegetation studies were undertaken to determine the state of the flora communities which would indicate habitat quality available to fauna species. This is due to the fact that certain vegetation communities will host specific fauna species based on their food and habitat requirements.

5.2.1 Vegetation

During the field survey, trees, shrubs, grasses and herbs (forbs) were recorded using the Braun-Blanquet method (Braun-Blanquet 1964). Text books and field guides were used during the field survey for identification (viz. Pooley, 1998; Sinclair et al, 2002; Van Oudtshoorn, 1999). The sampling points were positioned such that the whole area was represented and in cases where the area appeared homogenous, one or two representative samples were taken. This was achieved by identifying homogenous units that appeared on aerial photographs of the area. Sample plots were distributed within the area of interest with some natural grassland vegetation, wetlands, and disturbed areas being surveyed.

A comprehensive floristic and habitat survey was conducted within each of the sample plots. Taxon names were updated in accordance to the species list contained in the TURBOVEG (Hannekens, 1996b) database.

The floristic data, which consists of relevés (sample plots), were subjected to the Two-Way Indicator Species Analysis technique (TWINSPAN) (Hill, 1976b) on two levels of division in the Juice (Tichy, 2002). Results of TWINSPAN indicated a first approximation of the major units in the study area.

A sample plot size of 30 m x 30 m was adopted. In order to provide a clear reflection of the variation of the vegetation, sample plots were, as far as possible, equally distributed within the different stratification units, and one relevé was compiled in each plot. The exact position of each sample plot within the relevant stratification unit was chosen subjectively according to the methodology of the Zurich-Montpellier approach of phytosociology (Braun-Blanquet, 1964).The Braun-Blanquette sampling method (Mueller-Dombois & Ellenberg, 1974) has been successfully applied in other phytosociological studies in South African (viz. Bredenkamp, 1982; Bezeuidenhoudt & Bredenkamp, 1990) and also in many other vegetation studies (viz. Du Plessis, 2001). This is a standardised method used for vegetation classification within South Africa. A cover abundance value was estimated for each of the identified species according to the Braun-Blanquette scale.

The habitat was evaluated in terms of the topography (crest, midslope, foot slope, plain, river and plateau), aspect (north, south, east and west), slope (in degrees), altitude, soil and erosion (if present).

Species were identified in the field or sent to the University of Pretoria's H.G.W.J. Schweickerdt Herbarium for naming. Protected and Endangered plant species were identified using Raimondo et al (2009) i.e. the SANBI list.

Using the data sampled during the field survey the following was compiled:

- Vegetation classification and mapping thereof including sensitivity mapping;
- Species list for each plant community;
- Dominant species for each plant community;
- Exotic and Invasive species (if present) for each plant community;
- Endemic plant species (if present) of each community; and
- A species list for each of the study sites was compiled containing each of the above mentioned categories.

5.2.2 Fauna

Notes were made during this animal survey and animal species encountered including mammals, birds, reptiles, amphibians and insects were identified and recorded. Initially, desktop studies were conducted in order to collate species information. The following methods were used during the survey:

5.2.2.1 Mammalia

Visual sightings and ecological indications were used to record mammals present at each site; this includes scats, tracks and signs such as burrows and dens. Scats found were collected, photographed on scale along with any tracks found and used to identified the mammal species. For identification purposes a field guide to African Mammals by Kingdon (1997) was used.

The following was recorded:

- All mammals encountered, noted or captured during the survey, and a record of their prominence;
- Red Data species were determined from the above observations as well as from those species likely to occur in the area.

5.2.2.2 Avifauna

Visual sightings were conducted with binoculars and identification obtained from recognised field guides. A complete list of bird species encountered within the boundaries of study area was compiled. The following were recorded:

- All birds encountered or noted during the surveys were recorded; together with their prominence in the landscape

- A list of Red Data species from the above observations as well as those likely to occur in the area.

A species list of all the birds that can possibly be present within the relevant grid in which the study areas are situated was be compiled using the Roberts' Multimedia Birds of Southern Africa and the South African Bird Atlas.

5.2.2.3 Herpetofauna

Direct /opportunistic observation was done along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the project area were identified and recorded. Another method used was refuge examinations using visual scanning of terrains to record smaller herpetofaunal species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, under rocks, in leaf litter, rodent burrows, ponds, old termite mounds.

Branch (1996) and Carruthers (2001) were used to confirm identification where necessary.

5.2.2.4 Red Data Faunal Assessment

Red Data species were noted on the list of observed species. Legislation and protected species list consulted include:

- IUCN: The IUCN publishes a Threatened Species List (Red List of Threatened Animals) which categorizes globally-threatened animals as follows:
  - Vulnerable (VU): Species believed likely to move to the EN (Endangered) category, if the causal factors continue operating, because of rapidly decreasing populations and extensive habitat destruction.
  - Lower Risk (LR): Taxa which have been evaluated but do not satisfy the criteria for any of the above categories. There are three sub-categories
  - Near Threatened (NT): Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable
  - Data Deficient (DD): A taxon on which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well-studied, and its biology well-known, but appropriate data on abundance and/or distribution is lacking,
- CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna publishes a list of three Appendices (CITES Appendices, 2001) which limits global trade of certain categories of animal species.
  - Appendix I species are threatened species which cannot be traded in
  - Appendix II species are species for which levels of trade are limited

5.2.2.5 Invertebrates

Invertebrates were not sampled during this field survey, due to seasonality of the survey which was not appropriate.

6 KNOWLEDGE GAPS

The flora and fauna field survey was conducted during the dry season of the five study sites (December). The implication of this was that many of the plant species in the summer rainfall areas were dormant during this period and the species that were present were not easily identifiable. Theoretically sampling of plants should be completed over a full annual cycle. The most appropriate season for flora surveying, if a full cycle is not possible, is August to September. The implication of this timing is that the confidence in the data collected for both the flora and the fauna components of the study is medium to low.

To reiterate, the findings of certain aspects of the report are of low confidence due to numerous factors, while other aspects are of high confidence. Data used in the compilation of this report, apart from field work conducted by Digby Wells specialists, consisted of SKEP and CBA data. These data sets (SKEP and CBA) were used, in addition to field work to indicate areas of concern or sensitivity on each of the five study areas, as and where applicable. The confidence in these data sets are high as findings represented by them took in to consideration seasonality of species of concern. The process and methodology followed by Digby Wells is also beyond reproach as the process follows national and international best practice guidelines. The process is therefore of high confidence. The timing of the fauna and flora survey was however completed, against better judgement, in the least favourable season. The species composition of the study areas, according to the study, could change dramatically if the seasonality of plant species are taken into account.

7 REGIONAL NATURAL ENVIRONMENT

The Aggeneys and Kenhardt study areas are situated within the Nama Karoo Biome; the Loeriesfontein and Vanrhynsdorp study areas within the Succulent Karoo biome; and the Graafwater study area within the Fynbos biome (Figure 7-1).

7.1 Biomes

Biomes are climatically and geographically defined as similar climatic conditions on the Earth, such as communities of plants, animals, and soil organisms, and are often referred to as ecosystems. Some parts of the earth have more or less the same kind of abiotic and biotic factors spread over a large area, creating a typical ecosystem over that area. Such major ecosystems are termed as biomes. Biomes are defined by factors such as plant structures (such as trees, shrubs, and grasses), leaf types (such as broadleaf and needleleaf), plant spacing (forest, woodland, savanna), and climate (wikipedia.org).

7.1.1 Nama Karoo biome sites

APPLICABLE STUDY AREAS:	• Aggeneys • Kenhardt

The Nama Karoo makes up 25% of the land surface of South Africa. Climatically and biologically the Nama Karoo is a heterogeneous and ecotonal region. Topography varies from expansive rocky or sandy plains to escarpments and flat-topped mesas. Altitude ranges from 800 masl to 2000 masl. The region is generally exposed and windy, hot in the summer and cold in the winter. Temperature extremes range from -5°C in winter to 43°C in summer (AZEF, 2010). Sutherland is the coldest place in South Africa and receives snow in most winters (AZEF, 2010). Rainfall varies greatly, and ranges from 200 mm in the southwest to 400 mm in the northeast. The soils are as variable as the climate (AZEF, 2010). They range from Aeolian sands to saline clays, but are generally shallow and fairly fertile, and overlying either mudstones or intrusive igneous formations.

The Karoo region, because of its aridity and low shrubby vegetation, never supported the diversity of herbivorous large mammals found in the African savannas (AZEF, 2010). Plant eating animals of the Karoo are either small or confined to protected habitats, or are very mobile. Springbok and smaller herbivorous mammals including hares, rabbits, the rock hyrax, and rodents are common. Much of the nutrient cycling in the Nama Karoo is done by Termites these also form the staple food of many other species. Specialized insectivorous mammals include aardwolf, aardvark, bat-eared fox, and a variety of long-nosed elephant shrews (AZEF, 2010). Birds include some of the smallest and largest species in South Africa, and the reptile fauna is rich, including snakes, geckos, lizards and tortoises. There is a high diversity of invertebrates. The brown locust and Karoo caterpillar appear under favourable, local rainfall events.

Small stock (sheep and goats) is farmed throughout the Karoo region. Ranches are generally large (4 000 ha to 15 000 ha) because it takes 2 ha to 7 ha of natural veld to support one small-stock unit in this region (AZEF, 2010). There is a mining industry in the north west of the region and growing of citrus, olives, deciduous fruit and wine grapes in the major river valleys. Threats to the fauna include overgrazing (desertification) and land transformation by mining, agriculture and development. Less than 1% of the biome is conserved in formal areas.

7.1.2 Succulent Karoo biome

APPLICABLE STUDY AREAS:	• Loeriesfontein • Vanrhynsdorp

The Succulent Karoo Biome starts from Sutherland westwards to Nieuwoudtville and Calvinia, over the escarpment, encompassing Loeriesfontein and Vanrhynsdorp, and in a broad band along the west coast into Namibia in the north. This region, and in particular Namaqualand, which is strongly influenced by winter rainfall and fog, is a desert that harbours a range of succulent plants beyond compare. It has a bulb flora richer than any other arid region and produces a springtime display of annual flowers. Some 5000 plant species exist in this region (AZEF, 2010).

The terrain varies from coastal sandy flats to mountain ranges of diverse geological formations - granite, gneiss, quartzitic sandstone, lava, quartzite, dolomite, conglomerate and shale (AZEF, 2010). The mild temperatures during winter and summer remain mostly constant as a result of the influence of the cold Benguela Current of the Atlantic Ocean. In summer temperatures can reach in excess of 40°C (AZEF, 2010). During the winter months rain is carried in on cold fronts, and is on average less than 400 mm a year. Fog is common the closer on gets to the coast. The rainfall in Namaqualand is for the most part reliable and this is the defining explanation for its unparalleled diversity of leaf succulents, bulbs, and high numbers of minute succulents and the regular displays of spring flowers.

In this dwarf succulent shrubland, leaf succulents dominate, and most of these species are in the Mesembryanthemaceae (> 2000 species) and Crassulaceae families (AZEF, 2010). Most of the succulents are small and compact, and as a result there is a lot of space and habitat available in which to develop, this is why succulent species have such high diversity in this biome. The high floral diversity of this region and the fact that 50% of the species are strictly endemic, means Namaqualand is the only desert hotspot of biodiversity in the world (AZEF, 2010).

Annual plants, mostly of the daisy family, can be seen in colourful displays during the spring months. However, these annuals constitute only 8% of the flora of the Succulent Karoo (AZEF, 2010). The annuals are a result of human interference with the environment as they reclaim the ploughed wheat fields.

In addition to the species rich plant life, this area has a diversity of tortoises, lizards, molerats, monkey beetles, bee flies, bees, wasps and scorpions. Mammals such as bat-eared fox, aardwolf, steenbok and duiker, as well as reptiles are abundant. Brant's whistling rat is responsible for the burrow systems in sandy areas, which provide ideal conditions for seed germination. Of importance in the area are heuweltjies, raised mounds of calcium-rich soil, which support distinctive plant communities (AZEF, 2010). It is thought that these were created by termites.

Small stock farming (sheep and goats) is practiced in the Succulent Karoo. Mining for limestone, gypsum, diamonds and zinc, although contributing to the economy, results in destruction of the vegetation and heaps of un-vegetated spoil (AZEF, 2010). Fruit is grown along the river valleys and Ostrich farming is practiced in the south of the Biome. Less than 0.5% of the area of the Succulent Karoo Biome is conserved (AZEF, 2010). Ecotourism might be a viable option for a conservative means of land-use, as long as there is careful management.

7.1.3 Fynbos biome sites

APPLICABLE STUDY AREAS:	• Graafwater

The Cape Floristic Region (CFR) is one of the most biologically diverse regions on earth. Considered the Fifth Floral Kingdom, this relatively small region at the south-western tip of Africa is home to about 9,000 vascular plant species, 69 % of which are endemic (worldwildlife.org 2010). The Lowland Fynbos and Renosterveld ecoregion, found roughly below 300 m elevation within the CFR, is a fire-prone ecosystem characterized by its small-leafed, evergreen shrubs, and predominantly winter rainfall. The infertile, sandy soils have supported a spectacular and massive diversification of plant taxa (worldwildlife.org 2010). This ecoregion also boasts unusual fauna, with high levels of endemism among reptiles, amphibians, insects, and freshwater fish. The loss of biodiversity continues today, and less than four percent of this lowland ecoregion is formally conserved (worldwildlife.org 2010). Invasive plants, new systems of agriculture that allow the cultivation of marginal soil, and rapidly escalating urbanization, pose the greatest threats to the biodiversity of the ecoregion (worldwildlife.org 2010).

The Karoo region, because of its aridity and low shrubby vegetation, never supported the diversity of herbivorous large mammals found in the African savannas (AZEF, 2010). Plant eating animals of the Karoo are either small or confined to protected habitats, or are very mobile. Springbok and smaller herbivorous mammals including hares, rabbits, the rock hyrax, and rodents are common. Much of the nutrient cycling in the Nama Karoo is done by Termites these also form the staple food of many other species. Specialised insectivorous mammals include aardwolf, aardvark, bat-eared fox, and a variety of long-nosed elephant shrews (AZEF, 2010). Birds include some of the smallest and largest species in South Africa, and the reptile fauna is rich, including snakes, geckos, lizards and tortoises. There is a high diversity of invertebrates. The brown locust and Karoo caterpillar appear under favourable, local rainfall events.

Small stock (sheep and goats) is farmed throughout the Karoo region. Ranches are generally large (4 000 ha to 15 000 ha) because it takes 2 ha to 7 ha of natural veld to support one small-stock unit in this region (AZEF, 2010). There is a mining industry in the north west of the region and growing of citrus, olives, deciduous fruit and wine grapes in the major river valleys. Threats to the fauna include overgrazing (desertification) and land transformation by mining, agriculture and development. Less than 1% of the biome is conserved in formal areas.

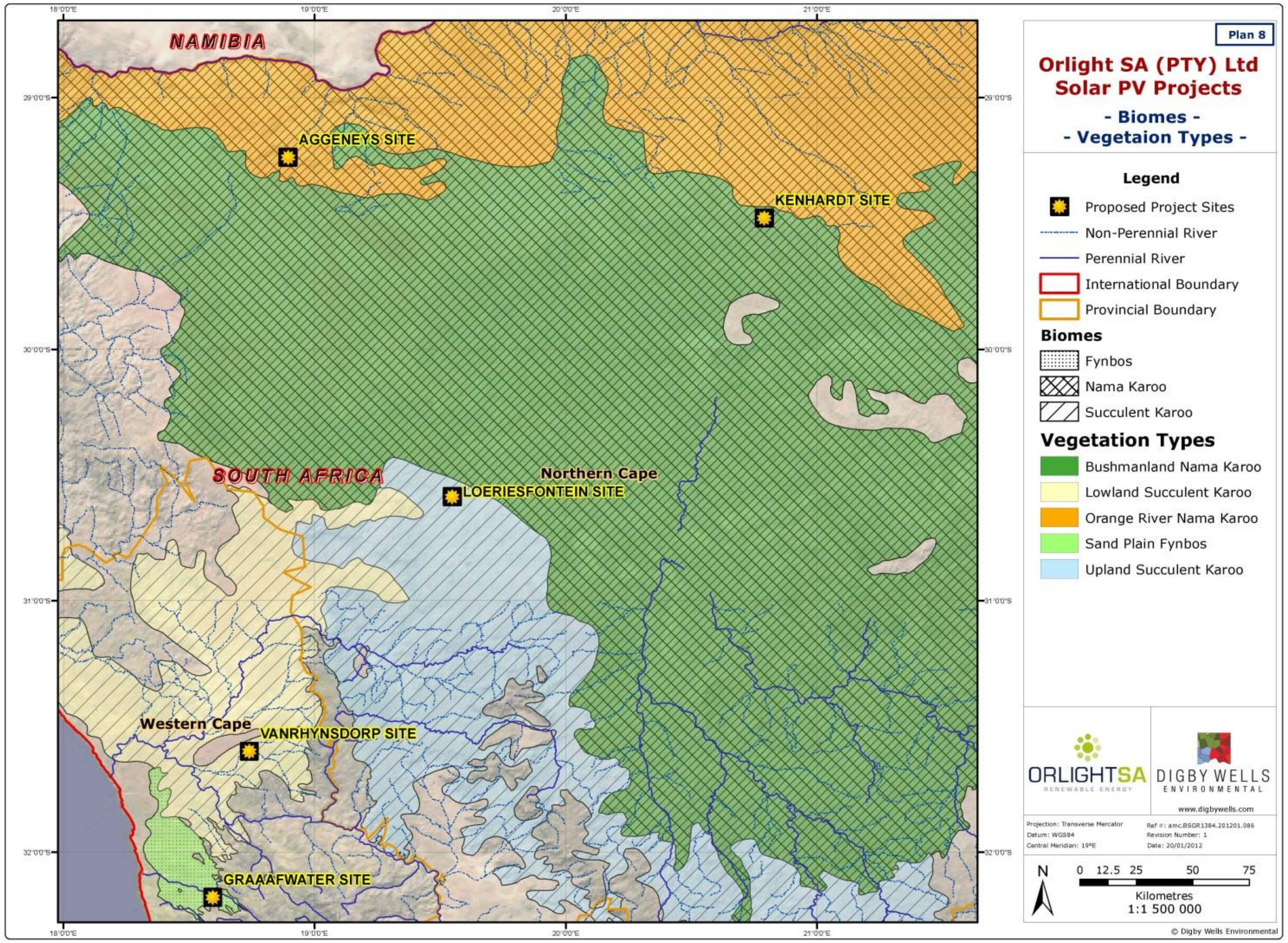


Figure 7-1: Biomes and Vegetation Types

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

7.2 Vegetation types

7.2.1 Aggeneys

This study site is located within the Bushmanland and West Griqualand. The study area stretches across two vegetation types described by Mucina and Rutherford (2006), namely the Bushmanland Sandy Grassland (NKb 4) and Bushmanland Arid Grassland (NKb 3).

Bushmanland Sandy Grassland (NKb 4)

The Bushmanland Sandy Grassland (NKb 4) vegetation type is situated in the Northern Cape, around Aggeneys (Northern Bushmanland) and according to Mucina and Rutherford (2006), isolated patches south of Copperton on the eastern edge of the Bushmanland Basin suggesting the course of the paleoriverine system of the Orange River and its tributaries. Furthermore Mucina and Rutherford (2006) indicates that this vegetation type fills the shallow valley of the intermittent Koa River southeast and West of Aggeneys where altitude varies mostly from 500 masl to 1 200 masl.

The dominant vegetation and landscape features include dense, sandy grassland plains with dominating white grasses (*Stipagrostis, Schmidtia*) and abundant drought-resistant shrubs (Mucina & Rutherford, 2006). After rainy winters, rich displays of ephemeral spring flora (e.g. *Grielum humifusum* and *Gazania lichtensteinii)* can occur.

Bushmanland Arid Grassland (NKb 3)

The Bushmanland Arid Grassland (NKb 3) vegetation type spans approximately one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the Northwest this vegetation unit borders on desert vegetation (Northwest of Aggeneys and Pofadder). The Northern border (in the vicinity of Upington) and the Eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the west is transformed by the edge of the Namaqualand hills. Altitude varies from 600 masl to 1 200 masl.

The dominant vegetation and landscape features are extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe'. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall, rich displays of annual herbs can be expected.

7.2.2 Kenhardt

This study site is also located within the Bushmanland and West Griqualand. According to Mucina and Rutherford (2006), the vegetation type is known as Bushmanland Basin Shrubland (NKb6).

Bushmanland Basin Shrubland (NKb6)

This vegetation type is located in the Northern Cape and more specifically, in the large Bushmanland Basin centred on Brandvlei and Van Wyksvlei area, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt vicinity in the north to Williston vicinity in the south. Altitude ranges from 800 masl to 1 200 masl.

The dominating vegetation and landscape features are slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny (and sometimes also succulent) shrubs (*Rhigozum, Salsola, Pentzia, Eriocephalus*), white grasses (Stipagrostis) and in years of high rainfall also abundant annuals such as *Gazania* and *Leysera* species (Mucina & Rutherford, 2006).

7.2.3 Loeriesfontein

The Loeriesfontein study area is found in the Trans-Escarpment Succulent Karoo. According to Mucina and Rutherford (2006), the vegetation type is called Hantam Karoo (SKt2).

Hantam Karoo (SKt2)

This vegetation type can be found in the Northern (and to a smaller extent also Western) Cape Province the Greater part of the Onder-Bokkeveld and Hantam region between Nieuwoudtville and Calvinia (Mucina & Rutherford, 2006). A small patch of the unit is found north of the Langberg (west of Loeriesfontein), where in places it also extends into the Western Cape Province. According to Mucina and Rutherford (2006) altitude varies from 400 masl in the western part of the unit, to 1 280 masl in the east and southeast.

Dominant vegetation and landscape features include Dwarf Karoo Shrubland with nearly equal proportions of succulent elements and low microphyllous karroid shrubs, particularly of the family Asteraceae. Rich displays of spring annuals and Geophytes (Mucina & Rutherford, 2006).

7.2.4 Vanrhynsdorp

The Vanrhynsdorp study area is located in the Knersvlakte. According to Mucina and Rutherford (2006) the vegetation type is called Vanrhynsdorp Gannabosveld (SKk5).

Vanrhynsdorp Gannabosveld (SKk5)

This vegetation type is located in the Western Cape, Namaqualand, southern knersvlakte between Vredendal and Vanrhynsdorp at the foot of the Matsikamma and Gifberg mountains, as well as north east of Vanrhynsdorp. The altitude of about half the area lies between 100 masl and 200 masl, with the rest at 200 masl to 300 masl.

Dominant vegetation and landscape features include mainly flat or only slightly undulating landscape, supporting succulent shrubland dominated by *Salsola, Drosanthemum, Ruschia* and some disturbance indicators such as *Aizoaceae (*Mucina & Rutherford, 2006). In the south the shale plains can acquire a grassland appearance through seasonal dominance of *Bromus pectinatus* and *Stipa capensis*. Spectacular annual and geophyte flora can appear in spring after good winter rains.

Special species: *Eriospermum eriophorum* is a rare local endemic from just south of Vanrhynsdorp, and *Oxalis fabaefolia* is largely endemic to this habitat. Mucina & Rutherford (2006) list the following endemic species – *Brownanthus glareicola, Euphorbia faciculata, Ornithogalum diluculum*, and *Cotula pedunculata*, but the true list of special species is substantially longer than this, as it would also include many rare, localised, or poorly known species shared with the similar Knersvlakte Vygieveld.

7.2.5 Graafwater

The Graafwater study area is located within the Graafwater Sand fynbos. According to Mucina and Rutherford (2006) the vegetation type is Leipoldtville Sand Fynbos (FFd2).

<u>Leipoldtville Sand Fynbos (FFd2)</u>

This vegetation type is located in the Western Cape, on the coastal plains on either side of the Olifants River to Aurora and extending deep inland to the foot of the Graafwater Mountains and Piketberg. It also occurs in the Olifants River valley from Bulshoek Dam to The Baths, with a gap between Klawer vlei and Sandkop. Outliers are found scattered in the Swartland from Het Kruis to the vicinity of Porterville. Altitude varies between 50 masl to 350 masl. The important vegetation and landscape features include plains, slightly rolling in places, covered with shrubland with an upper open stratum of emergent, tall (2 m to 3 m) shrubs in clumps. The vegetation matrix is formed by fairly dense restiolands (1 m to 1.2 m tall), with numerous medium tall to low shrubs scattered in between (Mucina & Rutherford, 2006).

Understorey with a conspicuous winter to spring herbaceous complement of annuals and geophytes occurs in years of good rain. Structurally, these are mainly restioid and asteraceous fynbos types, with localised patches of proteoid fynbos also present (Mucina & Rutherford, 2006). This is a dry form of sand fynbos, lacking Ericaceae and with Proteoid elements relatively rare. Sward communities associated with grazing are dominated by *Aizoon canariense* and *Tribolium echinatum*. At its northern (arid) boundary the sand fynbos structure becomes very diffuse and is progressively replaced by strandveld.

This vegetation type is exceptionally rich in special species, which is one of the primary reasons for concern about the high rate of habitat loss. Species totally or largely restricted to this unit include *Albuca clanwilliamigloria, Athanasia sertulifera, Cullumia floccosa, C. micracantha, Felicia josephinae, Heterorachis* sp. nov., *Steirodiscus capillaceus, Wahlenbergia constricta, Erica dregei, Pelargonium appendiculatum, P. attentuatum, P. fasciculaceum, Babiana confusa, Geissorhiza barkerae, G. louisabolusiae, Limonium sp. nov., Leucadendron brunioides var. flumenlupinum, Leucospermum arenarium, Lotononis racemiflora, Agathosma insignis, A. involucrata, Macrostylis hirta, Dischisma squarrosum*, and *Manulea pillansii*.

Additional rare and/or threatened species found within this unit inlude *ia* sp.nov., *Babiana scabrifolia, Euchaetis tricarpellata, Leucadendron procerum, L. loranthifolium, Serruria fucifolia, S. decipiens, Leucospermum rodolentum, Lachnaea capitata, L.grandiflora,* *Eriospermum arenosum, Lebeckia leucoclada, Argyrolobium velutinum, Lotononis bolusii*, and *Phylica cuspidata*. *Aspalathus rostripetala* is known only from one collection, possibly in this habitat, north of Citrusdal.

7.3 Landscape features

7.3.1 Mountains ridges and koppies

APPLICABLE STUDY AREAS:	• Aggenys; • Kenhardt; • Loeriesfontein; • Vanrhynsdorp; • Graafwater.

A very important landscape feature present in the study areas were mountains, ridges and koppies. These features were present in varying shapes and compositions from flat topped dolerite mesas to granite domes and varying in height from 50 m to 500 m. Often flanking the plains and vlaktes they offered a variety of different habitats. Various geological features that are present on and just below the surface exhibit various characteristics which differentiate habitat types and subsequent vegetation composition and vigour. Lower footslopes exhibit different vegetation types than plateaus and peaks. The difficulty livestock has in accessing these areas, coupled with the lack of watering points, makes them ideal for heavily grazed plants to find refuge in. These areas provide valuable catchment areas for rainfall and the hills are interspersed with drainage lines. The different directions that slopes face also provide warmer and cooler and wetter and drier slopes for plants and animals (Esler *et al*, 2010).

7.3.2 Plains

APPLICABLE STUDY AREAS:	• Aggenys; • Kenhardt; • Loeriesfontein; • Vanrhynsdorp; • Graafwater.

These areas have the potential to be as diverse in species as the mountains ridges and koppies habitat feature. However the plains and vlaktes are the most accessible for livestock and are therefore the most impacted from grazing and human based land use. The patchiness exhibited by the plains and vlaktes are a major feature in the diversity of species (plant and animal) that utilise these areas. The patchiness can occur due to geology, and soil characteristics present, or can occur due to animals such as white termites that form "heuweltjies" at their nests due to changes in soil they create. These "heuweltjies" in tern create micro habitats for other organisms such as birds that perch there, and drop seeds, which forms vegetation stands. The flat plateaus where the underlying bedrock is close to the surface have relatively shallow soils, whereas plains and vlaktes that lie between ridges and hills usually have deep soils mixed with gravel and stones from nearby hill slopes. Because plains soils are more even in depth and texture that soil of slopes, the plant communities they support are shorter and uniform in height and composition than veld on koppies and ridges (Esler *et al*, 2010).

7.3.3 Rivers, wetlands and pans

APPLICABLE STUDY AREAS:	• Aggenys; • Kenhardt; • Loeriesfontein.

Watercourses and accompanying silty floodplains were encountered on the study areas, these areas vary in width and differ in soil and vegetation composition that surrounding plains. These riverine areas exhibited tall dense and sometimes thorny vegetation and are essential to landscape functioning, as far as nutrient absorption, erosion prevention, flood attenuation, water quality and discharge of ground water. Furthermore these areas seldom hold water for more than a few days. Fast moving water carries away fine soil particles but deposit sand and gravel in river beds. Vegetation in the river beds depend on how often the river flows, how fast it flows, how much water it carries, how saline the water is, and on, whether soil is being eroded or deposited. High water availability allows vegetation that is taller and denser. Removing the riparian vegetation will speed up water flow and increase erosion occurrences (Esler *et al,* 2010).

8 RESULTS AND DISCUSSIONS

8.1 Flora

8.1.1 Plant species recorded during the field surveys

Plant species recorded in the study are shown in Appendix A. 38 plant species were recorded from the Aggeneys study area and 27 plant species from the Kenhardt study area. This included six and five tree species respectively, 11 and 10 shrub species, two and three herb or forb species, six and six grass species, one sedge, no reeds, and one aloe species (Table 8-1).

The Succulent Karoo biome exhibited 41 species at Loeriesfontein study area and 18 at the Vanrhynsdorp study area. This included four and one tree species respectively, 10 and seven shrub species, five and three herb and forb species, two and three grass species, one sedge species, 2 reed species, eight succulent species and no aloe species.

The only Fynbos biome study area, Graafwater, exhibited 39 plant species. This study site three tree species, seven shrub species, 11 herbs or forbs, three grass species, no sedge or reed species, eight succulent species and no aloe species.

Table 8-1: Plant species growth forms encountered.

Site	Tree	Shrub	Herb/Forb	Grass	Sedge	Reed	Succulent	Aloe
Aggeneys	6	11	2	6	1		10	1
Kenhardt	5	10	3	6			4	
Loeriesfontein	4	10	5	2	1		5	
Vanrhynsdorp	1	7	3	3			3	
Graafwater	3	7	11	3		2	8	

The plant growth forms listed in Table 8-1 illustrates the dominance of certain growth forms within the vegetation types present on the study areas which they prefer.

8.1.2 Red Data Plant Species

During the field surveys only one RED Data species was encountered, viz. *Aloe dichotomy* which is designated as Vulnerable (Raimondo et al., 2009). *Boscia albitrunca* is designated as a protected tree species in terms of the National forest Act of 1998. The habitat where these two species were encountered was Aggeneys.

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on plants and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an on-going taxon-specific conservation programme (i.e., are Near Threatened).

Plants and animals that have been evaluated to have a low risk of extinction are classified as Least Concern. (IUCN.org).

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

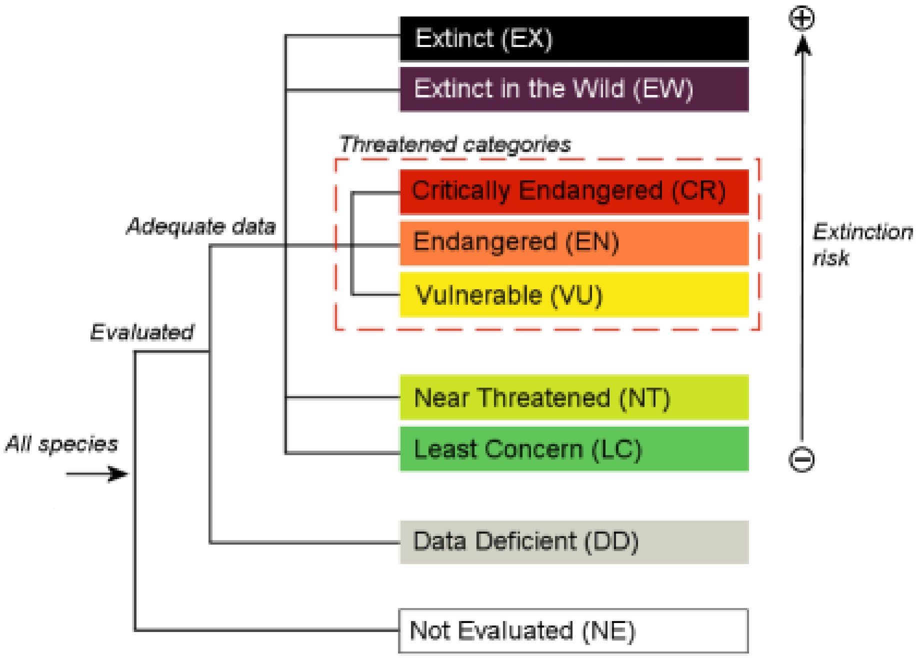


Figure 8-1: IUCN categories (IUCN.com)

Red Data plant lists were obtained from SANBI (Raimondo et al., 2009), which indicated that each of the study areas could contain Red Data and protected plant species, these are:

Aggeneys:

- *Conophytum burgeri* L.Bolus EN. African endemic Northern Cape Aggeneys;
- *Conophytum ratum* S.A.Hammer VU. Northern Cape Ghaamsberg near Aggeneys;
- *Eriospermum pusillum* P.L.Perry Rare. Northern Cape Springbok to Aggeneys;
- *Lithops olivacea* L.Bolus VU. African endemic Northern Cape Aggeneys to Pofadder.

Kenhardt:

- *Aloe striata* Haw. subsp. *karasbergensis* (Pillans) Glen & D.S.Hardy LC.

Loeriesfontein:

- *Amphiglossa corrudifolia* DC. VU Northern Cape, Western Cape Loeriesfontein and Prince Albert.
- *Babiana cinnamomea* J.C.Manning & Goldblatt. Rare the Langeberg north-west of Loeriesfontein.
- *Conophytum caroli* Lavis Rare. Northern Cape Kliprand near Loeriesfontein. *Cylindrophyllum hallii* L.Bolus VU. African endemic Northern Cape Loeriesfontein.
- *Dregeochloa calviniensis* Conert Rare. African endemic Northern Cape Loeriesfontein and Van Wyksvley.
- *Gladiolus lapeirousioides* Goldblatt VU. African endemic Northern Cape Loeriesfontein.

- *Haemanthus dasyphyllus* Snijman Rare. Northern Cape Kamiesberg to Loeriesfontein.
- *Lachenalia barkeriana* U.Müll.-Doblies, B.Nord. & U.Müll.-Doblies Rare. Vanrhynsdorp to Kliprand to Loeriesfontein.
- *Lithops divergens* L.Bolus NT. African endemic Northern Cape Loeriesfontein and Vanrhynsdorp
- *Lithops otzeniana* Nel VU. African endemic Northern Cape Loeriesfontein to Gamoep.
- *Lithops viridis* H.A.Lückh. VU. African endemic Northern Cape Loeriesfontein.
- *Strumaria aestivalis* Snijman VU. African endemic Northern Cape Loeriesfontein.
- *Strumaria massoniella* (D.&U.Müll.-Doblies) Snijman VU. Northern Cape Kamiesberg to Loeriesfontein.
- *Zaluzianskya inflata* Diels Rare. Bokkeveld to Klein Toren near Loeriesfontein.

Vanrhynsdorp

- *Agathosma marifolia* Eckl. & Zeyh. NT. Western Cape Nieuwoudtville, Vanrhynsdorp, and Clanwilliam.
- *Aloe comosa* Marloth & A.Berger LC. northwards to Calvinia and Vanrhynsdorp, also in Olifants River vally.
- *Aloe krapohliana* Marloth DDD. Northern Cape Namaqualand, from Vanrhynsdorp to the Orange River.
- *Annesorhiza lateriflora* (Eckl. & Zeyh.) B.-E.van Wyk Rare. Northern Cape Kamiesberg and Vanrhynsdorp district.
- *Antimima nordenstamii* (L.Bolus) H.E.K.Hartmann Rare... African endemic Western Cape Vanrhynsdorp, Hol River.
- *Argyroderma framesii* L.Bolus subsp. hallii (L.Bolus) H.E.K.Hartmann Rare. Western Cape Koekenaap to Vanrhynsdorp.
- *Aspalathus cuspidata* R.Dahlgren VU. Western Cape Brand-se-baai to Vanrhynsdorp.
- *Aspalathus dianthopora* E.Phillips LC. Cape mountain ranges between Vanrhynsdorp and Ceres.
- *Babiana cinnamomea* J.C.Manning & Goldblatt Rare. African endemic. Western Cape Vanrhynsdorp to the Langeberg.
- *Babiana toximontana* J.C.Manning & Goldblatt EN. Mountains between Klawer and Vanrhynsdorp.
- *Brownanthus glareicola* Klak VU. African endemic Western Cape Vanrhynsdorp.
- *Conophytum uviforme* (Haw.) N.E.Br. subsp. *subincanum* (Tischer) S.A.Hammer VU. African endemic Western Cape Vanrhynsdorp.
- *Crassula arborescens* (Mill.) Willd. subsp. *arborescens* LC. African endemic Western Cape Vanrhynsdorp to Prince Albert.
- *Crassula barklyi* N.E.Br. LC. Northern Cape Port Nolloth to Vanrhynsdorp.

- *Crassula capensis* (L.) Baill. var. *capensis* LC. Endemic Western Cape South of Vanrhynsdorp to Caledon.
- *Crassula dodii* Schönland & Baker f. DDT in the Cape Province, near Vanrhynsdorp
- *Crassula hirtipes* Harv. LC. Northern Cape Port Nolloth to Vanrhynsdorp.
- *Crassula obtusa* Haw. LC. Eastern Cape, Western Cape Vanrhynsdorp to the Cape Peninsula.
- *Cyphia salteri* E.Wimm. DDD. African endemic Western Cape Vanrhynsdorp.
- *Diascia glandulosa* E.Phillips var. glandulosa DDD. African endemic Western Cape Vanrhynsdorp, Gifberg.
- *Drosanthemum ramosissimum* (Schltr.) L.Bolus Rare. African endemic Western Cape Vanrhynsdorp, Knersvlakte.
- *Eriospermum attenuatum* P.L.Perry DDD. Quartz covered saline soils in Vanrhynsdorp Gannabosveld.
- *Eriospermum eriophorum* P.L.Perry C. From one location south of Vanrhynsdorp.
- *Eriospermum fragile* P.L.Perry Rare. African endemic Western Cape Vanrhynsdorp to Springbok.
- *Eriospermum laxiracemosum* P.L.Perry VU. African endemic Western Cape Vanrhynsdorp to Clanwilliam.
- *Eriospermum patentiflorum* Schltr. VU. Western Cape Clanwilliam and Vanrhynsdorp.
- *Eriospermum spirale* Schult. VU. Locations between Stellenbosch and Vanrhynsdorp. It is highly threatened.
- *Eriospermum subincanum* P.L.Perry EN. African endemic Western Cape Vanrhynsdorp to Biedouw.
- *Euphorbia pedemontana* L.C.Leach VU. African endemic Western Cape Vanrhynsdorp,
- *Euphorbia schoenlandii* Pax VU. Northern Cape, Western Cape Vanrhynsdorp to Vredendal.
- *Euryops namaquensis* Schltr. VU. African endemic Western Cape Vanrhynsdorp, Knersvlakte.
- *Haemanthus lanceifolius* Jacq. VU. African endemic Northern Cape Vanrhynsdorp to Calvinia.
- *Haemanthus pubescens* L.f. subsp. leipoldtii Snijman VU. African endemic Western Cape Vanrhynsdorp to Klawer.
- *Helichrysum cylindriflorum* (L.) Hilliard & B.L.Burtt LC. Northern Cape, Western Cape Vanrhynsdorp and Calvinia.
- *Helichrysum lambertianum* DC. LC. African endemic Western Cape Vanrhynsdorp southwards.
- *Helichrysum leptorhizum* DC. DDD. Northern Cape Namaqualand, Vanrhynsdorp and Springbok.
- *Helichrysum moeserianum* Thell. LC. Northern Cape, Western Cape Vanrhynsdorp to the Cape Peninsula.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

- *Heliophila leptophylla* Schltr. VU. African endemic Western Cape Vanrhynsdorp.
- *Hoplophyllum ferox* Sond. DDD. African endemic Western Cape Vanrhynsdorp.
- *Lachenalia barkeriana* U.Müll.-Doblies, B.Nord. & D.Müll.-Doblies Rare. African endemic Northern Cape Vanrhynsdorp to Kliprand.
- *Lithops divergens* L.Bolus NT Norththern Cape Loeriesfontein and Vanrhynsdorp.
- *Lotononis plicata* B.-E.van Wyk VU. African endemic Northern Cape Vanrhynsdorp to Bitterfontein.
- *Ornithoglossum gracile* B.Nord. NT. Northern Cape, Western Cape Vanrhynsdorp, Clanwilliam.
- *Othonna cakilifolia* DC. VU. African endemic Northern Cape Vanrhynsdorp and Hondeklipbaai.
- *Othonna hallii* B.Nord. VU. Northern Cape, Western Cape Vanrhynsdorp district.
- *Oxalis blastorrhiza* T.M.Salter VU. African endemic Northern Cape Vanrhynsdorp.
- *Oxalis cuneata* Jacq. VU. The other location, near Vanrhynsdorp,
- *Oxalis dines* Ornduff VU. African endemic Northern Cape Vanrhynsdorp to Clanwilliam
- *Oxalis lichenoides* T.M.Salter Rare. Northern Cape, Western Cape Vanrhynsdorp to Bitterfontein.
- *Oxalis melanograpta* T.M.Salter DDD. African endemic Western Cape Vanrhynsdorp.
- *Oxalis reflexa* T.M.Salter Rare. Northern Cape Northeast of Vanrhynsdorp.
- *Oxalis stenoptera* Turcz. var. *undulata* Rare. Northern Cape Kareeberg between Vanrhynsdorp and Nuwerus.
- *Oxalis tenuipes* T.M.Salter var. tenuipes Rare. African endemic Northern Cape Vanrhynsdorp, Gifberg.
- *Oxalis tenuis* T.M.Salter Rare. African endemic Western Cape Vanrhynsdorp, Gifberg.
- *Pelargonium caroli-henrici* B.Nord. Rare. African endemic Western Cape Vanrhynsdorp.
- *Phyllobolus chrysophthalmus* Gerbaulet & Struck Rare. African endemic Western Cape Vanrhynsdorp to Bitterfontein.
- *Pteronia pillansii* Hutch. DDD...Cape, Western Cape Garies and Vanrhynsdorp.
- *Quaqua framesii* (Pillans) Bruyns VU. between Nuwerus, Vredendal and Vanrhynsdorp.
- *Quaqua pulchra* (Bruyns) Plowes EN. Northern Cape Lutzville to Vanrhynsdorp.
- *Satyrium pulchrum* S.D.Johnson & Kurzweil VN. Northern Cape Knersvlakte, north of Vanrhynsdorp.
- *Steirodiscus schlechteri* Bolus ex Schltr. VU. African endemic Western Cape Vanrhynsdorp.
- *Tylecodon suffultus* Bruyns ex Toelken Critically Rare. Northern Cape Knersvlakte, near Vanrhynsdorp.
- *Ursinia pygmaea* DC. Rare. African endemic Northern Cape Vanrhynsdorp to Kamiesberg.

- *Ursinia subflosculosa* (DC.) Prassler EN. Western Cape Clanwilliam and Vanrhynsdorp.
- *Wahlenbergia tumida* Brehmer DDD. Cape Bokkeveld Escarpment and Vanrhynsdorp.
- *Zaluzianskya kareebergensis* Hilliard DDD. African endemic Northern Cape Vanrhynsdorp, Kareeberg.

Graafwater

- *Aloe microstigma* Salm-Dyck subsp. *framesii* (L.Bolus) Glen & D.S.Hardy NT. Lamberts Bay and Graafwater.
- *Cliffortia acanthophylla* C.M.Whitehouse CR. Olifants River Mountains around Graafwater and Cederberg.
- *Heterorhachis hystrix* J.C.Manning & P.O.Karis CR. African endemic Western Cape Graafwater.
- *Koenigia* sp. nov. (Helme 3468 NBG) EN. South African endemic Graafwater.
- *Lampranthus peersii* (L.Bolus) N.E.Br. DDD. African endemic Western Cape Graafwater.
- *Lampranthus stenopetalus* (L.Bolus) N.E.Br. VU. Cultivation threat, especially around Graafwater.
- *Leucadendron brunioides* Meisn. var. *flumenlupinum* I.Williams CR. African endemic Western Cape Graafwater to Aurora.
- *Macrostylis hirta* E.Mey. ex. Sond. VU. Western Cape Paleisheuwel to Graafwater.
- *Pelargonium lobatum* (Burm.f.) L'Hér. LC. Eastern Cape, Western Cape Graafwater to Knysna.
- *Phylica cuspidata* Eckl. & Zeyh. var. *cuspidata* VU. Endemic Western Cape Aurora to Graafwater.
- *Selago heterotricha* Hilliard EN. Western Cape Heerenlogement to Graafwater.
- *Wahlenbergia constricta* Brehmer DDD Cape Olifants River Valley and Graafwater to Redelinghuys.

8.1.3 Exotic and Invasive Plant Species

The Conservation of Agricultural Resources Act regards weeds as alien plants, with no known useful economic purpose and as a result, should be eradicated. Invader plants, also considered by the Act, are also of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits. These plants need to be managed and prevented from spreading.

Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in regulation 15.D of the Conservation of Agricultural Resources Act. Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas. Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas. The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation.

The Graafwater study area was found to have to most number of exotic species; this is most probably due to the previous and current land use, which appeared to be ploughed fields that were prepared for rooibos planting. However this did not happen and these areas are now being invaded by alien invasive and weed plant species. The Vanrhynsdorp study area was found to be in close proximity to the town of Vanrhynsdorp, bordering on the town in fact. Furthermore this site seemed to be used regularly by people as a thoroughfare from one side of town to the other, which created many footpaths with rubble strewn next to these paths with regularity. The general misuse of this site could explain the relatively high number of alien invasive species encountered here. The Loeriesfontein study area was located approximately 25 km outside of the town on a sheep farm. In general the study area appeared to be moderately to heavily grazed, with the second most alien invasive and weed species found here (Table 8-2). Alien invasive species often tend to out-compete indigenous vegetation; this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 2010). They are tough, can withstand unfavourable conditions and are easily dispersed. This is indicative of early stages of succession and although these species are invasive their use in aid of the prevention of erosion, is valuable.

Table 8-2: Alien invasive and Weed species recorded from each site (Bromilow 2010).

Species	Common Name	Ecological Status	Form	Ag	Ke	Lo	Gr	Va
Acacia melanoxylon	Black Wattle	Invader**	Tree				X	
Argemone mexicana	Mexican Poppy	Invader*	Forb				X	
Argemone ochroleuca		Weed*	Dwarf Shrub			X		
Atriplex lindleyi	Sponge Fruit Saltbush	Invader***	Shrub					X
Atriplex vestita	Australian saltbush	Invader**	Shrub				X	
Datura ferox	Thorn Apple	Invader*	Shrub					X
Prosopis glandulosa	Mesquite	Invader**	Tree	X	X	X	X	X
Tamarisk ramosissima	Pink Tamarisk	Invader*	Tree			X		
Total				**1**	**1**	**3**	**4**	**3**

Note: * - Category 1 plants according to CARA
** - Category 2 plants according to CARA
*** - Category 3 plants according to CARA
Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp

The presence of exotic invasive and weed plant species in an area is either an indication of recent disturbance where these species are pioneering re-establishment of plants, or misuse of an area where the natural plant species were selectively or completely removed possibly by livestock.

The presence or absence of these plants in a specific habitat type could therefore be an indication of the ecological capacity and importance of that specific habitat type, where the presence of these plants indicates a potentially disturbed habitat. Areas that contained high numbers of alien invasive and weed species are found not to support high numbers of animals as animals are not used to feeding on these plant species.

8.1.4 Medicinal Plant Species

Medicinal plants are important to many people and are an important part of the South African cultural heritage (Van Wyk et al, 1997). Plants have been used traditionally for centuries to cure many ailments, as well as for cultural uses such as building material and for spiritual uses such as charms.

During the field work, 38 medicinal plants were observed these are listed in Table 8-3, together with the study site where these were encountered.

Table 8-3: Medicinal plant species (Van Wyk and Van Wyk 1997, Shearing 1997, Esler et. al. 2010).

Scientific Name	Common Name	Form	Ag	Ke	Lo	Gr	Va
Acacia karoo	Sweet thorn	Tree		X			
Albuca setosa	-	Geophyte					X
Aloe dichotoma	Kokerboom	Aloe	X				
Aptosimum spinescens	Kankerblarebossie	Shrub		X			
Argemone mexicana	Mexican Poppy	Forb			X	X	
Asparagus aethiopicus	-	Herb				X	
Boscia albitrunca	Shepherds tree	Tree	X				
Chrysocoma ciliata	-	Dwarf Shrub				X	
Euryops speciosissimus	Giant resinbush	Shrub				X	
Hoodia gordonii	Ghaap	Succulent	X	X	X		
Melianthus comosus	-	Shrub			X		
Mesembryanthemum nodiflorum	-	Succulent				X	
Monsonia spinosa	Spiny Bushman's Candle	Succulent	X				
Oncosiphon grandiflorum		Forb				X	
Peliostomum leucorrhizum	Veld violet	Dwarf shrub	X	X			X
Rhus undulata	-	Tree	X		X		
Salsola tuberculata	-	Shrub	X	X			X

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Salvia disermas	-	Forb			X		
Sarcostemma viminale	Melktou	Succulent creeper	X	X			X
Searsia pyroides	Five Thorn	Tree				X	
Tamarisk ramosissima	Pink Tamarisk	Tree			X		
Total			**8**	**6**	**6**	**7**	**4**

Ag = Aggeneys; Key = Kenhardt; Lo = Loeriesfontein; Gr = Graafwater; Va = Vanrhynsdorp

The results from the field survey indicate that Aggeneys contains the largest number of medicinal species (Table 8-3), further enforcing the argument that this area is sensitive as far as medicinal plant species populations.

8.1.5 Summary

From Table 8-4, it can be seen that the number of different plant species, medicinal plant species and the cultural (including magical) plant species are all more prominent in areas of less disturbance with exotic and weed species being more prominent within the areas of high disturbance or transformed areas, because of disturbance. Disturbance is seen as overgrazing.

Table 8-4: Summary of flora species composition of each study area

Site	Richness	Red data	Medicinal	Endemic	Alien invasive	Important Landscapes
Aggeneys	38	2	8	0	1	3
Kenhardt	27	0	6	0	1	2
Loeriesfontein	31	0	6	1	3	3
Vanrhynsdorp	18	0	4	0	3	0
Graafwater	36	0	7	0	4	1

Species richness is closely associated with the general health of an area, with un-impacted study areas tending to display greater species richness.

In Figure Table 8-3 the comparison between the five study areas with regard to number of plant species and their designations can be seen.

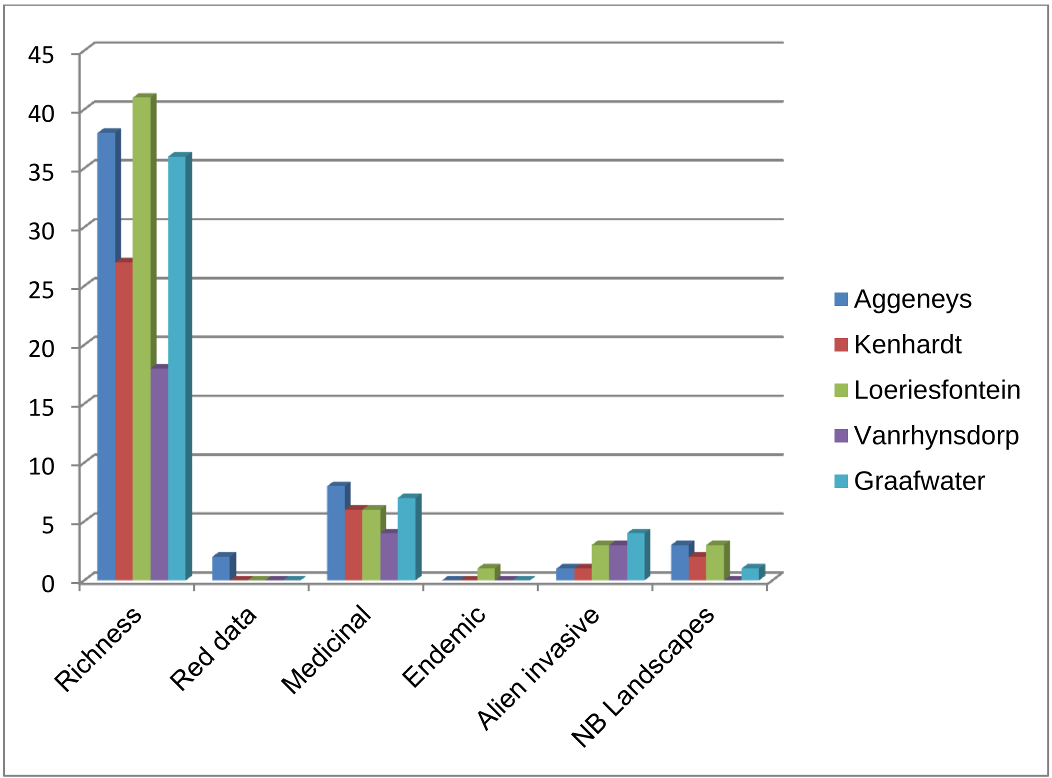


Figure 8-2: Chart indicating a comparison between plant species and important landscapes of the five study areas.

8.2 Fauna

8.2.1 Mammals

The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. Sherman traps were placed close to fresh burrows for three days and two nights at four localities in an attempt to identify smaller mammals possibly present in the area. Table 8-5 lists all mammals observed during the field survey. The mammals recorded were found within the natural grassland areas.

Table 8-5: Mammal species recorded during the field surveys

Species	Common Name	Ag	Ken	Ag	Lo	Va	Gr
Antidorcas marsupialis	Springbok		X				
Rhaphicerus campestris	Steenbok	X	X	X	X		X
Vulpes chacma	Silver Backed Fox		X				
Canis mesomelas	Jackal		X				
Vulpes chacma	Blackbacked Jackal	X		X			
Otocyon megalotis	Bat Eared Fox				X		
Caracal caracal	Caracal		X				
Suricatta suricatta	Meerkat	X		X			
Hystrix africaeaustralis	Porcupine		X				

Lepus capensis	Cape Hare	X	X	X	X		X
Xeris inauris	Cape Ground Squirrel	X	X	X			
Hystrix africaeaustralis	Porcupine				X		
Total		**5**	**8**	**5**	**4**	**0**	**2**

Note: Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp.

From Table 8-5, one can see that Kenhardt has the greatest observed species richness with regards to mammal species, with Aggeneys containing the second highest species richness, no mammal species were encountered within the Vanrhynsdorp site. The Vanrhynsdorp site was located directly adjacent to the town residential areas and it was evident that the area was used as a thoroughfare by local residents, which influences the habitat quality.

8.2.2 Avifauna

Aggenys and Kenhardt

Among the birds that can be expected to occur in these study areas, the ferruginous lark (*Certhilauda burra,* VU) (Dean et al. 1991) and Sclater's lark (*Spizocorys sclateri*) are strictly endemic to this ecoregion, while another five species are near-endemic: Karoo chat (*Cercomela schlegelii*), tractrac chat (*Cercomela tractrac*), red lark (*Certhilauda burra*), Karoo scrub robin (*Cercotrichas coryphaeus*), red-headed cisticola (*Cisticola subruficapillus*), and the Namaqua prinia (*Phragmacia substriata*). Other characteristic species of the Nama Karoo that could be expected and which are regarded as "Vulnerable" in South Africa are tawny (*Aquila rapax*) and martial (*Polemaetus bellicosus*) eagles, African marsh harrier (*Circus ranivorus*), lesser kestrel *(Falco naumanni*), blue crane (*Anthropoides paradiseus*), kori (*Ardeotis kori*) and Ludwig’s (*Neotis ludwigii*) bustards, and the red lark (Dean et al. 1991, McCann 2000, Barnes 2000).

Loeriesfontein and Vanrhynsdorp

Only five of the ecoregion’s 226 birds are endemic, the Karoo chat (*Cercomela schlegii*), Tractrac chat (*Cercomela tractracs*), long-billed lark (*Certhilauda curvirostris*), the bank cormorant (*Phalacrocorax neglectus*), and the recently described Barlow’s lark (*Certhilauda barlowi*) (Ryan et al. 1999). These species could possibly occur within the study area.

Graafwater

Bird diversity is not particularly high, owing to the structural uniformity of the vegetation and the shortage of food (McMahon and Fraser 1988). Only 288 (excluding seabirds) species have been recorded from the region, and just seven of these are endemic or near-endemic. Among the endemic species, most are found in both the Lowland and Montane Fynbos and Renosterveld ecoregions, which means they could possibly occur in the area of interest: Victorin’s warbler (*Bradipterus victorini*), Cape rock-jumper (*Chaetops frenatus*), orange-breasted sunbird (*Nectarina violacea*), Cape sugarbird (*Promerops cafer*), Cape siskin (*Serinus totta*), and the Cape francolin (*Francolinus capensis*). The Kenhardt study area displayed the greatest avifauna diversity during the field survey, with Loeriesfontein and

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Graafwater following closely with eight and seven respectively. The Aggeneys study area displayed low numbers of bird species, however the time of day when the field study was conducted was not conducive to bird spotting as it was exceptionally hot. The bird species encountered is tabulated in Table 8-6.

Table 8-6: Bird species encountered

Species	**Common Name**	**Ag**	**Ke**	**Lo**	**Va**	**Gr**
Melierax canorus	Pale Chanting Goshawk		X			
Buteo rufuscus	Jackal Buzzard			X		
Meliorax canorus	Pale Chanting Goshawk			X		
Elanus axillaris	Black Shouldered Kite				X	
Mirafra apiata	Clapper Lark					X
Falco rupicollis	Rock Kestrel		X			
Oena capensis	Namaqua Dove	X	X			X
Corvus albus	Pied Crow	X	X	X		X
Rhinoptilus africanus	Double Banded courser		X			
Telophorus capensis	Bokmakierie			X		X
Myrmecocichla formicova	Ant Eating Chat		X			
Numida melagris	Guinea Fowl				X	X
Ardeotis kori	Kori Bustard		X			
Neotis ludwigii	Ludwig's Bustard		X			
Eupodotis afra	Southern Black Korhaan		X	X		
Passer melanurus	Cape Sparrow			X		X
Pternistis capensis	Cape Francolin				X	X
Philetairus socius	Sociable Weaver	X	X			
Plocepasser mahali	White Browed Sparrow Weaver		X			
Ploceus capensis	Cape Weaver			X		
Ploceus velatus	Southern Masked Weaver			X		
Agapornis roseicollis	Rosy faced Lovebird		X			
Pterocles namaqua	Namaqua Sandgrouse		X			
Total		**3**	**14**	**8**	**3**	**7**

Note: Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp.

8.2.3 Herpetofauna

During the field survey of the five project areas three reptile species were encountered, the Namaqua Speckled Padloper, the Angulate Tortoise and the Karoo Girdled Lizard. Of the two, the Namaqua Speckled Padloper is an endangered species (Table 8-7) (Figure 8-3).

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Figure 8-3: Namaqua Speckled Padloper.

The herpetofauna of xeric landscapes in general tends to be poor due to a paucity of suitable habitat. This is evident in the fact that reptile species richness within the Nama Karoo, is generally low and there are few endemic species, furthermore, few of the reptile species that occur in this ecoregion are of conservation concern or classified as threatened (Alexander and Marais 2008). The Succulent Karoo ecoregion contrasts the Nama by having a relatively high species richness of reptiles and a high percentage of these are endemic. Many species are rupicolous (Alexander and Marais 2008), making rocky habitats on the project areas of special concern. The Fynbos ecoregion exhibits a moderate number of reptile species, but many of these tend to have small ranges and several are of conservation concern (Alexander and Marais 2008). All amphibians remain physiologically dependant on moisture and temperature, subsequently a larger number will be found in areas that are warm and wet. A steady decline in number of frog species is evident in the decline of rainfall from east to west in South Africa.

From the desktop review completed for the study area it was found that approximately 15 amphibian species are found in the Succulent Karoo, including three endemics: Boulenger's short-headed frog (*Breviceps macrops*), Namaqualand short-headed frog (*B. namaquensis*), and *Bufo robinsoni*. Among the region's 115 reptile species, 48 are endemic and 15 are strict endemics. The genus *Cordylus* (spinytail lizards) includes six strict endemics. Other strict endemics are Broadley's lance skink (*Acontias litoralis*), Richtersveld dwarf leaf-toed gecko (*Goggia gemmula*), Smith's sand lizard (*Meroles ctenodactylus*), Calvinia thick-toed gecko (*Pachydactylus labialis*), Namaqua thick-toed gecko (*P. namaqua*), and Meyer's legless skink (*Typhlosaurus meyeri)* (Hilton-Taylor 2000).

Table 8-7:Reptiles and amphibians encountered on the various study areas

Species	Common Name	IUCN	Ag	Ke	Lo	Va	Gr

		Status					
Homopus signatus	Namaqua Speckled Padloper	VU	X	X	X		X
Chersina angulata	Angulate tortoise	-					X
Rhopterus sp.	Gekko Species						
Cordylus polyzonus	Karoo Girdled Lizard	-	X	X			
Total			**2**	**2**	**1**	**0**	**2**

Note: Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp.

8.3 Study areas sensitivity

Through the field work conducted it was found that each of the five study areas contained a collection of habitat types each of which was assigned a different sensitivity rating based on survey findings. These findings consider various aspects which contribute to sensitivity, which is described in Sensitivity Type Maps (Plan 1a, 1b, 1c, 1d and 1e). Sensitive areas include Red Data Species (*Boscia albitrunca*), protected species (*Aloe dichotoma)* Terrestrial Critical Biodiversity Areas, as well as areas defined in SKEP as Sensitive (Plant priority Areas, Ridge Areas, Bufers, Drainage Lines, Sand Corridors and Quartz Patches).

From this information various ratings were developed which defined “No go” areas, which are most sensitive, Highly Sensitive, Sensitive, Minimally Sensitive, Favourable and Least Sensitive Areas.

“No Go’ Areas within the study sites are to be avoided at all costs; these areas have a very high potential to support sensitive plant and animal species, but more importantly they are integral for ecosystem functioning within the general area and once removed will have a far reaching effect on the site and surrounding areas.

“Highly sensitive” areas are areas that could very possibly provide habitat for sensitive flora and fauna species, and have a role to play in ecosystem functioning but are not integral to this function. Removal or damage to these areas will only affect the habitat present on site and possibly surrounding habitats.

“Sensitive” areas could once again provide habitat for sensitive flora and fauna species and they may contribute to ecosystem functioning within the study area, they are not integral and removal of them will not affect the surrounding ecosystems.

“Minimal sensitive” areas have a small chance of containing sensitive flora and fauna species; however these areas have very little ecosystem functioning value on or off the study area.

“Favourable” areas are areas where construction of the solar PV panels will have the least effect on the prevailing habitat; these are therefore favourable in that sense only. “Least sensitive” and “Favourable” areas could be interchangeable from a flora and fauna perspective; however the distinction is made due to the influence of other factors such as proximity of national roads.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

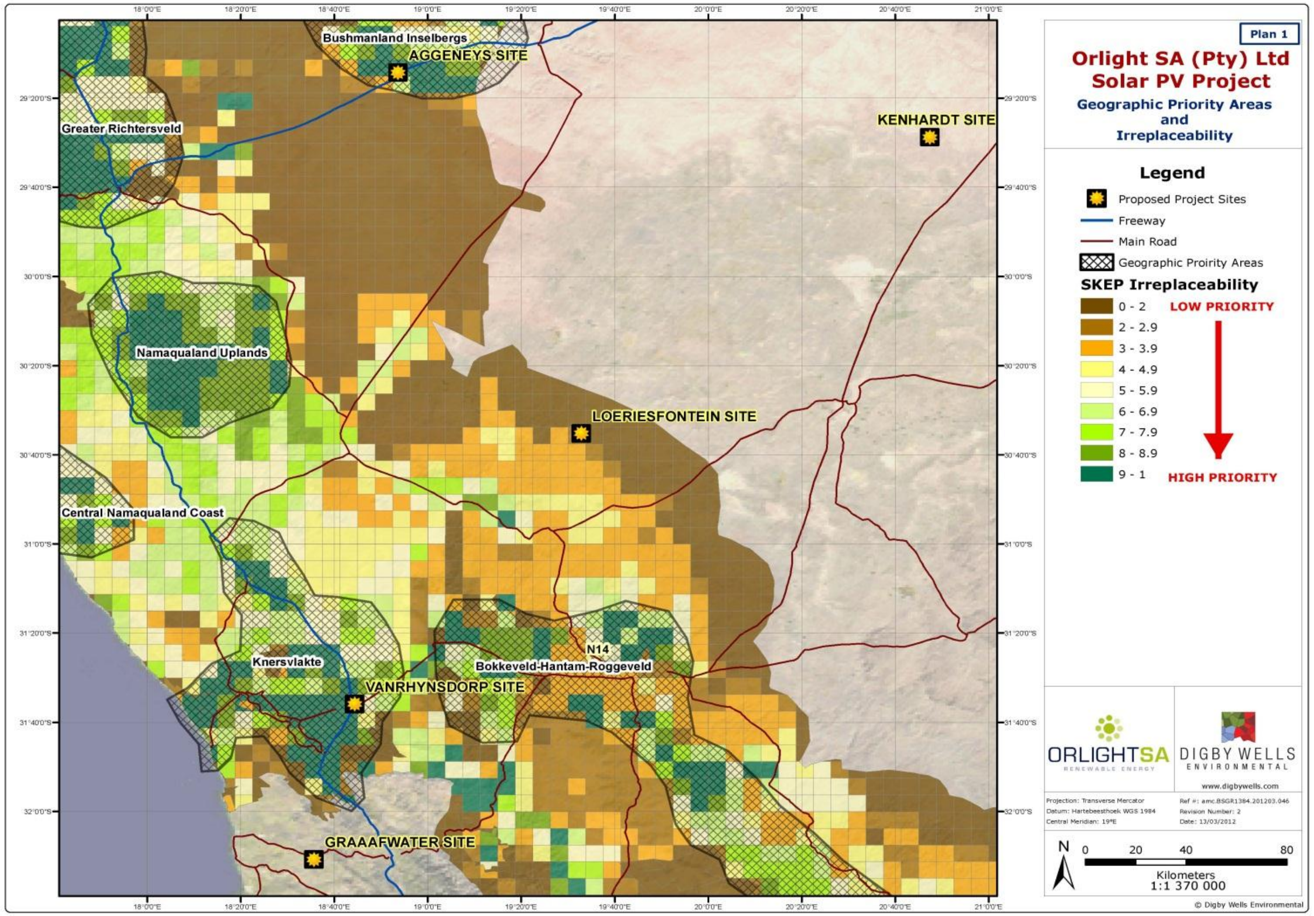


Figure 8-4: Geographical priority areas and Study area sensitivity (BGIS 2010) (SKEP 2010).

8.3.1 Aggeneys

The Aggeneys study area is situated approximately three kilometres east of the town of Aggeneys within the Nama Karoo. As a result the plant species encountered here have evolved to cope with the low amounts of moisture, even during the rainy season. A distinct division is evident between the dominating landscape types present within this study area, this also corresponds with the different plant communities that was delineated. The drainage line that flows from the north eastern corner of the project site to the central western boundary displayed the physical characteristics of these landscape types. A drainage line was the concave part of the habitat also called the valley bottom, here the sediment (sand) collects during rain events, creating favourable habitat for certain plants while excluding others (Figure 8-5). The grass species *Stipagrostis namaquensis* or River Bushman's grass dominated the grass sward of the drainage line, with the tree species *Boscia foetida* subsp. *foetida,* and *Prosopis glandulosa* occurring exclusively within the drainage line. This vegetation community is designated as a No go area because it is a regional sensitive landscape.

Figure 8-5: Drainage line, Aggeneys

The higher lying landscapes encountered on Aggeneys consisted of Ridges and relatively flat plains (Figure 8-7). The ridge areas are located to the central and northern sections of the study area. With the northern ridges (highly sensitive) forming part of the foot slopes of a mountain range. The grass sward here was dominated by *Stipagrostis obtusa* and *Stipagrostis uniplumis,* the shrub component was dominated by *Rhigozum trichotomum* and *Searsia (Rhus) undulata.* The tree *Boscia albitrunca* was also encountered here.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Figure 8-6: Aggeneys ridge areas

The plains present on the Aggeneys study area were sparsely covered by grass and shrub species, no tree species were encountered here. The dominant grass species were *Stipagrostis obtusa* and *Stipagrostis uniplumis,* and the shrub component was dominated by *Rhigozum trichotomum*. Within this vegetation three categories of sensitivity were broadly defined, the first was designated as minimal sensitivity (Figure 8-9) and cover areas that are situated adjacent to more sensitive areas.

The second category describes favourable areas, these are areas adjacent to human disturbances (the N14), and is affected by this disturbance, in ways such as grass burning next to the road, which is not currently evident but is highly probable.

The third category was least sensitive areas where prior disturbance (overgrazing) has impacted the plant species richness in a negative way, if compared to other areas within this study area (Figure 8-9).

Figure 8-7: Aggeneys plains

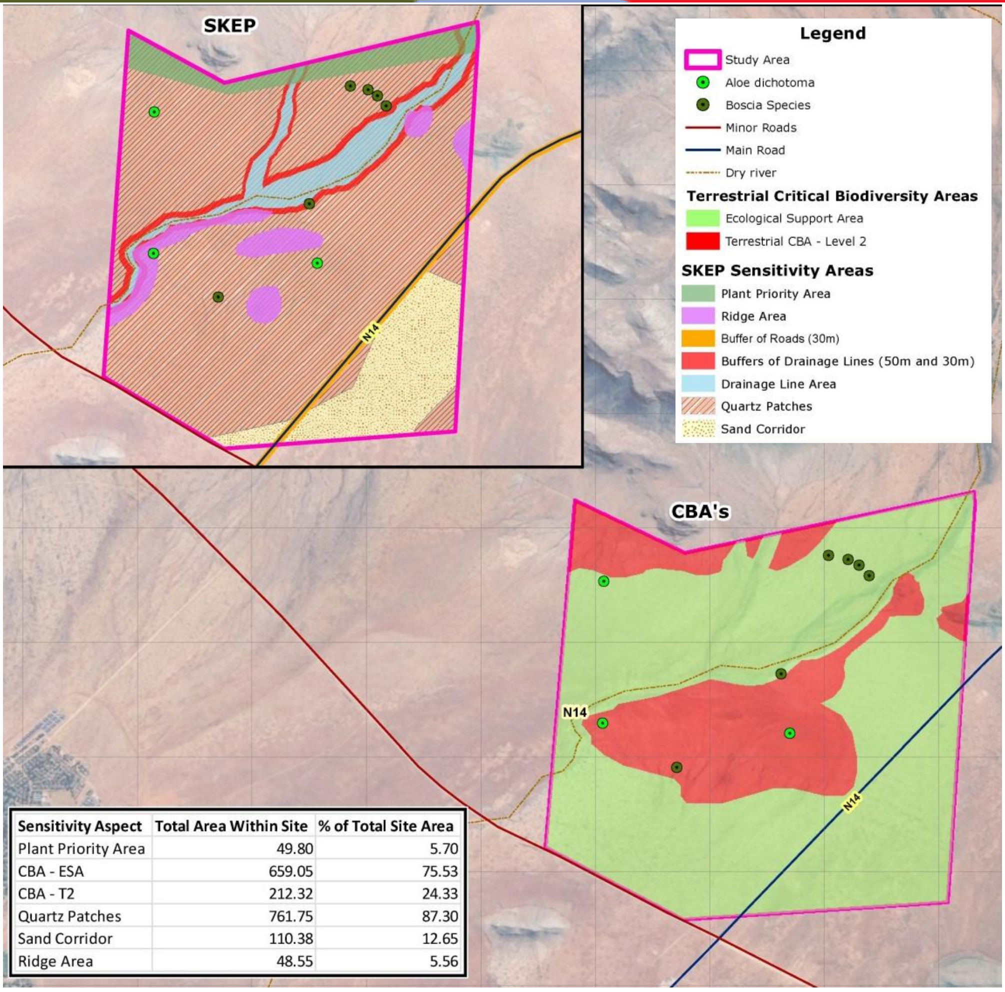
In relation to the CBA and SKEP data, the Aggeneys study areas is of importance for the following habitat components (Figure 8-9).

As far as vegetation is concerned the plains that occur on study area is of importance because of the presence of quartz gravel patches which are the preferred habitat for *Lithops* spp., or stone plants, demarcated as highly sensitive areas on Figure 8-9. The study area also falls within an area that is a local centre of biodiversity for amphibians (SKEP 2010), in addition the study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP 2010). Because of all the reasons mentioned above the No go areas of the drainage lines, or plant community 1 was delineated. As far as avifauna is concerned, the area is approximately 3 km away from an area that is described as a unique habitat for birds (SKEP 2010).

As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects (SKEP 2010). Furthermore, the study area falls within an area where eastern Bushmanland Quartz and Gravel patches are found.

CBA: Falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change (BGIS 2010).

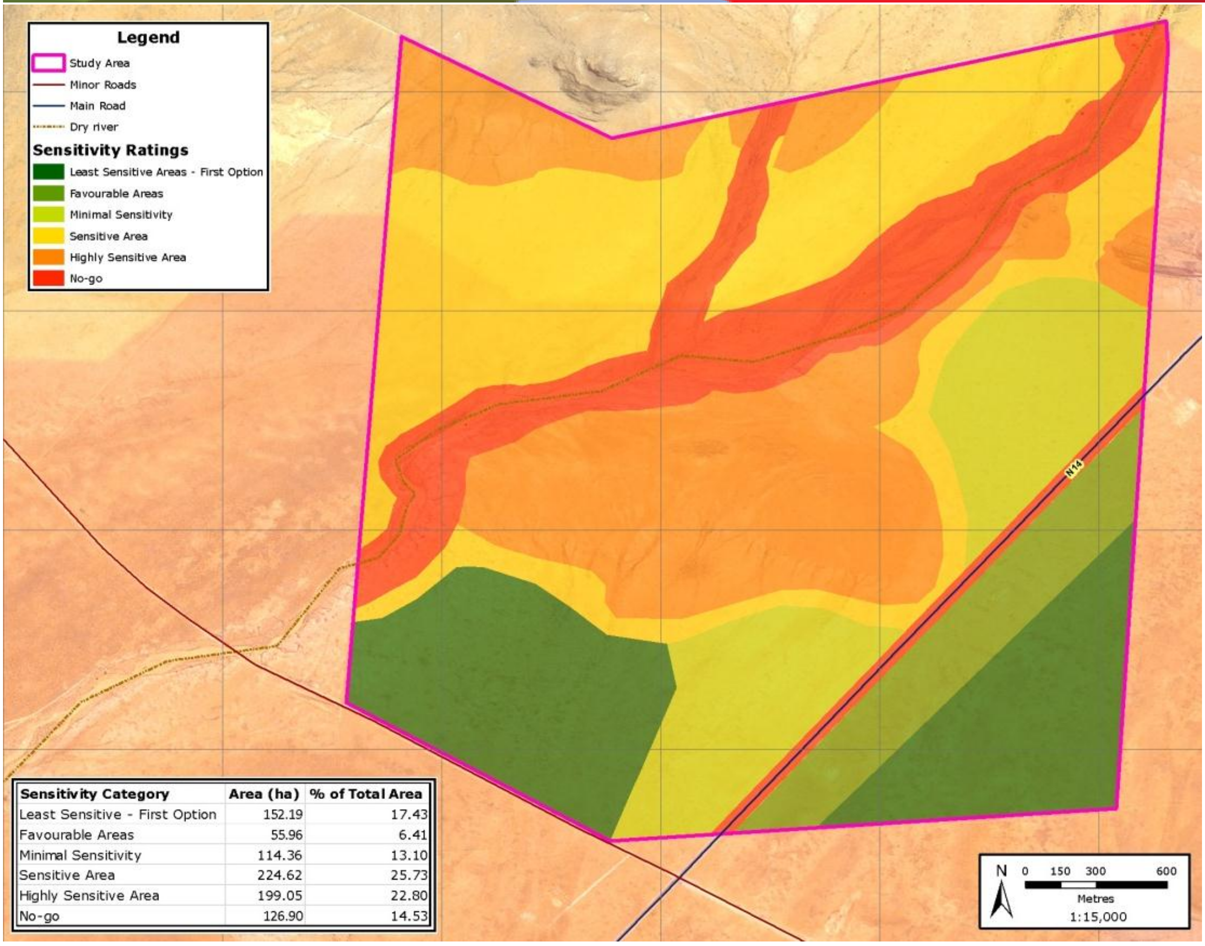
Entire area falls within the Geographic Priority area, specifically the Bushmanland Inselberg area. This priority area is located on the northeast margin of the Succulent Karoo Hotspot, just south of the Orange River and the border between Namibia and South Africa. The area is dominated by a plain of desert grasslands and peppered by Inselbergs, ancient rocky outcrops in irregular patterns. These Inselbergs are important refugia for plants and animals and act as stepping-stones for rock-loving species migrating east west across the sand-covered plains of Bushmanland. Isolation of populations has led to diversification within the dwarf succulent shrublands. In total, the 31,400-hectare area includes 429 plant species, of which 67 are found only in this hotspot and 87 are Red List species. Mining has impacted many of the Inselbergs, and a proposed opencast zinc mine may devastate most of the spectacularly diverse Gamsberg Inselberg, home to two endemics: *Conophytum ratum* and *Lithops dorotheae*. The Red Lark (*Certhilauda albescens*) is also an important endemic species, although severe overgrazing on communal lands in this part of the Bushmanland plateau is impacting its habitat. The study area has a Very High irreplaceability status (BGIS 2010). Namaqua Speckled Padloper was encountered According to the IUCN this tortoise is vulnerable. All these considerations and findings are integrated and described in Figure 8-8.



Sensitivity Aspect	Total Area Within Site	% of Total Site Area
Plant Priority Area	49.80	5.70
CBA - ESA	659.05	75.53
CBA - T2	212.32	24.33
Quartz Patches	761.75	87.30
Sand Corridor	110.38	12.65
Ridge Area	48.55	5.56

Figure 8-8: Sensitive Land Types, Aggeneys

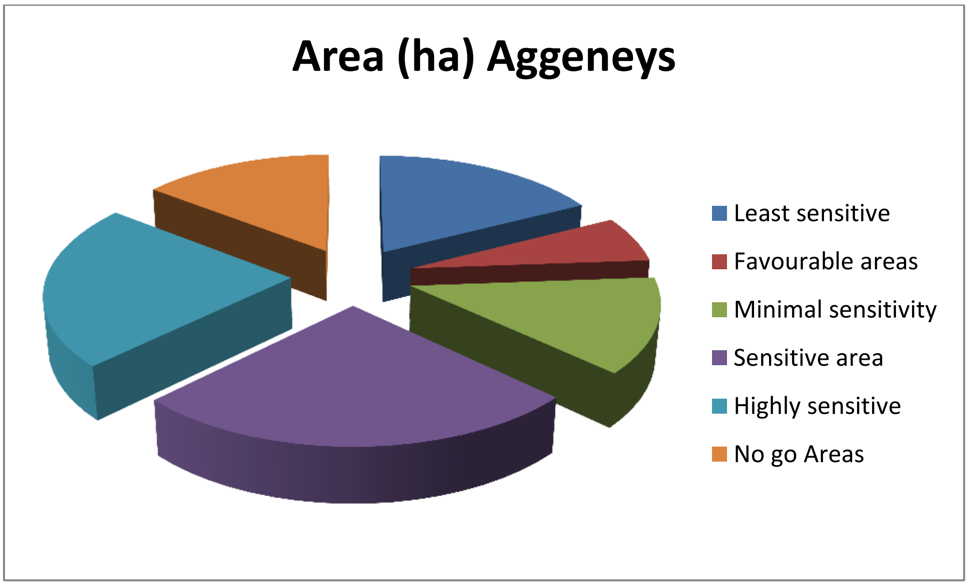
From these integrated findings, a sensitivity map was developed, as seen in Figure 8-9 below, describing the levels of sensitivity associated with the various areas within the study area. The NO Go area generally describes the drainage line running through the project area, areas of high sensitivity include the sensitive habitat of the ridges and areas which include protected and red data species. Least sensitive and favourable areas exist in southern parts of the study area.



Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	152.19	17.43
Favourable Areas	55.96	6.41
Minimal Sensitivity	114.36	13.10
Sensitive Area	224.62	25.73
Highly Sensitive Area	199.05	22.80
No-go	126.90	14.53

Figure 8-9: Sensitive Landscapes, Aggeneys

In Figure 8-10 the proportion of different sensitive or not sensitive areas are displayed. From the figure one can see that the sensitive areas on the study site combined with the highly sensitive areas account for almost have the study site. Very little favourable areas for development were encountered here.



confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Figure 8-10: Proportional display of sensitivity map.

8.3.2 Kenhardt

The Kenhardt study area was situated 37 kilometres south west of the town of Kenhardt in the Nama Karoo biome. The general land use in the areas is livestock farming and as expected displayed a low flora and fauna diversity for this time of the year, also partly due to it being the dry season.

This study area consists of a dominant shrub component which occurred predominantly within the drainage lines where it flows from the eastern (higher lying) part of the project site to the central western boundary (lower lying). The concave nature of the drainage lines at the valley bottoms were offset by the convex nature of the hill tops that interspersed the drainage lines. The deposition of sediment at the valley bottoms has resulted in the sandy nature of these areas, where conversely the removal of the sandy sediment (through water flow during rain events) on the hill tops has resulted in rocky and stony ground. A definite distinction is therefore present between these two habitat types from a flora perspective.

Towards the north western corner of the study area an artificial water source has been constructed within the drainage line. Water is pumped from the drainage line to support livestock. The effect of this water source is that tree species that rely on this water for survival have colonised the immediate surroundings, creating shade for livestock.

The grass sward of the drainage lines was limited but did contain *Enneapogon desvauxii, Aristida adscensionis Stipagrostis uniplumis* and *Stipagrostis ciliate.* The shrub component was dominated by *Rhigozum trichotomum Aptosimum spinescens* and *Salsola tuberculata.* And the tree component was dominated by *Prosopis glandulosa* and *Acacia karoo* occurring exclusively within the drainage line.

The higher lying landscapes encountered on Kenhardt consisted of gravelly hills dominated by *Stipagrostis obtusa* and *Stipagrostis uniplumis* and relatively flat plains.

Areas exist within this vegetation which have been disturbed. Overgrazing has impacted the plant species richness in a negative way, if compared to other areas within this study area. As a result these areas are considered less sensitive than he more natural areas which exhibited higher numbers of species.

Figure 8-11: Sandy soil inside drainage line.

The plains present on the Kenhardt study area was sparsely covered by grass and shrub species, no tree species were encountered here. The dominant grass species were *Stipagrostis obtusa* and *Stipagrostis uniplumis,* and the shrub component was dominated by *Salsola calluna* and *Eriocephalus spinescens*.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Figure 8-12: Gravel and rocky soil outside drainage line, Kenhardt

The Kenhardt site falls outside of CBAs and The SKEP management units. The ecological sensitive aspects for the Kenhardt site are illustrated in Figure 8-13 below.

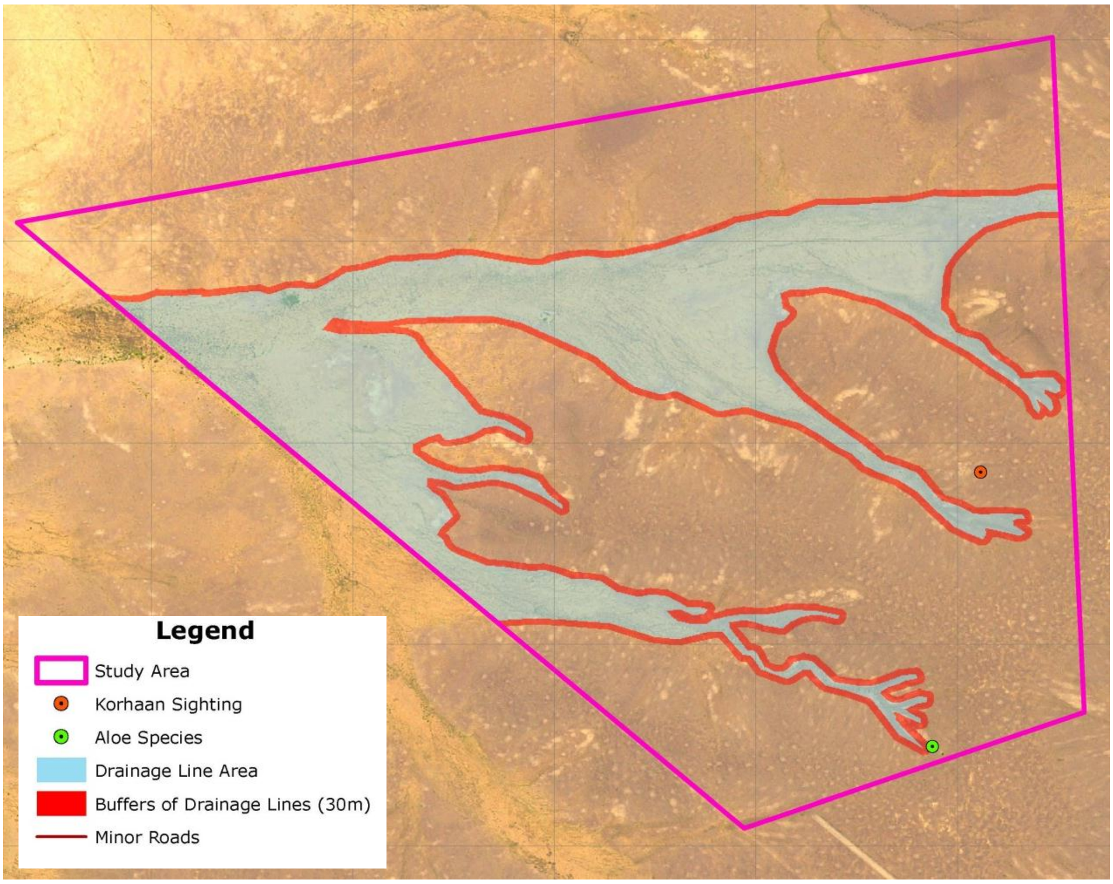


Figure 8-13: Sensitive Land types, Kenhardt

The Korhaan habitat and Aloe species identified are illustrated to be ecologically sensitive considerations. These further inform the sensitive areas defined in Figure 8-14.

The No Go areas described below follow the drainage line area and include these sensitive species habitats. The least sensitive area is defined to be the southernmost area of the site.

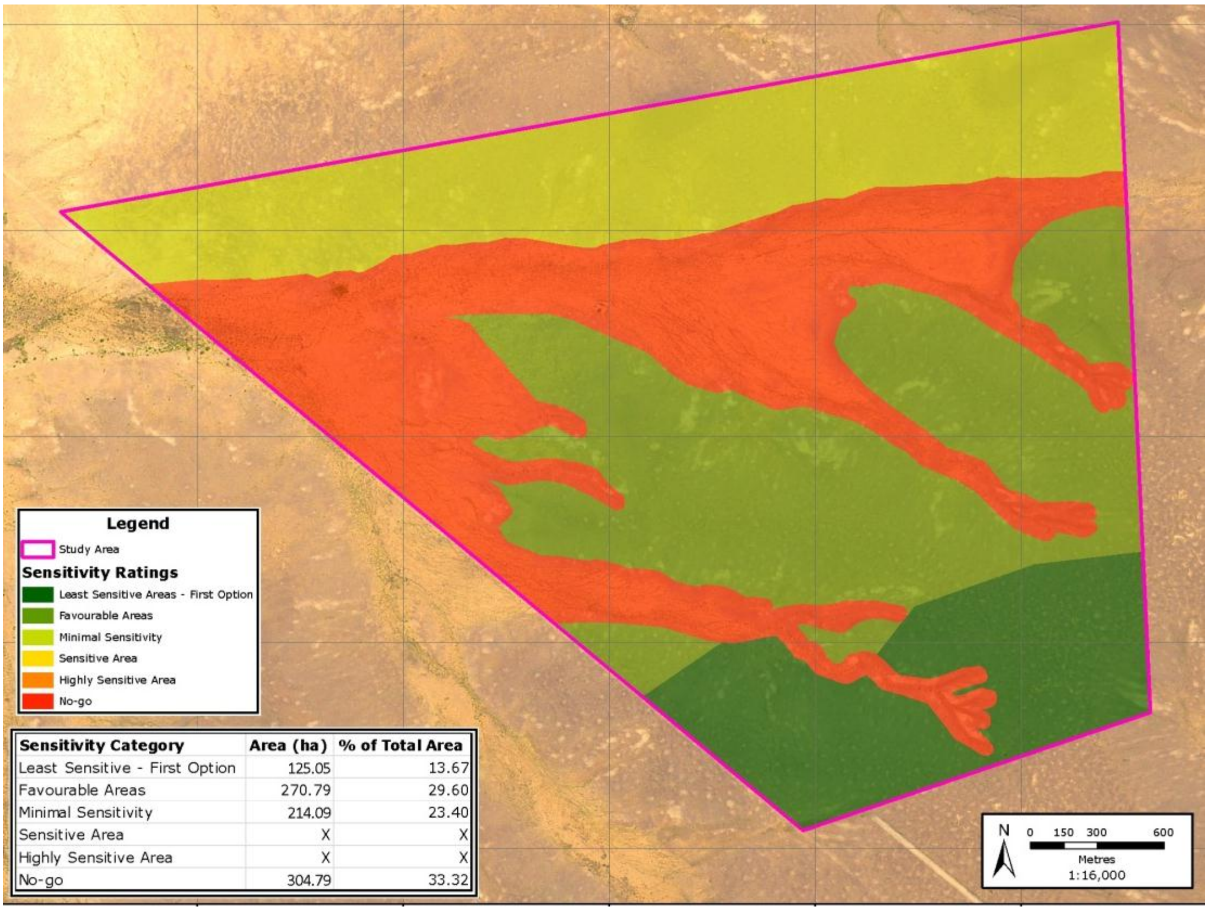


Figure 8-14: Sensitive Landscapes Kenhardt

The proportion of sensitive to not sensitive areas on the study site is indicated in Figure 8-15. From this figure one can see that the no go area within this study site is extensive but the minimal sensitive areas are also forming a large part of the study area.

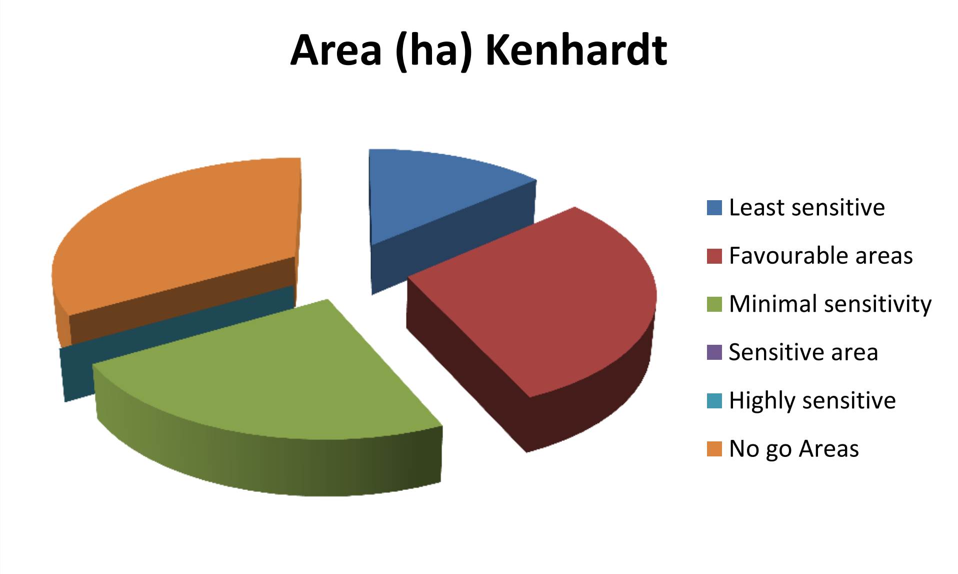


Figure 8-15: Proportional display of sensitivity map

8.3.3 Loeriesfontein

The Loeriesfontein study area is situated approximately 40 kilometres north of the town of Loeriesfontein, within the Succulent Karoo biome. The area has a number of drainage lines which have vegetation which is zoned and very different from the surrounding landscape vegetation. A network of drainage lines flow into the centre of the site and feed a linear central drainage line that generally runs in a southerly direction along a dirt road. The main channel of the drainage line is situated to the east of the dirt road with the majority of the tributaries emanating from the footslopes of the western mountain slopes. The drainage lines are the concave part of the habitat also called the valley bottoms. Here the sediment (sand) collects during rain events, creating favourable habitat for certain plants while excluding others (Figure 8-16) through niche differentiation. The vegetation and subsequently the animal life encountered in this area are strongly influenced by winter rain and fog.

Figure 8-16: Watercourse with deposited sediment, Loeriesfontein

The alluvial material present has created habitat for the grass species *Stipagrostis namaquensis,* the invasive shrub *Argemone ochroleuca* and the tree species *Prosopis glandulosa* and *Tamarisk ramosissima,* also a weed species*.* The graminoids *Scirpoides (Scirpus) dioecus, Juncus punctorius, Cyperus laevigatus, Cyperus marginatus* and*, Phragmites australis* were exclusively encountered within the drainage lines (Figure 8-17)*.*

Figure 8-17: Loeriesfontein drainage line east of the road

The hilltops, mountain footslopes (western boundary) and open plains that intersperse with the drainage lines consisted of a gravelly to rocky substrate, mainly due to surface water runoff (Figure 8-18). The shrubs *Ruschia intricata, Salsola tuberculata*, *Eriocephalus spinescens* and *Mesembryanthemum (Brownanthus) ciliatum*, were commonly found here, with the grass cover was diminished due to grazing pressure and seasonality. Key grass species were *Stipagrostis obtusa*, *Stipagrostis uniplumis, Stipagrostis ciliata*, *Stipagrostis namaquensis* and *Enneapogon scaber.* No tree species were found in these habitats, although *Aloe falcata* or the Vanrhynsdorp Aloe, was encountered in the northern corner of the study area, as illustrated in Figure 8-20.

Figure 8-18: Loeriesfontein plains

This study area falls outside of the CBAs and SKEP areas (Figure 8-21) (SKEP 2010), (BGIS 2010).

During the dry season field work one protected plant species was encountered, *Hoodia gordonii*, as seen in Figure 8-19 below, the implications of this on site selection will be a potential buffer zone around this species as prescribed by the authorities. The location of this species is also described in Figure 8-20.

Figure 8-19: Hoodia gordonii

All the above mentioned findings are described in the sensitive landscapes types which are illustrate in Figure 8-20 below.

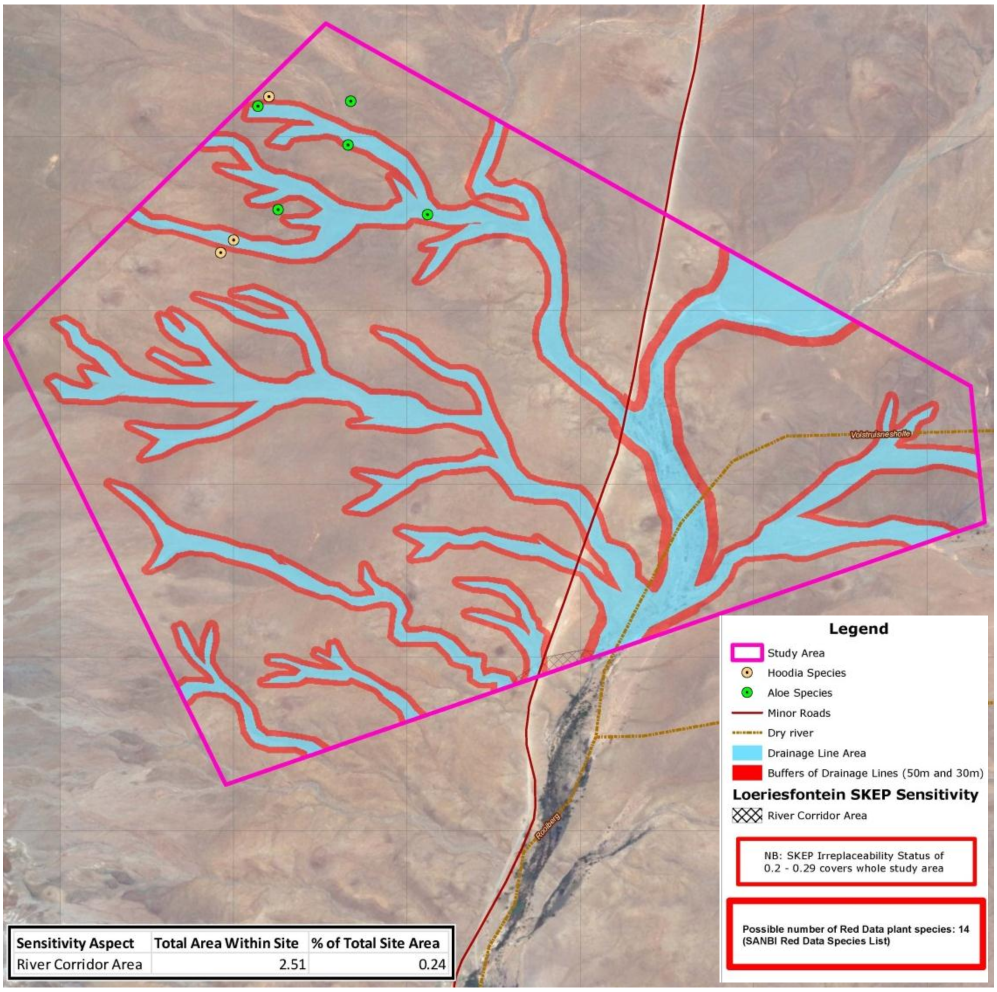
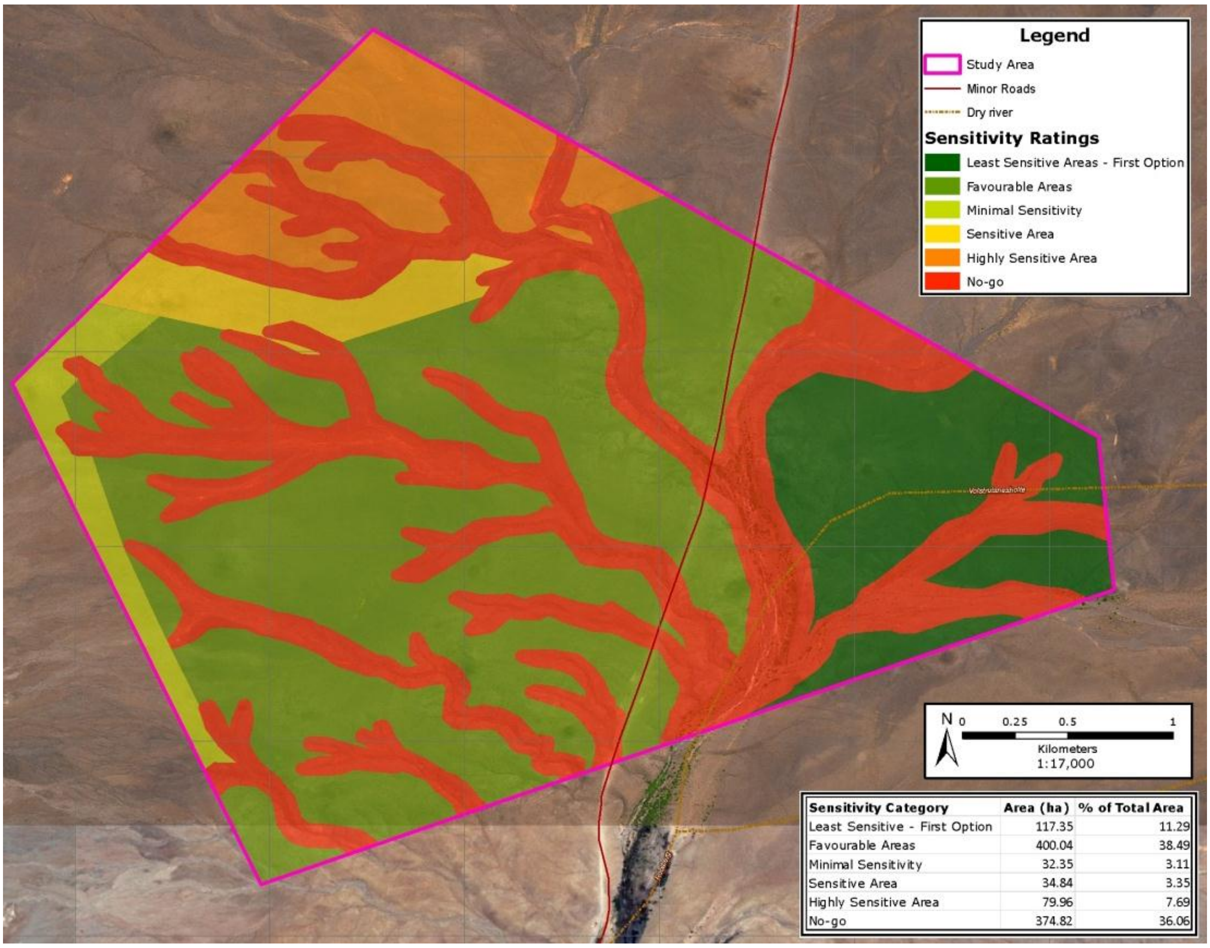


Figure 8-20: Sensitive Land types, Loeriesfontein

From this, areas and their sensitivity ratings were developed and are described in Figure 8-21 below. The sensitive aspects are described as No Go areas, while the areas of land in between are defined as favourable and least sensitive. The Northern area of the site, in which the Hoodia and Aloe species were found is defined as Highly sensitive.



Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	117.35	11.29
Favourable Areas	400.04	38.49
Minimal Sensitivity	32.35	3.11
Sensitive Area	34.84	3.35
Highly Sensitive Area	79.96	7.69
No-go	374.82	36.06

Figure 8-21: Sensitive Landscapes, Loeriesfontein

In Figure 8-22 the large proportion of No go areas on the Loeriesfontein study site is displayed and compared to the other study area sensitivity ratings. There is however a large proportion of favourable areas also available.

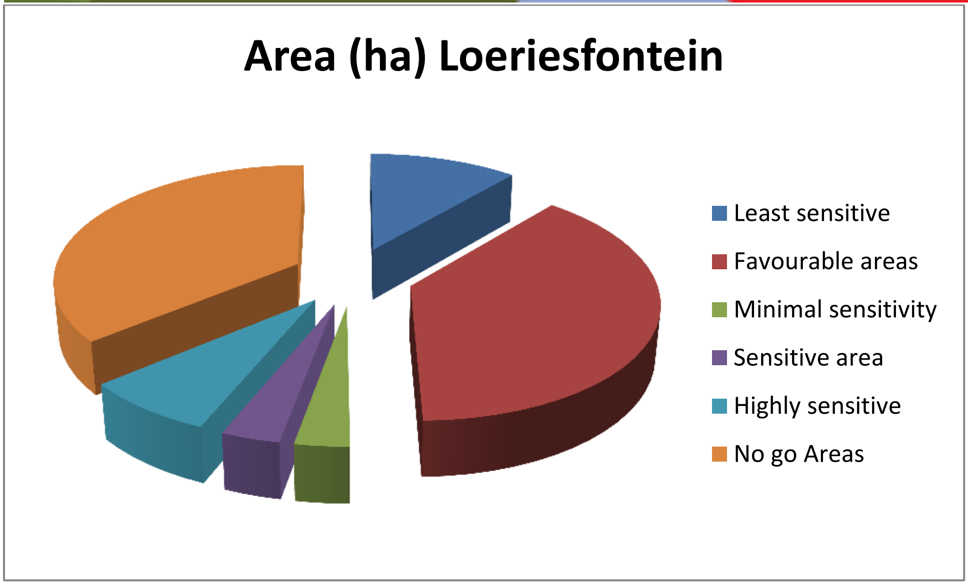


Figure 8-22: Proportional display of sensitivity map

8.3.4 Vanrhynsdorp

The Vanrhynsdorp study area is situated to the north of the town of Vanrhynsdorp and falls within the Succulent Karoo biome. Evidence of misuse was found on site where the study area was utilised as a thoroughfare by local people. In addition to this illegal dumping was also taking place. As far as important landscapes are concerned, this study area consisted only of rolling plains with sets of heuweltjies. The latter are initially caused by harvester termites *(Microhodotermes viator*) that construct their nests here and accumulate plant matter and store this in their burrows (Lovegrove 2003). The accumulated organic material creates a heuweltjie that is different in soil characteristics (such as nutrient availability) than the surrounding areas. This creates a microhabitat that consists of a different species mix that the surrounding areas (Lovegrove 2003). These are thus ecologically important landscape features. Depicted in Figure 8-23 one can see the side of a heuweltjie that is bare, and the top that has a different vegetation species mix that the surrounding landscape.

Molerats (*Cryptomys hottentotus*) are known to nest in these heuweltjies and store corms and bulbs in them (Lovegrove 2003). This could explain the burrows on some of these areas such as in Figure 8-24.

Figure 8-23: Heuweltjie, Vanrhynsdorp

The heuweltjies differ in species composition and many will be covered on grass (Figure 8-24).

Figure 8-24: Heuweltjie covered in grass, Vanrhynsdorp

Vanrhynsdorp study area in relation to CBA and SKEP:

As far as mammals are concerned the area does not fall within, but is about 3 km away from, the mapped distribution of Grant's golden mole (the mole is endemic to this area) (SKEP 2010).

Invertebrate sensitivity is low, however the study site falls within an area that is described as an area of endemism, a local centre of biodiversity, a unique habitat, is imperative for ecological processes and is a threatened habitat for insects (SKEP 2010).

CBA: The are falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed (Figure 8-26) (BGIS 2010). These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change (BGIS 2010). The northern part of the study area was found to be a part of the critical biodiversity areas.

Entire area falls within the Geographic Priority area, specifically the Knersvlakte. This is an extensive dry plain in the centre of the Succulent Karoo hotspot bounded on the east by the Bokkeveld Mountains. Fields of white quartz pebbles cover the gently rolling hills of the area and are associated with unique dwarf succulent plants. The 48,500-hectare area is extremely rich in plant species, with a total of 1,324 species, 266 of which are Succulent Karoo endemics. Within the hotspot, this priority area has the greatest percentage of threatened endemics with 128 species being listed on the Red List. Small-scale mining for gypsum, diamonds and limestone/marble, overgrazing and the illegal harvesting of rare and spectacular species for national and foreign plant collections are the greatest pressures in this area (SKEP 2010). Sensitive landscape types for the Vanrhynsdorp site are described in Figure 8-25 below. As seen in the plan, the site does not possess high levels of ecological sensitivity.

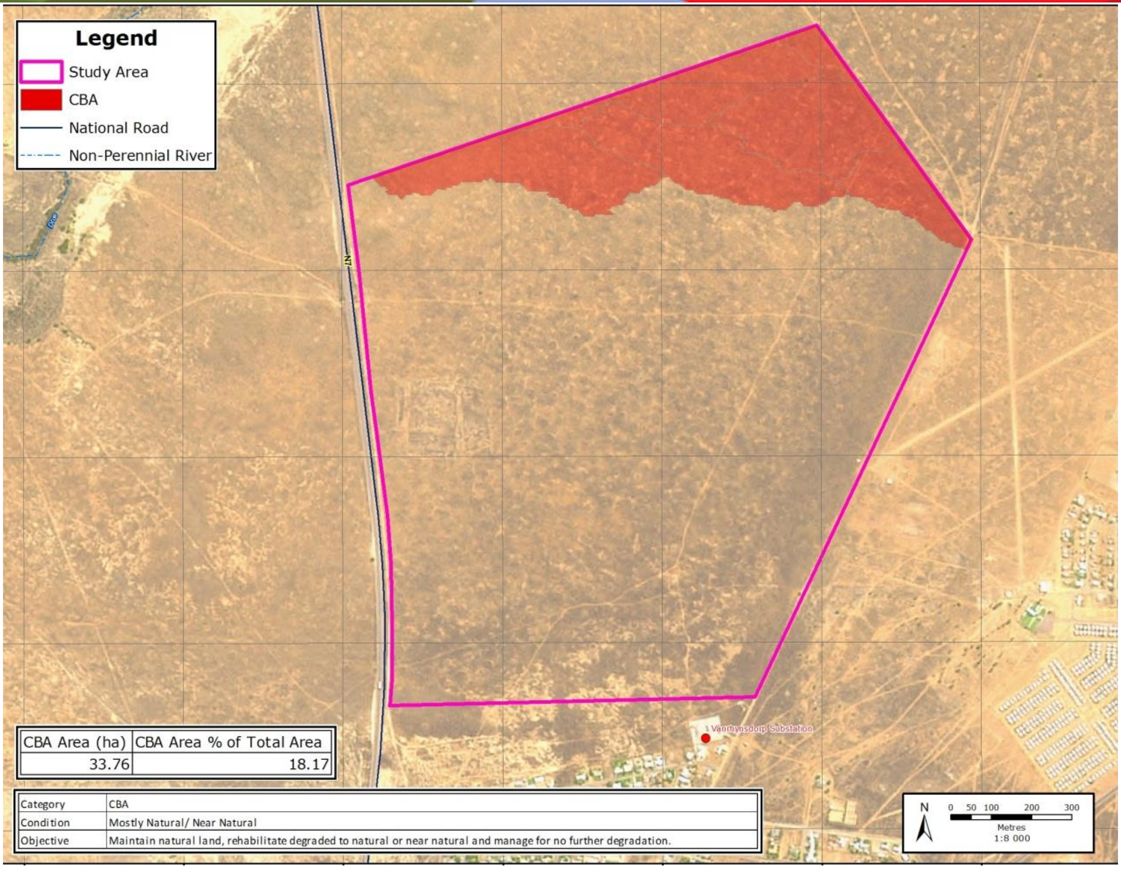
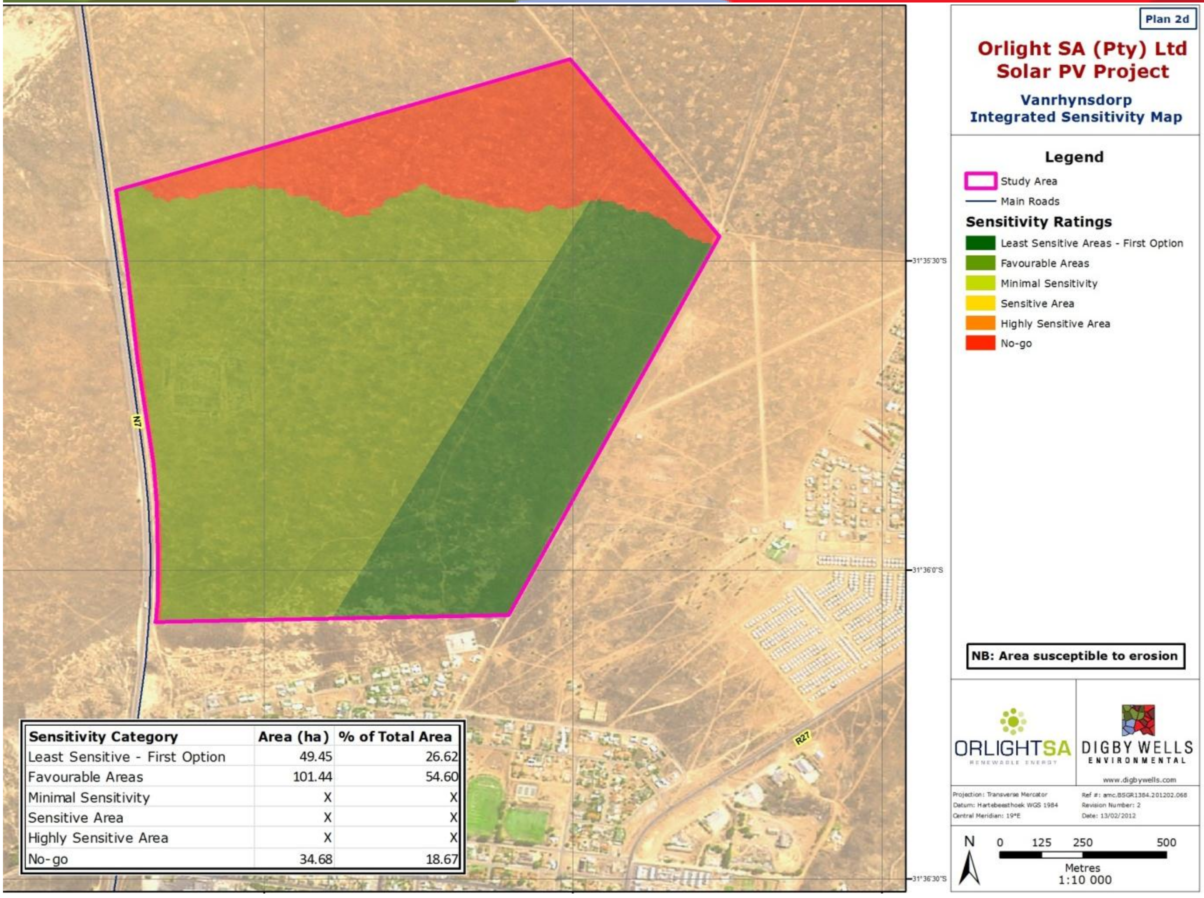


Figure 8-25: CBA Sensitive land types, Vanrhynsdorp

In consideration of all the above mentioned aspects Sensitive areas were defined. These are described in Figure 8-26 below. The site possesses no go, least sensitive and favourable areas.



Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	49.45	26.62
Favourable Areas	101.44	54.60
Minimal Sensitivity	X	X
Sensitive Area	X	X
Highly Sensitive Area	X	X
No-go	34.68	18.67

Figure 8-26: Sensitive Areas, Vanrhynsdorp

In Figure 8-27 the large area that is seen as favourable for development due to its low sensitivity is displayed and compared to the rest of the site's sensitivity ratings.

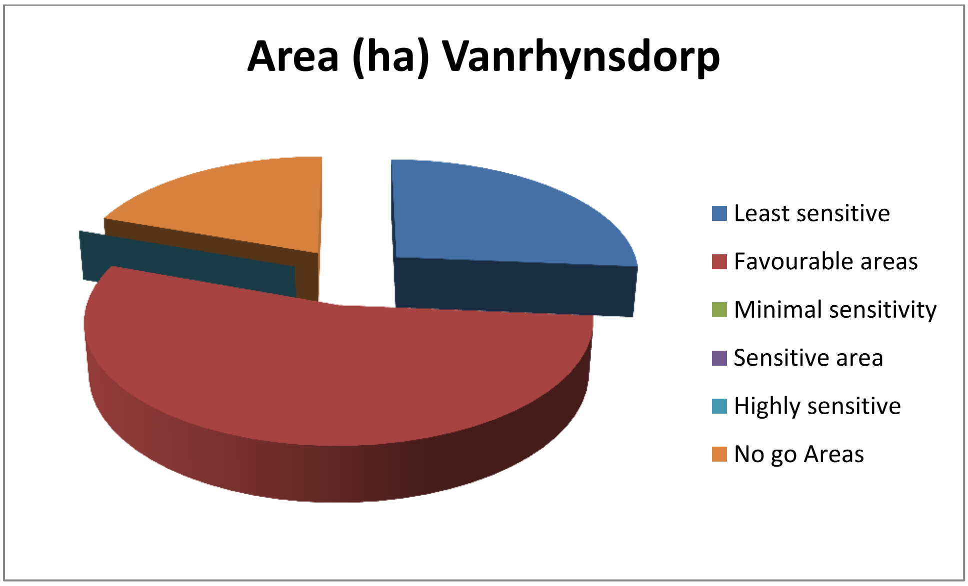


Figure 8-27: Proportional display of sensitivity map.

8.3.5 Graafwater

The Graafwater study area is located about a kilometre south of the town of Graafwater, and falls within the Fynbos biome (Figure 8-28). During field investigations it was found that previous and current land use has had a detrimental effect of the vegetation composition of the study area. Large tracts of natural fynbos have been removed by heavy machinery to facilitate rooibos plantations. Access to the site was via a dirt road that split the study area in half, to the east of this road approximately 70% of the surface area has been disturbed, and to the west of the road approximately 45% of the area has been disturbed. The important landscape feature encountered on Graafwater was the natural fynbos located on hillslopes that were found on the eastern border and the north western corner of the study area. Within the strandfynbos vegetation the dominant grass species encountered were *Ehrharta longiflora* (Oat seed grass), *Centropodia glauca* (Gha grass) and *Phalaris minor* (Small Canary grass) and *Ehrharta calycina* (Common ehrharta). Dominant shrub species encountered were *Metalasia fastigiata* (Pink bristle bush), *Euryops speciosissimus* (Giant resinbush), *Atriplex nummularia* (Old man's salt Bush) and *Salsola calluna* (Swartganna). Dominant restio encountered was *Elegia capensis* (Fonteinriet) and. The few tree species that were encountered included *Acacia melanoxylon* (Black Wattle) and *Prosopis glandulosa* (Mesquite).

Figure 8-28: Sandfynbos, Graafwater

In relation to CBA, the study area falls inside CBA fine scale areas (BGIS 2010). The Graafwater study area falls within an area that is identified as being important in terms of insect biodiversity but there in minimal information available (SKEP 2010). The sensitive ecological aspects of the site are described in Figure 8-29 below. These are illustrated to be potentially extensive.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

- Namaqua Speckled Padloper was encountered. According to the IUCN this tortoise is vulnerable.

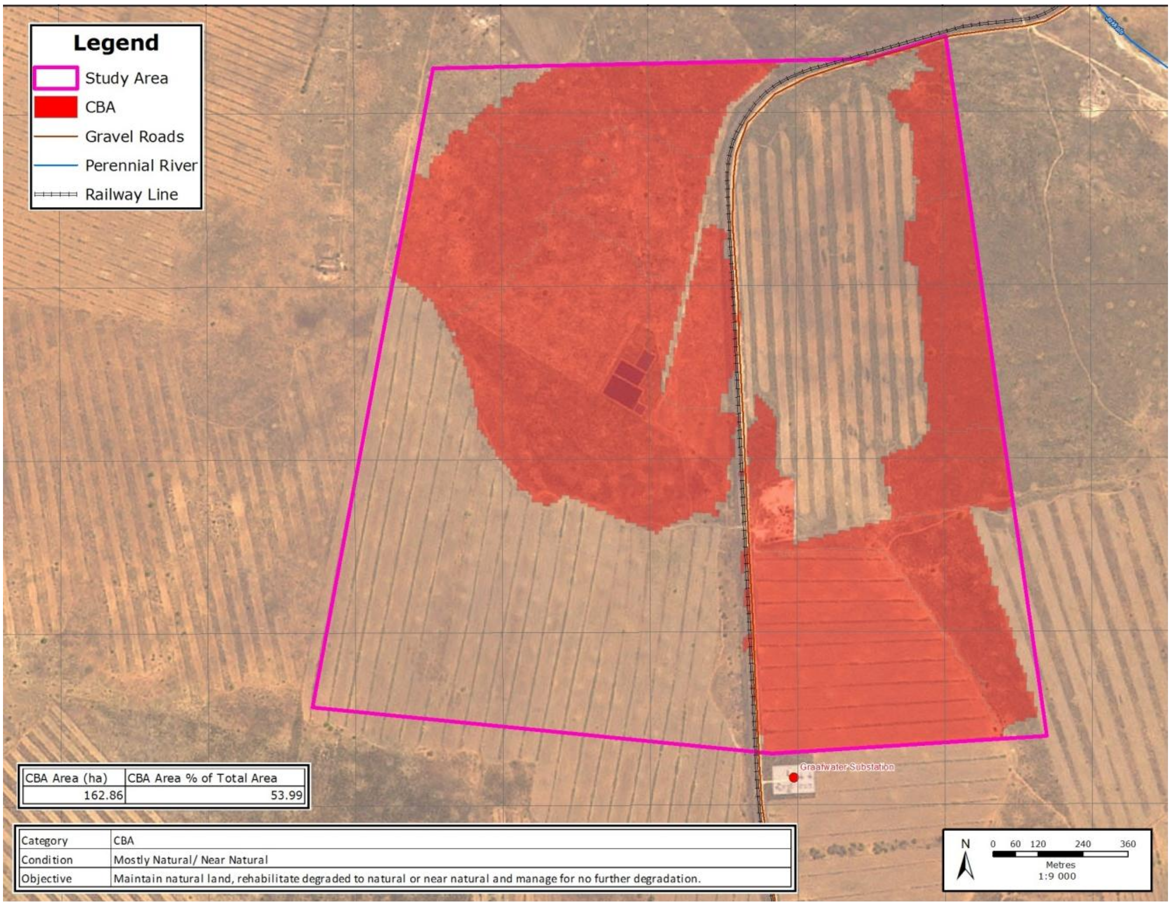


Figure 8-29: Sensitive land types, Graafwater

Areas of concern are depicted in (Figure 8-30), from this one can see that the study area is regarded as highly sensitive and least sensitive, almost in equal parts. This is due to the fact that these are ploughed fields, and relatively natural habitat that remain. The ploughed fields are seen as a possible breeding areas for insects, however this habitat type is available in abundance outside the study area. The infrastructure placement is currently only in the north eastern corner ploughed field.

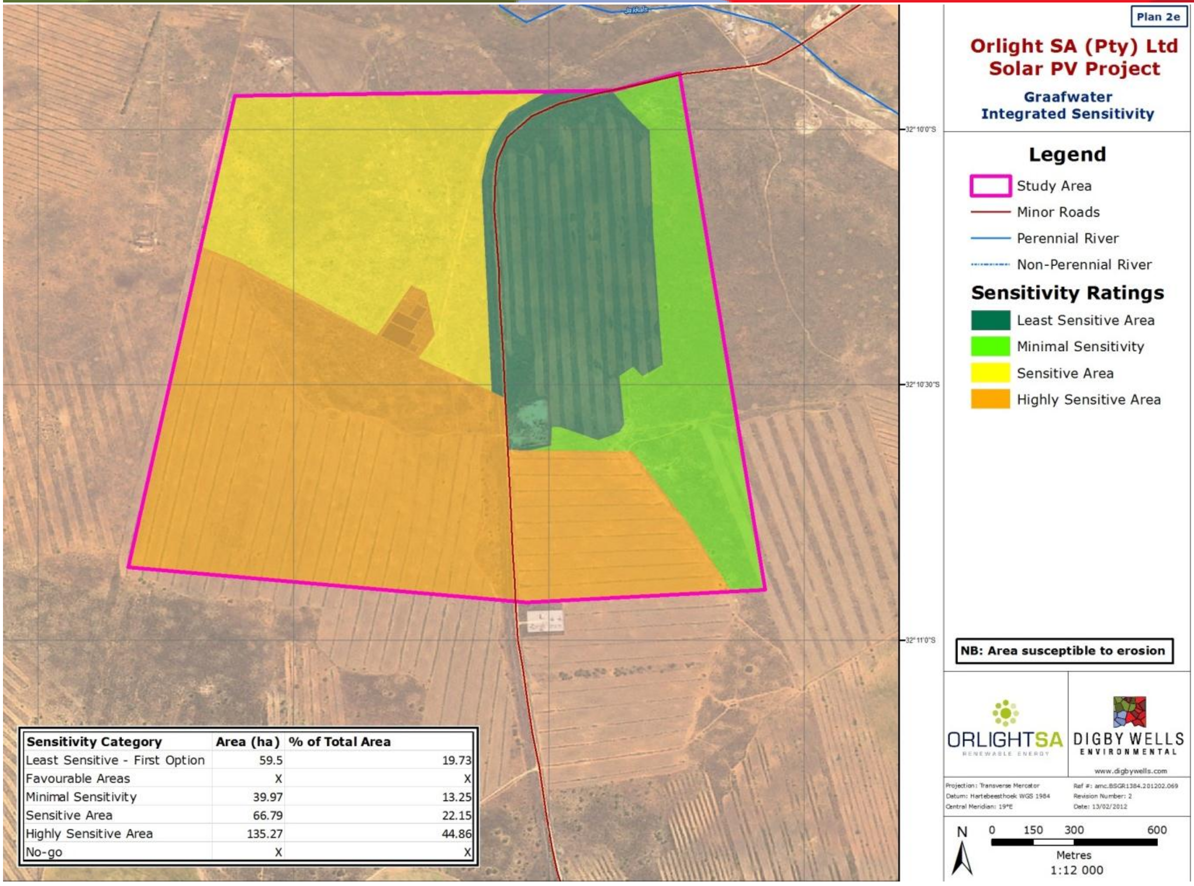


Figure 8-30: Graafwater sensitive landscapes

In Figure 8-31, large area that is seen as sensitive area are displayed and compared to the highly sensitive and least sensitive area on the study site.

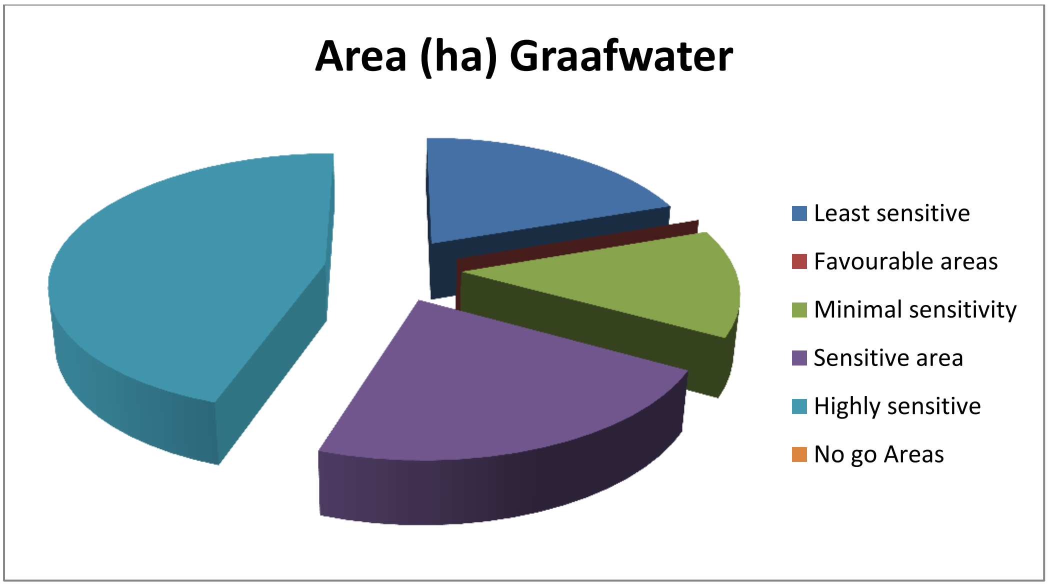


Figure 8-31: Proportional display of sensitivity map.

9 KNOWLEDGE GAPS

The flora and fauna field survey was conducted during the dry season of the five study sites (December). The implication of this was that many of the plant species in the summer rainfall areas were dormant during this period and the species that were present were not easily identifiable. Theoretically sampling of plants should be completed over a full annual cycle. The most appropriate season for flora surveying, if a full cycle is not possible, is August to September. The implication of this timing is that the confidence in the data collected for both the flora and the fauna components of the study is medium to low.

10 SUMMARY

Table 10-1, and Figure 10-1 presents the different sensitivity categories and their relative areas and percentages.

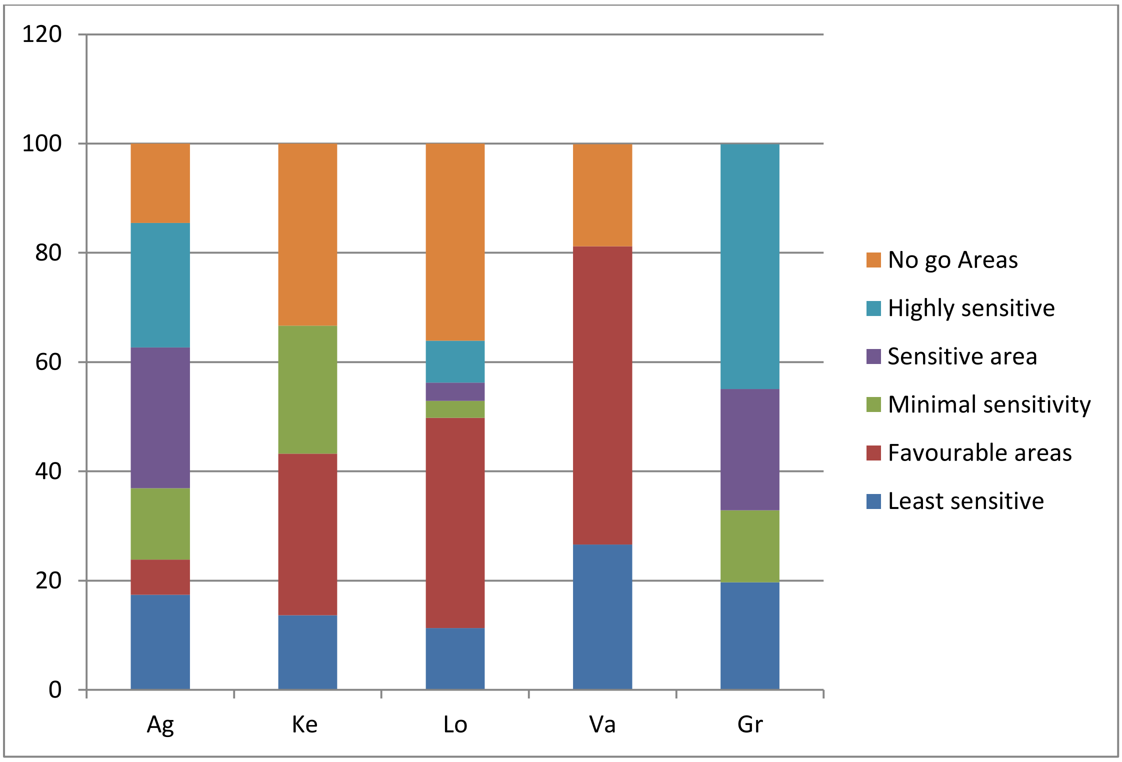


Figure 10-1: Comparison between the sensitivity rating of the five study areas.

The Loeriesfontein, Aggeneys Kenhardt and Graafwater study areas are described as having the highest percentages of No go, Highly sensitive and Sensitive areas, with Vanrhynsdorp and having the least amount of these sensitive habitats.

Table 10-1: Comparison between the five study areas and associated sensitivity percentages.

Sensitive aspect	Ag	Ke	Lo	Va	Gr
Least sensitive	17.43	13.67	11.29	**26.6**	19.7
Favourable areas	6.41	29.6	38.49	**54.6**	0
Minimal sensitivity	13.1	**23.4**	3.11	0	13.2
Sensitive area	**25.73**	0	3.35	0	22.15
Highly sensitive	22.8	0	7.69	0	**44.86**
No go Areas	14.53	33.32	**36.06**	18.67	0

Note: Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp.

The quality and quantity of the habitat available within each of the five study areas will determine the sensitivity of each and therefore the preferred areas for construction will have the least amount of No go, Highly sensitive and Sensitive habitat. The No go, Highly sensitive and Sensitive designation is seen as having highest probability of containing protected plant species, but more importantly contributing the most towards ecosystem functioning. Taking the data in Table 10-1 and Table 10-2 into consideration, Vanrhynsdorp and Kenhardt study areas displayed the largest areas suitable for development.

The quality of the available habitat types present within each of the study areas was evaluated through the potential of these habitat types to contain plant species, and the contribution the area makes to ecosystems functioning. Presented in Table 10-2, is the determination of each habitat type, with Aggeneys, Loeriesfontein and Graafwater having the three highest percentages of all areas unsuitable for development (sensitive), however only Aggeneys displayed a percentage of unsuitable higher than suitable. All the other study sites, displayed a higher percentage of areas suitable for development than areas unsuitable for development (Table 10-2).

Table 10-2: Quality of each study area

	Sensitive aspect	**Ag**	**Ke**	**Lo**	**Va**	**Gr**
Unsuitable for development	Sensitive area	25.73	0	3.35	0	22.15
	Highly sensitive	22.8	0	7.69	0	44.86
	No go Areas	14.53	33.32	36.06	18.67	0
Totals		**63.06**	**33.32**	**47.1**	**18.67**	**67.01**
Suitable for development	Least sensitive	17.43	13.67	11.29	26.6	19.7
	Favourable areas	6.41	29.6	38.49	54.6	0
	Minimal sensitivity	13.1	23.4	3.11	0	13.2
Totals		**36.94**	**66.67**	**52.89**	**81.2**	**32.9**

Note: Ag = Aggeneys, Ke = Kenhardt. Lo = Loeriesfontein, Gr = Graafwater, Va = Vanrhynsdorp.

11 IMPACT ASSESSMENT

The methodology employed for the EIA is divided into two distinct phases, namely: (i) impact identification; and (ii) impact assessment.

11.1 Impact identification

Impact identification is performed by use of an input and output model, which serves to guide the assessor in assessing all the potential instances of ecological, socio-economic and cultural change, pollution and resource consumption that may be associated with the activities required during the construction, operational, closure and post-closure phases of the project.

Outputs may generally be described as any changes to the biophysical, socio-economic and cultural environments, both positive and negative in nature, and also include the product and waste produced by the activity.

During consultation with I&APs, perceived impacts were identified. These perceived impacts will become part of the impact assessment and significance rating in order to differentiate between probable impacts and perceived impacts.

A non-exhaustive list of activities that should be considered in the identification of potential positive and negative impacts via the input-output model is described in Table 11-1.

Table 11-1: Project activities

Phase	Activities	Description (if applicable)
Construction	Job creation	Approximately four direct job opportunities will be created per MW generation capacity during the construction phase. There will be opportunities for skills development.
	Construction workers	Accommodation will be provided in the town closest to the project site. Construction workers will be transported to site in buses on a daily basis. Temporary kitchen and ablution facilities will be provided on-site.
	Transportation of construction materials	The components for the Solar PV Power Plants will be transported to site, in sections, by road. Civil engineering construction equipment (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) will be transported to site. The transportation routes need to be confirmed. Use will be made of existing local

Phase	Activities	Description (if applicable)
		roads to access the sites.
	4. Internal access roads and vehicular activities on site	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.
	5. Site preparation	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.
	6. Access control and fencing	
	Establishment of construction equipment camps	A construction equipment camp will need to be established within the project site. The purpose of this camp is to confine activities and storage of equipment to limit the potential impacts associated with this phase of the project. This will include a lay-down area for assembly purposes, as well the general placement and storage of construction equipment, vehicles and materials.
	Installation of PV panels	The panels will be sited a certain distance away from each other to prevent shadows falling on adjacent panels. Panel foundation holes will be excavated to a depth less than 2 m, after which concrete foundations will be poured (where necessary) and left to cure. Underground cables will require the excavation of trenches of approximately

Phase	Activities	Description (if applicable)
		40 cm to 100 cm deep within which they will be laid.
	Establishment of ancillary infrastructure	Ancillary infrastructure will include invertors, a security room and substations.
	Undertake site remediation	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitated.
Operation	Job creation	Approximately one direct employment opportunity per MW generation capacity will be created during the operational phase. There will be opportunities for skills development.
	Generation of renewable energy	The electricity that is generated from the PV panels will be stepped up through the on-site inverters and transformers at the on-site switching station.
	Access control and fencing	
	Plant maintenance	Maintenance will include the replacement of damaged panels and the cleaning of panels, either by water or pressurised air.
Decommissioning	Job creation	Limited temporary job opportunities will be created during the decommissioning phase of the projects.
	Construction workers	Accommodation will be provided in the town closest the project site.
	Site preparation	This will include confirming the integrity of the access to the site for the decommissioning equipment.
	Disassemble components	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible0 or disposed of in accordance with regulatory

Phase	Activities	Description (if applicable)
		requirements.

11.2 Impact significance assessment

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the input and output model. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where Consequence = Severity + Spatial Scale + Duration

And Probability = Likelihood of an impact occurring

The severity, spatial scale, duration and probability of an impact occurring are assigned a rating out of seven as indicated in Table 11-2. The matrix calculates an overall significance rating out of 147. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP.

The significance of an impact is determined by reference the significance rating to the probability consequence matrix shown in Table 11-3 after which it is categorised into one of four categories, as indicated in Table 11-4.

Table 11-2: Impact assessment parameter ratings

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	International The effect will occur across international borders.	Permanent without mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/definite The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	National Will affect the entire country.	Permanent with mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Provincial/regional Will affect the entire province or region.	Project life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Municipal area Will affect the whole municipal area.	Long term 6 to 15 years.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	On-going social issues. Damage to items of cultural significance.	Local Local extending only as far as the development site area.	Medium term 1 to 5 years.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with or without help of external consultants.	Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year,	Rare or improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact occurring is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance. Will have no impact on the environment.	Low-level repairable damage to commonplace structures.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely Expected never to happen.

Table 11-3: Probability consequence matrix

Probability / Likelihood	Consequence (severity + scale + duration)								
	1	3	5	7	9	11	15	18	21
1	1	3	5	7	9	11	15	18	21
2	2	6	10	14	18	22	30	36	42
3	3	9	15	21	27	33	45	54	63
4	4	12	20	28	36	44	60	72	84
5	5	15	25	35	45	55	75	90	105
6	6	18	30	42	54	66	90	108	126
7	7	21	35	49	63	77	105	126	147

Table 11-4: Significance summary table

High	**108- 147**	
Medium-High	**73 - 107**	
Medium-Low	**36 - 72**	
Low	**0 - 35**	

11.3 Aggeneys

11.3.1 Construction phase

Impact 4

AGGENEYS					
Aspect	Internal access roads and vehicular activities on site				
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.				
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid no go and sensitive areas as stipulated by the sensitivity maps. Vegetate and irrigate open areas to limit erosion, but take care not to cause erosion by irrigating. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines.				
Impact Significance (Pre-Mitigation)	Severity 5	Spatial Scale 3	Duration 3	Probability 7	77 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.				

Impact 5

AGGENEYS	
Aspect	Site preparation
Potential Impact	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only and completely avoid no go and sensitive areas as stipulated by the sensitivity maps. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk

	of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines and completely avoid no go and sensitive areas as stipulated by the sensitivity maps. Removal of vegetation must be followed closely by rehabilitation by specialists qualified in this vegetation type's remediation. The general condition of the veld is currently in a pioneer/sub-climax stage, these are the first stages in succession. Pioneer stage facilitates the emergence of the sub-climax stage by improving growth conditions through decreasing run-off, increasing infiltration and increasing the build-up of organic material. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this. Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species.				
Impact Significance (Pre-Mitigation)	Severity 5	Spatial Scale 3	Duration 4	Probability 7	84 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 3	Probability 7	42 (medium-low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 6

AGGENEYS	
Aspect	**Access control and fencing**
Potential Impact	Access control will mean the construction of fences.
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move

	between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 10

AGGENEYS					
Aspect	**Undertake site remediation**				
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitate where practical.				
Mitigation Required	Make use of indigenous, local plant species.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.3.2 Decommissioning:

Impact 18

AGGENEYS	
Aspect	Disassemble components
Potential Impact	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.
Mitigation Required	The disassembly of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of the infrastructure components. Of concern here is the destruction of

	vegetation, creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from construction vehicles. In the event that spillages and leaks do occur, these would impact negatively on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas; special care must be taken not to destroy rehabilitated areas. This activity is considered to be medium in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (medium - low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.4 Kenhardt

11.4.1 Construction phase:

Impact 4

KENHARDT					
Aspect	**Internal access roads and vehicular activities on site**				
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.				
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid no go and sensitive areas as per the sensitivity maps. Vegetate and irrigate open areas to limit erosion, taking care not to cause erosion by irrigation. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. Removal of vegetation must be followed closely by rehabilitation.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium - high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	12 (low)

I&AP Concern	No
Conditional Authorisation	No

Impact 5

KENHARDT					
Aspect	**Site preparation**				
Potential Impact	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.				
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid no go and sensitive areas as stipulated on the sensitivity maps. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Conduct search and rescue operations for protected plant species on infrastructure footprint areas. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines, unique plant communities and rare species. Removal of vegetation must be followed closely by rehabilitation that is completed by specialist. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this. Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. Sensitive animals are likely to have moved away from the area due to the agricultural activities already taking place in the general area, and hardier animals are likely to be more adaptable to increased activities at the proposed site. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species.				
Impact Significance	Severity	Spatial Scale	Duration	Probability	63 (medium - high)

(Pre-Mitigation)	4	2	4	7	
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 3	Probability 7	42 (medium - low)
I&AP Concern	No				
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.				

Impact 6

KENHARDT					
Aspect	**Access control and fencing**				
Potential Impact	Access control will mean the construction of fences.				
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed, such as alien vegetation control.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium - high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 10

KENHARDT	
Aspect	**Disassemble components**
Potential Impact	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing

	vegetation to recover from overgrazing. Veld management measures will have to be employed, such as alien vegetation control.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.4.2 Decommissioning:

Impact 18

KENHARDT					
Aspect	**Undertake site remediation**				
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitate where practical.				
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed, such as alien vegetation control.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (medium-low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.5 Loeriesfontein

Impact 4

11.5.1 Construction phase

LOERIESFONTEIN					
Aspect	**Site preparation**				
Potential Impact	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.				
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas, and only completely avoid no go and sensitive areas as per the sensitivity maps. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. Removal of vegetation must be followed closely by rehabilitation by qualified specialists.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.				

Impact 5

LOERIESFONTEIN	
Aspect	**Internal access roads and vehicular activities on site**
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.

Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. Removal of vegetation must be followed closely by rehabilitation. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this. Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. Sensitive animals are likely to have moved away from the area due to the agricultural activities already taking place in the general area, and hardier animals are likely to be more adaptable to increased activities at the proposed site. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 4	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 3	Probability 7	42 (medium - low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 6

LOERIESFONTEIN	
Aspect	**Access control and fencing**
Potential Impact	Access control will mean the construction of fences.
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing

	vegetation to recover from overgrazing. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 3	Spatial Scale 2	Duration 3	Probability 7	56 (medium-high)
Impact Significance (Post-Mitigation)	Severity 1	Spatial Scale 1	Duration 2	Probability 7	28 (medium - low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 10

LOERIESFONTEIN					
Aspect	**Undertake site remediation**				
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitate where practical.				
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 3	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.5.2 Decommissioning:

Impact 18

LOERIESFONTEIN

Aspect	**Disassemble components**				
Potential Impact	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.				
Mitigation Required	The disassembly of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of the infrastructure components. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from construction vehicles. In the event that spillages and leaks do occur, these would impact negatively on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas; special care must be taken not to destroy rehabilitated areas. This activity is considered to be medium in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.6 Vanrhynsdorp

11.6.1 Construction phase

Impact 4

VARHYNSDORP	
Aspect	**Internal access roads and vehicular activities on site**
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only, and completely avoid no go and sensitive areas as per the sensitivity maps. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive

	areas such as the ridges or drainage lines. Removal of vegetation must be followed closely by rehabilitation by qualified specialists.				
Impact Significance (Pre-Mitigation)	Severity 3	Spatial Scale 2	Duration 3	Probability 7	56 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.				

Impact 5

VARHYNSDORP	
Aspect	**Site preparation**
Potential Impact	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the heuweltjies. Removal of vegetation must be followed closely by rehabilitation. Pioneer plants were widely encountered here. Pioneer stage facilitates the emergence of the sub-climax stage by improving growth conditions through decreasing run-off, increasing infiltration and increasing the build-up of organic material. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this.

	Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. Sensitive animals are likely to have moved away from the area due to the agricultural activities already taking place in the general area, and hardier animals are likely to be more adaptable to increased activities at the proposed. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species				
Impact Significance (Pre-Mitigation)	Severity 3	Spatial Scale 2	Duration 3	Probability 7	56 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 6

VARHYNSDORP					
Aspect	**Access control and fencing**				
Potential Impact	Access control will mean the construction of fences.				
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 7	35 (low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 10

VARHYNSDORP					
Aspect	**Undertake site remediation**				
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitate where practical.				
Mitigation Required	The construction of fences around the property will allow vegetation to recover from uncontrolled burning and over grazing that is currently a problem. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.6.2 Decommissioning:

Impact 18

VARHYNSDORP	
Aspect	**Disassemble components**
Potential Impact	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.
Mitigation Required	The disassembly of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of the infrastructure components. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from construction vehicles. In the event that spillages and leaks do occur, these would impact negatively on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas; special care must be taken not to destroy rehabilitated areas. This activity is considered to be medium in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.

Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.7 Graafwater

11.7.1 Construction phase

Impact 4

GRAAFWATER	
Aspect	**Internal access roads and vehicular activities on site**
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant site during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation.
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid the no go areas and sensitive areas as per the sensitivity map. Vegetate and irrigate open areas to limit erosion taking care not to cause more erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the natural fynbos in the area. Removal of vegetation must be followed closely by rehabilitation by specialist that has experience in coastal fynbos rehabilitation The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process as the areas designated for construction is in the more disturbed vegetation areas. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this.

	Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. Sensitive animals are likely to have moved away from the area due to the agricultural activities already taking place in the general area, and hardier animals are likely to be more adaptable to increased activities at the proposed site. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area specifically the tortoises that are confirmed to be on site. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 4	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 3	Probability 7	42 (medium - low)
I&AP Concern	No				
Conditional Authorisation	No				

Impact 5

GRAAFWATER	
Aspect	**Site preparation**
Potential Impact	Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled.
Mitigation Required	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and irrigate open areas to limit erosion. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. Removal of vegetation must be followed closely by rehabilitation. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. During construction the risk of soil contamination by spills

	of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this. Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. Sensitive animals are likely to have moved away from the area due to the agricultural activities already taking place in the general area, and hardier animals are likely to be more adaptable to increased activities at the proposed site on the route. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 4	Probability 7	63 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 3	Probability 7	42 (low)
I&AP Concern	No				
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.				

Impact 6

GRAAFWATER					
Aspect	**Access control and fencing**				
Potential Impact	Access control will mean the construction of fences.				
Mitigation Required	The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing. Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 7	63 (medium-high)
Impact Significance	Severity	Spatial Scale	Duration	Probability	35 (low)

(Post-Mitigation)	2	1	2	7	
I&AP Concern	No				
Conditional Authorisation	No				

Impact 10

GRAAFWATER					
Aspect	**Undertake site remediation**				
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site must be rehabilitate where practical.				
Mitigation Required					
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (medium-high)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

11.7.2 Decommissioning:

Impact 18

GRAAFWATER	
Aspect	**Disassemble components**
Potential Impact	The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.
Mitigation Required	The disassembly of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of the infrastructure components. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from construction vehicles. In the event that spillages and leaks do occur, these would impact negatively on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas; special care must be taken not to destroy rehabilitated areas. This activity is considered to be medium in duration as well as site specific in extent with impacts being on

	site. The severity of the impact was determined to be minor.				
Impact Significance (Pre-Mitigation)	Severity 4	Spatial Scale 2	Duration 3	Probability 5	45 (medium-low)
Impact Significance (Post-Mitigation)	Severity 2	Spatial Scale 1	Duration 2	Probability 3	12 (low)
I&AP Concern	No				
Conditional Authorisation	No				

12 CUMULATIVE IMPACTS

The cumulative effects of the planned infrastructure and its maintenance, in addition to the effect of the current land use practices, will affect the available graze and browse that wild herbivores need for survival. The ecosystem functioning and services that are currently produced in the area could be impaired or reduced in small areas; these include food and shelter for the animals.

The footprint of the proposed solar PV panels will impact on the ecosystem services and vulnerable habitats such as drainage lines, rocky outcrops and plains. This will be through reduced flow in drainage lines, reduced viability in plant communities due to reduction in area and compromising of habitats due to fencing and keeping out of fauna and pollinators.

12.1 Ecosystem services

The Millennium Ecosystem Assessment (MEA) report 2005 defines *Ecosystem services* as benefits people obtain from ecosystems and distinguishes four categories of ecosystem services. The following lists represent samples of each:

12.1.1 Provisioning services

• food (including seafood and game), crops, wild foods, and spices

• water

• minerals (including diatomite)

• pharmaceuticals, biochemicals, and industrial products

• energy (hydropower, biomass fuels)

12.1.2 Regulating services

• carbon sequestration and climate regulation

• waste decomposition and detoxification

- purification of water and air
- crop pollination
- pest and disease control

12.1.3 Supporting services

- nutrient dispersal and cycling
- seed dispersal
- Primary production

12.1.4 Cultural services

- cultural, intellectual and spiritual inspiration
- recreational experiences (including ecotourism)
- scientific discovery

Table 12-1: Ecosystems services to humans of the study areas.

Services offered	Provisioning	Regulating	Supporting	Cultural
Ag	Food, Minerals	carbon sequestration and climate regulation, purification of water and air.	nutrient dispersal and cycling, seed dispersal, primary production.	cultural, intellectual and spiritual inspiration recreational experiences (including ecotourism) scientific discovery
Ke	Food	carbon sequestration and climate regulation	nutrient dispersal and cycling, seed dispersal.	cultural, intellectual and spiritual inspiration
Lo	Food, crops, wild foods, minerals.	carbon sequestration and climate regulation, purification of water and air	nutrient dispersal and cycling, seed dispersal Primary production	cultural, intellectual and spiritual inspiration
Va		carbon sequestration and climate regulation	nutrient dispersal and cycling, seed dispersal.	cultural, intellectual and spiritual inspiration
Gr		carbon sequestration and climate regulation, purification of water and air	nutrient dispersal and cycling, seed dispersal.	cultural, intellectual and spiritual inspiration

In Table 12-2 the ecosystem services that each study site provides to the general environment is listed together with services they do not provide.

Table 12-2: Ecosystem services to the ecosystem.

Service	**Ag**	**Ke**	**Lo**	**Va**	**Gr**
Pollination	X	X	X	X	X
Fulfilment of people's cultural spiritual and intellectual needs	X		X		X
Regulation of climate					
Insect pest control					
Maintenance and provision of genetic resources	X	X	X	X	X
Maintenance and regeneration of habitat	X	X	X	X	X
Provision of shade and shelter	X	X	X	X	X
Prevention of soil erosion	X	X	X	X	X
Maintenance of soil fertility	X	X	X	X	X
Maintenance of soil health	X	X	X	X	X
Maintenance of healthy waterways					
Water filtration	X	X	X	X	X
Regulation of river flows and groundwater levels	X	X	X	X	X
Waste absorption and breakdown	X	X	X	X	X
Total	**11**	**10**	**11**	**10**	**11**

13 MITIGATION MEASURES AND MANAGEMENT PLAN

Recommended measures to mitigate the potential impacts of the proposed project on Flora and Fauna are listed in Table 13-1.

Table 13-1: Mitigation measures

Activity	Aspect	Objectives	Mitigation measure	Frequency	Legal requirements	Recommended Action Plan	Responsibility	Cost
Internal access roads and vehicular activities on site. **Vegetation clearing during site preparation**.		Limit degradation and destruction of natural environment to designated project areas. Limit loss of natural vegetation and key species Restrict alien invasive plant establishment.	• Keep the footprint of the disturbed area to the minimum and designated areas only. Rehabilitate open areas to limit erosion. • Restrict removal of vegetation during construction to minimise open areas. • Adhere to existing roads, and if new roads are constructed, these must not cross important and rare habitats. • Removal of vegetation must be followed closely by rehabilitation. • Proper maintenance of operating vehicles and regular vehicle inspections to reduce the possibility of hydrocarbon spills which will negatively affect soils. • Stockpile construction materials away from natural water sources and important and rare habitats. • Adhere to speed limits to minimise animal road deaths.	Daily	National Environmental Management Act (NEMA), 1998 (Act no. 107 0f 1998). Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983).	Removal of lose sediment and rehabilitation of exposed areas.	Environmental Co-ordinator EPC contractor	
Access control and fencing.		Limit the effect of fencing on animal feeding. Avoid negative impacts to vegetation and soil through erosion. Limit the negative effects of excessive dust.	• Keep the footprint of the disturbed area to the minimum and designated areas only. Rehabilitate open areas to limit erosion. • Restrict removal of vegetation during construction to minimise open areas. • Adhere to existing roads, and if new roads are constructed, these must not cross important and rare habitats. • Removal of vegetation must be followed closely by rehabilitation. • Proper maintenance of operating vehicles and regular vehicle inspections to reduce the possibility of hydrocarbon spills which will negatively affect soils. • Stockpile construction materials away from natural water sources and important and rare habitats. • Adhere to speed limits to minimise animal road deaths.	Daily ,Weekly	National Environmental Management Act (NEMA), 1998 (Act no. 107 0f 1998). Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983).		Environmental Co-ordinator EPC contractor	
Demolition of infrastructure		Avoid spillage of hazardous materials, thereby protecting vegetation and soil. Avoid destruction of vegetation, the creation of favourable habitat for fast growing invasive plants and ground compaction.	• The correct and careful handling of the infrastructure pollutants and toxicants to prevent spillages and leaks. • Vehicles to make use of existing roads and designated areas. • Avoid natural and rehabilitated areas as far as possible.	Daily ,Weekly	National Environmental Management Act (NEMA), 1998 (Act no. 107 0f 1998). Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983).			
Rehabilitation of impacted areas		Restore natural vegetation.	• The footprint of the area disturbed by the operation, maintenance and demolition will have topsoil replaced to restore the vegetation cover.	Daily ,Weekly				

Activity	Aspect	Objectives	Mitigation measure	Frequency	Legal requirements	Recommended Action Plan	Responsibility	Cost
		Limit the erosion potential of exposed areas.	• Exposed areas will be re-vegetated.					

14 MONITORING PROGRAMME

The on-site effects that the solar PV panels and related infrastructure have on the plants and animals of the area can be quantified with continuous monitoring of natural areas on the project site. Such a monitoring program must concentrate on the sensitive landscape management, red data species management and alien invasive species management. A monitoring program will include seasonal assessments to identify areas where adaptive management will have to be applied, which means all management measures are adapted if they do not produce the correct outcome. In addition the management of the sensitive landscapes and red data species will have to take place, mainly by excluding development form habitat types that could contain these species, or by rescuing such plants if they area encountered. Follow up surveys of the identified problem areas will have to be conducted in order to adapt management plans to suit specific areas. Seasonal monitoring of the effects of the solar PV panels on flora and fauna in the general area must be conducted, this can be accomplished through information sharing with local land owners and surveys conducted on the surrounding farms.

The major management measure to be employed with regards to the sensitive areas and red data species will be exclusion of all activities (construction and operational) within the buffer zones. The buffer zone prescribed was chosen after consideration was given to the distribution of the current populations of red data species being present.

A monitoring program needs to evaluate the management actions on each of these components. The method of monitoring will employ the Braun Blanquet survey method, which is a specialised method designed specifically for vegetation survey/monitoring purposes. To summarise:

- Monitoring must take place annually;
- Monitoring must be completed by qualified specialists;
- Adaptive management must applied;
- Monitoring during the spring is essential; and
- Findings must be compared to previous years.

The alien vegetation monitoring will be of importance due to the threat posed by site clearance which provides open areas where alien invasive species could establish, and with certain alien invasive species already present within the study areas, this is a real possibility. Therefore the open areas created during the construction phase could persist during the operational phase, and thereby create areas where alien invasive species could establish.

The monitoring program will include an ecological audit. This audit will take place prior to any construction, to ensure all species that occur within the areas to be developed are relocated. This is due to the fact that burrowing animals might have young and for this reason will not move despite the disturbance. The ecological audit will continue during the construction phase daily to ensure disturbance to the natural environment is reduced and limited to demarcated areas. During the operational phase, assessments could be conducted every six months or annually determining the level of rehabilitation achieved and the current ecological state. Before the decommissioning phase a final survey should be conducted to determine how the environment can be rehabilitated based on the monitoring completed over the life of the solar PV panels and facilitate in the final closing procedures, rehabilitation and management.

15 STUDY SUMMARY

The objectives that were initially set in order to accomplish the aim of the study are displayed in Table 15-1.

Table 15-1: Objectives status

Objectives	Status	Section
To delineate the various vegetation/habitat types and describe their sensitivity, present within the study area.	Completed	6 (Results sections)
To determine if any flora and fauna species or assemblages will be directly impacted by the proposed Solar PV activities and their associated infrastructure; this includes plant and fauna communities present, the state of these communities, identification of possible red data species according to IUCN, National and Provincial criteria.	Completed	7 (Findings)
To undertake an assessment of the impacts associated with various activities on the health of the flora and fauna species or assemblages and identify ecologically sensitive areas.	Completed	7 (Findings)
To recommend measures that should be included in the Environmental Management Plan (EMP) to prevent or limit impacts to flora and fauna species or assemblages.	Completed	1 (Introduction), 7 (Findings)

16 CONCLUSION AND RECOMMENDATIONS

During the field assessment the identified habitat features was seen as having a positive impact on the biodiversity in the study areas. This was primarily because of the diversity of plant and animal species that were encountered here. It is recommended that a management plan be implemented which will firstly monitor flora and fauna present in the area, and secondly devise management measures to enhance the status of the habitat present. Destruction of the sensitive species and landscapes areas such as drainage lines, ridges and plains should be avoided. Monitoring of flora and fauna will indicate the effectiveness of any management measures employed.

The opportunity to maintain or increase the ecological functioning of these study areas exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the natural habitat types and removing the threats, the ecological functioning of the areas will be positively affected thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonize.

All five study areas were found to be under pressure from current and previous land use, most notably grazing of domestic animals. Despite these threats it was found that the natural habitat present within the study areas provide an ecological service to the plant and animal species encountered during the field survey and very possibly to the plant and animal species that were identified during the desktop survey.

The vegetation/habitat units identified were all responsible for varied degrees of natural to transformed habitat present; in turn this resulted in the mosaic effect with regards to the vegetation which in turn has an effect on the animal species present. The combined effect of the area that is under pressure and the different habitat types are reflected in the results of this study. Few mammal species were found during this fry season study, but this is only a reflection of species present on the specific day of study and not of species that are of a transient nature, therefore the population of animal species that these areas supports could be larger than that which was encountered. Furthermore, the animal species present are only the species adapted and associated with the limited habitat present, which can survive the anthropogenic pressure exerted on them.

Further recommendations include initiating a biodiversity off-set area that will compensate disturbed areas and make a positive contribution towards available natural habitat. Monitoring will also have to be conducted in order for management measures to be updated and reviewed on an annual basis.

17 REFERENCES

ACOCKS, J.H.P. 1988. Veld types of South Africa. 3rd edition. Memoirs of the Botanical Survey of South Africa 57: 1-147

ALEXANDER, G. and MARAIS, J. 2008. A guide to the reptiles of Southern Africa.

BGIS. 2010. Biodiversity GIS. (Online) Available at: http://www.bgis.sanbi.org.za/ (Accessed 11 January 2012).

BRAUN-BLANQUET, J. 1964. Pflanzensociologie. 3 Aulf. Weien. Springer

BROMILOW, C. 2010. Problem Plants of South Africa. Briza Publications, Pretoria.

DU PREEZ, L. & CARUTHERS, V. 2009. A Complete guide to the frogs of South Africa. Struik Nature, South Africa.

DRIVER, A., MAZE, K., LOMBARD A.T., NEL, J., ROUGET, M., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K. & STRAUSS, T. 2004. South African National Spatial Biodiversity Assessment 2004: Summary Report. South African National Biodiversity Institute, Pretoria.

ESLER, K.J. MILTON, S.J. DEAN, W.R.J. (Eds.) 2010. Karoo Veld, Ecology and Management. Briza.

FRIEDMAN, Y. AND DALY, B. 2004 Red Data Book of the Mammals of South Africa: A Conservation Assessment. CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust. South Africa.

GRANT, R. & THOMAS, V. 2002 Sappi Tree Spotting: Highveld and the Drakensberg. Jacana Press. Johannesburg.

HANNEKENS, S.M. 1996b. TURBOVEG – Software package for input, processing and presentation of phytosociological data. Users guide. University of Lancaster, Lancaster.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book – Butterflies. Sasolburg Litho, Vanderbijlpark.

HILL, M.O. 1979b. TWINSPAN. A Fortran program for arranging multivariate data in an ordered two-way table by classification of individuals and attributes. Ithaca, New York: Cornell University.

HILTON-TAYLOR, C. 1996. Red Data List of Southern African Plants. Strelitzia 4. Aurora Printers, Pretoria.

KINGDON, J. 2007. The Kingdon Field Guide to African Mammals. Academic Press, San Diego, CA.

LOVEGROVE, B. 2003. The Living Deserts of Southern Africa. Fernwood Press. CapeTown.

LOW, A.B. & REBELO, A.G. 1996. Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria.

MANNING, J. & GOLDBLATT, P. 2007. Nieuwoudtville Bokkeveld Plateau and Hantam. South African Wildflowers Guide 9. Botanical Society of South Africa.

MUCINA, L, RUTHERFORD, M.C. & POWRIE, L. 2006. Vegetation Map of South Africa, Lesotho & Swaziland. SANBI, Pretoria.

MUELLER-DOMBOIS, D. & ELLENBERG, H. 1974. Aims and methods of vegetation ecology. John Wiley & Sons, New York

PASSMORE N.I. & CARRUTHERS, V.C. 1995. South African Frogs: A complete Guide. Southern Book Publishers, Witwatersrand University Press, South Africa

POOLEY, E.S. 1998. A Field Guide to Wildflowers Kwazulu-Natal and the eastern region. Natal Flora Publishers Trust: Durban, South Africa.

PICKER, M., GRIFFITHS, C & WEAVING, A. 2002. Field Guide to Insects of South Africa. Struik Publishers, Cape Town.

ROBERTS 2010. Roberts' Multimedia Birds of Southern Africa.

SHEARING, D. 1997. Karoo. South African Wildflower Guide 6. Botanical Society of South Africa.

SKEP. 2010. Succulent Karoo Ecosystem Program. (Online) Available at: http://www.skep.org.za/ (Accessed 12 January 2012).

SKINNER J.D. & CHIMIMBA C.T. 2005. The Mammals of the Southern African Subregion (3rd Ed.). Cambridge University Press, Cape Town.

TAINTON, N.M. 1999. Veld Management in South Africa. Univ. Natal Press, Pietermaritzburg.

TICHÝ, L. 2002. JUICE software for vegetation classification. Journal of Vegetation Science 13(3): 451–453.

VAN OUTSHOORN, F. 1999. Guide to grasses of Southern Africa. Briza Publications, Pretoria, South Africa.

VAN WYK, B., VAN OUDTSHOORN, B. & GERICKE, N. 1997. *Medicinal Plants of Southern Africa.* Briza Publications, South Africa.

VAN WYK, A.E. & VAN WYK, P. 1997. *Field Guide to the Trees of Southern Africa.*

Struik Publishers, Cape Town.

Appendix A: Plant List

Scientific Name	Common Name	Ecological Status	Form	Ag	Ke	Lo	Gr	Va
Acacia karoo	Sweet thorn	Medicinal	Tree		X			
Acacia melanoxylon	Black Wattle	Category 2 invader	Tree				X	
Albuca setosa		Medicinal	Geophyte					X
Aloe dichotoma	Kokerboom	VU, Medicinal	Aloe	X				
Aloe falcata	Vanrhynsdorp Aloe		Succulent		X	X		
Amellus tridactylus		SA endemic	Forb			X		
Aptosimum leucorrhizum	Veld violet		Herb/Dwarf shrub	X				
Aptosimum spinescens	Kankerblarebossie, Violet	Medicinal	Shrub		X			
Argemone mexicana	Mexican Poppy	Category 1 invader, Medicinal	Forb			X	X	
Argemone ochroleuca		Alien invasive Catgory 1b	Dwarf Shrub			X		
Aristida adscensionis	Annual three awn	Pioneer Increase 2	Grass	X	X			
Asparagus aethiopicus		Medicinal	Herb				X	
Asparagus capensis			Forb				X	
Asparagus elongata			Forb				X	
Asparagus sp.			Shrub					X
Atriplex lindleyi	Spunge fruit saltbush	Category 3 invader	Shrub					X
Atriplex nummularia	Old man's salt Bush		Shrub			X	X	
Atriplex vestita	Australian saltbush	Category 2 invader	Shrub				X	
Berkheya heterophylla sub radiata			Forb	X				
Blepharis mitrata			Forb			X		
Blepharis capensis			Herb	X	X	X		
Boscia albitrunca	Shepherds tree	Medicinal/Protected	Tree	X				

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Boscia foetida subsp foetida	Stink bush		Tree	X				
Brownanthus ciliatus			Succulent			X		
Centropodia glauca	Gha grass	Decreaser - Subclimax to climax	Grass				X	
Chrysocoma ciliata		Medicinal	Dwarf Shrub				X	
Conicosia elongata			Succulent				X	
Crassula muscosa			Succulent					X
Crossyne flava			Geophyte					X
Cyperus laevigatus			Reed/Sedge			X		
Cyperus marginatus			Sedge			X		
Cyphia extenta			Succulent				X	
Datura ferox	Thorn Apple	Category 1 Invader	Shrub					X
Diosma sp.			Herb				X	
Elegia capensis	Fonteinriet		Restio/Reed				X	
Enneapogon desvauxii	Eight day grass	Pioneer Subclimax Increaser 2	Grass	X	X			
Enneapogon scaber	Rock Nine-awned grass	Climax	Grass			X		
Eragrostis lehmaniana	Lehmans love grass	Subclimax Climax increaser 2	Grass					X
Eragrostis obtusa	Dew grass	Pioneer Subclimax Increaser 2	Grass					X
Ehrharta calycina	Common ehrharta	Subclimax Climax Decreaser	Restio/Reed				X	
Erharta longiflora	Oat seed grass	Pioneer Increaser 2	Grass				X	
Eriocephalus spinescens	Doringkapok		Shrub	X	X	X		
Euphorbia atrispina			Succulent	X				
Euphorbia dregeana	Drege's Euphorbia		Succulent	X				
Euphorbis decepta			Succulent	X				

Euryops speciosissimus	Giant resinbush	Medicinal	Shrub				X	
Felicia australis	Blue Karoo Daisy		Shrub				X	
Felicia dubia			Dwarf Shrub		X	X		
Fingerhuthia africana	Thimble Grass	Decreaser - Subclimax to climax	Grass		X			
Galenia fruticosa			Shrub	X	X	X		
Galenia africana			Shrub	X	X	X		
Gethyllis afra	Kukumakranka		Bulb				X	
Gomphocarpus filiformis			Shrub	X				
Hermania amoena			Shrub/forb	X				
Hermannia alnifolia			Forb				X	
Hermannia trifurca			Forb				X	
Hoodia gordonii	Ghaap	Medicinal	Succulent	X	X	X		
Huernia sp.			Succulent				X	
Justicia cuneata			Dwarf Shrub					X
Juncus dregeanus			Sedge			X		
Juncus exsertus			Sedge			X		
Juncus punctorius			Restio/Reed			X		
Kleinia longiflora	Sjambok bush		Succulent Shrub	X		X		
Limonium longifolium			Forb				X	X
Lycium cinereum			Dwarf Shrub		X	X		
Lycium horridum			Dwarf Shrub			X		
Manochlamys albicans			Dwarf Shrub	X				
Melianthus comosus		Medicinal	Shrub			X		
Mesembryanthemum guerichianum	Ice plant		Succulent	X		X	X	
Mesembryanthemum nodiflorum		Medicinal	Succulent				X	

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Mesembyanthemum guerichianum			Succulent					X
Metalasia fastigiata	Pink bristle bush		Shrub				X	
Monsonia spinosa	Spiny Bushman's Candle	Medicinal	Succulent	X				
Moquinella rubra	Lighted Candles Mistletoe	Parasite	Herb		X			
Muraltia spinosa			Shrub				X	
Oncosiphon grandiflorum		Medicinal	Forb				X	
Osteospermum pinnatum			Succulent				X	
Othonna sedifolia			Succulent shrub	X				
Parkinsonia africana			Tree		X			
Pelargonium senecoides			Forb				X	
Peliostomum leucorrhizum	Veld violet	Medicinal	Herb/Dwarf shrub	X	X			X
Pentaschistis sp.			Grass					X
Phalaris minor	Small Canary grass		Grass				X	
Phragmites australis	Common reed		Reed			X		
Putterlickia pyracantha	False spike thorn		Shrub				X	
Prosopis glandulosa	Mesquite	Category 2 invader	Tree	X	X	X	X	X
Psilocaulon spp.				X				
Pteronia pallens	Armoedsbos		Shrub		X	X		X
Rhigozum obovatum	Yellow Pomegranite		Tree	X	X	X		
Rhigozum trichotomum	Three Thorn		Tree	X	X	X		
Rhus undulata		Medicinal	Tree	X		X		
Ruschia extensa			Succulent				X	
Ruschia intricata			Succulent			X		
Ruschia spinosa			Succulent	X	X			
Salsola calluna	Swartganna		Shrub	X	X	X	X	

Salsola tuberculata		Medicinal	Shrub	X	X	X		X
Salvia disermas		Medicinal	Forb			X		
Sarcostemma viminale	Melktou	Medicinal	Succulent creeper	X	X			X
Schmidtia kalahariensis	Kalahari Sour grass	Pioneer, Increaser 2	Grass			X		
Scirpus ficinioides			Sedge			X		
Scirpus dioecious			Sedge	X				
Searsia pyroides	Five Thorn	Medicinal	Tree				X	
Selago albida			Shrub	X				
Senecio bulbinifolius			Forb					X
Stapelia hirsuta			Succulent				X	
Stipagrostis ciliata	Tall Bushmans grass	Climax decreaser	Grass	X	X	X		
Stipagrostis namaquensis	River Bushman grass	Climax	Grass	X	X	X		
Stipagrostis obtusa	Small Bushmans grass	Climax decreaser	Grass	X		X		
Stipagrostis uniplumis	Silky Bushmans grass	Subclimax increaser 2	Grass	X	X	X		
Tamarisk ramosissima	Pink Tamarisk	Category 1 invader, Medicinal	Tree			X		
Tylecodon wallichii			Succulent				X	
Wahlenbergia androsacea			Herb				X	

Appendix B: Birds

Family	***Species***	**Common Name**
Accipitridae	*Melierax canorus*	Pale Chanting Goshawk
Accipitridae	*Buteo rufuscus*	Jackal Buzzard
Accipitridae	*Meliorax canorus*	Pale Chanting Goshawk
Accipitridae	*Elanus axillaris*	Black Shouldered Kite
Alaudidae	*Mirafra apiata*	Clapper Lark
Accipitridae	*Falco rupicollis*	Rock Kestrel
Columbidae	*Oena capensis*	Namaqua Dove
Corvidae	*Corvus albus*	Pied Crow
Glareolidae	*Rhinoptilus africanus*	Double Banded courser
Malacanotidae	*Telophorus capensis*	Bokmakerie
Muscicapidae	*Myrmecocichla formicova*	Ant Eating Chat
Numididae	*Numida melagris*	Guinea Fowl
Ottididae	*Ardeotis kori*	Kori Bustard
Ottididae	*Neotis ludwigii*	Ludwig's Bustard
Ottididae	*Eupodotis afra*	Southern Black Korhaan
Passeridae	*Passer melanurus*	Cape Sparrow
Phasianidae	*Pternistis capensis*	Cape Francolim
Ploceidae	*Philetairus socius*	Sociable Weaver
Ploceidae	*Plocepasser mahali*	White Browed Sparrow Weaver
Ploceidae	*Ploceus capensis*	Cape Weaver
Ploceidae	*Ploceus velatus*	Southern Masked Weaver
Psitticidae	*Agapornis roseicollis*	Rosy faced Lovebird
Pteroclidae	*Pterocles namaqua*	Namaqua Sandgrouse

Appendix C Mammals

Bovidae	*Antidorcas marsupialis*	Springbok
Bovidae	*Rhaphicerus campestris*	Steenbok
Canidae	*Vulpes chacma*	Silver Backed Fox
Canidae	*Canis mesomelas*	Jackal
Canidae	*Vulpes chacma*	Blackbacked Jackal
Canidae	*Otocyon megalotis*	Bat Eared Fox
Felidae	*Caracal caracal*	Caracal
Herpestidae	*Suricatta suricatta*	Meerkat
Hystricidae	*Hystrix africaeaustralis*	Porcupine
Leporidae	*Lepus capensis*	Cape Hare
Sciuridae	*Xeris inauris*	Cape Ground Squirrel
	Hystrix africaeaustralis	Porcupine

Appendix D Reptiles

Testonidae	*Homopus signatus*	Namaqua Speckled Padloper
Cordylidae	*Cordylus polyzonus*	Karoo Girdled Lizard
	Chersina angulata	Angulate tortoise

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Appendix G: Visual Impact Assessment

VISUAL IMPACT ASSESSMENT

PROPOSED DEVELOPMENT OF FIVE SOLAR PV POWER PLANTS IN THE NORTHERN CAPE AND WESTERN CAPE PROVINCES

REPORT SUBMITTED TO:

ORLIGHT SA (PTY) LTD

8 MARCH 2012

SITE	*AFFECTED FARM*	*DEA REF. NO.*	*NEAS REF. NO.*
Aggeneys	Portion 1 of Aroams 57 RD	***12/12/20/2630***	***DEA/EIA/0000818/2011***
Kenhardt	Remaining Extent (RE) of Klein Zwart Bast 188 RD	***12/12/20/2631***	***DEA/EIA/0000813/2011***
Loeriesfontein	Portion 1 of Klein Rooiberg 227 RD	***12/12/20/2632***	***DEA/EIA/0000825/2011***
Vanrhynsdorp	Remaining Extent (RE) of Paddock 257 RD	***12/12/20/2633***	***DEA/EIA/0000822/2011***
Graafwater	Portion 1 of Graafwater 97 RD Remaining Extent (RE) of Bueroskraal 220 RD	***12/12/20/2636***	***DEA/EIA/0000828/2011***

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa

Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by **Digby Wells Environmental (Pty) Ltd** © 2012

Project Title: Visual Impact Assessment for the proposed development of five Solar Photovoltaic (PV) Power Plants in the Northern Cape and Western Cape Provinces

Project Number: BSG1384

Name	**Responsibility**	**Signature**	**Date**
Alice McClure *Environmental GIS Specialist*	Report Writer		02 March 2012
Bradly Thornton *Department Manager*	1st Review		02 March 2012
Mia Ackerman Project Manager	2nd Review		05 March 2012

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

100% Recycled Paper

EXECUTIVE SUMMARY

In line with the growing need for electricity supply and cleaner energy production in South Africa, Orlight SA (Pty) Ltd (Orlight SA) is proposing the construction of five Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces.

Digby Wells Environmental (Digby Wells) has been appointed by Orlight SA as the independent Environmental Assessment Practitioner (EAP) responsible for undertaking the Environmental Impact Assessment (EIA) process for the proposed Solar PV Power Plants.

The five proposed Solar PV Power Plants will be situated near the towns of Aggeneys, Kenhardt and Loeriesfontein in the Northern Cape Province and Vanrhynsdorp and Graafwater in the Western Cape Province.

The study areas for and preliminary generation capacities of the proposed Solar PV Power Plants are listed below. Studies were undertaken to determine the optimal generation capacity that can be accommodated in each study area based on their ecological, cultural and socio-economic characteristics and other technical factors:

- Proposed 40 MW up to 150 MW generation capacity on Portion 1 of the farm Aroams 57 RD near Aggeneys in the Namakwa District Municipality, Northern Cape Province;
- Proposed 70 MW up to 100 MW generation capacity on the Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD near Kenhardt in the Siyanda District Municipality. Northern Cape Province;
- Proposed 40 MW up to 150 MW generation capacity on Portion 1 of the farm Klein Rooiberg 227 RD near Loeriesfontein in the Namakwa District Municipality, Northern Cape Province;
- Proposed 20 MW up to 45 MW generation capacity on the RE of the farm Paddock 257 RD near Vanrhynsdorp in the West Coast District Municipality, Western Cape Province; and
- Proposed 35 MW up to 75 MW generation capacity on Portion 1 of the farm Graafwater 97 RD and the RE of the farm Bueroskraal 220 RD near Graafwater in the West Coast District Municipality, Western Cape Province.

Potential impacts associated with the proposed Solar PV Power Plants were identified during a screening assessment undertaken for the project in December 2011. The five study areas were subsequently visited by the visual impact assessment (VIA) team in January 2012 to assess the landscape and visual contexts of each of the study areas. Viewshed and sensitivity analyses were performed in a Geographic Information System (GIS) and potential visual receptors were identified in order to determine the visibility of the proposed plant components.

The study areas were rated on a visual sensitivity scale that was developed in order to demarcate favourable areas for the development of the Solar PV Power Plant components, construction lay-down yards and ancillary infrastructure, thereby mitigating visual impacts through the design process.

It is believed that if the potential infrastructure is constructed within the areas demarcated as having the lowest visual impact (based on the visual sensitivity scale), the visual impacts associated with the construction and operation of the Solar PV Power Plants at Aggeneys, Kenhardt, Loeriesfontein or Graafwater will not be significant. The visual impacts, associated with the construction and operation of a Solar PV Power Plant within the heritage and tourism landscape of Vanrhynsdorp, are likely to be more significant.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

TABLE OF ABBREVIATIONS

Abbreviation	**Meaning**
VIA	Visual impact assessment
EIA	Environmental impact assessment
EAP	Environmental assessment practitioner
PPP	Public participation process
I&AP	Interested and affected party
GIS	Geographic information system
PV	Photovoltaic
CV	Curriculum Vitae

1 INTRODUCTION

In line with the growing need for electricity supply and cleaner energy production in South Africa, Orlight SA (Pty) Ltd (Orlight SA) is proposing the construction of five Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces.

The five proposed Solar PV Power Plants will be situated near the towns of Aggeneys, Kenhardt and Loeriesfontein in the Northern Cape Province and Vanrhynsdorp and Graafwater in the Western Cape Province.

Digby Wells Environmental (Digby Wells) has been appointed by Orlight SA as the independent Environmental Assessment Practitioner (EAP) responsible for undertaking the Environmental Impact Assessment (EIA) process for the proposed Solar PV Power Plants.

The objective of the EIA process was to identify potential impacts associated with the project and thereafter, ensure that the development is undertaken in such a way as to promote the positive impacts (i.e. contribution to fulfilment of national electricity demand, training and skills development and creation of local employment opportunities) and to minimise the negative impacts (i.e. soil erosion, visual disturbance and ecological impacts) of the proposed project.

This report presents the findings of the Visual Impact Assessment (VIA) that was undertaken for the proposed project.

1.1 Expertise of the Specialists

The assessment was undertaken by Bradly Thornton and Alice McClure of Digby Wells Environmental. Bradly completed his Honours degree in Environmental Management and has been utilising GIS to aid in project decision making at Digby Wells for 5 years. He is the manager of the GIS department and has a number of years of experience in conducting Visual Impact Assessments. Alice completed her Masters in Conservation Planning using GIS and has been working with contemporary VIA methods, amongst other GIS functions, since she joined Digby Wells Environmental in January 2011. Please refer to Appendix B for an abridged Curricula Vitae (CVs) of the specialists.

1.2 Legislative and Policy Framework

The following international, national and regional legislative and policy documents form part of the legislative and policy framework of the VIA. The objective was to ensure that the assessments meet all stipulated requirements to ensure legal compliance and successful integration into the regional planning context.

1.2.1 International Conventions

The European Landscape Convention (ELC), created by the Council of Europe, was the first international convention to focus exclusively on landscapes (Berry, 2010). The purpose of the convention is to promote effective management and planning of landscapes and was signed by the United Kingdom government in 2006 and became binding from 2007. Public documents that explore the impacts of large scale developments on any landscape should take into account the effects of these developments, such as wind farms or Solar PV Power Plants, as defined in the ELC. A landscape, as defined by the ELC, "means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (i.e. the natural, visual and subjectively perceived landscape) (Contesse 2011) (European Landscape Convention 2007).National Legislation and Policy

At a national level, the following legislative documents potentially apply to VIA;

Regulations in Chapter 5 (Integrated Environmental Management) of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) and the Act in its entirety. The act states that "the State must respect, protect, promote and fulfil the social, economic and environmental right of everyone…" landscape is both moulded by, and moulds, social and environmental features;

The National Heritage Resources Act (Act No. 25 of 1999) (NHRA) in terms of the related provincial regulations – in some instances there are policies or legislative documents that give rise to the protection of listed sites. The heritage act states that it aims to promote "good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed for future generations". A holistic landscape whose character is a result of the action and interaction and/or human factors has strong cultural associations as societies and the landscape in which they live are affected by one another in many ways;

Section 17 of the Protected Areas Act (Act 57 0f 2003) (PAA) which stipulates the protection of natural landscapes. Landscapes are defined by the natural, visual and subjectively perceived landscape (ELC); these aspects of a landscape are intertwined to form a holistic landscape context.

1.2.2 Regional Regulatory Context

In the Western Cape, visual and aesthetic resources, along with other natural resources, are protected by local authorities, such as the City of Cape Town, where policies and by-laws relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. have been formulated (Oberholzer, 2005).

2 STUDY AREAS

The study areas for and preliminary generation capacities of the proposed Orlight SA Solar PV Power Plants are listed below. Studies were undertaken to determine the optimal generation capacity that can be accommodated in each study area based on their ecological, cultural and socio-economic characteristics and other technical factors:

- Proposed 40 MW up to 150 MW generation capacity on Portion 1 of the farm Aroams 57 RD near Aggeneys in the Namakwa District Municipality, Northern Cape Province;

- Proposed 70 MW up to 100 MW generation capacity on the Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD near Kenhardt in the Siyanda District Municipality. Northern Cape Province;
- Proposed 40 MW up to 150 MW generation capacity on Portion 1 of the farm Klein Rooiberg 227 RD near Loeriesfontein in the Namakwa District Municipality, Northern Cape Province;
- Proposed 20 MW up to 45 MW generation capacity on the RE of the farm Paddock 257 RD near Vanrhynsdorp in the West Coast District Municipality, Western Cape Province; and
- Proposed 35 MW up to 75 MW generation capacity on Portion 1 of the farm Graafwater 97 RD and the RE of the farm Bueroskraal 220 RD near Graafwater in the West Coast District Municipality, Western Cape Province.

The study areas are larger than the required footprint areas for the proposed Solar PV Power Plants, to provide adequate space for optimising site layout by avoiding ecological and archaeological sensitive areas. Please refer to Plan 1 in Appendix A for the regional setting of the proposed solar PV power projects.

Each of these study areas were described in the context of the visual environment (grouped into physical and human descriptions) and topographical aspects below.

2.1 Aggeneys

2.1.1 Physical Environment: Topography and Landscape

The Aggeneys study area is south facing and fairly flat, but is bordered by steep outcrops in the northern part. The study area falls within the Nama Karoo. The landscape and flora of the site and its surrounds are therefore typical of a dry climate. The area is sandy and rocky and is covered by low-lying vegetation (Figure 1). A drainage line, which spans approximately 50m in width, runs in a south-westerly direction through the study area.

The outcrops on the northern border of the study area are typical of the regional area in which the Aggeneys study site falls; a diversity of fauna and flora is supported by the unique ecologies on these arid inselbergs, outcrops and plains.

Figure 1: Aggeneys landscape, vegetation and topography

2.1.2 Human Elements, Aesthetic Value and Associations

The mining town of Aggeneys is located approximately 5 km from the study area and is therefore just visible from the northern border of the study area. The N14 is the most prominent man-made feature in the area and cuts through the study area in an east-west direction. Fences, a telecommunications tower, transmission lines and a picnic site on the side of the national road are the only notable man-made features. There are very few potential visual receptors in and around the area that will experience a visual impact from the project and there is already a mining operation taking place just outside the town; the aesthetic value and sense of place of the area as a whole has, therefore, already been somewhat altered from a pristine to a somewhat transformed landscape.

Figure 2: Fence lines on the north westerly boundary of the site - Aggeneys town just visible

2.2 Kenhardt

2.2.1 Physical Environment: Topography and Landscape

The Kenhardt study area is flat and north-easterly facing,. The study area falls within the Nama Karoo Biome and the vegetation composition is a result of a dry and hot climate. The landscape in and around the Kenhardt study area is mildly undulating (Figure 3). There are two main drainage lines within the study area.

Figure 3: Kenhardt landscape, vegetation and topography

2.2.2 Human Elements, Aesthetic Value and Associations

The Kenhardt study area is approximately 38 km away from the town of Kenhardt. In terms of man-made structures, there is a large Eskom substation about 1 km south of the study area, on the other side of a gravel road (Figure 4). The study area is surrounded by fences and two overhead transmission lines pass through the site to connect with the substation. Besides from the farmers that utilise the gravel road, it is expected that very few receptors will experience a visual impact from the proposed Solar PV Power Plant. The aesthetic value of the site and the surrounding areas is affected by presence of the substation and transmission lines.

Figure 4: Aries substation 1 km south of the study area

2.3 Loeriesfontein

2.3.1 Physical Environment: Topography and Landscape

The Loeriesfontein study area is positioned on the farm Kleine Rooiberg, after the name is representative of the landscape which displays outcropping areas that are reddish in colour and dominate the west and north of the study area (Figure 5). The study area itself is flat and slightly east-facing. The Loeriesfontein study area falls within the Succulent Karoo biome. The landscape is dominated by vegetation that is comprised of low-lying shrubs and succulents and rocky areas. A number of drainage lines that vary in size are evident throughout the study area of which the largest of the drainage lines is approximately 50 m wide


.

Figure 5: Landscape, vegetation and topography at Loeriesfontein study area

2.3.2 Human Elements, Aesthetic Value and Associations

The study area is situated 40 km to the north of the town of Loeriesfontein. It is nestled between steep outcrops and there is a gravel farm road that passes through site. Fences surround the western, eastern and southern boundaries of the site and transmission lines are visible to the north-east of the study area. The Helios substation is approximately 8 km north of the study area.

2.4 Vanrhynsdorp

2.4.1 Physical Environment: Topography and Landscape

The Vanrhynsdorp study area is flat to mildly sloping. The majority of the study area is north facing as the area forms a hill with the highest point approximately 1 third to the south. The study area is covered by low-lying grassy vegetation. The study area falls within the Succulent Karoo. The town of Vanrhynsdorp borders the site to the south and the large Matzikamma Mountain is visible on the other side of the town (Figure 6).

Figure 6: Topography, landscape and vegetation of Vanrhynsdorp study area in the fore-ground and Matzikmma Mountain in the background

2.4.2 Human Elements, Aesthetic Value and Associations

Since the study area is very close to the town itself, houses on the periphery of the town are visible from the study area and vice versa. The study area is surrounded by fences and the N7 national road runs along its western boundary (Figure 7). Due to the position of the study area from the town and the national road, there will be many visual receptors that will be impacted upon by the proposed Solar PV Power Plant.

Figure 7: View of Vanrhynsdorp study area from the N7

2.5 Graafwater

2.5.1 Physical Environment: Topography and Landscape

The Graafwater study area falls within the Fynbos Biome. The vegetation type that covers the study area is that of Sand Plain Fynbos and the Fynbos species on and around the study area grow up to 2 m high. Although the study area itself is fairly flat and is north facing, the topography of the general landscape of the area is much more mountainous (Figure 8).

Figure 8: Graafwater study area vegetation, landscape and topography with Graafwater town in the background

2.5.2 Human Elements, Aesthetic Value and Associations

The town of Graafwater is located 1.5 km to the north of the study area. The study area is divided by a gravel farm road and a railway line and is surrounded by fences. There is currently a small-scale quarry mining operation on the eastern side of the gravel road that runs through the study area. The proposed Solar PV Power Plant will be visible to people utilising the R346 provincial road which runs through the town of Graafwater and to a fair portion of the community members residing in the town. The proposed project will have an impact on the sense of place of the town itself and on its aesthetic value, as the town is currently a small farming town where Rooibos and potatoes are farmed commercially.

3 APPROACH AND METHODOLOGY

3.1 Approach to Visual Impact Assessment

Landscape and visual impacts, caused by any change to a region, are two closely related elements. A 'landscape' refers to the appearance of the land and takes into account its shape, texture and colours and the overall effect of the combination of these factors.

The four predominant groups of factors that contribute to landscape are:

- *Physical:* Geology, landform, drainage, soils, ecology and climate;
- *Human:* Archaeology, landscape history, land use/management, buildings and settlements;
- *Aesthetic:* Visual factors (i.e. views, viewers and visual amenity) and other senses (i.e. sounds, smells, tastes and touch); and
- *Associations:* Cultural and historical (Shetland Islands Council, 2006).

Impacts to the landscape are described as "…changes in the fabric, character, and quality of the landscape as a result of development," while visual impacts "…relate solely to the changes in views of the landscape, and the effect of those changes on people," (Shetland Islands Council, 2006).

VIAs are formalised assessments to quantify and describe both the landscape and visual impacts that a potential infrastructure development might have.

3.1.1 Requirements of Visual Impact Assessment

There are a number of elements that need to be included and considered when a VIA is carried out in order to address as many of the problematic queries that could arise (Fisher, 1996). In many cases, visual assessments are simply viewed as a "check-box" item in the EIA process, often not given as much weighting as other studies. For this reason, the methodology utilised during visual assessments is, in some cases, out-dated or not thorough or contemporary enough to produce optimal results and recommendations. When a VIA is undertaken under these conditions, many aspects of a comprehensive assessment are left out.

It is therefore important to carry out VIAs that take into account a full range of visual, aesthetic, cultural, natural and spiritual aspects of the specific environment, since they contribute to that area's sense of place and determine how different landscape elements interact with one another (Oberholzer, 2005). This calls for some level of subjectivity and sensitivity towards social contexts and issues, since visual and scenic resources are, by nature, difficult to quantify and assess using purely scientific methods.

A VIA should describe the potential effect of the proposed infrastructure on the holistic aesthetic and "feel" of a location. This is a complicated process and it is not sufficient to simply quantify where a structure will be seen from and where it will be hidden based on the topography. In some cases the proposed infrastructure might have the potential to add value to the visual or aesthetic quality of a landscape, depending on the current contextual cultural, social and physical aspects of the proposed site. A VIA can be further complicated in some cases where the potential infrastructure traverses a mosaic of landscapes that differ in their physical and social composition. The outcome of a VIA is therefore highly site specific.

3.1.2 Visual Impact Assessment criteria

There are, however, a few criteria that should form the skeletal structure of all VIAs (Oberholzer 2005), these criteria are listed below. They may be adapted for site specific results and other criteria may be utilised if needs be (Oberholzer, 2005).

- *Visibility of the proposed structure:* Visibility of a proposed structure is defined by the topography of the area in which it will be situated and the height of the proposed structure. Theoretically, it is a quantifiable criterion and can be measured using a viewshed function in a Geographic Information System (GIS). There are, however, a number of other factors that might affect visibility - these either need to be included systematically in the study or mentioned in the results;
- *Visual exposure of the proposed structure:* Visual exposure is determined by the distance of the viewer from the proposed structure. This differs for different structures and is affected by the landscape character;
- *Visual sensitivity of the contextual area:* The sensitivity of a landscape is determined by its character, topography and how it has been utilised or populated. All of these factors will contribute towards determining how drastically the proposed development will alter the overall landscape;
- *Visual sensitivity of the potential receptors in the area:* The receptors that are included and analysed in a VIA are those locations where people inhabit or utilise land from where the proposed infrastructure will potentially be seen;
- *Visual absorption capacity (VAC) of the landscape:* The visual sensitivity of an area is fairly closely related to its VAC, depending on the current landscape and population situation and whether the proposed infrastructure will have the potential to 'blend in' with its surroundings (to an extent); and
- *Visual intrusion of the proposed structure:* VAC of a landscape is, in turn, related to the visual intrusion of the proposed structure. If the structure is not compatible with the qualities of an area (and is not easily 'absorbed') then the landscape integrity will be affected causing visual intrusion.

Many of these criteria are more qualitative than quantitative in nature. In order to define the status of each criterion for the proposed structure, a number of various current site-specific elements need to be taken into account and analysed using both quantitative and qualitative methods. By doing so, the current visual resource can be defined. It must be remembered that they are all affected by both natural physical and cultural attributes and are intertwined with one another.

Table 1 describes these elements and how each notion contributes towards a robust VIA (Theron, 2010; Oberholzer, 2005).

Table 1: Aspects that define and affect the visual and landscape character of a potential project site

Visual resource element	Description	Relevance to criteria
Landscape Character	All of the elements that a landscape is comprised of affect the landscape character (i.e. significant features, water bodies, terrain, vegetation type etc.). Landscape character is one of the more tangible aspects of a VIA and can therefore be quantified by viewing the particular landscape or photographs of it. However, in some cases the landscape character can be influenced by more intangible aspects, such as historical or cultural associations. These aspects therefore need to be considered when assessing or defining landscape character.	Relevant to all criteria
Scenic Value of the Landscape/ Landscape Quality	The "beauty" of a landscape is described by its scenic value. This is, again, a fairly difficult notion to define contextually since "beauty in things exists merely in the mind which contemplates them" (Hume, 1742). The scenic value of a place is therefore defined based on the context in which a landscape is viewed and the conceptual norms of aesthetic appeal and ecological integrity.	Relevant to visual sensitivity of the area and receptors, VAC and visual intrusion
Sense of Place	People who reside in the landscape, are familiar with it, or make use of it create a sense of place – it is created through cognitive and sensory experiences of these individuals or groups of people.	Relevant to visual sensitivity of the area and the potential receptors

3.1.3 Cultural and Heritage Associations

An important aspect of any VIA is the consideration of visual values of a place that are linked to cultural or heritage characteristics, as… "Culture changes landscapes and culture is embodied by landscapes," (Nassauer, 1995). How a certain community or society has utilised a piece of land and, to an extent, the relationship that the community has had with the area over time can affect the landscape character. Land characters that have heritage or cultural associations can be defined as the following:

- *Designed Landscape:* A landscape that has been consciously designed by an urban designer, architect, engineer, landscape architect or any other persons that have used design principles or recognised styles or traditions;
- *Historic Site:* A landscape that is significant for its association with a historic event, activity or person;
- *Vernacular Landscape:* A landscape that has evolved through uses by people whose activities or occupancy has shaped the landscape. Through social or cultural attitudes of an individual, family or community the landscape reflects the physical, biological and cultural character of the everyday lives of the people living within it; and
- *Ethnographic Landscape:* A landscape containing a variety of natural and cultural resources that the associated people define as heritage resources.

Intangible heritage aspects are sensitive to visual impacts. Cultural landscapes (such as farm complexes) have the potential to change with the introduction of a new structure or infrastructure that subsequently becomes part of the landscape. It is important to identify areas or locations of archaeological and cultural significance in order to determine how the potential infrastructure might impact the sense of place or ambience of the landscape in which these locations exist. For example, if a homestead is recognised for its cultural or heritage significance, the introduction of a solar PV power plant could disrupt the visual and ambient landscape in which the homestead exists. Heritage and cultural landscapes are directly related to their visual environment and a negative impact on one leads to a negative impact on the other.

3.2 Objectives

The main objectives of the VIA are to quantify the potential impacts that the proposed Solar PV Power Plants will have on visual receptors and the landscape as a whole and to develop a site selection decision-making tool for the proposed projects. The specific objectives of the VIA were:

- To identify the current aspects of the study area/ landscape that are relevant to the VIA by carrying out a site visit and defining the various landscape units;
- To develop a model in GIS that provides a tool to aid decision-making in the selection of the placement of the potential infrastructure so that it will have the lowest negative visual impact on the surrounding environment;
- To run the model for each individual study area and create set of visual sensitivity maps;
- To advise the developers as to where the proposed solar PV infrastructure should be located in order to have the lowest negative visual impact, while ensuring the optimal utilisation of the study areas for electricity generation;
- To identify potential receptors that will be impacted on by the proposed Solar PV Power Plants;

- To identify the impacts that the proposed Solar PV Power Plants will have on the visual landscape and to rate the scale, duration, severity and probability of the impacts occurring; and
- To provide recommendations and mitigation measures so as to reduce the negative visual impacts that the proposed Solar PV Power Plants, transmission lines and substations will have.

3.3 Methodology

When dealing with the impact that a potential structure is going to have on the visual environment of a landscape, two important facets of a visual impact need to be considered, namely:

- The ability that the structure will have to alter the current landscape; and
- The impact that the structure will have on visual receptors (i.e. viewers).

The first consideration is based purely on the current landscape character which is a tangible aspect and is therefore easier to quantify. The latter is based on the perception of people that experience the visual impact and is therefore harder to quantify, necessitating a certain level of subjectivity. Aspects such as cultural and heritage associations, the current social, economic and even political characteristics of a community have the potential to influence or alter how visual receptors perceive the new infrastructure.

A number of different strategies were employed to ensure that all of the aspects of a comprehensive VIA were covered. These strategies comprise of subjective, objective, quantitative and qualitative decision-making tools.

3.3.1 Preliminary Risk Assessment

A preliminary risk assessment, or environmental screening, of the proposed project was undertaken in December 2011 with the objective of identifying the potential impacts of project activities on the visual environment. A summary of these impacts is provided in Table 2 and the assessment of the significance of these potential impacts will be the focus of the visual assessment.

Table 2: Potential impacts on the visual environment

Project activity	Potential impact	Knowledge gaps and proposed way forward
Construction phase		
Site clearance	Change in aesthetic characteristics	Conduct full visual impact assessment by carrying out the following activities; Carry out theoretical viewshed models using Geographic Information Systems. Ground-truth theoretical models and gather information about the visual sensitivity and characteristics of the proposed sites. Further identify potential receptors and attempt to quantify the extent of the visual impacts on these receptors. Synthesise viewshed model results, information gathered in the field and additional visual impact assessment research done to determine, as accurately as possible, the full range of visual impacts that the Solar PV Power Plants, and their respective construction / maintenance activities, will have on their surrounding visual environments.
Vehicular activity	Dust disturbance which affects visibility and visual nature of the areas	
Construction lay-down yard	Minor visual disturbance due to machinery and construction activities occurring	
Vehicle hard park and hydrocarbon management (fuel, oil and waste oil)	Minor visual impact due to introduction / presence of management tools and equipment	
On site-accommodation of construction workers	Minor visual impact due to introduction / presence of camps for workers	
Domestic waste and sewage management	Minor visual impact due to introduction / presence of sewage waste management tools and equipment	
Access control and fencing of site	Minor visual impact due to the erection of fencing and boom gates / access control centres	
Anchoring and installation of solar PV panels	Main visual impact due to the introduction and erection of large, reflective solar panels	

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Project activity	**Potential impact**	**Knowledge gaps and proposed way forward**
Operational phase		
Operation of Solar PV Power Plants	Main visual impact due to the presence of large, reflective solar panels	Same as above
Access control and fencing of site	Minor visual impact due to the erection of fencing and boom gates / access control centres	Same as above

3.3.2 Assessing subjective visual sensitivity, scenic value and sense of place

In order to obtain the potential visual impact that a structure might have on a landscape, the intangible and physical aspects of the landscape need to be assessed. Site visits were carried out in order to document the tangible characteristics within the landscape such as topography, vegetation, man-made structures, etc. The intangible aspects of the areas, such as sense of place and the “feel” of the area could only truly be documented through observation and interaction with interested and affected parties (I&APs) and landowners. Public information sharing meetings were attended and the perceptions, ideas and issues that were raised by the public were recorded. These meetings and the opinions of the attendees, allowed for the general perceptions of the people within the community to be documented or at least experienced.

3.3.3 Viewshed analyses: Visibility of proposed structure

Systematic viewshed analyses were run in order to determine where the proposed Solar PV Power Plant components and ancillary infrastructure will be visible from. The viewshed analyses were carried out in the following way.

- A Digital Elevation Model (DTM) was created in a GIS using contours of the existing topography;
- Viewsheds (the total area that has a direct visual connection for the infrastructure) were modelled to establish the degree of visibility that the proposed preliminary infrastructure will have. A worst-case scenario of a 10 m height was factored into these viewshed analyses; and
- Viewsheds were assessed and compared in terms of intensity and spatial extent.

3.3.3.1 Methodological considerations

A visually sensitive area of concern of 5 km around each of the study areas was chosen to be assessed thoroughly in terms of the viewshed and overall visual sensitivity analyses. The viewshed models that are run in a GIS provide results that are relative to the topography layer that is used as an input in the model and can therefore extend as far as the topography layer extends. However, consideration of climate aspects which affect visibility and visual exposure were taken into account and real-world visual study area was defined in order to practically carry out the analyses for each of the five project study areas within time and monetary limitations.

3.3.4 Visual sensitivity and site selection

The site selection methodology was also a systematic process that utilised the viewshed analysis function.

Potential receptors were identified using aerial imagery within a 5 km radius of the proposed study areas. These receptors were grouped into the following:

- National roads (i.e. those people travelling on the National roads);

- Provincial roads (i.e. those people travelling on the Provincial roads);
- Gravel roads (i.e. those people travelling on the Gravel roads); and
- Towns (i.e. those people who reside in or are visiting the town).

A model was created in ArcGIS for the viewshed analyses to be run for each of these groups. The height of the proposed structure (absolute worst-case scenario) was factored into these viewshed analyses by assigning an "offset" height of the potential structure of 10 m. The model also converted the resultant raster viewshed layers for each group into polygon layers. The results of this model were 12 polygon viewshed layers for each receptor group for each site, denoting which points they would be seen from and, concurrently, which points in the landscape the persons within these receptor groups would be able to see.

Values were then assigned for the viewshed polygons based on the receptor group such that the areas visible by more sensitive visual receptors were given a higher value (i.e. the visibility areas for the towns and national roads are likely to be experienced more frequently/by a larger number of people). The values assigned were decided upon during a specialist meeting with two GIS specialists and are shown in Table 3.

Table 3: Potential receptor weightings

Receptor Type	Visual Impact Score
Gravel road	0.25
Provincial road	1
Town	3
National road	3

All of the viewshed polygons for all of the different receptor groups were then merged in order to obtain one comprehensive visual sensitivity layer. This merging process allowed both the number of receptors and the type of receptors to be factored into an all-inclusive visual sensitivity index that ranged from 0 (areas within the study site that are not visible from any of the identified receptors) to 7.25 (areas that are visible from a range of receptors, including the most sensitive receptors – towns and a national road).

These scores were then grouped into visual sensitivity ratings (Plans 8, 9, 10, 11 and 12) with red shading over areas that were rated as potentially having a very high visual impact, orange shading over areas that were deemed as having a potential high visual impact, yellow shading over areas that were depicted as having a potential significant visual impact, light green shading for areas that will potentially have a minor visual impact and dark green shading for the areas that would result in the lowest visual impact if the infrastructure were to be built on them. Based on the definition of the visual sensitivity scale, areas for potential construction that would lead to lower visual impacts were recommended.

3.3.5 Cultural and Heritage Associations

A Heritage Statement was compiled in order to identify sites of archaeological, cultural and heritage importance within and around the study areas at a desktop level. Co-ordinates of the relevant documented sites were researched and used to plot the sites as points on the viewshed analyses results maps in order to determine which of the sites could possibly be impacted by the change in visual landscape.

Although the location of the identified sites in relation to the study areas was determined, those that were within the visual study area (5 km radius around each of the sites) were not included in the overall visual sensitivity analyses for each of the sites. This is due to the fact that the significance of the visual landscape to each and every one of the sites has not been quantified; since the sites have merely been classified into groups and HIA. It is therefore difficult to quantify how a change in the visual environment will impact each of these cultural or heritage sites specifically. Detailed studies should be carried out during the phase 1 HIA in order to determine the significance of the visual environment to these sites, and how a change in the visual environment will impact their intangible heritage associations.

3.4 Impact Assessment Methodology

The methodology employed for the EIA is divided into two distinct phases, namely: (I) impact identification; and (ii) impact assessment.

3.4.1 Impact identification

Impact identification is performed by use of an input and output model, which serves to guide the assessor in assessing all the potential instances of ecological, socio-economic and cultural change, pollution and resource consumption that may be associated with the activities required during the construction, operational, closure and post-closure phases of the project.

Outputs may generally be described as any changes to the biophysical, socio-economic and cultural environments, both positive and negative in nature, and also include the product and waste produced by the activity.

During consultation with I&APs, perceived impacts were identified. These perceived impacts will become part of the impact assessment and significance rating in order to differentiate between probable impacts and perceived impacts.

A non-exhaustive list of activities that should be considered in the identification of potential positive and negative impacts via the input-output model is described in Table 2.

3.4.2 Impact significance assessment

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the input and output model. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where	Consequence	= Severity + Spatial Scale + Duration
And	Probability	= Likelihood of an impact occurring

The severity, spatial scale, duration and probability of an impact occurring are assigned a rating out of seven as indicated in Table 4. The matrix calculates an overall significance rating out of 147. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP.

The significance of an impact is determined by reference the significance rating to the probability consequence matrix shown in Table 5, after which it is categorised into one of four categories, as indicated in Table 6

Table 4: Impact assessment parameter ratings

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	International The effect will occur across international borders.	Permanent without mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/definite The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	National Will affect the entire country.	Permanent with mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Provincial/regional Will affect the entire province or region.	Project life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Municipal area Will affect the whole municipal area.	Long term 6 to 15 years.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	On-going social issues. Damage to items of cultural significance.	Local Local extending only as far as the development site area.	Medium term 1 to 5 years.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with or without help of external consultants.	Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year,	Rare or improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact occurring is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance. Will have no impact on the environment.	Low-level repairable damage to commonplace structures.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely Expected never to happen.

Table 5: Probability consequence matrix

		Consequence (severity + scale + duration)								
		1	3	5	7	9	11	15	18	21
Probability / Likelihood	1	1	3	5	7	9	11	15	18	21
	2	2	6	10	14	18	22	30	36	42
	3	3	9	15	21	27	33	45	54	63
	4	4	12	20	28	36	44	60	72	84
	5	5	15	25	35	45	55	75	90	105
	6	6	18	30	42	54	66	90	108	126
	7	7	21	35	49	63	77	105	126	147

Table 6: Significance summary table

High	**108- 147**	
Medium-High	**73 - 107**	
Medium-Low	**36 - 72**	
Low	**0 - 35**	

3.5 Knowledge Gaps

The visual impact that the proposed structure will have on a landscape is, for the most part, dependent on the subject who is viewing it; visual impacts are rated based on social norms and the effect to the overall ecological integrity of the area, but for some people infrastructure may be an indication of urbanisation and, consequently, economic upliftment in the area. This would result in a positive visual impact for the viewer. For other receptors the construction of the Solar PV Power Plants might be a negative factor which could impede tourism in the area. Ideally the perceptions of people residing in each and every household, shop or restaurant that will potentially be affected would be included in the VIA, but this is impossible, especially for a project of this magnitude.

However, In the case of this VIA, the specialists carried out their field work in conjunction with the public participation process (PPP) specialists and therefore sat in on all of the PPP meetings that were held in each of the different towns. This was highly beneficial since the attendees included people from the local communities, government officials, landowners and other interested and affected parties (I&AP's). During the presentation that was given, the attendees were shown photos of other Solar PV Power Plants and were made aware of how the potential infrastructure will look and their reactions were noted by both the PPP and VIA specialists. The PPP meetings also allowed the VIA specialists to get a feel for the 'sense of place' of each of the towns.

Because of the nature of the proposed project and the deliverables that were expected from the VIA, a novel and context specific approach was adopted to carry out the VIA. Although this was essential in order to achieve appropriate and defendable results, there is always potential for error when adopting original techniques as methods are refined through repetition.

A possible pitfall of the VIA, which is imperative to document, is the fact that the site visit was not carried out during the flowering season for the areas in which the sites are located. Both Loeriesfontein and Aggeneys are situated in the "Namakwa Land" (Plan 2), a tourist region known for its daisies and other flowers after the rainy season. Although Vanrhynsdorp falls outside of this region, after conversing with the local people in the different areas, it was established that Aggeneys does not experience the flowering daisies phenomenon, but, in fact, that Loeriesfontein and Vanrhynsdorp do. Documentation of the landscape character, scenic value and sense of place could change dramatically after a visit to the sites during the flowering season since the dry, barren landscapes become vibrant and colourful in some cases (Figure 9). The Namakwa is also known for its variety of succulents which, in some cases such as on the Vanrhynsdorp site, are also seasonal.

Figure 9: Namakwaland landscape when flowers are in bloom

4 RESULTS AND DISCUSSIONS

4.1 Landscape Character, Scenic Value and Sense of Place

4.1.1 Aggeneys

The Aggeneys study area (Northern Cape) is utilised for sheep grazing. The surrounding landscape is impressive with large, flat open spaces and contrasting large rocky outcrops. The dry landscape is somewhat dramatic with its contrasting features and has a rugged and stark beauty. There is definitely a sense of place within many of the small Karoo towns or "dorpies", however, Aggeneys is a mining town and was built during the 1970's; it therefore lacks a long standing social or cultural history. The study area evokes a sense of remoteness since it is about 5 km from the town and it is a semi-natural landscape that has only been utilised by people for livestock grazing. There is evidence for Stone Age use of the landscape. Consideration should thus be given to an archaeological sense of place, especially when interpreting Stone Age deposits. A Phase 1 Heritage Impact Assessment (HIA) will be conducted, wherein the Visual Impact Assessment will be reviewed to address specific heritage related issues, if any. The area does, however, have a sense of being transformed by people, not only because of the visibility of the town form the border of the study area, but also because a transmission lines runs through the study area and fences on the border of the property. The N14 also dissects the study area towards the south-eastern corner which adds to the aspect of the area being transformed.

4.1.2 Kenhardt

The Kenhardt study area falls within the Northern Cape. There are a few houses outside of the study area, but the study area itself is situated in open land approximately 37.5 km away from the town of Kenhardt and the sense of place, or remoteness, is therefore not influenced by present day social or cultural contexts. The historical sense of place may be affected. Many of Lucy Lloyd's and Wilhelm Bleek's San informants were originally from the Kenhardt region. Lloyd and Bleek compiled significant oral histories of the last /Xam San, Their information subsequently informed much later San rock art research and interpretation. Some of the /Xam recorded histories may in fact make reference to particular landscapes in the Kenhardt region. As such the character of the historical recorded landscape will be severely affected.

4.1.3 Loeriesfontein

The flat and barren Loeriesfontein study area falls within the Northern Cape and the areas has flat open plains which are contrasted by large, dramatic outcrops "rooiberge" or Red Mountains on its outskirts. These unusual "rooiberge" definitely add to the aesthetic value of the Loeriesfontein study area. The study area is situated approximately 40 km outside of the town of Loeriesfontein and there are no residences nearby it. The study area is surrounded by fences and high voltage overhead transmission lines are evident within and adjacent to the study area. Since the study area is nestled between mountains within a landscape that is not urbanised the sense of place on the site is not influenced by the present day social contexts that influence the sense of place within Loeriesfontein town. It has, instead a "sense of remoteness". There is extensive evidence of Stone Age occupation and land use at Loeriesfontein. Similar to the Aggeneys site, the archaeological sense of place must be assessed during the Phase 1 HIA. There is furthermore evidence of a paleontological landscape, the effect of the proposed Solar PV Power Plants in terms of visual impacts on paleontological resources are unknown. Specialist opinion will be required by palaeontologists.

4.1.4 Vanrhynsdorp

The Vanrhynsdorp study area comprises a field-like area on the outskirts of the town of Vanrhynsdorp. There are a number of man-made footpaths evident amongst the dry, low-lying vegetation that was observed during the site visit in the dry season. The Matzikamma Mountain on the other side of the town contributes substantially to the scenic value of Vanrhynsdorp town is, which is home to a proud, close-knit community. The impacts on visual resources at this site are likely to be significant since the aesthetic appeal of the area is related to the arid plains (or Knersvlakte) and the historical aspects associated with the town.

The Knersvlakte is a semi-desert area within the Namakwaland that is renowned for its level of biodiversity richness (Haarmeyer 2009); the vast rolling plains that surround Vanrhynsdorp are characteristic of the Knersvlakte and accommodate a high level of succulent biodiversity. Vanrhynsdorp town itself has a high heritage and visual resource due to the origins and history (and consequently the architecture) that is associated with the town which was founded in 1887 (Van Tonder-Pieterse 2006, cited in Orton 2011). The project area is situated adjacently north of a more modern part of the town, the historical and vernacular landscape of the town and its surrounds is likely to be negatively affected if solar panels and other infrastructure, that is associated with the proposed Solar PV Power Plants, are erected. The N7 national road is a popular tourist route which passes near the outskirts of Vanrhynsdorp town and the provincial road connecting Nieuwoudtville, Vanrhynsdorp and Vredendal runs through the Vanrhyns Pass, which is an impressive natural feature of the landscape (Figure 10);

Figure 10: Vanrhyns Pass (travelling from Nieuwoudtville/Clanwilliam to Vanrhynsdorp)

The visual resource of the local area will experience a negative impact with the introduction of a Solar PV Power Plant which will, consequently, transform the current historical landscape and have a negative impact on the visual resource of the tourist route as a whole. A possible impact may also be on known and unknown rock shelters that may contain rock art and archaeological deposit. The location of such sites will need to be determined or affirmed during a Phase 1 HIA, and visual impacts reassessed.

4.1.5 Graafwater

The study area is on the outskirts of the town of Graafwater which is a farming town and does not have significant heritage or tourism associations.. The R364 is used by tourists travelling from Clanwilliam to Lamberts Bay but the scenic tourism resource of the area is not significant at a regional of even local scale. Two Grade II heritage sites (provincially protected) are known to exist on the farm Graafwater. These are a historical dovecote and Second Anglo-Boer blockhouse. The actual locations of these monuments are unknown and must be determined in a Phase 1 HIA. The visual impacts on these will be assessed in the HIA.

4.1.6 Summary

The descriptions of landscape character, scenic value and sense of place were based on the site visits that were carried out between 9 and 14 January 2012. An overall baseline landscape sensitivity score was given for each of the sites (Table 7); the study areas were rated from 1 to 5, with 5 being the highest sensitivity score and 1 being the lowest.

Table 7: Landscape sensitivity of the study areas

Study area	Overall Landscape Sensitivity Score (1 – 5)
Aggeneys	4
Kenhardt	3
Loeriesfontein	3.5
Vanrhynsdorp	4.5
Graafwater	3

4.2 Cultural and heritage associations

32 archaeological, cultural and heritage sites were identified during the Cultural Resources Pre-Assessment that was compiled in January 2012 (Appendix B). These sites included rock shelters, grave sites, structures, features and artefact scatters (Table 8).

Table 8: Relevant archaeological and heritage sites (adapted from Table A in the Cultural Resources Pre-Assessment, January 2012)

Site	Y Co-ordinate	X Co-ordinate	Type
1	-32.12572	18.6144	Rock Shelter
2	-31.526	18.6011	Rock Shelter
3	-31.52438	18.6038	Rock Shelter
4	Not available	Not available	Grave Site
5	-32.18675	18.69458	Structure
6	-32.18645	18.69563	Structure
7	-32.18608	18.69479	Grave Site
8	-32.18878	18.70195	Artefact Scatter
9	-32.19181	18.70758	Artefact Scatter
10	-32.19236	18.71142	Feature
11	-32.19236	18.71211	Artefact Scatter
12	-32.19371	18.71466	Rock Shelter
13	-32.14483	18.66613	Structure
14	-32.14619	18.6504	Artefact Scatter
15	-32.1445	18.65486	Structure
16	-32.18632	18.68391	Rock Shelter

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

17	-32.18647	18.68344	Rock Shelter
18	-32.14466	18.66463	Rock Shelter
19	-32.14433	18.66472	Rock Shelter
20	-32.18829	18.70008	Rock Shelter
21	-32.18801	18.70084	Rock Shelter
22	-32.17697	18.86717	Grave Site
23	-32.17852	18.84125	Rock Shelter
24	-29.25722	18.8033	Rock Shelter
25	-29.19952	18.9803	Artefact Scatter
26	-29.10232	19.39923	Artefact Scatter
27	-29.05551	19.4438	Structure
28	-28.97807	19.52695	Structure
29	-29.2303	18.89361	Feature
30	-29.2214	18.90597	Feature
31	-29.2229	18.90953	Feature
32	-29.4615	20.77483	Structure

Sites 29 and 31 are within the Aggeneys study area; the construction of the Solar PV Power Plant will therefore definitely have an impact on the visual landscape that might be associated with the sites. Both sites are described as natural features; both are rocky outcrops that hold potential for rock art. These sites need to be investigated further in the Phase 1 HIA. Site 25, which is a Late Stone Age lithic scatter, is located approximately 7. 3 km north east of the study area while site 24 (a rock shelter/boulder with rock art) is located approximately 7.6 km south west of the study area. They both fall outside of the area of high visual concern (the 5 km radius around the study area). The development of Solar PV Power Plants will significantly affect the sense of place connected with rock art, which are often imbued with ritual, symbolic and spiritual associations. Rock art is furthermore intrinsically linked with the landscape, making use of natural features to emphasise some of the motifs, designs and figures.

Site 32, which was identified on satellite imagery as possible stone feature falls within the Kenhardt study area but is within an area of non-visibility. The Loeriesfontein study area has evidence of Stone Age occupation and paleontological resources. In addition, These sites are just over 14 km north-west of the Vanrhynsdorp study area, both are defined as Stone Age rock shelters that contain a number of archaeological items including ostrich egg shell beads, decorated pottery, marine shell and others. A change in the visual environment could therefore potentially change their intangible heritage aspects if the structure is viewable from the rock shelters, or passed or visible when approaching these sites. The shelters are, however, in between two foothills of raised pieces of land, one of which is between the shelters and the Vanryhnsdorp study area. It is unlikely that the infrastructure will be viewable from these locations but the phase 1 heritage impact assessment that is to be carried out should investigate further.

Site 1 (a rock shelter containing lithics, pottery, worked bone and other items) and site 14 (an ephemeral artefact scatter on a rock shelf) are within the visual sensitivity study area.

Site 15 (an old road with dry stone embankments) is just outside of it. According to the viewshed analyses, the potential infrastructure will not be visible from site 1 but will be visible from site 14. The phase 1 heritage impact assessment needs to take heed how the potential infrastructure could impact the visual landscape associated with site 14 and determine whether site 15 will also be impacted.

The detailed Phase 1 HIA that will be undertaken should examine all of the identified sites, and other that are discovered, within the visual landscape. An attempt needs to be made to quantify, drawing on archaeological and heritage knowledge, the impact that the potential infrastructure might have on the intangible heritage aspects of the sites within the visual landscape.

5 QUANTITATIVE FINDINGS

5.1 Viewshed analyses

The results from the viewshed analyses, are depicted in Plans 3, 4, 5, 6 and 7, and summarised in Table 9. These plans illustrate the extent to which the proposed infrastructure will be visible within a 5 km radius of each of the study areas. The green areas are those that will experience a visual impact from the potential infrastructure while the pink areas will not experience a visual impact. The results are based on the topography of the current landscape and its ability to screen the potential infrastructure.

Table 9: Percentages of potential visibility and non-visibility of the Solar PV Power Plant infrastructure within a 5 km radius of the study areas

Site	% Visibility	% Non-visibility
Aggeneys	40.46	59.54
Kenhardt	47.14	52.86
Loeriesfontein	52.12	47.88
Vanrhynsdorp	57.33	42.67
Graafwater	61.84	38.16

The large outcrops and inselbergs to the north and east of the Aggeneys study area boundary shield the visibility of the potential infrastructure anywhere beyond these outcrops. There are also smaller outcrops that are scattered around the study area which also decrease visibility of the proposed infrastructure. The potential Solar PV Power Plant will therefore likely only be visible from less than half (40.46%) of the surrounding environment (within a 5 km radius of the site itself). The N14 national road, Aggeneys town and a number of gravel roads were identified as potential receptors within the 5 km radius around the Aggeneys study area.

The undulating topography of the Kenhardt study area region results in the potential infrastructure being likely visible within about half, or slightly less (47.14%), of the surrounding landscape within a 5 km radius. The infrastructure will potentially be visible mostly within areas to the north-west of the study area as there is a mild slope increase traveling from the north westerly corner to the south east corner of the study area. Only one gravel road was identified as a potential receptor within the radius of interest for the Kenhardt site.

There are fairly large outcrops ("rooiberge") to the west of the Loeriesfontein study area which results in the overall visibility within the 5 km radius being localised mostly within the eastern areas. These outcrops result in an overall lower area being exposed to visibility (47.88%) within the 5 km radius than that which is likely to experience visibility of the potential infrastructure (52.12%). Only one gravel road was identified as a potential receptor within the radius of interest for the Loeriesfontein site.

The topography of the Vanrhynsdorp site leads to a higher proportion of the area within the 5km radius around the study area likely to experience visibility (57.33%) than that area which will most probably not experience visibility of the proposed infrastructure (42,67%). Most of the land extending north and that which lies directly south of the study area will potentially experience visibility. A gentle slope downwards towards the "droe" river on the opposite side of the N7 (south west of the study area) leads to a lack of potential visibility within this region. Vanrhynsdorp town, the N7 national road, provincial roads and a number of gravel roads were all identified as potential visual receptors within the area.

A much larger area (61.84%) within the 5 km radius of the Graafwater is likely to experience visibility of the proposed infrastructure than that which is not (38.16%). The area that is likely not to experience visibility of the proposed infrastructure falls predominantly within the area that is south east of the study area, behind a very gentle slope that shields this region. Graafwater town, the R363 provincial road and a number of gravel roads were identified as potential visual receptors within the 5 km radius around the Graafwater study area.

Table 10: Potential receptors identified within a 5 km radius of the study areas

	Potential receptors			
Site	*Town*	*National road*	*Provincial road*	*Gravel road*
Aggeneys	X	X		X
Kenhardt				X
Loeriesfontein				X
Vanrhynsdorp	X	X	X	X
Graafwater	X		X	X

It is important to note where the potential receptors that were identified lie within the viewshed results displayed on Plans 3, 4, 5, 6 and 7.

The majority of the National road falls within the non-visibility area of the 5 km radius around the Aggeneys study area, while about a third of the town infrastructure also falls within this area. It is likely that the proposed infrastructure will be visible from the majority of the gravel roads that were identified.

The proposed infrastructure is unlikely to be visible from the gravel roads identified within the 5 km radius of the Kenhardt study area according to the viewshed analysis.

Half of the gravel road identified within the vicinity of the Loeriesfontein study area is likely to experience visual impacts.

More than half of the national road stretch and about two thirds of the actual town within the vicinity of Vanrhynsdorp is likely to experience visibility of the proposed infrastructure. Most of the provincial roads identified within the vicinity of the Vanrhynsdorp study area fall within the non-visibility areas, while more gravel roads fall within the visibility areas of the viewshed results.

Theoretically, most of the receptors identified within the vicinity of the Graafwater study area should experience visual impacts, including all of the town and most of the provincial road.

5.2 Visual Sensitivity

The results from the visual sensitivity model are depicted in Plans 8, 9, 10, 11 and 12. These plans show which areas, if developed, will have a higher visual impact than others, based purely on potential receptors that were identified. The results are illustrated on a relative visual impact scale; with areas that are shaded in orange or red depicting construction locations that would lead to a higher visual impact. It is favourable, based on visual impact concerns, to place infrastructure on areas that are green or yellow (i.e. infrastructure built on these areas will have a lower visual impact). A worst case scenario of 10 m high infrastructure was adopted during the visual impact and sensitivity methodologies in reaction to time and resource constraints. If the infrastructure height is less, the visual impact will be less, but the scale will still be relative.

Table 11: Percentages of visual sensitivity categories of the entire study area

Site	% Total Area				
	No Visual Impact	*Minor Visual Impact*	*Significant Visual Impact*	*High Visual Impact*	*Very High Visual Impact*
Aggeneys	X	24.13	62.85	X	13.02
Kenhardt	55.87	44.13	X	X	X
Loeriesfontein	7.75	92.25	X	X	X

Vanrhynsdorp	X	X	55.04	11.66	33.3
Graafwater	X	24.12	X	75.88	X

The Vanrhynsdorp site has the potential to have a high visual impact (Table 11) since all of the land falls either within the significant visual impact, high visual impact or very high visual impact categories (i.e. a high visual impact will be experienced no matter where the infrastructure is erected). From a visual perspective, it would be most favourable, in this situation to build on the areas demarcated as having a significant visual impact (comparatively). These high visual sensitivity results are a consequence of the proposed site being directly north of Vanrhynsdorp town itself and the fact that the N7 runs on the western border of the site.

From a visual perspective, the proposed infrastructure can be built anywhere within the Loeriesfontein and Kenhardt sites and the impact will be, at worst, only minor impacts (Table 11). This is due to the fact that there is only one, comparatively infrequently used gravel road (this is the case at both sites) that will receive the visual impact of the potential Solar PV Power Plants.

There are likely to be a higher number of potential receptors at the Aggeneys site which could experience a negative visual impact (Table 11) if the Solar PV Power Plant infrastructure (or part of it) is built on the red sections of the site (Plan 8). A lower visual impact will be experienced if the infrastructure is placed within the green sections on the map.

About three quarters of the Graafwater site is in a position to impose high visual impacts on receptors (in particular the town which is north of the site). Infrastructure should be placed within that quarter of land that is displayed as yellow on Plan 12 so that minor visual impacts will be experienced.

5.3 Summary

It is important to bear in mind that the mathematical models used to compute the viewshed and visual sensitivity results for the proposed Solar PV Power Plants are based purely on the topography of the landscape and do not take into account the vegetation, climate effects or man-made structures within the study areas. It is therefore important to synthesise the qualitative information gathered while visiting the site, the viewshed results and the visual sensitivity results in order to obtain comprehensive findings that are "real-world", contextual and can be applied practically.

Table 12 summarises the findings from the qualitative and quantitative visual impact methodologies that were adopted in order to determine the landscape character, scenic value and sense of place of the existing study areas and the respective towns, as well as the visibility and visual sensitivity of the potential Solar PV Power Plant infrastructure and its placement within the landscape and study area. The overarching and all-encompassing score given for three aforementioned visual aspects is the "overall landscape sensitivity rating". This is based on visits to the study areas (the visual aspects analysed and assessed) and interaction with people in the local communities.

The scores given for visibility and visual sensitivity of the potential infrastructure at each site (using mathematical and technical models) are based on the current topographical and contextual visual environment; these scores are derived from the percentage of areas that will be exposed to a visual impact created by the potential Solar PV Power Plants, and the receptors that were identified and recorded for the area. Lower scores indicate a lower impact.

The summary table also shows one final overarching score for the sensitivity of the entire visual environment for each of the sites. The score was derived by applying the equation below. This score was used as a basis for the impact assessments. Thus:

$$Overall\ visual\ sensitivity = \frac{(\text{overall landscape sensitivity } + \text{ visibility } + \text{ visual sensitivity})}{3}$$

Table 12: Summary table showing landscape sensitivity, visibility), visual sensitivity and the final comprehensive visual impact score

Site	Landscape sensitivity rating	Visibility rating	Visual sensitivity	Final visual impact score
Aggeneys	4	3.5	3.5	3.7
Kenhardt	3	0.5	1	1.5
Loeriesfontein	3.5	1	1	2
Vanrhynsdorp	4.5	4.5	4	4.3

Graafwater	3	3.5	3	3.2

6 IMPACT ASSESSMENT

This impact assessment considers two types of impacts, namely:

- Impacts which have the potential to alter/introduce elements into the landscape; and
- Impacts which alter sense of place of a landscape.

Both positive and negative impacts have been identified and considered in the impact matrices. Where positive impacts have the change to be enhanced, their “severity” is given a higher score. Since many of the activities that will be carried out have similar/the same visual impacts, a number of them have been grouped together – especially all of the visual impacts associated with construction since the different construction activities are usually experienced together as one visual impact.

6.1 Aggeneys

6.1.1 Construction phase

Nature: Potential impact on the aesthetics of the town of Aggeneys and surrounds

Accommodation of construction workers in the town of Aggeneys

The additional need for housing within Aggeneys to house workers during the construction phase might have an indirect impact on the aesthetics of the town and possibly, the surrounding area. The town might increase in size but that will not make a significant difference in the contextual landscape.

Parameters	**Without mitigation**	**With mitigation**
Severity	2 (Minor)	1 (Limited)
Spatial scale	2 (Limited)	1 (Very limited)
Duration	3 (Medium term)	3 (Medium term)
Probability	3 (Unlikely)	3 (Unlikely)
Significance	21 (Low)	15 (Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No

Can impacts be mitigated?	Yes
Residual impacts:	NA
Enhancement/mitigation	The additional housing that might be built should be constructed in line with the already existing housing infrastructure. If the dwellings are placed within an already existing urban or peri-urban context then there will not be a drastic change to the visual landscape of the town. Temporary housing can easily be disassembled after the Solar PV Power Plant has been built.

Nature: Potential impact on the aesthetics and sense of place of the town of Aggeneys

Construction activities and the installation of the Solar PV Power Plant components might have an impact on the aesthetics and sense of place of the area.

Due to the active mining operation in the town of Aggeneys, large transportation trucks and other construction activities are not unusual in the area and will not introduce a significant novel visual impact.

Preparation of the site will involve flattening the landscape and removing vegetation and although this will alter the low-lying vegetation composition, the flat topography of the landscape will not be altered significantly. The erection of security fences will not introduce a significant new impact, as existing transmission lines, fences and even a telecommunications tower are visible on the site.

Transportation of infrastructure and building material to and from the site will also introduce dust plumes due to vehicular movement.

Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Site and immediate surrounds)	2 (Site and immediate surrounds
Duration	3 (Medium-Term)	3 (Medium-Term)
Probability	7 (Certain)	6 (Likely)
Significance	56 (Medium-Low)	42 (Medium-Low)

Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was given. Although the study area straddles the N14, the visual impact of construction activities and the installation of the Solar PV Power Plant components will be reduced if activities are restricted within the recommended development areas.	
Residual impacts:	NA	

6.1.2 Operational phase

Nature: Potential impact on the aesthetics and sense of place of the town of Aggeneys

The presence of the Solar PV Power Plant will introduce a negative visual impact to the current semi-remote landscape character of Aggeneys town and its surrounds.

Parameters	**Without mitigation**	**With mitigation**
Severity	4 (Fairly serious and on-going)	2 (Moderate)
Spatial scale	2 (Site and immediate surrounds)	2 (Site and immediate surrounds)
Duration	5 (Project Life)	5 (Project Life)
Probability	7 (Certain)	6 (Almost Certain)
Significance	77 (Medium-Low)	54 (Medium-Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual	No	No

resources?		
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was given. Although the study area straddles the N14, the visual impact of the presence and operation of the Solar PV Power Plant will be reduced if development is restricted within the recommended development areas.	
Residual impacts:	Residual impacts will include a transformation of the landscape character as a whole during the project lifetime	

6.1.3 Decommissioning phase

Nature: Potential impact on the aesthetics of the landscape around the town of Aggeneys – demolition activities

The components of the plant will be disassembled after its expected lifetime (20 years) and removed once the life span of the Solar PV Power Plant has come to an end. The noisy and abrasive activities associated with demolition and decommissioning phase are likely to introduce a negative visual impact.

Parameters	**Without mitigation**	**With mitigation**
Severity	4 (Serious)	3 (Moderate)
Spatial scale	2 (Limited)	2 (Limited)
Duration	2 (Short Term)	2 (Short Term)
Probability	6 (Highly Likely)	6 (Highly Likely)
Significance	48 (Medium-Low)	42 (Medium-Low)
Status	Negative	Negative
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No

Can impacts be mitigated?	Yes
Enhancement/mitigation measures:	The infrastructure should be demolished and removed as quickly and efficiently as possible
Residual impacts:	NA

Nature: Potential impact on the aesthetics of the landscape around the town of Aggeneys – rehabilitation (outcome)

Removal of the Solar PV Power Plant and its associated structures will be a step towards rehabilitating the land to a state that it is in now. Visually, land that is being rehabilitated and returned to its natural state is normally aesthetically pleasing. After the abrasive demolition activities have been carried out, the outcome of rehabilitated land would be considered a positive impact. Rehabilitation activities always have the ability to be enhanced by best practices.

Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Limited)	2 (Limited)
Duration	7 (Permanent)	7 (Permanent)
Probability	4 (Probable)	4 (Probable)
Significance	48 (Medium-Low)	44 (Medium-Low)
Status	Positive	Positive
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement/mitigation measures:	Best practice rehabilitation methods should be adopted	
Residual impacts:	NA	

6.2 Kenhardt

6.2.1 Construction

Nature: Potential impact on the aesthetics and sense of place of Kenhardt Town The current landscape will experience visual impacts associated with construction of the Solar PV Power Plants, building of roads and transportation of materials. Transportation of infrastructure and building material to and from the site will also introduce dust plumes due to vehicular movement. Preparation of the site will involve flattening the landscape and removing vegetation and although this will alter the vegetation composition, the flat topography of the landscape will not be altered significantly. The erection of security fences will not introduce a significant new impact, as existing transmission lines and fences are visible on the site and there is a substation 1 km south of the study area. The site is, however, being constructed outside of town – the likelihood of town residents and visitors to the town experiencing these visual impacts associated with construction activities is minimal,		
Parameters	**Without mitigation**	**With mitigation**
Severity	2 (Minor)	1 (Limited)
Spatial scale	2 (Site and immediate surrounds)	1 (Very Limited)
Duration	3 (Medium-Term)	3 (Medium-Term)
Probability	4 (Probable)	4 (Probable)
Significance	28 (Low)	20 (Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact associated with construction activities will be	

	reduced.
Residual impacts:	NA

6.2.2 Operational phase

Nature: Potential impact on the aesthetics and sense of place of Kenhardt Town		
The currently remote landscape will experience visual impacts associated with existence and operation of the Solar PV Power Plants. However, the site is being constructed fairly far outside of town and next to a road that is not likely to be utilised by tourists – the likelihood of town residents or visitors experiencing these visual impacts is minimal,		
Parameters	**Without mitigation**	**With mitigation**
Severity	2 (Minor)	1 (Limited)
Spatial scale	2 (Site and immediate surrounds)	1 (Very limited)
Duration	3 (Medium-term)	3 (Medium-term)
Probability	4 (Probable)	3 (Unlikely)
Significance	28 (Low)	15 (Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact of the operational Solar PV Power Plant will be reduced since the visibility aspect will be reduced.	
Residual impacts:	Residual impacts will include a transformation of the landscape character as a whole during the project lifetime	

6.2.3 Decommissioning phase

Nature: Potential impact on the aesthetics of the landscape around the town of Kenhardt

The components of the plant will be disassembled after its expected lifetime (20 years) and removed once the life span of the Solar PV Power Plant has come to an end. The noisy and abrasive activities associated with the demolition phase are likely to introduce a negative visual impact, but the site will be located a substantial distance outside of Kenhardt town and very few potential receptors have been identified within the area – it is therefore unlikely that the impact associated with the activities will be experienced.

Parameters	**Without mitigation**	**With mitigation**
Severity	4 (Serious)	3 (Moderate)
Spatial scale	1 (Very limited)	1 (Very limited)
Duration	2 (Short term)	2 (Short term)
Probability	3 (Unlikely)	3 (Unlikely)
Significance	21 (Low)	18 (Low)
Status	Negative	Negative
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	The infrastructure should be demolished and removed as quickly and efficiently as possible	
Residual impacts:	NA	

Nature: Potential impact on the aesthetics of the landscape – rehabilitation (outcome)

Removal of the Solar PV Power Plant and its associated structures will be a step towards rehabilitating the land to a state that it is in now. Visually, land that is being rehabilitated and returned to its natural state is normally aesthetically pleasing. After the abrasive demolition activities have been carried out, the outcome of rehabilitated land would be considered a positive impact. Rehabilitation activities always have the ability to be enhanced by best practices.

Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Limited)	2 (Limited)
Duration	7 (Permanent)	7 (Permanent)
Probability	4 (Probable)	4 (Probable)
Significance	48 (Medium-Low)	44 (Medium-Low)
Status	Positive	Positive
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement/mitigation measures:	Best practice rehabilitation methods should be adopted	
Residual impacts:	NA	

6.3 Loeriesfontein

6.3.1 Construction

Nature: Potential impact on the aesthetics and sense of place of Loeriesfontein Town		
Loeriesfontein will experience visual impacts associated with construction of the Solar PV Power Plants, building of roads and transportation of materials. Transportation of infrastructure and building material to and from the site will also introduce dust plumes due to vehicular movement. The site is, however, being constructed over 40km away from Loeriesfontein Town and the likelihood of town residents or visitors of the town experiencing these visual impacts is minimal.		
Parameters	**Without mitigation**	**With mitigation**
Severity	2 (Minor)	1 (Limited)
Spatial scale	1 (Very Limited)	1 (Very Limited)

Duration	3 (Medium-Term)	3 (Medium-Term)
Probability	4 (Probable)	4 (Probable)
Significance	24 (Low)	20 (Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact of the construction activities and Solar PV Power Plant will be reduced.	
Residual impacts:	NA	

6.3.2 Operational phase

Nature: Potential impact on the aesthetics and sense of place of Loeriesfontein Town The currently remote landscape will experience visual impacts associated with existence and operation of the Solar PV Power Plants. However, the site is being constructed 40km's outside of Loeriesfontein town, nestled between mountains, and next to a road that is not likely to be utilised by tourists – the likelihood of town residents or visitors experiencing these visual impacts is minimal,		
Parameters	**Without mitigation**	**With mitigation**
Severity	2 (Minor)	1 (Limited)
Spatial scale	1 (Very Limited)	1 (Very Limited)
Duration	5 (Project Life)	5 (Project Life)
Probability	3 (Unlikely)	3 (Unlikely)
Significance	24 (Low)	21 (Low)

Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact of the construction activities and Solar PV Power Plant will be reduced.	
Residual impacts:	Residual impacts will include a transformation of the landscape character as a whole during the project lifetime	

6.3.3 Decommissioning phase

Nature: Potential impact on the aesthetics of the landscape around the town of Loeriesfontein The components of the plant will be disassembled after its expected lifetime (20 years) and removed once the life span of the Solar PV Power Plant has come to an end. The noisy and abrasive activities associated with the demolition phase are likely to introduce a negative visual impact, but the site will be located a substantial distance outside of Loeriesfontein town and very few potential receptors have been identified within the area – it is therefore unlikely that the impact associated with the activities will be experienced.		
Parameters	**Without mitigation**	**With mitigation**
Severity	4 (Serious)	3 (Moderate)
Spatial scale	1 (Limited)	1 (Limited)
Duration	2 (Short term)	2 (Permanent)
Probability	3 (Unlikely)	3 (Unlikely)
Significance	21 (Low)	15 (Low)
Status	Negative	Negative

Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	The infrastructure should be demolished and removed as quickly and efficiently as possible	
Residual impacts:	NA	

Nature: Potential impact on the aesthetics of the landscape – rehabilitation (outcome)		
Removal of the Solar PV Power Plant and its associated structures will be a step towards rehabilitating the land to a state that it is in now. Visually, land that is being rehabilitated and returned to its natural state is normally aesthetically pleasing. After the abrasive demolition activities have been carried out, the outcome of rehabilitated land would be considered a positive impact. Rehabilitation activities always have the ability to be enhanced by best practices.		
Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Limited)	2 (Limited)
Duration	7 (Permanent)	7 (Permanent)
Probability	4 (Probable)	4 (Probable)
Significance	48 (Medium-Low)	44 (Medium-Low)
Status	Positive	Positive
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement/mitigation measures:	Best practice rehabilitation methods should be adopted	

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Residual impacts:	NA

6.4 Vanrhynsdorp

6.4.1 Construction phase

Nature: Potential impact on the aesthetics and sense of place of Vanrhynsdorp Town

While the Solar PV Power Plant is being constructed, a fair amount of activity will take place in and around the town, including fencing of the site and trucks transporting necessary equipment. Since the town of Vanrhynsdorp is rather small, construction activities will likely have an impact on the quaint "dorpie" and the tourism and cultural aspects associated with it.

The N7 and R27 are fairly popular tourist routes and the likelihood of the impact being experienced is therefore high

Parameters	**Without mitigation**	**With mitigation**
Severity	6 (Severe)	5 (Severe)
Spatial scale	3 (Local)	3 (Local)
Duration	3 (Medium Term)	3 (Medium Term)
Probability	7 (Certain)	7 (certain)
Significance	84 (Medium-High)	77 (Medium-High)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area were made. If these recommendations are followed, the visual impact of the construction activities and the project will be reduced slightly.	

Residual impacts:	NA

6.4.2 Operational phase

Nature: Potential impact on the aesthetics and sense of place of Vanrhynsdorp Town and the surrounding landscape The current landscape will experience visual impacts associated with the existence and operation of the Solar PV Power Plant. The potential site is situated in a visually sensitive area and the likelihood of both residents of the town and tourists experiencing the impacts is severe likely.		
Parameters	**Without mitigation**	**With mitigation**
Severity	7 (Very Significant)	6 (Significant)
Spatial scale	4 (Municipal - tourism)	4 (Municipal - tourism)
Duration	5 (Project Life)	5 (Project Life)
Probability	7 (Definite)	7 (Definite)
Significance	112 (High)	105 (Medium-High)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact of the construction activities and Solar PV Power Plant will be reduced very slightly.	
Residual impacts:	Residual impacts will include a transformation of the landscape character as a whole during the project lifetime	

6.4.3 Decommissioning phase

Nature: Potential impact on the aesthetics of the landscape around the town of Vanrhynsdorp

The components of the plant will be disassembled after its expected lifetime (20 years) and removed once the life span of the Solar PV Power Plant has come to an end. The noisy and abrasive decommissioning activities associated with the demolition of the infrastructure are likely to introduce a negative visual impact.

Parameters	**Without mitigation**	**With mitigation**
Severity	5 (Very Serious)	4 (Serious)
Spatial scale	2 (local)	2 (Local)
Duration	2 (Short Term	2 (Short term)
Probability	7 (Certain)	7 (Certain)
Significance	63 (Medium-High)	56 (Medium-Low)
Status	Negative	Negative
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	The infrastructure should be demolished and removed as quickly and efficiently as possible	
Residual impacts:	NA	

Nature: Potential impact on the aesthetics of the landscape – rehabilitation (outcome)

Removal of the Solar PV Power Plant and its associated structures will be a step towards rehabilitating the land to a state that it is in now. Visually, land that is being rehabilitated and returned to its natural state is normally aesthetically pleasing. After the abrasive demolition activities have been carried out, the outcome of rehabilitated land would be considered a positive impact. Rehabilitation activities always have the ability to be enhanced by best practices.

Parameters	**Without mitigation**	**With mitigation**

Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Limited)	2 (Limited)
Duration	7 (Permanent)	7 (Permanent)
Probability	4 (Probable)	4 (Probable)
Significance	48 (Medium-Low)	44 (Medium-Low)
Status	Positive	Positive
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement/mitigation measures:	Best practice rehabilitation methods should be adopted	
Residual impacts:	NA	

6.5 Graafwater

6.5.1 Construction phase

Nature: Potential impact on the aesthetics and sense of place of Graafwater Town Graafwater will experience visual impacts associated with construction of the Solar PV Power Plants, building of roads and transportation of materials which cannot be mitigated. Transportation of infrastructure and building material to and from the site will also introduce dust plumes due to vehicular movement. Graafwater is a farming town and does not have a significant tourism component. The significance of the activities will therefore not be very severe and the most likely receptors to experience the visual impact are residents within the town.		
Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Site and immediate surrounds)	2 (Site and immediate surrounds)

Duration	3 (Medium-Term)	3 (Medium-Term)
Probability	7 (Certain)	6 (Almost Certain)
Significance	56 (Medium-Low)	42 (Medium-Low)
Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact associated with the construction activities of the Solar PV Power Plant will be reduced since the visibility aspect will be reduced. .	
Residual impacts:	NA	

6.5.2 Operational phase

Nature: Potential impact on the aesthetics and sense of place of Graafwater Town and the surrounding landscape The current landscape will experience visual impacts associated with the existence and operation of the Solar PV Power Plant. The visual sensitivity of the landscape is not extremely high since it is an agricultural landscape and does not have a significant tourism aspect.		
Parameters	**Without mitigation**	**With mitigation**
Severity	4 (Serious)	3 (Moderate)
Spatial scale	2 (Limited)	2 (Limited)
Duration	5 (Project Life)	5 (Project Life)
Probability	7 (Definite)	6 (Probable)
Significance	77 (Medium-High)	60 (Medium-Low)

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Status	Negative	Negative
Reversibility?	Yes	Yes
Irreplaceable loss of visual resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	Recommendations about positioning of the Solar PV Power Plant components, based on the VIA and viewshed analyses that compare various options for placement within the study area was made. If these recommendations are followed, the visual impact of the existence and operation of the solar PV power plant will be reduced.	
Residual impacts:	Residual impacts will include a transformation of the landscape character as a whole during the project lifetime	

6.5.3 Decommissioning phase

Nature: Potential impact on the aesthetics of the landscape around the town of Graafwater The components of the plant will be disassembled after its expected lifetime (20 years) and removed once the life span of the Solar PV Power Plant has come to an end. The noisy and abrasive decommissioning activities associated with the demolition of the infrastructure are likely to introduce a negative visual impact.		
Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Low)
Spatial scale	2 (Local)	2 (Local)
Duration	2 (Short-Term)	2 (Short-Term)
Probability	7 (Likely)	6 (Likely)
Significance	49 (Medium-Low)	55 (Medium-Low)
Status	Negative	Negative
Reversibility?	No	No
Irreplaceable loss of visual	No	No

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

resources?		
Can impacts be mitigated?	Yes	
Enhancement/mitigation measures:	The infrastructure should be demolished and removed as quickly and efficiently as possible	
Residual impacts:	NA	

Nature: Potential impact on the aesthetics of the landscape – rehabilitation (outcome) Removal of the Solar PV Power Plant and its associated structures will be a step towards rehabilitating the land to a state that it is in now. Visually, land that is being rehabilitated and returned to its natural state is normally aesthetically pleasing. After the abrasive demolition activities have been carried out, the outcome of rehabilitated land would be considered a positive impact. Rehabilitation activities always have the ability to be enhanced by best practices.		
Parameters	**Without mitigation**	**With mitigation**
Severity	3 (Moderate)	2 (Minor)
Spatial scale	2 (Limited)	2 (Limited)
Duration	7 (Permanent)	7 (Permanent)
Probability	4 (Probable)	4 (Probable)
Significance	48 (Medium-Low)	44 (Medium-Low)
Status	Positive	Positive
Reversibility?	No	No
Irreplaceable loss of visual resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement/mitigation measures:	Best practice rehabilitation methods should be adopted	
Residual impacts:	NA	

7 CUMULATIVE IMPACTS

There is, at present, a lot of interest being expressed in the construction of renewable energy projects in the regions in which the five proposed Orlight Solar PV Power Plants will be located.

Table 13 is a comprehensive list of other proposed renewable energy projects (solar PV, concentrating solar power and wind energy) near the sites that have been assessed during this study. The impacts that have been identified and quantified are for the contextual current visual landscape and do not consider potential future developments. If the areas become hotspots for renewable energy project development, all of the landscapes that have been described will be altered drastically/completely. The sense of place of each landscape and the associated towns will change with the increase in renewable energy projects and their respective construction activities.

Table 13: Other proposed renewable energy projects within the areas of interest

Site / Area	Applicants	Size of proposed project (MW)
Aggeneys	Solar Capital	75
	Aurora Power Solutions	10
Kenhardt	Aurora Power Solutions	10
	Green Continent Energy	75
	Texforce - Cape Solar CC	40
Loeriesfontein	Solar Capital	5 X 75
	Mainstream - Wind	100
	Mainstream - Solar	50
Vanrhynsdorp	No competitors	
Graafwater	iNCA Energy	25

The size of the footprints of disturbed areas on which construction takes place definitely affects the magnitude of visual impacts. A single Solar PV Power Plant, surrounded by a natural landscape would have a smaller visual impact than an extensive landscape dominated by similar projects. Whether the sight of the solar PV panels extending into a landscape will have a negative or positive impact is dependent on the viewer – some might deem it as exciting and ‘futuristic’.

The sense of place will, however, definitely be altered since the landscapes will be transformed from dramatic, vast expanses of open land, or small towns that have the 'in the middle of nowhere' charm. The alteration of a sense of place within communities and landscapes also leads to an impact on other aspects that are intertwined, such as the extraordinary heritage characteristics that a town, group of people, or even an archaeological site possesses. An archaeological site is a result of the cultural environment and landscape that surrounds it. It is therefore also very sensitive to changes in the cultural landscape or environment. The Gamsberg, which is located 2.5 km east of the proposed Solar PV Power Plant at Aggeneys has been identified as a possibly sensitive visual receptor of cumulative visual impacts if the area is transformed further (it has already been transformed by mining activities and the development of infrastructure such as transmission lines and roads) by renewable energy projects. Morris (2010) has discussed the importance of the Gamsberg as a potential "genocide site for the San"; the phase 1 HIA should therefore further explore the cumulative impacts of all of the possible renewable energy projects, along with the current and future mining activities, within the vicinity.

Future development of renewable energy projects in the regions will not only cause more side-spread visual impacts and changes to the landscape, but it will modify the sense of place (and remoteness around the Aggeneys, Kenhardt and Loeriesfontein study areas). The way in which the sense of place will be modified depends on the extent of the developments in the area, the way in which communities react to the developments and the relative successes of the first few projects that are initiated.

8 RECOMMENDATIONS

There are few mitigation measures that can be put in place in order to reduce the visual impacts that will be created by the infrastructure associated with the proposed Solar PV Power Plants.

The most important objective is to synthesise the current visual sensitivity data with the information collected from other environmental and cultural studies to delineate sensitive areas. A set of comprehensive sensitivity plans should play a role in the decision making process with regards to site layout of the proposed Solar PV Power Plants and its associated components. It is crucial that the relationship between the visual landscape and the archaeological and heritage sites that were identified during the cultural resources pre-assessment be explored thoroughly during the phase 1 HIA. The identified sites need to be described in detail and the occurrence/significance of visual impacts associated with the potential Solar PV Power Plant need to be quantified within the context of their intangible heritage aspects. Investigation and exploration of the study areas will determine whether there are other cultural and heritage resources within the area; if there are the visual impacts that might affect their intangible heritage aspects also need to be investigated.

The visual impacts associated with those study areas that could have potentially medium to high visual impacts when the infrastructure is built (Aggeneys, Vanrhynsdorp and Graafwater) could possibly be alleviated by carrying out the following actions;

- For the proposed Graafwater site, the natural vegetation that occurs on site has the capability to screen the proposed infrastructure. Existing natural vegetation should be retained between the Solar PV Power Plant and the road to the north that runs through the town of Graafwater to screen the infrastructure.
- Exotic tree species have been introduced in the town of Aggeneys along avenues. Planting of fast-growing species between receptors and the proposed Solar PV Power Plants is an option for visual screening; however it is not advised considering water scarcity and the threat of spreading of alien invasive species.

The nature of visual impacts is such that the impact is highest when first experienced, but as receptors become used to the site and the new landscape aspects become part of the sense of place and the landscape itself, the visual impact is reduced.

9 STUDY SUMMARY AND CONCLUSION

The proposed Orlight SA Solar PV Power Plants is an exciting opportunity for South Africa to adopt a "greener" technology in terms of energy production. The VIA aims to objectively report on the possible visual impacts that the people living within a certain radius to the proposed Solar PV Power Plants and those people passing through the environment of interest might experience. The VIA also aims to suggest favourable options for the construction of the Solar PV Power Plants so that the lowest possible visual impacts will be experienced.

Many of the landscapes of interest are open and are more natural than urbanised – the potential infrastructure does, therefore, have the ability to alter the current landscape character and scenic value of all of the sites.

The Loeriesfontein and Kenhardt study areas lie at least 35 km from the towns themselves and the landscapes will definitely be transformed should the projects take place. However, there will be few to no people experiencing a negative visual impact as there are very few identified potential receptors and the construction of Solar PV Power Plants might even bring about positive visual impacts. This positive visual impact could be introduced if the Solar PV Power Plants are constructed in a responsible manner that takes into account all of the aspects of visual (and ecological) sensitivity since the construction and presence of the infrastructure could introduce a sense of progress and opportunity to local and impoverished communities.

The Aggeneys study area is close to the town, but it is a mining town and existing construction and mining related activities contribute to the landscapes' already existing industrial character. The landscape type will therefore not be completely transformed by the proposed Solar PV Power Plant.

The Graafwater study area is situated very close to the town and consequently, a number of receptors have been identified within the visual study area. However, the landscape is already transformed due to agricultural activities, transmission lines and the borrow pit and therefore has a higher visual absorption capacity. The tourism aspect of the area is not highly significant and should not be a limiting factor when considering the impacts associated with the construction of the Solar PV Power Plant.

The visual sensitivity of the Vanrhynsdorp area is very high due to tourism and cultural aspects associated with the old and quaint 'dorpie' and the ecological landscape that surrounds it. The likelihood of the visual impact being experienced is high due to the positioning of the town in relation to the N7 and the route connecting Nieuwoudtville, Vanrhynsdorp and Vredendal.

It was evident that very few I&APs perceive the proposed Solar PV Power Plants to have a negative visual impact. In fact, some opinions were voiced that the proposed projects would have a positive visual impact in terms of attaching a "green energy" sense to the town.

It is believed that the identified visual impacts associated with the construction and operation of the proposed Solar PV Power Plants, will not be too severe at the Aggeneys, Kenhardt, Loeriesfontein, or the Graafwater sites, provided that the developments take place within the low visual sensitivity areas that were delineated through the course of this assessment. The visual impacts associated with the heritage and tourism landscape of Vanrhynsdorp are likely to be more severe.

10 REFERENCES

CONTESSE, E. 2011. Landscape and Wind Turbines. Report Presented at the 6th Council of Europe Conference of the European Landscape Convention. Available online: http://www.coe.int/t/dg4/cultureheritage/heritage/landscape/reunionconf/6econference/CEP-CDPATEP(2011)11_en.pdf [06/03/2012]

ESRI 2011. Using Viewshed and Observer Points for Visibility Analysis: ArcGIS 10.

EUROPEAN LANDSCAPE CONVENTION. 2007. A Framework for Implementation. Available online: http://www.naturalengland.org.uk/Images/elcframework_tcm6-8169.pdf [06/03/2011]

HAARMEYER, D.H. 2009. Effects of Domestic Livestock on the Vegetation of the Knersvlakte, South Africa. Unpublished Diploma Thesis, Department of Biology, University of Hamburg

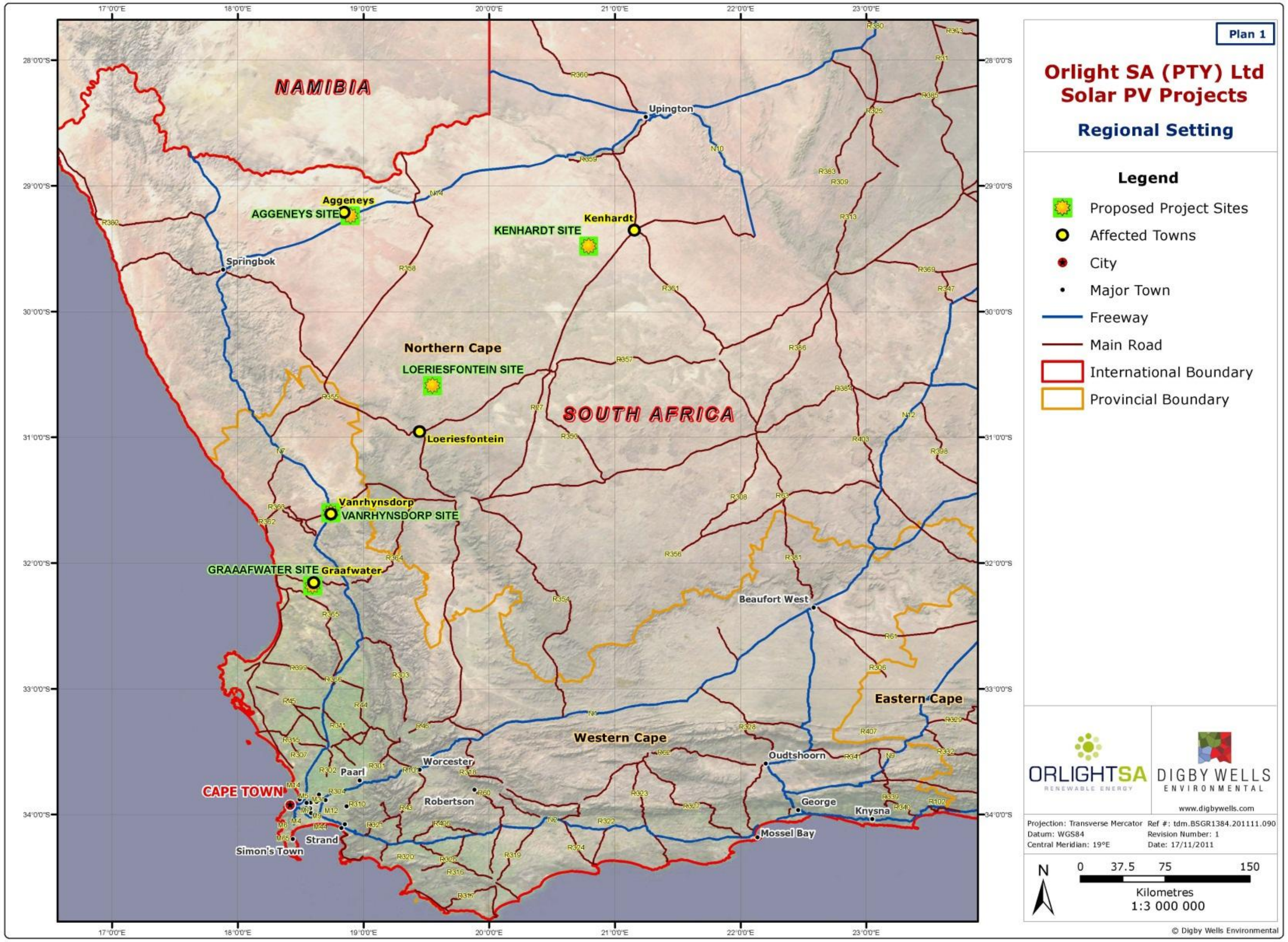
OBERHOLZER, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in the EIA Processes; Edition 1. CSIR Report No. ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Developmental Planning, Cape Town.

SHETLANDS ISLANDS COUNCIL. 2006. Basic Principles of Landscape and Visual Impact Assessment for Sponsors of Development. Planning; Infrastructure Services Department, Grantfield, Lerwick, Scotland.

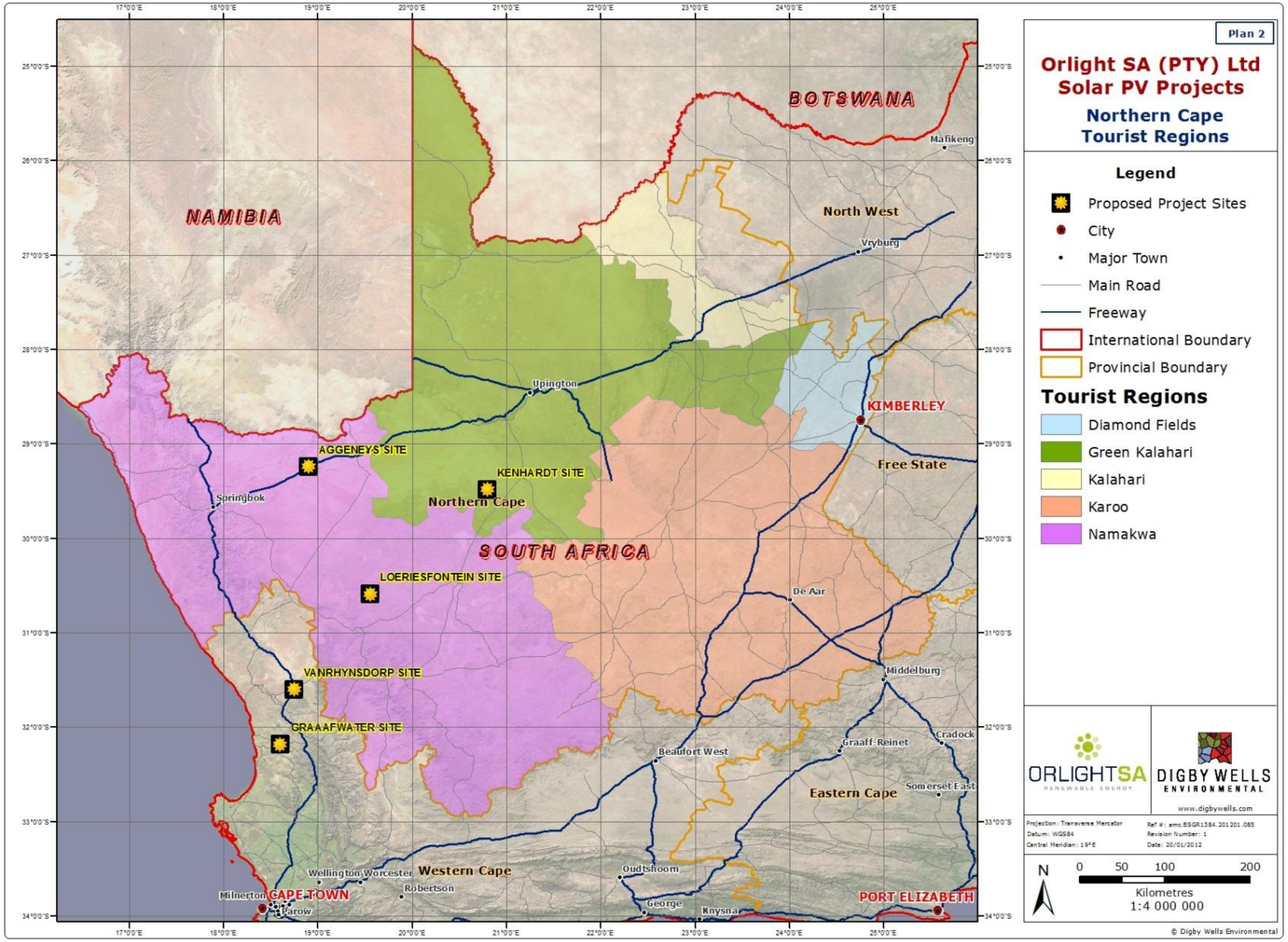
NAUSSER, J.I. 1995. Culture and changing landscape structure. Landscape Ecology 10:

Appendix A: Plans

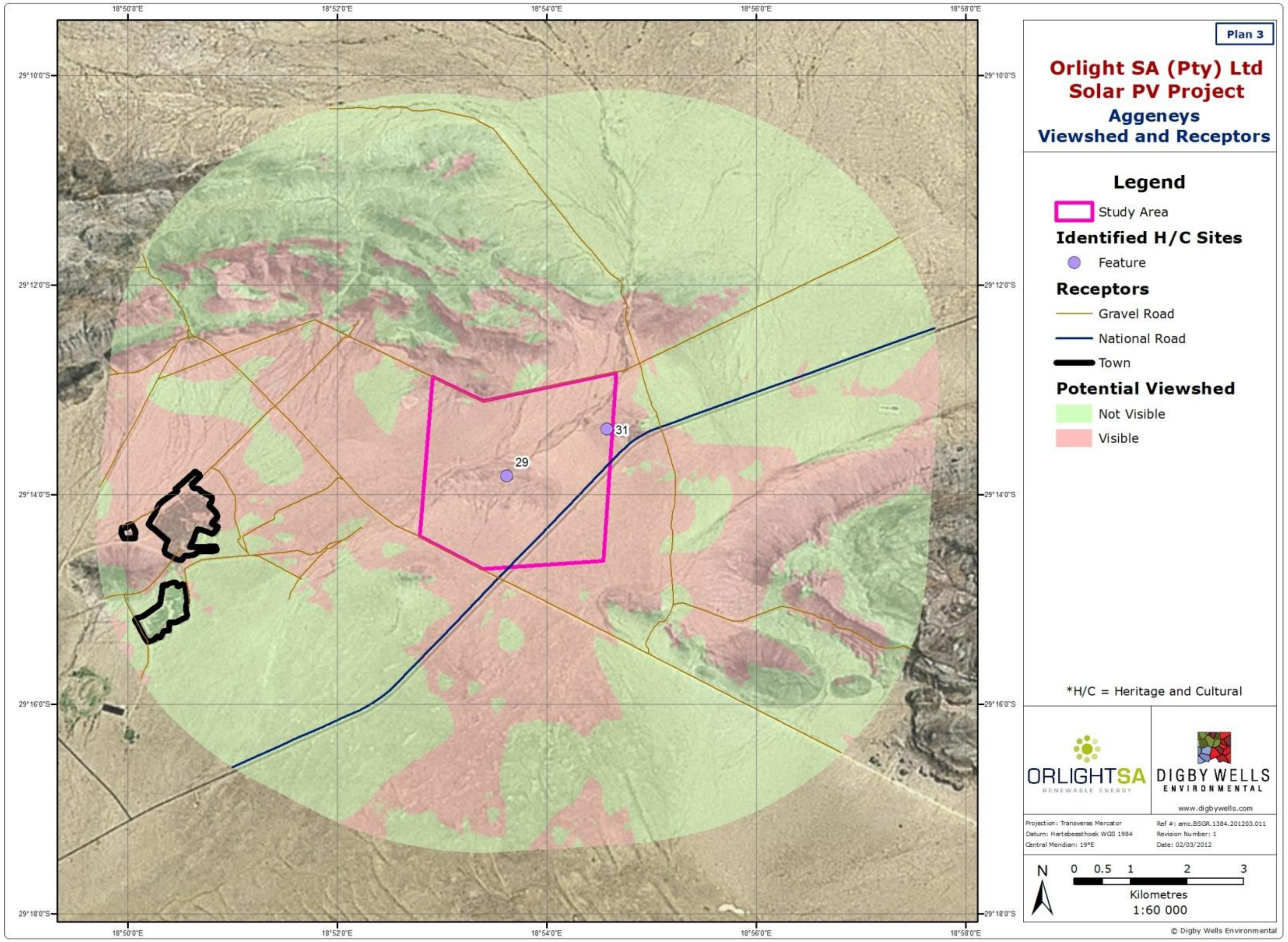
confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36



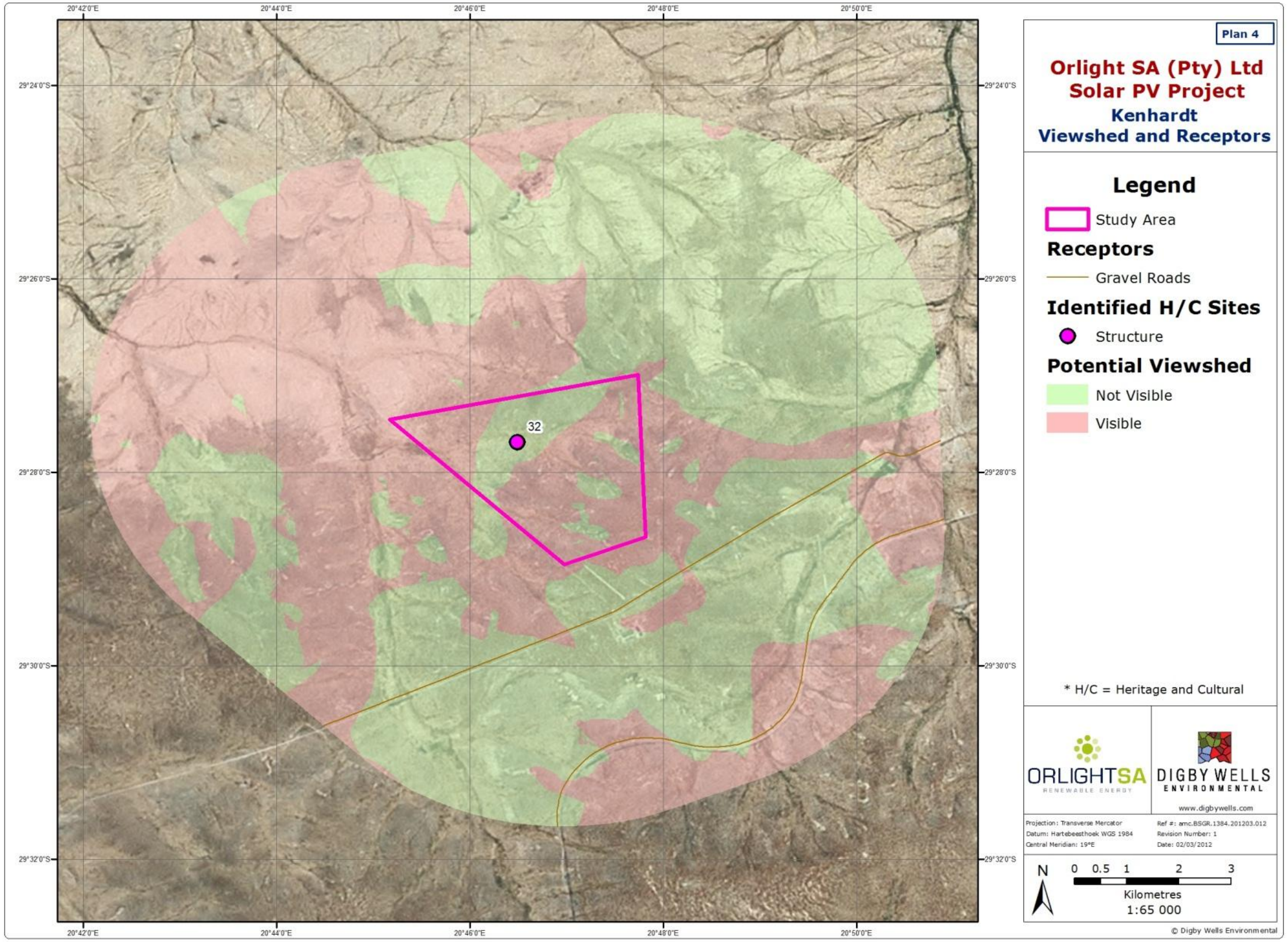
Plan 1: Regional study area



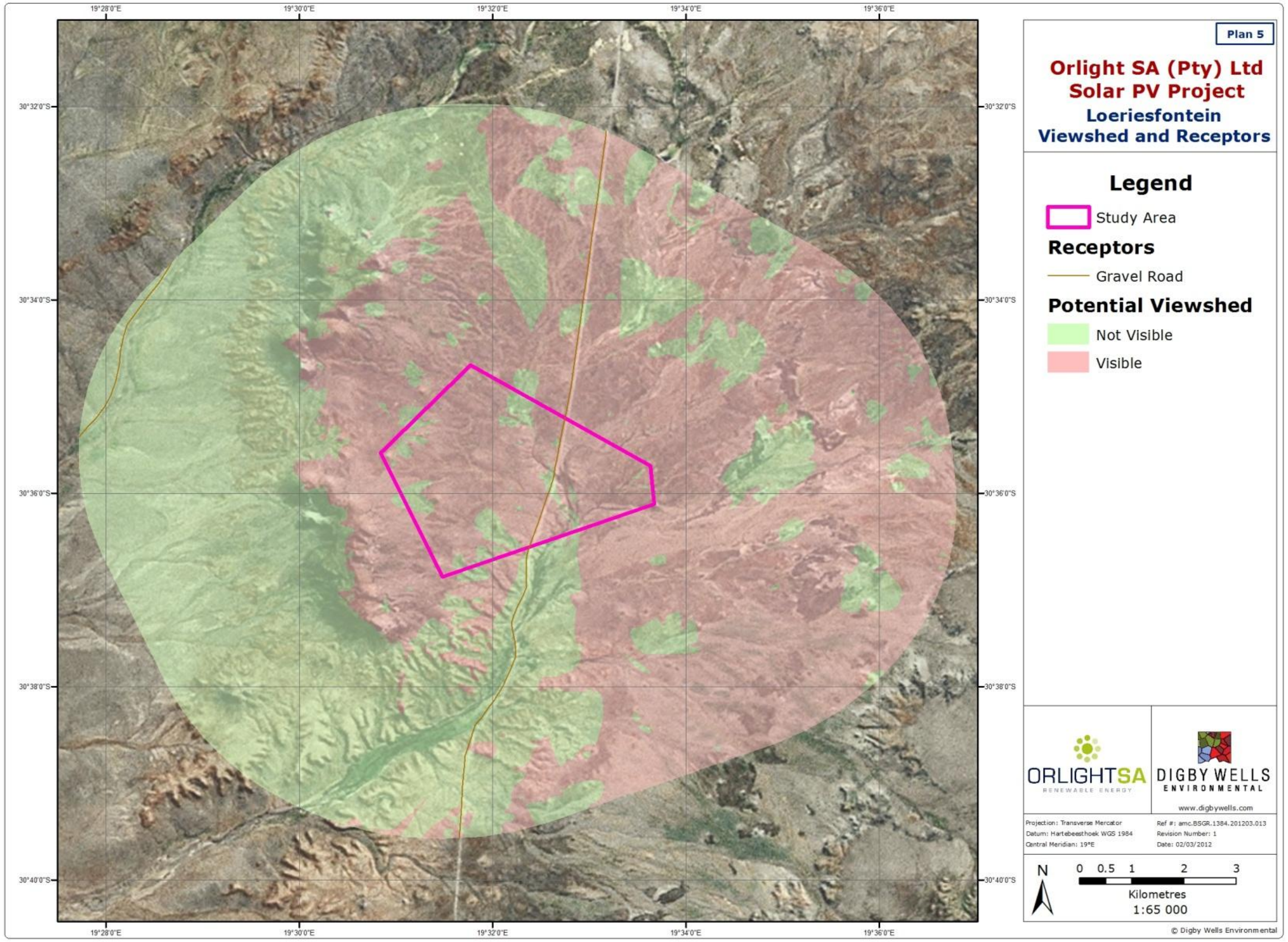
Plan 2: Tourism regions within the Northern Cape



Plan 3: Aggeneys study area viewshed results

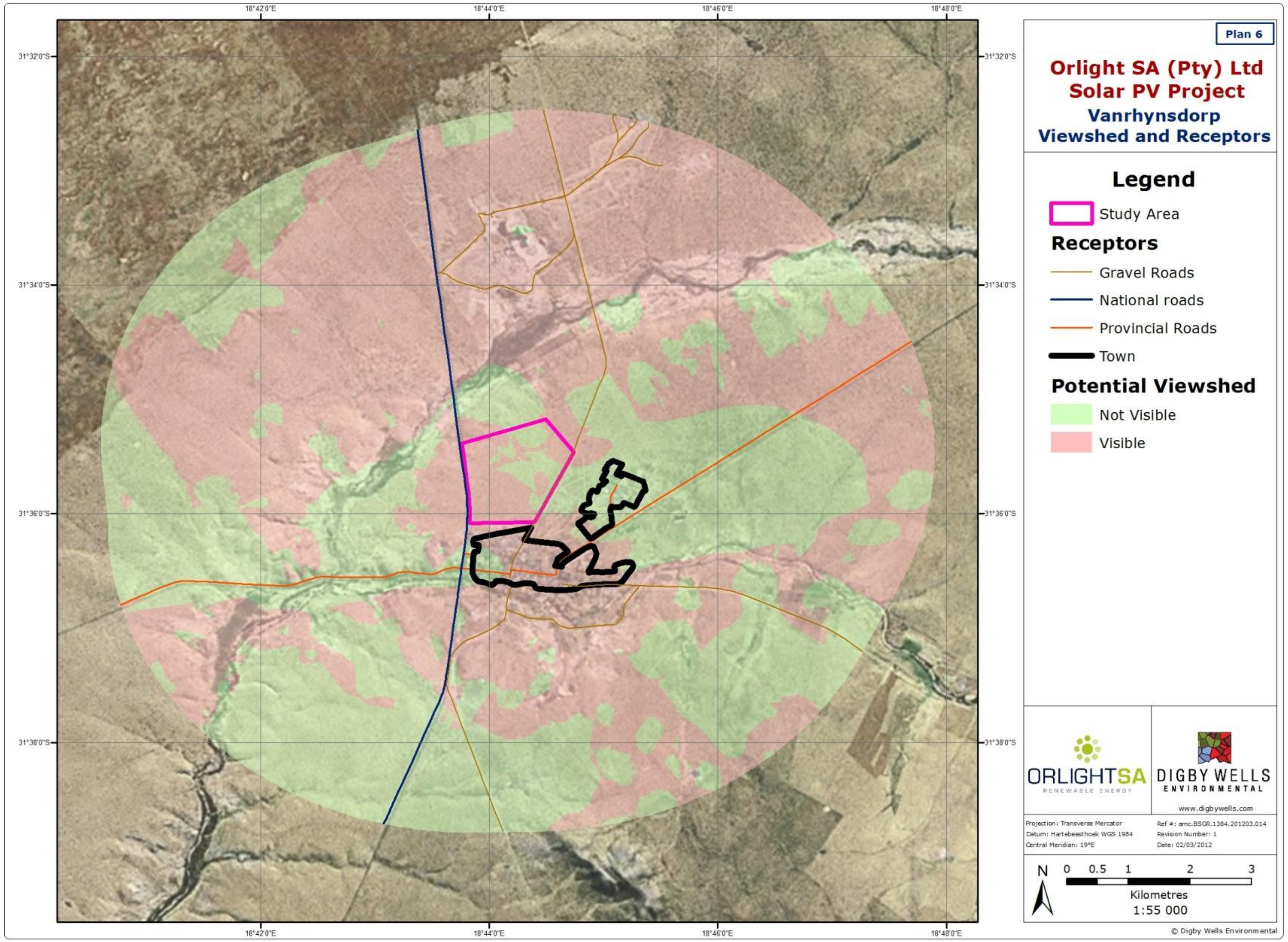


Plan 4: Kenhardt study area viewshed results



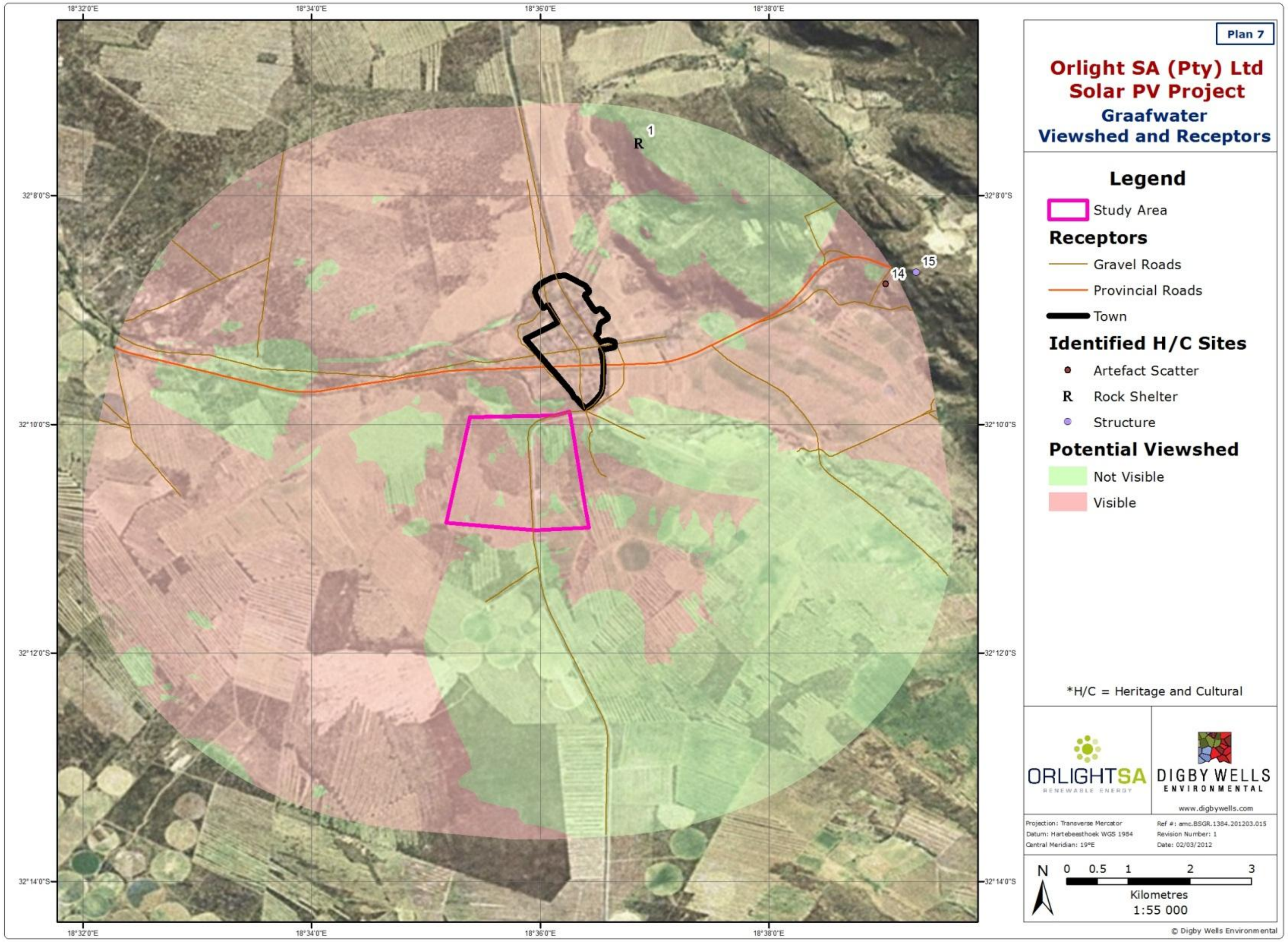
Plan 5: Loeriesfontein study area viewshed results

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

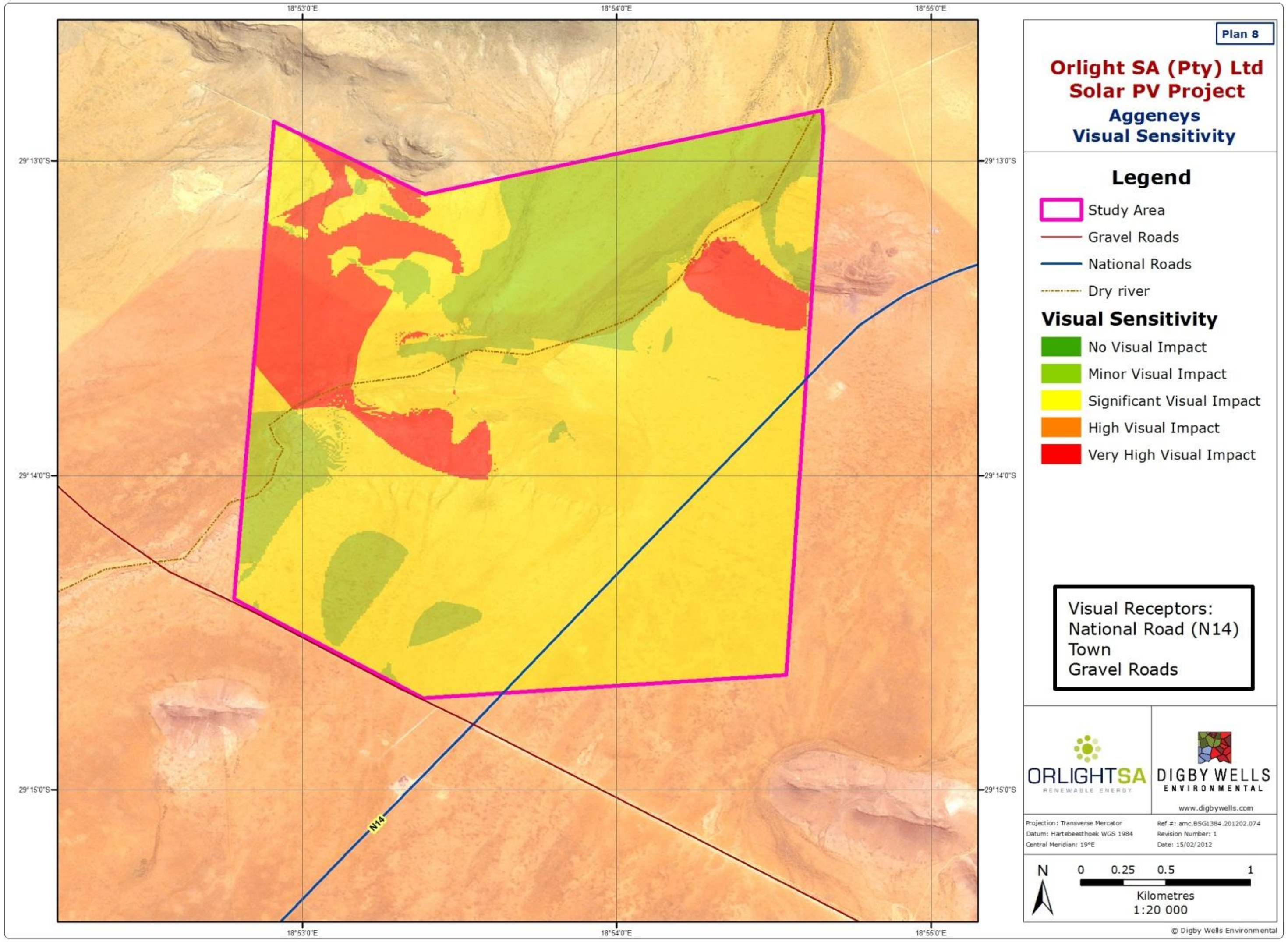


Plan 6: Vanrhynsdorp study area viewshed results

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

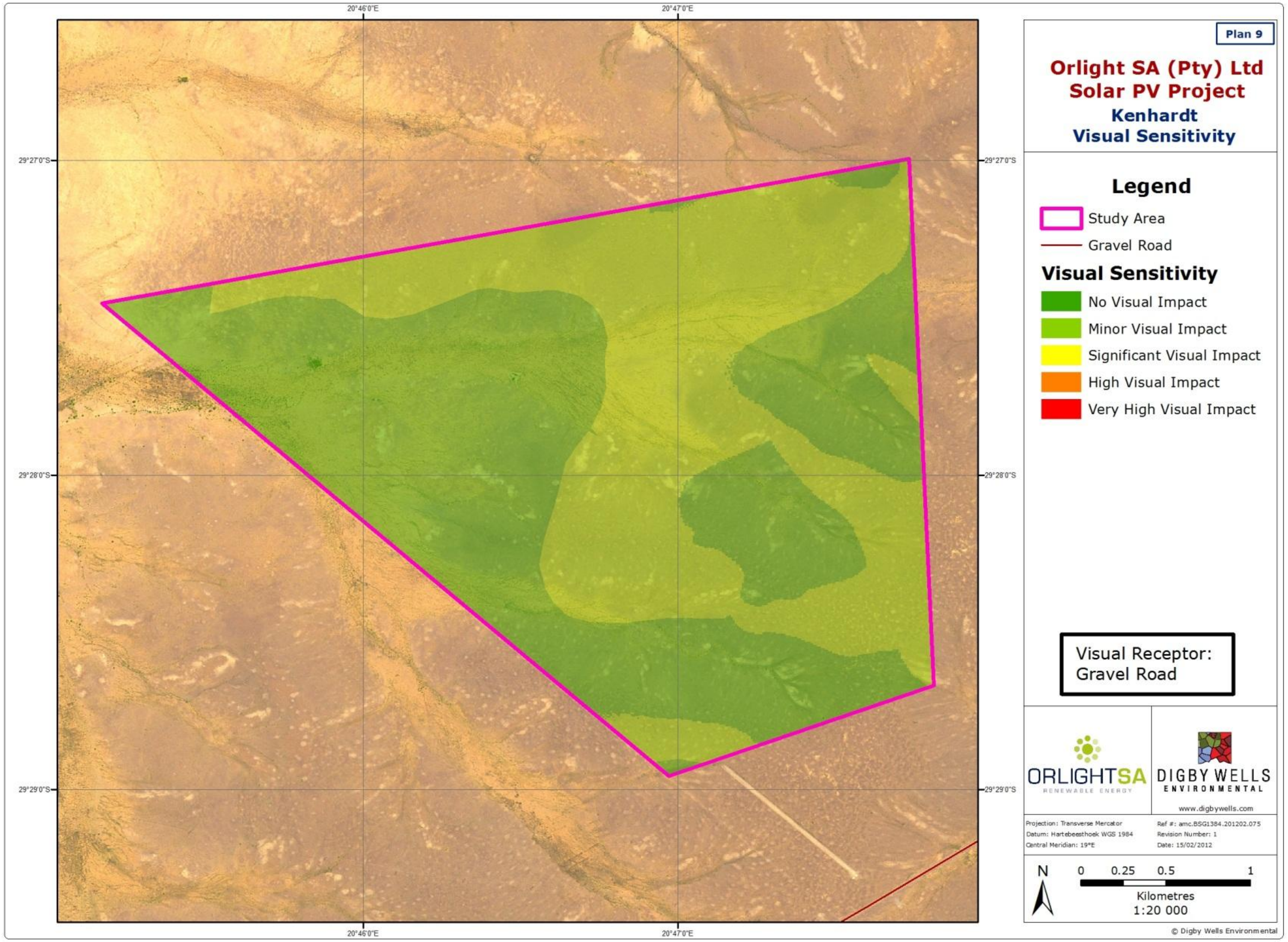


Plan 7: Graafwater study area viewshed results

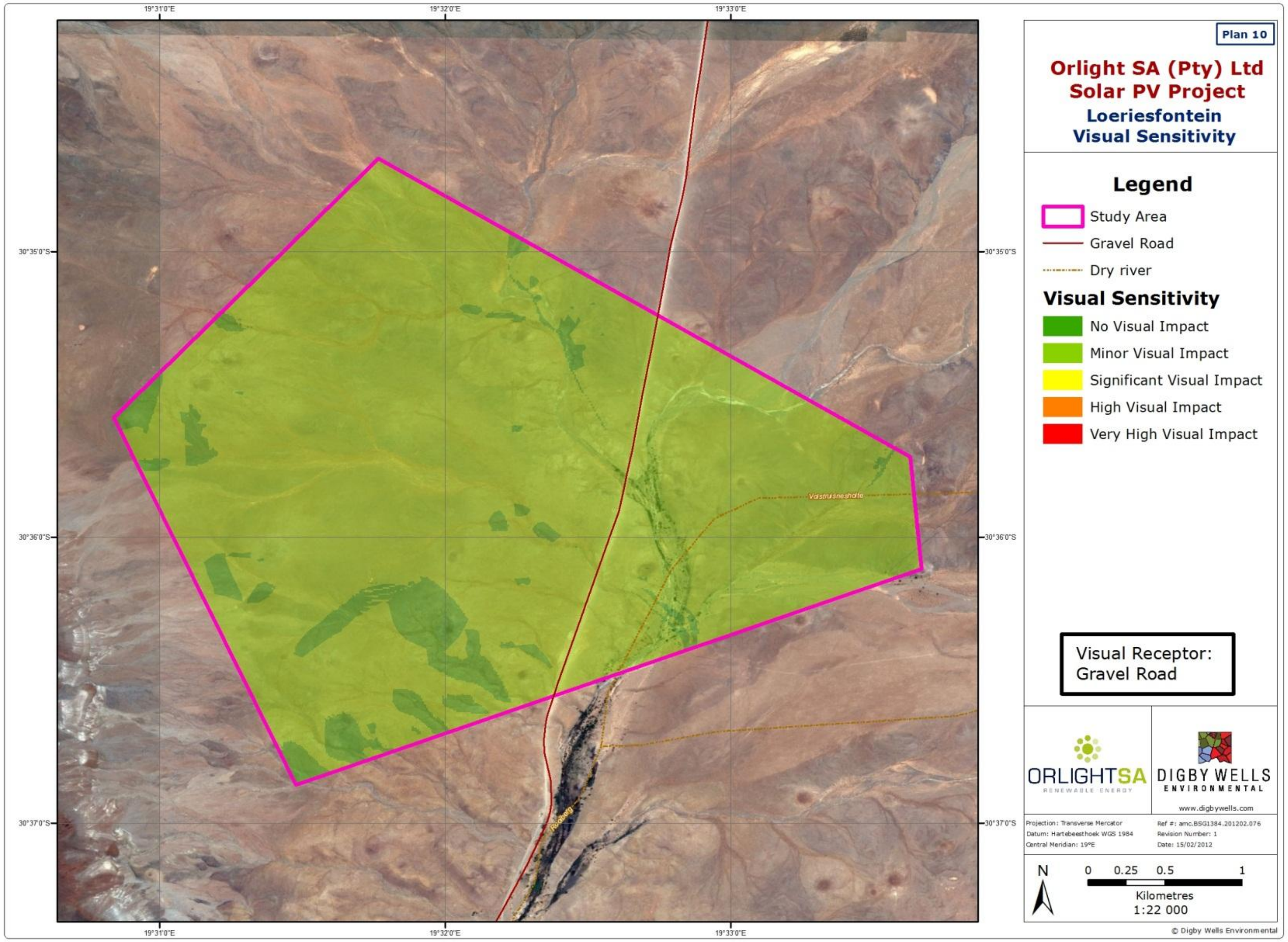


Plan 8: Aggeneys overall visual sensitivity

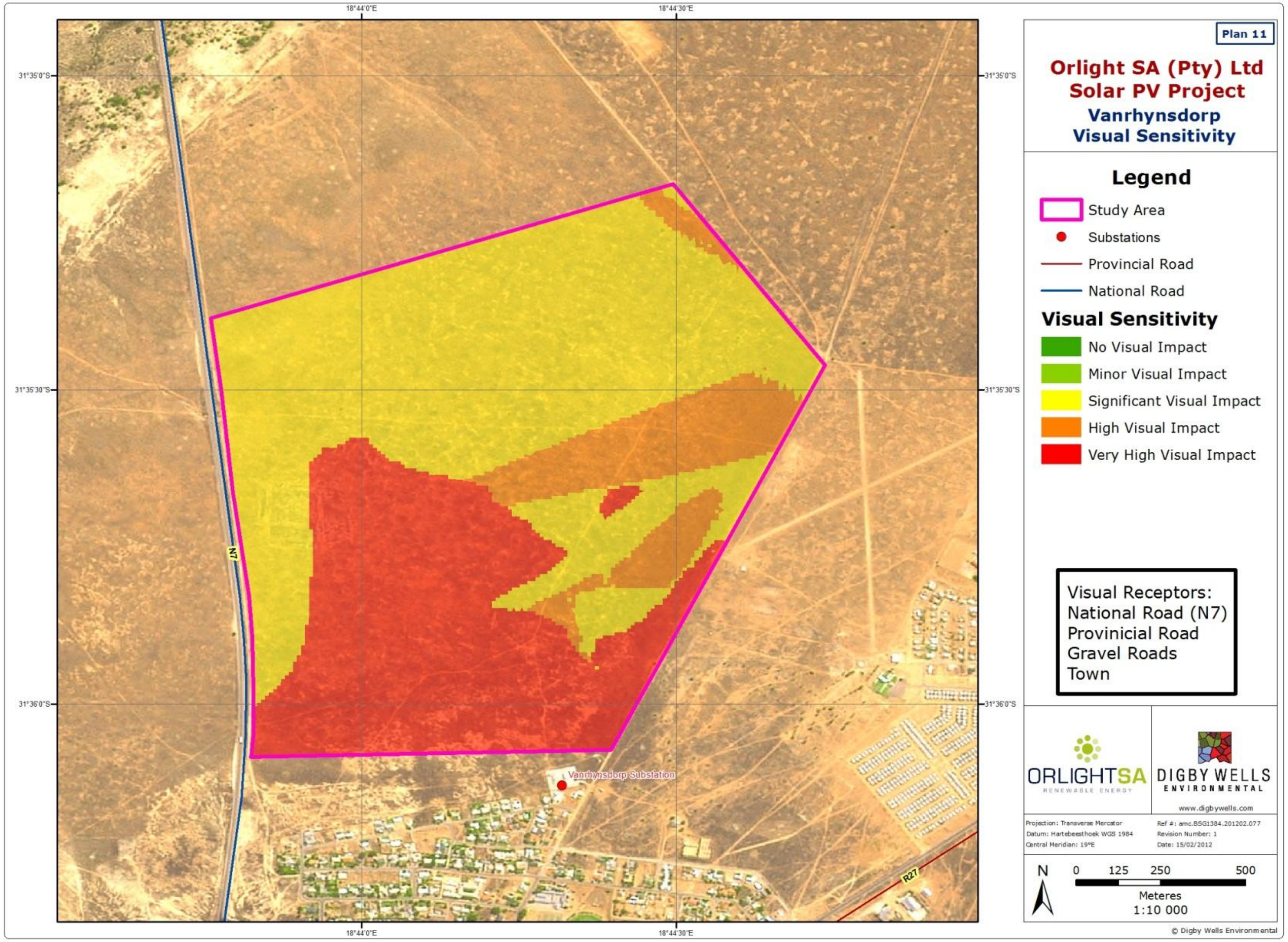
confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36



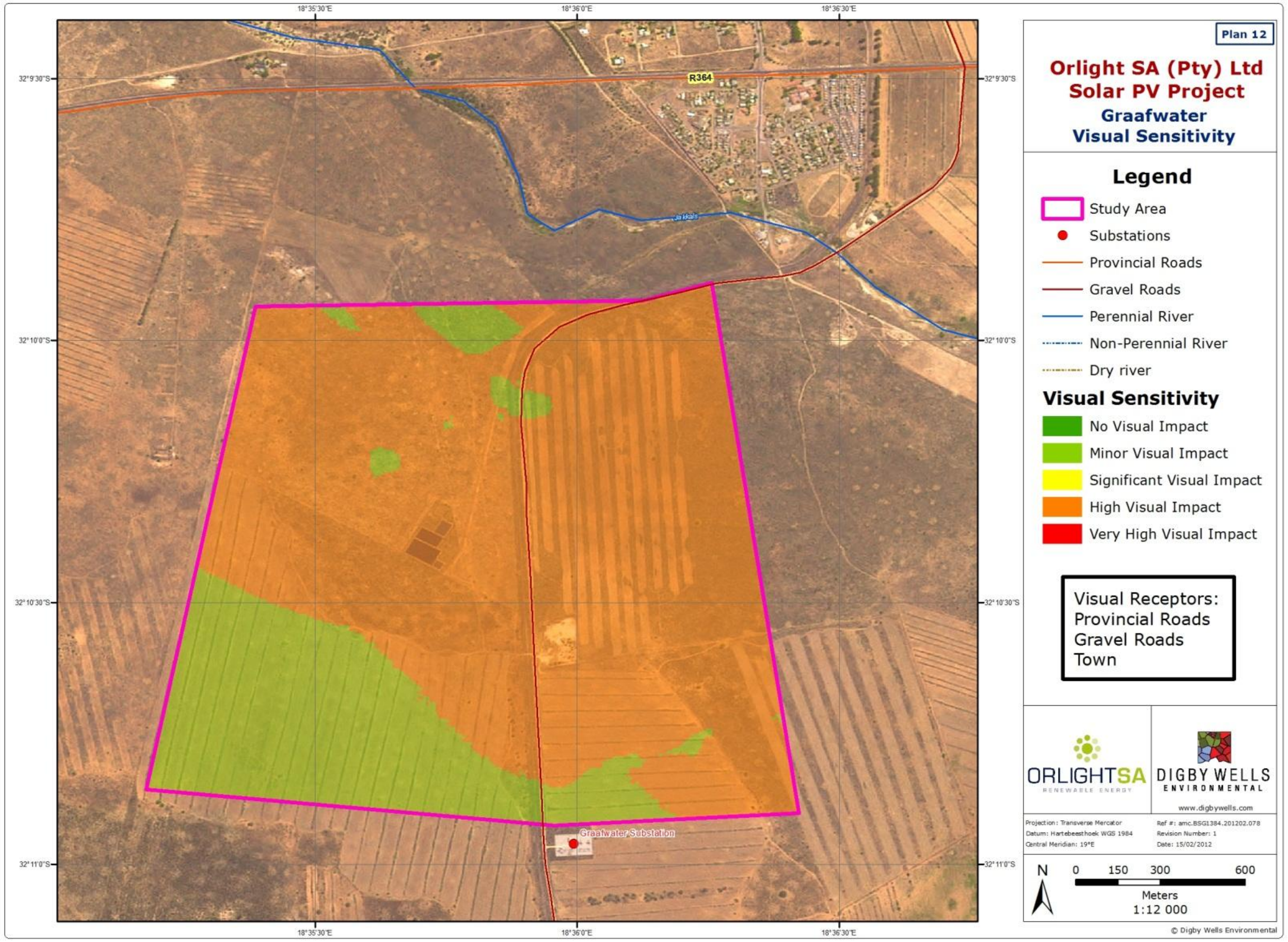
Plan 9: Kenhardt overall visual sensitivity



Plan 10: Loeriesfontein overall visual sensitivity



Plan 11: Vanrhynsdorp overall visual sensitivity



Plan 12: Graafwater overall visual sensitivity

Appendix B: Curriculum vitae's and declarations of independence of specialists

DIGBY WELLS
ENVIRONMENTAL

CURRICULUM VITAE OF REPORT WRITER/GIS SPECIALIST

Miss Alice McClure

Specialist: Geographic Information Systems (GIS) & Air Quality

GIS & Air Quality Department

Digby Wells Environmental

Education

2005 - 2007: B.Sc. Environmental Sciences: Majored in Environmental Science and Entomology (Rhodes University)

2008: B.Sc. (Hons) Environmental Sciences: Courses in Conservation Planning, Rehabilitation Ecology, Non-timber Forest Product Uses, Geographic Information Systems (GIS), Environmental Impact Assessment (EIA) and a short course in statistics (Rhodes University)

2009 – 2010: M.Sc. Environmental Sciences: Proactive conservation planning with a strong social focus using GIS

Language Skills

English, Afrikaans and limited Zulu

Employment

March 2011 to present	Digby Wells Environmental
January 2009 – August 2010	Eden to Addo Corridor Initiative

Experience

GIS specialist in the Geographic Information Systems (GIS) and Air Quality Department. Graduated with an MSc in Environmental Sciences. The research associated with my master's degree was carried out while I was employed at Eden to Addo and was utilised practically to begin the systematic design of a conservation corridor between Addo Elephant National Park and Tsitsikamma National Park. Special consideration was given to the high social sensitivity of the area and the controversy surrounding conservation in the area. I used GIS to explore the effect and outcomes of incorporating social data into systematic conservation planning using least-cost corridor models. Since employment at Digby Wells, my expertise in ArcGIS processes has grown exponentially and techniques to solve spatial, temporal and analytical problems have been refined.

Responsibilities at Digby Wells Environmental currently include but are not limited to:

Generation of maps for company projects;

Compilation of Visual Impact Assessments;

Assist in the completion of Biodiversity Assessments;

Assist in the completion of Due Diligence Reports

Assist in the development of a systematic and efficient tree-relocation plan;

Assist in the maintenance of the GIS database by storing all electronic files in a well organised structure

Assist in the completion of Closure Cost Assessments by solving the spatial and analytical queries involved

Assist in the design and completion of Rehabilitation Plans

Assist in carrying out air quality assessments

Produce spatial information in map format; and

Application of GPS technology, aerial photo and satellite images

Professional affiliations

Geographic Information Society of South Africa (GISSA)

International Association for Impact Assessment (IAIA)

DECLARATION OF INDEPENDANCE OF REPORT WRITER AND GIS SPECIALIST

I, **Alice McClure**, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed project: **Visual Impact Assessment for BSGR Resources**;
- 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 Environmental Impact Assessment Regulations, 2006;
- Do no have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;

Alice McClure

Name of specialist

Signature of the specialist

Digby Wells Environmental

Name of company

2012/03/05

Date

CURRICULUM VITAE OF GIS SPECIALIST

Mr. Error! Reference source not found.

Department Manager: Geographic Information Systems (GIS) & Air Quality

GIS & Air Quality Department

Digby Wells Environmental

Education

2000 – 2002: BSc Natural Sciences: Majored in Geology, Geography & Environmental Management (Rand Afrikaans University).

2003: B.Sc. (Hons) Geography and Environmental Management: Strong focus on Geographic Information Systems (GIS), Environmental Management and Physical Geography (Rand Afrikaans University).

2007: Introduction to ArcGIS (GIMS)

2008: Advanced Analysis with ArcGIS (GIMS)

2008: Flood Hydrology (University of Stellenbosch)

Language Skills

English & Afrikaans

Employment

March 2007 to present	Digby Wells Environmental
May 2003 – April 2006	Fernridge Consulting
April 2006 – February 2007	OPSI Systems

Experience

Department manager of the Geographic Information Systems (GIS) and Air Quality department. Graduated with a BSc (Hons) in the field of Geography and Environmental Management. Several years of experience in using GIS techniques for solving spatial and temporal problems within the human and natural environments. After inaugurating GIS technology at Digby Wells, expertise has further developed in the areas of Aerial Photographic and Satellite Remote Sensing applications, topographical and three dimensional (3D) data modelling, statistical analytics and digital cartographic applications. Has a keen interest in identifying natural and social relationships which lends itself to a better understanding of the environment and enhancing informed decision making.

Responsibilities at Digby Wells Environmental currently include but are not limited to:

Management of the GIS & Air Quality Department;

Technological development of GIS and Remote Sensing solutions;

Expanding and improving GIS databases by identifying gaps and sources of additional mapping data;

The production of spatial information in map format;

Application of GPS technology, Aerial photo and satellite images.

Professional affiliations

Geographic Information Society of South Africa (GISSA)

DECLARATION OF INDEPENDANCE OF REPORT WRITER AND GIS SPECIALIST

I, **Bradly Thornton**, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed project: **Visual Impact Assessment for BSGR Resources**;
- 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 Environmental Impact Assessment Regulations, 2006;
- Do no have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;

Bradly Thornton

Name of specialist

Signature of the specialist

Digby Wells Environmental

Name of company

2012/03/05

Date

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Appendix H: Tourism and Sustainability Assessment

TOURISM AND SUSTAINABILITY ASSESSMENT

FOR THE

PROPOSED SOLAR PHOTOVOLTAIC POWER PLANTS IN THE NORTHERN CAPE AND WESTERN CAPE PROVINCES

ORLIGHT SA (PTY) LTD

JUNE 2012

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa

Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

DIGBY WELLS
ENVIRONMENTAL

This document has been prepared by **Digby Wells Environmental**.

Report title: Tourism and sustainability assessment for the proposed solar photovoltaic power plants in the Northern Cape and Western Cape provinces

Project number: BSG1384

NAME	RESPONSIBILITY	SIGNATURE	DATE
Marike de Klerk	Project administrator		14 June 2012
Mia Ackermann	Project manager		15 June 2012

This report is provided solely for the purposes set out in it and may not,

in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

100% Recycled Paper

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa

Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

Directors: AR Wilke, LF Koeslag, PD Tanner (British)*, AJ Reynolds (Chairman) (British)*, J Leaver*, GE Trusler (C.E.O)

*Non-Executive

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

EXECUTIVE SUMMARY

Project Overview

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Orlight SA (Pty) Ltd (Orlight SA) Solar Photovoltaic (PV) Power Plants, in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

This Tourism and Sustainability Assessment (T&SA) was conducted to assess the significance of impacts of the proposed projects on the tourism industry and to evaluate the long-term economic viability and benefits of the proposed project to society.

Report Overview

The T&SA report is divided into eight chapters, providing details on the tourism industry and sustainability of the relevant project regions, as well as on the local environment, potential impacts associated with the proposed project on the local social, cultural and natural environment, as well as recommendations.. In essence, this report provides a better understanding of the current status of the tourism industry in each project area (Chapter 4). It also evaluates the potential direct and indirect impacts on the local tourism industries resulting from the proposed Solar PV Power plants in the project areas (Chapter 5). The T&SA report makes recommendations how the proposed Orlight SA (Solar PV Power Plants can support the sustainable growth of existing tourism industries through potential multiplier effects and indirect employment opportunities (Chapter 6 and Chapter 7) and encourages integrated development with the ultimate objective of sustainable development.

Findings

The Northern Cape Province relies on its natural and cultural heritage to satisfy tourist demands. Tourism demands generally refer to the motivation of travellers to visit a destination. This province is classified as a vast semi-desert region, renowned for its eco-tourism attractions, adventures, natural and cultural heritage, as well as unique ecological attractions specifically during the flowering season in spring. The Western Cape Province offers some of the most significant overall tourist products and services in South Africa and also relies on its natural and cultural heritage to satisfy tourism demands. Eco-tourism, adventure, culture, trade and investment, sport and events were identified as the some of the most significant tourist aspects of the Western Cape Province.

Due to the tourism industry's dependence on natural and cultural heritage, a few concerns were raised by Interested and Affected Parties (I&APs) regarding the loss of fauna and flora and negative visual impacts in the project areas. However, from a holistic tourism and sustainability point of view, the potential negative impacts of the proposed solar PV plants are regarded as medium-low. It was found that the Orlight Solar PV Power Plants may provide a number of opportunities to the project regions, such as employment opportunities, raising environmental awareness and supporting existing tourism establishments and services.

DIGBY WELLS ENVIRONMENTAL

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

An Environmental Impact Assessment (EIA) process was undertaken by Digby Wells Environmental (Digby Wells) for the proposed Orlight SA (Pty) Ltd Solar Photovoltaic (PV) Power Plants, to be constructed in the Northern and Western Cape Provinces of South Africa.

As part of the EIA process, a Scoping Report was compiled and submitted to the Department of Environmental Affairs (DEA) for their perusal. After the review of the Scoping Reports, the DEA requested that the significance of impacts of the proposed projects on the tourism industry be investigated in more detail and the long-term economic viability and benefits to society be evaluated. Digby Wells concedes the issues and concerns relating to tourism and sustainability and subsequently compiled this Tourism and Sustainability Assessment (T&SA).

2 TERMS OF REFERENCES

2.1 Aims and purpose

With the focus on tourism and sustainability, the main purpose of the T&SA is to:

- Identify and understand the current status of the tourism industry in each project area (Chapter 4, with specific focus on Section 4.3 and Section 4.4);
- Investigate the potential direct and indirect impacts of the proposed Solar PV Power Plants on the local tourism industries in the project areas (Chapter 5, with specific focus on Section 5.3);
- Provide recommendations how the proposed Solar PV Power Plants can support the sustainable growth of existing tourism industries through potential multiplier effects and indirect employment opportunities, e.g. transport services, accommodation/ hospitality and catering, amongst others (Chapter 6); and
- Encourage integrated development which promotes overall sustainable development through cooperation between renewable energy industries in the area to minimise impacts on the natural, social and biophysical environments, whilst supporting local employment and skills development (Chapter 7).

The aims and objectives listed above needs to be integrated into the tourism and sustainability context:

The local tourism industries: Local tourism industries in the proposed project areas of the Northern and Western Cape Provinces is mainly dependent on natural and cultural resources such as seasonal flowers, vast open areas and outdoor activities such as hiking and 4x4 routes. These natural and cultural resources therefor need to be conserved to ensure a feasible and growing tourism industry is maintained.

Sustainability: Sustainability encompasses three main aspects including social justice, environmental integrity and developments must consider not only the financial 'bottom line' of prosperity and profit of the specific project, but also other 'bottom lines' such as environmental quality and social equity in the geographical proximity of the proposed project areas. This implies that the proposed project needs to consider all the elements encompassing sustainability in the project areas.

2.2 Methodology

The approach and methodology for this assessment consisted of two primary phases:

- Phase 1: Literature review, research, data evaluation and desktop study; and
- Phase 2: Integration of data and compilation of report.

2.2.1 Phase 1: Literature review, research, data evaluation and desktop study

Data from various sources, including journals, articles, brochures and websites were sourced to assist with the literature reviews and research for this assessment. The desktop study also includes an examination of existing aerial photographs and project data. Alternative land users and land uses, such as tourism attractions and services were identified and researched in and around the geographical proximity of the proposed project areas.

2.2.2 Phase 2: Integration of data and compilation of report

This phase entailed the integration of existing information, including Geographic Information Systems (GIS) data and findings of the Public Participation Process (PPP). Consultation with the relevant tourism establishments and tourism industry stakeholders in the local and regional surroundings were undertaken. Tourism authorities were also consulted to determine the strategies and aims for the relevant regions. The findings from the first phase were integrated with the findings from the second phase. Information was assessed in terms of the potential impacts and the T&SA Report was compiled.

2.3 Legislative requirements

As part of the EIA process for the Solar PV Power Plants, various laws and regulation were considered. The comprehensive list of legislative requirements is detailed in the main EIA Report (Digby Wells, 2012). The legislative requirements listed in Table 2-1 are applicable to tourism and sustainability.

Table 2-1: Legal requirements applicable to tourism and sustainability

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	<u>Section 24:</u> This section of the Bill of Rights stipulates 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. Prevent 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.	Parliament Constitutional Court
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	<u>Section 2:</u> This section defines the principles of integrated environmental management. According to these principles, developments must take the following factors into consideration: - *Section 2(3)* – Development must be **socially, environmentally and economically sustainable**; - *Section 4(1)* – **Sustainable development** requires the consideration of all relevant factors including the following: - That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied…; - That the disturbance of landscapes and sites that constitute the nation´s cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied …;	DEA Northern Cape Department of Environment Affairs and Nature Conservation (DEANC)

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY
	- That negative impacts on the environment and on people´s environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.	
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	Section 38: This section of the act state that Heritage Impact Assessments (HIAs) are required for certain types of development, including activities which result in changes to the **character of a site** exceeding 0.5 ha in extent. The relevant heritage authority must be notified of the development and will advise on the scope of the heritage assessments that need to be undertaken.	South African National Heritage Resources Agency (SAHRA)

2.4 Limitations and knowledge gaps

Although this T&SA report does not give a comprehensive and statistically correct representation of all the tourism establishments, products and services in and around the proposed project areas, various environmental and cultural assessments were undertaken as part of the EIA process, which were integrated where relevant. It should be noted that the main focus of this T&SA is not on the proposed project locations themselves; however, it is mainly placed on the surrounding region and the towns in closest geographical proximity to the project areas.

Although the tourism industry is one of the fastest growing industries in South Africa, it is dependent on variable factors, such as fluctuating economies and natural disasters, which cannot be predicted or managed. Even though these variables were not taken into consideration in this assessment, economic and natural variables needs to be considered in totality due to its potential negative impact on a local tourism industry. A detailed economical assessment was not conducted for the local tourism industries; therefore, the capital growth and potential financial impact on the economies of the proposed project areas were not calculated. From a holistic tourism and sustainability point of view, the aforementioned limitation and knowledge gaps did not affect the objectives and outcomes of this assessment.

3 PROJECT DESCRIPTION

3.1 Introduction

BSG Resources Limited (BSGR) is an international natural resources company that operates in the fields of mining and energy. In line with the growing need for electricity and cleaner energy production in South Africa, BSGR established a new company, Orlight SA, for the construction and operation of five new Solar PV Power Plants in the Western Cape and Northern Cape Provinces. As illustrated in Figure 3-1 below, the proposed sites for development of the Solar PV Power Plants are located in the vicinity of the towns of Aggeneys, Kenhardt and Loeriesfontein (Northern Cape Province) and Vanrhynsdorp and Graafwater (Western Cape Province). These sites, which are indicated on the Regional Location Plan in Appendix A, are located in low populated areas of high solar irradiation and in close proximity to existing Eskom substations and transmission lines, which allows for easy access to the national grid.

3.2 Project Areas

3.2.1 Project locations

As listed in Table 3-1, the proposed Orlight SA Solar PV Power Plants will be located on specific land potions, in the geographical proximity of the towns Aggeneys, Kenhardt, Loeriesfontein, Vanrhynsdorp and Graafwater.

Table 3-1: Land Tenures for the proposed project areas

PROJECT SITE	FARM NAME	PORTION NUMBER	CONTACT PERSON/ LANDOWNER
Aggeneys	Aroams 57 RD	Portion 1	Mr Abrie van Niekerk
Kenhardt	Klein Zwart Bast 188 RD	RE (Portion 0)	Mr Abrie Jordaan
Loeriesfontein	Klein Rooiberg 227 RD	Portion 1	Mr Herman van Heerden
Vanrhynsdorp	Paddock 257 RD	RE (Portion 0)	Mr Theunis van Zyl
Graafwater	Graafwater 97 RD	Portion 1	Mr Gert Genis (Trust)
	Bueroskraal 220 RD	RE	Mr Gert Genis (Trust)

3.2.2 Existing Infrastructure

In the study areas, existing infrastructure is limited and sites are generally undeveloped. There is some infrastructure in the study areas, such as transmission lines, reservoirs and roads. Existing infrastructure on the relevant study areas are described in Table 3-2. This illustrated that there are no significant tourism infrastructure located on the proposed project sites.

Table 3-2: Existing infrastructure in the study areas

SITE	INFRASTRUCTURE	ILLUSTRATION
Aggeneys	There are two existing transmission lines constructed on Aggeneys that divide the site in two. The site can be accessed directly from the N14 via the existing farm access road. There is a two track service road that follows the transmission lines, which can be used to access the deeper areas of the site. Farm fences are present on the property. No other significant infrastructure or tourism attractions were identified in this study area.	
Kenhardt	The Aries Substation is located 1 km south of the study area on the opposite side of the Kenhardt – Bossiekom District Road. Existing Cross Rope Suspension (CRS) 400 kV transmission lines cross the SW corner of site and there is a two track service road that runs below the transmission line. The site can be accessed from the two track service road which is connected directly to the main road. Farm fences are established on the property. No other significant infrastructures or tourism attractions were identified on site.	

SITE	INFRASTRUCTURE	ILLUSTRATION
Loeriesfontein	There are two transmission lines near the site, including a 66 kV transmission line that runs along the district road towards the substation and a 400 kV transmission line that runs towards the north of site in the direction of the Klein Rooiberg. A district road that runs through the project site is capable of accommodating large trucks. There is also a small concrete farm dam located on the property next to a windmill. This functional unit may be used to pump and store good quality groundwater. Farm fences have been erected on the property. No other infrastructure or tourism attractions were identified on site.	
Vanrhynsdorp	The Vanrhynsdorp Substation is located on the proposed project site. The site can be accessed via a road from the town. An existing transmission line cuts through the site in a north to south direction. There is an existing service road along this transmission line and other roads on the site can also be utilised to access the site during construction. Farm fences are present on the property. There is an accessible borehole next to the substation, which may be considered for utilisation during construction and operational phase. There are a number of footpaths through the area; however, no other infrastructure or tourism attractions were identified.	
Graafwater	The substation for Graafwater is located adjacent to the study area. Access to the site is possible from the Graafwater – Sandberg dirt road which cuts through the study area. There are three existing transmission lines on the project site. There is also an operating sewerage treatment plant located in the study area. The sewerage treatment is currently fenced and this will be unaffected by the proposed project. Farm fences are situated on the property. No other infrastructure or tourism attractions were identified on site.	

3.3 Project Details

Solar PV technology is used to generate electrical power to convert solar irradiation energy into a direct electrical current. The solar PV panels are composed of a number of solar cells containing two layers of a photovoltaic material. When sun (solar irradiation) shines on the panels, the electric field across the junction between these two layers causes electricity to flow.

For the purpose of the Orlight Solar PV Power Plant project, the solar PV panels will be mounted into metal frames which are anchored to the ground with either concrete or screw pile foundations. Generally, a power plant consists of the following components:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters;
- Electricity distribution boxes and cabling;
- Earthing systems;
- Ancillary infrastructure; and
- Electrical substation.

The proposed Orlight SA Solar PV Power Plants will be connected to the respective substations with overhead transmission lines. The project details are discussed in more detail the main EIA Reports (Digby Wells in 2012).

4 TOURISM BASELINE

4.1 Tourism Industry

The definition of the World Tourist Organisation (WTO) for the tourism industry is based on individuals or groups "*travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited*" (Max Planck Institute for Chemistry, 2012). The 'tourism economy' in a broader sense includes related sectors such as transport and branches that are dependent on the tourism industry. Tourism can also be defined as a service industry with three main *foci*:

- Transport: bringing people from one place to another;
- Accommodation: giving people a place to stay; and
- Services: offering goods and efforts in order to fulfil the wishes of the travellers.

4.2 International and national tourism growth

In 2011, it was reported that the global travel and tourism industry was one of the world's fastest growing economic sectors in the world, contributing 9.2% of global domestic product, 4.8% of the world exports, and 9.2% of world investment. According to results produced by the World Tourism Organisation, the total tourist arrivals by region shows that by 2020 the top three receiving regions will be Europe (717 million tourists), East Asia and the Pacific (397 million) and the Americas (282 million), followed by Africa, the Middle East and South Asia (World Tourism Organization, 2012).

As illustrated by the orange trend in Figure 4-1, it is expected that tourism will increase into Africa over the next decade. This growth in tourism may lead to subsequent social, economic and cultural opportunities, such as employment, training, skills development, entrepreneurship, conservation and socio-economic development.

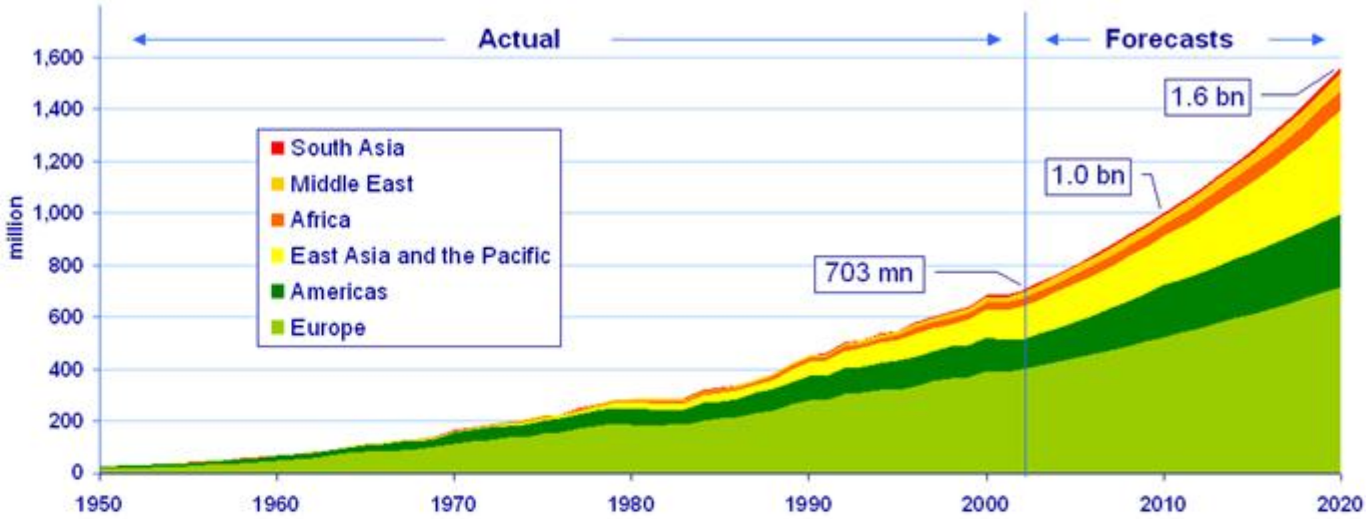


Figure 4-1: World Tourism Organisation 2020 Vision forecasts

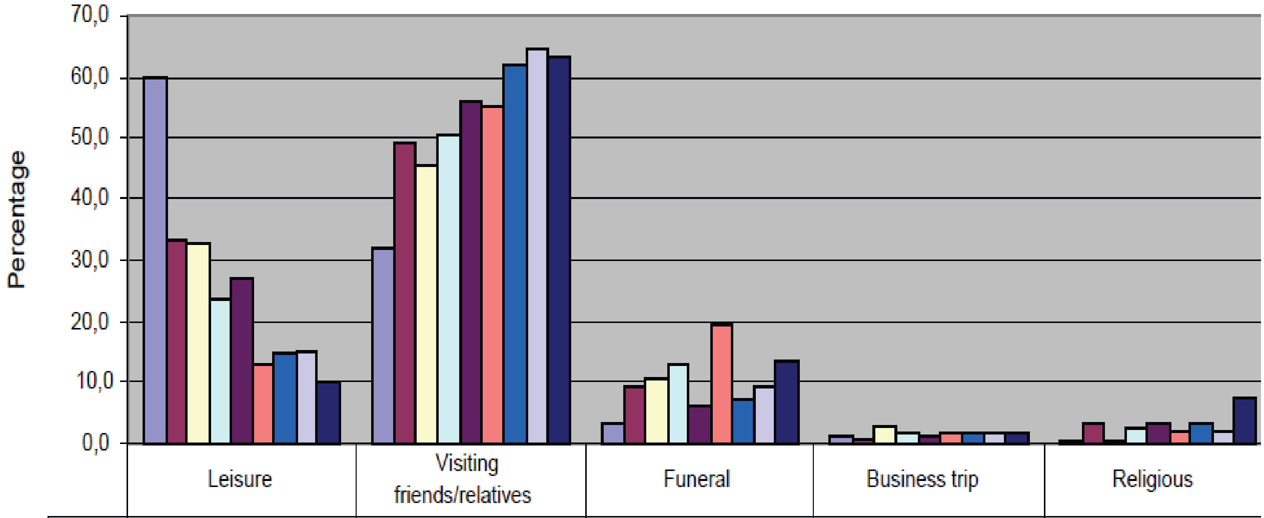
Tourism's contribution to South Africa's gross domestic product (GDP) rose from 2.7% to 7.9% during the period between 2009 and 2010. The tourism sector is relatively labour-intensive and has less barriers and has subsequently been identified as one that is vital to ensure the country achieves its goals set out in the Accelerated and Shared Growth Initiative for South Africa , which aims to halve unemployment and poverty in the country by 2014. Over the new few years, the South African government aims to increase the tourism sector's contribution to 12% of GDP (Media Club South Africa, 2012).

4.3 Provincial Tourism

The second Domestic Tourism Survey that was conducted by Statistics South Africa covered the period December 2008 to February 2009. The months of December, January and February are generally the peak period for domestic travel in South Africa. From these results, it was estimated that 8.7 million day trips and 12.3 million overnight trips were taken during the three month reference period. The age group most likely to travel was the 30 to 34 year age group.

As indicated in Table 4-1, the preferred destination on overnight trips for leisure or holiday purposes was Western Cape, with 60% of trips (Statistics South Africa, 2009). The Northern Cape is also a popular tourism destination, with an estimated 33% trips to this province being undertaken for leisure activities or holiday. It is clear that the Western Cape and Northern Cape Provinces are two popular tourist destinations in South Africa. Other popular provinces that are frequently visited by tourists in South Africa include the Eastern Cape Province, the Freestate Province and Kwazulu Natal.

The growing tourism industries in South Africa presented many opportunities in terms of economic growth and diversification. Based on the tourism strategies and marketing plans of the Northern Cape Province and Western Cape Province, both of these provinces endeavour to accelerate economic growth and support development through economic development that includes research, planning, quality control, tourism business development and tourism awareness. The tourism outlook and approach of the Northern Cape and Western Cape Provinces are discussed in more detail in the next sections (Section 4.3.1 and Section 4.3.2).



	Leisure	Visiting friends/relatives	Funeral	Business trip	Religious
WC	60,0	31,9	3,3	1,2	0,5
EC	33,2	49,4	9,1	0,8	3,3
NC	32,7	45,5	10,4	2,8	0,6
FS	23,5	50,5	12,9	1,8	2,6
KZN	27,1	56,2	6,3	1,1	3,4
NW	13,1	55,3	19,4	1,5	2,3
GP	14,7	62,0	7,3	1,7	3,3
MP	15,2	64,4	9,2	1,5	2,3
LP	10,2	63,3	13,3	1,7	7,4

Figure 4-2: Main destination by main purpose of visit for domestic overnight trips

4.3.1 Northern Cape Province

The Northern Cape Province relies on its natural and cultural heritage to satisfy tourist demands. Tourism demands generally refer to the motivation of travellers to visit a destination. The Northern Cape is a vast semi-desert region, renowned for its eco-tourism attractions, adventures, natural and cultural heritage, as well as unique ecological attractions specifically during the flowering season in spring.

In order to promote, support and increase awareness of the tourism industry, there are a number of tourism authorities and campaigns in the Northern Cape Province. Tourism authorities and campaigns that are dedicated to promote and grow tourism in the Northern Cape are listed in Table 4-4.

Table 4-1: Tourism authorities in the Northern Cape Province

TOURISM AUTHORITIES	DESCRIPTION
Northern Cape Tourism Authority (Tel: 054 9510238, northerncapetourism@telkomsa.net) Kimberley	Northern Cape Tourism Authority provides a range of services to tourists. They present tourism information, products and services to potential tourists at tourism events, exhibitions, through marketing and on the internet (website).
Northern Cape Department of Environmental Affairs and Nature Conservation (Tel: +27 53 807 7300) Kimberley http://denc.ncpg.gov.za	The Northern Cape Department of Environmental Affairs and Nature Conservation is committed to ensuring the sustainable management of the environment and nature. The department also aims to promote tourism, ensure effective biodiversity

	policy, planning, monitoring and authorisation and provide professional impact management services.
The Northern Cape Economic Development Agency (NCEDA), established through a partnership between the Northern Cape Provincial Government and the Industrial Development Corporation (IDC)	NCEDA focusses on: Agriculture and agro-processing / value adding; Mining and beneficiation and Tourism infrastructure. NCEDA aims to be the catalyst for the acceleration of sustainable economic growth and development in the Northern Cape through efficient and effective use of public sector resources and public/private partnerships.
The Northern Cape Ministry of Tourism, Environment and Conservation and Department of Tourism, Environment and Conservation http://www.northern-cape.gov.za/	The mission of the Northern Cape Government is to provide strategic leadership that will stimulate economic growth to its full potential and ensure high levels of social development, including tourism growth and sustainable development.

As described in the environmental reports of the specific project areas, there are also a number of tourism development strategies endorsed by the Northern Cape Department of Economic Development and Tourism. A few examples of these strategies are listed in Table 4-3.

Table 4-2: Strategies endorsed by the Northern Cape Department of Economic Development and Tourism

LED PROJECTS FOR THE NAMAKWA DISTRICT MUNICIPALITY (DIGBY WELLS, 2012)		
Project LE12 – Tourism and Environment Cluster (Development of Biodiversity in Namakwa)	To promote initiatives such as the Greening Namakwa, Skeppies Fund and Tourism Hub projects, including development of heritage sites.	Notes: The project site itself is not located next to a main tourist route and is therefore not considered an integral part of these tourism initiatives. However, the opportunity exists for Orlight SA to promote a new form of tourism in the area, namely "renewable energy tourism".
RELEVANT PRIVATE AND PUBLIC SECTOR PROJECTS AND INTERVENTIONS (DIGBY WELLS, 2012)		
Techno tours (local space and energy projects) Eco-tourism and flower mapping tours	The Namakwa Tourism information office should package these opportunities and present them at relevant expos and Indabas.	Notes: The proposed project may have a negative impact on eco-tourism due to the removal of natural vegetation; however, this impact is not considered to be of great significance due to the geographical remote location of most of the project sites. To compensate for any potential negative impacts. Orlight SA could consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists visiting the area.
National Rural Tourism Strategy implemented by the National Department of Tourism tbloem@tourism.gov.za msimelane@tourism.gov.za	The strategy is aimed at developing rural tourism.	The implementation of the National Rural Tourism Strategy in the proposed project areas can greatly contribute to the alleviation of pressure in areas that are often characterised by poverty and underdevelopment. Rural tourism can be supported by selling local produce and establish tourism services and products in accordance with tourism demand.

In the context of the regional tourism industries, the proposed project areas are located in well-known tourist regions, as illustrated on the regional map in Appendix A, which was included as Plan 7 (Tourist Regions) in the main EIA Reports (Digby Wells, 2012). The tourism and sustainability assessment will be focussed on the following three towns and its surroundings in the Northern Cape Province:

- Aggeneys: Aggeneys is located roughly 65 km west of Pofadder, on the N14 highway to Springbok in the Hantam Local Municipality of the Namakwa District Municipality, in the Northern Cape Province;
- Kenhardt: The town of Kenhardt is situated approximately 115 km south of Upington on the R27 in the Northern Cape Province; and
- Loeriesfontein: Loeriesfontein is 64km north east of Nieuwoudtville where Namaqualand, Bushmanland and the Hantam meet. South-western Loeriesfontein forms part of the wider region known as Namaqualand.

The tourism industry in these towns will be discussed in more detail in Section 4.4 of this report.

4.3.2 Western Cape Province

The Western Cape Province reportedly offers the most significant overall tourist products and services in South Africa and also relies on its natural and cultural heritage to satisfy tourism demands. Eco-tourism, adventure, culture, trade and investment, sport and events were identified as the some of the most significant tourist aspects of the Western Cape Province.

In order to promote, support and increase awareness of the tourism industry, there are a number of tourism authorities and campaigns in the Western Cape Province. A number of tourism authorities and campaigns that are dedicated to promote and grow tourism in the Western Cape are listed in Table 4-4.

Table 4-3: Tourism authorities and campaigns in the Western Cape Province

TOURISM AUTHORITIES	DESCRIPTION
Western Cape Department of Economic Development and Tourism	Strives to create a vibrant, innovative, and sustainable economy, characterised by growth, employment and equitable opportunities, and built on the full potential of all.
Western Cape Tourism Board www.tourismcapetown.co.za	The Tourism Board aims to become an effective economic development delivery agency of the Western Cape Government, and its official implementing agency for tourism development. It is aimed at raising awareness and promoting services and products.

As described in the environmental reports of the specific project areas, there are also a number of tourism development strategies endorsed by the Western Cape Province. An example of these strategies is listed in Table 4-5.

Table 4-4: Strategies endorsed by the Northern Cape Department of Economic Development and Tourism

RELEVANT PRIVATE AND PUBLIC SECTOR PROJECTS AND INTERVENTIONS (DIGBY WELLS, 2012)		
The Tourism Growth Strategy for the Matzikama	The strategy formulated with the objective to grow the tourism industry thereby	Notes: One of the main developments proposed in the strategy is the establishment of an "Information Gateway" in Vanrhynsdorp as acknowledgement of the town's importance

Tourist Association (2010 – 2015)	creating employment opportunities and promoting economic development.	as gateway to the Western Cape Province. It is of utter importance that the proposed project does not negatively impacts on the growth of the local tourism industry. Tourism in the area is currently mainly based on eco-tourism and adventure tourism and therefore, the proposed project will have an impact on these tourism industries. However, the opportunity exists for the proposed project to stimulate growth in the energy tourism industry (i.e. renewable energy) and therefore, Orlight SA should identify initiatives to promote energy tourism in the area.
Green Paper: Western Cape Tourism Policy Framework and Strategy	This is a policy document which sets out a strategy for the Western Cape to become a leading global tourism destination.	This policy outlines the fundamental policy principles for future tourism development and identifies clear strategies for the Western Cape to establish a competitive advantage and maximise tourism growth. The document also proposes institutional and financing arrangements to help implement the strategy. In context of this policy, the Department of Economic Development and Tourism (Western Cape Government) and Western Cape Tourism Board can initiate tourism strategies in Vanrhynsdorp and Graafwater.

In the context of the regional tourism industries, the proposed project areas are also located in well-known tourist regions, as illustrated on the regional map in Appendix A, which was included as Plan 7 (Tourist Regions) in the main EIA Reports (Digby Wells, 2012). The tourism and sustainability assessment will be focussed on the following three towns and its surroundings in the Western Cape Province:

- Vanrhynsdorp: Vanrhynsdorp is located in the heart of the Nama Karoo and forms part of the Matzikama Local Municipality of the West Coast District Municipality; and

Graafwater: This town lies roughly midway between Clanwilliam and Lambert's Bay. It was built as a railway junction in 1910 to serve the transportation of agricultural products of the Clanwilliam area and the seafood products of Lambert's Bay.The tourism industry in these towns will be discussed in more detail in Section 4.4 of this report.

4.4 Local Tourism Assessment

4.4.1 Aggeneys

Aggeneys falls into the Namakwa tourist district. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. The Aggeneys town itself is not a major tourist attraction, as it mainly accommodates the employees of the mining industry in the area. The main tourist attraction in the regional area is the unique natural and cultural resources found in this area. Beyond the edges of town the arid conditions and the unique ecologies on the various inselbergs, peaks, hills and plains, with their varied rocky and shallow soil substrate, support a wide range of plants, animals, birds and insects, including rare and endemic species, as evident from the findings of the fauna and flora assessment. The Quiver tree (*Aloe dichotoma)* is a well-known attraction in this region and was encountered on site during the flora survey.

In the LED Strategy for the Namakwa District Municipality, the following opportunities have been identified to further develop the tourism industry in the area:

- Eco-tourism: Vast open land, unique natural flora and a number of national parks and conservancies;
- Adventure tourism: Numerous 4x4 trails and hiking;
- Historical and cultural tourism: A rich heritage of the Khoi San/Nama people in the area, as well as mining museums; and
- Technological tourism: Potentially the SKA radio telescope project (if awarded to the Northern Cape) and renewable energy tourism.

Although the town is currently focused mainly on mining, the tourism industry may provide an alternative for sustainable development once minerals have been depleted or when mining ceases in this area through accommodation, catering and leisure activities in the area. A number of existing tourism establishments, product and services are listed in Table 4-6.

Table 4-5: Tourism industry in and around Aggeneys

TOURISM SECTOR	DETAILS INDUSTRY IN AND AROUND THE AGGENEYS REGION
Accommodation	• Karsten Farm Klein Pella Guesthouse, Open Space, Namakwaland, Tel: 054 9729712 • Vineyard Hotel and Spa, Colinton Road 1 Newlands, Aggeneys • Townhouse Hotel, 60 Corporation Street, Aggeneys • Bushveld Lodge, Airport Road, Aggeneys • Aggeneys Hotel, 294 Orange St, South Village, Aggeneys, Tel: 054 9832053 • Black Mountain Hotel, 1 Black Mountain Road, Aggeneys, Tel: 054 9832129 • Culture Overnight Rooms, Pella, Tel: 054 9710040 • Oase in die Wildernis Holiday Resort, Pella, Tel: 054 9710193 • Vraweer Gastehuis, 117 Voortrekker St, Pofadder, 8890, Tel: 054 9330158, Cell: 082 3737697, Email: cranft2@hotmail.com • Weltevrede Gastehuis, 26 B Truterstr, Pofadder, Tel: 084 2997229 • Nelson's Guest House, Cell (Annie): 078 310 3051 • Oasis Guest House, Tel (Teresa): 054 9832433, Cell: 072 6318608 • Pofadder Hotel, Voortrekker Street, Pofadder, Tel: 054 9330063 • Klein Pella Guest Farm, Pofadder, Tel: 054 9729712 • Pop Huis Self Catering Flats, Skool Street, Pofadder, Tel: 054 9330063 • 7de Laan Guesthouse - Self Catering, 7th Street, Pofadder, Tel: 054 9330195
Catering	• Black Mountain Restaurant, Bolidenst, North Village Recreation Club, Tel: 054 9832226 • Proe-I-Bietjie, 155 Voortrekkerstr, Pofadder, Tel: 054 9330450
Transport	• Jowells Transport, Black Mountain Road, Aggeneys, Tel: 054 9832712 • Aggeneys Airport (AGZ)
Services	• Aggeneys: Khai-Ma Municipality (Onseepkans), RC Mission, Farm, Onseepkans, • Aggeneys Tourism Information: Tel: 054 9839301
Products	• Aggeneys, AmAm4X4 Trails, Driving, Tel (Lydia): 054 9832689 • Dutch Reformed & Catholic Churches: mixture of old and new architecture (Pofadder) • Pofadder Hiking Trail, Tel: 054 933 0066

	• 4x4 Trail, Namakwa 4x4 Exploration. Tel: 027 712 8035/6 –in Pella • Catholic Cathedral –Built over seven years by Fathers JM Simon and Leo Wolf, both of whom are buried in the church's grounds –in Pella. • Adventure and sport: Set in an oasis, it offers a welcome round of golf: 18-hole golf course at the feral animal camp. • Fauna and flora: Krater: The red dunes near town are home to the red lark. • Parks and Reserves: Goegap Nature: just east of Springbok, supports 600 different indigenous plant species, 45 mammal species and 94 bird species. • Parks and Reserves: The Hester Malan Wild Flower Garden showcases many Namakwa succulents and a rock garden.

As representative prototype of the existing tourism establishments, products and services listed above, the Black Mountain Restaurant in Aggeneys is illustrated on the map attached in Appendix A of this report.

4.4.2 Kenhardt

Tourism industry in the Kenhardt area is mainly dependent on natural and cultural resources such as seasonal flowers, vast open areas and outdoor activities such as hiking and 4x4 routes. Kenhardt falls within the renowned 'Green Kalahari Tourism Region', which is located in the Kai !Garib Local Municipality. Tourism attractions in this region include San artwork, salt pans and interesting vegetation, such as quiver trees and seasonal flowers.

The vegetation on site forms part of the Northern Cape's Nama-Karoo. This comprises dwarf bushes, grasses and seasonal flowering annuals on gravel soils. During the rainy seasons, birds flock to the surrounding pans. There are numerous Quiver Trees (Kokerbome) found in the region, including a Quiver Tree forest close to Kenhardt. In the town of Kenhardt, tourists can visit the first library, which was built in 1897 and used as a library until 1977. The 500 to 600 year old Camel Thorn tree, under which Kenhardt was founded, can also be visited. There are also numerous architectural attractions, as well as outdoor activities such off-road trails for 4x4 and hiking. The study area is situated along the Pofadder gravel road between Kenhardt and Pofadder. This road is not a main tourist route.

The existing tourism industry in Kenhardt may be expanded to ensure sustainable development through embracing new business sectors and expanding accommodation, catering and leisure activities in the area. A number of existing tourism establishments, product and services are listed in Table 4-7.

Table 4-6: Tourism industry in and around Kenhardt

TOURISM SECTOR	DETAILS INDUSTRY IN AND AROUND THE KENHARDT REGION
Accommodation	• Pofadder Hotel - Rest Camp Rondawels, Open Space, Kenhardt, Tel: 054 9330061 • Hooggelegen Lodge & Restaurant, 14 Hoofstr, Groblershoop, 8850, Tel: 054 8330445 • Kenhardt Hotel, Hoofstr, Kenhardt, Cell: 072 2224983 • Kambro-Kind Guest House Kenhardt, Tel:054 6510022, Cell: 082 6926350 • Bushmanland Guesthouse & Tours, Main St, Kenhardt, 8890, Tel: 054 6510020, Email: info@bushmanland.co.za, Website: Http://www.bushmanland.co.za • Ouma Miemie's Accommodation, 1071 Hoof St, Kenhardt, Tel: 054 6510494 • Sonop Guesthouse, Kenhardt, Cell: 082 3377554
Catering	• Vergelegen Restaurant, Kakamas North Settlement, Gordonia, Tel: 054 4310976

	• De Werf Coffee Shop & Restaurant, Keimoes, Tel: 054 6411635 • Oma Miemie's Farm Stall, Main Road, Kenhardt, Tel: 054 6510695 • Hooggelegen Lodge & Restaurant, 14 Hoofstr, Groblershoop, 8850, Tel: 054 8330445 • Pavillion Pub & Grill, 198 Hoof St, Keimoes, Tel: 054 4611018 • Snoekie Wegneemetes, 4 11 Laan, Tel: 054 4310944 • Die Kospaleis, Keeromst, Kakamass Centre, Tel: 054 4310375
Transport	• K C Taxis, Ekuphumluni Flats, Stand 1701, Kakamas, 8870, Tel: 054 4311396
Services	• Wine Tasting and Tours: Orange River Wine Cellars –for tours and wine tasting • Tourist Information: Municipality Park Street, • Kenhardt, 8900. Tel: 054 6516500, Fax: 054 6516501 • Bushmanland Tours, Kenhardt, Tel: 054 6510022
Products	• Tierberg Nature Reserve, 4 km outside Keimoes. • Augrabies Falls National Park • Richtersveld Cultural and Botanical Landscape • Rooiberg Dam: A unique opportunity for bird viewing - Approximately 124 different species of birds were identified. • Adventure and Sport: Verneukpan: The wide-open spaces of Verneukpan offer ideal opportunities for parasailing. • Archaeology and Palaeontology: San Trail. • Fauna and Flora: Quiver Tree Forest consisting of approximately 4 000 to 5 000 trees • History and Architecture: Giant Camelthorn Tree: The tree under which the special magistrate set up camp in 1868 is between 500 and 600 years old. • History and Architecture: Old Library Building: The building dates from 1897 and was used as a library until 1977. Declared a national monument in 1978.

As representative prototype of the existing tourism establishments services listed above, three accommodation facilities were listed and illustrated on the map attached in Appendix A of this report.

4.4.3 Loeriesfontein

Loeriesfontein falls into the Namakwa tourist district. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. Loeriesfontein has a vibrant community with a growing tourism industry. Various annual events are held each year, such as the flowering festival and the annual agricultural show. South-western Loeriesfontein forms part of the wider region known as Namaqualand, an area well known for its spring flowers (August and September) and its variety of different plants. Loeriesfontein is the windmill capital of South Africa. This is one of the prime tourist attractions in the area. There are a number of accommodation options offered in Loeriesfontein for the traveller, including farmstays, guesthouses and the Loeriesfontein Hotel.

In the LED Strategy for the Namakwa District Municipality, the following opportunities have been identified to further develop the tourism industry in the area:

- Eco-tourism: Vast open land, unique natural flora and a number of national parks and conservancies;
- Adventure tourism: Numerous 4x4 trails and hiking;

- Historical and cultural tourism: A rich heritage of the Khoi San/Nama people in the area, as well as mining museums; and
- Technological tourism: Potentially the SKA radio telescope project (if awarded to the Northern Cape) and renewable energy tourism.

The proposed project site for the Loeriesfontein Solar PV Power Plant is not situated near a main tourist route, but is adjacent to the Granaatboskolk/Zout Dwaggas gravel road.

The existing tourism industry in Loeriesfontein may be expanded to ensure sustainable development through embracing new business sectors and expanding accommodation, catering and leisure activities in the area. A number of existing tourism establishments, product and services are listed in Table 4-8.

Table 4-7: Tourism industry in and around Loeriesfontein

TOURISM SECTOR	DETAILS INDUSTRY IN AND AROUND THE LOERIESFONTEIN REGION
Accommodation	• Hotel Loeriesfontein, Hoofstr, Loeriesfontein, 8185, Tel: 027 6621001 • Die Skerm Gastehuise, 7 Hodgsonweg, Loeriesfontein, 8185, Cell (Gina): 082 4512272 • Van Zijl Gastehuis & Restaurant, Neethling St, Tel: 027 2181535 Email: Nieuvz@Intekom.co.za • Elim Gastehuis, Elim Ramskop, Calvinia, Tel: 027 3411710, Cell: 079 5857874, Email: Elimcalvinia@gmail.com • Malalla Guesthouse, 30 Main Road, Loeriesfontein • Rolbos Gastehuis, 15 Paul Krugerstr, Calvinia, 8190, Tel: 027 3411666, Email: Joey@rolbos.co.za, Website: Http://www.rolbos.co.za • Klipwerf Luukse Selfsorg & Kampering, 16 Paul Krugerstr, Calvinia, 8190, Tel: 027 3411126 • Swiss Villa Guest House, 116 Nassau St, Nieuwoudtville, 8180, Tel: 027 2181347 • Bokveld Gastehuise, Neethlingstr, Nieuwoudtville, Tel: 027 2181426 • Die Hantamhuis Kompleks, 44 Hoop St, Calvinia, 8190, Tel: 027 3411606, Email: Hantamhuis@calvinia.co.za, Website: Http://www.calvinia.co.za • Carmel Villa Gastehuis, 19 Pastoriestr, Calvinia, 8190, Tel: 027 3411446 • Blou Nartjie Gastehuis & Restaurant, 35 Waterstr, Calvinia, 8190, Tel: 027 3411484 • Rus 'N Bietjie - Self Catering, Hoop Street, Calvinia, Cell: 083 6386030 • Maku - Tuis Self Catering, Church, Calvinia, Cell: 083 2271062 • Klein Katryn Self Catering, Holden, Calvinia, Cell: 073 1744059 • Nieuwoudtville Hotel, Voortrekker Street, Nieuwoudtville, Tel: 027 2181046 • Self-Catering, Stigling Street, Calvinia, Cell: 073 8080948
Catering	• Van Zijl Gastehuis & Restaurant, Neethling St, Tel: 027 2181535 Email: nieuvz@intekom.co.za • Blou Nartjie Gastehuis & Restaurant, 35 Waterstr, Calvinia, 8190, Tel: 027 3411484 • Boesmanland Pub & Grill, Hoofstr, Loeriesfontein, 8185, Tel: 027 6621119
Transport	• I A Visser Transport, 5 Keeromstr, Loeriesfontein, 8185, Tel: 027 6621406, Email: Iavisser@Hantam.co.za • Cassims Bus Service, 511 Berg str, Calvinia, 8190, Tel: 027 3411499

Services	• Tourist Information: The Publicity Officer, PO Box 181, Loeriesfontein, 8185, Tel: 027 6621001 / 027 6628600 • Toerisme Inligting & Akkommodasie, Hoofstr, Loeriesfontein, Tel: 027 6621001 • Loeriesfontein Tourist Information: Tel: 027 6621119, Cell: 083 2184846
Products	• Adventure and Sport: 4x4: The Hantam Flower Trails start south of Loeriesfontein and head to the north of Calvinia. • Fauna and Flora: Quiver tree forest: The quiver tree ("kokerboom" in Afrikaans): Loeriesfontein is the site of one of the largest quiver tree forests in the world. • Fauna and Flora: Spring flowers. • The flowers attract visitors to the region, but at other times activities centre on agriculture (sheep) and mining (salt). • History and Architecture: Museum: Fred Turner / Windmill Museum. • Rheboksfontein Farm: 25km from town, is a farm museum as well as a "perdemeul" (freely translated horse-mill) which is still in working order. • Birds: About 80 species have been identified during winter months. • Parks and Reserves: Oorlogskloof Nature Reserve -10km south of Nieuwoudville, series of deep ravines incised by the Oorlogskloof River with unique hiking trails • Home to several rare bird species. • Parks and Reserves: Tankwa Karoo National Park

As representative prototype of the existing tourism establishments listed above, a restaurant, an accommodation facility and transport services were documented and illustrated on the map attached in Appendix A of this report.

4.4.4 Vanrhynsdorp

The Vanrhynsdorp study area is situated in Namakwa Land, a tourist region known for its daisies and other flowers. Documentation of the landscape character, scenic value and sense of place could change dramatically after a visit to the sites during the flowering season since the dry, barren landscapes become vibrant and colourful in some cases. Vanrhynsdorp is a growing tourism destination and is actively involved in marketing and tourism development.

The town has a distinct Victorian character and offers a wide range of tourist experiences, from culture historical to several eco-experiences. Vanrhynsdorp has one of the largest succulent nurseries in the world, which has become the centre of preservation of a variety of indigenous succulents. Vanrhynsdorp consist of the world's only quartz succulent trail, as well as adventure routes and hiking trails, waterfalls and unique water features. Three botanical kingdoms converge in the Vanrhynsdorp area, namely the Nama-Karoo vegetation, succulents in the Knersvlakte and Cape Fynbos in the mountains. Other leisure tourist attractions in and around Vanrhynsdorp include Latsky Radio Museum, Victorian architecture, bird watching, 4 x 4 drives, hiking trails, Olifants River wine route/wine tasting, salt mining at Papendorp and the Vanrhyns Pass built in (circa) 1881 by Thomas Bain. The study area for this project is not specifically used for tourism, but often used by locals for leisure activities such as taking their dogs for a walk.

Two scenic routes of concern exist here. The first is the N7 (Cape to Namibia Route) running north-south past the western edge of Vanrhynsdorp and the study area. Coming over the final hill before Vanrhynsdorp comes into view, one gets presented with the wide open vista that is the Knersvlakte and, just in front of you, the apparent "oasis" that is the town of Vanrhynsdorp.

The view is framed by the mountains of the escarpment on the far right hand side. Driving south on the N7 one passes through kilometre after kilometre of open gravel and sandy plains before arriving at Vanrhynsdorp. However, long before the town comes into view, one sees the Matzikamaberg looming proudly. This mountain is spectacular and its cliffs are strongly emphasised after the flatness of the Knersvlakte. It serves as a symbol of the mountainous Cape that lies beyond. Approaching Vanrhynsdorp the proposed solar energy facility would impinge upon this view, especially since the panels would face northwards and may be brightly reflective at certain times. A view of the project site from the N7 is shown in Figure 4-2 and Figure 4-3. The approximate position of the proposed facility is indicated by the white dashed line.

Figure 4-3: View northwards along the N7 from the point where Vanrhynsdorp first comes into view.

Figure 4-4: View southwards along the N7 shortly before arriving at Vanrhynsdorp (1.6 km north of the study area and 3.2 km north of the town). The Droerivier lies in the middle ground.

With regards to existing land use:

- The area is dependent on the following economic activities:
- Agriculture – There are wine farms and cellars in the region which produce wine and brandy. Small-scale wheat and maize farming is undertaken in the area, as well as sheep farming;
- Processing of agricultural products (e.g. viniculture);
- Mining (e.g. Exxaro Namaqua Sands heavy minerals);

- Fishing industry (limited to recreational and small fishing rights); and
- Tourism – The tourism sector in the area has developed over the last few years and it is the second largest sector that contributes to the economy. The main tourism attraction in the region is the Namaqualand Nature Reserve which is a seasonal attraction during the flower season in September/October.

The existing tourism industry in Vanrhynsdorp may be expanded to ensure sustainable development through embracing new business sectors and expanding accommodation, catering and leisure activities in the area. A number of existing tourism establishments, product and services are listed in Table 4-9.

Table 4-8: Tourism industry in and around Vanrhynsdorp

TOURISM SECTOR	DETAILS INDUSTRY IN AND AROUND THE VANRHYNSDORP REGION
Accommodation	• Vanrhynsdorp Self Catering Resort, Lazarus Street, Vanrhynsdorp, Cell: 072 4536766 • Namaqualand Country Lodge, 22 Voortrekker St, Van Rhynsdorp, 8170, Tel: 027 2191633, Email: info@namaqualodge.co.za, Website: http://www.namaqualodge.co.za • Doring Rivier (Gifberg) Tel: (0)27 219 1555 • Vanrhynsdorp Caravan Park Tel Nr: 027 2191287 • Aan't Dorpseind B&B, Church Street, Vanrhynsdorp, Cell: 083 6309611 • La Rochelle Guesthouse, Vanrhynsdorp, Cell: 084 5116601
Catering	• ZAR Restaurant, Vanrhynsdorp, Cell: 076 2932578 • Cornelissen Beleggings BK, Vdd Nissan, 13 Kerk Str, Vredendal, Tel: 027 2132667 • Olifants River Wines: The Namaqua wine centre sells exquisite wines and wine-tasting opportunities are also available.
Transport	• Koeglenberg Transport, Hospital St, Vredendal, 8160, Tel: 027 2131181 • Bok Bus & Taxi Diens, 456 Bloekomstr, Van Rhynsdorp, 8170, Tel: 027 2191396
Services	• Namakwa Toere, 22 Voortrekker Str, Vanrhynsdorp, Cell: 082 6500666 • Cape Flower Route (Cirusdal), Tel: Flower line +27 (0)83 910-1028 (June-October) • Namaqua Tours: Vanrhynsdorp, Tel: 027 219 1377 – 219 1633 / Fax: 027 2191635 – 086 51 22344, Innes: 082 65 00 666 / Mike: 082 89 66 444 / Jenny: 082 654 8877, Email: info@namakwatoere.com • Vanrhynsdorp Tourism: Van Riebeeck Street, Vanrhynsdorp, 8170Tel: 027 2191552; Fax: 027 2191552, Email: vanrhynsdorp@matzikamamun.co.za
Products	• Five-day itinerary for the West Coast –leaving Vanrhynsdorp. • Latsky Radio Museum , 4 Church Street, Vanrhynsdorp, 8170, Tel: 027 2191032 • Van Rhijn Museum, Van Riebeeck Street. • Adventure and Sport: Adventure Activities: Off-road motor cycling, 4x4 routes, paragliding, river-rafting, rock-climbing and swimming. • Adventure and Sport: Hiking: Several hiking trails traverse the region i.e. the Succulent Hiking Trail. Snorkfontein also offers hiking and has camping facilities. • Adventure and Sport: Mountain-climbing / biking: The Matzikamma Mountain Range. • Adventure and Sport: Photography: Amateur and professional photographers are presented with lovely views.

	• Archaeology and Palaeontology: San Rock Art: Gifberg is the site of many paintings, most of which include the traditional San colours of red and yellow ochre. • Archaeology and Palaeontology: San Rock Art: The farm Papkuilsfontein lies approximately 51 km from the town. • Archaeology and Palaeontology: Wiedouw San Rock Art site: The site lies in the Gifberg ("Poison Mountain"). • Art and Crafts: Vanrhynsdorp has many arts and crafts dealers, specialising in items such as veldskoene, photographs, iron candle-holders, paintings and pottery. • Fauna and Flora: Black eagle; Fynbos; Karoo vegetation; Spring Flower Circle Route; Urionskraal and Gifberg Roads –good night-drive routes for those studying nocturnal animals inhabiting the area. • History and Architecture: Anglo-Boer War Route; Graves of fallen Boers and British soldiers, as well as the war headquarters and Jan Smuts residence, are located in Vanrhynsdorp. • History and Architecture: Het Gesticht –the first meeting place of the Dutch Reformed Congregation. • History and Architecture: Old Gaol Prison –dates back to 1895. • History and Architecture: Van Rhyn Museum: dates back to 1897, focusing on local history. • Natural Wonders: Rock formations: The rock formations of Knersvlakte, Maskam, Khobee and Ouberg Sandstone all date back millions of years. • Natural Wonders: Nama-Karoo: this landscape is over 650 million years old. • Observatory: The open-air observatory offering spectacular star-gazing opportunities.

As representative prototype of the existing tourism establishments listed above, three accommodation facilities and one restaurant were documented and illustrated on the map attached in Appendix A of this report.

4.4.5 Graafwater

The tourism industry in Graafwater is not well-developed. Tourism generally depends on visitors to the surrounding area who pass through the region, or visit the area for the flowering season. Wild-flowers bloom in the area from late July to September. Figure 4-5 illustrates the view of the project site from the main tourist route.

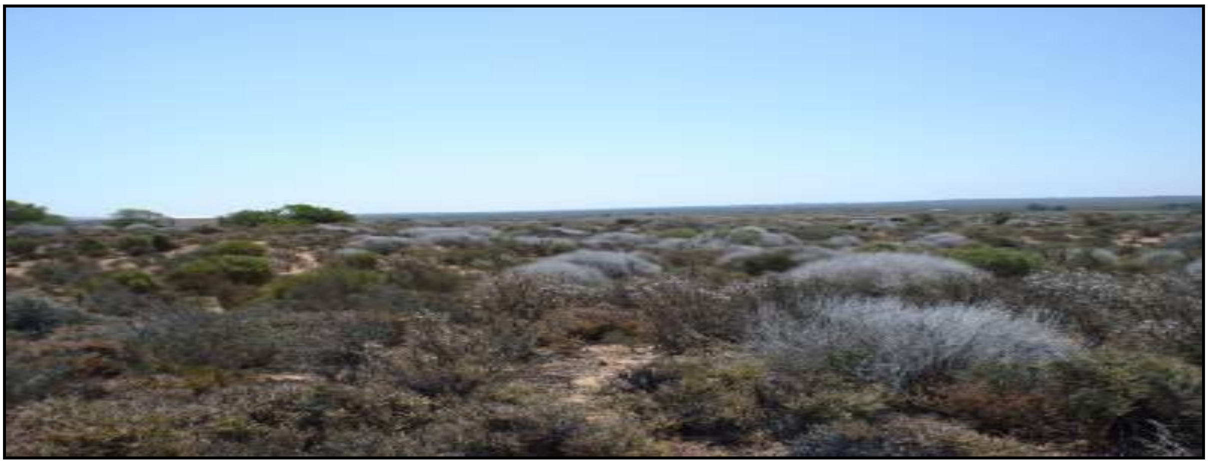


Figure 4-5: Main view of the Graafwater site

During the site visit, it was noted that Coastal fynbos and succulents are found in the northern part of proposed project site. Although wildlife in this region is scarce, many species fauna and indigenous flora still add to the unique character of this region.

The existing tourism industry in Graafwater may be expanded to ensure sustainable development through embracing new business sectors and expanding accommodation, catering and leisure activities in the area. A number of existing tourism establishments, product and services are listed in Table 4-10.

Table 4-9: Tourism industry in and around Graafwater

TOURISM SECTOR	DETAILS INDUSTRY IN AND AROUND THE GRAAFWATER REGION
Accommodation	• Lebanon Citrus Holiday Farm, Clanwilliam (6km From Graafwater) • Vredeoord Place, R 363, Vredeoord, Clanwilliam, Tel: 027 4821333 • Rectory Guest House, Main Road, Clanwilliam, Tel: 027 4821629 • De Pakhuys • Clanwilliam (27km From Graafwater) • Biedouws Guest House, Biedows Valley, Clanwilliam, Tel: 027 4822833 • Saint Du Barrys, Clanwilliam • Blommenberg Gastehuis, 1 Graafwaterweg, Clanwilliam, Tel: 027 4821455 • Graafwater Hotel, 44 Station Road, Graafwater, 8120 Tel: 027 422 1324, • Vanputtensvlei (22km From Graafwater) Tel: +27 (0)27 432 2508 • Clanwilliam Lodge (27km From Graafwater) • Cedar Waters Guesthouse, National Road, Clanwilliam, 8135, Tel: 027 4822186
Catering	• West Coast Hacienda Restaurant / Conference/ Functions 1.3 Km Outside Of Graafwater Call: Marius Or Karen 027 422 1113 • Xamarin Country Club Home; Panorama Park Nature Reserve (26km From Graafwater) • Kreefhuis Restaurant, Strand St, Lamberts Bay, 8130, Tel: 027 4322235, E • Muisbosskerm Restaurant - Lamberts Bay,(Clanwilliam) Cell: 083 2709530 • Cedar Inn, Nasionalepad, , Clanwilliam, Clanwilliam, Tel: 027 4821551 • De-Kelder Restaurant, Graafwater Road, Clanwilliam, Tel: 027 4821037 • The Palms Restaurant, 1 Graafwater Road, Clanwilliam, Tel: 027 4821009 • Nancy's Tea Room, Main St, Clanwilliam, Tel: 027 4822661 • Funky Tastebuds Deli, 68 Voortrekker Road, Lamberts Bay, Tel: 027 4321796 • Feedam Catering Service (Pty) Ltd, 1 Sederhof Outehuis, 663 School St, Clanwilliam
Transport	• Cederberg Transport, Panorama, , Clanwilliam, Cell: 082 5630807 • Rl Goieman Vervoer, 41 Anemoon Av, Clanwilliam, Tel: 027 4821860 • Smit Ingenieurswerke & Transport Bk, 1415 Kooperasie St, Clanwilliam, Tel: 027 4821271
Services	• Car Rental: Cartrawler • Du Plessis Gj Transport • Graafwater, 8120, Tel: 027 4221018, Fax: 027 4221326
Products	• History and Architecture: Heerenlogement ("Gentlemen's Lodging"): (30 km north of Graafwater) Old cave called the Heerenlogement. During the 17th century, travellers used it as overnight accommodation. It is now a national monument.

As representative prototype of the existing tourism establishments listed above, one accommodation facility (Graafwater Hotel) was documented and illustrated on the map attached in Appendix A of this report.

4.5 Summary

All five proposed project regions have the potential to improve its existing tourism industries and develop new product and services in their local tourism industry in terms of ecotourism and agricultural tourism, as well as leisure tourism. In consultation with local communities and stakeholders, there is a general consensus on the positive impacts that the proposed development may have on the five project areas. These include:

- Potential poverty reduction through economic diversification;
- Job creation/ employment opportunities during the construction and operational phases;
- Effective use of natural resources and sustainable development;
- Creation of opportunities for local youth to be educated in environmental issues;
- Diversification of existing tourism industry/ markets (e.g. business tourism and renewable energy);
- Support and enhance existing tourism establishments (e.g. catering and accommodation); and
- Enhance tourism and investment opportunities (e.g. multiplier effect of increased business).

Due to the dependence of the tourism industry on natural and cultural heritage in the proposed project regions, there were concerns regarding the loss of fauna and flora and negative visual impacts. In agreement with the EIA Report (Digby Wells, 2012), a number of stakeholders recommended that the proposed development should avoid any significant damage to areas' diverse and unique vegetation], which is considered to be vital tourism asset. Although tourism is mainly seasonally based (during the flowering period between July and November each year), it provides a great economic boost for the relevant regions. A chief concern for Mrs. Elma le Roux from Bushmanland Tours (Kenhardt), who also owns a guesthouse in the town, is the issue of the visual integrity of the proposed sites being adversely impacted upon.

To address these and other visual concerns, a Visual Impact Assessment (VIA) was conducted as part of the EIA process. It was found that, although the Solar PV Power Plant Panels may be visible from the roads in some instances, the proposed project areas are not situated directly on popular scenic routes and is not expected to cause any significant impacts on the flowering landscape of the Namaqua Region. Most respondents made reference to the importance of tourism on local economies and regard their natural resources as assets.

Precaution consequently ought to be taken to ensure that this proposed development does not impact on the region's natural resources and the tourism potential of the local areas within their respective provinces. The majority of the respondents saw a great advantage in the proposed project as they feel that the facilities would become an attraction or a landmark within the areas.

Tourism products and services needs to be developed in the context of the provincial and local tourism strategies and local economic development plans. These, amongst others, may include initiatives such as transportation services, travel agencies, accommodation, guided tours and tour guides, renewable energy tourism services and hospitality.

Through integrated marketing opportunities and business development support, these areas should be able to optimise the positive impacts and benefits that increased business (such as renewable energy projects) may bring. The potential negative impacts associated with proposed industrial developments needs to be minimised. The next chapter presents the most significant impacts associated with the Orlight Solar PV Power Plants.

5 IMPACT ASSESSMENT

5.1 Approach and Methodology

This section presents the findings of the assessment of potential impacts that may result from the development of the proposed Solar PV Power Plants.

The results of the impact assessment are based on the following aspects:

- Issues and concerns – The findings of the PPP undertaken for the proposed project are described;
- Significance assessment – An assessment of the significance of anticipated positive and negative impacts on the local tourism industry associated with project activities is provided; and
- Cumulative impacts – The results of a qualitative assessment of the potential cumulative impacts of the proposed project, similar projects and other developments in the project area is presented.

In order to assess the significance of the potential impacts on the local tourism industry, a semi-quantitative impact assessment methodology was used, which is based on an assessment of the following parameters:

- Severity – The magnitude of change from the current baseline status of the affected environmental, socio-economic or heritage aspect;
- Spatial scale – The physical area which is impacted on by the potential impact;
- Duration – The expected time period during which a potential impacted will be experienced; and
- Probability – The likelihood of occurrence of the impact, based on knowledge of the operating conditions and the type of activities that will be undertaken.

More detail on the quantitative ratings attached to each of the above parameters and the EIA methodology is attached in Appendix B. Recommended measures to enhance the positive environmental impacts and mitigated negative environmental impacts have been detailed in Chapter 6 of this report.

5.2 Significance assessment

5.2.1 Aggeneys

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have medium-high significance. The table summarising the significance of the potential impacts on the tourism industry during the project phases is presented below.

Nature of impact	Impacts on the tourism industry.
Description of impact	The existing tourism industry in the area, which is currently based on eco-tourism, will most likely change to incorporate energy tourism, due to the development of solar PV projects in the vicinity of Aggeneys. The development of Solar PV Plant in the area may become a unique tourist attraction for this area. In addition, the proposed Solar PV Plant Project will necessitate procurement of goods and services, many of which could be sourced from local companies, Small, Medium and Micro Enterprises (SMMEs) or entrepreneurs, thereby enhancing the socio-economic benefits associated with the project’s construction phase. The project could have a potentially visual impact on motorists using the N14 highway; however, this could be interpreted as an additional attraction for

Nature of impact	Impacts on the tourism industry.				
	the Aggeneys area. Therefore the significant impacts remain of positive nature.				
Enhancement required	Orlight SA may consider the establishment of a visitor's centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area. If there is a shortage of accommodation in Aggeneys, the proposed project may contribute towards the establishment of new accommodation facilities and catering services.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Probable (4)	Positive medium-low (36)
Post- Mitigation	Serious (4)	Provincial (5)	Project life (5)	Almost certain (6)	Positive medium-high (84)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

5.2.2 Kenhardt

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have low significance. The table summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	Impacts on the tourism industry.				
Description of impact	Kenhardt falls within the renowned 'Green Kalahari Tourism Region', which is located in the Kai !Garib Local Municipality. Tourism attractions in this region include San artwork, salt pans and interesting vegetation, such as quiver trees and seasonal flowers. The study area is situated along the Pofadder gravel road between Kenhardt and Pofadder. This road is not a main tourist route. The power plant may become a unique tourist attraction for this area and increased influx of workers may also boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider contributing to the establishment of a visitor's centre in the town with educational opportunities on solar energy for tourists that visit the area. Local tourism operators may consider expanding business to renewable energy tourism, offering guided tours to the sight and providing informative tours to renewable energy sites in the region.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Improbable (2)	Positive low (14)
Post- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Probable (4)	Positive low (28)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced				

Nature of impact	Impacts on the tourism industry.
	during the PPP.
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.

5.2.3 Loeriesfontein

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have low significance. The table summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	**Impacts on the tourism industry.**				
Description of impact	Loeriesfontein falls into the Namakwa Tourist District. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. Loeriesfontein has a vibrant community with a growing tourism industry. Various annual events are held each year, such as the flowering festival and the annual agricultural show. The main tourist attraction in the regional area is the unique natural and cultural resources found in this area and the removal of indigenous vegetation from the project site will have a negative impact on eco-tourism. Due to the fact the proposed project site is located 45 km from Loeriesfontein on a route that is not known as a main tourist route, the project is unlikely to have an impact on the tourism industry. The power plant may become a unique tourist attraction for this area and increased influx of workers may also boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider contributing to the establishment of a visitor's centre in the town with educational opportunities on solar energy for tourists that visit the area. Local tourism operators may consider expanding business to renewable energy tourism, offering guided tours to the sight and providing informative tours to renewable energy sites in the region. The proposed project may also contribute towards conservation and environmental awareness through recuing and relocating certain plant species during the operational phase. Plant specimens may be sponsored to local nurseries or schools.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Improbable (2)	Positive low (14)
Post- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Probable (4)	Positive low (28)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

5.2.4 Vanrhynsdorp

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have medium-low significance. The table summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	**Impacts on the tourism industry.**				
Description of impact	Vanrhynsdorp is a growing tourism destination and is actively involved in marketing and tourism development. The study area for this project is not specifically used for tourism, but often used by locals for leisure activities such as taking their dogs for a walk. The tourism industry in the surrounding area will not be negatively affected by the development of the Solar PV Power Plant at Vanrhynsdorp. The power plant may become a unique tourist attraction for this area. Increased influx of workers may boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitor's centre or the "Information Gateway" in the town with educational opportunities on solar energy for tourists that visit the area. Local tourism operators may consider expanding business to renewable energy tourism, offering guided tours to the sight and providing informative tours to renewable energy sites in the region. The proposed project may also contribute towards conservation and environmental awareness through recuing and relocating certain plant species during the operational phase. Plant specimens may be sponsored to local nurseries or schools.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Probable (4)	Positive medium-low (36)
Post- Mitigation	Serious (4)	Municipal (4)	Medium-term (3)	Almost certain (6)	Positive medium-low (66)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

In addition, the study area itself contributes minimally to the aesthetic value of the town, which has the scenic value of being a "dorpie". Houses on the periphery of the town are visible from the study area and vice versa. Since the study area is located directly north of the town, it adopts the sense of place of the town itself, which seems to home to a proud, close-knit community. The visual sensitivity of the Vanrhynsdorp area is very high due to tourism and cultural aspects associated with the old and quaint 'dorpie' and the ecological landscape that surrounds it. The likelihood of the visual impact being experienced is high due to the positioning of the town in relation to the N7 and the route connecting Nieuwoudtville, Vanrhynsdorp and Vredendal. Planting of fast-growing species next to the N7 highway could provide some form of visual screening.

5.2.5 Graafwater

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have medium-high significance.

The table summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	**Impacts on the tourism industry.**				
Description of impact	The tourism industry in Graafwater is not well-developed. Tourism generally depends on visitors to the surrounding area who pass through the region, or visit the area for the flowering season. The tourism industry in general will not be negatively affected by the development of the proposed project, as the creation of energy tourism (i.e. renewable energy projects) is possible in the area. The power plant may become a unique tourist attraction for this area. Increased influx of workers may also boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area. Local tourism operators may consider expanding business to renewable energy tourism, offering guided tours to the sight and providing informative tours to renewable energy sites in the region.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Probable (4)	Positive medium-low (36)
Post- Mitigation	Serious (4)	Provincial (5)	Project life (5)	Almost certain (6)	Positive medium-high (84)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

5.3 Cumulative Impacts

NEAREST TOWN	**CUMULATIVE IMPACTS**
Aggeneys	The tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of solar PV projects in the vicinity of Aggeneys. In order to maximise the benefits associate with the establishment of an energy-focused tourism industry, the different proponent of solar PV project in the area should consider the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.
Kenhardt	During consultation with SAHRA, they requested that the assessment should consider whether the cumulative impact of the solar energy facilities proposed in the area may compromise the cultural landscape and its archaeological significance. There are no significant issues relating to the cultural landscape. The landscape comprises typical Bushmanland scrub. There are no prominent geological features such as hills or valleys. The farm is used for grazing livestock. The area has already been transformed by a substation and transmission lines. The proposed project site falls within the 'Green Kalahari' tourism region and is an attraction due to the heritage aspects associated with the region (such as San artwork and salt pans). In spite of this, the Pofadder gravel road is not considered a major tourist route and therefore, cumulative impacts on tourism are expected to be low.
Loeriesfontein	The proposed project site is located within the 'Namakwa' tourism region and the town of Loeriesfontein itself is a tourist attraction. The little town is, however, approximately 45 km from the

NEAREST TOWN	CUMULATIVE IMPACTS
	area in which the proposed solar and wind developments will take place and the single main dirt road that used most extensively within the area, is utilised by local farmers and not by tourists visiting the region. It is unlikely that there will be a negative cumulative impact on the tourism resources of the area. On the contrary, the tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of renewable energy projects in the area. In order to maximise the benefits associate with the establishment of an energy-focused tourism industry, the different proponents of these projects in the area should consider the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.
Vanrhynsdorp	This section considers and assesses the possible cumulative effects that may occur due to the incremental effects of the proposed Vanrhynsdorp Solar PV Power Plant in combination with other projects within the vicinity. In order to analyse the cumulative impacts associated with a project, the following activities were undertaken: • The geographic scope of the cumulative impact resource or environmental aspect analysis was defined, based on the potential areas within which impacts from other present or future projects could combine with the project in question; and • The combined effects of the proposed project in combination with past, present and future projects or activities were analysed in terms of the potential cumulative impacts within the relevant geographical extent. After literature reviews and research was undertaken, it was found that there are no other potential solar or renewable energy developments within the vicinity of Vanrhynsdorp. However, the impacts associated with the construction of the proposed project are likely to interact or affect the current visual and social context of the town to result in a significant cumulative impact. Vanrhynsdorp is a historical town with many late 19th Century buildings (some are up to 150 years old) and is bordered by the N7 and R27 (which passes from east to west through the town). The N7 is a busy highway with a fair amount of tourism associations and the Vanrhyns Pass is a spectacular viewing point from where the town can be seen. The construction and operation of a solar PV power plant may have a highly significant negative cumulative impact on the visual, heritage and tourism attributes of the area as a whole. If plans to expand the town materialise, the incremental impacts associated with expansion will also add to the overall cumulative impact on visual, heritage and tourism attributes since it is possible that noise and visual pollution will be introduced.
Graafwater	The tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of solar PV projects in the vicinity of Graafwater. In order to maximise the benefits associate with the establishment of an energy-focused tourism industry, the different proponent of solar PV project in the area should consider the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

6 MITIGATION AND MANAGEMENT

6.1 Objectives

Responsible community-based tourism needs to be developed in line with local and national strategies so that locals can optimise the benefits of increased socio-economic development. In order to set the foundation for sustainable development, industrial developments such as renewable energy must support training and interaction with local communities, government bodies, tourism organizations, and private sector and enable them to develop and promote responsible and community-based tourism in their areas so that positive impacts of tourism are maximized and negative one minimized.

The main motivations for tourists to travel to the proposed project regions are focussed on natural and cultural attractions. The flower season in the Namaqua area is one of the biggest motivators for travellers to visit the area. Therefore, in order to ensure sustainable development of the tourism industry, the environment needs to be protected and conserved. For the purpose of this project, effective environmental mitigation and management will be of crucial importance during the construction, operational and decommissioning phases. The mitigation and management measures listed in this section focus on the conservation and maintenance of the natural environment to ensure seasonal tourism is not adversely affected.

6.1.1 Construction phase

In the context of tourism and sustainability, the environmental objectives for the construction phase of the proposed project are to:

- Ensure that construction activities are undertaken in accordance with the specifications and outcomes of the planning and design phase;
- Implement an environmental training and awareness plan to familiarise all parties with the contents of the Environmental Management Programme (EMP);
- Establish clear communication channels between parties responsible for implementing the EMP;
- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the construction activities;
- Ensure that construction activities are managed in such a way as to reduce the risk of potential environmental impacts occurring;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area;
- Minimise degradation or loss of the soil resource;
- Minimise the impact of the project on indigenous vegetation, Red Data and protected plant species and other sensitive ecological areas;
- Ensure that site remediation is undertaken where necessary and within the stipulated timeframes;
- Minimise impacts to sites of heritage significance, should they be identified during the construction phase;
- Minimise negative impacts associated with the presence of construction workers and migrant job-seekers; and

- Enhance the potential socio-economic benefits associated with the construction of the proposed project.

6.1.2 Operational phase

The objectives for the operational phase of the proposed project are to:

- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the operation of the proposed project;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area and further degradation or loss of the soil resource; and
- Control and prevent the propagation of alien invasive species.

The overall objective of the decommissioning phase is to leave the project area in a condition that minimises adverse impacts on the socio-economic and biophysical environment, with a legacy that contributes to sustainable development.

6.1.3 Objectives

The objectives of the decommissioning phase of the proposed project are to:

- Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase;
- After the lease has expired and the project is in decommissioning phase, leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Return rehabilitated land-use to a standard that can be useful to the post-project land user, such as grazing;
- Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm water management systems;
- Comply with local regulatory requirements and international best practise;
- Maintain active partnerships with local communities; and
- Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

The most significant implementation plans for the project phase of the proposed Solar PV Power Plants are presented in the following tables. For the purpose of this report, the focus is only on the construction phase, which is anticipated to have the most significant and likely impact on the tourism industry and sustainable development of each region.

6.2 Aggeneys

<table>
<tr><th colspan="4">CONSTRUCTION PHASE</th></tr>
<tr><td>Objectives</td><td colspan="3">From a tourism and sustainability perspective, the objectives during the construction phase are to:
• Mitigate visual impacts to motorists on the N14 national road;
• Manage complaints and grievances regarding visual impacts;
• Minimise dust impacts and visual pollution;
• Minimise negative impacts on ecological aspects (e.g. vegetation removal);
• Optimise project benefits (e.g. economic diversification and employment); and
• Ensure the EMP is effectively implemented.</td></tr>
<tr><td>Risk sources</td><td colspan="3">The following risk sources have been identified:
• Increase in vehicular and other activity levels during the construction phase;
• The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
• Fencing of the project site; and
• Installation of the solar PV panels and construction of all related project infrastructure.</td></tr>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on the visual environment include:
• The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur;
• The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials;
• The removal of vegetation will lead to the decrease of naturally occurring vegetation;
• An ineffective implementation of the EMP may lead to mismanagement, pollution and irreparable damage to the environment.</td></tr>
<tr><td rowspan="2">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>• Recommendations for positioning of the solar PV panels and associated infrastructure were made during the site layout design process. Activities should therefore be restricted to the project</td><td>Orlight SA</td><td>Project planning</td></tr>
</table>

	development footprint to reduce visual impacts to receptors;		
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);	Contractor	Construction
	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Re-vegetate soil stockpiles to avoid dust creation; and	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; and • No signs of pollution of spillages.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

6.3 Kenhardt

CONSTRUCTION PHASE	
Objectives	From a tourism and sustainability perspective, the objectives during the construction phase are to:

	• Mitigate visual impacts to motorists on the Pofadder gravel road; • Manage complaints and grievances regarding visual impacts; • Minimise dust impacts and visual pollution; • Minimise negative impacts on ecological aspects (e.g. vegetation removal); • Optimise project benefits (e.g. economic diversification and employment); and • Ensure the EMP is effectively implemented.		
Risk sources	The following risk sources have been identified: • Increase in vehicular and other activity levels during the construction phase; • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Fencing of the project site; and • Installation of the solar PV panels and construction of all related project infrastructure.		
Potential impacts	The potential impacts on the visual environment include: • The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur; • The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials; • The removal of vegetation will lead to the decrease of naturally occurring vegetation; • An ineffective implementation of the EMP may lead to mismanagement, pollution and irreparable damage to the environment.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);	Contractor	Construction

	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Re-vegetate soil stockpiles to avoid dust creation; and	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; and • No signs of pollution of spillages.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

6.4 Loeriesfontein

CONSTRUCTION PHASE	
Objectives	From a tourism and sustainability perspective, the objectives during the construction phase are to: • Mitigate visual impacts to motorists on the Granaatboskolk/Zout Dwaggas gravel road; • Manage complaints and grievances regarding visual impacts; • Minimise dust impacts and visual pollution • Minimise negative impacts on ecological aspects (e.g. vegetation removal); • Optimise project benefits (e.g. economic diversification and employment); and • Ensure the EMP is effectively implemented.

<table>
<tr><td>Risk sources</td><td colspan="3">The following risk sources have been identified:
• Increase in vehicular and other activity levels during the construction phase;
• The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
• Fencing of the project site; and
• Installation of the solar PV panels and construction of all related project infrastructure.</td></tr>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on the visual environment include:
• The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur;
• The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials;
• The removal of vegetation will lead to the decrease of naturally occurring vegetation;
• An ineffective implementation of the EMP may lead to mismanagement, pollution and irreparable damage to the environment.</td></tr>
<tr><td rowspan="7">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;</td><td>Orlight SA</td><td>Construction</td></tr>
<tr><td>• No vegetation removal should be allowed outside the designated project development footprint;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>• The possible tourism aspect of the solar PV power plant should be explored and promoted;</td><td>Orlight SA</td><td>Pre-construction</td></tr>
<tr><td>• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.</td><td>Contractor
ECO</td><td>Construction</td></tr>
</table>

Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; and • No signs of pollution of spillages.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.

6.5 Vanrhynsdorp

CONSTRUCTION PHASE	
Objectives	From a tourism and sustainability perspective, the objectives during the construction phase are to: • Mitigate visual impacts to motorists on the N7 highway • Mitigate visual impacts and impacts on the sense of place of the town of Vanrhynsdorp; • Manage complaints and grievances regarding visual impacts and potential impacts on tourism; • Minimise dust impacts and visual pollution; • Minimise negative impacts on ecological aspects (e.g. vegetation removal); • Optimise project benefits (e.g. economic diversification and employment); and • Ensure the EMP is effectively implemented.
Risk sources	The following risk sources have been identified: • Increase in vehicular and other activity levels during the construction phase; • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Fencing of the project site; and • Installation of the solar PV panels and construction of all related project infrastructure.

<table>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on the visual environment include:
Since the town of Vanrhynsdorp is rather small, construction activities will likely have an impact on the quaint “dorpie”;
The potential site is situated in a visually sensitive area and the likelihood of both residents of the town and tourists experiencing the impacts is severe likely;
The removal of vegetation will lead to the decrease of naturally occurring vegetation;
An ineffective implementation of the EMP may lead to mismanagement, pollution and irreparable damage to the environment;
On a positive note, there is an opportunity for the town, which already has a tourism aspect to it, to proudly adopt the Solar PV Power Plant as part of its infrastructure. The Solar PV Power Plant might lead to positive perceptions that the town is part of a larger-scale “greener” approach to supplying electricity. If the project is adopted and punted as part of the tourism aspect of the town, the visual impacts associated with the solar PV power plant could be positive.</td></tr>
<tr><td rowspan="9">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>Recommendations for positioning of the solar PV panels and associated infrastructure were made during the site layout design process. Activities should therefore be restricted to the project development footprint to reduce visual impacts to receptors;</td><td>Orlight SA</td><td>Project planning</td></tr>
<tr><td>Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;</td><td>Orlight SA</td><td>Construction</td></tr>
<tr><td>No vegetation removal should be allowed outside the designated project development footprint;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>An alien invasive and weed control programme should be implemented throughout the project lifetime;</td><td>ECO</td><td>Construction</td></tr>
<tr><td>The possible tourism aspect of the solar PV power plant should be explored and promoted;</td><td>Orlight SA</td><td>Project planning</td></tr>
<tr><td>Re-vegetate soil stockpiles to avoid dust creation; and</td><td>ECO</td><td>Construction</td></tr>
<tr><td>Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan</td><td>Contractor</td><td>Construction</td></tr>
</table>

	during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	ECO	
	• Exotic tree species have been introduced in the town of Vanrhynsdorp along avenues. Planting of fast-growing species between receptors and the proposed Solar PV Power Plant is an option for visual screening; however it is not advised considering water scarcity and the threat of spreading of alien invasive species	ECO	Pre-construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; • No signs of pollution of spillages; and • Proof of consultation with the Matzikama Tourism authority to contribute to tourism planning in the area; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

6.6 Graafwater

CONSTRUCTION PHASE	
Objectives	From a tourism and sustainability perspective, the objectives during the construction phase are to: • Mitigate visual impacts to motorists on the R346 road; • Manage complaints and grievances regarding visual impacts; • Minimise dust impacts and visual pollution; • Minimise negative impacts on ecological aspects (e.g. vegetation removal); • Optimise project benefits (e.g. economic diversification and employment); and

	• Ensure the EMP is effectively implemented.		
Risk sources	The following risk sources have been identified: • Increase in vehicular and other activity levels during the construction phase; • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Fencing of the project site; and • Installation of the solar PV panels and construction of all related project infrastructure.		
Potential impacts	The potential impacts on the visual environment include: • The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur; • The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials; • The removal of vegetation will lead to the decrease of naturally occurring vegetation, as well as decreased availability of land for agricultural practices; • An ineffective implementation of the EMP may lead to mismanagement, pollution and irreparable damage to the environment.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Recommendations for positioning of the solar PV panels and associated infrastructure were made during the site layout design process. Activities should therefore be restricted to the project development footprint to reduce visual impacts to receptors;	Orlight SA	Project planning
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);	Contractor	Construction
	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction

	• Re-vegetate soil stockpiles to avoid dust creation; and	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; and • No signs of pollution of spillages.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

7 CONCLUSION AND RECOMMENDATIONS

The tourism industry is considered to be one of the pivotal economic diversification sectors in terms of employment opportunities and potential skills development for locals and investments in the Northern Cape and Western Cape Provinces. As discussed in Chapter 4 of this report, the tourism industries in these provinces mainly rely on natural and cultural heritage to satisfy tourism demands. With specific focus on the proposed project areas, which includes Aggeneys, Kenhardt, Loeriesfontein, Vanrhynsdorp and Graafwater, the tourism industry constitutes a growing sub-sector, and offers unique potential for growth in the future of all five areas.

This T&SA report focussed on the main issues, concerns and opportunities and strengths of the tourism industries in the project areas and surroundings. Telephonic interviews were conducted with various provincial tourism authorities. The impact assessment detailed in Chapter 5 presented the findings of the development of the Orlight Solar PV Power Plants. Chapter 5 highlighted the potential impacts, both positive and negative, that the proposed solar plant project may have on the respective areas. From a tourism and sustainability perspective, the potential negative impacts of the proposed solar PV power plants on the respective areas is regarded as medium-low.

The potential negative impacts should be minimised or avoided and the benefits should be optimised through the effective implementation of the EMP, effective environmental monitoring and interaction with the relevant stakeholders and I&APs. This may support the opportunities and potential of a growing tourism industry and sustainability in the proposed project areas.

8 REFERENCES

Atmospheric Chemistry Department (2012), Max Planck Institute for Chemistry, http://www.atmosphere.mpg.de/enid/Nr_9_July__6_Air_traffic/C__Tourism_5rw.html, Germany

Digby Wells Environmental (2012) Environmental Impact Assessment Reports for the proposed Orlight Solar PV Power Plants in the Northern and Western Cap Provinces, unpublished.

Endangered Wildlife Trust (2012), Website June 2012, http://www.eiatoolkit.ewt.org.za/process/index.html

Media Club South Africa (2012) http://www.mediaclubsouthafrica.com, Article on tourism, online

Statistics South Africa (2009), Domestic Tourism Survey, Pretoria

World Tourism Organization (2012) http://www.unwto.org/facts/eng/vision.htm, Statistics, online

Appendix A: Maps and Plans

Plan 1

Orlight SA (PTY) Ltd Solar PV Projects

Regional Setting

Legend

- Proposed Project Sites
- Affected Towns
- City
- Major Town
- Freeway
- Main Road
- International Boundary
- Provincial Boundary

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

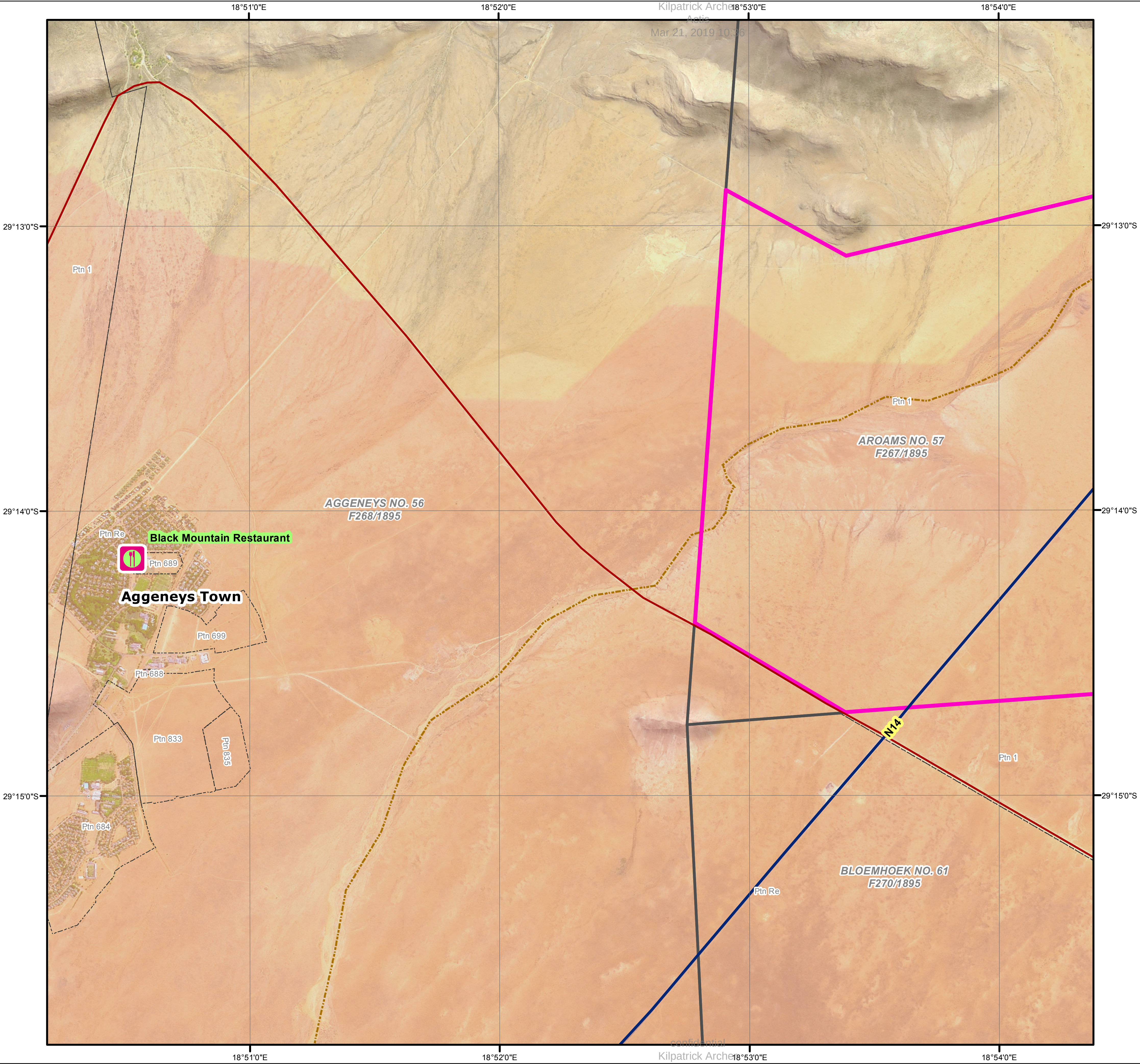
www.digbywells.com

Projection: Transverse Mercator
Datum: WGS84
Central Meridian: 19°E

Ref #: tdm.BSGR1384.201111.090
Revision Number: 1
Date: 17/11/2011

N

0 37.5 75 150
Kilometres
1:3 000 000



Plan 1

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Tourism

Legend

- Study Area
- Tourism - Catering
- Gravel Roads
- National Roads
- Dry river
- Farm Boundaries
- Farm Portions

ORLIGHTSA RENEWABLE ENERGY

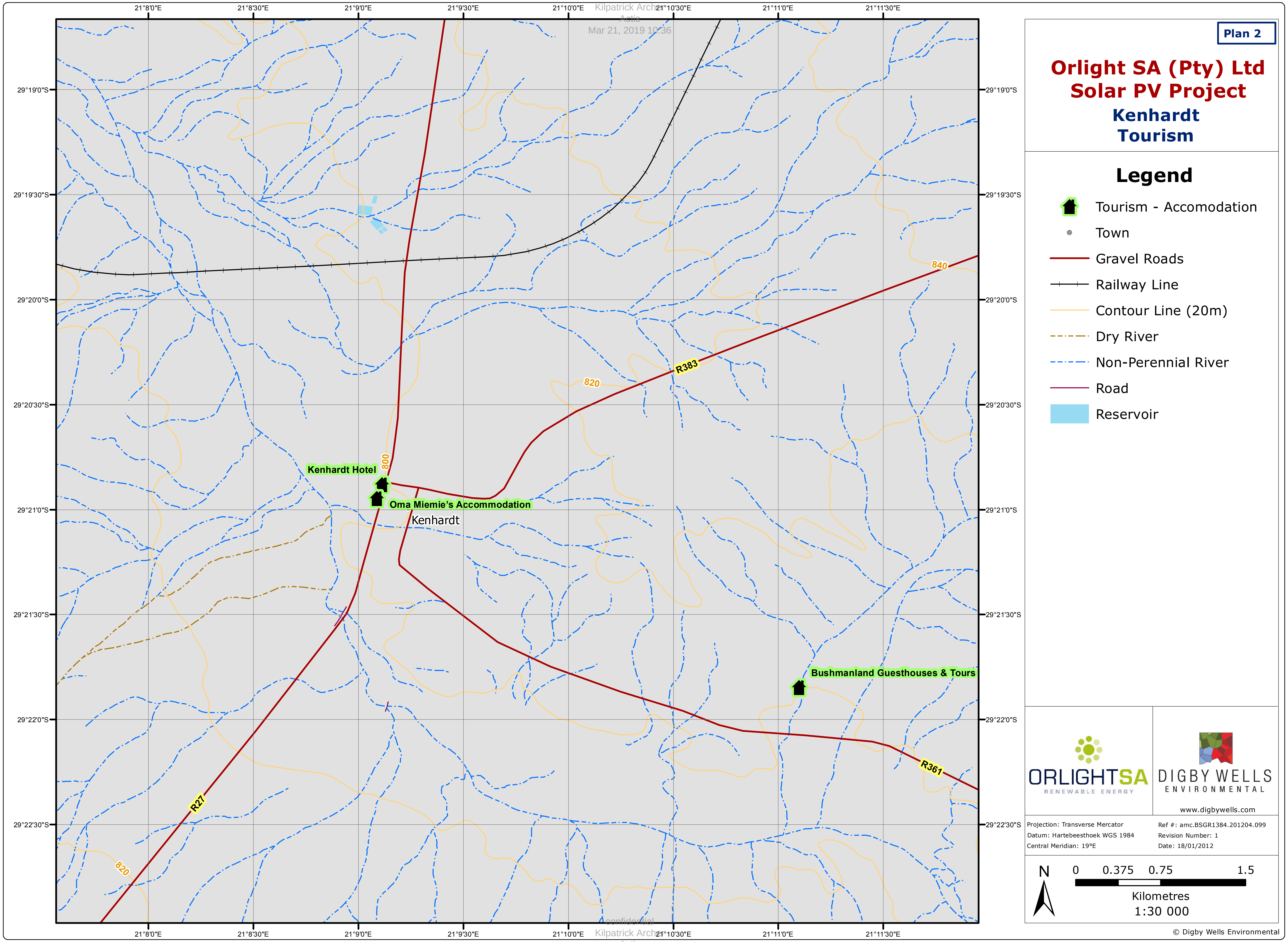
DIGBY WELLS ENVIRONMENTAL

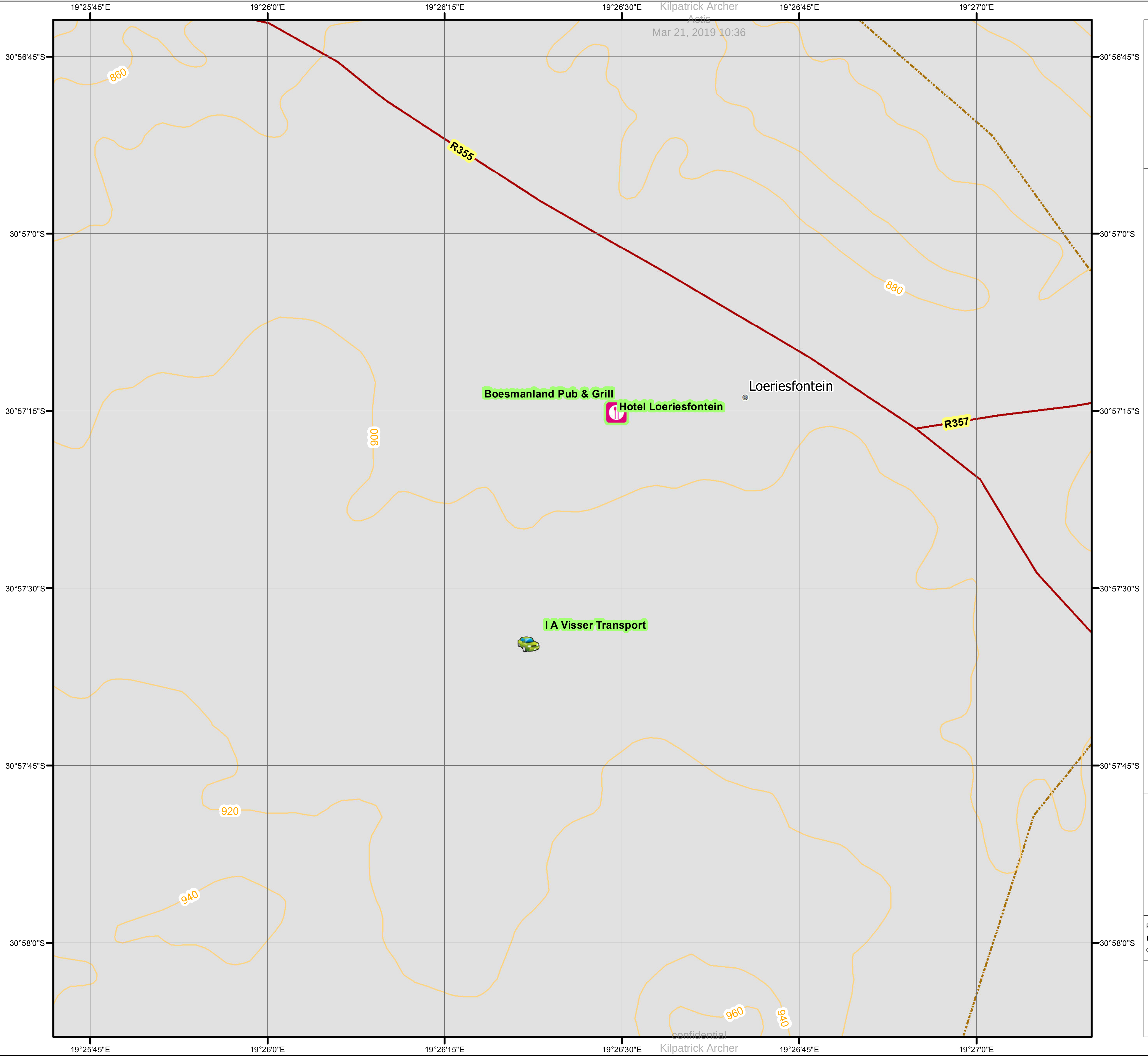
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #:amc.BSGR1384.201206.63
Revision Number: 1
Date: 08/06/2012

N 0 0.375 0.75 1.5
Kilometres
1:25 000


Plan 2
Orlight SA (Pty) Ltd
Solar PV Project
Kenhardt
Tourism
Legend
Tourism - Accomodation
Town
Gravel Roads
Railway Line
Contour Line (20m)
Dry River
Non-Perennial River
Road
Reservoir
Kenhardt Hotel
Oma Miemie's Accommodation
Kenhardt
Bushmanland Guesthouses & Tours
R383
R361
R27
840
820
800
21°8'0"E
21°8'30"E
21°9'0"E
21°9'30"E
21°10'0"E
21°10'30"E
21°11'0"E
21°11'30"E
29°19'0"S
29°19'30"S
29°20'0"S
29°20'30"S
29°21'0"S
29°21'30"S
29°22'0"S
29°22'30"S
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E
Ref #: amc.BSGR1384.201204.099
Revision Number: 1
Date: 18/01/2012
N
0 0.375 0.75 1.5
Kilometres
1:30 000
© Digby Wells Environmental



Plan 3

Orlight SA (Pty) Ltd
Solar PV Project

Loeriesfontein Tourism

Legend

- Tourism - Catering
- Tourism - Transport
- Town
- Contour (20m)
- Gravel Roads
- Dry river

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

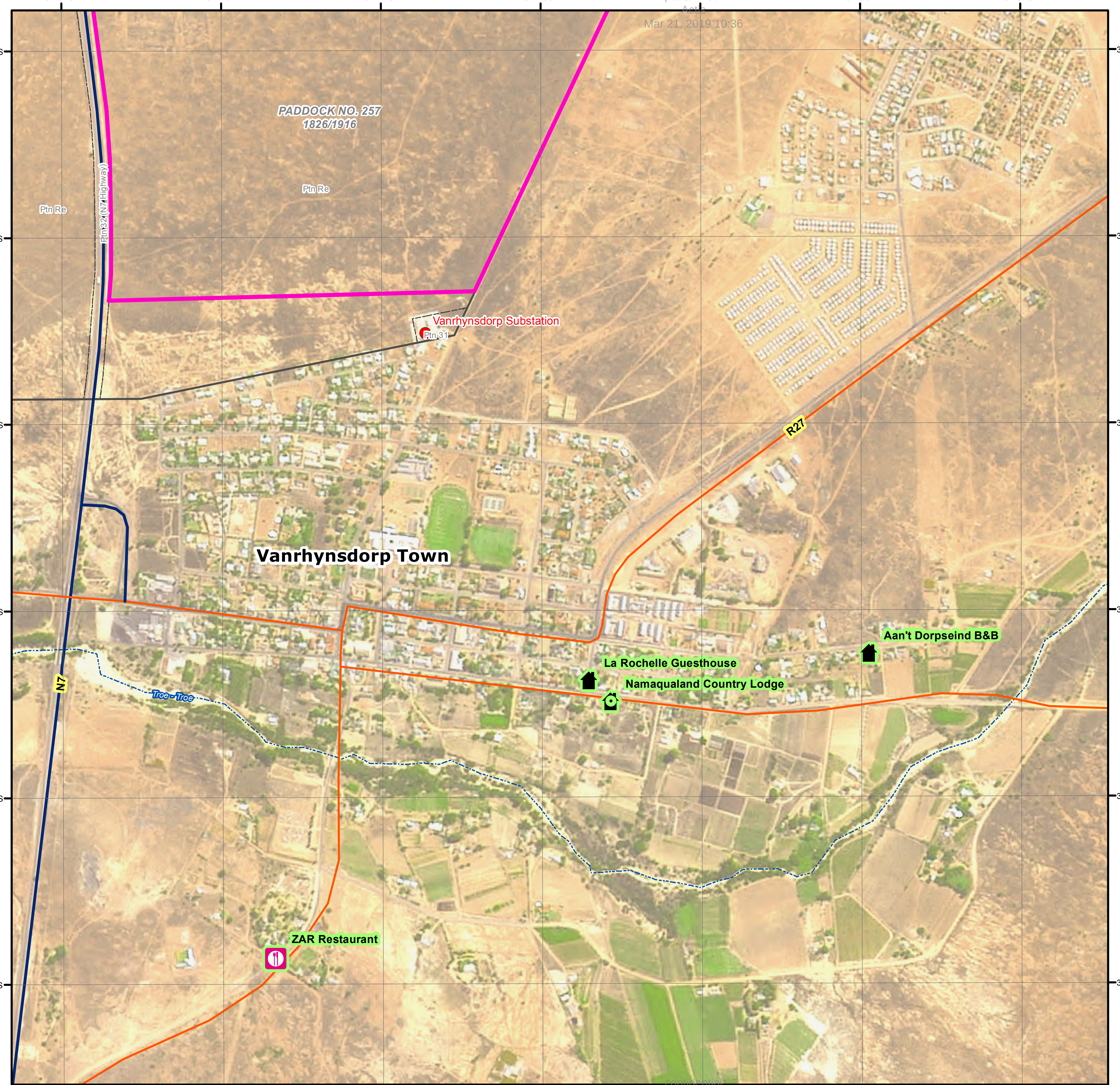
Ref #: amc.BSGR1384.201206.66
Revision Number: 1
Date: 18/01/2012

N

0 0.125 0.25 0.5

Kilometres

1:10 000



Plan 4

Orlight SA (Pty) Ltd Solar PV Project

Vanrhynsdorp Tourism

Legend

- Study Area
- Tourism - Accomodation
- Tourism - Catering
- Tourism - Services
- Non-Perennial River
- Provincial Roads
- Highway
- Farm Boundaries
- Farm Portions

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

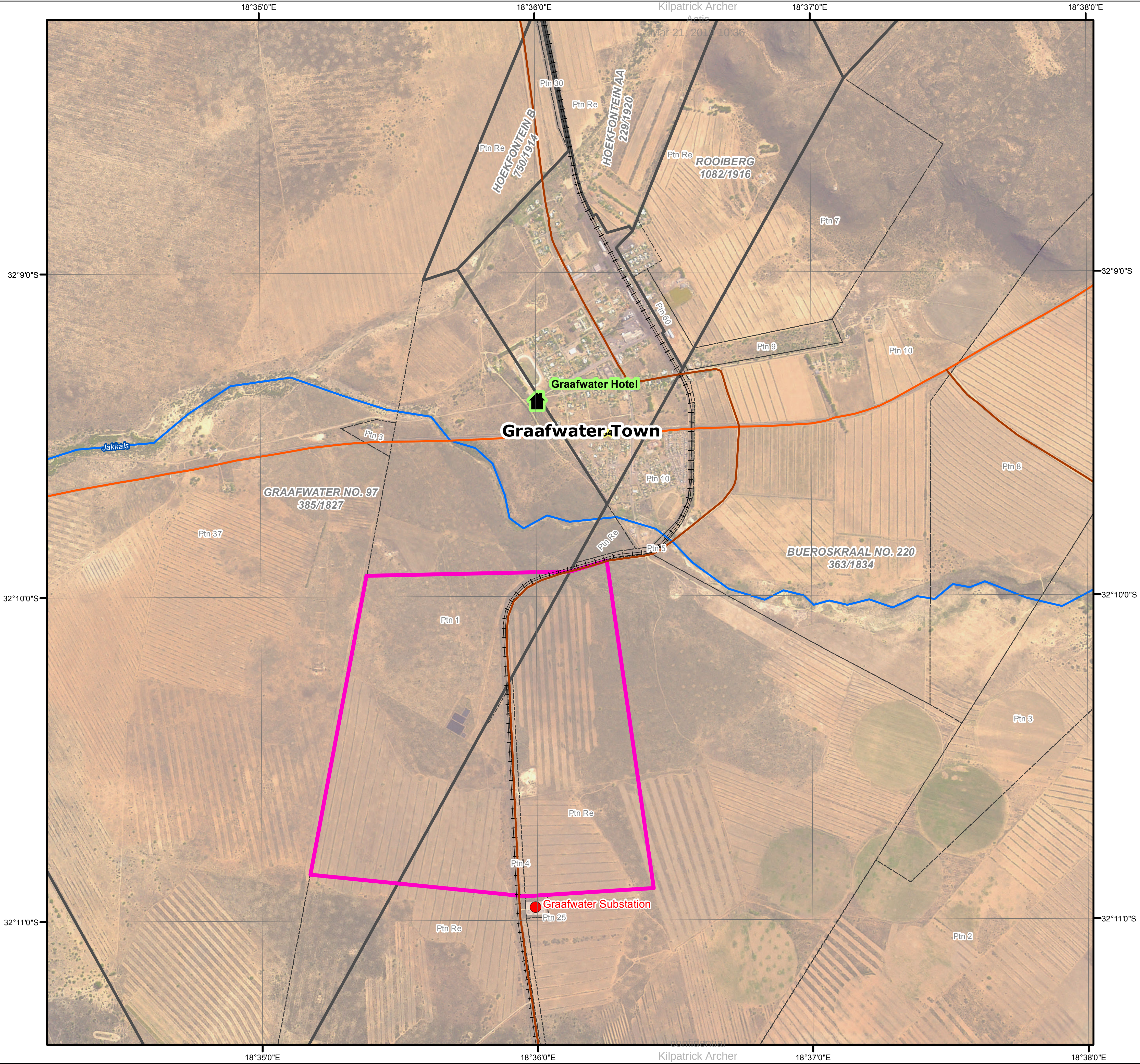
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201206.67
Revision Number: 1
Date: 12/06/2012

N

0 125 250 500
Metres
1:10 000



Plan 5

Orlight SA (Pty) Ltd Solar PV Project

Graafwater Tourism

Legend

- Tourism - Accomodation
- Study Area
- Provincial Roads
- Gravel Roads
- Railway Line
- Perennial River
- Farm Boundaries
- Farm Portions

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

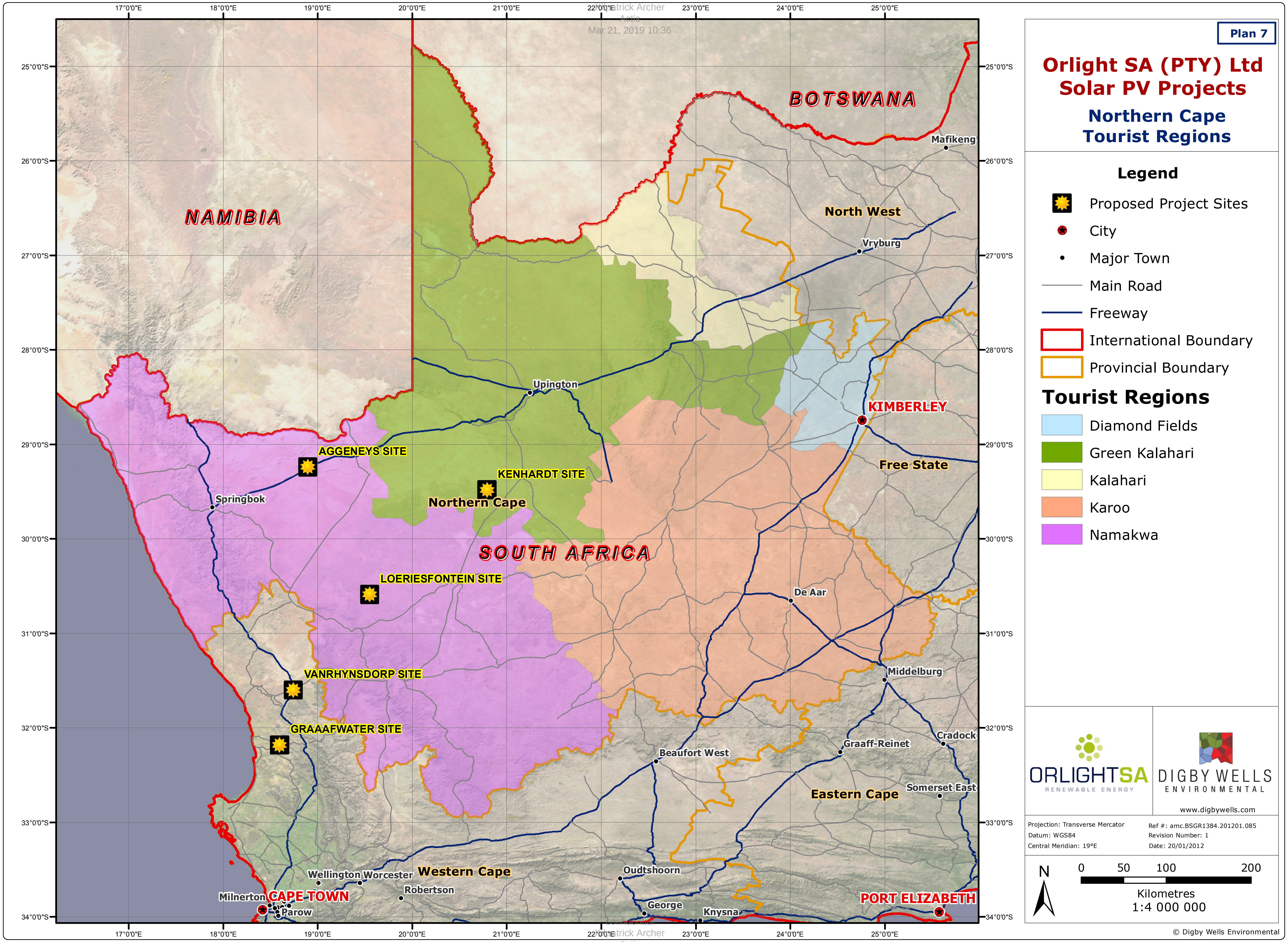
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201206.64
Revision Number: 1
Date: 08/06/2012

N

0 0.25 0.5 1
Kilometres
1:22 000


Plan 7
Orlight SA (PTY) Ltd
Solar PV Projects
Northern Cape
Tourist Regions
Legend
Proposed Project Sites
City
Major Town
Main Road
Freeway
International Boundary
Provincial Boundary
Tourist Regions
Diamond Fields
Green Kalahari
Kalahari
Karoo
Namakwa
BOTSWANA
NAMIBIA
SOUTH AFRICA
North West
Northern Cape
Free State
Eastern Cape
Western Cape
AGGENEYS SITE
KENHARDT SITE
LOERIESFONTEIN SITE
VANRHYNSDORP SITE
GRAAAFWATER SITE
KIMBERLEY
CAPE TOWN
PORT ELIZABETH
Mafikeng
Vryburg
Upington
Springbok
De Aar
Middelburg
Cradock
Graaff-Reinet
Beaufort West
Somerset East
Oudtshoorn
George
Knysna
Wellington
Worcester
Robertson
Milnerton
Parow
ORLIGHTSA
RENEWABLE ENERGY
DIGBY WELLS
ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: WGS84
Central Meridian: 19°E
Ref #: amc.BSGR1384.201201.085
Revision Number: 1
Date: 20/01/2012
N
0 50 100 200
Kilometres
1:4 000 000
© Digby Wells Environmental

Appendix B: EIA Methodology

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though Digby Wells and the majority of environmental impact assessment practitioners propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to the each factor of a potential impact and the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, Interested and Affected Parties (I&APs) and authorities who provide input into the process. It is for this reason that it is crucial that all Environmental Impact Assessments (EIAs) make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. It is not the purpose of the EIA process to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defendable methodology of rating the relative significance of impacts within a specific context.

The methodology employed for the EIA is divided into two distinct phases, namely impact identification and impact assessment.

Impact identification

Impact identification is performed by use of an input and output model, which serves to guide the assessor in assessing all the potential instances of ecological and socio-economic change, pollution and resource consumption that may be associated with the activities required during the construction, operational, closure and post-closure phases of the project.

Outputs may generally be described as any changes to the biophysical and socio-economic environments, both positive and negative in nature, and also include the product and waste produced by the activity. During the determination of outputs, the effect of outputs on the various components of the environment (e.g. topography, water quality, etc.) is considered.

During consultation with I&APs, perceived impacts were identified. These perceived impacts will become part of the impact assessment and significance rating in order to differentiate between probable impacts and perceived impacts.

Impact rating

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the input and output model. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where *Consequence = Severity + Spatial Scale + Duration*

And *Probability = Likelihood of an impact occurring*

The severity, spatial scale, duration and probability of an impact occurring are assigned a rating out of seven as indicated in Table 8-1. The matrix calculates an overall significance rating out of 147. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP. The significance of an impact is determined by reference the significance rating to the probability consequence matrix shown in Table 8-2 after which it is categorised into one of four categories, as indicated in Table 8-3.

Table 8-1: Impact assessment parameter ratings

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	International The effect will occur across international borders.	Permanent without mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/definite The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	National Will affect the entire country.	Permanent with mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Provincial/regional Will affect the entire province or region.	Project life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Municipal area Will affect the whole municipal area.	Long term 6 to 15 years.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	On-going social issues. Damage to items of cultural significance.	Local Local extending only as far as the development site area.	Medium term 1 to 5 years.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with or without help of external consultants.	Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year.	Rare or improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact occurring is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance. Will have no impact on the environment.	Low-level repairable damage to commonplace structures.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely Expected never to happen.

Table 8-2: Probability consequence matrix

Significance

Probability / Likelihood	Consequence (severity + scale + duration)								
	1	3	5	7	9	11	15	18	21
1	1	3	5	7	9	11	15	18	21
2	2	6	10	14	18	22	30	36	42
3	3	9	15	21	27	33	45	54	63
4	4	12	20	28	36	44	60	72	84
5	5	15	25	35	45	55	75	90	105
6	6	18	30	42	54	66	90	108	126
7	7	21	35	49	63	77	105	126	147

Table 8-3: Significance summary table

High	108- 147	
Medium-High	73 - 107	
Medium-Low	36 - 72	
Low	0 - 35	

Appendix I: Traffic Impact Statement

BKS reference: J01439 – TIA Solar PV Projects

19 March 2012

Digby Wells Environmental
Private Bag X10046
Randburg
2125

Attention: Me Mia Ackermann

TRAFFIC IMPACT ASSESSMENT: AGGENEYS PHOTOVOLTAIC POWER PLANT

Dear Mia

Please find attached hereto the Traffic Impact Assessment for the Aggeneys Photovoltaic power plant. Please do not hesitate to contact the undersigned if any further traffic engineering inputs are required.

Kind regards

Gerhard de Wet, PrEng
For BKS (Pty) Ltd

BKS (Pty) Ltd
Reg No. 1966/006628/07

www.bks.co.za

Pretoria Head Office
Block D, Hatfield Gardens
333 Grosvenor Street, Hatfield
Pretoria 0083

Postal Address
PO Box 3173
Pretoria 0001
South Africa

Tel | +27 (0)12 421-3500
Fax | +27 (0)12 421-3501
E-mail | bkspta@bks.co.za

1. Background

It is proposed by Orlight SA (Pty) Ltd to develop a photovoltaic (PV) power plant on portion 1 of the farm Aroams RD near the Aggeneys substation in the Namakwa District Municipality in the Northern Cape. A locality map (Figure 1) and a preliminary site layout plan are attached for reference.

BKS was appointed by Digby Wells Environmental, acting as Orlight's consultant, to conduct a Traffic Impact Assessment (TIA) for the development.

2. Development Data

The generation capacity of the PV plant will be between 40 MW and 150 MW, and preliminary indications are that the optimum capacity on the available land will be approximately 80 MW.

The most severe traffic impact will be felt during the construction phase. Most of the materials will be transported to site using 40 foot containers. This implies the use of 6-axle articulated trucks. The number of truck deliveries per megawatt construction is estimated at 15, consisting of 7 containers for structural materials, 6 containers for PV panels and 2 more containers for transformers, inverters, switchgears, cables etc.

It was assumed that trucks will be loaded to a gross combination mass of 46 t, which is close to the maximum legal allowance. The average equivalent standard axle loading (E80s) under such loading conditions is approximately 4.77 E80 per truck. Once trucks have off-loaded on site, their pavement loading will drop to about 3 % of that of a loaded truck, and pavement loading resulting from return trips is therefore negligible.

The development data for the purpose of the TIA is summarised below.

Table 1: Development Data

Description	Development Extent		
	Minimum	Optimum (to be confirmed)	Maximum
Generation Capacity (MW)	40	80	150
Construction phase trucks	600	1200	2250
Cum E80 (million)	0.003	0.006	0.011
Construction period, months	8	18	24
Truck deliveries per day	3.4	3.0	4.3

3. Traffic Impact

Even if a 150 MW plant is developed, the construction phase truck trip generation will be less than 10 trucks per day (in and out combined). The total trip generation during the construction phase is not expected to exceed 30 trips/day, and during the operational phase it will be negligible. Vehicle trip generation is therefore of no concern from a traffic capacity point of view, and the TIA focuses on practical issues, traffic safety at the access location and the impact of heavy trucks on the road surface.

The development area is bisected by the N14 national road. Farm accesses on the N14 currently serve the two sides of the property, and are located approximately 1.5 km north-west of the Namies / Lus gravel road intersection (T-junction). It is proposed that the same accesses be used for the construction of the PV plant. The N14 is straight and flat at the access position and the sight distance along the N14 is more than a kilometre in both directions. The average daily traffic on this section of the N14 is in the order of 1 200 veh/day (SANRAL CTO Yearbook 2011). Conflicting traffic flows on the N14 at the access are therefore low, and there will be an abundance of safe gaps for turning vehicles. The N14 is a two-lane road with paved shoulders of approximately 1 m wide. Considering the low traffic volumes and excellent sight distances at the accesses, no road widening is recommended. Temporary warning signs should however be erected on the N14 on both sides of the accesses to indicate heavy vehicles turning (sign TW344/5 with appropriate wording).

During the operational phase hardly any traffic will access the site, and the construction of passing lanes or tapers will not be required. It is recommended that the same accesses should be retained for the operational phase. The road signs for trucks may then be removed.

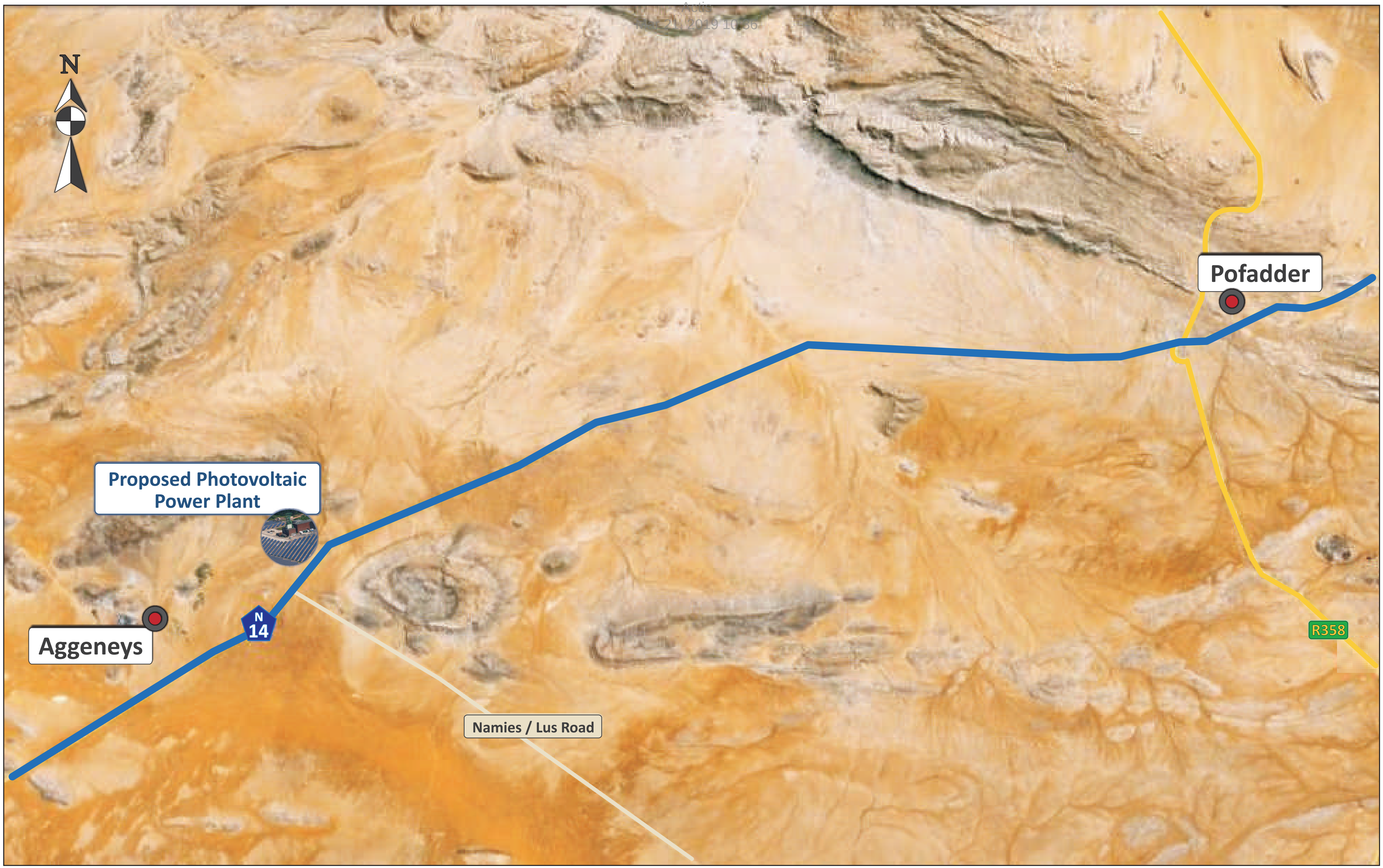
Even if a 150 MW plant is constructed, the cumulative pavement loading contributed by inbound trucks will be only 0.01 million E80s. Considering the design strength of national roads such as the N14, the impact on pavement life will be minimal and no mitigation is required. Care should however be taken to strengthen the N14 road edges with concrete edge beams at the accesses, each 40 m long, to prevent edge-breaks in the asphalt surface.

4. Recommendation

It is recommended that the development of the Aggeneys PV power plant be allowed on the following conditions:

- Access to the eastern and western sides of the development should be provided off the N14, opposite each other, at the current farm accesses located approximately 1.5 km north-west of the Namies / Lus gravel road T-junction.
- The N14 road edges at the accesses should be strengthened with concrete edge beams (40 m length) to prevent edge-breaks in the asphalt surface.
- “Heavy vehicles turning” warning signs should be provided on the N14 on both sides of the accesses during the construction phase (sign TW344/5 with appropriate wording).

Let_TIA_Aggeneys_Solar-PV_2012-03-19.docx



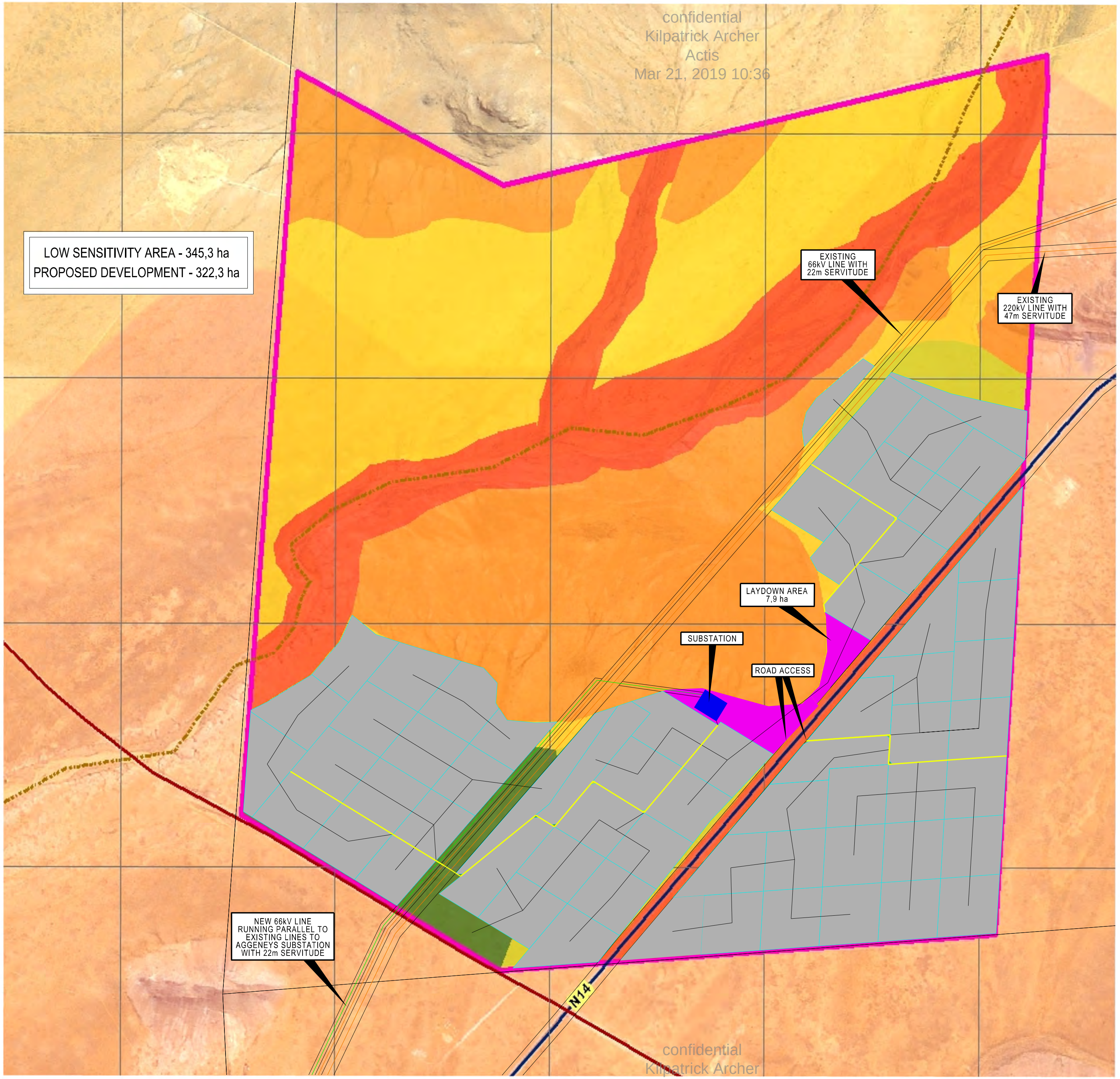
Gdw/0001M/2012 (J01439)

BKS

TRAFFIC IMPACT ASSESSMENT: AGGENEYS PHOTOVOLTAIC POWER PLANT

Locality Map

1



LEGEND

STUDY AREA
MAIN ROADS
NATIONAL ROADS
DRY RIVER
MAIN INTERNAL ROADS
EXISTING TRANSMISSION LINES
NEW TRANSMISSION LINES
SUB STATION
LAYDOWN AREA
BOREHOLE

SENSITIVITY RATINGS

LEAST SENSITIVE AREAS
FAVOURABLE AREAS
MINIMAL SENSITIVITY
SENSITIVE AREAS
HIGHLY SENSITIVE AREAS
NO–GO

DIGBY WELLS ENVIRONMENTAL
aurecon
www.aurecongroup.com

CLIENT

ORLIGHTSA RENEWABLE ENERGY

REV	DATE	REVISION DETAILS	APPROVED

PROJECT

ORLIGHT SOLAR PROJECTS

TITLE

AGGENEYS
PRELIMINARY LAYOUT DESIGN

DRAWN	DESIGNED	
DS	DS	
CHECKED		PROJECT No.
P NEL		107694
APPROVED		SCALE: 1 : 15 000 / SIZE: A3
DATE		DRAWING No. / REV

Appendix J: Heritage reports

HERITAGE IMPACT ASSESSMENT: PROPOSED AGGENEYS PHOTO-VOLTAIC SOLAR POWER PLANT ON PORTION 1 OF THE FARM AROAMS 57, NORTHERN CAPE PROVINCE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act 25 of 1999)

Prepared for:
Digby Wells Environmental
Private Bag X10046
Randburg, 2125.
Johan Nel
Tel: 011 789 9495
Cell: 072 288 5496
Email: johan.nel@digbywells.com

April 2012

Prepared by:

Lita Webley & David Halkett
ACO Associates
8 Jacobs Ladder
St James
7945

Phone (021) 650 2357
Fax (021) 650 2352

acoassociates@gmail.com
Lita@webleyonline.com

EXECUTIVE SUMMARY

The Archaeology Contracts Office at the University of Cape Town was appointed by Digby Wells Environmental, on behalf of the client Orlight South Africa, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on the farm Aroams 57, in the Namakwa District Municipality, Northern Cape Province. The proposed facility will be located on either side of the N14, half way between Springbok and Pofadder. It is lies on the plains between Black Mountain and the Gamsberg.

This assessment forms part of the EIA process. The Notice of Intent to Develop and Scoping phase was undertaken by Digby Wells Environmental. The NID was submitted to SAHRA (SAHRA file number: 9/2/066/0047) and they have requested a palaeontological and archaeological impact assessment. They have also asked that the “archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance”.

This report is based on a background study of the published and unpublished literature for the area as well as fieldwork undertaken by Lita Webley and David Halkett on the 16 April 2012. A desktop palaeontological study was also undertaken by Dr John Pether and is appended. No significant limitations to conducting the survey were encountered.

<u>The following heritage indicators were identified:</u>

Palaeontology:

- The bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The Pre-colonial Archaeology:

- Stone artefacts scatters from the Middle Stone Age are sparsely distributed across the study area and are found on gravel pavements between the vegetation;
- The absence of associated archaeological material, and lack of discrete individual sites reduces the significance of the material overall;
- Further mitigation of sites is considered unnecessary in this case.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- A few cairns were identified but their purpose was unclear. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:

- The proposed solar plant is positioned on both sides of the N14 and is located 2.5km east of the Gamsberg. A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered by the Visual Impact Specialist;
- The cultural landscape of the surrounding area has been significantly impacted by mining activities;
- However, in view of the discussion around the significance of the Gamsberg as a “genocide site” it is recommended that the Visual Impact specialist consider the impact of the proposed development with respect to the mountain.

Summary
The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended. However, the potential cumulative impact of a number of such facilities on the archaeological landscape of the Gamsberg should be examined by the Visual Impact specialist.

SPECIALIST TEAM AND DECLARATION OF INDEPENDENCE

David Halkett (BA, BA Hons, MA (UCT)) is an Archaeologist and Member of the Association of Professional Archaeologists of Southern Africa (ASAPA) accredited with Principal Investigator status. He has been working in heritage management for 23 years and has considerable experience in impact assessment with respect to a broad range of archaeological and heritage sites including those in the Northern Cape. He is a member of the Archaeology, Palaeontology and Meteorites Committee and the Impact Assessment Committee of the Heritage Western Cape (HWC), the Provincial Heritage Resources Authority.

Lita Webley (BA, BA Hons, MA (Stellenbosch), PhD (UCT)) is an Archaeologist and member of ASAPA accredited with Principal Investigator status. She has been involved with heritage and archaeological impact assessments on a part-time basis since 1996 and full time since 2008. Her PhD thesis was concerned with the archaeology of the Namaqualand region of the Northern Cape and she is familiar with the heritage of the region.

John Pether (MSc. Pr. Sci. Nat.(Earth Sci)) is an independent consultant/researcher and authority on coastal-plain and continental-shelf palaeoenvironments.

Mr David Halkett, Dr Lita Webley and Mr John Pether are independent specialist consultants who are in no way connected, financially or otherwise, with the proponent, other than in the delivery of consulting services on the project.

TABLE OF CONTENTS

1. INTRODUCTION

The Archaeology Contracts Office at the University of Cape Town was appointed by Digby Wells Environmental, on behalf of the client Orlight South Africa, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on Portion 1 the farm Aroams 57, in the Namakwa District Municipality, Northern Cape Province. The proposed facility will be located on either side of the N14, half way between Springbok and Pofadder. It is lies on the sandy plains between Black Mountain and the Gamsberg (Figure 1). This is to meet the growing demand for electricity generation and cleaner energy production in South Africa.

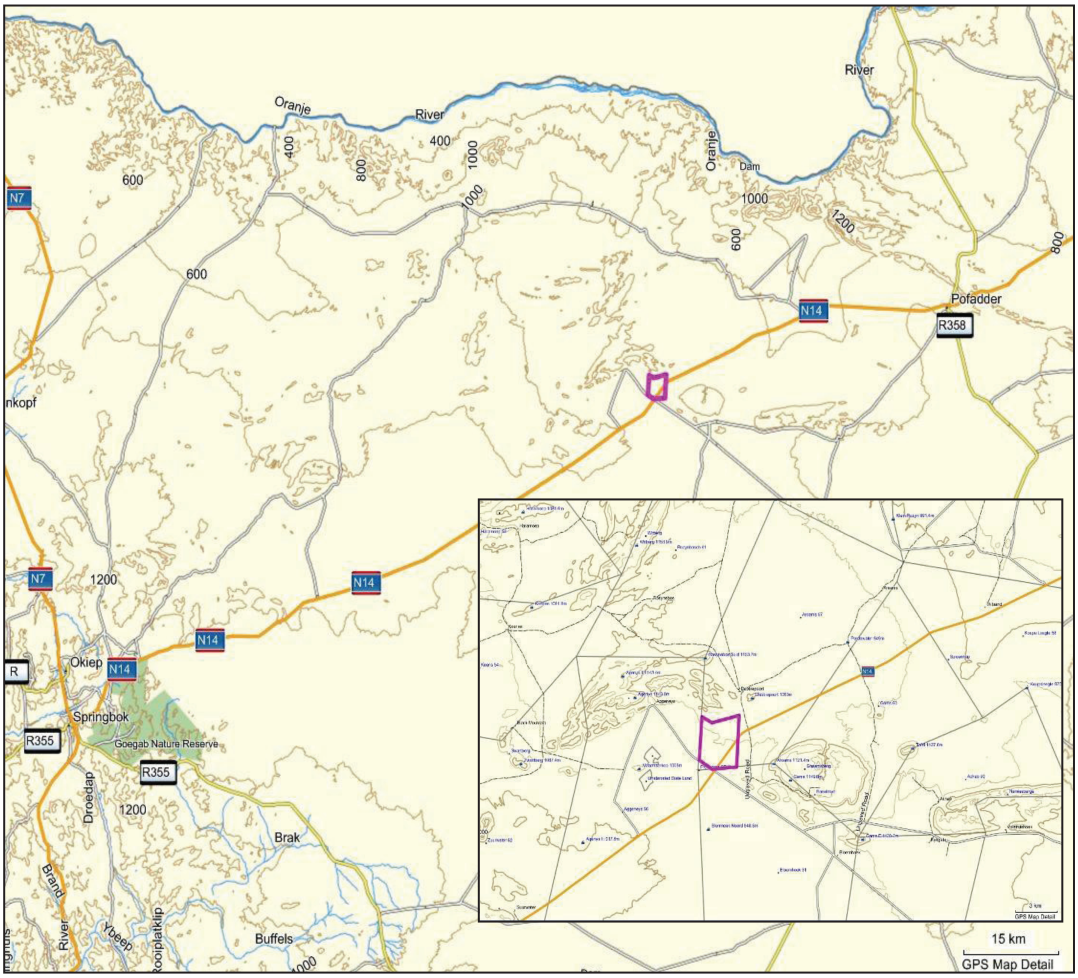


Figure 1: The location of the proposed facility on the N14 between Aggeneys and Pofadder. Note the location of the Gamsberg to the south-east.

2. DEVELOPMENT PROPOSALS

The Aggeneys solar project will have a generation capacity of 70MW resulting in the physical alteration of approximately 350ha of agricultural land on the farm Aroams 57. Only one preliminary layout has been proposed for the development (Figure 2). The facility may connect to the Aggeneys or Gamsberg substation through the establishment of an overheard power line, which could be 66kV or 132kV. Where possible the transmission route will be situated within, or parallel to, an existing servitude. The project will require the establishment of a ground mounting system, solar PV panels, inverters, switchboard and transformers.

Access roads to the facility from the nearest public road onto the site will be required. Internal site roads will also be required to access the solar panels for maintenance purposes. The solar panel plant will be fenced off from the surrounding farms. The site will need to be cleared of vegetation.

The following associated infrastructure will be required:

- Temporary container homes during the construction phase
- Office and technical service buildings
- Electricity distribution lines (from substation to Eskom power line)
- A perimeter high security fence
- Roads within the development footprint

The “no go” option (no development of the site) will also be considered.

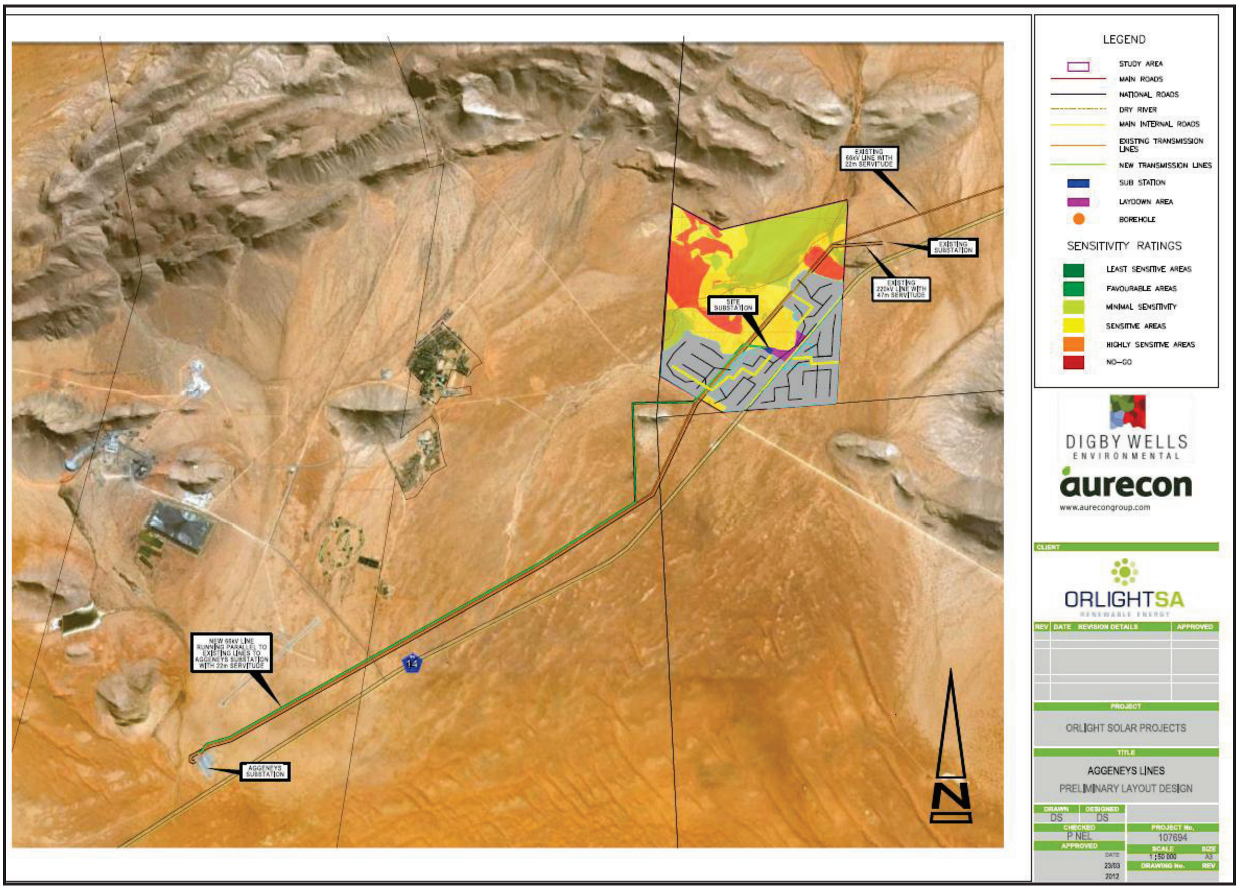


Figure 2: The location and design of the proposed facility on either side of the N14. The town of Aggeneys is located to the west.

The location and design of the proposed facility takes into consideration the position of sensitive features on the landscape, including a drainage channel which crosses the area from north-east to south-west. For this reason, the facility is position in the south-eastern corner of the property (Figure 2).

3. TERMS OF REFERENCE

This assessment includes:

- A site visit and desk top study to determine the pre-history and history of the property;
- The rating of significance of heritage resources on the property;
- An assessment of whether the development of the property will result in a loss of significant heritage resources;
- Recommendations for mitigation if necessary.

4. LEGISLATION

The National Heritage Resources Act, No 25 of 1999 (Section 38 (1)) makes provision for a compulsory notification of the intent to development when any development exceeding 5000 m² in extent, or any road or linear development exceeding 300m in length is proposed.

The NHRA provides protection for the following categories of heritage resources:

- Cultural landscapes (Section 3(3))
- Buildings and structures greater than 60 years of age(Section 34)
- Archaeological sites greater than 100 years of age(Section 35)
- Palaeontological sites and specimens
- Shipwrecks and aircraft wrecks
- Graves and grave yards (Section 36).

Only the Western Cape and Kwa-Zulu Natal have functioning Provincial Heritage Authorities, and consequently SAHRA administers heritage in the remaining provinces particularly where archaeology and palaeontology are the dominant concerns. Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with built environment issues at this stage. Amongst other things the latter administers:

- World Heritage Sites
- Provincial Heritage Sites
- Heritage Areas
- Register Sites
- 60 year old structures
- Public monuments & memorials

Archaeology, including rock art, graves of victims of conflict and other graves not in formal cemeteries are administered by the national heritage authority, SAHRA.

Digby Wells Environmental submitted a cultural resources pre-assessment report or Notice of Intent to Develop to SAHRA in January 2012.

SAHRA (SAHRA file number: 9/2/066/0047) have requested a palaeontological and archaeological impact assessment. Further, they have asked that the archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The topography and landscape is described as fairly uniform. The area has an elevation of 880m above mean sea level and the landscape is north facing. It is flat and bordered on the north by steep hills, the outlying foothills of Aggeneys mountain range. The study area consists of red sandy soils and some rocky sections. There is one major drainage line running in a south-westerly direction from the north-eastern corner to the south-western corner. This drainage line spans up to about 50 metres wide. A smaller drainage line, which is about 25 metres wide, flows in a south-south-westerly direction to meet up with the larger drainage line in the study area.

Plate 1: View across the flat grassy plains of the proposed facility with the mountains in the background.

Plate 2: View of the drainage channel which flows across the area. Large areas of the surface are covered in gravel consisting of quartz nodules. The stone artefacts occur in these gravels.

Plate 3: There are a few low rocky ridges in the northern portions of the property.

The drainage lines as well as 100m buffer zone adjoining the drainage lines are to be avoided. This results in a decrease in available surface area for infrastructure. Small trees (including kokerbome) occur along drainage lines and on rocky hillsides. The plains are dominated by low shrubs (generally less than 1 m in height) intermixed with grasses, succulents and geophytes.

In terms of human elements, there are farm fences and a small brick building as well as a wind pump. There are two existing transmission lines that divide the site in two. The site can be accessed directly from the N14 via the existing farm road. There is a two track service road that follows the transmission line.

6. BACKGROUND TO THE AREA

6.1 Palaeontology

The report on the palaeontology of the area was undertaken by Dr John Pether and is appended in full. In brief, the PIA report describes the bedrock of the area as comprising ancient basement rocks of the Bushmanland Terrance of the Namaqua Province. These are very old rocks and not of palaeontological interest. The overlying Quaternary sand cover is a combination of alluvium in the drainage lines and colluvium closer to the bedrock outcrops.

6.2 Archaeological Background

Information on the pre-colonial archaeology of the area is largely derived from a number of impact assessment reports which have been undertaken in the last few years. In general, Morris (2011c) notes that archaeological visibility is low around Aggeneys and Pofadder.

Beaumont *et al*. (1995) has described the widespread but low density stone artefact scatter of Early and Middle Stone Age material across areas of Bushmanland to the south of the study area. Systematic collections have been made at “Olyvenkolk, south-west of Kenhardt and at Maans Pannen to the east of Gamoep. The artefacts included a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA)”. This remark is contradicted by Morris’s (2011a) later statement that “substantial MSA sites are uncommon in Bushmanland” (1995:241). Certainly, the CRM studies which have been conducted in the area around Kenhardt during the last two years have shown substantial distributions of Middle Stone Age material.

Less information is available on the Early and Middle Stone Age around Aggeneys and Pofadder. Morris’s (2010) surveys of the northern slopes of the Gamsberg (2.5km east of the proposed facility) have identified five “significant locales” on the northern rim of the mountain. It includes an MSA factory site of high significance, two ESA (Acheulian) workshop site, a mixed ESA and MSA site and a small cave which did not appear to contain any deposit. Morris explains the presence of the MSA site in proximity to the Gamsberg as the need for access to suitable raw material. This is not easily accessible on the plains between Aggeneys Mountain and the Gamsberg.

Pelser (2011) in his survey of an area around the Paulputs substation near Pofadder describes finding material from the Middle and Later Stone Age, although his illustrations appear to be of LSA artefacts made on quartz. He also mentions the presence of ostrich eggshell. According to Morris (2011a) Later Stone Age (LSA) sites are the predominant archaeological trace noted in surveys in the Aggeneys-Pofadder region. Morris’s (2010) surveys of the northern slopes of the Gamsberg identified very few isolated LSA flakes. To the north-west of the Gamberg however, he found two stone cairns which could represent graves, as well as a ceramic LSA site, comprising ostrich eggshell, pottery, stone tools made on quartz, glass and porcelain. These isolated LSA settlements occur on the plains, near little rocky outcrops, rather than on the slopes of the Gamsberg itself. Morris's site B3, to the north of the N14 linking Aggeneys to Pofadder, also consists of a ceramic LSA site with pottery, stone tools, ostrich eggshell and glass. In addition he reports on "boat-shaped grinding grooves in the outcropping bedrock". These sites probably represent transient settlement by transhumant hunter-gatherers or herders, moving through the area. Morris refers to Beaumont *et al*. (1995) who have written that "virtually all the Bushmanland sites [LSA] so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river" (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself.

In fieldwork conducted by Webley & Halkett (2011) for a new transmission line commencing at the Aggeneis substation, it was observed that LSA sites (consisting mainly of quartz flakes) were concentrated at the base of small koppies. This information is supported by Morris (2011a, b & c) and Pelser (2011). "Surveys have located signs of human occupation mainly in the shelter of granite koppies, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *el al*. 1995).

Morris (2010) refers to an unpublished report by Janette Deacon of rock paintings on a boulder next to the Aggregate Quarry at Black Mountain Mine, Aggeneys. These are simple finger paintings including two "Star" motifs and an indented oval shaped image.

Finally, field work undertaken during the Scoping Phase (Digby & Wells Environmental 2012) describes quartz lithics scattered throughout the area. The authors report that the artefacts are mainly flakes with some formal scrapers noted. The authors briefly surveyed rock outcrops on the site for rock art, but no evidence of this was found.

5.2 Historical Background

Morris (2010) has summarised the colonial history of this frontier zone in his reports for the Aggeneys and Gamsberg areas. Early travel accounts show that "Place names were becoming fixed in this colonial frontier period (in a cadastral sense, on maps and in farm names), many such names having Khoe-San origins encapsulating vestiges of pre-colonial/indigenous social geography".

Morris (2010) comments that place names, such as Aggeneys/Aggeneis and Gams (Gamsberg) are derived from Nama names. He reviews the various interpretations for the name Aggeneys including the oral history which suggests that a massacre of Bushmen took place in a kloof at Aggeneys (Nienaber & Raper 1977:173). Other interpretations include the possibility that it means "place of red clay" or that it is associated with reeds. Morris (2010) also refers to the thesis by Burger (1986) which links the killing of the Bushmen with the Gamsberg rather that Aggeneys.

Nienaber and Raper cite a local farmer who similarly asserted that the origin of *Gams* or *Gaams* was in the word *Tha-aams*, where *Tha* means "grass" and *aams* means "mouth". The Nama |*Gâ-ams* literally means "Grasmond" or "Grasfontein" (Nienaber & Raper 1977).

Morris (2010) comments that recently appreciation has started emerging regarding the "genocide against the Bushmen in this area, with certain mountainous areas (like Gamsberg near Aggeneys) being likely massacre sites". This has resulted in moves to include the Gamsberg in a potential /Xam and Khomani Heartland World Heritage Site. This is further discussed below.

According to the Surveyor General's records, the farm Aroams 57 was surveyed and granted in 1895. This suggests a relatively recent date for the settlement of the area. Morris (2011c) explains that the name is derived from the Nama ‡*aro-* meaning "wag-'n-bietjie" tree (*Ziziphus mucronatus*) and *am* or *am-s* meaning "mouth". The name could thus be translated as "Wag-'n-bietjiebosfontein" (Nienaber & Raper 1977).

7. SURVEY METHODS

The property was visited by Lita Webley and David Halkett on the 16 April 2012. The survey was conducted by vehicle and on foot, and a Garmin GPS unit was used to record sites. No archaeological material was removed from the project area, but recorded and photographed *in situ*. Walk paths and site locations were recorded with GPS and finds were photographed and described. The assessment was primarily concerned with palaeontology and archaeology (as per the recommendations of SAHRA), but consideration was also given to the built environment where appropriate.

6.1 Limitations

We were able to access both sides of the N14. Although there are few roads across the property, the low shrub and the level topography meant that we could drive in the veld. Archaeological visibility was good.

- As with all archaeological surveys, it is not possible to be completely confident that all archaeological sites were identified during the fieldwork. Surface distributions give only a general indication of sub-surface remains. It is always possible that sub-surface archaeological sites may be present which were not identified during the survey;
- The only significant limitation is that we were not able to follow the route of the proposed new transmission line (Figure 2) as it crosses adjoining lands. These are not accessible because of locked gates. The transmission line crosses behind a koppie, and there may be Stone Age material on the lower slopes of the koppie. This is not considered to be a major limitation;
- Morris (2010) has also commented elsewhere in the area on the considerable "background noise" of massively preponderant small nodules of white quartz strewn over most the land surfaces. This may hamper the identification of artefacts, as local assemblages of are dominated by stone artefacts made from such nodules.

8. FINDINGS

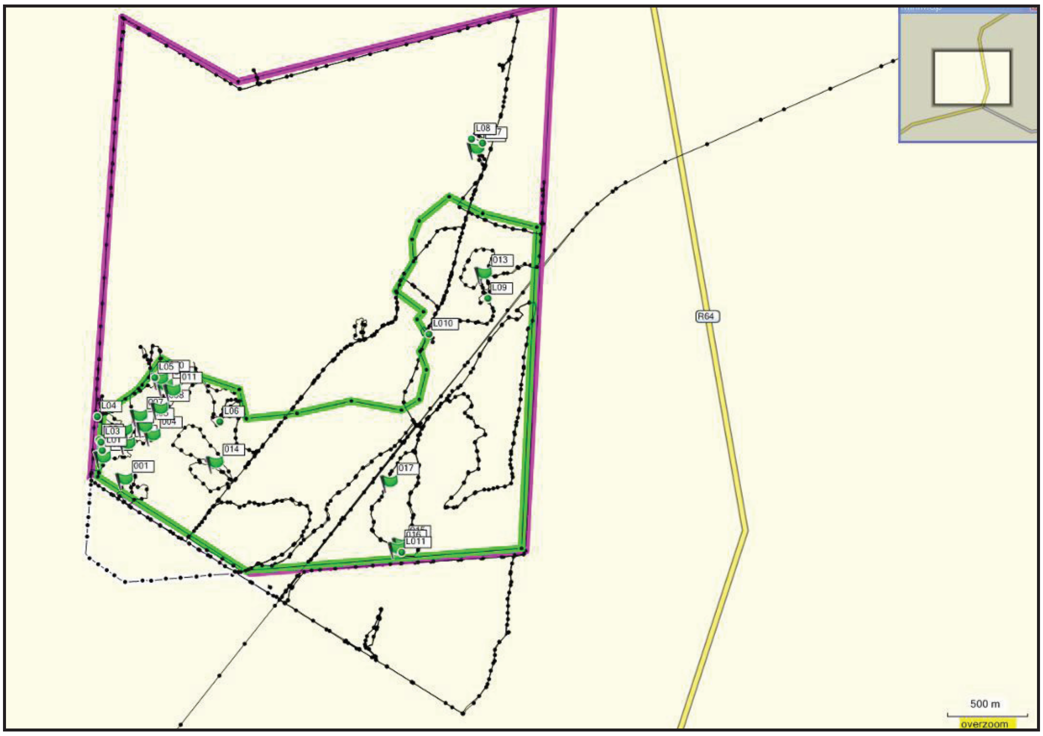


Figure 3: Map of tracks and location of sites recorded in Table 1.

8.1 Pre-colonial Archaeology

We found a dense background scatter of quartz flakes across the south-western section of the property. The material is particularly prevalent in those areas where the soil surface is covered in quartz pebbles and cobbles. These quartz "floors" occur in patches between the knee high grasses and are easy to see (Plate 4). The concentrations of stone tools appear to be highest near the drainage channel (see Figure 3).

Plate 4: Stone artefact scatters are found in these open patches of soil between the vegetation cover.

The artefacts comprise predominantly quartz flakes, cores and chunks, although quartzite stone artefacts are also present. Some of the quartzite flakes were side-struck and most of the flakes are quite large. The size of the artefacts suggests that they are of Middle Stone Age date. There are no distinctive features of the artefacts to categorically classify them as MSA, but they certainly do not conform to LSA design or size. In general, the scatter of stone tools is very widely distributed and does not appear to be concentrated in any specific location. The identification of "sites" in Table 1 is not a reflection of a site with *in situ* artefact distribution related to prehistoric settlement. It is merely a centre point of a scatter of stone tools.

Plate 5 & 6: Site L03 quartz and quartzite flakes. The scale is in centimetres.

Plate 7: Site 002 (scale 14 cm); **Plate 8**: A small (Fauresmith?) handaxe from Site 003.

Site 003 included a small handaxe which may be attributed to the Fauresmith, a final phase of the Early Stone Age.

Site L06 consisted of a single quartz bladelet which was the only suggestion of a Later Stone Age presence on the site.

A small koppie to the north of the proposed facility (Figure 3) contained a higher concentration of stone artefacts, particularly in quartzite. The koppie is located near a small farm building, and there are fragments of glass in the area, suggesting that livestock may have been kraaled in the shelter of the koppie in the recent past.

Rocky outcrops to the north of the area were also examined for signs of engravings, but the rock was not of a suitable dolerite material for engravings. A slight overhang in one of the rocky outcrops outside the study area was examined for signs of rock paintings, but none were found.

8.2 Built Environment

There is a small brick farm building located to the north of the proposed facility (Plate 9). It was constructed within the last few decades and has no heritage significance.

There is also evidence of some recent drilling in the area, including some stone cairns with glass and tin nearby (Plate 10). Although the cairns could indicate graves, they are more likely to relate to mining activities.

Plate 9: Small farm building near a rocky koppie outside the study area; **Plate 10**: Evidence for drilling in the study area.

8.3 Cultural Landscape

Morris (2010) comments in his “Cultural Heritage of the Gamsberg” that “a call has been made for massacre sites to be identified and declared as Provincial Heritage Sites”. This Morris points out would influence plans with respect to mining at Gamsberg. He also notes that sites such as the Gamsberg could ultimately form part of a /Xam and Khomani Heartland World Heritage Site, already on South Africa’s tentative list. However, it is likely that the main centre for the /Xam WHS will be further south-east, between Kenhardt and Carnarvon.

Gamsberg is about 2.5km directly east of the proposed facility (Figure 1) and the facility will therefore be clearly visible from the mountain, which forms a significant element of the cultural landscape of the area. It is likely that there will be a cumulative visual impact on the Gamsberg since several solar facilities are proposed for this particular area.

However, this Cultural Landscape has already been impacted by open cast mining at Black Mountain and mining shafts sunk into the northern rim of the Gamsberg. It could be argued that the landscape has already been significantly transformed by mining activities.

9. IMPACT IDENTIFICATION AND ASSESSMENT

The construction of the proposed facility may result in the physical disturbance and potential destruction of the context of surface and sub-surface material as a result of site clearance, the construction of lay down areas, the installation of solar PV panels during the construction phase and the construction of access roads.

With respect to Palaeontology, the PIA report indicates that the bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The stone artefact scatters which we have recorded during our survey are considered to be of minor significance. They are probably not in original context, and not associated with other archaeological material, such as bone, which could provide valuable information on prehistoric lifeways. There do not appear to be "archaeological sites" with stone tools left in their original context. For this reason, we believe the impact of the proposed development on the archaeology of the area to be low.

Table 2: Summary of impacts to archaeological material

Nature of Impact: Impacts to archaeological material could involve destruction of material at solar panel footings, underground cabling, access roads, etc.		
	Pre- Mitigation	**Post- Mitigation**
Extent	Local	Local
Magnitude	On-site	On-site
Duration	Permanent	Permanent
Intensity	Negligible	Negligible
Probability	Definite	Definite
Significance	Low	Low
Mitigation: Although some archaeological material will be impacted, the impact is considered Low. Lack of site boundaries or associated organic remains or reduces scientific value greatly. In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation. No mitigation has been suggested.		
Cumulative Impacts: The cumulative impact of several such facilities will result in the potential destruction of large scatter of archaeological material.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

* Once archaeological material is destroyed, it cannot be renewed or replaced.

There are no buildings or structures on that portion of the property identified for the development of the facility. The impacts to the Built Environment are considered to be negligible.

Table 3: Summary of impacts to Cultural Landscape

Nature of Impact: The proposed facility may have a negative visual impact on the cultural landscape and its archaeological significance		
	Pre- Mitigation	**Post- Mitigation**
Extent	Local	Local
Magnitude	Regional	Local
Duration	Long term	Long term
Intensity	Medium	Medium
Probability	Definite	Definite
Significance	Medium	Medium
Mitigation: A Visual Impact Assessment by a specialist which considers the proposed impact of the development on the Cultural Landscape, particularly the archaeological landscape.		
Cumulative Impacts: The cumulative impact of several such facilities will result in "industrialization" of the archaeological landscape.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

10. MITIGATION AND ASSESSMENT OF ALTERNATIVES

No Palaeontological mitigation will be required. The PIA report recommends that “an alert for the uncovering of fossil bone and implements be included in the construction EMP for the project”.

The lack of *in situ* archaeological surface sites or indications of stratified archaeological deposits means that the archaeological material on site has limited scientific value. We have photographed and recorded small collections of material across the solar plant site and believe that these are representative of the material as a whole. Further mitigation is unlikely to result in a greater understanding of the material and the various time periods, and as a result we do not believe further intervention from an archaeological point of view is necessary.

In the event that human remains are uncovered beneath the soil surface during the construction of the facility, work in that location should stop, and the heritage authorities (SAHRA) should be notified. They may recommend exhumation.

There are no issues relating to the Built Environment (e.g. buildings or structures older than 60 years which are protected by the NHRA). No mitigation is required.

SAHRA have requested that the assessment should whether the “cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance”. The most significant aspect of the archaeological landscape in the area is the Gamsberg, which is located 2.5km east of the proposed facility. Morris (2010) has discussed the importance of the Gamsberg as a potential “genocide site for the San” and the possibility (albeit unlikely) of its incorporation into a /Xam and Khomani Heartland World Heritage Site”. Morris (pers. com.) points to the impact of mining both at Aggeneys Mountain and at Gamsberg and the fact that the area has already been transformed by not only mining, but also by a substation and transmission lines.

Nevertheless, it is recommended that the Visual Impact Specialist consider the cumulative visual impact of several solar facilities in this area, on the archaeological landscape of the Gamsberg.

According to the NID application completed by Johan Nel of Digby Wells Environmental for SAHRA, at least two other applications for solar energy facilities are proposed on the same property and the cumulative impact of several facilities may be high.

The “no-go” alternative would mean that the status quo is retained and that the heritage resources of the area are maintained in their current condition.

11. CONCLUSIONS

In conclusion, the following heritage indicators were considered:

Palaeontology:

- The bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The Pre-colonial Archaeology:

- Stone artefacts scatters from the Middle Stone Age are sparsely distributed across the study area and are found on gravel pavements between the vegetation;

- The absence of associated archaeological material, and lack of discrete individual sites reduces the significance of the material overall;
- Further mitigation of sites is considered unnecessary in this case.

The Built Environment:
- There are no buildings of heritage significance on the site.

Graves:
- A few cairns were identified. They probably relate to drilling on site but could possibly be graves. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:
- The proposed solar plant is positioned on both sides of the N14 and is located 2.5km east of the Gamsberg. A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered;
- The cultural landscape of the surrounding area has been significantly impacted by mining activities;
- However, in view of the discussion around recognising the Gamsberg as a “genocide site” it is recommended that the Visual Impact specialist consider the impact of the proposed development with respect to the mountain.

The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended. However, the potential cumulative impact of a number of such facilities on the nearby archaeological significance of the Gamsberg should be examined by the Visual Impact specialist.

12. REFERENCES

Beaumont, P.B., Smith A.B. and Vogel J.C. 1995. Before the Einiqua: The archaeology of the frontier zone. In Smith A.B. ed. Einiqualand: Studies of the Orange River frontier. UCT Press: 236-264.

Burger, C.R. 1986. ’N ondersoek na die oorsprong en betekenis van plek- en plaasname in die Landdrosdistrik Namakwaland. Unpublished MA thesis: University of Stellenbosch.

Digby Wells Environmental. January 2012. Draft Scoping Report. Proposed development of five solar photovoltaic power plants in the Northern Cape and Western Cape Provinces. Unpublished report for Orlight SA (Pty) Ltd.

Morris, D. 2010. Cultural Heritage Assessment: Gamsberg. Supplementary observations to a previous specialist report on archaeological resources. Unpublished report.

Morris, D. 2011a. A Phase 1 Heritage Impact Assessment for the proposed Aggeneis – Paulputs 220kV transmission line. Unpublished report for SSI Engineers and Environmental Consultants.

Morris, D. 2011b. SATO Energy Holdings: Zuurwater Photovoltaic Energy Generation Facility development near Aggeneys, Northern Cape. Unpublished report for SATO Energy Holdings.

Morris, D. 2011c. Black Mountain Concentrated Solar Power Facility development at Aggeneys, Northern Cape. Unpublished report for Aurora Power Solutions (Pty) Ltd.

Nienaber, G.S., & Raper, P.E. 1977. *Toponymica Hottentotica*. SA Naamkundesentrum RGN Naamkudesreeks 6.

Pelser, A.J. 2011. A Report on an Archaeological Impact Assessment (AIA) for the proposed solar energy plant on Konkoonsies 91, Pofadder District, Northern Cape. Unpublished report for Robert de Jong & Associates.

Webley, L. & Halkett, D. 2011. Heritage Impact Assessment: Proposed Aggeneis – Oranjemond 400kV line and substations upgrade, Northern Cape Province. Unpublished report for Savannah Environmental (Pty) Ltd.

SAHRA 2009. Archaeology, Palaeontology & Meteorite Unit. Report Mapping Project. Version 1.0

Appendix 1: Location of archaeological sites.

Site Name	GPS Co-ordinates	Description	Significance	Mitigation
L01	S29.24015100 E18.88197200	Quartz flakes in an open area between grasses	Low	No
L02	S29.23894600 E18.88050100	Quartz flakes	Low	No
L03	S29.23818300 E18.88215000	Quartz flakes	Low	No
L04	S29.23771400 E18.88386000	Black quartz core	Low	No
L05	S18.88386000 E18.88331100	Two side struck flakes out of a dark quartz	Low	No
L06	S29.23743100 E18.88194500	One quartz bladelet on clear quartz, not retouched. Possibly LSA	Low	No
L07	S18.88194500 E18.88295700	One large quartzite flake near koppie	Low	No
L08	S29.23625600 E18.88435500	One quartzite flake, possibly MSA	Low	No
L09	S29.23496400 E18.88469600	Single quartz flake on plains	Low	No
L010	S29.23460300 E18.88437100	Two quartz flakes and 3 quartz cores near the koppie	Low	No
L011	S29.23524000 E18.88521400	On other side of N14 in plains, 5 quartz flakes.	Low	No
001	S29.24015100 E18.88197200	old borehole w cement cap (BH-AMS-1)	Low	No
002	S29.23894600 E18.88050100	widely dispersed stone artefact scatter including cores and flakes on fine quartzite and quartz on a generally gravel strewn pavement - msa	Low	No
003	S29.23818300 E18.88215000	isolated core/biface (Fauresmith?)	Low	No
004	S29.23771400 E18.88386000	widely dispersed stone artefact scatter including cores and flakes on fine quartzite and quartz on a generally gravel strewn pavement - msa?	Low	No
005	S29.23724400 E18.88331100	more concentrated scatter of stone flakes on gravel pavement,	Low	No

		quartzite and quartz - msa		
006	S29.23743100 E18.88194500	isolated large quartzite core - msa	Low	No
007	S29.23664700 E18.88295700	general artefact scatter - msa	Low	No
008	S29.23625600 E18.88435500	general artefact scatter - msa	Low	No
009	S29.23496400 E18.88469600	general artefact scatter - msa	Low	No
010	S29.23460300 E 18.88437100	general artefact scatter - msa	Low	No
011	S29.23524000 E18.88521400	general artefact scatter - msa	Low	No
012	S29.22190200 E18.90572800	small overhang below boulders on edge of a koppie just outside solar area. Ephemeral stone age artefact “scatter” (lsa/msa?). Also tins, and metal frags, bottle glass. Sandy floor but no real deposit	Low	No
013	S29.22878100 E18.90623200	isolated artefact - flake	Low	No
014	S29.23922900 E18.88809200	isolated artefact - flake	Low	No
015	S29.24372100 E18.90065900	isolated artefact - flake	Low	No
016	S29.24396000 E18.90038400	isolated artefacts including a core at a residual dry pan - msa	Low	No
017	S29.24027900 E18.89987000	Heap of rocks with bully beef can nearby. Probably an old prospecting drill hole.	Low	No

Appendix A: Palaeontological Impact Assessment

BRIEF PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED ORLIGHT SA DEVELOPMENT OF A SOLAR PHOTOVOLTAIC POWER PLANT NEAR AGGENEYS, NORTHERN CAPE PROVINCE
Portion 1 of Farm Aroams 57 RD

By

John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)
Geological and Palaeontological Consultant
P. O. Box 48318, Kommetjie, 7976
Tel./Fax (021) 7833023
Cellphone 083 744 6295
jpether@iafrica.com

Prepared at the Request of

Digby Wells & Associates (Pty) Ltd.
Fern Isle, Section 10, 359 Pretoria Ave, Randburg
Private Bag X10046, Randburg, 2125
Co. Reg. No. 1999/05985/07
Tel: 011 789 9495, Fax: 011 789 9498
johan.nel@digbywells.com, www.digbywells.com

For

ORLIGHT SA (PTY) LTD

23 April 2012

DEA REF. NO. 12/12/20/2630
NEAS REF. NO. DEA/EIA/0000818/2011

CONTENTS

SUMMARY

Orlight SA (Pty) Ltd (Orlight SA) proposes to construct five new Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces. Three proposed sites for development of the Orlight SA Solar PV Power Plants are located in the Northern Cape Province near the towns of Aggeneys, Kenhardt and Loeriesfontein. Two proposed sites are in the Western Cape Province adjacent to the towns of Vanrhynsdorp and Graafwater. Digby Wells Environmental (Digby Wells) is appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) processes for the proposed projects.

This desktop palaeontological assessment pertains to the Solar PV Plant near Aggeneys in the Namakwa District Municipality, viz. on Portion 1 of the farm Aroams 57 RD (Figure 1).

The solar PV panels will be mounted on metal frames (Figure 2) which are anchored to the ground with either concrete or screw pile foundations. These footings will be either hammered into the earth or anchored in a 1.5 m deep concrete foundation.

The bedrock underlying the property is unfossiliferous and of no palaeontological interest.

The overall potential for fossils in the Quaternary sand cover is very low. Furthermore, the scale of subsurface disturbance and exposure is quite limited, comprising mainly “post holes” to support the PV panel frames.

In view of the low fossil potential it is proposed that only a basic degree of mitigation is required. It is recommended that an alert for the uncovering of fossil bone and implements be included in the Construction Phase EMP for the project. Appendix 1 outlines monitoring by construction personnel and general Fossil Find Procedures. This is a general guideline, to be adapted to circumstances.

In the event of possible fossil and/or archaeological finds, the contracted archaeologist or palaeontologist must be contacted. For possible fossil finds, the palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

---oooOOOooo---

The author, John Pether, is an independent consultant/researcher and is a recognized authority in the field of coastal-plain and continental-shelf palaeoenvironments and is consulted by exploration and mining companies, by the Council for Geoscience, the Geological Survey of Namibia and by colleagues/students in academia pursuing coastal-plain/shelf projects.

Expertise

- Shallow marine sedimentology.
- Coastal plain and shelf stratigraphy (interpretation of open-pit exposures and on/offshore cores).
- Marine macrofossil taxonomy (molluscs, barnacles, brachiopods).
- Marine macrofossil taphonomy.
- Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones).
- Analysis of the shelly macrofauna of modern samples e.g. for environmental surveys.

Membership of Professional Bodies

- South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.
- Geological Society of South Africa.
- Palaeontological Society of Southern Africa.
- Southern African Society for Quaternary Research.
- Heritage Western Cape. Member, Permit Committee for Archaeology, Palaeontology and Meteorites.
- Accredited member, Association of Professional Heritage Practitioners, Western Cape.

---oooOOOooo---

1 INTRODUCTION

Orlight SA (Pty) Ltd (Orlight SA) proposes to construct five new Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces. Orlight SA is the local company established by BSG Resources Limited (BSGR), an international natural resources company that operates in the fields of mining, energy and engineering services.

Three proposed sites for development of the Orlight SA Solar PV Power Plants are located in the Northern Cape Province near the towns of Aggeneys, Kenhardt and Loeriesfontein. Two proposed sites are in the Western Cape Province adjacent to the towns of Vanrhynsdorp and Graafwater. Digby Wells Environmental (Digby Wells) is appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) processes for the proposed projects

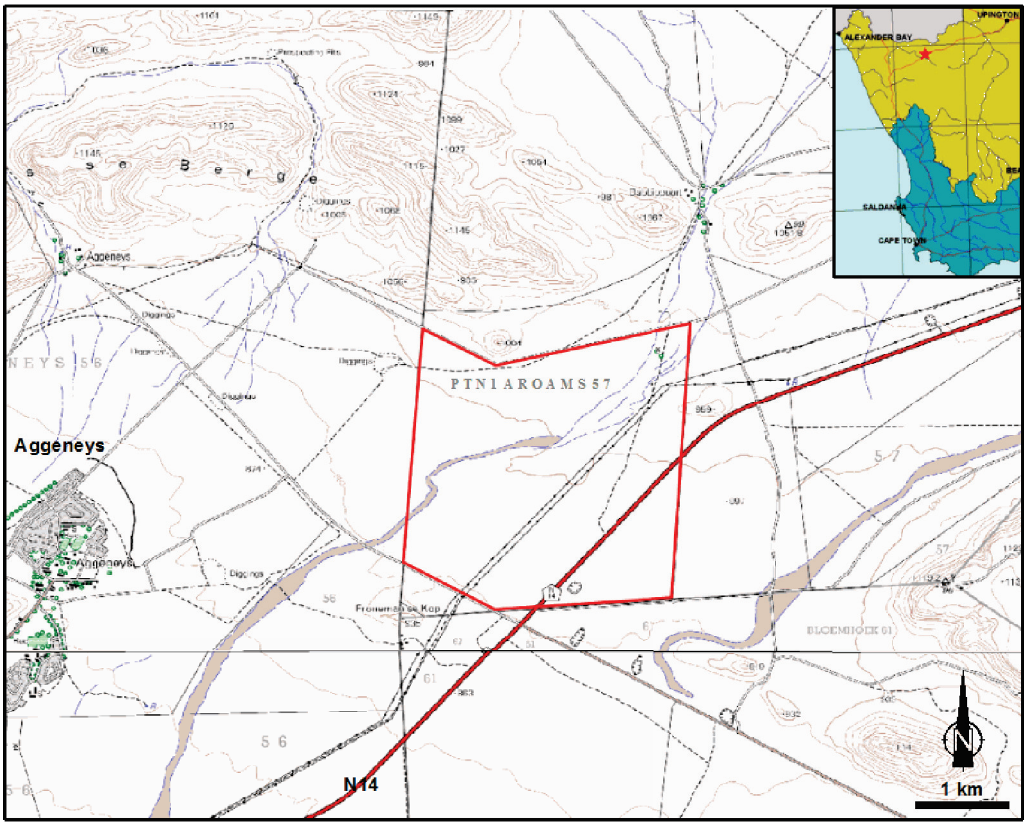


Figure 1. Location of the proposed Aggeneys Solar PV Plant. Extracts from 2918BB_2003_ED2_GEO.TIF and 2918BB_2003_ED2_GEO.TIF 1:50000 topo-cadastral maps. Chief Directorate: Surveys & Mapping.

This desktop palaeontological assessment pertains to the Solar PV Plant near Aggeneys in the Namakwa District Municipality, viz. on Portion 1 of the farm Aroams 57 RD (Figure 1). The preliminary generation capacity of the proposed Aggeneys Solar PV Power Plant is ~40 MW, but may be up to 150 MW. During the EIA Phase, studies will be undertaken to determine the optimal generation capacity that can be accommodated in the study area based on ecological, cultural and socio-economic characteristics and other technical factors.

The power plant infrastructure will consist of a ground mounting system, solar PV panels, cabling, inverters, switchboards and transformer/s and transmission lines to connect the proposed Solar PV Power Plant to an existing Eskom transmission line. Also involved are access roads and temporary construction-related laydown areas, temporary site offices and a workshop.

The solar PV panels will be mounted into metal frames (Figure 2) which are anchored to the ground with either concrete or screw pile foundations. These footings will be either hammered into the earth or anchored in a 1.5 m deep concrete foundation.

Figure 2. Example of a Solar PV installation (supplied by Digby Wells).

Figure 3. Simulated oblique view of the project area, looking north. From Google Earth.

2 GEOLOGICAL SETTING

The project area is situated on a flat, sandy plain (Figure 3) between ~880 m asl. in the southwest, rising to ~915 m asl. in the northeast. To the immediate north is the eastern end of the Aggeneys se Berge, a range of hills rising sharply as inselbergs above the plain. An ephemeral drainage crosses the area.

The bedrock of the study area (Figure 4) is comprised of ancient basement rocks of the Bushmanland Terrane of the Namaqua Province (Cornell *et al*., 2006). The Bushmanland Terrane here consists of metasediments and metavolcanics (Khurisberg Subgroup) that both overlie and are intruded by granitic gneisses (Stalhoek Complex, Achab Suite gneisses). These very old rocks (>1000 Ma) are not of palaeontological interest.

The Quaternary sand cover (pale yellow, Figure 4) is likely a combination of alluvium in the drainage lines and colluvium closer to bedrock outcrops, with a contribution of windblown, redistributed sands. Rock outcrops at several places in the project area suggests that the sand cover is not very thick.

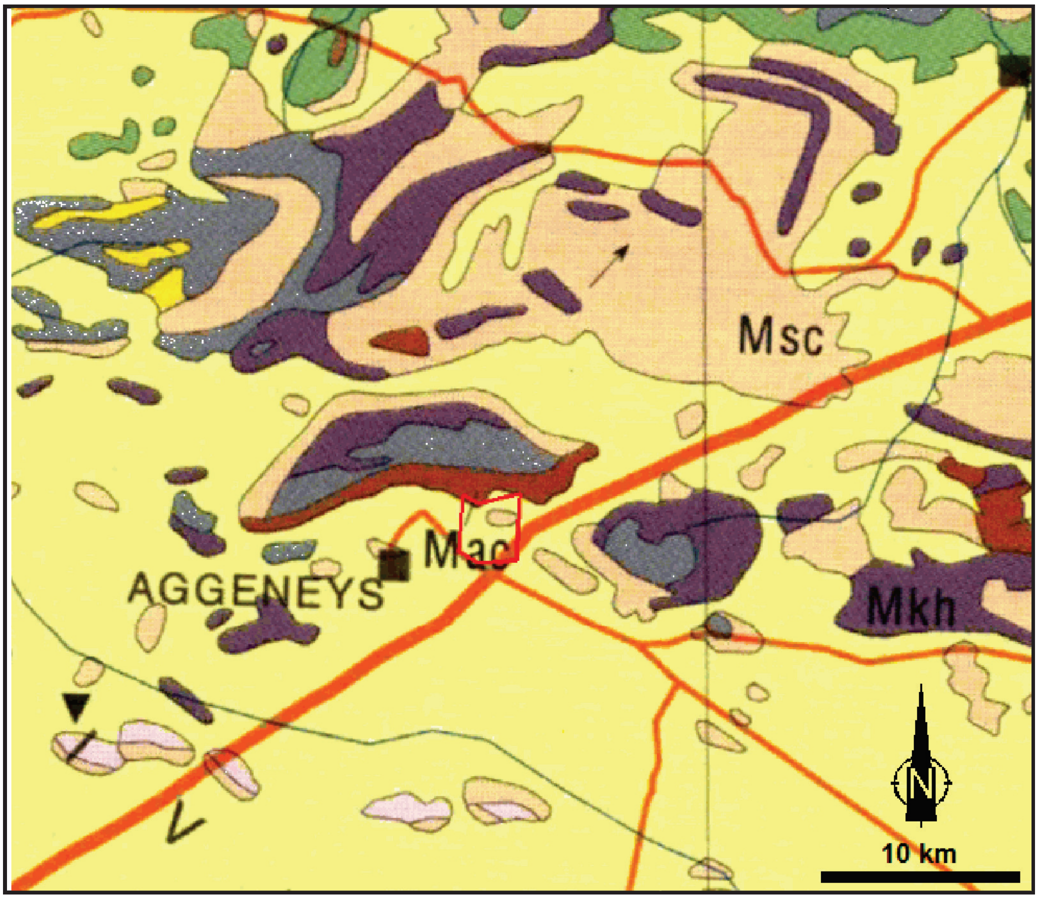


Figure 4. Geology of the study area. 1:1000000 Geological Map (CGS, 1997).

Mac – Achab Suite gneisses.
Msc – .Stalhoek Complex schists and gneisses.
Mkh – Khurisberg Subgroup metasediments and volcanics.

3 EXPECTED PALAEONTOLOGY

The bedrock underlying the property is unfossiliferous and of no palaeontological interest.

The overall potential for fossils in the Quaternary sand cover is very low. Furthermore, the scale of subsurface disturbance and exposure is quite limited, comprising mainly "post holes" to support the PV panel frames.

4 RECOMMENDATIONS

In view of the low fossil potential it is proposed that only a basic degree of mitigation is required.

It is recommended that an alert for the uncovering of fossil bone and implements be included in the construction EMP for the project.

Appendices 1 and 2 outline monitoring by construction personnel and general Fossil Find Procedures. This is a general guideline, to be adapted to circumstances.

In the event of possible fossil and/or archaeological finds, the contracted archaeologist or palaeontologist must be contacted. For possible fossil finds, the palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

5 APPLICATION FOR A PALAEONTOLOGICAL PERMIT

A permit from SAHRA is required to excavate fossils. The applicant should be the qualified specialist responsible for assessment, collection and reporting (palaeontologist). Should fossils be found that require rapid collecting, application for a palaeontological permit must be made to SAHRA immediately.

The application requires details of the registered owners of the sites, their permission and a site-plan map. All samples of fossils must be deposited at a SAHRA-approved institution.

6 REPORTING

Should fossils be found a detailed report on the occurrence/s must be submitted. This report is in the public domain and copies of the report must be deposited at SAHRA. The report must fulfil the reporting standards and data requirements of SAHRA.

7 REFERENCES

Cornell D.H. *et al*. 2006. The Namaqua-Natal Province. In: Johnson, M. R., Anhaeusser, C. R. and Thomas, R. J. (eds.), *The Geology of South Africa*. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. 325-379.

---oooOOOooo---

8 GLOSSARY

~ (tilde): Used herein as "approximately" or "about".

Aeolian: Pertaining to the wind. Refers to erosion, transport and deposition of sedimentary particles by wind. A rock formed by the solidification of aeolian sediments is an aeolianite.

AIA: Archaeological Impact Assessment.

Alluvium: Sediments deposited by a river or other running water.

Archaeology: 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.

asl.: above (mean) sea level.

Bedrock: Hard rock formations underlying much younger sedimentary deposits.

Calcrete: An indurated deposit (duricrust) mainly consisting of Ca and Mg carbonates. The term includes both pedogenic types formed in the near-surface soil context and non-pedogenic or groundwater calcretes related to water tables at depth.

Colluvium: Hillwash deposits formed by gravity transport downhill. Includes soil creep, sheetwash, small-scale rainfall rivulets and gullying, slumping and sliding processes that move and deposit material towards the foot of the slopes.

Coversands: Aeolian blanket deposits of sandsheets and dunes.

EIA: Environmental Impact Assessment.

EMP: Environmental Management Plan.

Fluvial deposits: Sedimentary deposits consisting of material transported by, suspended in and laid down by a river or stream.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

HIA: Heritage Impact Assessment.

Palaeontology: The study of any fossilised remains or fossil traces of animals or plants which lived in the geological past and any site which contains such fossilised remains or traces.

Palaeosol: An ancient, buried soil whose composition may reflect a climate significantly different from the climate now prevalent in the area where the soil is found. Burial reflects the subsequent environmental change.

Palaeosurface: An ancient land surface, usually buried and marked by a palaeosol or pedocrete, but may be exhumed by erosion (*e.g.* wind erosion/deflation) or by bulk earth works.

Pedogenesis/pedogenic: The process of turning sediment into soil by chemical weathering and the activity of organisms (plants growing in it, burrowing animals such as worms, the addition of humus *etc.*).

Pedocrete: A duricrust formed by pedogenic processes.

PIA: Palaeontological Impact Assessment.

SAHRA: South African Heritage Resources Agency – the compliance authority, which protects national heritage.

8.1 GEOLOGICAL TIME SCALE TERMS

ka: Thousand years or kilo-annum (10^3 years). Implicitly means "ka ago" *i.e.* duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present. Sometimes "kyr" is used instead.

Ma: Millions years, mega-annum (10^6 years). Implicitly means "Ma ago" *i.e.* duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present.

Holocene: The most recent geological epoch commencing 11.7 ka till the present.

Pleistocene: Epoch from 2.6 Ma to 11.7 ka. Late Pleistocene 11.7–135 ka. Middle Pleistocene 135–781 ka. Early Pleistocene 781–2588 ka (0.78-2.6.Ma).

Quaternary: The current Period, from 2.6 Ma to the present, in the Cenozoic Era. The Quaternary includes both the Pleistocene and Holocene epochs.

Pliocene: Epoch from 5.3-2.6 Ma.

Miocene: Epoch from 23-5 Ma.

Oligocene: Epoch from 34-23 Ma.

Eocene: Epoch from 56-34 Ma.

Paleocene: Epoch from 65-56 Ma.

Cenozoic: Era from 65 Ma to the present. Includes Paleocene to Holocene epochs.

For more details, see www.stratigraphy.org.

---oooOOOooo---

9 APPENDIX 1 - FOSSIL FIND PROCEDURES

A regular monitoring presence over the period during which excavations are made, by either an archaeologist or palaeontologist, is generally not practical.

The field supervisor/foreman and workers involved in digging excavations must be encouraged and informed of the need to watch for potential fossil and buried archaeological material. Workers seeing potential objects are to report to the field supervisor who, in turn, will report to the ECO. The ECO will inform the archaeologist and/or palaeontologist contracted to be on standby in the case of fossil finds.

In the context under consideration, it is improbable that fossil finds will require declarations of permanent “no go” zones. At most a temporary pause in activity at a limited locale may be required. The strategy is to rescue the material as quickly as possible.

The procedures suggested below are in general terms, to be adapted as befits a context. They are couched in terms of finds of fossil bones that usually occur sparsely. However, they may also serve as a guideline for other fossil material that may occur.

Bone finds can be classified as two types: isolated bone finds and bone cluster finds.

9.1 ISOLATED BONE FINDS

In the process of digging the excavations, isolated bones may be spotted in the hole sides or bottom, or as they appear on the spoil heap. By this is meant bones that occur singly, in different parts of the excavation. If the number of distinct bones exceeds 6 pieces, the finds must be treated as a bone cluster (below).

Response by personnel in the event of isolated bone finds

- **Action 1:** An isolated bone exposed in an excavation or spoil heap must be retrieved before it is covered by further spoil from the excavation and set aside.
- **Action 2:** The site foreman and ECO must be informed.
- **Action 3:** The responsible field person (site foreman or ECO) must take custody of the fossil. The following information to be recorded:
    - Position (excavation position).
    - Depth of find in hole.
    - Digital image of hole showing vertical section (side).
    - Digital image of fossil.
- **Action 4:** The fossil should be placed in a bag (*e.g.* a Ziplock bag), along with any detached fragments. A label must be included with the date of the find, position info., depth.
- **Action 5:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of isolated bone finds
The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

9.2 BONE CLUSTER FINDS

A bone cluster is a major find of bones, *i.e.* several bones in close proximity or bones resembling part of a skeleton. These bones will likely be seen in broken sections of the sides of the hole and as bones appearing in the bottom of the hole and on the spoil heap.

Response by personnel in the event of a bone cluster find

- **Action 1:** Immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil that may contain fossils.
- **Action 2:** Inform the site foreman and the ECO.
- **Action 3:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of a bone cluster find
The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. It is likely that a Field Assessment by the palaeontologist will be carried out asap.

It will probably be feasible to "leapfrog" the find and continue the excavation farther along, or proceed to the next excavation, so that the work schedule is minimally disrupted. The response time/scheduling of the Field Assessment is to be decided in consultation with developer/owner and the environmental consultant.

The field assessment could have the following outcomes:

- If a human burial, the appropriate authority is to be contacted (see AIA). The find must be evaluated by a human burial specialist to decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an archaeological context, an archaeologist must be contacted to evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an palaeontological context, the palaeontologist must evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.

9.3 RESCUE EXCAVATION

Rescue Excavation refers to the removal of the material from the just the "design" excavation. This would apply if the amount or significance of the exposed material appears to be relatively circumscribed and it is feasible to remove it without compromising contextual data. The time span for Rescue Excavation should be reasonably rapid to avoid any or undue delays, *e.g.* 1-3 days and definitely less than 1 week.

In principle, the strategy during mitigation is to "rescue" the fossil material as quickly as possible. The strategy to be adopted depends on the nature of the occurrence, particularly the density of the fossils. The methods of collection would depend on the preservation or fragility of the fossils and whether in loose or in lithified sediment. These could include:

- On-site selection and sieving in the case of robust material in sand.
- Fragile material in loose/crumbly sediment would be encased in blocks using Plaster-of Paris or reinforced mortar.

If the fossil occurrence is dense and is assessed to be a "Major Find", then carefully controlled excavation is required.

9.4 MAJOR FINDS

A Major Find is the occurrence of material that, by virtue of quantity, importance and time constraints, cannot be feasibly rescued without compromise of detailed material recovery and contextual observations.
A Major Find is not expected.

Management Options for Major Finds
In consultation with developer/owner and the environmental consultant, the following options should be considered when deciding on how to proceed in the event of a Major Find.

Option 1: Avoidance

Avoidance of the major find through project redesign or relocation. This ensures minimal impact to the site and is the preferred option from a heritage resource management perspective. When feasible, it can also be the least expensive option from a construction perspective.

The find site will require site protection measures, such as erecting fencing or barricades. Alternatively, the exposed finds can be stabilized and the site refilled or capped. The latter is preferred if excavation of the find will be delayed substantially or indefinitely. Appropriate protection measures should be identified on a site-specific basis and in wider consultation with the heritage and scientific communities.

This option is preferred as it will allow the later excavation of the finds with due scientific care and diligence.

Option 2: Emergency Excavation

Emergency excavation refers to the "no option" situation wherein avoidance is not feasible due to design, financial and time constraints. It can delay construction and emergency excavation itself will take place under tight time constraints, with the potential for irrevocable compromise of scientific quality. It could involve the removal of a large, disturbed sample by excavator and conveying this by truck from the immediate site to a suitable place for "stockpiling". This material could then be processed later. Consequently, emergency excavation is not the preferred option for a Major Find.

---oooOOOooo---

Appendix B: Visual Impact Assessment (refer to EIA report)

Appendix K: Environmental Management Programme

DIGBY WELLS
ENVIRONMENTAL

ORLIGHT SA (PTY) LTD

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

PROPOSED DEVELOPMENT OF THE AGGENEYS SOLAR PHOTOVOLTAIC POWER PLANT IN THE NORTHERN CAPE PROVINCE

SUBMITTED AS PART OF THE FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPLICANT:

ORLIGHT SA (PTY) LTD

ORLIGHTSA
RENEWABLE ENERGY

JULY 2012

DEA REFERENCE NO: 12/12/20/2630

NEAS REFERENCE NO: DEA/EIA/0000818/2011

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

This document has been prepared by **Digby Wells Environmental**.

Report title: Orlight SA (Pty) Ltd – Draft EMP for the proposed development of the Aggeneys Solar PV Plant in the Northern Cape Province

Project number: BSG1384

NAME	RESPONSIBILITY	SIGNATURE	DATE
Marike de Klerk	Project administrator and report compiler		26 April 2012
Mia Ackermann	Project manager and report compiler		02 July 2012
Grant Beringer	Project sponsor and report review		28 March 2012
Graham Trusler	Report review		02 May 2012

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental's prior written consent.

100% Recycled Paper

A. INSTRUCTIONS ON ACCEPTANCE OF THE FINAL SCOPING REPORT

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
8	The EMP must include the following:	N/A
8.1	All recommendations and mitigation measures recorded in the EIA Report.	Refer to Chapter 6 – Environmental Management Programme
8.2	The final site layout plan.	Refer to Plan 1a
8.3	Measures as dictated by the final site lay-out plan and micro-siting.	Refer to Section 6.1.1 – Design considerations
8.4	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Plan 2a
8.5	A map combining the final layout plan superimposed on the environmental sensitivity map.	Refer to Plan 1a
8.6	An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Refer to Table 6-6: Construction phase implementation plan – Alien invasive control Refer to Table 6-19: Operational phase implementation plan – Alien invasive control
8.7	A plant rescue and protection plan which allows for the maximum transplant of conservation important species from the areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Table 6-2: Pre-construction implementation plan – Protected and indigenous plant management
8.8	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Refer to Section 6.1.3 – Planning of site remediation and post-construction rehabilitation
8.9	An open space management plan to be implemented during the construction and operation of the facility.	Refer to Table 6-19: Operational phase implementation plan – Alien invasive control
8.10	A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters, e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Table 6-13: Construction phase implementation plan – Traffic

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
8.11	A transportation plan for the transport of PV components, main assembly cranes and other large pieces of equipment.	Table 6-13: Construction phase implementation plan – Traffic
8.12	A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Refer to 6.1.4 – Planning and design of storm water management measures Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems
8.13	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Refer to Table 6-4: Construction phase implementation plan – Soil and agricultural potential Refer to Table 6-18: Operational phase implementation plan – Soils and agricultural potential
8.14	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems Refer to Table 6-9: Construction phase implementation plan – Waste
8.15	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems Refer to Table 6-9: Construction phase implementation plan – Waste

B. INFORMATION REQUIREMENTS FOR AND ENVIRONMENTAL MANAGEMENT PLAN (EMP) IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

REQUIREMENTS	COMMENTS OR REFERENCE
IN TERMS OF SECTION 33 OF NEMA, AN EMP MUST COMPLY WITH SECTION 24N OF NEMA…	
(a) Details of – (i) the person who prepared the EMP; and (ii) the expertise of that person to prepare an EMP.	Section 1.3 – Details of the persons responsible for compiling the EMP
(b) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of: (i) planning and design; (ii) pre-construction and construction activities; (iii) operation or undertaking of the activity; (iv) rehabilitation of the environment; and (v) closure, where relevant.	Chapter 6 – Environmental Management Programme Section 6.1 – Planning and design phase Section 6.2 – Construction phase Section 6.3 – Operational phase Section 6.4 – Decommissioning phase
(c) A detailed description of the aspects of the activity that are covered by the draft EMP	Chapter 2 – Project activities
(d) An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b).	Chapter 4 – Responsibility of implementing the EMP Chapter 6 – Environmental Management Programme
(e) Proposed mechanisms for monitoring compliance with and performance assessment against the EMP and reporting thereon.	Chapter 6 – Environmental Management Programme
(f) As far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures	Chapter 6 – Environmental Management Programme Section 6.4 – Decommissioning phase
(g) A description of the manner in which it intends to— (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; (iii) comply with any prescribed environmental management standards or practices; (iv) comply with any applicable provisions of the Act regarding closure, where applicable; (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Table 3-1: Legislative and permitting requirements for the proposed project Chapter 6 – Environmental Management Programme
(h) Time periods within which the measures contemplated in the EMP must be implemented.	Chapter 6 – Environmental Management Programme
(i) The process for managing any environmental damage, pollution, pumping and	Chapter 6 – Environmental

REQUIREMENTS	COMMENTS OR REFERENCE
treatment of extraneous water or ecological degradation as a result of undertaking a listed activity.	Management Programme
(j) An environmental awareness plan describing the manner in which— (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment	Chapter 5 – Environmental Training and Awareness Plan
(k) Where appropriate, closure plans, including closure objectives.	Chapter 5 – Environmental Management Programme Section 5.4 – Decommissioning phase

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Aggeneys Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

The proposed site for development of the Aggeneys Solar PV Power Plants is located on Portion 1 of the farm Aroams 57 RD in the vicinity of the town of Aggeneys in the Namakwa District Municipality of the Northern Cape Province. A study area of 872.21 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 322 ha in extent. The optimal generation capacity of the power plant based on an estimated requirement of 4 ha surface area per MW generation capacity was determined to be 80 MW.

Site layout plans have been developed for a 70 MW project, which is well within the available area that was delineated to be suitable for infrastructure development.

This draft Environmental Management Programme (EMP) was based on the outcomes of the EIA process that was undertaken for the proposed development of the Aggeneys Solar PV Power Plant.

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level are described systematically in this EMP.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLANS

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

ABBREVIATIONS

AIA	Archaeological Impact Assessment
BSGR	BSG Resources Limited
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEANC	Northern Cape Department of Environmental Affairs and Nature Conservation
Digby Wells	Digby Wells Environmental
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIA Regulations	GN Regulations 543 to 546 (18 June 2010)
EMP	Environmental Management Programme
ESTA	Extension of Security of Tenure Act (Act 62 of 1997)
ETAP	Environmental Training and Awareness Plan
FEPA	Freshwater Ecological Priority Area
GIS	Geographic Information System
LED	Local Economic Development
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
NFA	National Forests Act, 1998 (Act 84 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
Orlight SA	Orlight SA (Pty) Ltd
PPP	Public Participation Process
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SKEP	Succulent Karoo Ecosystem Programme
SMME	Small, Medium and Micro Enterprise

VIA	Visual Impact Assessment
WMA	Water Management Area
WULA	Water Use License Application

1 INTRODUCTION

In line with the growing need for electricity supply and cleaner energy production in South Africa, the Orlight SA (Pty) Ltd (Orlight SA) Solar Photovoltaic (PV) Project was initiated by its holding company, BSG Resources Limited (BSGR). BSGR is an international natural resources company that operates in the fields of mining, and energy. BSGR established a new company, Orlight SA, for the construction and operation of five new Solar PV Power Plants in the Western Cape and Northern Cape Provinces.

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Aggeneys Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

1.1 Project overview

The proposed site for development of the Aggeneys Solar PV Power Plants is located on Portion 1 of the farm Aroams 57 RD [SG code C053-000-000-000-057-00001] in the vicinity of the town of Aggeneys in the Namakwa District Municipality of the Northern Cape Province.

A study area of 872.21 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 322 ha in extent. The optimal generation capacity of the power plant based on a conservative estimate of the required surface area (4 ha surface area per MW generation capacity) was determined to be 80 MW.

Site layout plans have been developed for a 70 MW project, which is well within the available area that was delineated to be suitable for infrastructure development.

The proposed power plant will make used of Solar PV technology and will be comprised of the following infrastructure:

- Solar PV panels;
- Support structures;
- Foundations;
- Electrical cabling;
- On-site substation;
- Transmission line;
- Access roads;
- Temporary construction lay-down yard; and
- Access control and fencing of the site.

The layout of the proposed project infrastructure within the project site and greater study areas is illustrated in Plan 1a.

1.2 Purpose of this report

An Environmental Management Programme (EMP) is an environmental management tool that is implemented with the objective of mitigating the undue or reasonably avoidable adverse impacts associated with the development of a project and to enhance any potential positive impacts that could be realised due to the development of a project.

This draft EMP was based on the outcomes of the EIA process that was undertaken for the proposed development of the Aggeneys Solar PV Power Plant. Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. A number of potentially problematic issues have been avoided by the choice of the site on which to place the project and also the placement of infrastructure on the chosen site has minimised a number of the environmental impacts. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level are thus systematically addressed in the EMP.

The specific objectives of this report are to:

- Define environmental management objectives to achieve an acceptable environmental standard and long-term sustainability of the proposed project;
- Outline mitigation measures and environmental specifications that will be required to be implemented during the construction, operational and decommissioning phases of the proposed project to realise the environmental management objectives;
- Formulate plans to manage specific environmental features that are known to be significantly affected during project implementation as a precautionary measure;
- Propose mechanisms to monitor the implementation of the mitigation measures; and
- Formulate plans that can be implemented in response to unforeseen or emergency events during project implementation.

1.3 Details of the persons responsible for compiling the EMP

Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions for clients in diverse sectors including the energy, minerals and mining industries. The names and expertise of the project team responsible for compilation of this report are provided in Table 1-1.

Table 1-1: Names and expertise of the report compilers

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Project manager	Mia Ackermann	2008: MSc Geography – UJ 2006: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – UJ 2003 – 2005: BSc Geography and Environmental Management – UJ
Project administrator	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2000 – 2002: BhcS (*Cum Laude*) – UP 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP

1.4 Approach to environmental management

The approach to this EMP has been based on two primary internationally recognised principles for environmental management:

- *Precautionary principle* – States that wherever there is doubt regarding the impacts that an activity may have on the environment, precautionary measures should be taken to prevent such impacts; and
- *Polluter pays principle* – The project applicant should be committed to preventing pollution and will make resources available to ensure that all reasonable safeguards are in place to do so. Full accountability and financial liability for any pollution that may occur lies with the project applicant.

This EMP should be made binding and enforceable on all the parties involved in the development of the proposed project, including the project applicant and contractors at the different operational management levels.

1.5 Report structure

The structure of this EMP and the respective objectives for each section is outlined as follows:

- *Chapter 2 – Project activities* provides an overview of the project activities that will be undertaken during the construction, operational and decommissioning phases of the project and that will result in environmental impacts. These activities will be managed in terms the various mitigation measures that have been included in this report;
- *Chapter 3 – Legislative requirements* is a summary of the legislative context in which the project will be implemented. Requirements and guidelines that must be adhered to during the undertaking of all activities and according to which the environmental and social performance of the project are described;
- *Chapter 4 – Responsibility of implementation* outlines the various levels of responsibility for implementing the supporting management plans, respective mitigation measures and this EMP;
- *Chapter 5 – Environmental Training and Awareness Plan* outlining the methodology that will be used to inform employees of any environmental impacts which may result from their work and the manner in which the impacts must be dealt with in order to avoid pollution to or the degradation of the environment;
- *Chapter 6 – Environmental Management Programme* includes the management objectives for each phase of the proposed project and a plan for the implementation of mitigation measures to mitigate negative impacts and enhance positive impacts associated with the proposed project; and
- *Chapter 7 – Conclusion* which includes a statement from the EAP regarding the level to which potential impacts can be mitigated by implementing the measures outlined in this report.

2 PROJECT ACTIVITIES

The proposed power plant will make used of Solar PV technology and will be comprised of the following infrastructure:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 70 MW will be installed over an area of 116.18 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide;
- *On-site substation* – The substation will occupy a surface area of approximately 0.8 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current (DC) to alternating current (AC);
- *Transmission line* – The proposed power plant will be connected to the Eskom Aggeneys substation with overhead transmission lines;
- *Access roads* – Access to the proposed project site will be from an existing farm road that joins up with the N14 national road. An internal network of roads will be required to access the different components of the proposed project;
- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.93 ha and will include a site office, mobile toilets and bathroom facilities, a car parking yard, water tank and the hydrocarbon management facility; and
- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, fencing will be installed.

The physical area that will be disturbed by the proposed project activities and components are summarised in Table 2-1 below. The layout of the proposed project infrastructure within the project site and greater study area is illustrated in Plan 1a.

In order to establish and operate the infrastructure described above, numerous activities will be undertaken during the pre-construction, construction, operational and decommissioning phases of the proposed project. These activities were described in the EIA Report and formed the basis according to which potential impacts were identified and assessed. Table 2-2 provides a summary of these activities.

Table 2-1: Scale of physical disturbances associated with the proposed project

COMPONENT	PHYSICAL DISTURBANCE
Solar panels, roads and cables (ha)	116.18
Area of laydown yard (ha)	8.93
Area of substation (ha)	0.8
Total (ha)	**125.91**
Area suitable for development (ha)	345.3
Portion of area suitable for development (%)	*37%*
Study area (ha)	872.2
Portion of study area (%)	*14%*

Table 2-2: Project phases and associated activities

ACTIVITY	DESCRIPTION
PHASE: PRE-CONSTRUCTION ***The duration of the pre-construction phase is approximately 4 months prior to the construction phase.***	
Environmental awareness and training	All contractors, sub-contractors and service providers will be made aware of the contents of the EMP. The effective implementation of this EMP will form part of their contractual agreement for this project.
Undertake pre-construction surveys	Areas delineated as no-go areas during the EIA phase will be surveys and demarcated to ensure that no construction activities are allowed in these areas. Other surveys that will be undertaken include a geotechnical survey to determine foundation requirements and degree of levelling that will be required, as well as a wet-season flora survey to identify Red Data and protected plant species that might not have been identified during the dry-season survey.
PHASE: CONSTRUCTION ***The duration of the construction phase of the proposed 70 MW solar PV power plant is approximately 16 months.***	
Employment opportunities and accommodation	In the event that a 70 MW power plant is developed, approximately 490 direct job opportunities will be created during the construction phase. An employment policy will be formalised and communicated to all job seekers and employees. Construction workers will be sourced from local areas and therefore, minimal additional housing will be required. Accommodation of workers from outside the local area will be provided in the town of Aggeneys. Only security will be allowed to stay on site overnight. No commercial activities such, as food stalls, will be allowed on the site and adjacent to the national road.
Establishment of access and internal roads	The site will be accessed from the existing farm road that connects to the N14 national road. This will not require widening of the N14, but the road edges will have to be strengthened with concrete edge beams at the accesses to prevent breaks in the road surface. Two-track gravel roads of approximately 6 m in width will be established to access the construction lay-down yard and development footprint.

ACTIVITY	DESCRIPTION
Site preparation	Site preparation will consist of the clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure. Topsoil will be removed from the footprint of the substation and car parking yard and stockpiled for use during site rehabilitation. Where the terrain is undulating, the terrain may be levelled. Large boulders and rocks will be removed. No protected tree species will be removed.
Construction lay-down yard	The construction lay-down yard will provide a storage area for construction material and will be used for assembly purposes.
Vehicle hard park and hydrocarbon storage	A vehicle hard park will be established where all construction vehicles and equipment will be parked overnight, serviced and refuelled. The hydrocarbon management area will be bunded for the safe storage of fuel, lubricants and waste oils.
Access control and fencing of site	Adequate systems and procedures will be put in place to minimise the risk of unauthorised access to the site. Carefully consideration will also be given to the plant layout to ensure access for day-to-day operations, emergency escape routes and maintenance of the plant and equipment.
Anchoring and installation of solar PV panels	The foundation types used for the solar PV mounting structures will depend on the terrain characteristics defined by the geotechnical studies. The mounting structure will either be hammered into the earth surface, or a shallow concrete foundation will be cast.
Installation of underground cables	Trenches will be excavated wherein underground electrical transmission cables will be laid.
Construction of facility substation	An on-site facility substation will be constructed which will include the casting of foundations, installation of the transformer and inverters and connecting of the conductors.
Construction of transmission lines	In the event that a 40 MW power plant is constructed, a short 66 kV transmission line will be constructed from the facility substation to loop into the existing 66 kV Eskom transmission line that crosses the site. For a 70 MW to 80 MW power plant, a new 66 kV transmission will be required from the facility substation to the Eskom Aggeneys substation. **Management of the activities required for construction of the 66 kV transmission line to the Aggeneys substation is not included in this EMP, but will be addressed in the EMP that supports the Basic Assessment process that is being undertaken for the proposed transmission line.*
Water use	Water will be used for domestic use and possibly for dust suppression during the construction phase. The total water requirements for the construction phase are estimated at 350 m^3 per month. Orlight SA has applied for water service provision from the local municipality.
Construction waste management	All construction phase waste will be collected and stored in a temporary waste storage area, where it will be collected by a waste removal contractor for disposal at a licensed waste disposal facility. No on-site burying or burning of wastes will be allowed. The only chemical toxins on site will be the gas used in welding, the concrete, sulphur hexafluoride housed inside the switchgears and the diesel for the power generators used during the construction. These will be handled with care according to regulatory requirements. Wherever possible, waste materials shall be recycled.
Sewage management	Temporary ablution facilities will be provided and a contractor employed to safely remove sewage from the site to a licensed disposal facility.
Site remediation	Upon completion of the construction phase, the site will be remediated by removing all temporary construction infrastructure, construction waste and construction materials. Topsoil that was removed from the substation footprint and car parking yard and stockpiled will be spread over

ACTIVITY	DESCRIPTION
	disturbed areas and vegetation re-established.
PHASE: OPERATION ***The typical lifecycle of a PV power plant is generally 20 years, where after it can be considered for upgrade and renewal or decommissioning, depending on the prevalent socio-economic conditions.***	
Employment opportunities and accommodation	In the event that a 70 MW power plant is developed, approximately 70 direct job opportunities will be created during the operational phase. Employees will be accommodated in the town of Aggeneys and daily transport to the site will be provided in buses.
Generation and transmission of electricity	The electricity generated by the solar PV panels will be stepped up through the inverters and transformers in the facility substation. The electricity will be evacuated from the facility substation via the overhead transmission lines described above.
Access control and fencing of the facility	The perimeter fence established during the construction phase will be maintained and access to the facility will be through a controlled access point.
Facility maintenance	Facility maintenance will include the replacement of damaged solar PV panels and cleaning of the panels using small amounts of water. Approximately 3 992 m^3 water will be required per month for cleaning purposes of a 70 MW power plant. Orlight SA has applied for water service provision from the local municipality.
PHASE: DECOMMISSIONING AND REHABILITATION ***Typical decommissioning and rehabilitation activities should take approximately 24 months.***	
Removal of infrastructure	Depending on the economic situation at the end-of-life of the solar PV panels, the facility will either be decommissioned or its operational phase extended past the planned life. Even if extended the facility will have to be decommissioned and closed.
Site rehabilitation	If and where applicable, sites will be rehabilitated. Rehabilitation is the process of returning the land in a given area to some degree of its former state, after some construction or operation activities may have resulted in its damage. This will involve shaping the surface, bringing back the removed soil and establishing vegetation to prevent erosion and to blend in with the surrounding landscape.

3 LEGISLATIVE REQUIREMENTS

The scope and content of this EMP has been informed by the following key legislation and guidelines:

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- Succulent Karoo Ecosystem Programme;
- Critical Biodiversity Areas;
- Freshwater Ecological Priority Area Programme;
- National Water Act, 1998 (Act No. 36 of 1998);
- Environment Conservation Act, 1989 (Act No. 73 of 1989);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999);
- Land Use Planning Ordinance, Ordinance 15 of 1985; and
- Local Economic Development (LED) Strategy for the Namakwa District Municipality.

A summary of the legislative and permitting requirements that are applicable to this EMP is provided in Table 3-1.

Table 3-1: Legislative and permitting requirements for the proposed project

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	Section 24 This section of the Bill of Rights stipulates 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. Prevent 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.	Parliament Constitutional Court	The constitutional rights from the basis of the environmental management objectives for the proposed project, namely to protect ecologically sensitive areas and support sustainable development and the use of natural resources, whilst promoting justifiable socio-economic development in the town nearest to the project site.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	Section 2 This section defines the principles of integrated environmental management. According to these principles, developments must take the following factors into consideration: • *Section 2(3)* – Development must be socially, environmentally and economically sustainable; • *Section 4(1)* – Sustainable development requires the consideration of all relevant factors including the following: o That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; o That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; o That the disturbance of landscapes and sites that constitute	Department of Environmental Affairs (DEA) Northern Cape Department of Environment Affairs and Nature Conservation (DEANC)	The principles of integrated environmental management have been taken into consideration throughout the EIA process that was undertaken for the proposed project. This EMP contains an implementation plan that is aimed at achieving the objectives for sustainable development as specified in Section 4 of the Act. Specific objectives included in this EMP are: • To minimise disturbance of ecosystems and loss of biological diversity in the study area; • To minimise the disturbance of sites and landscapes that are considered important in terms of their heritage value; • To minimise the generation of waste, promote recycling of wastes and ensure safe management and disposal of wastes;

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	the nation´s cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied; ○ That waste is avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner; ○ That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; ○ That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; ○ That a risk averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and ○ That negative impacts on the environment and on people´s environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.		• To prevent pollution and degradation of the environment; • To implement remediation measures in the event that pollution and degradation occur; • To prevent impacts on renewable resources, such as soil and water.
	Section 24 In terms of this section, a list of activities that will require environmental authorisation prior to their commencement can be identified by the minister. These activities have been identified in GNR 543 to 546 (18 June 2010) promulgated in terms of the Act.	DEA DEANC	A full Scoping & EIA process was required for the proposed project for activities listed in terms of GNR 543 to 546. The EIA Report forms part of this process and will be submitted to the DEA for review and consideration. The DEANC has been included as a commenting authority on the application.
	Section 28(1) This section of the Act stipulates a Duty of Care which requires the project applicant to ensure that reasonable measures are taken throughout the	DEA	A plan for the implementation of mitigation measures is included in this EMP.

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	project life cycle to ensure that any pollution or degradation of the environment associated with project implementation is avoided.		
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Succulent Karoo Ecosystem Programme (SKEP) Critical Biodiversity Areas (CBA)	The Act provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. Within the regional conservation context there are two conservation programmes which are underlain by NEMBA, namely the SKEP and the CBA. The aim of these programmes are to identify and conserve areas of high biodiversity and areas that are in support of these areas through defining conservation outcomes and working towards these.	DEA	A specialist fauna and flora assessment was undertaken during the EIA process as part of a characterisation of the ecological baseline of the study area and to manage potential impacts on biodiversity resources. SKEP and the CBA have been referred to as the basis for conservation planning for the project.
	<u>Section 57</u> This section of the Act states that person may not carry out a restricted activity (i.e. removal or destruction) of a specimen of a listed threatened or protected species without a permit issue by the relevant competent authority. A list of threatened and protected species was issued in GNR 151, 152 and 1187 promulgated in terms of the Act.	DEA	During the site layout design process, areas where threatened and protected species listed in terms of the Act occur were designated as no-go areas. <u>No destruction of protected species will be required and therefore, no permitting requirements apply.</u> <u>Should any threatened or protected plant species that were not identified to occur in the project development footprint be identified during the pre-construction wet-season survey, the necessary permits for the removal of the specimens will have to be obtained.</u>
	<u>Section 75</u> This section of the Act controls activities relating to the control and eradication of invasive species. The requirements that must be adhered to are: • *Section 75(1)* – The control and eradication of invasive or weed species must be undertake by means of a method that are	DEA	<u>An alien invasive control eradication programme will be implemented as part of this EMP. The control programme has been formulated based on the requirements listed in terms of Section 75 of the Act.</u>

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	appropriate for the species and the environment in which it occurs; • *Section 75(2)* – Actions taken to control and eradicate listed invasive species must be executed with caution and in a manner that may cause least possible harm to biodiversity and the environment; and • *Section 75(3)* – Methods must be directed at the offspring, propagating material and re-growth of the invasive species.		
National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA)	<u>Chapter 5</u> This chapter of the Act provides for the licensing of waste management activities, as listed in GNR 718 of the Act. Waste management activities require a Waste Management License and undertaking of an EIA prior to its commencement.	DEA NCDEANC	<u>No waste management activities will be triggered by the proposed project and therefore no permitting requirements have been identified.</u>
	<u>Chapter 4</u> This chapter of the Act defines the principles of waste management to avoid negative impacts on the environment. In terms of the Act, any person who stores waste must take the appropriate steps to ensure that: • *Section 21(a)* – The containers in which waste is stored are intact or rendered unfit for safe storage of waste; • *Section 21(b)* – Adequate measures are taken to prevent accidental spillage or leaking; • *Section 21(c)* – Waste is not blown away by wind; • *Section 21(d)* – Nuisances such as odour, visual impacts and vectors do not arise; • *Section 21(e)* – Pollution of the environment and harm to health are prevented; and	DEA NCDEANC	<u>The handling, storage and disposal of waste will have to be undertaken in accordance with a waste management plan that is based on the principles and requirements of this Act.</u>

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	• *Section 22(2)* – Waste that is reusable, recyclable or recoverable must be separated and stored apart from other general waste.		
National Water Act, 1998 (Act No. 36 of 1998) (NWA) Freshwater Ecological Priority Area Programme	<u>Section 19</u> In terms of this section of the Act, the project applicant must ensure that reasonable measures are taken to prevent and remedy any potential impacts of pollution to water resources.	Department of Water Affairs (DWA)	Mitigation measures to prevent impacts to water resources have been included in this EMP.
	<u>Section 21</u> Water uses listed in terms of this section of the Act requires a Water Use License Application (WULA) to be made, unless such water use falls into one of the categories listed in Section 22 of the Act or falls under a general authorisation.	DWA	No Section 21 water uses have been identified for the proposed project and therefore, will not require a WULA.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	The Act provides for control and conservation of the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, water sources and vegetation and the combating of weeds and invader plants; and for matters connected therewith. Category 1 plant in terms of the Act and needs to be eradicated using the control methods stipulated in Regulation 15D.	Department of Agriculture, Forestry and Fisheries (DAFF)	<u>The destruction of Category 1 plants that occur in the study area, as well as control of other alien invasive species is provided for in the alien invasive control programme, which is also guided by NEMBA.</u>
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	<u>Section 38</u> This section of the act state that Heritage Impact Assessments (HIAs) are required for certain types of development, including activities which result in changes to the character of a site exceeding 0.5 ha in extent. The relevant heritage authority must be notified of the development and will advise on the scope of the heritage assessments that need to be undertaken. Sand alone HIAs are not required where an EIA is undertaken and heritage considerations are integrated into the report.	South African National Heritage Resources Agency (SAHRA)	Heritage impacts have been considered during the EIA process and included a Phase 1 Archaeological Impact Assessment (AIA), Palaeontological Impact Statement and Visual Impact Assessment (VIA). <u>A permit may be required should identified in the project development footprint be disturbed or destroyed.</u>

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
Land Use Planning Ordinance, Ordinance 15 of 1985 Subdivision of Agricultural Land Act (Act No. 70 of 1970)	In terms of the provisions of these Acts, the property on which the proposed project is to be developed will require rezoning to land use for renewable energy generation.	Local Municipality	A rezoning application is being prepared for the proposed project. The subdivision of land can only be undertaken following the granting of the environmental authorisation for the proposed project and forms part of the rezoning process.
National Forests Act, 1998 (Act 84 of 1998) (NFA)	Section 5 In terms of this section of the Act, no person may cut, disturb, damage or destroy or remove any protected tree listed in terms of GNR 1042 of the Act without a licence granted by the minister.	DAFF	During the site layout design process, areas where threatened and protected species listed in terms of the Act occur were designated as no-go areas. No destruction of protected species will be required and therefore, no permitting requirements apply. Should any threatened or protected plant species that were not identified to occur in the project development footprint be identified during the pre-construction wet-season survey, the necessary permits for the removal of the specimens will have to be obtained.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

4 RESPONSIBILITY OF IMPLEMENTING THE EMP

4.1 Organisational commitment

The success of an EMP is dependent upon the commitment of the organisation, at all levels, to environmental excellence (Environmental Protection Agency, 1995). Commitment to structured and effective EMPs will benefit both the organisations' business success and the community in which it operates. This commitment requires that the organisation provide the necessary resources for employee training, reference material and reporting and response procedures.

The manager of the company shall be held responsible and accountable for health and safety of personnel while on duty as well as the environmental impacts caused by project activities. The competence of the work force will be ensured through selection, training and awareness in health, safety and environmental matters. Continual evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the proposed projects. Regular reviews of the company's performance are necessary during and after operations to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

4.2 Management areas and responsibility

The overall management responsibility for the implementation of the EMP will rest with the Environmental Manager of Orlight SA during construction, operation and closure. The Environmental Manager will be responsible for ensuring that all stakeholders understand and implement the plan. The Environmental Manager will also be responsible for ensuring that the plan remains effective and relevant through measurement and monitoring and adapting the plan where necessary to achieve its objectives. Although Orlight SA will ultimately be responsible for environmental management, it will also be the responsibility of all contractors to adhere to the plan. Specific requirements for environmental management relevant to their areas of operation should be detailed in their respective contracts. The management actions that will be the responsibility of the Environmental Manager include:

- Overview of EMP implementation;
- Ensure that environmental monitoring, recording and reporting are conducted;
- Adapting the EMP where required;
- Develop and implement environmental training and awareness plans, including protected species awareness; and
- Conduct internal Environmental Audits.

EMPs provide an essential tool for ensuring that the mitigation of negative impacts and enhancement of positive impacts is carried out effectively during the project life-cycle. The following tables therefore provides a summary of the potential mitigation measures that would be required for the potential impacts anticipated in the construction, operational and decommissioning phases for the Solar PV Power Plant project.

4.3 Contractors

The competence of the construction and operational workforce will be ensured through Orlight SA's tender process, as well as efficient selection, training, awareness and the effective implementation of applicable health and safety policies. The tendering requirements for potential contractors should be read in conjunction with the

EMP. Continual evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the development. Regular reviews of the contractors' performance and Environmental Audits are necessary during and after the construction phase to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

4.4 Environmental Control Officers

Environmental Control Officers (ECO) will be employed for the proposed project. The ECO would be responsible for ensuring that all stakeholders understand and implement the EMP. The ECO will also be responsible for ensuring that the plan remains effective and relevant. Specific requirements for environmental management relative to their areas of construction and subsequent operation will be detailed in their respective contracts. The management actions that will be the responsibility of the ECO are summarised below:

- Overview of EMP implementation;
- Ensure that environmental monitoring, recording and reporting are conducted;
- Develop and implement environmental training and awareness plans; and
- Conduct internal Environmental Audits.

5 ENVIRONMENTAL TRAINING AND AWARENESS PLAN

The purpose of an Environmental Training and Awareness Plan (ETAP) is to outline the methodology that will be used to inform employees of any environmental impacts which may result from their work and the manner in which the impacts must be dealt with in order to avoid pollution to or the degradation of the environment.

5.1 Responsibilities

Local contractors will be used during the construction and operational phases, where possible. People receiving contracts as a result of this project will be responsible for training and skills transfer to local labour and will be expected to present training plans to management and the ECO. Management will be responsible for ensuring that the plans are adequate and for the monitoring of the effectiveness of the training.

5.2 Timeframe

All construction workers and their supervisors will undergo environmental awareness training prior to workingat the proposed project site. Refresher courses will be held at suitable intervals. New contract staff and new employees on site will also be required to undergo training.

5.3 Training requirements

The ETAP will incorporate training on the following components:

- The social and environmental context within which the Solar PV Power Plants will be constructed;
- The risks associated with the activities which workers and supervisors will be responsible for and the associated mitigation measures;
- The relevant procedures and protocols to be followed; and
- The roles and responsibilities for implementing mitigation measures.

5.4 Performance management

The effectiveness of the environmental management training and awareness building interventions will be evaluated by:

- The performance as recorded by the environmental audits (conducted by the ECO) aimed at evaluating the environmental awareness of employees directly, and
- Analysing the root causes of environmental incidents, including non-conformance to legal requirements, to determine which incidents were caused by a lack of environmental awareness and training.

6 ENVIRONMENTAL MANAGEMENT PROGRAMME

The purpose of this section is to define the environmental objectives for each phase of the proposed project. The action plans that are required to achieve these objectives were compiled within the context of activities that could result in potential impacts to the biophysical, socio-economic and heritage environment.

These action plans are presented in tabular format to easily present the requirement for implementation of mitigation measures, as shown in Table 6-1.

Table 6-1: Structure of environmental management implementation plans

ENVIRONMENTAL ASPECT	
PHASE OF PROJECT	
Context	The context refers to the environmental, socio-economic and heritage conditions of the surrounding environment).
Objective	The management objective refers to the desired outcome of management measures for mitigating negative impacts and enhancing positive impacts related to project activities.
Risk sources	The risks sources refer to activities that will result in a potential impact.
Potential impacts	The potential impact refers to the changes or effects anticipated on the environment resulting from an environmental aspect, whether desirable or undesirable (i.e. positive or negative impact on the receiving environment).
Management and mitigation actions	The management actions refer to the practical actions aimed at achieving management objectives and targets.
Performance indicators	The performance indicator refers to probably key success factors according to which the implementation success of the management measures and objectives should be evaluated.
Monitoring and evaluation	Monitoring refers to the actions, tools or methods that should be implemented to evaluate whether management actions are being implementing and whether the desired objective is being achieved.

The tables and action plans were also compiled to assess the potential impacts associated with the construction phase (red), operational phase (yellow) and decommissioning or closure phase (green) of the project activities on the receiving environment.

CONSTRUCTION PHASE
OPERATIONAL PHASE
DECOMMISSIONING AND CLOSURE PHASE

<u>It should be noted that, as detailed in the main EIA Report, the most significant impacts are anticipated during the construction phase.</u>

6.1 Planning and design phase

The objectives of the planning and design phase for the proposed project are to:

- Ensure that the design of proposed project and associated infrastructure is undertaken in such a way that it does not directly impact on sensitive topographical, ecological, visual and socio-cultural areas;
- Ensure that a site remediation plan is prepared to ensure that impacts during the construction phase does not limit the success of site remediation efforts;
- Ensure that stakeholder concerns and recommendations have been integrated in the planning and design of the project, where appropriate; and
- Enable the continuation of some of the existing land uses throughout project development and operation.

6.1.1 Design considerations

The project design for the proposed project was finalised after suitable alternatives and necessary assessments were conducted. This was part of an integrated and dynamic process to ensure the most financially viable and environmentally sensitive designs were considered for the project.

Upon completion of the environmental and cultural assessments undertaken for the study area, including important feedback received from stakeholders during the PPP, sensitivity maps were created using a Geographic Information System (GIS) (Plan 2a).

The following sensitive and no-go areas were delineated:

- *Drainage line* – It is recommended that the main drainage line and associated system be avoided during construction and operation, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries;
- *Ecologically sensitive areas* –The no-go area generally describes the drainage line running through the project area. Other areas of high ecological sensitivity include the sensitive habitat of the ridges and areas which include protected and red data species. Least sensitive and favourable areas exist in southern parts of the study area;
- *Visually sensitive areas* – The viewshed analysis that was undertaken for the study area informed the delineation of favourable areas for the construction of the infrastructure within the study area so that the lowest possible visual impacts will be experienced. However the visual impact from the road was decided to have a lower priority than the ecologically sensitive zones;
- *N14 road reserve* – A 30 m buffer zone around the N14 national roads has been included in the site layout;
- *Eskom transmission line servitudes* – The existing 220 kV line has a servitude width of 47 m, while the existing 66 kV line has a servitude width of 22 m. An additional Eskom servitude was identified following public review of the draft EIA report, which is the proposed Eskom Aggeneys – Paulputs 220 kV line to be constructed within a 47 m servitude. No construction will take place within these servitudes;

The implementation plans for the construction, operational and decommissioning phases of the proposed project will make reference to the above mentioned no-go and sensitive areas that were delineated for the project area.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

6.1.2 Protected and indigenous plant management

During the pre-construction phase, a protected plant management programme must be implemented to allow for the maximum transplant of conservation important species from the areas to be transformed. The management plan for protected and indigenous plant species is shown in Table 6-2.

6.1.3 Planning of site remediation and post-construction rehabilitation

Site remediation and rehabilitation by definition means to replace that which was impacted by construction activities for the proposed project back to a sustainable and desirable condition. Thus the area of disturbance must be minimised to retain as much of the current land use capability as possible.

Important aspects to consider for rehabilitation are to minimise the area affected by the development, to minimise foreign material from entering the natural environment and to maximise the recovery and effective storage of material required for rehabilitation. Thus during construction of the relevant plants the following should be kept in mind:

- Construction activities must minimise their footprint of disturbance;
- Any soils to be removed from the footprint of the substation and car parking yard should be stockpiled in such a manner that they do not have to be moved before their replacement for rehabilitation; and
- All infrastructure should be constructed with final closure in mind i.e. infrastructure should be designed with ease of deconstruction in mind.

Vegetation conservation

A representative sample of rare and naturally occurring plant species that are present in the project development footprint should be conserved by removing and relocating them to another suitable section of the project area or these plants can be kept in a nursery so that the plants can then be replanted during rehabilitation of the disturbed areas.

Control and management of alien vegetation will contribute to the conservation of the natural vegetation. The alien species should therefore be removed from site and control measures must be implemented to ensure spreading of these species does not occur to other parts of the project area or the surrounding lands.

The areas not directly impacted upon by the project footprint but falling under the control of the project need to be managed for the duration of the time that the land is under project control.

Soil stripping

This section explains the correct measures that should be followed during the stripping of topsoil. This activity is important for rehabilitation purposes, because soil take many years to regenerate once it has been lost.

Correct stripping of topsoils will firstly ensure that enough soils are available for rehabilitation that seed banks are preserved and that soils are of good quality or of similar condition to surrounding soils to support vegetation growth, thus ensuring successful rehabilitation.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Table 6-2: Pre-construction implementation plan – Protected and indigenous plant management

PROTECTED AND INDIGENOUS PLANTS			
Context	In relation to the CBA and SKEP data, the Aggeneys study areas is of importance because of the presence of quartz gravel patches which are the preferred habitat for Lithops spp., or stone plants, demarcated as highly sensitive areas. The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. Protected plant species management is a critical part of any new development, as the management of such species are enforced by law. The current study revealed two protected plants present within the study area, an additional four could possibly occur here.		
PRE-CONSTRUCTION PHASE			
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the Protected plants present; • To prevent direct impacts on areas that were delineated as sensitive and could harbour more protected plants; • To minimise the footprint of disturbance during the construction phase; • To preserve as many natural plant species that can be used during site remediation; and • To eradicate alien invasive and weed species from the project area.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Removal of topsoil from the footprint of the substation site and car parking yard and stockpiling of topsoil for use during site rehabilitation; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Access control and fencing of the site.		
Potential impacts	The potential impacts on ecological components include: • During site preparation activities, protected plant species could be removed; • There is also a possibility that Red Data or protected plant species that have not been identified in areas within the project development footprint during dry-season surveys could be destroyed.		
Management and	**Actions**	**Responsibility**	**Timeframe**

PROTECTED AND INDIGENOUS PLANTS			
mitigation actions	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;	Flora specialist	Pre-construction
	• No vegetation removal should be allowed outside the designated project development footprint;	ECO Contractor	Pre-construction
	• Application for permits to relocate or destroy protected plants must be applied for through the relevant provincial authority before any plant species are disturbed, this applies to *Aloe dichotomy* and *Boscia albitrunca;*	ECO Contractor	Pre-construction
	• All protected plants encountered should be relocated to an on-site nursery. During site remediation and rehabilitation, these species could be replanted as per the protected plant species permit conditions, this includes the two species encountered during this study as well as species that could be encountered during the wet season survey. During site remediation and rehabilitation, these species could be replanted as per the Protected plant species permit conditions;	ECO Contractor	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no protected species are destroyed, and if encountered must be managed in accordance with provincial regulations;	ECO	Pre-construction
	• An alien invasive and weed control programme should be implemented;	Contractor ECO	Pre-construction
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences;		

PROTECTED AND INDIGENOUS PLANTS	
	• No destruction of vegetation outside designated areas; • Establishment of an on-site nursery; • Evidence of vegetation being relocated and re-established in other areas.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Inspections should be undertaken by the contractor to identify protected plant species during any vegetation clearance.

The steps that should be taken during soil stripping are as follows:

- Stripping should be supervised to ensure these soils are not mixed; and
- Soils should only be stripped when the moisture content will minimise the compaction risk (i.e. when they are dry).

Soil stockpiling

The steps that should be taken during soil stockpiling are as follows:

- Locate stockpiles to ensure re-handling is minimised;
- Ensure the location is free draining to minimise erosion loss and waterlogging;
- Minimise compaction during stockpile creation. The soils should be kept loose by preferably end-tipping and limit the stockpile height (no more than 3 m tall) to prevent internal compaction;
- Re-vegetate to avoid soil loss to erosion; and
- Ensure that the stockpiled soil is only used for the intended purposes.

Stockpiles need to be managed effectively, if they are to be used for rehabilitation. Poor stockpile management will result in erosion. Effective management will require that stockpiles located in an area for more than one year, be re-vegetated to avoid erosion losses. In addition soils stockpiled should be bunded to prevent both water and wind erosion whilst exposed to the natural elements of the environment. Fertilisation, seeding and replanting of plants should preferably be done by hand.

6.1.4 Planning and design of storm water management measures

The proposed project site falls in an arid climatic region, but high rainfall events occur from time to time resulting in flash floods. Procedures for storm water flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.

The main factors influencing the planning of storm water management measures and infrastructure are:

- Annual average rainfall;
- Rainfall intensities;
- Soil and vegetation cover;
- Topography and slope gradients; and
- Placing of infrastructure and infrastructure design.

The objectives for storm water management in general include:

- Protection of life and property from flood hazards;
- Prevention of land and watercourse erosion;
- Ensuring continuous operation through different stages of the hydrological cycle; and
- Preservation of the natural environment (watercourses and their ecosystems).

Site description

Aggeneys has an annual average rainfall figure of 75 mm with the highest rainfall (15 mm) occurring in June. The site is characterized by shallow soils and a gentle to flat topography with a gradient between 1% and 5%. A dry riverbed traverses the project site from the north-east to the south-west.

Solar panel and power substation infrastructure

A conceptual storm water management plan is illustrated in Plan 3a. The following principles should apply to the storm water management during the construction and operational phases of the proposed project:

- Infrastructure such as the substation should be constructed outside the 1:100 year flood line;
- Divert all surface water run-off away from the infrastructure areas through channels and upslope berms via erosion protected chutes to the nearest downstream point in the dry riverbed (this is situated on the western boundary of the study area) traversing the property. Water resulting from the area under the panels needs to be contained, or at least discharged in a controlled manner through a silt trap;
- A gravel or rock layer could be placed below the panels to prevent water and wind erosion; and
- The drainage system need to be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying storm waters around and away from infrastructure.

Roads

- Controlled drainage from road surfaces is necessary for the maintenance of the road integrity;
- All roads should be constructed with a 3% slope so as to allow storm water to drain from their surface as soon as possible in order to avoid soaking and erosion of the road surface; and
- Roads will have side drains to collect and channel storm water run-off and direct it away from the road to a designated area via an erosion protected chute.

6.2 Construction phase

The environmental objectives for the construction phase of the proposed project are to:

- Ensure that construction activities are undertaken in accordance with the specifications and outcomes of the planning and design phase;
- Implement an environmental training and awareness plan to familiarise all parties with the contents of the EMP;
- Establish clear communication channels between parties responsible for implementing the EMP;
- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the construction activities;
- Ensure that construction activities are managed in such a way as to reduce the risk of potential environmental impacts occurring;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area;
- Minimise degradation or loss of the soil resource;
- Minimise the impact of the project on indigenous vegetation, Red Data and protected plant species and other sensitive ecological areas;
- Ensure that site remediation is undertaken where necessary and within the stipulated timeframes;
- Minimise impacts to sites of heritage significance, should they be identified during the construction phase;
- Minimise negative impacts associated with the presence of construction workers and migrant job-seekers; and
- Enhance the potential socio-economic benefits associated with the construction of the proposed project.

The implementation plans for the construction phase of the proposed Aggeneys Solar PV Power Plant are presented in the tables below.

Table 6-3: Construction phase implementation plan – Surface water systems

SURFACE WATER SYSTEMS	
Context	The project area is situated in the Lower Orange Water Management Area (WMA 14). An ephemeral river system and associated drainage lines were identified and delineated for the study area. The project area is not recognised as a Freshwater Ecological Priority Area (FEPA) and this sub-catchment is not considered to be an upper management area. The project site is situated in an arid area which received very little rainfall, although flash floods are known to occur very infrequently.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for surface water systems are: • To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area; • To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products; and • To reduce the site's susceptibility to erosion during flash floods.
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation; • Levelling of the terrain where it is too undulating for installation of panels; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; • Storage of hydrocarbons and operation of equipment and vehicles; and • Generation and handling of domestic and industrial wastes.
Potential impacts	The potential impacts on surface water systems include: • The removal of natural vegetation from the project development footprint, removal of topsoil from the substation and car parking yard, levelling of undulating areas and creation of hard and compacted surfaces will alter the natural topography and drainage patterns of the project site; • During rainfall events, disturbed surfaces would be susceptible to erosion and altered surface flow dynamics will aggravate the natural erosion process and sediment transport on-site and off-site; • During surface flow events, increased sediment transported due to aggravated erosion from disturbed areas, as well as other contaminants (i.e. waste products, effluents, construction materials) stored on the construction site, may result in contamination of downstream water resources; and

SURFACE WATER SYSTEMS			
	• Flash floods could occur and the natural attenuation of these floods would be exacerbated after vegetation removal.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The majority of site preparation activities be undertaken during the dry season;	Orlight SA	Project planning
	• A storm water management plan should be implemented during the construction phase;	Contractor	Construction
	• Delineated drainage lines and buffer zones should be clearly delineated;	ECO	Project planning
	• No activities may be allowed with the delineated drainage lines and buffer zones;	Contractor	Construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented;	Contractor	Pre-construction
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels;	Contractor	Construction
	• Spillage should be managed through an emergency spill response plan. A hydrocarbon spill kit should be kept on site.	Contractor	Construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences;		

SURFACE WATER SYSTEMS	
	• No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • Topsoil in areas that are not to be further disturbed is replaced and vegetation restored; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.

Table 6-4: Construction phase implementation plan – Soil and agricultural potential

SOIL AND AGRICULTURAL POTENTIAL	
Context	The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments, implies susceptibility to water and wind erosion respectively, both of a moderate to high rating if no mitigation measures are in place. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for soils and agricultural potential are: • To minimise loss of the soil resources to support existing land use and land capability; • To minimise soil erosion by wind and water; • To reduce the site's susceptibility to erosion during flash floods; • To minimise compaction of soils during site preparation activities, including soil handling, stockpiling and vehicle use; and • To prevent soil contamination due to spillage of hydrocarbons or wastes.
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;

SOIL AND AGRICULTURAL POTENTIAL			
	• Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation; • Levelling of the terrain where it is too undulating for the installation of panels; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; • Storage of hydrocarbons and operation of equipment and vehicles; and • Generation and handling of domestic and industrial wastes.		
Potential impacts	The potential impacts on soils and agricultural potential include: • The coarse graded soils that occur on the project site have little cohesion between particles and consequently, these soils are highly susceptible to water erosion, depending on the force applied at the time of impact; • The very fine material in-between the fragments will be subjected to wind erosion where exposed and stockpiled; • The fine-graded soils of southern part of the site will also be vulnerable to wind erosion when exposed after the removal of vegetation during site preparation and stockpiling for later use; • Soil compaction of well sorted fine-graded sand and silty soils; and • The potential for contaminating the soil due to spillage of hydrocarbons from vehicles and machinery, or improper waste management.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The majority of site preparation activities to be undertaken during the dry season;	Orlight SA	Project planning
	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Minimise the period of exposure of soil surfaces through planning;	Contractor ECO	Project planning Construction
	• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour;	Contractor	Construction
	• During stockpiling, preferably use the 'end-tipping' method to keep stockpiled soils loose;	Contractor	Construction
	• Preserve looseness of stockpiled soil by applying fertiliser and seeding by hand;	Contractor	Construction
	• Limit stockpile height – a safe height can be regarded as the height at which material can be	Contractor	Project planning

SOIL AND AGRICULTURAL POTENTIAL			
	placed without repeated traffic over already placed material;	ECO	Construction
	• Re-vegetate soil stockpiles to avoid erosion losses;	Contractor	Construction
	• Ensure stockpiles are placed on a free draining location so as to limit erosion loss; •	Contractor ECO	Construction
	• Stripping operations should only be executed when soil moisture content will minimise the risk of compaction (i.e. during dry season);	Contractor ECO	Project planning Construction
	• A storm water management plan should be implemented during the construction phase;	Contractor	Construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• Where topsoil is partially removed, the soil surface can be loosened via tillage/ripping;	Contractor	Construction
	• Heavy vehicle movement over soil stockpiles should be prevented;	Contractor	Construction
	• Traffic over project areas that have not been stripped of topsoil should be minimised;	Contractor	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented;	Contractor	Pre-construction
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated	Contractor	Construction

SOIL AND AGRICULTURAL POTENTIAL			
	from clean water areas with berms or channels;		
	• Spillage should be managed through an emergency spill response plan. A hydrocarbon spill kit should be kept on site.	Contractor	Construction
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • Construction vehicles are restricted to designated areas; • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.		

Table 6-5: Construction phase implementation plan – Ecological components

ECOLOGICAL COMPONENTS	
Context	In relation to the CBA and SKEP data, the Aggeneys study areas is of importance for the following habitat components. As far as vegetation is concerned the plains that occur on study area is of importance because of the presence of quartz gravel patches which are the preferred habitat for Lithops spp., or stone plants, demarcated as highly sensitive areas. In addition, the study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP, 2010). Because of all the reasons mentioned above the no-go areas of the drainage lines was delineated. As far as avifauna is concerned, the area is approximately 3 km away from an area that is described as a

ECOLOGICAL COMPONENTS	
	unique habitat for birds. As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects. Furthermore, the study area falls within an area where eastern Bushmanland Quartz and Gravel patches are found. The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area; • To prevent direct impacts on other areas that were delineated as highly sensitive and unsuitable for development; • To minimise the footprint of disturbance during the construction phase; • To preserve as many natural plant species that can be used during site remediation; and • To eradicate alien invasive and weed species from the project area.
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Access control and fencing of the site.
Potential impacts	The potential impacts on ecological components include: • During site preparation activities, some of the naturally occurring vegetation will be removed; • There is also a possibility that Red Data or protected plant species that have not been identified in areas within the project development footprint during dry-season surveys could be destroyed; • Decrease in effective photosynthesis as result of elevated ambient dust; • During site clearance, it is also likely that alien invasive and weed species will propagate on disturbed areas; • Alien invasive species could out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

ECOLOGICAL COMPONENTS			
	a wide range of ecological niches; and • Loss of habitat for grazing animals due to removal of vegetation and fencing of the site.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;	Flora specialist	Project planning
	• No vegetation removal should be allowed outside the designated project development footprint;	ECO Contractor	Construction
	• A representative sample of indigenous plant species should be selected and relocated to an on-site nursery. During site remediation and rehabilitation, these species should be replanted on disturbed areas as per the rehabilitation plan;	ECO	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Construction
	• An alien invasive and weed control programme should be implemented.	Contractor ECO	Construction
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences;		

ECOLOGICAL COMPONENTS	
	• No destruction of vegetation outside designated areas; • Establishment of an on-site nursery; • Evidence of vegetation being relocated and re-established in other areas; • No visible evidence of alien invasive species.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish.

Table 6-6: Construction phase implementation plan – Alien invasive control

ALIEN INVASIVE CONTROL	
Context	Preservation of natural habitat is of prime importance within this study area, mainly because of the CBA and SKEP data that indicates the site as important because of the presence of quartz gravel patches which are the preferred habitat for Lithops spp., or stone plants, demarcated as highly sensitive areas. Furthermore, the study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP, 2010). As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects. The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. For these reasons the management of alien invasive species, that will be detrimental if left un attended, is essential.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for alien invasive control are: • To prevent the spread of alien invasive plant species present on the study area; • To remove the plant species *Prosopis glandulosa*; • To avoid the introduction of additional alien invasive plant species; and • To preserve as many natural plant species that can be used during site remediation.
Risk sources	The following risk sources have been identified:

ALIEN INVASIVE CONTROL			
	• The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure, will create favourable habitat for alien invasive plant species to colonise; • Stockpiling of topsoil for use during site rehabilitation will create favourable habitat for alien invasive plant species; • Open areas along roadsides will create favourable habitat for alien invasive plant species.		
Potential impacts	The potential impacts on ecological components include: • Potentially viable habitat for naturally occurring plant species could become undesirable; • There is also a possibility that Red Data or protected plant species habitat could be destroyed; • Loss of habitat for grazing animals due to alien invasive colonisation.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify alien invasive plant species that might not have been identified during dry-season surveys.	Flora specialist	Project planning
	• No vegetation removal should be allowed outside the designated project development footprint, as this will create favourable habitat for alien invasive plant species;	ECO Contractor	Construction
	• A representative sample of indigenous plant species should be selected and relocated to an on-site nursery. During site remediation and rehabilitation, these species should be replanted on disturbed areas as per the rehabilitation plan;	ECO	Pre-construction
	• *Removal of Prosopis glandulosa:* Cut stump foliar and soil applied herbicide can be successful, follow ups are always needed.	ECO	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Construction

ALIEN INVASIVE CONTROL			
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas; • Establishment of an on-site nursery; • Evidence of vegetation being relocated and re-established in other areas; • No visible evidence of alien invasive species.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish.		

Table 6-7: Construction phase implementation plan – Air quality

AIR QUALITY	
Context	The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments, implies susceptibility to wind erosion. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected.
CONSTRUCTION PHASE	
Objectives	The environmental objective for air quality is to minimise creation of dust.
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure • Vehicle movement on unsurfaced roads; and • Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation.

<table>
<tr><th colspan="4">AIR QUALITY</th></tr>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on air quality include:
• The coarse graded soils that occur on the project site have little cohesion between particles and consequently, these soils are highly susceptible to water erosion, depending on the force applied at the time of impact. The very fine material in-between the fragments will be subjected to wind erosion where exposed and stockpiled;
• The fine-graded soils of southern part of the site will also be vulnerable to wind erosion when exposed after the removal of vegetation during site preparation and stockpiling for later use;
• Increased levels of ambient dust may cause respiratory ailments to the receiving environment;
• Vehicles driving along unsurfaced roads at speeds which allow for the generation of dust;
• Increase health and safety risks as result of increased dust and traffic; and
• Decrease of plant productivity as result of dust on plants that limits photosynthesis.</td></tr>
<tr><td rowspan="7">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>• Minimise the period of exposure of bare surfaces through planning;</td><td>Contractor
ECO</td><td>Project planning
Construction</td></tr>
<tr><td>• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour;</td><td>Contractor</td><td>Construction</td></tr>
<tr><td>• Re-vegetate soil stockpiles to avoid dust creation;</td><td>ECO</td><td>Construction</td></tr>
<tr><td>• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation;</td><td>Contractor
ECO</td><td>Construction</td></tr>
<tr><td>• Dust suppression techniques such as applying water or non-toxic chemicals to minimise dust should be used, where feasible.</td><td>Contractor
ECO</td><td>Construction</td></tr>
<tr><td>Performance indicators</td><td colspan="3">The performance indicators are:</td></tr>
</table>

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

AIR QUALITY	
	• No visible signs of wind erosion; and • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.

Table 6-8: Construction phase implementation plan – Noise

NOISE			
Context	The town of Aggeneys is located approximately 5 km from the project site and there are no other receptors in close proximity. Ambient noise levels are very low, with occasional noise from traffic passing by on the N14.		
CONSTRUCTION PHASE			
Objectives	The environmental objective for noise is to: • Prevent generation of noise during certain times of the day (i.e. night time); and • Limit the overall noise levels from construction activities.		
Risk sources	The following risk sources have been identified: • All construction activities; and • Employment of workforce during the construction phase.		
Potential impacts	The potential impacts on noise include: • Increase in ambient noise levels due to noise emissions from vehicles and machinery used during construction activities; • Nuisance associated with noise during the transport of the workforce from the town of Aggeneys to the project site and the presence of the workforce in the area; and • Nuisance associate with noise generation during night time.		
Management and	**Actions**	**Responsibility**	**Timeframe**

NOISE			
mitigation actions	• Limit all construction activities to day-light hours;	Contractor	Construction
	• The construction workforce should be made aware of the risk of nuisance noise due to their presence in the area and a Code of Conduct implemented to reduce general levels of noise;	Contractor ECO	Construction
	• Construction machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers; and	Contractor	Construction
	• Switch off equipment when not in use.	Contractor	Construction
Performance indicators	The performance indicators are: • Evidence that noise assessments are being conducted with a noise meter ; • The noise from the proposed operation should not measure above a level of 45dBA (daytime) and 35dBA (night time) for rural districts; • Exhaust mufflers are installed on construction vehicles;		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Noise metre readings should be undertaken on a representative basis to determine whether noise levels are within the acceptable range.		

Table 6-9: Construction phase implementation plan – Waste

WASTE	
Context	The construction of the power plants will generate solid, liquid and non-hazardous waste. The municipal waste management site may not have the capacity to accommodate waste generated by the project and therefore, a waste management contractor would have to be employed to remove waste to a registered landfill site.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for waste management are to: • Minimise waste;

WASTE			
	• Contain movement of heavy vehicles to designated areas; • Avoid spillages and contamination; • Reuse, reduce and recycle, where possible; • Recover material such as glass, aluminium, as well as a variety of semiconductor materials. Recycling benefits the environment by reducing the volume of waste and helps to reduce the amount of energy required to provide raw materials and therefore the costs and environmental impacts of producing PV modules.		
Risk sources	The following risk sources have been identified: • Spillage during handling of waste or damaged containers; • Non utilisation of waste containers; • Waste being blown away from waste containers; • Waste vectors (i.e. rodents and cockroaches); • Littering by construction workers.		
Potential impacts	The potential impacts from waste generation include: • Surface water contamination; • Soil contamination; • Ecological degradation; • Negative visual impacts; and • Nuisance, such as bad odours.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure construction waste is effectively contained, stored and managed on site;	Contractor	Construction
	• Ensure waste bins (e.g. for organic waste) is sufficient vermin proof and weatherproof;	Contractor	Construction
	• Ensure all rubble and waste rock are disposed of at a registered disposal sites;	Contractor	Construction
	• Implement the "reduce, reuse and recycle" approach for all waste. This means that different bins need to be put in place to separate i.e. plastic, paper, glass and cans, where feasible;	Contractor	Construction
	• Ensure all solid and hazardous waste is disposed of at a registered disposal sites; and	Contractor	Construction

WASTE			
	• The ablution contractor needs to ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site.	Contractor	Construction
Performance indicators	The performance indicators are: • Evidence that waste is effectively contained, stored and managed on site; • No littering is visible on site or from the site; • Waste bins (e.g. for organic waste) has lids and is sufficient vermin proof and weatherproof; • Evidence that all solid waste, including rubble and waste rock, are removed and disposed of at a registered sites; • The "reduce, reuse and recycle" approach for all waste are being implemented by means of establishing separate bins for i.e. plastic, paper, glass and cans; and • There is no evidence of uncontrolled spillages or waste on site.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-10: Construction phase implementation plan – Visual Environment

VISUAL ENVIRONMENT	
Context	With regard to their visual considerations, the outcrops on the northern border of the study area are typical of the regional area in which the study area falls. A diversity of fauna and flora is supported by the unique ecologies on these arid inselbergs, outcrops and plains. The dry landscape is somewhat dramatic with its contrasting features and has a rugged and stark beauty. The surrounding landscape is impressive with large, flat open spaces and contrasting large rocky outcrops. The study area does, however, have a sense of being transformed by people, not only because of the visibility of the town form the border of the study area, but also because a transmission lines runs through the study area and there are fences on the border of the property.
CONSTRUCTION PHASE	
Objectives	The environmental objective for the visual environment are to: • Mitigate visual impacts to motorists on the N14 national road;

VISUAL ENVIRONMENT			
	• Manage complaints and grievances regarding visual impacts; and • Minimise dust impacts and visual pollution.		
Risk sources	The following risk sources have been identified: • Increase in vehicular and other activity levels during the construction phase; • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Fencing of the project site; and • Installation of the solar PV panels and construction of all related project infrastructure.		
Potential impacts	The potential impacts on the visual environment include: • The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur; • The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Recommendations for positioning of the solar PV panels and associated infrastructure were made during the site layout design process. Activities should therefore be restricted to the project development footprint to reduce visual impacts to receptors;	Orlight SA	Project planning
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);	Contractor	Construction
	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Re-vegetate soil stockpiles to avoid dust creation; and	ECO	Construction

VISUAL ENVIRONMENT			
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; and • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-11: Construction phase implementation plan – Employment creation

EMPLOYMENT CREATION	
Context	During the construction phase, the proposed project will create an estimated four direct job opportunities per MW generation capacity, translating to a construction workforce of 490 people. Some of these job opportunities will be for unskilled labourers, which will be sourced from the town of Aggeneys. The majority of youth in this town have low educational and skills levels, thus many are unemployed and well suited to unskilled labour. Given that Aggeneys is a mining town, there are most likely existing entrepreneurs, local businesses and Small, Medium and Micro Enterprises (SMMEs) in or around Aggeneys that supply the mine and its employees with necessary services. The social benefits associated with the proposed project will be enhanced if the proponent makes use of these businesses and SMMEs.
CONSTRUCTION PHASE	
Objectives	The environmental objective for employment creation are to: • Employ as many labourers from the immediate and larger study area as possible; and • Utilise local businesses and SMMEs as much as is feasible.
Risk sources	The following risk sources have been identified:

EMPLOYMENT CREATION			
	• Contractors making use of their own labour force, reducing the opportunity for locals to be temporarily gainfully employed; • Sub-contracting large companies operating primarily outside the study area to provide support services such as catering; and • Sourcing labour (un-, semi- and skilled) from outside the larger study area if the required skills are available within that area.		
Potential impacts	The potential impacts of employment creation include: • Socio-economic benefits associated with creating local employment and business opportunities;		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure that a minimum of 80% of the unskilled workers are sourced from Aggeneys (surrounding towns, if insufficient labourers are available in Aggeneys);	Orlight SA Contractor	Pre-construction
	• Ensure that a minimum of 20% of the unskilled employment opportunities are awarded to women and previously disadvantaged individuals residing in the local and surrounding areas;	Orlight SA Contractor	Pre-construction
	• In conjunction with the local municipality and other local organisations and companies, identify suitable individuals in the local and regional areas to fill the available job opportunities;	Orlight SA Contractor	Pre-construction
	• Set-up a local labour and enterprise desk in Aggeneys to allow local labourers, entrepreneurs, SMMEs and companies to register their details and skills/ service to facilitate the employment and contracting of local labourers and entrepreneurs, SMMEs and companies;	Orlight SA	Pre-construction Construction
	• Relevant information regarding employment opportunities (including job descriptions, skills required, and number of opportunities), as well as contracting of entrepreneurs, SMMEs and other local companies (including the type and scale of service required) will be made available at the local labour and enterprise desk;	Orlight SA	Pre-construction Construction
	• Create conditions conducive to the involvement of local companies, SMMEs and entrepreneurs during the construction phase;	Orlight SA	Pre-construction
	• Provide guidelines in tender documentation regarding the employment of locals and use of local enterprises; and	Orlight SA	Pre-construction

EMPLOYMENT CREATION			
	• Skills training will be provided for the construction workforce and entrepreneurs, SMMEs and local businesses as relevant and required.	Orlight SA Contractor	Pre-construction Construction
Performance indicators	The performance indicators are: • The majority of unskilled job opportunities are awarded to local individuals (at least 80% from Aggeneys or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; • The proponent/contractor has a list of candidates (including contact details, age, sex, skills level, educational levels and resident town) that may be able to fulfil unskilled job openings; • The proponent/contractor has a list of entrepreneurs, SMMEs and companies operating in the local area (including company name, services provided, number of employees and location) that could be used to provided services required during construction; • A labour and enterprise desk is operational and visible in Aggeneys; • Some services are provided by local entrepreneurs, SMMEs and businesses; • Tender documentation stipulates guidelines pertaining to the employment of locals, women and previously disadvantaged individuals, as well as the subcontracting of local entrepreneurs, SMMEs and businesses; and • The proponent/ contractor are able to provide records of training provided for local employees and entrepreneurs, SMMEs and businesses, including the nature of training, number of individuals/ entrepreneurs/ SMMEs/ businesses who received training, and the training provider.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-12: Construction phase implementation plan – Influx of job seekers

INFLUX OF JOB-SEEKERS	
Context	News of the proposed project and employment opportunities may result in an influx of job-seekers into Aggeneys and surrounding towns. Due to the limited housing available in these areas, such an influx may result in the development of informal settlements. Although it is unlikely that this will happen, the potential adverse impacts associated with it should not be underestimated. Influx of job-seekers must thus be prevented as far as possible. It is likely that the rate of influx will be highest during pre-construction and the early stages of construction, and that the unsuccessful job-seekers will leave Aggeneys and surrounding towns shortly after their arrival in search of other opportunities.

INFLUX OF JOB-SEEKERS			
CONSTRUCTION PHASE			
Objectives	The environmental objective to minimise influx of job-seekers are: • Proactively discouraging the influx of migrant job-seekers; and • Actively preventing the establishment of informal housing and settlements.		
Risk sources	The following risk sources have been identified: • Some unsuccessful job-seekers may establish temporary informal housing without adequate services. This poses a health hazard for the migrants and the local population; • Some unsuccessful job-seekers may rent accommodation from locals, contributing to increased pressure on local service delivery; and • The local population may reject the unemployed migrants and their lifestyles, possibly resulting in social conflict and violence.		
Potential impacts	The potential impacts of influx of job seekers include: • The development of informal settlements due to the limited housing available in the area; • Congregation at the construction site; • Social conflict between the incumbent and migrant populations, due to the incumbent population feeling that the migrants are taking opportunities away from them; • An increase in social pathologies (prostitution, conflict and violence, alcohol abuse, drug use and crime). • Petty crimes and stock theft; • Risks to the security of the project site and equipment or goods.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Establish and communicate an effective grievance mechanism through which the surrounding land owners and local population can lay grievances and have it resolved prior to the grievance becoming contentious;	Orlight SA	Pre-construction Construction
	• Transparently communicate the available job opportunities and emphasise that preference will be given to local labourers for these positions (by means of the labour and enterprise desk in Aggeneys);	Orlight SA Contractor	Pre-construction Construction
	• The recruitment process and use of subcontractors will be clearly communicated to the residents	Orlight SA	Pre-construction

INFLUX OF JOB-SEEKERS			
	of Aggeneys and surrounding towns;	Contractor	Construction
	• Employ as many local labourers as possible in un- and semi-skilled positions as feasible, and encourage these labourers to remain at their existing residences;	Orlight SA Contractor	Pre-construction Construction
	• In collaboration with the local residents and local municipality, devise a strategy to report the establishment of any informal housing and settlements and a procedure to dismantle such housing as soon as possible, without contravening the Extension of Security of Tenure Act (Act 62 of 1997) (ESTA); and	Orlight SA	Pre-construction Construction
	• Local residents will be discouraged from renting accommodation to unsuccessful job-seekers. Such residents should rather be encouraged to reserve their available accommodation for the construction workforce.	Orlight SA	Pre-construction Construction
Performance indicators	The performance indicators are: • Residents in Aggeneys and surrounding towns are aware of the grievance mechanism; • Grievances that have been lodged were dealt with in accordance with the grievance mechanism's protocol; • Residents in Aggeneys and surrounding towns are aware of the number and type of job opportunities available to local residents, as well as the recruitment procedure; • Local labourers live in their own residences where feasible; • Labourers not from Aggeneys or surrounding towns are accommodated in formal (albeit temporary) housing with adequate services; • The proponent/ contractor becomes immediately aware of the erection of informal housing and is able to dismantle such housing without contravening the ESTA; and • Few or no local residents are renting accommodation to unemployed job-seekers.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-13: Construction phase implementation plan – Traffic

TRAFFIC

TRAFFIC			
Context	The construction phase of the proposed project will necessarily increase the volume of traffic in the vicinity of the project site, as well as change the nature of the traffic (there will be an increased number of heavy motor vehicles). By imposing traffic and transportation rules, carefully planning access to the site, maintaining the access roads and ensuring that construction vehicles are roadworthy, the risk of traffic-related incidents involving construction traffic is reduced.		
CONSTRUCTION PHASE			
Objectives	The environmental objective to minimise impacts on traffic are: • To minimise the impact of traffic associated with construction activities on the quality of roads, local traffic flow, local residents, land owners and livestock; • To minimise the probability of traffic accidents involving construction vehicles, public road users and livestock; and • To ensure that all construction vehicles are roadworthy and have the appropriate permits or licenses.		
Risk sources	The following risk sources have been identified: • Construction vehicle movement; • Speeding on local roads; • Degradation of local road conditions; and • Transport of materials required for the construction phase.		
Potential impacts	The potential impacts on traffic include: • An increase in traffic (including heavy vehicle traffic) increases the risk of traffic accidents involving non-project personnel and livestock; and • An increase in traffic could have a negative impact on the quality of the roads in the vicinity of the proposed project, especially the gravel (farm) roads, further increasing the risk for traffic accidents.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The contractors preferred access road(s) to the site, procedures, schedules and traffic volumes will be communicated with the affected parties prior to the commencement of construction. The affected parties will be given the opportunity to suggest changes in cases where the impact on the local community and land owners will be significantly adverse;	Contractor	Pre-construction Construction
	• Appropriate signage should be erected outside the project footprint adjacent to the N14 national road to inform motorists driving past of the construction activities that are being undertaken.	Orlight SA	Pre-construction

TRAFFIC			
	• The gravel access road(s) to the site will be maintained to its original (or better) state and an appropriate dust suppressant measure will be employed if required;	Contractor	Construction
	• Construction vehicles will be inspected regularly to confirm that they are roadworthy, have the required license/ permit to transport their load and are not overloaded. Additionally, vehicles will be adequately maintained;	Contractor	Construction
	• Construction vehicles will be limited to travelling 80 km/h on tar roads and 40 km/h on gravel roads. This limitation will be strictly enforced;	Contractor	Construction
	• Drivers' shifts will be limited to 8 hours per day to prevent driver fatigue;	Contractor	Construction
	• Access from the national road to the gravel road leading to the site will be clearly marked and appropriate road signs will be used to warn public road users of the presence of heavy motor vehicles;	Contractor	Construction
	• Any traffic delays that may be caused by construction traffic will be coordinated with the relevant local authorities prior to the delay occurring;	Contractor	Pre-construction Construction
	• All drivers of construction vehicles will be in possession of the appropriate drivers' license for that vehicle;	Contractor	Construction
	• Drivers of construction vehicles will not be allowed to transport any passengers; and	Contractor	Construction
	• Any traffic-related accident (including accidents involving just the construction vehicle, or the construction vehicle and a member of the public and/ or livestock) will be reported to the contractor immediately.	Contractor	Construction
Performance indicators	The performance indicators are: • Affected parties (including surrounding land owners) are aware and satisfied with the contractor's traffic-related logistics; • The access road is in the same or better state than what it was at the outset of construction; • Dust generation from traffic on the access road(s) is of an acceptable level; • The construction vehicles are not involved in any traffic-related incidents;		

TRAFFIC	
	• Access to the site is clearly marked with appropriate road signs; and • The project-affected and surrounding communities do not lay any traffic-related complaints (such as reckless driving or speeding).
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.

Table 6-14: Construction phase implementation plan – Safety and security

SAFETY AND SECURITY	
Context	The influx of job-seekers, the presence of a construction workforce as well as construction activities pose a potential safety and security risk for the residents of Aggeneys and surrounding towns. The presence of unemployed job-seekers as well as 'outsiders' (whether employed or not) could lead to petty crimes and stock theft. The safety of the construction workforce is also a concern (both while 'on-the-job' and at their accommodation), as well as that of the project-affected communities when in the vicinity of construction activities. Additionally, the security of the project site should also be considered.
CONSTRUCTION PHASE	
Objectives	The environmental objective to minimise impacts on safety and security are: • Maximise the employment of locals, thereby minimising the number of 'outsiders' to enter the project-affected community; and • Implement strict security measures in the vicinity of the construction site and other project infrastructure.
Risk sources	The following risk sources have been identified: • The safety of construction workers, job-seekers, local communities and livestock may be at risk; • Livestock theft and petty crime; • Theft of construction material; • Vandalism of project infrastructure; and • Project-related accidents (including accidents on site).
Potential impacts	The potential impacts on safety and security include: • The presence of 'outsiders' create conditions conducive to petty crime and stock theft; • Construction activities (including construction traffic and the actual site) pose a safety risk; and • Potential vandalism of the site or other project infrastructure.

SAFETY AND SECURITY			
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The number of non-local employees will be minimised;	Orlight SA Contractor	Pre-construction
	• Construction workers will be easily identifiable through their uniforms and name tags;	Contractor	Construction
	• Local law enforcement officials will be kept appraised of the project plans;	Orlight SA	Pre-construction
	• If any of the construction workers will be required to move outside the construction site or designated access road(s), the surrounding land owners and residents of Aggeneys will be notified prior to the occurrence;	Contractor	Construction
	• The contractor will cooperate fully with the local law enforcing agencies (police and any community-based committee, if present) should a construction worker be suspected of committing a crime;	Contractor	Construction
	• The construction site and laydown yard will be completely fenced off and access into the sites will be controlled by a 24-hour security service;	Contractor	Construction
	• The fence surrounding the construction site and laydown yard will be inspected daily for damage, and any damage will be repaired as soon as possible;	Contractor	Construction
	• Security personnel will be briefed about possible stock theft and poaching and taught to identify criminal elements/ activities in this regard;	Contractor	Construction
	• Contact details of emergency services will be prominently displayed at the construction site and laydown yard;	Contractor	Construction
	• Appropriate fire-fighting equipment will be made available on site and at the laydown yard, and representatives from the construction workforce will be trained as fire marshals; and	Contractor	Construction
	• Open fires made by the construction workforce will be strictly forbidden.	Contractor	Construction
Performance	The performance indicators are:		

SAFETY AND SECURITY	
indicators	• Crime rates do not increase as a result of the proposed project; • The construction site and laydown areas are not vandalised; • No on-site or construction related accidents reported; • No veld fires started by open fires by the construction workforce are reported; and • Aggeneys residents do not report any cases of trespassing by construction workers.
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.

Table 6-15: Construction phase implementation plan – Social conflict

SOCIAL CONFLICT	
Context	The proposed project will employ a construction workforce of 490 people. Although some of these workers will be from the local and surrounding towns, many will come from outside the study area. Minimising the adverse impact these workers may have on the local communities is important for the successful completion of the construction of the proposed project, as is the well-being of the construction workforce. It is not anticipated that social conflict or an increase in social pathologies will materialise as a result of the presence of the construction workforce. Nevertheless, measures need to be taken to further minimise this risk. The well-being of the migrant workforce also requires attention.
CONSTRUCTION PHASE	
Objectives	The environmental objective to minimise social conflict are to: • Ensure adequate living and working conditions for the construction workforce; and • Avoid social conflict between migrant workers and the local residents.
Risk sources	The following risk sources have been identified: • Construction accommodation and ablution facilities; and • Interaction between migrant construction workers and local residents.
Potential impacts	The potential impacts of social conflict include: • Potential social conflict with local residents; • Potential spread of social pathologies as a result of the presence of the construction workforce;

SOCIAL CONFLICT			
	• Mobilisation against the proposed project by surrounding communities; and • Strikes if the working and living conditions of the construction workforce is not of an acceptable standard.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Local construction workers will remain resident at their current residences as far as it feasible;	Contractor	Pre-construction Construction
	• If required, temporary accommodation and ablution facilities for construction workers will be of an acceptable standard in terms of cleanliness and comfort;	Contractor	Pre-construction Construction
	• Construction workers will be granted one long weekend per month (coinciding with their remuneration date) during which they will be encouraged to travel home if feasible;	Contractor	Construction
	• All construction workers will receive a contract at the outset of their employment stipulating their conditions and duration of employment, remuneration and job description;	Contractor	Pre-construction
	• Waste removal facilities will be maintained, emptied and cleaned once a week. Such facilities will be the only designated area for waste removal will be clearly marked, closed off and animal-proof;	Contractor	Construction
	• Cooking of meals will take place in designated areas only and meals will be provided to staff;	Contractor	Construction
	• Fire-fighting equipment will be provided at the temporary accommodation and relevant training will be provided prior to the commencement of construction;	Contractor	Construction
	• A Code of Conduct for the construction workforce will be established prior to the commencement of construction, the workers will be informed and familiarised with this code and will be contractually bound to it;	Contractor	Pre-construction
	• Only construction workers will be allowed at the temporary accommodation and ablution facilities;	Contractor	Construction
	• The construction accommodation and ablution facilities will be under 24 hour security;	Contractor	Construction
	• Personal hygiene practices may only take place in the designated ablution facilities. No construction worker will be allowed to discard of water used for personal hygiene purposes	Contractor	Construction

SOCIAL CONFLICT			
	anywhere other than at the ablution facilities provided;		
	• Upon completion of the construction phase, all workers residing in temporary accommodation will be required to vacate within one week, after which the accommodation and ablution facilities will be dismantled unless earmarked for use during the operational phase of the project;	Contractor	Post-construction
	• A recreational room will be established in the vicinity of the temporary accommodation facilities. This room will have a television and pool table, as well as a kiosk. No alcohol will be sold at the kiosk.	Contractor	Construction
	• The excessive use of alcohol and/ or illicit drugs will be strictly prohibited in the construction camp. Possession of illicit drugs and excessive alcohol use will be deemed as grounds for dismissal; and	Contractor	Construction
	• Any negative interaction between the migrant workforce and members of the local community will be reported to the contractor and ECO immediately.	Contractor	Construction
Performance indicators	The performance indicators are: • Not incidences of social conflict between the local communities and construction workforce are reported; • No strikes by the construction workforce take place; • None of the construction workers fall ill due to unhygienic conditions at the construction accommodation or ablution facilities; • No rodents are found at the waste management site used by the construction workforce; and • No incidents of excessive alcohol or illicit drug use are reported.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-16: Construction phase implementation plan – Heritage

HERITAGE	
Context	The palaeontological landscape is described as bedrock comprising ancient basement rocks of the Bushmanland Terrance of the Namaqua Province. This geology is of negligible palaeontological interest. The stone artefact scatters which were recorded during the survey are considered to be of minor significance. They are probably not in original context and not associated with other archaeological material, such as bone, which could provide valuable information on

HERITAGE			
	prehistoric life ways. There do not appear to be “archaeological sites” with stone tools left in their original context.		
CONSTRUCTION PHASE			
Objectives	The environmental objectives for the heritage environment are to: • To minimise impacts on the cultural landscape.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Removal of topsoil from the footprint of the substation and car parking yard and stockpiling of topsoil for use during site rehabilitation; and • The installation of solar PV panels and all associated infrastructure.		
Potential impacts	The potential impacts on heritage resources include: • Although some archaeological material will be impacted, the impact is considered Low. Lack of site boundaries or associated organic remains reduces scientific value greatly; • The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation.	ECO	Concstruction
	• Recommendations for positioning of the solar PV panels and associated infrastructure were made during the site layout design process. Activities should therefore be restricted to the project development footprint to reduce visual impacts to receptors;	Orlight SA	Project planning
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e.	Contractor	Construction

HERITAGE			
	adhering to the designated internal road network);		
Performance indicators	The performance indicators are: • Notify SAHRA and an archaeologist in the event that unmarked graves are identified during construction.		
Monitoring and evaluation	None required.		

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

6.3 Operational phase

The objectives for the operational phase of the proposed project are to:

- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the operation of the proposed project;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area and further degradation or loss of the soil resource; and
- Control and prevent the propagation of alien invasive species.

The implementation plans for the operational phase of the proposed Aggeneys Solar PV Power Plant are presented in the tables below.

Table 6-17: Operational phase implementation plan – Surface water systems

SURFACE WATER SYSTEMS			
Context	The project area is situated in the Lower Orange Water Management Area (WMA 14). An ephemeral river system and associated drainage lines were identified and delineated for the study area. The project area is not recognised as a FEPA and this sub-catchment is not considered to be an upper management area. The project site is situated in an arid area which received very little rainfall, although flash floods are known to occur very infrequently.		
OPERATIONAL PHASE			
Objectives	The environmental objectives for surface water systems are: • To reduce the site's susceptibility to erosion during flash floods or rainfall events; and • To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products.		
Risk sources	The following risk sources have been identified: • Internal access roads; • Surfaces of solar PV panels and roofs of infrastructure; and • Maintenance of solar PV panels.		
Potential impacts	The potential impacts on surface water systems include: • During rainfall events, compacted surfaces and areas below the solar PV panels will be susceptible to erosion due to the altered surface flow dynamics. The natural erosion process and sediment transport on-site and off-site will be aggravated; • During surface flow events, increased sediment transported due to aggravated, as well as other contaminants (i.e. hydrocarbon spills, waste products and effluents), may result in contamination of downstream water resources.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The storm water management infrastructure should be maintained during the operational phase;	Operator	Operation
	• All waste products must be managed according to a waste management plan; and	Operator	Operation
	• Spillage should be managed through an emergency spill response plan.	Operator	Operation
Performance	The performance indicators are:		

SURFACE WATER SYSTEMS	
indicators	• No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The operator of the solar PV power plant must undertake quarterly site inspections; • An independent auditor will be responsible for auditing implementation of the EMP on an annual basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.

Table 6-18: Operational phase implementation plan – Soils and agricultural potential

SOILS AND AGRICULTURAL POTENTIAL	
Context	The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments, implies susceptibility to water and wind erosion respectively, both of a moderate to high rating if no mitigation measures are in place. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected.
OPERATIONAL PHASE	
Objectives	The environmental objectives for soils and agricultural potential are: • To reduce the site's susceptibility to erosion during flash floods; and • To minimise compaction of soils.
Risk sources	The following risk sources have been identified: • Internal access roads; and • Surfaces of solar PV panels and roofs of infrastructure.
Potential impacts	The potential impacts on surface water systems include: • During rainfall events, compacted surfaces and areas below the solar PV panels will be susceptible to erosion due to the altered surface flow dynamics. The natural erosion process and sediment transport on-site and off-site will be aggravated.

SOILS AND AGRICULTURAL POTENTIAL			
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The storm water management infrastructure should be maintained during the operational phase;	Operator	Operation
	• Traffic over project areas that have not been stripped of topsoil should be minimised;	Contractor	Construction
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure; and • No visible evidence of sediment transport during surface flow events.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The operator of the solar PV power plant must undertake quarterly site inspections; • An independent auditor will be responsible for auditing implementation of the EMP on an annual basis; and • During and after surface water flows, the site must be expected to identify potential erosional problems.		

Table 6-19: Operational phase implementation plan – Alien invasive control

ALIEN INVASIVE CONTROL	
Context	Preservation of natural habitat is of prime importance within this study area, mainly because of the CBA and SKEP data that indicates the site as important because of the presence of quartz gravel patches which are the preferred habitat for Lithops spp., or stone plants, demarcated as highly sensitive areas. Furthermore, the study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP, 2010). As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects. The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. For these reasons the management of alien invasive species, that will be detrimental if left un attended, is essential.
OPERATIONAL PHASE	
Objectives	The environmental objectives for ecological components are: • To prevent the spread of alien invasive plant species present on the study area;

ALIEN INVASIVE CONTROL			
	• To remove the plant species *Prosopis glandulosa*; • To avoid the introduction of additional alien invasive plant species; and • To preserve as many natural plant species that can be used during site remediation.		
Risk sources	The following risk sources have been identified: • Open areas along roadsides, solar PV panels and substations will create favourable habitat for alien invasive plant species.		
Potential impacts	The potential impacts on ecological components include: • Potentially viable habitat for naturally occurring plant species could become undesirable; • There is also a possibility that Red Data or protected plant species habitat could be destroyed; • Loss of habitat for grazing animals due to alien invasive colonisation.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Operator	Operation
	• Removal of *Prosopis glandulosa:* Cut stump foliar and soil applied herbicide can be successful, follow ups are always needed; and	Operator	Operation
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Operator	Operation
Performance indicators	The performance indicators are: • No destruction of vegetation outside designated areas; • No visible evidence of alien invasive species.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Quarterly inspections should be undertaken by the contractor to identify area where alien invasive species could establish.		

Table 6-20: Operational phase implementation plan – Employment creation

EMPLOYMENT CREATION			
Context	The operational phase of the proposed project will require 70 permanent employees for an estimated period of 20 years. Some of these long-term job opportunities will be for un- and semiskilled workers, which can be filled by local residents. Given the low educational and skills levels in the local municipal area, as well as the high unemployment rate of particularly the youth, the small number of permanent long-term job opportunities constitutes a significant (albeit small scale) socio-economic benefit for the directly-affected communities. Additionally, the use of local entrepreneurs, SMMEs and businesses further enhance the socio-economic benefit associated with the proposed project. Possible opportunities for local service providers include security and cleaning services, maintenance of the construction camp and equipment, as well as the provision of chemical toilets for use on site. Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building. The project also stands to benefit from such training and capacity building as it will enable the employees and local service providers to better perform their duties.		
OPERATIONAL PHASE			
Objectives	The environmental objectives for employment creation are to: • Employ as many labourers from the immediate and larger study area as possible; • Utilise local entrepreneurs, businesses and SMMEs as much as is feasible; and • Provide the required training and capacity building to better enable the employees and service providers to perform their duties.		
Risk sources	The following risk sources have been identified: • Locals not employed despite availability of skills; and • Local service providers not subcontracted despite availability of service.		
Potential impacts	Socio-economic benefits associated with creating local employment and business opportunities, as well as training and capacity building.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• A skills development and capacity building plan will be developed in conjunction with the relevant employees and local service providers to ensure that the training opportunities are relevant and required by the target beneficiaries;	Orlight SA Operator	Operation
	• Ensure that a minimum of 20% of the unskilled employment opportunities are awarded to women	Operator	Post-construction

EMPLOYMENT CREATION			
	and previously disadvantaged individuals residing in the local and surrounding areas;		
	• Ensure that a minimum of 80% of the unskilled workers are sourced from Aggeneys (and surrounding towns if insufficient labourers are available in Aggeneys); and	Operator	Post-construction
	• The proponent/ contractor will retain the list of local job-seeking individuals and service providers as compiled during the construction phase and will allow for period updates of the list.	Contractor Operator	Post-construction
Performance indicators	The performance indicators are: • The majority of unskilled job opportunities are awarded to local individuals (at least 80% of individuals are from Aggeneys or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; • The proponent/ contractor has a list of candidates (including contact details, age, sex, skills level, educational levels and resident town) that may be able to fulfil unskilled job openings; • The proponent/ contractor has a list of entrepreneurs, SMMEs and companies operating in the local area (including company name, services provided, number of employees and location) that could be used to provided services required during the operational phase of the project. Some services are provided by local entrepreneurs, SMMEs and businesses; and • The proponent/ contractor are able to provide records of training provided for local employees and entrepreneurs, SMMEs and businesses, including the nature of training, number of individuals/ entrepreneurs/ SMMEs/ businesses who received training, and the training provider.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a quarterly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-21: Operational phase implementation plan – Local economic development

LOCAL ECONOMIC DEVELOPMENT	
Context	In addition to the skills training and capacity building for the employees and service providers utilised by the proponent, the proponent has a social responsibility towards the communities in which it operates. Fulfilling this social responsibility will take place in conjunction with the Khai Ma Local Municipality and will be aligned with the municipality's Local Economic Development (LED) Strategy.
OPERATIONAL PHASE	
Objectives	The environmental objectives for LED are to:

LOCAL ECONOMIC DEVELOPMENT			
	• Create and strengthen skills among the residents in Aggeneys and surrounding towns; and • Assist the municipality to fulfil their LED objectives.		
Risk sources	The following risk sources have been identified: • No social responsibility from Orlight SA; • No contribution towards the local municipality's LED initiatives; and • Insufficient training and capacity building among residents in Aggeneys and surrounding towns.		
Potential impacts	The potential impacts on LED include: • Capacity building and skills training continuously undertaken during the operational phase of the project; and • Positively contributing to the local municipality's LED initiatives.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Capacity building and skills training opportunities will be identified in conjunction with the local municipality and will be aligned with the municipality's LED initiatives;	Orlight SA	Operation
	• Once a year, local residents and entrepreneurs, SMMEs and businesses will be given an opportunity to express interest in receiving training by registering with the proponent;	Orlight SA	Operation
	• Records will be kept of the training or capacity building provided, including the service provider, description of the training/ capacity building, date of training, names, ages and sex of beneficiaries or the name of SMME or local business; and	Orlight SA	Operation
	• The usefulness of the training and capacity building will be determined by means of a survey to be completed by as many of the beneficiaries as possible to establish how it has contributed to their income-generating ability. This survey will be administered twice; once six months after the completion of training, and once one year after the completion of training. The results of the surveys will inform decisions regarding future training.	Orlight SA	Operation
Performance indicators	The performance indicators are: • LED initiatives identified by the municipality are supported; • The proponent is able to provide records of training provided; and		

LOCAL ECONOMIC DEVELOPMENT	
	• Local residents are aware of training and capacity building embarked on by the proponent.
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a quarterly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.

6.4 Decommissioning phase

The overall objective of the decommissioning phase is to leave the project area in a condition that minimises adverse impacts on the socio-economic and biophysical environment, with a legacy that contributes to sustainable development.

6.4.1 Objectives

The objectives of the decommissioning phase of the proposed project are to:

- Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase;
- After the lease has expired and the project is in decommissioning phase, leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Return rehabilitated land-use to a standard that can be useful to the post-project land user, such as grazing;
- Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm water management systems;
- Comply with local regulatory requirements and international best practise;
- Maintain active partnerships with local communities; and
- Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

<u>The implementation plan for the decommissioning phase of the proposed Aggeneys Solar PV Power Plant is presented in the tables below.</u>

6.4.2 Approach to the decommissioning phase

It is recommended that planning of the decommissioning of the project and rehabilitation of the site take place at least two years prior to its decommissioning. Important factors that need to be taken into consideration are described below.

<u>Identification of structures for post-closure use</u>

All structures on site should be assessed in conjunction with the ultimate land users and authorities to determine which items could be used in future. Care should be taken when this assessment is undertaken to ensure that the infrastructure left behind will not become abandoned due to unsuccessful enterprises.

All infrastructure planned for removal and demolition will need to be assessed for their viable re-use or recycling opportunity. Structures destined for demolition or recycling need to be separated.

<u>Removal of infrastructure</u>

All infrastructure not destined for future use on the relevant property will be removed and/or demolished. Concrete and brick structures are to be demolished along with their associated concrete foundations. Inert demolished rubble must be removed from site and disposed of at a registered landfill site. All foundations must be removed to a depth of 1 m. Hard surfaced must be ripped to a depth of 1 m and vegetated.

confidential
Kilpatrick Archer
Actis
Mar 21, 2019 10:36

Landform re-creation

Successful replacement of topsoil starts with planning the final landform prior to construction. This will ensure that final rehabilitation costs are minimised as well as ensuring that the final landform accounts for free-draining areas and minimal slopes thereby minimising risks of erosion.

Soil amelioration

The steps that should be taken during the amelioration of soils are as follows:

- The deposited soils must be ripped to ensure reduced compaction;
- An acceptable seed bed should be produced by surface tillage;
- Restore soil fertility;
- Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
- Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

Establishment of vegetation

The objective is to restore the project site to a self-sustaining cycle i.e. to realise the re-establishment of the natural nutrient cycle with ecological succession initiated.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;
- Restore the land to the agreed land capability;
- Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
- Restore the biodiversity of the area as far as possible.

Maintenance

Established vegetation requires regular maintenance. If the growth medium consists of low-fertility soils, then regular application of plant food will be required until the natural fertility cycle has been restored. Annual fertiliser application should continue for three to five years.

Monitoring

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the progress of establishment of desired final ecosystems.

The following items should be monitored continuously:

- Depth of topsoil stripped and placed;
- Chemical, physical and biological status of replaced soil;
- Erosion status;
- Surface drainage systems and surface water quality;
- Vegetation basal cover;
- Vegetation species diversity; and
- Faunal re-colonisation.

Table 6-22: Decommissioning phase implementation plan – Surface water systems

<table>
<tr><th colspan="4">SURFACE WATER SYSTEMS</th></tr>
<tr><td>Context</td><td colspan="3">The project area is situated in the Lower Orange Water Management Area (WMA 14). An ephemeral river system and associated drainage lines were identified and delineated for the study area. The project area is not recognised as a FEPA and this sub-catchment is not considered to be an upper management area.
The project site is situated in an arid area which received very little rainfall, although flash floods are known to occur very infrequently.</td></tr>
<tr><th colspan="4">DECOMMISSIONING PHASE</th></tr>
<tr><td>Objectives</td><td colspan="3">The environmental objectives for surface water systems are:
• To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area;
• To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products;
• To reduce the site’s susceptibility to erosion during rainfall events or flash floods; and
• To restore a sustainable surface that will not be susceptible to erosion after project decommissioning.</td></tr>
<tr><td>Risk sources</td><td colspan="3">The following risk sources have been identified:
• Removal of infrastructure and ripping of compacted surfaces;
• Generation of demolitions wastes; and
• Machinery and vehicles used for decommissioning activities.</td></tr>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on surface water systems include:
• The removal of infrastructure will create bare surface which will be susceptible to erosion and could lead to increased sediment transport during surface flow events; and
• During surface flow events contaminants (i.e. waste products, effluents, hydrocarbons) stored on the construction site, may result in contamination of downstream water resources.</td></tr>
<tr><td rowspan="3">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>• The majority of decommissioning activities must be undertaken during the dry season;</td><td>Orlight SA</td><td>Pre-decommissioning</td></tr>
<tr><td>• A storm water management plan should be implemented during the decommissioning phase and until such a point as rehabilitation has been successfully completed;</td><td>Contractor</td><td>Decommissioning and post-closure</td></tr>
</table>

SURFACE WATER SYSTEMS			
	• Delineated drainage lines and buffer zones should be clearly delineated;	ECO	Pre-decommissioning
	• No activities may be allowed with the delineated drainage lines and buffer zones;	Contractor	Decommissioning
	• Site rehabilitation should be undertaken on a concurrent basis according to the rehabilitation plan to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Decommissioning
	• All waste products and demolition waste must be managed according to a waste management plan;	Contractor	Decommissioning
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Decommissioning
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels;	Contractor	Decommissioning
	• Spillage should be managed through an emergency spill response plan.	Contractor	Decommissioning
Performance indicators	The performance indicators are: • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • No visible evidence of hydrocarbon spills on site; • Vegetation has been successfully re-established; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.		

Table 6-23: Decommissioning phase implementation plan – Soils and agricultural potential

<table>
<tr><th colspan="4">SOILS AND AGRICULTURAL POTENTIAL</th></tr>
<tr><td>Context</td><td colspan="3">The sandy red soils covering the majority of the site at Aggeneys and partly infested with coarse fragments, implies susceptibility to water and wind erosion respectively, both of a moderate to high rating if no mitigation measures are in place. The fine particles in particular will be easily picked up by prevailing winds if exposed and not protected.</td></tr>
<tr><td colspan="4">DECOMMISSIONING PHASE</td></tr>
<tr><td>Objectives</td><td colspan="3">The environmental objectives for soils and agricultural potential are:
• To minimise loss of the soil resources to support existing land use and land capability;
• To minimise soil erosion by wind and water;
• To reduce the site’s susceptibility to erosion during flash floods;
• To minimise compaction of soils during site preparation activities, including soil handling, stockpiling and vehicle use; and
• To prevent soil contamination due to spillage of hydrocarbons or wastes.</td></tr>
<tr><td>Risk sources</td><td colspan="3">The following risk sources have been identified:
• Removal of infrastructure and ripping of compacted surfaces;
• Generation of demolitions wastes; and
• Machinery and vehicles used for decommissioning activities.</td></tr>
<tr><td>Potential impacts</td><td colspan="3">The potential impacts on soils and agricultural potential include:
• The removal of infrastructure will create bare surface which will be susceptible to erosion and could lead to increased sediment transport during surface flow events ;
• The very fine material in-between the fragments will be subjected to wind erosion where exposed;
• The fine-graded soils of southern part of the site will also be vulnerable to wind erosion when exposed after the removal of infrastructure and ripping;;
• Soil compaction of well sorted fine-graded sand and silty soils; and
• The potential for contaminating the soil due to spillage of hydrocarbons from vehicles and machinery, or improper waste management.</td></tr>
<tr><td rowspan="2">Management and mitigation actions</td><td>Actions</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>• The majority of decommissioning activities should be undertaken during the dry season;</td><td>Orlight SA</td><td>Project planning</td></tr>
</table>

SOILS AND AGRICULTURAL POTENTIAL			
	• Minimise activities on windy days. Temporary cessation of activities could be required during very windy periods;	Contractor	Construction
	• Minimise the period of exposure of soil surfaces through planning and immediate rehabilitation;	Contractor ECO	Project planning Construction
	• Where feasible, activities that are usually undertaken by machinery (i.e. applying fertiliser and seeding), should be replaced with manual labour;	Contractor	Construction
	• A storm water management plan should be maintained during the decommissioning phase;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• Where topsoil is partially removed, the soil surface can be loosened via tillage/ripping;	Contractor	Construction
	• Heavy vehicle movement over rehabilitated areas should be prevented;	Contractor	Construction
	• Traffic over project areas that have not been stripped of topsoil should be minimised;	Contractor	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• Vehicles should be serviced and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels;	Contractor	Construction
	• Spillage should be managed through an emergency spill response plan.	Contractor	Construction
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure;		

SOILS AND AGRICULTURAL POTENTIAL	
	• No visible evidence of sediment transport during surface flow events; • Vehicles are restricted to designated areas; • Topsoil in disturbed areas have been replaced and vegetation successfully restored; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.

Table 6-24: Decommissioning phase implementation plan – Ecological components

ECOLOGICAL COMPONENTS	
Context	In relation to the CBA and SKEP data, the Aggeneys study areas is of importance for the following habitat components. As far as vegetation is concerned the plains that occur on study area is of importance because of the presence of quartz gravel patches which are the preferred habitat for Lithops spp., or stone plants, demarcated as highly sensitive areas. In addition, the study area falls within an area that is imperative for maintenance of ecological processes that support amphibian biodiversity, is described as threatened (in terms of amphibian habitat) and one endemic amphibian species occurs in the area (SKEP, 2010). Because of all the reasons mentioned above the no-go areas of the drainage lines was delineated. As far as avifauna is concerned, the area is approximately 3 km away from an area that is described as a unique habitat for birds. As far as invertebrate sensitivity is concerned the area falls within an area that is a centre of endemism, a local centre of biodiversity and a unique habitat for insects. Furthermore, the study area falls within an area where eastern Bushmanland Quartz and Gravel patches are found. The site falls within CBA 2 (Near Natural landscapes) which means the ecosystems and species in it are largely intact and undisturbed. These are areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change.

ECOLOGICAL COMPONENTS			
	DECOMMISSIONING PHASE		
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the ephemeral river system and associated drainage lines; • To prevent direct impacts on other areas that were delineated as highly sensitive and unsuitable for development; • To minimise the footprint of disturbance during decommissioning; • To return as many as possible naturally occurring plant species to the site during rehabilitation; • To eradicate alien invasive and weed species from the project area; and • To achieve a sustainable land surface that can support ecological diversity and natural ecological succession during rehabilitation.		
Risk sources	The following risk sources have been identified: • Movement of vehicles outside the designated site into natural areas; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Soil erosion due to surface water flows from disturbed areas; • Alien invasive species.		
Potential impacts	The potential impacts on ecological components include: • Upon exposure of bare surface after demolition of infrastructure, it is likely that alien invasive and weed species will propagate on disturbed areas; and • Alien invasive species could out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and high ecologically sensitive areas should be demarcated and avoided at all costs;	Contractor	Decommissioning
	• No vegetation removal should be allowed outside the designated demolition footprint;	ECO Contractor	Decommissioning
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Decommissioning

ECOLOGICAL COMPONENTS			
	• An alien invasive and weed control programme should be implemented.	Contractor ECO	Decommissioning
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas; • Evidence of vegetation being re-established in disturbed areas; • No visible evidence of alien invasive species.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish; and • A flora survey of the project development footprint should be undertaken upon completion of rehabilitation to determine the success of rehabilitation efforts.		

Table 6-25: Decommissioning phase implementation plan – Waste

WASTE	
Context	The demolition of the power plants will generate solid, liquid and non-hazardous waste. The municipal waste management site may not have the capacity to accommodate waste generated by the project and therefore, a waste management contractor would have to be employed to remove waste to a registered landfill site. A large amount of recyclable materials will be produced upon decommissioning of the solar PV panels and infrastructure. The fixed structure is 100% made of galvanized steel and therefore it could be said that the 100% of the structure is recyclable. PV modules can be reused in either new PV modules or other new products. Industrial recycling processes exist for both thin-film and silicon modules. By recycling end-of-life modules, the PV industry enables the sustainable use of PV technology, furthering PVs ability to help meet the energy needs while protecting the environment.
DECOMMISSIONING PHASE	
Objectives	The environmental objectives for waste management are to:

WASTE			
	• Minimise waste generation; • Avoid spillages and contamination; • Reuse, reduce and recycle, where possible; • Recover material such as glass, aluminium, as well as a variety of semiconductor materials. Recycling benefits the environment by reducing the volume of waste and helps to reduce the amount of energy required to provide raw materials and therefore the costs and environmental impacts of producing PV modules.		
Risk sources	The following risk sources have been identified: • Spillage during handling of waste or damage containers; • Waste vectors (i.e. rodents and cockroaches); • Littering by construction workers.		
Potential impacts	The potential impacts from waste generation include: • Surface water contamination; • Soil contamination; • Ecological degradation; • Negative visual impacts; and • Nuisance, such as bad odours.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure construction waste is effectively contained, stored and managed on site;	Contractor	Decommissioning
	• Ensure waste bins (e.g. for organic waste) is sufficient vermin proof and weatherproof;	Contractor	Decommissioning
	• Ensure all rubble and waste rock are disposed of at a registered disposal sites;	Contractor	Decommissioning
	• Implement the “reduce, reuse and recycle” approach for all waste. This means that different bins need to be put in place to separate i.e. plastic, paper, glass and cans, where feasible;	Contractor	Decommissioning
	• Ensure all solid and hazardous waste is disposed of at a registered disposal sites; and	Contractor	Decommissioning
	• The ablution contractor needs to ensure that no spillage occurs when the toilets are cleaned or	Contractor	Decommissioning

WASTE			
	emptied and that a licensed service provider removes the contents from site.		
Performance indicators	The performance indicators are: • Evidence that waste is effectively contained, stored and managed on site; • No littering is visible on site; • Waste bins (e.g. for organic waste) has lids and is sufficient vermin proof and weatherproof; • Evidence that all solid waste, including rubble and waste rock, are removed and disposed of at a registered sites; • The “reduce, reuse and recycle” approach for all waste are being implemented by means of establishing separate bins for i.e. plastic, paper, glass and cans; and • There is no evidence of uncontrolled spillages or waste on site.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-26: Decommissioning phase implementation plan – Socio-economic environment

SOCIO-ECONOMIC ENVIRONMENT	
Context	It is likely that the proposed project will be decommissioned after an operational lifespan of 20 years, implying that 70 jobs will be lost at this time. Although this is an inevitable element of such projects, certain measures can be taken to minimise the adverse socio-economic impact this will have on the town of Aggeneys, its residents, service providers and project employees. Another source of potential adverse socio-economic impacts is the project infrastructure used for operational purposes. Depending on the manner this infrastructure will be dealt with upon decommissioning, it may hold positive impacts for the local community and municipality. Additionally, as with the construction phase, decommissioning will bring some temporary employment opportunities.
DECOMMISSIONING PHASE	
Objectives	The environmental objectives for socio-economic environment are: • Minimise the negative socio-economic impacts associated with decommissioning activities; and • Enhance positive socio-economic impacts associated with temporary job opportunities.
Risk sources	The following risk sources have been identified:

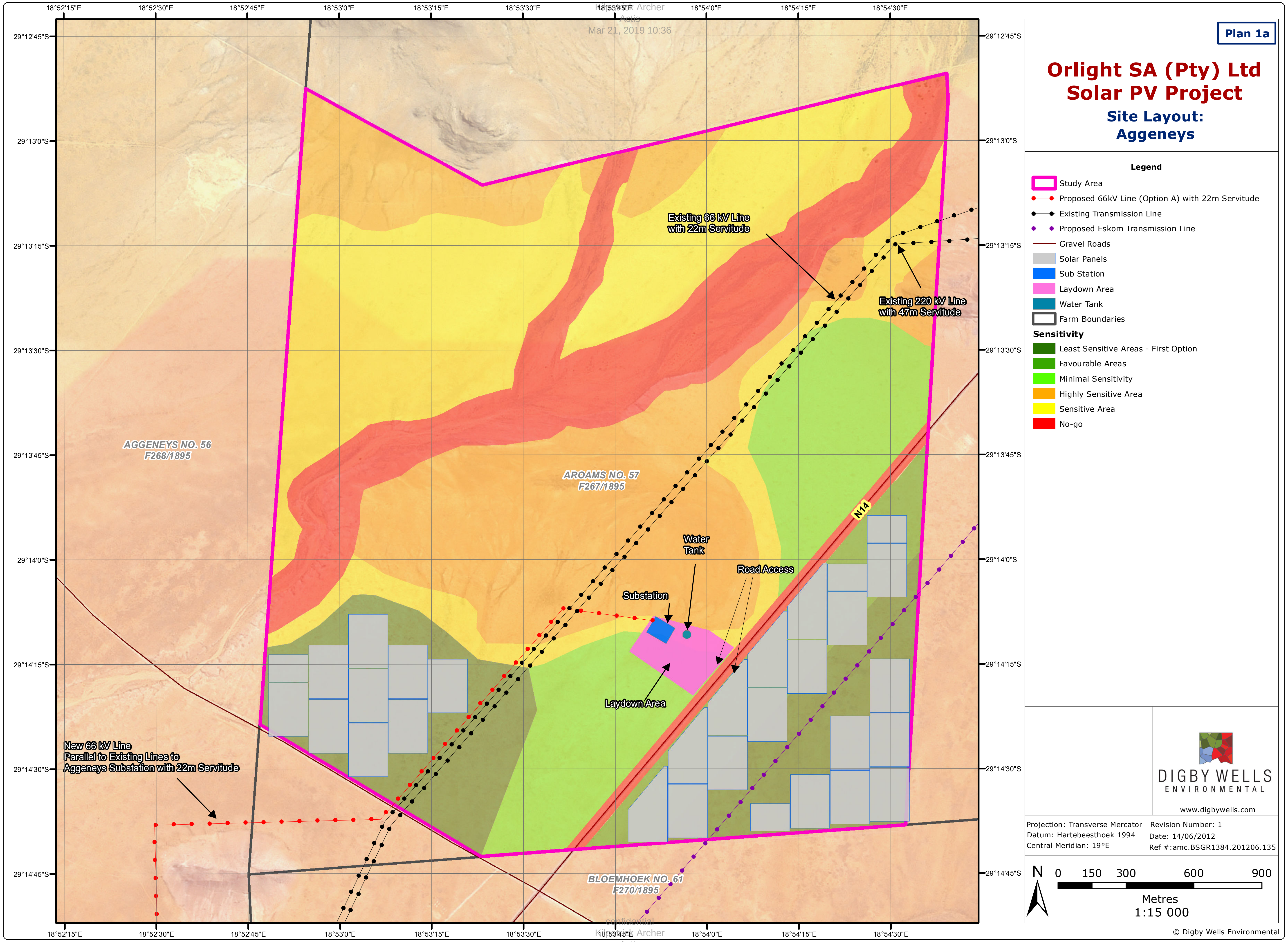
SOCIO-ECONOMIC ENVIRONMENT			
	• Inappropriate decommissioning of project infrastructure.		
Potential impacts	The potential impacts on the socio-economic environment include: • Job losses and associated adverse socio-economic impacts; • Invasion of operational infrastructure (offices) and associated negative socio-economic, health and safety impacts; and • Creation of temporary employment opportunities.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Retrenchment of project employees will be in line with the requirements of the South African Labour Legislation;	Orlight SA	Decommissioning
	• If the local municipality has a use for, and is able to maintain the project infrastructure (office, technical service buildings and laydown yard), this infrastructure will be donated to the municipality. If not, it will be dismantled within two weeks after operation has ceased;	Orlight SA	Decommissioning
	• A retraining programme should be initiated for employees that will be retrenched at least one year before cessation of the project;	Orlight SA	Decommissioning
	• At least 80% of the unskilled labour required for decommissioning activities will be sourced from Aggeneys and the surrounding towns; and	Orlight SA	Decommissioning
	• At least 20% of the unskilled labour positions required for decommissioning activities will be filled by women and previously disadvantaged individuals.	Orlight SA	Decommissioning
Performance indicators	The performance indicators are: • All retrenchments were aligned with the requirements of South African labour legislation; • The majority of unskilled job opportunities are awarded to local individuals (at least 80% from Aggeneys or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; and • Project infrastructure is not informally used for housing purposes.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

7 CONCLUSION

This draft EMP was based on the outcomes of the EIA process that was undertaken for the proposed development of the Aggeneys Solar PV Power Plant.

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level were systematically addressed in this EMP.

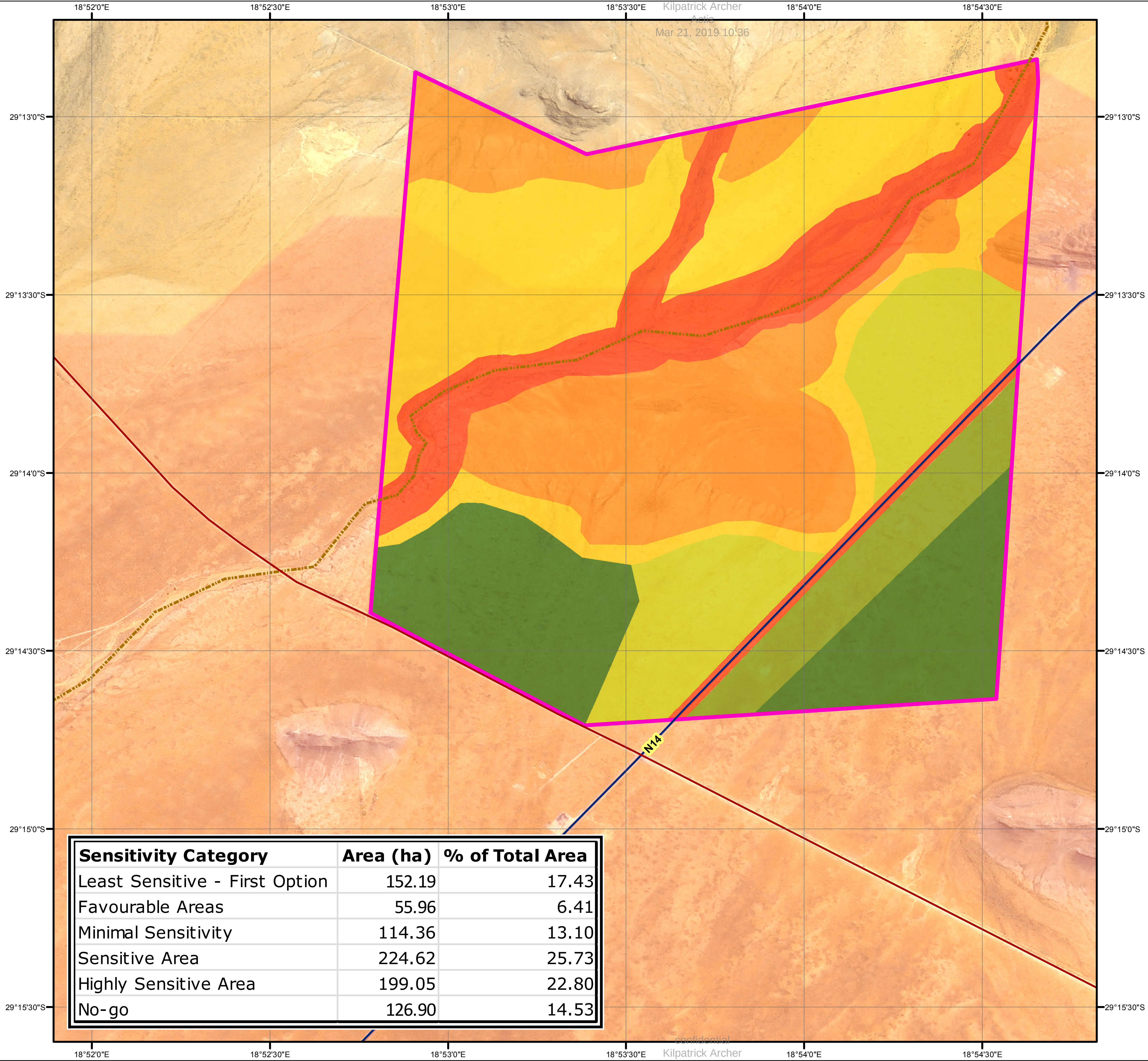
The EMP should be considered a dynamic document and will require updating and the inclusion of additional environmental specifications as and when required.


Plan 1a
Orlight SA (Pty) Ltd
Solar PV Project
Site Layout:
Aggeneys
Legend
Study Area
Proposed 66kV Line (Option A) with 22m Servitude
Existing Transmission Line
Proposed Eskom Transmission Line
Gravel Roads
Solar Panels
Sub Station
Laydown Area
Water Tank
Farm Boundaries
Sensitivity
Least Sensitive Areas - First Option
Favourable Areas
Minimal Sensitivity
Highly Sensitive Area
Sensitive Area
No-go
Existing 66 kV Line with 22m Servitude
Existing 220 kV Line with 47m Servitude
AGGENEYS NO. 56 F268/1895
AROAMS NO. 57 F267/1895
BLOEMHOEK NO. 61 F270/1895
N14
Water Tank
Road Access
Substation
Laydown Area
New 66 kV Line Parallel to Existing Lines to Aggeneys Substation with 22m Servitude
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E
Revision Number: 1
Date: 14/06/2012
Ref #:amc.BSGR1384.201206.135
N
0 150 300 600 900
Metres
1:15 000
© Digby Wells Environmental

Plan 2a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys Integrated Sensitivity Map



Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	152.19	17.43
Favourable Areas	55.96	6.41
Minimal Sensitivity	114.36	13.10
Sensitive Area	224.62	25.73
Highly Sensitive Area	199.05	22.80
No-go	126.90	14.53

Legend

- Study Area
- Minor Roads
- Main Road
- Dry river

Sensitivity Ratings

- Least Sensitive Areas - First Option
- Favourable Areas
- Minimal Sensitivity
- Sensitive Area
- Highly Sensitive Area
- No-go

NB: Area susceptible to erosion

ORLIGHTSA RENEWABLE ENERGY

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201202.065
Revision Number: 2
Date: 13/02/2012

N

0 0.25 0.5 1

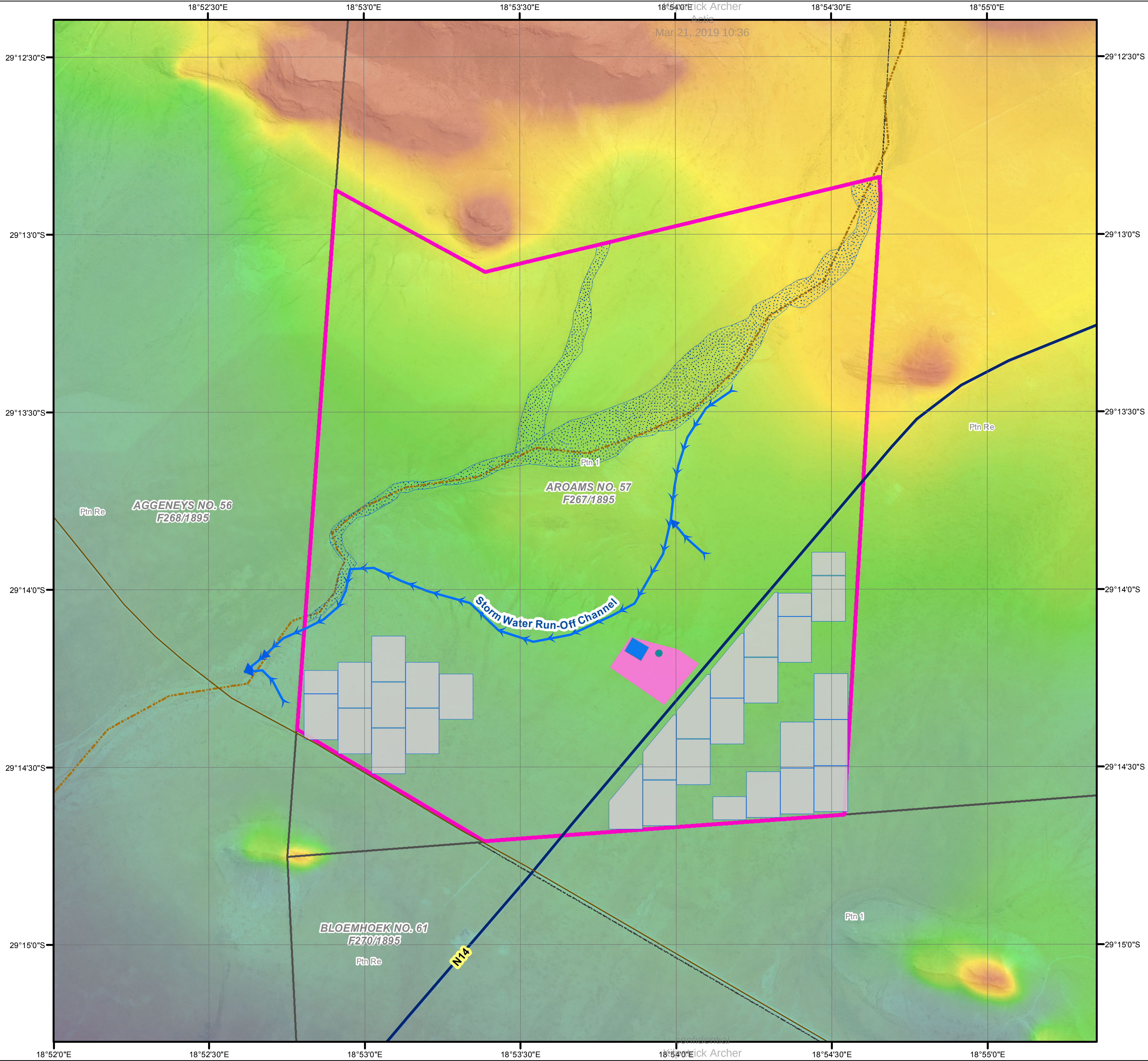
Kilometers

1:20 000

Plan 3a

Orlight SA (Pty) Ltd Solar PV Project

Aggeneys: Storm Water Management



Legend

- Study Area
- Storm Water Run-off Channel
- Main Roads
- National Roads
- Dry river
- Drainage Lines
- Solar Panels
- Sub Station
- Laydown Area
- Water Tank
- Farm Boundaries
- Farm Portions

Elevation (m.a.m.s.l)

High : 1131

Low : 857

DIGBY WELLS
ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E

Revision Number: 1
Date: 04/06/2012
Ref #:amc.BSGR1384.201206.010

N

0 0.25 0.5 1
Kilometers
1:20 000

Appendix L: EIA Methodology

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

ORLIGHT SA (PTY) LTD

PROPOSED SOLAR PV POWER PLANTS

1 INTRODUCTION

In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though Digby Wells and the majority of environmental impact assessment practitioners propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to the each factor of a potential impact and the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, Interested and Affected Parties (I&APs) and authorities who provide input into the process.

It is for this reason that it is crucial that all Environmental Impact Assessments (EIAs) make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. It is not the purpose of the EIA process to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defendable methodology of rating the relative significance of impacts within a specific context.

The methodology employed for the EIA is divided into two distinct phases, namely impact identification and impact assessment.

1.1 Impact identification

Impact identification is performed by use of an input and output model, which serves to guide the assessor in assessing all the potential instances of ecological and socio-economic change, pollution and resource consumption that may be associated with the activities required during the construction, operational, closure and post-closure phases of the project.

Outputs may generally be described as any changes to the biophysical and socio-economic environments, both positive and negative in nature, and also include the product and waste produced by the activity. During the determination of outputs, the effect of outputs on the various components of the environment (e.g. topography, water quality, etc.) is considered.

During consultation with I&APs, perceived impacts were identified. These perceived impacts will become part of the impact assessment and significance rating in order to differentiate between probable impacts and perceived impacts.

1.2 Impact rating

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the input and output model. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where *Consequence = Severity + Spatial Scale + Duration*

And *Probability = Likelihood of an impact occurring*

The severity, spatial scale, duration and probability of an impact occurring are assigned a rating out of seven as indicated in Table 1-1. The matrix calculates an overall significance rating out of 147. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP.

The significance of an impact is determined by reference the significance rating to the probability consequence matrix shown in Table 1-2 after which it is categorised into one of four categories, as indicated in Table 1-3.

Table 1-1: Impact assessment parameter ratings

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	International The effect will occur across international borders.	Permanent without mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/definite The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	National Will affect the entire country.	Permanent with mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Provincial/regional Will affect the entire province or region.	Project life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Municipal area Will affect the whole municipal area.	Long term 6 to 15 years.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	On-going social issues. Damage to items of cultural significance.	Local Local extending only as far as the development site area.	Medium term 1 to 5 years.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with or without help of external consultants.	Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year,	Rare or improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
		affected.			occurring is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance. Will have no impact on the environment.	Low-level repairable damage to commonplace structures.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely Expected never to happen.

Table 1-2: Probability consequence matrix

Significance	Consequence (severity + scale + duration)								
Probability / Likelihood	1	3	5	7	9	11	15	18	21
1	1	3	5	7	9	11	15	18	21
2	2	6	10	14	18	22	30	36	42
3	3	9	15	21	27	33	45	54	63
4	4	12	20	28	36	44	60	72	84
5	5	15	25	35	45	55	75	90	105
6	6	18	30	42	54	66	90	108	126
7	7	21	35	49	63	77	105	126	147

Table 1-3: Significance summary table

High	108- 147	
Medium-High	73 - 107	
Medium-Low	36 - 72	
Low	0 - 35	