GEOHYDROLOGY

GEOTECHNICAL

ENVIRONMENTAL

SOCIAL DEVELOPMENT

Final EIA Report **14/12/16/3/3/2/929**

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON THE FARM GROOTVLEI 296, BARKLEY WEST, KGATELOPELE LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Short name: MANLENOX EXPANSION SOLAR PARK

November 2016

Commissioned by: Manlenox (Pty) Ltd

Document version 2.0 – Final

AGES

Purpose with Passion

Proudly Supporting

TOUCHING AFRICA

Final EIA Report: **14/12/16/3/3/2/929**

Prepared by

AGES

Purpose with Passion

Final EIA Report: **14/12/16/3/3/2/929**

Proposed Renewable Energy Generation Project on the Farm Grootvlei 296, Barkley West RD, Kgatelopele Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province
Short name: Manlenox Expansion Solar Park

November 2016

PROJECT APPLICANT

Company name:	**Manlenox (Pty) Ltd**
Contact Person:	Ms Izel van Rooy (PlanWize)
Physical Address:	4th Floor Aloe Grove, Houghton Estate Office Park, 2 Osborn Road, Houghton 2198, South Africa
Postal Address:	P.O. Box 225, Highlands North 2037, South Africa
Telephone Number:	+27 (0) 14 772 1758
Fax Number:	+27 (0) 14 772 1758
E-mail:	planwize@telkomsa.net

ENVIRONMENTAL ASSESSMENT PRACTITIONER

Company Name:	AGES Limpopo (Pty) Ltd (Reg. No: 2006/020831/07)
Contact Persons:	Mr. Johan Botha / Ms. Engela Grobler
Physical Address:	120 Marshall Street, Polokwane, 0699, South Africa
Postal Address:	P.O. Box 2526, Polokwane, 0700, South Africa
Telephone Number:	+27 (83) 557 6494 / +27 0(15) 291 1577
Fax Number:	+27 (15) 291 1577
E-mail:	**jbotha@ages-group.com/egrobler@ages-group.com**

AGES (Pty) Ltd
J. H. Botha (Senior Environmental Scientist – M. Sc. Environmental Management (**Pri Sci Nat)**
E. Grobler (Environmental Scientist – M. Sc. Environmental Management (Univ of Stellenbosch)

Although AGES (Pty) Ltd exercises due care and diligence in rendering services and preparing documents, AGES (Pty) Ltd accepts no liability, and the client, by receiving this document, indemnifies AGES (Pty) Ltd and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by AGES (Pty) Ltd and by the use of the information contained in this document.

REPORT DISTRIBUTION LIST

Name	Institution
Ms. Izel van Rooy	Manlenox (Pty) Ltd
Ms. Nonhlanhla Mkhwanazi	Department of Environmental Affairs (DEA) (2 copies)
Mr. S Lekota	DEA: Directorate Biodiversity Conservation
Chief Director: Northern Cape Provincial Office	Department of Water Affairs – Lower Orange WMA
Ms. M Marubini	Department of Agriculture, Forestry & Fisheries (DAFF)
Mr. Mothibi	Department of Agriculture, Land Reform & Rural Development
Head of Department	Northern Cape Department of Environment and Nature Conservation (DENC)
Municipal Manager	Kgatelopele Local Municipality
Municipal Manager	ZF Mgcawu District Municipality
Ms. N. Nongauza Mr. J Geeringh. Ms. A van Gensen	Eskom
Dr.Sita	Department of Science and Technology (DST)
Dr. P Lochner	Council for Scientific and Industrial Research (CSIR)
Dr Adrian Tiplady	Square Kilometre Array (SKA)
	Registered Interested and Affected Parties

DOCUMENT HISTORY

Report No	Date	Version	Status
14/12/16/3/3/2/929	September 2016	1.0	Draft
14/12/16/3/3/2/929	November 2016	1.0	Final

PROJECT MAIN FEATURES

Project main features - according to the EIA guidelines
Summary of information included in the report

General site information

Site location	
Farm	**GROOTVLEI 296**
Portion	**Portion 0**
Registration Division	**BARKLY WES**
Surveyor-general 21 digit site	C00700000000029600000
Local Municipality	Kgatelopele
District Municipality	ZF Mgcawu
Province	Northern Cape

Property details	
Extent	2720.5654 ha
Land Owner	AUSTIN PETER EDWARD
Diagram deed number	GWQ20/40
Title deed number	T206/1999
Registration date	19990208
Current land use	farming

Site data	
Latitude - Alternative location 1	28° 20' 10" S
Longitude - Alternative location 1	23° 48' 05" E
Latitude - Alternative location 2 (preferred)	28° 20' 55" S
Longitude - Alternative location 2 (preferred)	23° 47' 12" E
Altitude	1410 m a.m.s.l.
Ground slope	flat

Adjacent farm portions	
Farm **Portion** Surveyor-general 21-digit site Land Owner Diagram deed number Title deed number Registration date Extent Current land use	**PERDEVLEI 295 (BARKLY WES R.D.)** **0** C00700000000029500000 T J Cloete GWQ18/63 2157.9938 ha farming
Farm **Portion** Surveyor-general 21-digit site Land Owner Diagram deed number Title deed number Registration date Extent Current land use	**268 (BARKLY WES R.D.)** **1** C00700000000026800001 I A J Van Niekerk T20789/1929 T40/1982 19820114 1049.2842 ha farming

Farm	**269 (BARKLY WES R.D.)**
Portion	**1**
Surveyor-general 21-digit site	C00700000000026900001
Land Owner	NIEUWOUDT GERT JOHANNES HERMIAS WILHELMUS
Diagram deed number	T20496/1929
Title deed number	T2155/1997
Registration date	19961015
Extent	1027.8384 ha
Current land use	Farming and tourism
Farm	**297 (BARKLY WES R.D.)**
Portion	**0**
Surveyor-general 21-digit site	C00700000000029700000
Land Owner	JANSEN JAN PAUL DE VILLIERS/A JANSEN
Diagram deed number	GWQ20/39
Title deed number	T1272/1983
Registration date	19830927
Extent	1583.1384 ha
Current land use	farming
Farm	**297 (BARKLY WES R.D.)**
Portion	**1**
Surveyor-general 21-digit site	C00700000000029700001
Land Owner	WILLIAMS RETHA
Diagram deed number	T466/1955
Title deed number	T1664/1990
Registration date	19900926
Extent	1583.1434 ha
Current land use	farming
Farm	**PADDAFONTEIN 508 (BARKLY WES R.D.)**
Portion	**0**
Surveyor-general 21-digit site	C00700000000050800000
Land Owner	STEENKAMP PHILLIPUS CHRISTOFFEL
Diagram deed number	GWQ12/67
Title deed number	T1663/1990
Registration date	19900926
Extent	2699.4362 ha
Current land use	farming
Farm	**GROENVLEI 509 (BARKLY WES R.D.)**
Portion	**0**
Surveyor-general 21-digit site	C00700000000050900000
Land Owner	STEENKAMP PHILLIPUS CHRISTOFFEL
Diagram deed number	GWQ18/29
Title deed number	T133/2004
Registration date	20030806
Extent	1284.7980 ha
Current land use	farming
Farm	**GROENVLEI 509 (BARKLY WES R.D.)**
Portion	**1**
Surveyor-general 21-digit site	C00700000000050900001
Land Owner	LANGSTRAND FAMILIE TRUST
Diagram deed number	T826/1962
Title deed number	T3195/2005

Registration date	20050729
Extent	725.3345 ha
Current land use	farming

PV power plant design specifications and connection to the Eskom grid

Project data	
Project name	**MANLENOX EXPANSION SOLAR PARK**
Technology	**Photovoltaic power plant**
Number of Phases	**1**
Maximum generating capacity at the delivery point	**up to 120 MW**
Type of PV modules	Thin-film or Mono/Polycrystalline
Type of mounting system	fixed or horizontal single-axis trackers (SAT)
Average annual energy production (up to)(*)	up to 160GWh/year with fixed mounting system up to 190GWh/year with trackers
Load factor (*)	0.223 with fixed mounting system 0.251 with trackers
Full net equivalent hours (EOH) (*)	1950h/year (Wh/Wp/y) with fixed mounting systems 2200 h/year (Wh/Wp/y) with trackers
(*) calculated by PVSYST, simulation professional tool	

Technical specifications	
Installed power capacity - AC side	**up to 120 MW**
Installed power capacity - DC side	**up to 86.25 MWp**
Number of PV modules	up to 638,900 thin film modules of 135 Wp up to 287,500 mono/polycrystalline modules of 300 Wp
Number of structures (PV arrays)	up to 24,570 fixed structures up to 15,130 1-axis horizontal trackers (SAT)
Minimum structure height above ground level	1.0 m
Maximum structure height above ground level	3.1 m

Other information	
Fenced area	up to 250 ha
Footprint	up to 250 ha
PV power plant lifetime	25 - 30 years
Construction camp (temporary)	10 ha
Construction timeframe	up to 15 months

Connection to the Eskom grid

The connection to the Eskom grid will be done according to the Eskom connection solution which entails:

(i) one small on-site high voltage substation with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid, a control building and one busbar with metering and protection devices (also called "switching station");

(ii) two new small sections of high-voltage power line allowing the **Eskom "SILVERSTREAMS-ULCO" 132 kV power line** - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site loop-in loop-out substation.

The connection solution may also entail intervention on the Eskom grid.

Water requirements	
Water consumptions	See paragraph 4.2.5 - water requirements

Site maps and GIS information

Status quo information - site	ESRI shape files
Site	Farm Grootvlei 296 (project site)
Building and other structures	farm lodge
Agricultural field	Not applicable
Natural and endangered vegetation areas	vegetation and sensitivity map
Cultural historical sites and elements	Not applicable
Contours with height references	1_m contours
Slope analysis	1_m contours, land use map
High potential agricultural areas	Not applicable
Eskom's substation(s) / power line(s)	Eskom SILVERSTREAMS-ULCO 132kV power line Eskom OLIEN-ULCO 132kV power line Eskom BOUNDARY-OLIEN_1 275kV power line Eskom BOUNDARY-OLIEN_2 275kV power line

Development proposal maps	ESRI shape files
Project site	Farm Grootvlei 296 (project site)
Access road and internal roads	secondary road from R31, secondary road from R385, internal roads
Position of solar facilities	PV arrays
Permanent laydown area footprint	footprint (fenced area)
Construction period laydown footprint	construction camp area
River, stream, water crossing	Not applicable
Substation and transformers	HV loop-in loop-out substation
Connection routes	new sections of HV lines
Buildings	MV stations, HV loop-in loop-out substation, control building, warehouse
Other features	Vegetation buffer zone; fire breakers

Annexures

Layout and technical drawings of the PV Power Plant and of the connection infrastructure	Annexure A
Photos of the project site	Annexure B
Public Participation Process	Annexure C
Ecological Impact Assessment	Annexure D
Avifauna Impact Assessment	Annexure E
Agricultural Potential Assessment	Annexure F
Wetland Delineation Study	Annexure G
Archaeological Impact Assessment and Palaeontological assessment	Annexure H
Geo-technical and Geo-Hydrological Report	Annexure I
Visual Impact Assessment	Annexure J
Socio-economic Impact Assessment	Annexure K
Services Report	Annexure L
Draft Environmental Management Programme	Annexure M
EAP details and CV	Annexure N

TABLE OF CONTENTS

1. INTRODUCTION 1
2. Motivation and Rationale of the MANLENOX EXPANSION solar park in light of the IPp PROCURMENT ..... ProgramME requirements 3
2.1. THE CHOICE OF THE NORTHERN CAPE PROVINCE AND OF THE SITE LOCATION 3
2.2. NEED AND DESIRABILITY OF THE PROPOSED PROJECT 3
3. Authorities, LEGAL CONTEXT AND ADMINISTRATIVE REQUIREMENTS 6
3.1. REGULATORY AUTHORITIES 6
3.1.1. National Authorities 6
3.1.2. Provincial Authorities 6
3.1.3. Local Authorities 6
3.2. LEGISLATION, REgulations and Guidelines 7
3.4. LISTED ACTIVITIES IN TERMS OF NEMA 10
4. PROJECT DESCRIPTION AND FUNCTIONING 12
4.1. PROJECT LAYOUT 13
4.2. PRIMARY COMPONENTS 16
4.2.1. Project functioning and connection of the solar park to the Eskom grid 17
4.2.2. Access road and internal roads 20
4.2.3. Lighting system 20
4.2.4. Stormwater collection system 20
4.2.5. Water requirements 21
4.2.5.1. Water requirements during the construction phase 21
4.2.5.2. Water requirements during the operational phase 22
4.2.5.3. Water provision during construction and operation 23
4.2.6. Sewerage 23
4.2.8. Refuse removal 24
4.3. CONSTRUCTION SITE 24
4.3.1. Phase I 24
4.3.2. Phase II 24
4.3.3. Phase III 24
4.3.4. Phase IV 25
4.3.5. Earthworks 25
4.4. TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT 26
4.4.1. Traffic impact – construction phase 26
4.4.3. Traffic impact – operation phase 27
4.5. MANAGEMENT OF THE SOLAR PARK DURING OPERATION 27
5. PROJECT ALTERNATIVES 28
5.1. SITE ALTERNATIVES 28
5.2. TECHNOLOGY ALTERNATIVES 31
5.2.1. PV Plant and Solar Thermal Power Plant 31
5.2.2. Solar Photovoltaic Technology – PV 31
5.2.3. Alternatives for the Mounting System of the PV Modules 31
5.3. LAYOUT DESIGN, LOCATION AND CONNECTION ALTERNATIVES 32
5.3.1. Layout design and Location alternatives 32
5.3.2. Connection alternatives 32
5.4. NO-GO ALTERNATIVE 34
6. STATUS QUO OF THE RECEIVING ENVIRONMENT 35
6.1. PROPERTY DESCRIPTION AND CURRENT LAND USE 35
6.2. ENVIRONMENTAL FEATURES 35
6.2.1. Climate 35
6.2.2. Topography 35
6.2.3. Soils and geology 36
6.2.4. Geo-hydrology 36
6.2.4.1. Boreholes, groundwater availability and quality on the project site 37
6.2.5. Ecology (fauna and flora) 37
6.2.5.1. Vegetation types 37
6.2.5.2. Fauna 38
6.2.5.3. Summary and results of the Ecological Impact Assessment 38
6.2.6. Avifauna 39
6.2.7. Visual 40
6.3. SOCIO-ECONOMIC ENVIRONMENT 40
6.4. AGRICULTURAL POTENTIAL 41
6.5. CULTURAL AND HERITAGE RESOURCES 41
7. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS AND PUBLIC PARTICIPATION PROCESS (PPP) 45
7.1. SCOPING PHASE 45
7.2. EIA PHASE 45

7.3. PUBLIC PARTICIPATION PROCESS (PPP) 46
7.3.1. Further steps in Public Participation Process 46
7.3.2. Results of the public participation process 47
7.3.2.1. Comments from DEA - Biodiversity 47
7.3.2.2. Comments from DENC 48
8. METODOLOGY USED FOR THE IDENTIFICATION AND ASSESSMENT OF THE IMPACTS 50
8.1. PROJECT PHASING 50
8.2. ASSESSMENT CRITERIA 50
9. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES 53
9.1. POTENTIAL IMPACTS 53
9.2. CUMULATIVE IMPACTS 53
9.3. SPECIALIST STUDIES 54
9.4. IMPACTS & MITIGATION MEASURES 54
9.4.1. Construction & operational phases impacts and mitigation measures 54
9.4.1.1. Atmospheric pollution and noise 54
9.4.1.2. Groundwater and surface water pollution 56
9.4.1.3. Water use / water quantity 58
9.4.1.4. Land and soils 59
9.4.1.5. Archaeological, Cultural and Social Features 61
9.4.1.6. Impact of the development on the ecology (fauna & flora) of the area 62
9.4.1.7. Visual impacts 65
9.4.1.8. Safety, security and fire hazards 66
9.4.1.9. Socio-economic impact 67
9.6. POTENTIALLY SIGNIFICANT IMPACTS 68
9.6.1. Cumulative impacts 68
9.6.2. Nature of impact 68
9.6.3. Extent and duration of impact 68
9.6.4. Probability of occurrence 68
9.6.5. Degree to which impact can be reversed 69
9.6.6. Degree to which impact can cause irreplaceable loss of resource 69
9.6.7. Degree to which impact can be mitigated 69
10. DECOMMISSIONING PHASE 70
10.1. SITE PREPARATION 70
10.2. DISASSEMBLE AND REPLACEMENT OF EXISTING COMPONENTS 70
10.3. RESTORATION OF THE SITE 70
10.4. ALTERNATIVE OPTION: UPGRADING THE SOLAR PARK 70
11. CONCLUSIONS AND RECOMMENDATIONS 71

LIST OF FIGURES

Figure 1: Locality map of the project site and study area for EIA 5
Figure 2: Alternative Layout plan1 - Manlenox Expansion Solar Park Figure 3: Alternative Layout plan1 - Manlenox Expansion Solar Park 14
Figure 3: Lateral views of PV arrays mounted on fixed mounting systems 17
Figure 4: Frontal view of PV arrays mounted on fixed mounting systems 18
Figure 5: Simulation views of the PV arrays mounted on 1-axis horizontal tracker 18
Figure 6: Frontal views of the PV arrays mounted on 1-axis horizontal tracker 19
Figure 7: Location of the alternative sites 29
Figure 8: Location of the alternative development sites on Grootvlei 296 30
Figure 9: Sensitivity Map 33
Figure 10: Vegetation Map of the project site 43
Figure 11: Sensitivity Map of the project site 44

LIST OF TABLES

Table 1: Review of relevant legislation 7
Table 2: Listed Activities in terms of sections 24 and 24D of NEMA potentially involved in the proposed development. 10
Table 3: Water consumption during the construction phase of the project 21
Table 4: Water consumption during the operational phase of the project 22
Table 5: Construction timeframe: average daily trips of medium - heavy vehicles 26
Table 6: Impact Assessment Criteria 51

LIST OF ANNEXURES

Annexure A Layout and technical drawings of the PV Power Plant and of the connection infrastructure:

- MN12SP_00.1_r0 Locality Map and Study Area for EIA
- MN12SP_00_r3 Locality Map
- MN12SP_01_r3 Site_1 Lay out Plan
- MN12SP_02_r3 Site_2 Lay out Plan
- MN12SP_03.1_r0 Mounting System – trackers
- MN12SP_03.2_r0 Mounting System – fixed
- MN12SP_05_ Control building and medium-voltage receiving station - site 1
- MN12SP_06_ Control building and medium-voltage receiving station - site 2
- MN12SP_07_r0 On-site high-voltage substation – Site 1
- MN12SP_08_r0 On-site high-voltage substation – Site 2
- MN12SP_09_r0 Warehouse 1_2
- MN12SP_09_r0 Warehouse 2_2
- Sensitivity Map

Annexure B Photos of the project site

Annexure C Public Participation Process

Annexure D Ecological Impact Assessment

Annexure E Avifauna Impact Assessment

Annexure F Agricultural Potential Assessment

Annexure G Wetland & Riparian Delineation Report

Annexure H1 Heritage Impact Assessment

Annexure H2 – Palaeontological Impact Assessment

Annexure I Geo-technical and Geo-Hydrological Report

Annexure J Visual Impact Assessment

Annexure K Socio-economic Impact Assessment

Annexure L Services Report

Annexure M Draft Environmental Management Programme

Annexure M1 Rehabilitation and Revegetation Plan

Annexure M2 Alien Invasive Management Plan

Annexure M3 Rescue and Protection Plan

Annexure N EAP details, and CV

ABBREVIATIONS AND ACRONYMS

AGES	Africa Geo-Environmental and Engineering Consultants (Pty) Ltd
BID	Background Information Document
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Concentrating Solar Power
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DENC	Northern Cape Department of Environment and Nature Conservation
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environment Impact Assessment Report
EMP	Environmental Management Plan
ESS	Environmental Scoping Study
FIT	Feed in Tariffs
GHG	Green House Gases
GIS	Geographic Information Systems
GN	Government Notice
GWh	Giga Watt hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
kV	kilovolt
MW	Mega Watt
MWp	Mega Watt peak
Manlenox Expansion	Manlenox (Pty) Ltd (applicant)
NEMA	National Environmental Management Act - Act no. 107 of 1998
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act - Act no. 25 of 1999
NWA	National Water Act - Act no. 36 of 1998
PoS	Plan of Study
Property	Farm Grootvlei 296
Project	Manlenox Expansion Solar Park
Project company	Manlenox (Pty) Ltd (applicant)
Project site	Farm Grootvlei 296, Barkley West RD
PV	Photovoltaic
REFIT	Renewable Energy Feed-in Tariffs
RFP	Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SANS	South African National Standard
UPS	Uninterruptible Power Supply

1. INTRODUCTION

Manlenox (Pty) Ltd (Reg. n. 2012/016629/07) is proposing the development of a **renewable solar energy facility** (with associated infrastructure and structures) in a key strategic location in terms of the connection to the Eskom grid and in terms of the favourable solar irradiation.

The proposed site is located on the north-eastern side of the **Farm Grootvlei 296, Barkly West Registration Division (Kgatelopele Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province),** for the establishment of a solar energy facility with associated infrastructure and structures.

Site location: Farm Grootvlei 296 Surveyor-general 21-digit site code:

C	0	0	7	0	0	0	0	0	0	0	0	0	2	9	6	0	0	0	0	0

The project is called MANLENOX EXPANSION SOLAR PARK and it entails the establishment of a Photovoltaic (PV) Power Plant having a maximum generation capacity of 120 MW on a development footprint of 250 ha.

The farm Grootvlei 296 is 2 720.56 ha in size.

The PV power plant will have a **footprint up to 250 ha**, to be located on the northern side of the Farm Grootvlei 296. Previously, environmental authorisation was obtained for the development of a PV solar plant on Grootvlei 296. This was for a 60 MW solar plant on 170 ha and the DEA Reference no.: 14/12/16/3/3/2/453. A new application was submitted to the DEA and the project has been registered with the **DEA application reference number 14/12/16/3/3/2/929.**

Manlenox Expansion Solar Park will participate in the Renewable Energy Independent Power Producer (REIPP) Procurement Programme, issued on 3 August 2011 by Department of Energy (DoE).

In order to develop the facility, Manlenox Expansion must conduct an Environmental Impact Assessment (EIA) and acquire environmental authorization from the National Department of Environmental Affairs (DEA), in consultation with the **Northern Cape Department of Environment and Nature Conservation (DENC)**, in terms of the EIA Regulations (2014) published in terms of Section 24(2) and 24D of the National Environmental Management Act (NEMA, Act No. 107 of 1998).

The Manlenox Expansion Solar Park will deliver the electrical energy to the **Eskom's "SILVERSTREAMS-ULCO" 132 kV power line**, crossing the project site (**preferred connection solution**). The Eskom's 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation, via two new sections of 132 kV line approximately 100 m long.

As **alternative connection solution**, the Manlenox Expansion Solar Park may be connected to the Eskom's "BOUNDARY-OLIEN 1" 275 kV power line or to the Eskom's "BOUNDARY-OLIEN 2" 275 kV power line, crossing the southern side of the project site. However, this is not the preferred connection.

The EIA procedure of the Manlenox Expansion Solar Park **includes the connection to the Eskom grid.** Eskom is the entity which assesses the connection solution included and described in this EIA Report. Eskom also coordinated the necessary liaising between the developer, Eskom Transmission, Eskom Distribution and Eskom Land & Rights Department.

All or part of the infrastructure required for the connection (all located inside the site) may be owned and/or operated by Eskom Distribution, this will depend on the Eskom grid code in relation to the IPPs (Independent Power Producers) and on the Connection Agreement to be finalized prior to or simultaneously with the conclusion of the PPA (Power Purchase Agreement) in respect of the options of retaining ownership of the connection works once completed.

The independent Environmental Assessment Practitioners (EAPs) which have been appointed for the undertaking of the detailed environmental studies in compliance with the 2014 EIA Regulations are **AGES (Pty) Ltd.**

With the aim of identifying and assessing all potential environmental impacts related to the development as well as suggesting possible mitigation measures and alternatives, AGES has appointed specialist sub-consultants to compile detailed reports and to study the activities necessary for the assessment of the specific impacts related to their field of expertise.

AGES and the other specialist consultants are in a position of independency from Manlenox (Pty) Ltd; therefore, they are not subsidiaries or affiliated to the latter. AGES and the specialist consultants have no secondary interest connected with the development of this project or of other projects which may originate from the authorization of the project.

The characteristics, the technology and the extent of the Manlenox Expansion Solar Park are defined and evaluated in this Final EIA Report and its annexures.

.

2. MOTIVATION AND RATIONALE OF THE MANLENOX EXPANSION SOLAR PARK IN LIGHT OF THE IPP PROCURMENT PROGRAMME REQUIREMENTS

2.1. THE CHOICE OF THE NORTHERN CAPE PROVINCE AND OF THE SITE LOCATION

The Manlenox Expansion Solar Park will be in the Northern Cape Province. The Northern Cape Province has been identified by Manlenox (Pty) Ltd as an ideal macro area for establishing a solar PV plant based on several important considerations:

- solar resource is exceptionally high: the **global horizontal irradiation** of the site is 2,140 kWh/m^2/year;
- there are several green projects currently under development in the Northern Cape, because of the high solar resources and the availability of desolate lands with low ecological and agricultural value;
- Northern Cape Province and the local municipalities and communities are eager to start establishing an eco-green image in consideration of the burden of CO_2 emissions they have to bear.

In addition to these very favourable characters in terms of desirability of renewable solar energy projects in the Northern Cape Province, the site of the Manlenox Expansion Solar Park has been chosen by Manlenox (Pty) Ltd on the grounds of several considerations, in particular:

- the availability of an easy connection solution, due to the presence of two parallel Eskom 132 kV power lines, called "OLIEN-ULCO" and “SILVERSTREAMS-ULCO”, which cross the northern side of the project site;
- the flatness of the proposed project site;
- the low ecological sensitivity and agricultural value of the proposed project site.

With specific reference to the Manlenox Expansion Solar Park, Eskom has indicated that the project does not interfere with Eskom’s present and future developments and do not negatively affect the voltage in the area. Eskom, as an interested and affected party, recognized the positive outcome of the project in terms of the possibility of meeting the local growth of the energy consumption that is expected.

2.2. NEED AND DESIRABILITY OF THE PROPOSED PROJECT

South Africa currently relies principally on fossil fuels (coal and oil) for the generation of electricity. At the present date, Eskom generates approximately 95% of the electricity used in South Africa. On the other hand, South Africa has a largely unexploited potential in renewable energy resources such as solar, wind, biomass and hydro-electricity to produce electricity as opposed to other energy types (fuel or coal).
South Africa’s electricity supply still heavily relies upon coal power plants, whereas the current number of renewable energy power plants is very limited. In the last few years, the demand for electricity in South Africa has been growing at a rate approximately 3% per annum.

These factors, if coupled with the rapid advancement in community development, have determined the growing consciousness of the significance of environmental impacts, climate change and the need for sustainable development. The use of renewable energy technologies is a sustainable way in which to meet future energy requirements. The development of clean, green and renewable energy has been qualified as a priority by the Government of South Africa with a target goal for 2013 of 10,000 GWh, as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol.Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa’s 20-year electricity plan, called Integrated Resources Plan 2010-2030 (**IRP 2010**).

The IRP1 (2009) and the IRP 2010 (2011) outline the Government’s vision, policy and strategy in matter of the use of energy resources and the status of energy policies in South Africa. The IRP

2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.

In order to achieve this goal, the DoE recently announced a renewable energy IPP (Independent Power Producers) Procurement Programme. **The IPP Procurement Programme, issued on 3 August 2011, envisages the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before end 2020.** Therefore, the development of photovoltaic power plants will represent a key feature in the fulfilment of the proposed target goal and the reduction of CO_2 emissions.

The purpose of the Manlenox Expansion Solar Park is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the IPP Procurement Programme and to meet the "sustainable growth" of the Northern Cape Province.

The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. The generation of renewable energy will contribute to the growth of South Africa's electricity market, which has been primarily dominated up to this date by coal-based power generation. With specific reference to photovoltaic energy, and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

The reasons for the location of the project in the selected area include the following:

- low requirement for municipal services;
- compliance with national and provincial energy policies and strategies;
- no impact on people health and wellbeing;
- no waste and noise;
- no impact on air quality;
- compatibility with the ecosystem and the surrounding landscape;
- likelihood of social and economic development of marginalized, rural communities; and

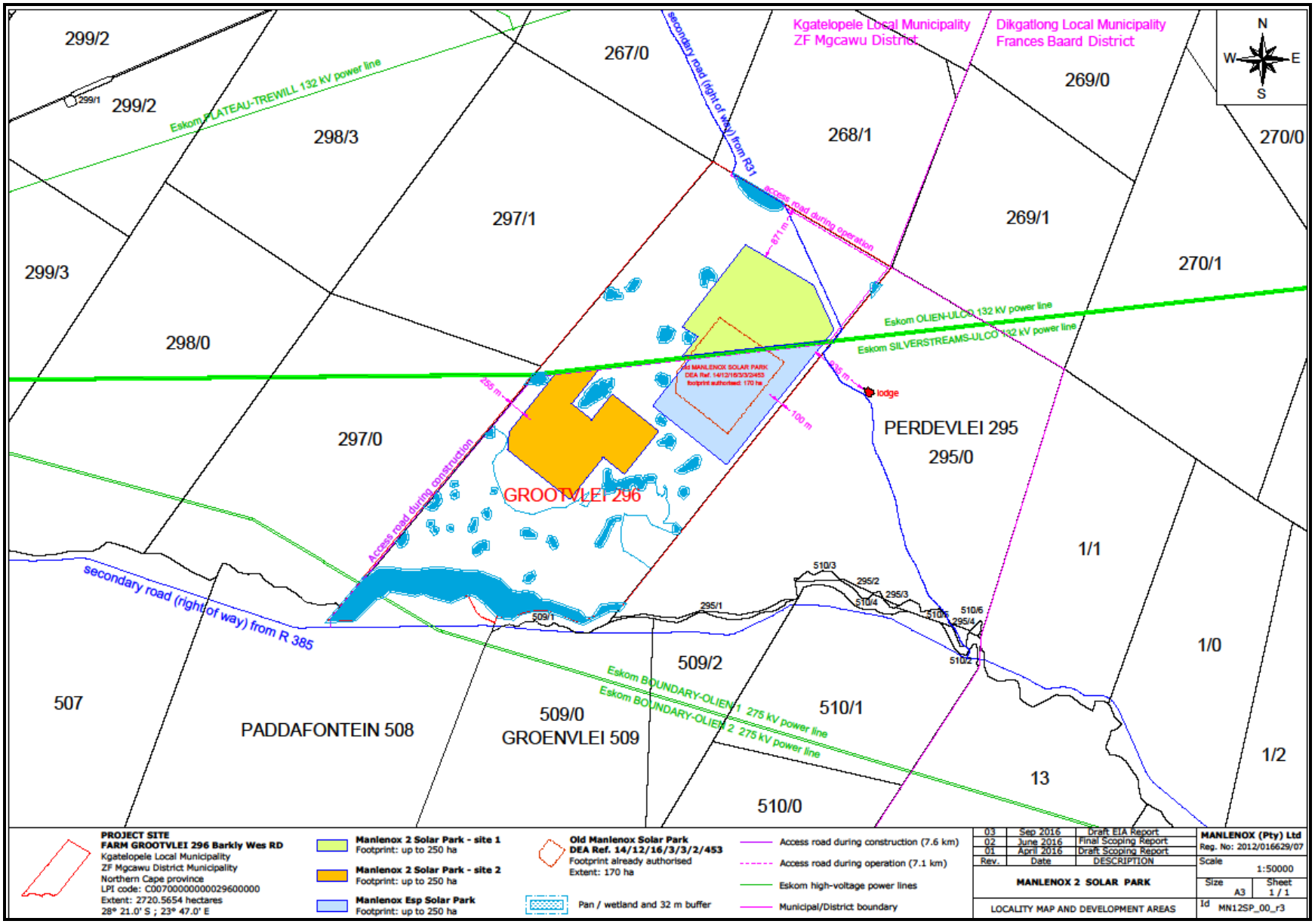


Figure 1: Locality map of the project site and study area for EIA

3. AUTHORITIES, LEGAL CONTEXT AND ADMINISTRATIVE REQUIREMENTS

The legislative and regulatory framework of reference for the solar power plant project includes statutory and non-statutory instruments by which National, Provincial and Local authorities exercise control throughout the development of the same project.
The development and the environmental assessment process of a solar power plant project involve various authorities dealing with the different issues related to the project (economic, social, cultural, biophysical etc.).

3.1. REGULATORY AUTHORITIES

3.1.1. National Authorities

At national level, the main regulatory authorities and agencies are:

- **Department of Energy (DoE):** the Department is competent and responsible for all policies related to energy, including renewable energy. Solar energy is contemplated and disciplined under the White Paper for Renewable Energy and the Department constantly conducts research activities in this respect;
- **Department of Environmental Affairs (DEA):** the Department is competent and responsible for all environmental policies and is the controlling authority under the terms of NEMA and EIA Regulations. The DEA is also the competent authority for the proposed project, and is entrusted with granting the relevant environmental authorisation;
- **National Energy Regulator of South Africa (NERSA):** the Regulator is competent and responsible for regulating all aspects dealing with the electricity sector and, in particular, issues the licence for independent power producers;
- **South African Heritage Resources Agency (SAHRA):** the Agency is responsible for the protection and the survey, in association with provincial authorities of listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes under the terms of the National Heritages Resources Act (Act no. 25 of 1999);
- **South African National Roads Agency Limited (SANRAL):** the Agency is responsible for all National road routes.

3.1.2. Provincial Authorities

At provincial level, the main regulatory authority is the **Northern Cape Department of Environment and Nature Conservation;** this Department is responsible for environmental policies and is the Provincial authority in terms of NEMA and the EIA Regulations. The Department is also the commenting authority for the proposed project.
The project should comply with the **Northern Cape Nature Conservation Act** (Act No. 9 of 2009).

3.1.3. Local Authorities

At a local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape Province, Municipalities and District Municipalities are involved in various aspects of planning and the environment related to solar energy facilities development. The Local Municipality is *Kgatelopele*, which is part of the *ZF Mgcawu District Municipality*.
Under the terms of the Municipal System Act (Act no. 32 of 2000), all municipalities are deemed to go through an Integrated Development Planning (IDP) process in order to devise a five-year strategic development plan for the area of reference. The identification of priority areas for conservation and their positioning within a planning framework of core, buffer, and transition areas is the subject of bioregional planning. Priority areas are individuated and defined with reference to visual and scenic resources and their identification and protection is granted through visual guidelines drafted for the area included in bioregional plans.

Local authorities also provide specific by-laws and policies in order to protect visual and aesthetic resources with reference to urban edge lines, scenic drives, special areas, signage, communication masts etc.

3.2. LEGISLATION, REGULATIONS AND GUIDELINES

A review of the relevant legislation involved in the proposed development is detailed in table 1.

Table 1: Review of relevant legislation

National Legislation	Sections applicable to the proposed project
Constitution of the Republic of South Africa (Act no. 108 of 1996)	• Bill of Rights (S2) • Rights to freedom of movement and residence (S22) • Environmental Rights (S24) • Property Rights (S25) • Access to information (S32) • Right to just administrative action (S33)
Fencing Act (Act no. 31 of 1963)	• Notice with reference to a boundary fence (S7) • Clearing bush for boundary fencing (S17) • Access to land for purpose of boundary fencing (S18)
Conservation of Agricultural Resources Act (Act no. 43 of 1983)	• Prohibition of the spreading of weeds (S5) • Classification of categories of weeds & invader plants and restrictions in terms of where these species may occur (Regulation 15 of GN R0148) • Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R0148)
Environment Conservation Act (Act no. 73 of 1989)	• National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act no. 36 of 1998)	• Entrustment of the National Government to the protection of water resources (S3) • Entitlement to use water (S4) - Schedule 1 provides the purposes which entitle a person to use water (reasonable domestic use, domestic gardening, animal watering, fire-fighting and recreational use) • Duty of Care to prevent and remedy the effects of water pollution (S19) • Procedures to be followed in the event of an emergency incident which may impact on water resources (S20) • Definition of water use (S21) • Requirements for registration of water use (S26 & S34) • Definition of offences in terms of the Act (S151)
National Forests Act (Act no. 84 of 1998)	• Protected trees
National Environmental Management Act (Act no. 107 of 1998)	• Definition of National environmental principles (S2): strategic environmental management goals and objectives of the government applicable within the entire Republic of South Africa to the actions of all organs of state, which may significantly affect the environment • NEMA EIA Regulations 2014 • Requirement for potential impact on the environment of listed activities to be considered, investigated, assessed and reported on to the competent authority (S24 - Environmental Authorisations)

	• Duty of Care (S28): requirement that all reasonable measures are taken in order to prevent pollution or degradation from occurring, continuing and recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment • Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)
National Heritage Resources Act (Act no. 25 of 1999)	• SAHRA, in consultation with the Minister and the Member of the Executive Council of every province must establish a system of grading places and objects which form part of the national estate (S7) • Provision for the protection of all archaeological objects, paleontological sites and material and meteorites entrusted to the provincial heritage resources authority (S35) • Provision for the conservation and care of cemeteries and graves by SAHRA, where this is not responsibility of any other authority (S36) • List of activities which require notification from the developer to the responsible heritage resources authority, with details regarding location, nature, extent of the proposed development (S38) • Requirement for the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites for promotion of tourism (S44)
National Environmental Management: Biodiversity Act (Act no. 10 of 2004)	• Provision for Member of Executive Council for Environmental Affairs/Minister to publish list of threatened ecosystems in need of protection (S52) • Provision for the Member of the Executive Council for Environmental Affairs/Minister to identify any process or activity which may threaten a listed ecosystem (S53) Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of: critical endangered species, endangered species, vulnerable species and protected species (S56(1) - see Government Gazette 29657 • Three government notices have been published up to the present date: GN R150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened Protected Species Regulations)
National Environmental Management: Air Quality Act (Act no. 39 of 2004)	• Provision for measures in respect of dust control (S32) • Provision for measures to control noise (S34)
National Environmental Management: Waste Management Act (Act no. 59 of 2008)	• Waste management measures • Regulations and schedules • Listed activities which require a waste licence
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	• Indigenous flora protected under this act • No hunting to take place without a permit
Occupational Health and Safety Act (Act No. 85 of 1993)	• Health and safety of all involved before and after construction must be protected.

Guideline Documents	Sections applicable to the proposed project
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA no. 107 of 1998	• Impact of noise emanating from a proposed development may have on occupants of surrounding land by determining the rating level • Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	• The Guidelines outline rules and conditions related to transport of abnormal loads and vehicles on public roads and detailed procedures to be followed for the grant of exemption permits

Policies and White Papers	Sections applicable to the proposed project
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	• The White Paper supports investment in renewable energy initiatives, such as the proposed solar power plant project
The White Paper on Renewable Energy (November 2003)	• The White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for the promotion and the implementation of renewable energy in South Africa
Integrated Resource Plan (IRP1) Integrated Resources Plan 2010-2030 (IRP 2010).	• First Integrated Resource Plan (IRP1) was released late 2009. Subsequently the DoE decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (IRP 2010). • The IRP1 and the IRP 2010 outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. • **IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.**
Request For Qualification and Proposals For New Generation Capacity under the IPP Procurement Programme(3 August 2011)	• IPP Procurement Programme, issued on 3 August 2011 by the DoE, plans the commissioning of **3725 MW** of renewable projects (**1450 MW with Solar photovoltaic technology**) **capable of beginning commercial operation before the end of 2020**.
Equator Principles (July 2006)	• The Equator Principles provide that future developments with total project capital costs of US$10 million or more shall be financed only if socially and environmentally sustainable

3.4. LISTED ACTIVITIES IN TERMS OF NEMA

The "listed activities" in terms of sections 24 and 24D of NEMA involved (or **potentially** involved) in the proposed development are detailed in table 2 below.

Table 2: Listed Activities in terms of sections 24 and 24D of NEMA potentially involved in the proposed development.

Relevant notice:	**Activity No:**	**Description of each listed activity**:
R.984, 4 December 2014 *The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more*	**1**	Manlenox Expansion Solar Park will consist of construction, operation and maintenance of a Photovoltaic Power Plant with a generating capacity of **120 MW** with associated infrastructure and structures.
R.984, 4 December 2014 *The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.*	**9**	The connection of the Manlenox Expansion Solar Park to the Eskom grid will be done according to the Eskom connection solution which will require: (i) one small on-site 22kV/275kV loop-in loop-out substation with one or more 22kV/275kV power transformers and a 275kV busbar (switching station) to connect to one of the two Eskom 275 kV power lines crossing the project site; (ii) two new small sections of 275kV power line allowing the Eskom's 275 kV power line to loop in and out of the 275 kV busbar of the new on-site substation. The connection solution may also entail intervention on the Eskom grid.
R.984, 4 December 2014 *The clearance of an area of 20 hectares or more of indigenous vegetation*	**15**	An area larger than 20 ha (250 ha) will be cleared from indigenous vegetation for the construction of a PV Power Plant with associated infrastructure and structures.
R.983, 4 December 2014 *The development of facilities or infrastructure for the transmission and distribution of electricity:* *Outside urban areas or industrial complexes with a capacity of more than 33 kilovolts but less than 275 kilovolts:*	**11**	The connection of Manlenox Expansion Solar Park to the Eskom grid will be done outside an urban area and will include: (i) one small on-site 22kV/132kV loop-in loop-out substation with one or more 22kV/132kV power transformers and a 132kV busbar (switching station) to connect to the one of the two Eskom 132 kV power lines crossing the project site ("OLIEN-ULCO" 132 kV power line or SILVERSTREAMS-ULCO" 132 kV power line); (ii) two new small sections of 132kV power line allowing the Eskom 132 kV power line to loop in and out of the 132 kV busbar of the new on-site substation. The connection solution may also entail intervention on the Eskom grid.
R.983, 4 December 2014 *The infilling or depositing of any material of more than 5 m³ into, or the dredging, excavation, removal or moving of soil, sand, more than 5 m³ from:* *(i) a watercourse;*	**19**	The farm Grootvlei 296 is scattered with pans and seasonal wetlands and the possibility exists that excavations will take place from these wetlands and or the moving of soil in order to accommodate the PV power plant.
R.983, 4 December 2014	**22**	*The development of -* (ii) *a road, with a reserve wider than 13.5 metres, or where no reserve exists where the road is wider than 8 meters.* An access road wider than 8m or a reserve wider than 13.5m will be constructed. Some internal roads will be wider than 8m. This will mainly be needed for construction purposes as construction vehicles will need extra space to manoeuvre.

The current EIA procedure of the Manlenox Expansion Solar Park **includes the connection to the Eskom grid.** Furthermore, a part of the connection infrastructure (the 132 kV (275 kV) busbar of the on-site substation and the two new sections of 132 kV (275 kV) power line) may be executed, owned and operated by Eskom.

Final layout and site plans already drafted by Manlenox Expansion (Pty) Ltd will be completed once inputs, via public participation have been received, analysed and reviewed. All information acquired will be analysed in order to determine the proposed final development layout and site plans.

Such approach will ensure a holistic view of future requirements of the site and that resources are utilised to their full availability in terms of social and environmental sustainability. It must also be pointed out that this application and all other development applications, in the area, are considered together in order to ensure general sustainability in the Kgatelopele Local Municipality and in the ZF Mgcawu District Municipality areas.

4. PROJECT DESCRIPTION AND FUNCTIONING

Manlenox Expansion is proposing the establishment of a **solar power plant with a maximum generation capacity at the delivery point up to 120 MW.**
The construction timeframe is estimated to be approximately 15 months, whereas the commissioning date will depend on the IPP Procurement Programme timeframe.

The preferred technical solutions envisage:

- **thin-film PV modules or mono/polycrystalline PV modules,**
- **fixed mounting systems** or **single-axis horizontal trackers (SAT).**

The estimated annual energy production is calculated in approximately:

- **1,950 kWh/kWp/year** (load factor = 0.223), in the case of PV modules mounted on fixed mounting systems; or
- **2,200 kWh/kWp/year** (load factor = 0.251) in the case of PV modules mounted on trackers.

Therefore, the Manlenox Expansion Solar Park will generate:

- **160.1GWh per year** in the case of PV modules mounted on fixed systems; or
- **190.1GWh per year** in the case of PV modules mounted on trackers.

The calculation is made by the professional tool "PVSYST" and the simulation is done for 1 MWp (1 "PV field"). The site data (irradiation, temperature, etc.) charged on the database consists of hourly meteo-data registered by NASA satellites (NASA-SSE satellite data 1983-1993, release 6) and the simulation is made for the timeframe of 1 year.
The output (1,950 kWh/kWp/year and 2,200 kWh/kWp/year) is also called “full net equivalent hours”, which represent the average energy injected into the grid per 1 kWp of installed capacity.
The **Global Horizontal Irradiation** of the site is 2,126 kWh/m^2/year (NASA-SSE satellite data, 1983-1993, release 6).

The energy generated by the Manlenox Expansion Solar Park will reduce the quantity of pollutants and greenhouse gases emitted into the atmosphere. The reduced amount of CO_2 will be the emissions that would have been generated by a thermal power plant using fossil fuels for producing the same quantity of energy that it is produced by the Manlenox Expansion Solar Park.

The quantity of the avoided CO_2 is calculated as follows: the energy produced by the Manlenox Expansion Solar Park (up to 160.1 GWh/y or 190.1GWh/y) is multiplied by the Eskom’s average emission factor which is 1.015 t CO_2/MWh (**source**: Energy Research Centre, University of Cape Town. (2009 **Carbon accounting for South Africa**).

A detailed description of the characteristic and functioning of the plant and its connection is given in the following paragraphs.

Two applications for Environmental Authorization was submitted on the Farm Grootvlei 296. One is for the expansion of the already authorized Manlenox Solar Park and the second is for Manlenox Expansion Solar Park. This final EIA Report is applicable to the application for EA for Manlenox Expansion.

As the two solar parks is planned to be adjacent to each other, it is, in essence, one development. Thus, the impacts considered and evaluated in this report is applicable to both sites, cumulatively and not individually. All the specialists considered both sites and their recommendations and mitigation measures are based on the possibility that both solar parks will, in the end, form part of one larger development.

4.1. PROJECT LAYOUT

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of some specialists' studies conducted / under drafting during this scoping phase.

The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 25-30 years.

The main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: horizontal 1-axis trackers with polycrystalline solar modules, or thin-film solar modules mounted on fixed mounting systems;
- to develop the PV power plant on the northern side of the Portion 0 of the Farm Grootvlei 296 (2720 ha), which is flat and has a **medium** ecological sensitivity, while the southern side has a **medium - high** sensitivity, due to the presence of several protected trees, and it is affected by several wetlands / drainages;
- to avoid the high sensitivity areas (**pans / wetlands**) sparsely located on the project site, by providing a minimum buffer 32 m wide;
- furthermore, a tree buffer zone will be kept around the footprint, in order to minimise the visual impact of the proposed development.

The footprint (fenced area) of the solar park will be 250 ha. The preferred location for the proposed development is the north-eastern part of the farm, which has a low ecological sensitivity and the pans or wetland areas as identified in the Wetland Delineation study are avoided (Annexure G).

In the case of polycrystalline modules mounted on trackers, the layout plans do not change, except for the orientation of the PV arrays: north-south instead of east-west.

The required **footprint** - corresponding on the fenced area - will be the same: **approximately 250 ha**, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore, the impacts and mitigation measures will remain the same.

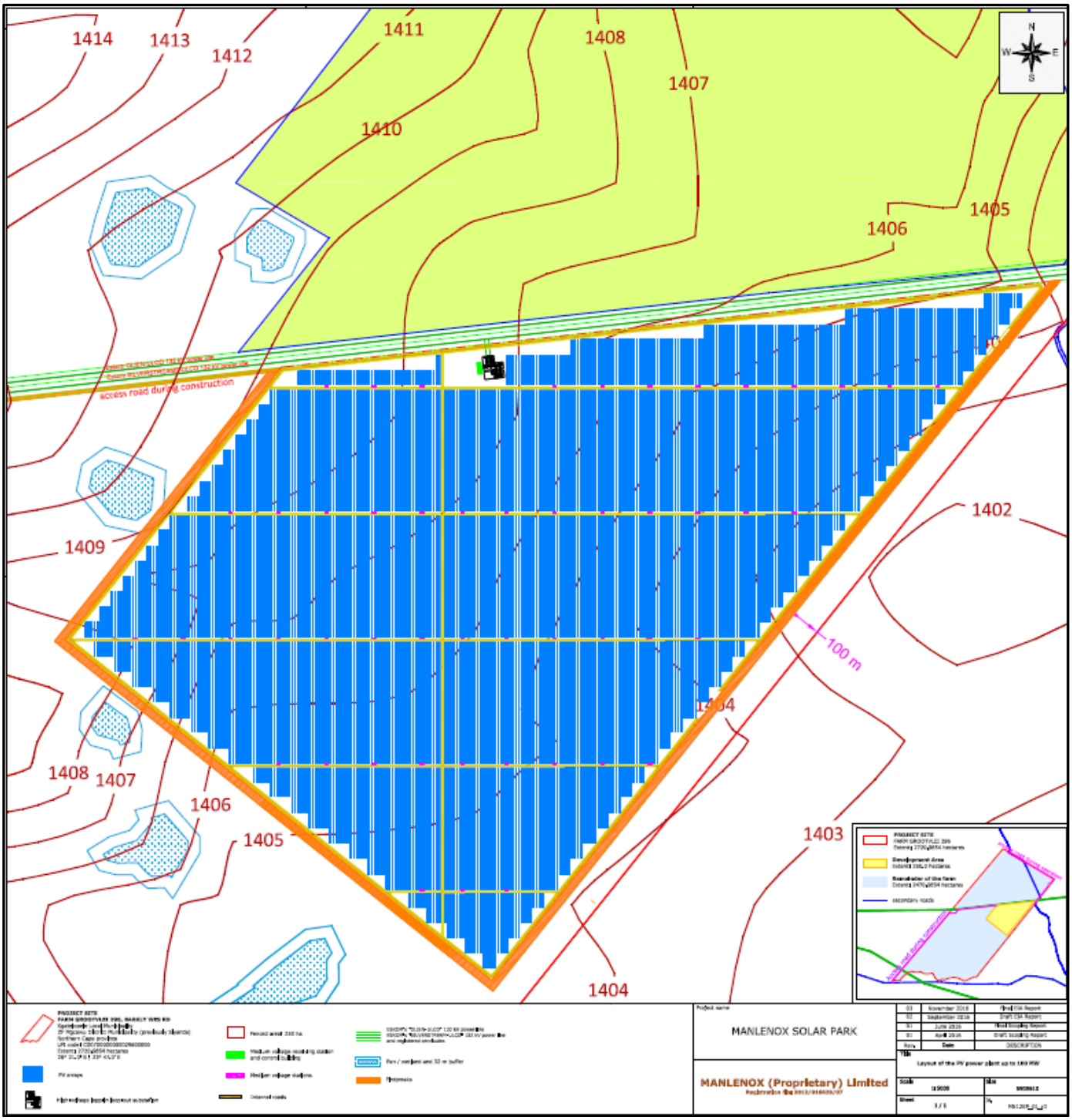


Figure 2: Layout plan - Manlenox Expansion Solar Park

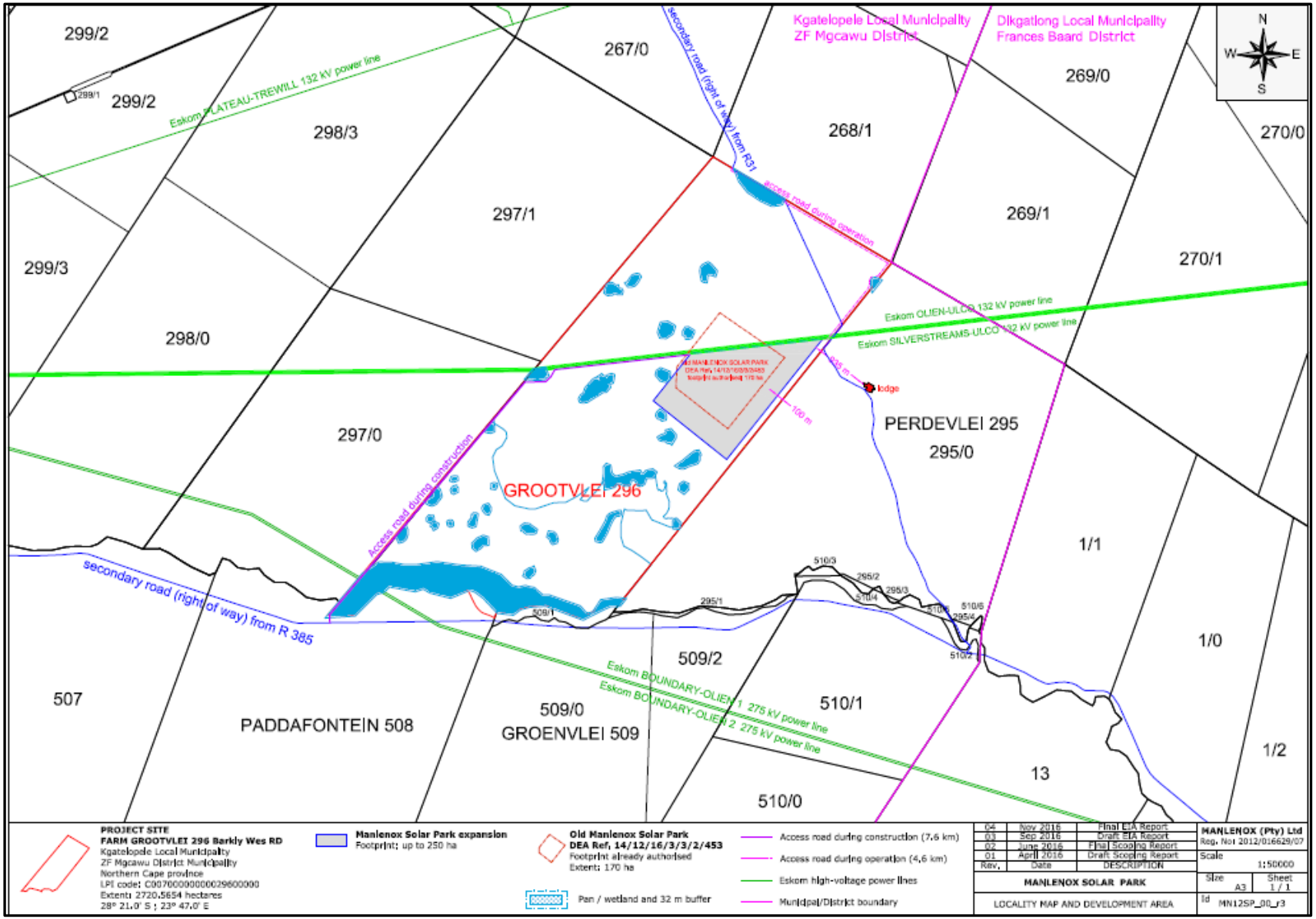


Figure 3: Manlenox Expansion Solar Park in relation to previously approved Manlenox Solar Park site

4.2. PRIMARY COMPONENTS

The Photovoltaic (PV) Power Plant together with its connection infrastructures and structures will require the installation of the following equipment:

- Photovoltaic modules
- Mounting systems (fixed or trackers) for the PV arrays
- Internal cabling and string boxes
- Medium voltage stations hosting DC/AC inverters and LV/MV power transformers
- Medium voltage receiving station & Control building, with offices and small parking area
- Workshop & warehouse
- One small on-site high-voltage loop-in loop-out substation with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid, and one high-voltage busbar with metering and protection devices (also called "switching station")
- two new small sections of high-voltage power line allowing the the **Eskom's "OLIEN-ULCO" 132 kV power line** or to the **Eskom's "SILVERSTREAMS-ULCO" 132 kV power line** to loop in and out of the 132 kV busbar of the new on-site substation (**preferred connection solution**)
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Storm water collection system
- Lighting system
- Grounding system
- Access road and internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities (**Ballam Waterslot** system).

The connection may also entail interventions on the Eskom grid according to Eskom's connection requirements/solution.

4.2.1. Project functioning and connection of the solar park to the Eskom grid

Solar energy facilities using PV technology convert sun energy to generate electricity through a process known as the Photovoltaic Effect, which consists of the generation of electrons by photons of sunlight in order to create electrical energy.

The preferred technical solutions are:

- thin-film modules mounted on fixed mounting systems, and,
- mono or polycrystalline modules mounted on horizontal 1-axis trackers,

which at present represent the best performing options in terms of reliability and costs/efficiency.

The PV technology is in constant and rapid evolution, this means that the final choice of the type of solar modules (thin-film, monocrystalline or polycrystalline) and mounting system (fixed or tracker) can be taken at the time of the commission date, based on the availability of PV modules and mounting systems, of the worldwide market and of the cost-efficiency curve.

The required footprint will be approximately 250 ha, and maximum height of structures (PV modules and support frames) is approximately 3.1 m above ground level. Therefore, the impacts and mitigation measures will not change. Please refer to section 5.2.

The following description refers to both preferred technical solutions (mono/polycrystalline modules mounted on horizontal single-axis trackers and thin film modules mounted on fixed mounting system or a combination of them).

The required **footprint** (including internal roads) will be **approximately 250 ha.**

PV modules will be assembled on zinced steel or aluminium frames, to form PV arrays. The metal frames that sustain PV arrays are set to the ground by fixed support poles.

A) In the case of PV modules mounted on fixed mounting systems:

Each mounting frame will host several PV modules along two or more parallel rows consisting of PV modules placed side by side, with the position of the PV arrays northwards and at an optimized tilt. The rows are mounted one on top of the other, with an overall mounting structure height **up to 3.1 meters above ground level**.

Figure 3: Lateral views of PV arrays mounted on fixed mounting systems

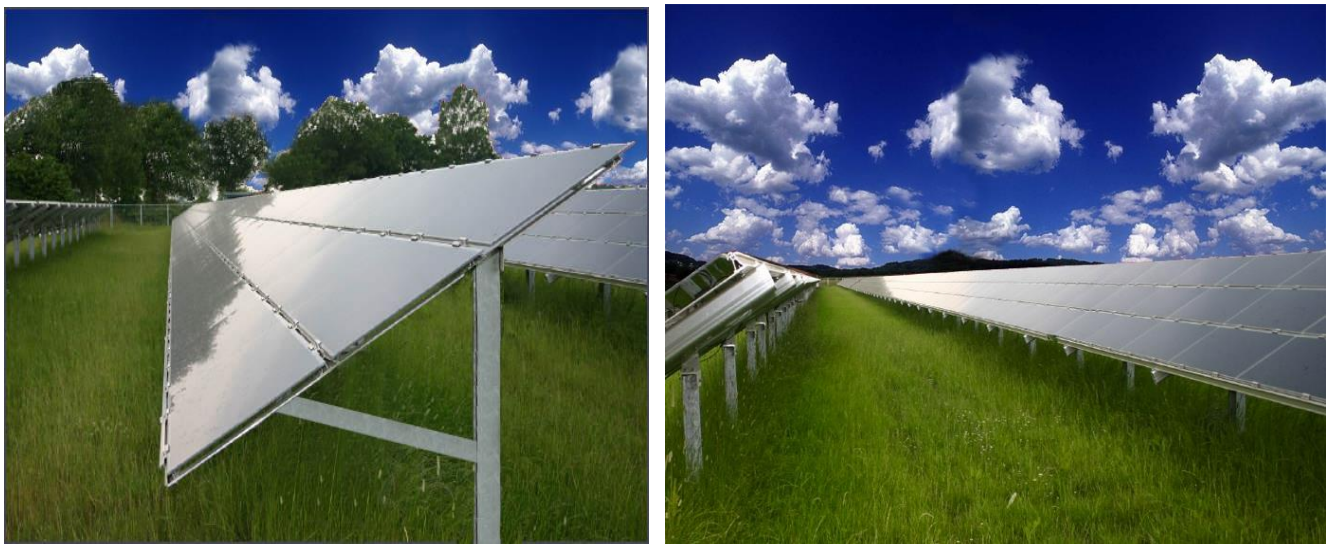


Figure 4: Frontal view of PV arrays mounted on fixed mounting systems

For further details, Please refer to the Figures 4 and 5 above and to the drawing of the Annexure A:

- RH2SP_03_r0 *Mounting System – Alternative option 1: fixed mounting systems*

B) In the case of PV modules mounted on single-axis horizontal trackers (SAT):

Each PV array is composed of several PV modules disposed along one or more parallel rows consisting of PV modules placed side by side. Each tracker is composed by several PV arrays North-South oriented and linked by a horizontal axis, driven by a motor. The horizontal axis allows the rotation of the PV arrays toward the West and East direction, in order to follow the daily sun path.

The maximum mounting structure height will be **up to 3.1 meters above ground level**.

Figure 5: Simulation views of the PV arrays mounted on 1-axis horizontal tracker

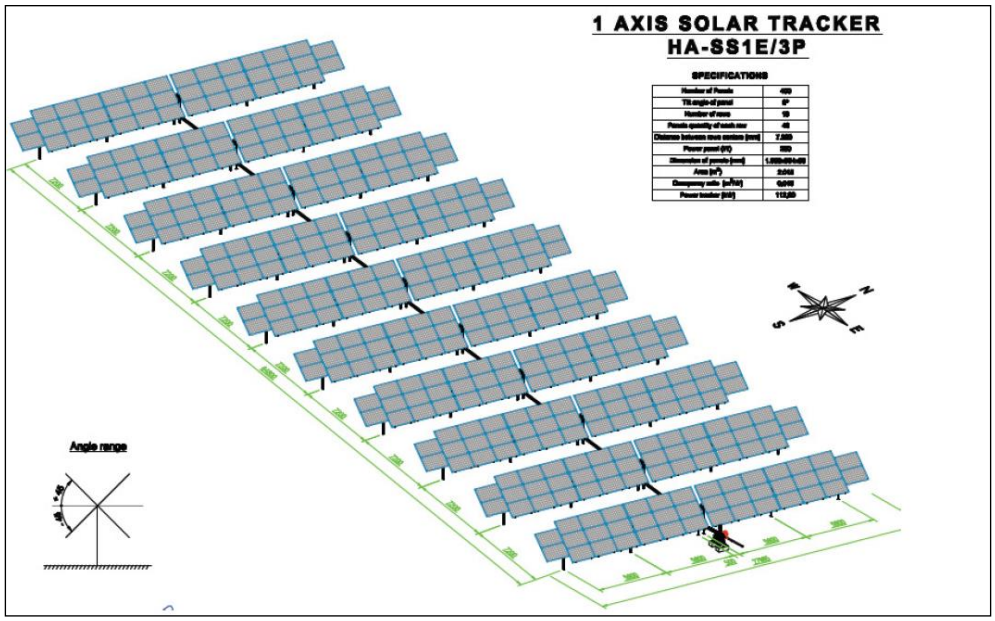


Figure 6: Frontal views of the PV arrays mounted on 1-axis horizontal tracker

For further details, see also the drawings and maps included in Annexure A:

C) In both cases:

PV modules are series-connected outlining PV strings made of several modules, so that the PV string voltage fits into the voltage range of the inverters. PV strings are set up to be connected to DC-connection boxes. Each String Box allows the parallel connection of several PV strings (also called "PV sub-field").
String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a circuit breaker to disconnect the PV sub-fields from the inverters.

The PV sub-fields are thought to be linked to central inverters, located in **120 medium voltage stations**. Each station comprises two adjacent prefabricate buildings designed to host two **DC/AC inverters**, with a total nominal output AC power of 1,000 kW (16 parallel sub-fields), and a **medium voltage power transformer** of 1000 kVA. The DC/AC inverters are deemed to convert direct current (DC) into alternate current (AC) at low voltage (270 V); subsequently the AC will pass through a medium-voltage transformer in order to increase the voltage up to 22 kV (or 11 kV).

The medium-voltage stations are detailed in the drawing in Annexure A. The energy delivered from the 120 medium voltage stations will be collected into one (or more) **medium voltage receiving station**(s), parallel connecting all the 120 PV fields of the PV generator.

From the medium voltage receiving station, the energy will be delivered to two high-voltage power transformers (40 MVA each, plus one as spare), which will step up the electric energy from the medium voltage level (11 kV or 22 kV) to the Eskom required connecting voltage (i.e.132 kV). The power transformers will be connected to an on-site 132 kV busbar (the so called "switching station"), to be equipped with protection and metering devices, per Eskom requirements.

The new HV substation will need to be equipped with circuit breakers upstream and downstream, to disconnect the PV power plant and/or the power line in case of failure or grid problems**.**

The new power line and the busbar (**switching station**) of the on-site HV substation may be owned and operated by Eskom Distribution.
The layout of the high-voltage substation as well as of the control building and the subdivision between Eskom's side and Manlenox Expansion's side respectively are detailed in the drawings included in Annexure A.

Manlenox Expansion Solar Park may connect to the Eskom "OLIEN-ULCO" 132 kV power line or Eskom “SILVERSTREAMS-ULCO” 132 kV power line, which bisects the farm from east to west. The possibility exists that the Eskom “BOUNDARY-OLIEN 1” 275 kV and “BOUNDARY-OLIEN 2” 275 kV power lines, crossing the southern side of the project site can also be used. However, the last option is not the preferred connection as a number drainage and wetland areas will have to be crossed and a much longer power line will have to be constructed. Whereas, if the Olien-Ulco and Silverstreams-Ulco power lines are connected to, no drainage or wetlands will be crossed and the power lines will be no longer than 100m from each solar park (Expanded Manlenox and Manlenox Expansion Solar Parks).

The power generation capacity at the delivery point will be up to 120 MW.

4.2.2. Access road and internal roads

The access road during the construction period will be from the R385, which is a secondary road, entering the farm from the south. The access road during the operational phase will be from the secondary road R31, which enters the farm to the north.

Internal roads will consist of gravel roads designed in accordance with engineering standards. The roads will have a width of 8.0 meters allowing for the slow moving heavy vehicles.
Once the solar farm is in operation, the internal roads will mainly be used for maintenance and inspections.

Once the solar farm is in operation, the internal roads will mainly be used for maintenance and inspections. The vertical alignment of the roads will not present significant challenges due to the flatness of the terrain. The entire development will be contained inside a fenced area and the roads are not intended for public use.

4.2.3. Lighting system

The lighting system will consist of the following equipment:

- Floodlight-towers: maximum10 meters high, with 6x400W directional lamps, installed around the HV loop-in loop-out substation. Normal lighting: 15 lux; up to 40 lux in case of emergency.
- Street lighting along internal roads, for the stretch from the access point up to the HV substation inside the property: 1 streetlamp, maximum 5.5 meters high, every 20 meters, having a metal-haloids lamp of 400 W.
- 2x400 W spotlights (SAP type) mounted on the top of medium-voltage stations.

The lighting of the MV stations and of the on-site HV substation will be on only in case of intrusion/emergency or necessity to reach the MV stations / HV substation during the night.

During the night, the video-surveillance system will use infra-red (or micro-wave) video-cameras, which do not need a lighting system (which could reduce the functioning). Only streetlamps along internal roads, for the stretch from the main access up to the HV substation inside the property, may be switched on at night.

4.2.4. Stormwater collection system

Given the low rainfall, flat topography and low flow speed of run-off, **no formal storm water structures are required** as the proposed gravel roads will be developed at ground level so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated and the existing drainage patterns will be left undisturbed.

4.2.5. Water requirements

4.2.5.1. Water requirements during the construction phase

The construction timeframe is estimated to be approximately **15 months.**

A) Construction of internal gravel roads

- Water is necessary for the construction of internal gravel roads, in order to get the gravel compacted to optimum moisture content (OMC).
- The surface of internal gravel roads will be approximately 137,000 m^2.
- 50 liters of water / m^2 of internal of roads will be required.

B) Workers

- approximately 100 people are expected to be employed during the construction period, although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Manlenox Expansion - once being selected as Preferred Bidder by the DoE and having finalized the Connection Agreement with Eskom, where it is agreed the timeframe is to be shorter than 15 months (i.e. 330 working days). For example, in the case the construction works are planned to last only 6 months (i.e. 132 working days), the average number of workers required on site during construction is 250.
- Each worker needs 50 liters / 8 working hours for sanitary use.
- Water consumption will be:
  - 100 people per project x 50 l/person x 330 working days = 1650 m^3 over 15 months, or:
  - 250 people per project x 50 l/person x 132 working days = 1650 m^3 over 6 months.

C) Concrete production

- Concrete is necessary for the basements of the medium-voltage stations, the high-voltage loop-in loop-out substation, the control building and the warehouse and for the foundations of the mounting systems. The overall amount of concrete to be produced will be approximately 15,000 m^3 per project.
- 200 litres of water are needed for 1 cubic meter of concrete.

D) Vehicle cleaning

As mitigation measure, the cleaning of vehicles like excavators, mechanical diggers and pile rammers will be done once or twice per month and no during working days, also in order to not increase the water requirement during the construction activities. In order not to waste a large amount of water, high pressure cleaners will be used. Overall, the water requirement for cleaning activity is very low. The overall and average water consumption during construction is detailed in the following table.

Table 3: Water consumption during the construction phase of the project

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Timeframe of the construction activities	**months**	15
Timeframe of the construction activities - calendar days	**days**	450
Overall water consumption for internal roads	**m^3**	6,850
Overall water consumption for sanitary use	**m^3**	1,650
Overall water consumption for concrete production	**m^3**	3,000
OVERALL WATER CONSUMPTION	m^3	**11,500**
Daily water consumption (average over 450 calendar days)	m^3/day	**25.5**

Storage tanks will be sized in order to provide a reserve of water approximately **200 cubic meters**.

4.2.5.2. Water requirements during the operational phase

During operation, water is only required for the operational team on site (sanitary use), as well as for the cleaning of the solar panels.
Further water consumption may be only for routine washing of vehicles and other similar uses.

A) Water for sanitary use

Approximately **35-40 people** will be employed during the operation phase of the PV power plant, which will have a lifetime of 25 - 30 years.
Manlenox Expansion Solar Park will be in operation 7 days per week; therefore, personnel will operate according to shifts. The surveillance team will be present during day-time, night-time and weekends. The average number of people working at the site on the same time will be of **14 people daytime and 6 people at night**.

The average daily water consumption for sanitary use is estimated to be**150 litres / day / person** per **20 people** (14 people daytime and 6 people at night), The daily water consumption will be approximately **3,000 litres/day.**

B) Water consumption to clean the PV modules

The cleaning activities of the solar panels will take place **twice per year**.
It is assumed that up to 1.0 liters per m^2 of PV panel surface will be needed.
The amount of water for cleaning is up to **850 m^3 per cleaning cycle**, therefore **1,700 m^3per year.**

PV modules cleaning activity can last less than 1 month. If the cleaning activity lasts approximately 2 weeks (12 working days), the daily water consumption will be approximately **71,000 liters/day**, **over 12 days**.

Conclusion

The daily water requirement will be approximately **3,000 liters/day** over 12 months for sanitary use (i.e. **90,000 l/month** and **1,095 m^3/year**).

The water consumption will increase up to **74,000 liters/day** during the cleaning of the solar modules (71,000 liters/day for cleaning activity and 3,000 for sanitary use), which will last less than a month and will occur **twice per year** during the dry period. PV modules are conceived as self-cleaning with the rain. It is further proposed that **90,000 l** of water will be stored in **storage tanks** for fire, emergency and washing of panels twice a year.

The overall and average water consumption during operation is detailed in the table below.

Table 4: Water consumption during the operational phase of the project

WATER REQUIREMENT DURING THE OPERATIONAL PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Average daily water consumption for sanitary use	**l/day**	3,000
Average daily water consumption during cleaning activity (*)	**l/day**	74,000
Average monthly water consumption for sanitary use (over 30 days)	**l/month**	90,000
Annual water consumption for sanitary use	m^3/year	**1,095**
Annual water consumption for PV modules cleaning activities (twice/year)	m^3/year	**1,700**
ANNUAL WATER CONSUMPTION DURING OPERATION	m^3/year	**2,795**
DAILY WATER CONSUMPTION DURING OPERATION (average over 365 day)	m^3/day	**7.66**

(*) over 12 working days, twice per year

4.2.5.3. Water provision during construction and operation

The site is located within the **C92A Quaternary Catchment**, where 45 m³/ha/annum of groundwater abstraction is allowed for under the DWA General Authorization. The proposed development site falls under the Lower Vaal Water Management Area (WMA). The estimated annual groundwater recharge (10.3 mm/m2 per annum) from an average annual precipitation of 367 mm falling on the property (2,720 ha) will result in **280,160 m^3 of water available**. The maximum annual water requirements are:

- 2795 m^3 / year for the project;
- 6300 m^3 / year for livestock (350 head of cattle consumes 50 l of water per day);
- 360 m^3 / year for human consumption (landowners).

The scale of abstraction relative to recharge is 3.4% (Category A).

As indicated in the Geo-technical and Geo-Hydrological Report (Annexure I), three boreholes were identified on the property, two of them (**Borehole 2 and 3**) close to the proposed lease portion. These two boreholes are equipped with wind pumps. The groundwater level in both is shallow, at 4 m below surface. These boreholes are 12 deep and currently used to supply drinking water to livestock.

Borehole 2 and Borehole 3 have a sustainable yield of more than 20,000 l/hour, therefore the water needed for both the construction phase (**11,500 m^3**) and the operational phase (**2,795 m^3/year**) can be provided from them.

With the information available, a sustainable abstraction of **50,000 l/day** is assumed for the aquifer. Before construction of the solar park commence, pump testing should be conducted to verify the aquifer and borehole yields.

The water quality analysis of the samples collected from the wind pump conforms to the SANS 241 drinking water standards. All the parameters tested were within specification.

A Water Use Licence application will be submitted to the Department of Water Affairs by Manlenox (Pty) Ltd.

4.2.6. Sewerage

Considering that the proposed development will not include formal residential properties there is no need to connect the municipal sewer reticulation system. Sewer reticulation will be handled by the patented and commercially available **Ballam Waterslot** (or similar) sewer treatment system.

The sewer system will therefore consist of an installation to serve the offices of the control building. It is foreseen that the system will be installed in line with the requirements of the manufacturer. Typical systems consist of a conservancy tank (built underground on site), and a patented digester. Most systems require electricity to power the pumps and fans used in aeration process, although some systems use wind power (whirlybird). The system could require chlorine tablets available commercially. The effluent from the **Ballam Waterslot** (or similar) system will be suitable for irrigation of lawns, or re-use in the dwellings as water for the flushing of toilets, or for fire-fighting purposes. This could reduce the overall water requirement of the development substantially.

A Water Use License application (21g water use) will be submitted to the Department of Water Affairs by Manlenox Expansion with regard to the water treatment system on site.

4.2.8. Refuse removal

Manlenox Expansion will enter into an agreement with the Kgatelopele Local Municipality for the PV plant's refuse at the nearby municipal refuse site. No refuse will be buried or incinerated on site.

4.3. CONSTRUCTION SITE

The construction site (approximately 10 ha) will be located on the south-western corner of the planned footprint - covering the area where the last 4 MWp are planned. Consequently, the construction site area will be gradually reduced at the completion of the last four PV fields (4 MWp), and at the end of the works all the construction area will be converted into the last PV arrays.

The optimal location of the construction site is an important element of the planning phase also in order to minimize impacts on the surrounding environment.

The site's location has been dictated by the nature of the works to be undertaken, specialist studies, site restrictions, town planning intended uses and access.

The area identified for the construction site had to meet the following requirements:

- sufficient size;
- proximity to existing roads;
- availability of water and energy;
- low environmental and landscape value;
- sufficient distance from residential areas; and
- proximity to the worksite.

In addition, to ensure environmental compatibility, the following factors have been considered:

- restrictions on land use (landscape, archaeological, natural, hydrological, etc.);
- terrain morphology;
- presence of high environmental value areas (e.g. wetlands); and
- sand & stone supply.

The establishment of the construction site will be divided into four distinct phases. The steps individuated hereinafter do not follow a time sequence, but it should be considered as overlapping and simultaneous events.

4.3.1. Phase I

The area will be fenced to prevent intrusion of animals and to protect against materials theft within the site. A video surveillance system will be provided.

4.3.2. Phase II

During the fencing operation as described in Phase I, the most valuable trees, if any, will be removed and placed temporarily in a safe location for future planting at the end of work. This procedure is required for environmental mitigation. The other low value tree species will be cut down and transferred to facilities for wood processing.

4.3.3. Phase III

At completion of the works defined in Phases I and II, the following step will be the site clearing and the construction of internal roads. The internal road network should ensure a two-way traffic of heavy goods vehicles in order to minimize trips. The road system is planned for a width of 8 meters. Roads will be of dry and compacted materials.

The facility will require constant access control, a weigh-house for heavy trucks, removable structures for the storage of yard tools and temporary storage areas.

During Phase III, the installation of MV/LV transformers connected to the Eskom grid is also planned, as well as the laying of underground electrical cables.

4.3.4. Phase IV

Temporary storage areas of materials and workshops will be constructed and used for:

- temporary storage of photovoltaic modules (covered with compacted dry material in order to avoid direct contact with the ground);
- temporary storage for frames and piles of the mounting systems of the PV arrays;
- storage and processing of building material for construction (sand, gravel, concrete batching and mixing plant, steel, etc.);
- drinking water storage for human consumption;
- worker care facilities and site management buildings,
- prefabricated housing modules for workers who may require accommodation inside the site (only key personnel should be allowed to stay overnight);
- technical cabins and management offices;
- medical care unit in a prefabricated module, in order to allow immediate first aid and minor surgical emergency;
- recreation area and canteen (prefabricated modules);
- parking lots for employees (located close to the staff housing), for visiting staff (located close to the offices area), and for trucks and work vehicles during inactivity;
- workshop and storage facilities on the site for contractors;
- electrical network for living units, offices and service structures;
- water supply for living units through polyethylene pipes connected to storage;
- **Ballam Waterslot** or similar sewer treatment system. The treated water will be used to moisten dusty areas and reduce dust gathering due to windy actions;
- chemical toilets (one every 15 workers); and
- solid waste collection point.

All facilities present in the construction site will be covered with dry material in order to avoid mud formation in case of rain.

4.3.5. Earthworks

Earthworks will be required during the construction of internal roads. Vertical alignment of the roads will not present any significant challenges due to the flatness of the terrain so that no deep cuts or fills will be required. Considering a road pavement thickness of 300 mm and an overall road surface approximately 137,000 m^2, the amount of cut or fill is estimated to be approximately 41,100 m^3.

Further items of earthworks would be required where temporary storage areas will be prepared for the storage of the photovoltaic modules and other equipment during construction of the solar park. Small earthworks will be required for the installation of the PV modules and of the medium-voltage stations. None of these activities should require earthworks in excess of 500 mm cut or fill.

Only the foundation plate for the small high-voltage substation may require earthworks more than 500 mm cut or fill (the footprint will be up to 4000 m^2). The topsoil stripping will result in temporary spoils heaps which must be spread over the site upon completion of the project.

Concrete necessary for the basements of the medium-voltage stations, the high-voltage substation, the control building and the warehouse and will be manufactured using aggregate and sand from commercial sources near the development (Danïelskuil or Barkley West).

4.4. TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT

4.4.1. Traffic impact – construction phase

The construction timeframe is estimated to be approximately **15 months.**

Approximately 100 people are expected to be employed during the construction period (15 months), although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Manlenox Expansion - once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Manlenox Expansion Solar Park in a timeframe shorter than 15 months (i.e. 330 working days). For example, in the case the construction works are planned to last only 6 months (i.e. 132 working days), the average number of workers required on site during construction is 250-300. A small accommodation area with few prefabricated buildings inside the work site may be foreseen, if accommodation facilities in Danïelskuil are not sufficient to accommodate all workers.

Overall traffic to and from the work site will amount to approximately **1000 medium / heavy vehicle trips** over the whole construction period. As indicated in the table below, the average number of medium and heavy trucks to and from the site will be of **3 trucks per working day.**

Table 5: Construction timeframe: average daily trips of medium - heavy vehicles

Transportation of:	**months**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
fencing and tools	trips/month	8	8	0	0	0	0	0	0
clearance of the site (vegetation transportation)	trips/month	56	32	0	0	0	0	0	0
piles / frames for mounting systems	trips/month	0	0	20	20	20	20	20	0
sands & gravel for on-site concrete production	trips/month	0	30	48	48	48	52	52	54
PV modules	trips/month	0	0	0	0	0	0	0	0
MV stations	trips/month	0	0	0	0	0	12	12	12
HV substation components	trips/month	0	0	8	8	8	0	0	0
cables	trips/month	0	0	0	0	0	0	0	16
Average trips per month	trips/month	**64**	**70**	**76**	**76**	**76**	**84**	**84**	**82**
Average trips per working day (*)	trips/day	**2.9**	**3.2**	**3.5**	**3.5**	**3.5**	**3.8**	**3.8**	**3.7**

Transportation of:	**months**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**TOTAL**
fencing and tools	trips/month	0	0	0	0	0	0	0	**16**
clearance of the site (vegetation transportation)	trips/month	0	0	0	0	0	0	0	**88**
piles / frames for mounting systems	trips/month	0	0	0	0	0	0	0	**100**
sands & gravel for on-site concrete production	trips/month	52	48	32	0	0	0	0	**464**
PV modules	trips/month	0	16	32	68	66	34	0	**216**
MV stations	trips/month	12	12	0	0	0	0	0	**60**
HV substation components	trips/month	0	0	0	0	0	0	0	**24**
cables	trips/month	16	0	0	0	0	0	0	**32**
Average trips per month	trips/month	**80**	**76**	**64**	**68**	**66**	**34**	**0**	**1000**
Average trips per working day (*)	trips/day	**3.6**	**3.5**	**2.9**	**3.1**	**3.0**	**1.5**	**0.0**	**3.03**

(*)22 working days per month

Medium and heavy trucks will access / leave the site only during working days (Monday to Friday), during daytime (8:00 – 17:00). The provision of a fuelling area at the site could reduce the load of heavy vehicles on public roads. The installation of two steel fuel tanks (30,000 l each) is planned.

4.4.3. Traffic impact – operation phase

The traffic impact during the operation phase will be insignificant, considering that about 35-40 people will work on the PV facility, in the following manner:

- during the daytime approximately 14 people;
- during the night-time, 6 people.

4.5. MANAGEMENT OF THE SOLAR PARK DURING OPERATION

Approximately 35-40 people will be employed during the operation phase, which will have a lifetime of 25 - 30 years. The Manlenox Expansion Solar Park will be in operation 7 days per week; therefore, personnel will operate according to shifts. The surveillance team will be ensured during day-time, night-time and weekends.

The operational team of the project will consist of the following people:

- 1 person as plant manager
- 1 person for administration
- 4 people as technicians / plant operators
- 9/12 people for electric and generic maintenance
- 20/22 people as guards

The "**fire team**" will comprise of people for generic maintenance, who will attend a fire-fighting training program. After this training programme, the fire team will be able to drive/use/manage properly the fire extinguishers and the fire fighting vehicle, that will be available on the site.

5. PROJECT ALTERNATIVES

The EIA Regulations, Section 28(1)(c) and NEMA, Section 24(4), require investigation and consideration of feasible and reasonable alternatives for any proposed development as part of the environmental impact assessment process. Therefore, a number of possible alternatives for accomplishing the same objectives must be identified and investigated.

In particular:
- the property on which, or location where, it is proposed to undertake the activity;
- the location within the current identified site;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity (schedule, process);
- the sustainability of other alternatives, and
- the option of not implementing the activity (No Go Alternative).

5.1. SITE ALTERNATIVES

Several sites have been inspected in order to find out the best solution for the PV power plant. The following selection criteria were applied:
- Connection availability and proximity
- Land availability
- Proper land surface area (±300ha)
- Current land use
- Low environmental impact (low biodiversity)
- Low agricultural potential
- High solar radiance
- Socio-economic issues (land cost and local community unemployment)

The macro area between Delportshoop and Lime Acres towns - south from the road R31 - was investigated, due to the high value of solar irradiation and to the presence of two parallel Eskom's 132 kV power lines (i.e. the Eskom's "Olien-Ulco" 132 kV power line and the Eskom's "Silverstreams-Ulco" 132 kV power line).

Several sites along such two parallel Eskom's 132 kV power lines were investigated during the feasibility assessment, due to the flatness of the areas, such as:

a) Portion 0 of the Farm Grootvlei 296 - Kgatelopele Local Municipality, ZF Mgcawu District
b) Portion 1 of the Farm 269 - Dikgatlong Local Municipality, Frances Baard District
c) Portion 1 of the Farm 270 - Dikgatlong Local Municipality, Frances Baard District
d) Other farm portions crossed by the Eskom's "Olien - Ulco" and "Silverstreams - Ulco" 132 kV power lines

a) **Farm Grootvlei 296,** 2720 ha in extent, were found to be available; the northern side of this farm portion is highly suitable for a solar park, being flat and with a low / medium ecological sensitivity and low agricultural potential.

b) **Portion 1 of the Farm 269**, approximately 1030 ha in extent, even if almost suitable for a solar park, resulted to be not ideal for the proposed development, due to the presence of a huge drainage / wetland which crosses the site form the southern boundary to the north eastern corner.

c) **Portion 1 of the Farm 270**, approximately 1600 ha in extent, even if suitable for a solar park, resulted to be not available for the proposed development.

d) Other farm portions crossed by the Eskom's "Olien - Ulco" and "Silverstreams - Ulco" 132 kV power lines resulted to be not suitable for an ecological point of view, due to the presence of several wetlands / drainage areas, which reduce the suitable areas to less than the required minimum footprint (200 hectares).

Therefore, **the Farm Grootvlei 296** is the **preferred site**, being the most suitable and available alternative.

The location of the alternative sites is indicated in the Figure 7 below.

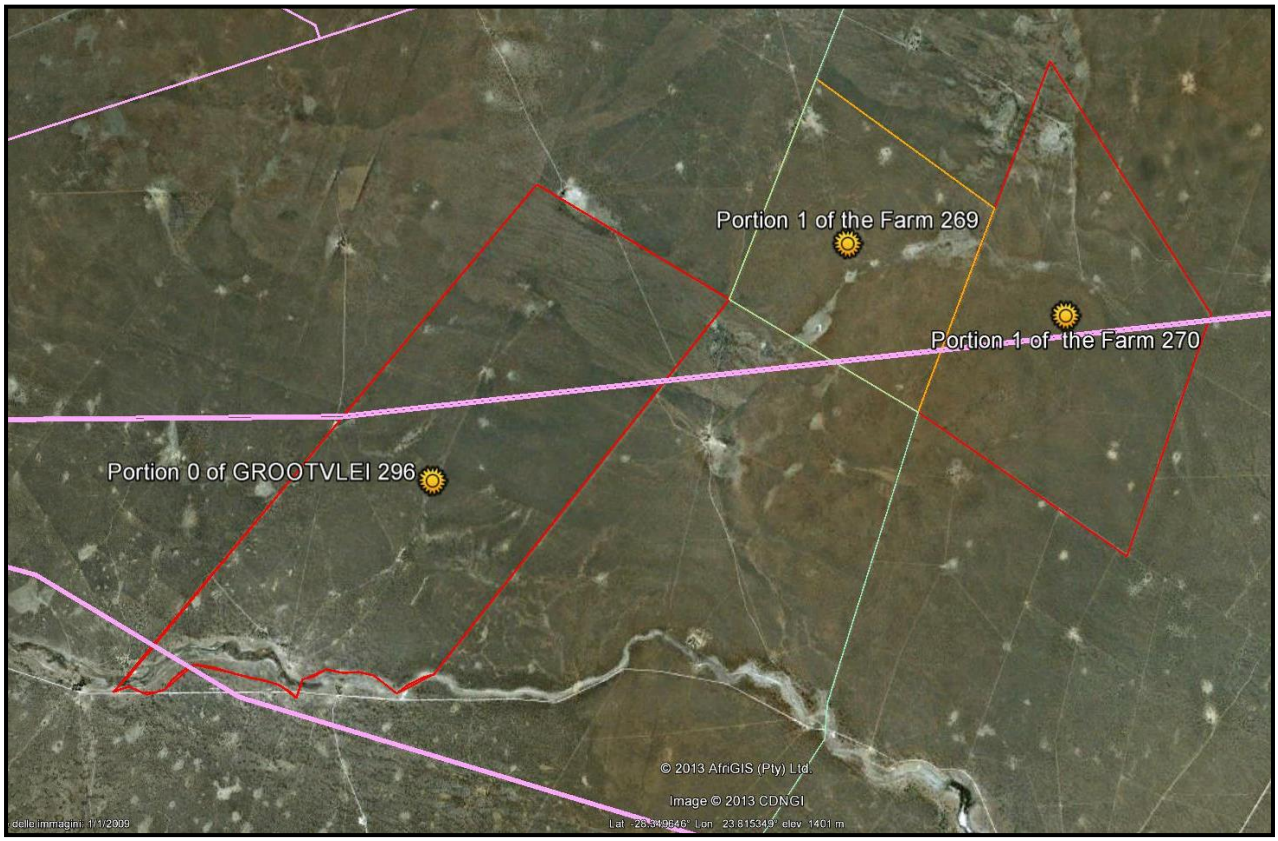


Figure 7: Location of the alternative sites

Although alternative farms were investigated in terms of viability and availability for the development of a solar farm, there were alternative sites investigated on the farm Grootvlei itself.

A number of pans and temporary wetland areas were found on the farm Grootvlei 296 and these are well documented in the Ecological Report (Annexure D) as well as the Wetland and Riparian Delineation Report (Annexure G). Based on the findings of the Ecologist and the sensitivity map drawn up as a result of his investigations, three sites were identified that would be potentially viable for the development of a 120MW solar plant. The first site is located just south of two 132 kv power lines crossing the farm in the northern half of the farm. This site will form part of the Expansion of the previously approved Manlenox Solar Park and forms part of another application for Environmental Authorization to be called Manlenox 2 Solar Park. An alternative site, located to the south west of the power line that traverses the farm is not considered the preferred alternative. In Figure 8 it is clear that the preferred alternatives are next to fewer wetland and pan areas as opposed to the alternative in the south west of the farm. This alternative (which is not preferred) is close to a high number of wetlands and pans as well as a drainage line.

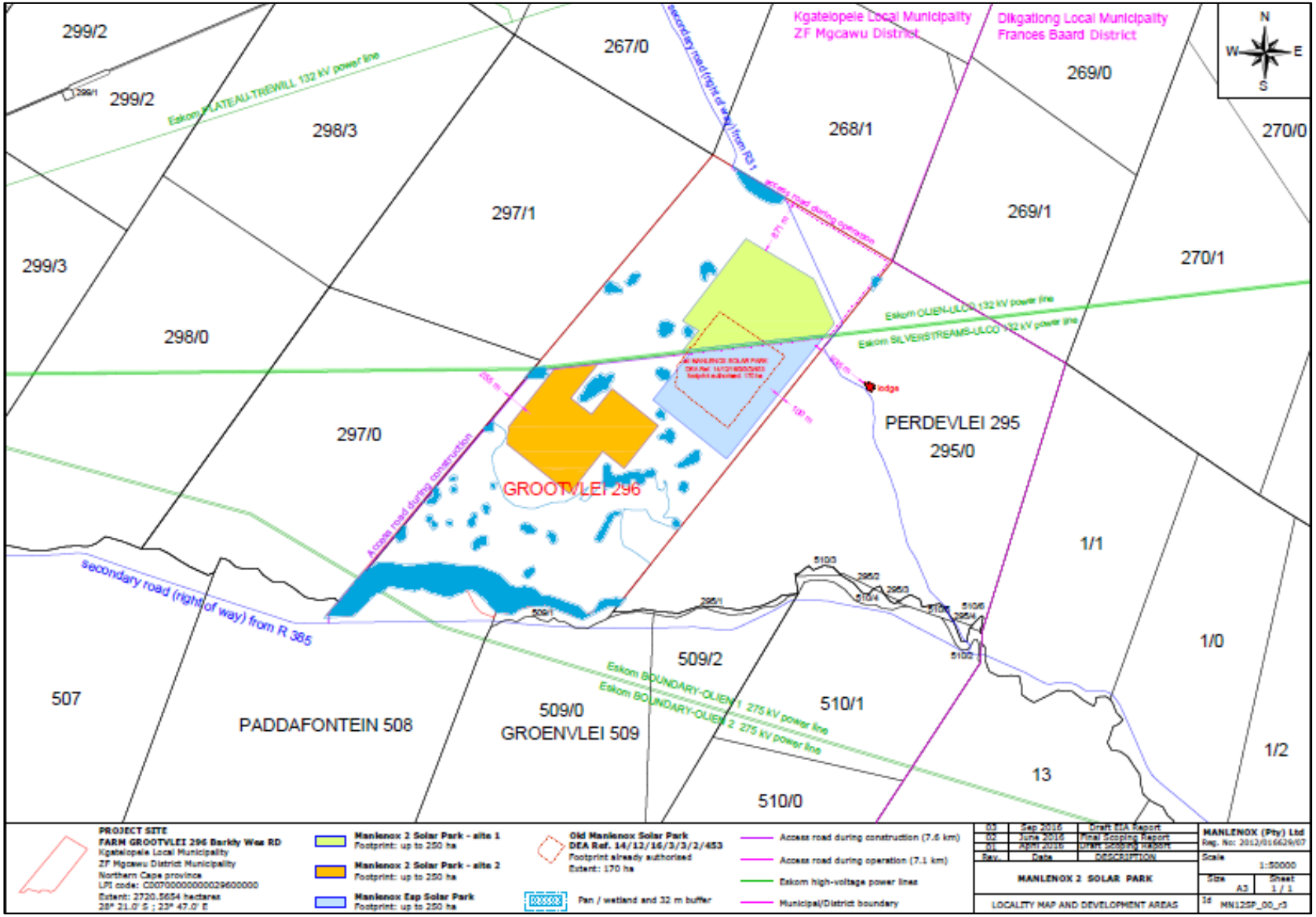


Figure 8: Location of the alternative development sites on Grootvlei 296

5.2. TECHNOLOGY ALTERNATIVES

5.2.1. PV Plant and Solar Thermal Power Plant

The alternative to PV for producing energy from the sun is the thermal solution. There are different forms of this technology: linear Fresnel, parabolic through or tower. These technologies can also be with or without thermal storage and they can use diathermic oils or, the more sophisticated ones can use water and/or molten salts. Final choice is a PV option because these kinds of project result in:

- lower construction costs;
- lower operating and maintenance costs (O&M);
- it is a simpler, quicker and more experienced technology; and
- lower environmental impact, considering that, among other factors, the PV solution requires a minor quantity of water.

5.2.2. Solar Photovoltaic Technology – PV

The project consists of a photovoltaic power plant with a generating capacity of 120 MW, on a footprint of up to 250 ha.

The preferred types of PV modules are:

- **mono-crystalline or polycrystalline PV modules** and,
- **thin-film PV modules**,

which currently represent the best performing options in terms of reliability and costs/efficiency.

At present, mono/polycrystalline modules provide higher solar conversion efficiency (14% to 16%), if compared to the thin-film /PV modules (9% to 13%).On the other hand, thin-film modules (or amorphous silicon / Cd-Te as well) are cheaper and best performing at high temperatures, having an efficiency degradation of only 0.25 %/°C instead of 0.45 %/°C in the case of mono/polycrystalline modules. PV technology is in continuous evolution and it may be possible that thin-film (or amorphous silicon / Cd-Te as well) PV modules achieve a higher solar conversion efficiency in a very short time.
The high volatility of prices of PV modules which depends on the worldwide availability of modules, should be considered. Therefore, the final choice will be taken at the commissioning date, on the basis of the prices and availability of mono/polycrystalline and thin-film / amorphous silicon / Cd-Te PV modules. The development will not exceed the current planned footprint (250ha). Therefore, the final choice of the type of PV modules, whatever it is, will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures.

5.2.3. Alternatives for the Mounting System of the PV Modules

The preferred technical solutions for the proposed solar park entails PV modules mounted on **fixed mounting systems** (**alternative option 1**) or on **single-axis horizontal trackers** (**alternative option 2**).

The tracking solution is the best performing in terms of efficiency, because its energy production is approximately 15% more if compared with fixed systems. This type of technology is characterized by higher technical complexity and deeper installing and maintenance costs, if compared with the fixed mounting solution. The selected tracking system is the horizontal single-axis tracker (SAT), which doesn't differ from the fixed system, except for the presence of the tracking devices and the orientation of the rows of the PV arrays (north - south instead of west – east direction).
The technology of mounting systems is under continuous evolution. Consequently, the final decision about the mounting system technology will be taken only at the commissioning date: if addressed toward the fixed mounting system or toward horizontal single-axis trackers, the layout of the PV power plant will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures. The development will not exceed the currently planned footprint (250 ha) and the height of the structures (PV modules and support frames) will be maximum 3.1 m above the ground level.

Both fixed and horizontal single-axis tracking solutions grant the reversibility of the development in respect of the terrain's morphology, geology and hydrogeology. This means that at the end of the PV plant's lifetime, the site can easily be returned to its status prior to the establishment of the PV plant.

5.3. LAYOUT DESIGN, LOCATION AND CONNECTION ALTERNATIVES

The site chosen for the establishing of the proposed Manlenox Expansion Solar Park is **the Farm Grootvlei 296, Barkley West RD**. The PV power plant will have a generation capacity **up to 120 MW**, on a footprint **up to 250 ha**.

5.3.1. Layout design and Location alternatives

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of some specialist's studies conducted during this scoping phase.
The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 25-30 years. The main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: thin-film or mono/polycrystalline solar modules mounted on horizontal 1-axis trackers or on fixed mounting systems;
- to develop the PV power plant on the northern side of the Farm Grootvlei 296 (2720 ha), which is flat and has a **medium** ecological sensitivity, while the southern side has a **medium - high** sensitivity, due to the presence of several protected trees, and it is affected by several wetlands / drainages;
- to avoid the high sensitivity areas (**pans / wetlands**) sparsely located on the project site, by providing a minimum buffer 32 m wide;
- furthermore, a vegetation buffer zone will be kept around the footprint, in order to minimise the visual impact of the proposed development.

5.3.2. Connection alternatives

The Farm Grootvlei 296 is traversed by several Eskom's overhead power lines, such as:

- the Eskom's "OLIEN-ULCO" 132 kV power line
- the Eskom's "SILVERSTREAMS-ULCO" 132 kV power line;
- the Eskom's "BOUNDARY-OLIEN 1" 275 kV power line;
- the Eskom's "BOUNDARY-OLIEN 2" 275 kV power line.

Two possible connection solutions have been considered with reference to the proposed project:

- the **first connection alternative (**preferred**)** foresees the construction of an on-site "loop in loop out" 22 kV / 132 kV substation linked to one of the two Eskom's "OLIEN-ULCO" or "SILVERSTREAMS-ULCO" 132 kV power lines crossing the northern side of the property.
  This connection solution resulted to be the preferred one, due to the low cost of the connection (being the voltage level only 132 kV) and the low ecological sensitivity of the planned location for the on-site substation, (the northern side of the farm).
- The **second connection alternative** foresees the construction of an on-site "loop in loop out" 22 kV / 275 kV substation linked to one of the two Eskom's "BOUNDARY-OLIEN 1" or "BOUNDARY-OLIEN 2" 275 kV power lines crossing the southern side of the property.
  This connection solution resulted to be extremely costly: it would entail a "loop in loop out" 22 kV / 275 kV sub-station with high levels of protection for the 275 kV busbar. Furthermore, this alternative is not recommended from the ecological point of view, since it entails the constriction of the on-site substation close to the Eskom's 275 kV power line, i.e. on the southern side of the farm, having a medium-high ecological sensitivity, due to the presence of several protected trees and drainage features and wetland areas.

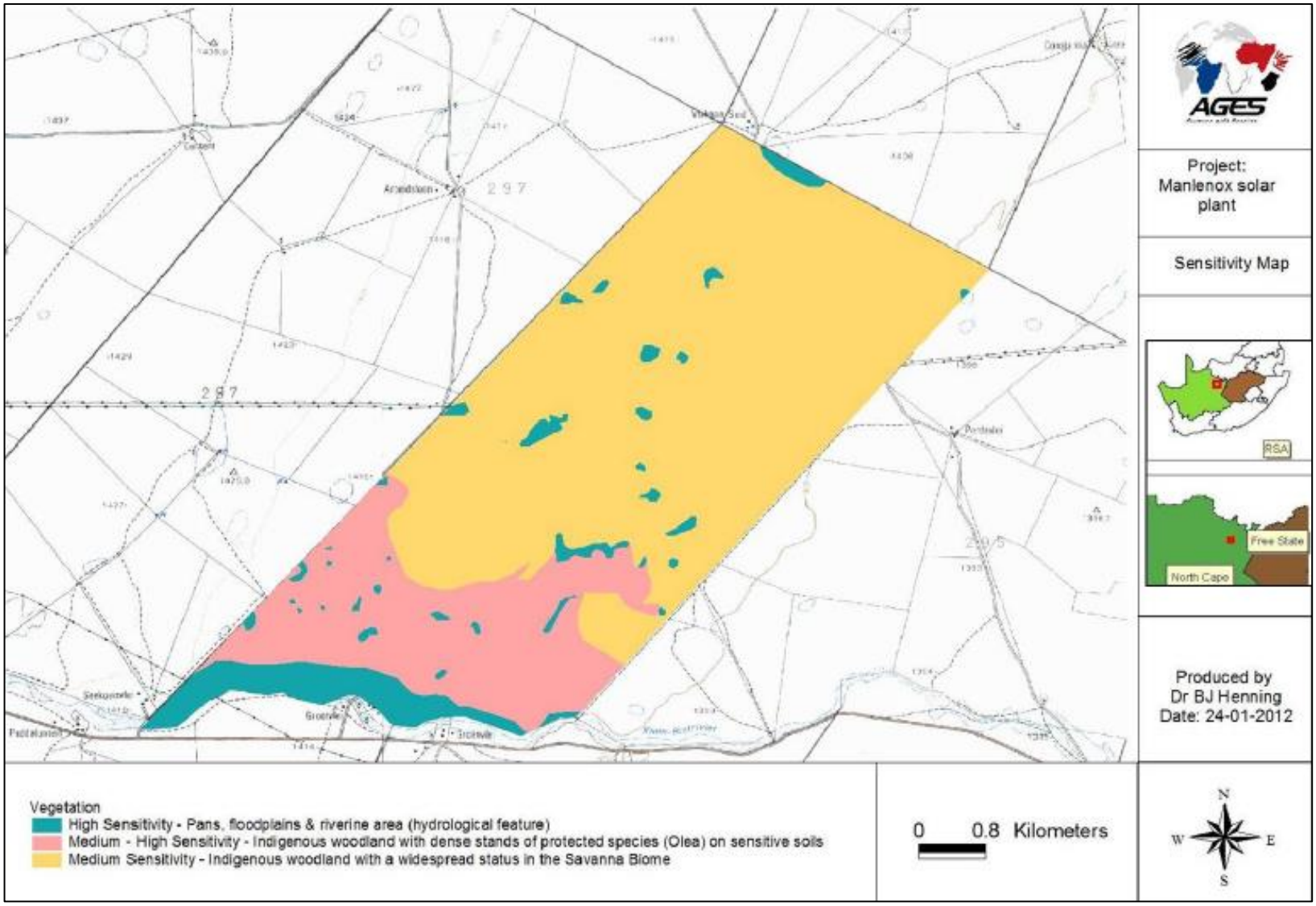


Figure 9: Sensitivity Map

5.4. NO-GO ALTERNATIVE

The no-go alternative is the option of not establishing Photovoltaic Power Plants on the site, or any of its alternatives. The environment will remain in its current state (**status quo**). This will not create any new employment opportunities, and therefore the anticipated economic benefits of the project will accrue to the study area (see the paragraph 6.4 **Socio-Economic Environment**).

Should this alternative be selected the socio-economic and environmental benefits related to the use of renewable energy resources will not be realised with prejudice to the development of the area. The benefits related to the establishment of a renewable energy power plant are for example analysed in detail in the REFIT Regulatory Guideline published by NERSA (March 2009:

- Enhanced and increased energy security: renewable energy plays an important role in terms of power supply, improving grid strength and supply quality and contemporarily reducing transmission and distribution costs and losses.
- Resource economy and saving: the energy production by coal fired plants consumes a significant amount of water, this amount of water could instead be saved if a renewable energy facility like the proposed one is put in operation.(the Energy White Paper envisages that the implementation of its targets will determine water savings approximately 16.5 million kilolitres). This will be beneficial on the large scale for the water conservation measures that the country is currently undertaking.
- Support of new technologies and new industrial sectors: the development and establishment of renewable energy power plants contribute to the growth of new technologies and new industrial sectors with benefits for its economy.
- ***Exploitation and capitalization of South Africa's renewable resources***: with the aim of increasing energy security.
- Employment creation and career opportunities: the construction and operation of a renewable energy power plant contributes to job creation and new career opportunities.
- Pollution reduction: the use of renewable energy resources decreases the demand and the dependence from coal and oil for electricity generation.
- Contrast to Global warming and climate mitigation: the development of renewable energy contributes to reduce global warming through the reduction of greenhouse gas (GHG) emissions.
- Protection of natural foundations of life for future generations: the development and establishment of renewable energy power plants offers the opportunity of consistently reducing the risks related to climate change caused by CO2 and CO emissions, therefore preserving life for future generations.
- Acceptability to society and community: the use of renewable energy is largely accepted by society and community as a mean to reduce pollution concerns, improve human health and wellness, protect the environment, the ecosystem and climate;
- Commitment to and respect of international agreements: in particular in light of the possible commitment to the Kyoto Protocol.

6. STATUS QUO OF THE RECEIVING ENVIRONMENT

The receiving environment has been described using a combination of specialist inputs, on-site observations, a review of existing literature and utilizing Geographic Information Systems (GIS) planning tools.

6.1. PROPERTY DESCRIPTION AND CURRENT LAND USE

The proposed development will stretch over a part of the **Farm Grootvlei 296**.

Farm Grootvlei 296 (Barkly West R.D.)

Surveyor-general 21-digit site	C00700000000029600000
Local Municipality	Kgatelopele
District Municipality	ZF Mgcawu
Province	Northern Cape
Extent	2720.5654 ha
Land Owner	AUSTIN PETER EDWARD
Diagram deed number	GWQ20/40
Title deed number	T206/1999
Registration date	19990208
Current land use	farming
Geo-graphical Co-ordinates	28° 20' 55" S; 23° 47' 12" E (preferred location of the lease portion)

The site is located 30 km east from the town of Limes Acre, 54 km west from Delportshoop / Tidimalo and 100 m west - north-west from Kimberley.

As aforementioned, Portion 0 of the Farm Grootvlei 296 is already affected by energetic infrastructure such as:

- the Eskom's "OLIEN-ULCO" 132 kV power line
- the Eskom's "SILVERSTREAMS-ULCO" 132 kV power line;
- the Eskom's "BOUNDARY-OLIEN 1" 275 kV power line;
- the Eskom's "BOUNDARY-OLIEN 2" 275 kV power line.

Farm portions close to the project site are mainly used for farming purpose.

6.2. ENVIRONMENTAL FEATURES

6.2.1. Climate

The study area is situated within the summer and autumn rainfall region with very dry winters. The mean annual precipitation varies between 200 and 400mm. The mean maximum and minimum monthly temperatures for the area are 36.3°C and -7.5°C, for January and July respectively.

6.2.2. Topography

The proposed development area is underlain by a valley floor land facet with gentle slope of 0.4% from south to northeast across the site, the average elevation is 1407 mamasl with the lowest point 1403 m a.m.s.l and the highest point 1409 m a.m.s.l.
Drainage occurs as sheet-wash in a north-eastern direction towards local low lying areas north of the site. The river forming the southern boundary of the farm lies beyond a local topographical watershed. There is no flooding risk from drainage on the site.

6.2.3. Soils and geology

A site visit was conducted on 6 April 2013, when 13 trial pits were excavated across the property. The Geo-technical and Geo-Hydrological Report attached as Annexure I is a revised and amended report. This report was amended to include the new specifications of the Manlenox Expansion Solar Park, which is a 120 MW solar park on 250 ha.

The site is underlain by aeolian sand and quaternary calcrete overlying the limestone of the Ghaap Plateau Formation (Vgl). Sporadic outcrop of limestone was noted across the site during the site investigation. The surface calcrete (Ql) occur as a capping on the dolomite and in places cemented limestone boulders were observed.

The higher relief area in the western portion of the site is underlain by Kalahari sand and calcrete.

The proposed solar park development area is underlain by a single profile and the whole area is underlain by calcrete overlying and in places cemented to the underlying limestone bedrock covered with a thin veneer of windblown Kalahari sand.

Using the COLTO Standard, **excavatability** is classified as **hard** (boulders larger than 0.1 m^3, blasting or pneumatic and Mechanical rock breaking tools required) **below 300 mm depth**. The potential for collapse of side walls of deep excavations is low. It is recommended that the sidewalls excavated be battered back to a 1:1.5 grade slope or shored in excavations deeper than 1.5 m to comply with minimum safety regulations.

Due to the shallow bedrock conditions across the site, **LAND USA AREA A** is classified as **developable with precautions**.

The **pan area**s (**LAND USE AREA B**) cannot be developed, due to the possibility of water ponding after heavy rains.

No shallow groundwater conditions were encountered in any of the trial pits on site.

No mining activities past or present are present on the property or will impact the property.

The Geo-technical and Geo-Hydrological Report concluded that - from a geotechnical perspective - both the Alternative Locations 1 and 2 are suitable for the proposed development.

6.2.4. Geo-hydrology

As indicated in the Geo-technical and Geo-Hydrological Report (Annexure I) The site is located within the **C92A Quaternary**, where 45 m^3/ha/annum of ground water abstraction is allowed for under the DWA General Authorization. The proposed development site falls within the Lower Vaal Water Management Area (WMA).

Recorded Mean annual precipitation is 367 mm per annum, with an annual run-off of 8 mm. Groundwater recharge is 10.3 mm per year and groundwater level of the area is 4m below surface. The Eco status is category B. The total groundwater use in the quaternary is 0.83 mm^3 per year.

The estimated annual groundwater recharge (10.3 mm/m2 per annum) from an average annual precipitation of 367 mm falling on the property (2,720 ha) will result in **280,160 m^3 of water available**. The maximum annual water requirements are:

- 2795 m^3 / year for the project;
- 6300 m^3 / year for livestock (350 head of cattle consumes 50 l of water per day);
- 360 m^3 / year for human consumption (landowners).

The scale of abstraction relative to recharge is 3.4% (Category A).

6.2.4.1. Boreholes, groundwater availability and quality on the project site

Three boreholes were identified on the property. The three boreholes (Borehole 1 to Borehole 3) are situated in a line, indicating that the sighting of those boreholes is along a feature.

Borehole 2 and Borehole 3 are equipped with wind pumps. The groundwater level in both boreholes is shallow, at 4 m below surface. These boreholes are 12 deep and currently used to supply drinking water to livestock.

Borehole 2 and Borehole 3 have a sustainable yield of more than 20,000 l/hour, therefore they can be also used for the water needs of the proposed development. Currently the two boreholes are equipped with wind pumps capable of pumping no more than a 1000 l/h when the wind blows.

With the information available, a sustainable abstraction of **50,000 l/day** is assumed for the aquifer. Before construction of the solar park commence, pump testing should be conducted to verify the aquifer and borehole yields.

The water quality analysis of the samples collected from the wind pump conforms to the SANS 241 drinking water standards. All the parameters tested were within specification.

6.2.5. Ecology (fauna and flora)

An Ecological Impact Assessment was conducted by Exigo to describe the ecology (fauna and flora) present in the site, to assess its ecological sensitivity and to indicate the most suitable areas for the proposed development.

For this purpose, detailed ecological (fauna habitat & flora) surveys were conducted on January 2013 to verify the ecological sensitivity and ecological components of the site at ground level. The reports as included here has been revised and amended for the new specifications of both Manlenox Expansion and Manlenox Expansion Solar Park.

6.2.5.1. Vegetation types

The vegetation of the proposed development site falls within the north-eastern range of the Griqualand West Centre of Endemism and is one of the 84 African centres of endemism and one of 14 centres in southern Africa and these centres are of global conservation significance.
The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Ghaap Plateau Vaalbosveld.

The landscape features of this vegetation type are a flat plateau with well-developed shrub layer dominated by **Tarchonanthus camphoratus** underlain by surface limestone and dolomite. The conservation status of the Ghaap Plateau Vaalbosveld is Least Threatened with none conserved in statutory reserves and only 1% transformed (Mucina & Rutherford, 2006).
This vegetation type covers most of the Ghaap Plateau, and is found on different types of soils, such as calcareous tufa, dark brown to red sands and acid gravels, all underlain by dolomite (van Rooyen & Bredenkamp 1996).

The vegetation varies from open to closed bushveld, composed mostly of shrubs and some small trees, in mixed grassland. The principal shrubs are Camphor Tree **Tarchonanthus camphoratus**, Threethorn **Rhigozum trichotomum**, Puzzle Bush **Ehretia rigida**, **Grewia flava** and **Gymnosporia buxifolia**. The tree species present are Wild Olive **Olea europaea** subsp. **africana**, Umbrella Thorn **Acacia tortilis** and Shepherd's Tree **Boscia albitrunca** (van Rooyen & Bredenkamp 1996).

Grasses are tall, and Red Grass **Themeda triandra**, Copperwire Grass **Aristida diffusa** and Silky Bushman Grass **Stipagrostis uniplumis** are common. Thickets of shrubs and trees are present and include Fringed Karee **Searsia ciliata**, Black Thorn **Acacia mellifera subsp. detinens**, and Umbrella Thorn **Acacia tortilis**.

The pans on the proposed development site represent the Southern Kalahari Salt Pans vegetation type on site. These pans represent low grasslands on pan bottoms. The pans as an entity have a Least Threatened conservation status and are subject to natural degradation / regeneration cycles controlled by concentration of grazing animals.

6.2.5.2. Fauna

A survey was conducted during January 2013 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree grid. Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat will be low.

A number of ecological potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance. The recommendations and mitigating measures highlighted in the Ecological Impact Assessment (Annexure D) should be implemented to ensure the survival of these species other fauna habitats and feeding grounds.

6.2.5.3. Summary and results of the Ecological Impact Assessment

Detailed ecological (fauna habitat & flora) surveys were conducted during January 2013 to verify the ecological sensitivity and ecological components of the site at ground level. The report was revised and amended to consider the new site lay out plans for both Manlenox Expansion and Manlenox 2 Solar Parks. The two development sites were not considered in isolation and was evaluated cumulatively and the impact of both solar parks, functioning as one solar park, were evaluated.

The site lay out plans were based on the findings by the ecologist and the sensitivity map provided. All sensitive areas were avoided as far as possible and buffer zones were include around pans and wetland areas as well as along the periphery of the development footprints.

Considering the results from the field surveys, mitigation needs to be implemented to prevent any negative impacts on the ecosystem, since most of the site is in a natural state. A sensitivity analyses was conducted to identify the most suitable site for the development of the Photovoltaic Power Plant. From this investigation and ecological surveys, the following main observations was made:

- The most suitable area for the development of the project would be throughout most parts of the site, even though the most parts of the site represents natural Savanna vegetation types. The shrubveld variations of the site have a moderate sensitivity. Limited mitigation is needed for the preservation of some sections of this natural vegetation entity, while the eradication of invasive species such as **Prosopis** should be considered a high priority. The herbaceous layer should preferably be preserved below the solar panels and managed through slashing during the entire lifetime of the project.
- The **Olea Tarchonanthus** woodland has a moderate to high sensitivity as a result of the dense stands of the protected wild olive trees (NCNCA). This area should preferably be preserved and therefore the development footprint was placed slightly further north into the shrubveld.
- The salt pans and valley bottom without a channel (Klein Riet River) represent sensitive wetland habitat type that will be seasonally wet and have a high sensitivity. No development can occur in these areas and a buffer zone of 32 meters should be implemented around these areas.

No red data plant species were found on the site due to the state of the vegetation and physical environment of the larger area mostly not being suitable for any of the red data plant species that may be found in the area. Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat. Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. If al mitigation measures and recommendations in the report are strictly adhered to, the proposed development won't significantly influence the potential rare habitats for flora and fauna on the site. However, *Olea europea* trees found on site, is protected under Northern Cape Nature Conservation Act and an application for a permit to remove some of these trees will be submitted to the DENC once the project has received preferred bidder status from the DoE.

6.2.6. Avifauna

An Avifauna Impact Assessment (Annexure E) was conducted by Exigo in order to determine whether the proposed development would have negative impact on avifauna. A number of potential impacts were individuated and assessed:

- **Direct Habitat Destruction** will occur with the construction of the Solar Plants, substations and power line connections will result in loss of and damage to natural bird habitats. However, most habitat destruction will be caused during the construction of the solar plants and power lines.
- Regarding **habitat fragmentation**, the development will have a relatively small impact on the natural movement patterns and fragmentation of avifauna habitats. Such impacts would only be temporary in the solar plank sites.
- In the context of overhead power lines, **electrocutions** are not a major issue. Due to the large size of the clearances on most overhead lines in the area, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. Electrocution on the proposed power lines is improbable given the adequate clearances and short length of the power lines.
- **Collisions** with power lines and Solar panels and solar installations often feature large areas of reflective panelling. Any vertical, reflective surfaces may confuse approaching birds with the result that they are disorientated and displaced from the area, or killed in collisions with such surfaces. Other bird species may seek to benefit from the solar installations, using structures as prominent perches, sheltered roost sites or even nesting or foraging sites. Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with facility operators.
- **Construction and maintenance activities** impact on birds through disturbance, particularly during breeding activities. An increase in human activity on the site and surrounding areas is anticipated, especially during the construction phase of the solar parks. Birds will move out of the area during construction activities because of noise disturbance. The presence of many construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires which might cause loss of bird diversity when ground-living birds are killed in the fires or their nests destroyed.

A series of specific mitigation measures are included in the Avifauna Impact Assessment, addressing all the above-mentioned identified impacts. The Avifauna Impact Assessment concluded that the proposed development of the Photovoltaic Power Plant would not impact significantly over any avian habitats of high conservation value.

Considering the layout and design of the proposed development as well as the impact assessment, the extent of the habitat that will be affected will be minimal.

The Avifauna Report concluded that, if the suggested mitigation measures and recommendations are adhered to, it is unlikely that the proposed development will have a long-term, significant negative impact on the local avifauna.

6.2.7. Visual

A Visual Impact Assessment was conducted to determine the visual impact of the proposed solar park. Vegetation plays a major role in screening the proposed intervention from adjacent and nearby sensitive viewers. Vegetation buffer screens (40m wide on the north- and south-western sides, 371m on the north-eastern and 375m on the south-eastern sides) are included in the layout plan in order to increase the distance between the viewer and the project components. With the effective implementation and proper maintenance of the vegetation buffer screen the visibility would be reduced to a minimum and the possible views from the Constantia Game Farm would be screened. The effect of the lighting at night will be low, considering that at night only streetlamps from the access point up to the loop-in loop-out substation on the property will be switched on. This is because video-surveillance system will use infra-red (or micro-wave) video-cameras, which do not need a lighting system, which could reduce its functioning.

The Visual Impact Assessment as included in Annexure J, was revised and updated to include the new specifications of the Manlenox Expansion and Manlenox 2 Solar Parks. The two developments were assessed cumulatively and not in isolation.

6.3. SOCIO-ECONOMIC ENVIRONMENT

A report on the socio-economic considerations related to the proposed project was compiled by Glen Steyn & Associates - development economists (Annexure K). this report was revised and amended to consider both Manlenox Expansion and Manlenox 2 Solar Parks. The following section is an excerpt from the report:

The following socio-economic impacts may arise during the construction phase of the proposed project:

- The national and local economies will benefit from civil contractor work, labour and building materials that will be required on site. On the whole, a share of approximately 20% of total CAPEX (investment costs) will be sourced within the country. This share is likely to increase once there will be a specific and competitive industry in the Republic of South Africa able to supply PV modules and other technological components.
- Socio-economic benefits for local population due to job creation (especially in lower skilled levels).
- Association of employment to training and capacity building with enhancement of the skill of individual workers.
- Local procurement for general materials, goods and services (catering and security).

During the operational phase the following impacts and issues have been identified:

- Contribution to the generation of “green energy” which could reduce South Africa’s dependency on coal generated energy and the impact of such energy sources on the bio-physical environment;
- Positive marketing of the Kgatelopele Municipality as a development area for renewable energy sources;
- Employment opportunities with benefit for unemployed individuals within local communities, also in compliance with the Government’s new “green economy” growth path;
- Skills development and capacity building during the life of the facility;
- Local procurement for general materials, goods and services (catering and security) and for maintenance works by local sub-contractors;
- The presence of permanent security personnel may be beneficial to the overall safety and security situation in the area.

Furthermore, Manlenox (Pty) Ltd intends to make a corporate social investment in the proposed project area in addition to the investment in the solar plant, according to the IPP Procurement Programme rules. Kgatelopele Local Municipality will be consulted about the configuration of the corporate social investment initiative.

In summary, the site that has been selected is very well suited for the proposed projects, which will enable the national and provincial governments to advance the implementation of their strategic objectives for renewable energy and the development of a hub for this purpose in the Northern Cape. The low value creation from livestock grazing, which is the current land use, and access to two Eskom transmission lines, implies than the proposal of two solar projects adjacent to each other and capable of generating 240 MW in total, is a more preferable option than a single solar project only.

6.4. AGRICULTURAL POTENTIAL

An Agricultural Potential Impact Assessment on soils potential is attached as Annexure F; the site surveys were conducted during February 2012. However, the report as attached here has been revised and amended in terms of the new specifications for Manlenox Expansion and Manlenox 2 Solar Parks. The current land-use of the proposed development site is grazing by livestock. Neighbouring farms are being used for livestock grazing, with some isolated crop cultivation further away from the site in the deeper soils adjacent to the rivers where water is available for irrigation.

The results of the Agricultural Potential Study (Annexure F) indicate that the agricultural potential of soils on the proposed development area is mostly low (shallow, gravelly soils with limited suitability for grazing). The results obtained from the study were done after field observations were done to verify the soil potential classified by the Department of Agriculture on a small scale. The site should be considered as moderate potential grazing land with low potential for arable agriculture considering the climatic conditions, soil physical characteristics and size of land potentially available. Considering that re-growth of grass will take place under the panels as the mounting systems are at least 1m above ground level, the grazing value of the land will not be lost entirely since smaller livestock such as game, goats and sheep will still be able to utilize the grass layer underneath the panels. At the end of the lifetime of the solar plant, structures will be removed and natural vegetation will re-establish naturally.

6.5. CULTURAL AND HERITAGE RESOURCES

A Heritage Impact Assessment (Annexure H) was conducted to ascertain whether there are any remains of significance in the area that will be affected by the proposed development. Previous study was done for the original Manlenox Solar Park. The report attached in Annexure H has been revised to include both Manlenox Expansion and Manlenox 2 Solar Parks.

Prof. Bruce Rubidge previously completed a desktop palaeontological study for the study area (included in Annxure H). He concluded that the development of the two proposed Manlenox Solar Parks will extend over Precambrain rocks of the Transvaal Supergroup as well as Caenozoic calcrete deposits of the Kalahari Group. It is extremely unlikely that fossils will be exposed as a result of the Solar Park developments. He recommended that, from a palaeontological perspective, the development of the two proposed Manlenox Solar Parks should proceed, but that if fossils are uncovered in the course of construction activities, the developer immediately calls in a qualified palaeontologist to assess the situation and, if necessary, undertake excavation of the fossils.

The following have been concluded in the Heritage Impact Assessment Report.

Isolated finds of a few Late Stone Age stone tools were made during the study. These stone tools were found amongst protruding calcrete reefs/outcrops across the study area. These finds did not constitute a heritage site/s due to their limited numbers and isolated nature. It is however important to note that these stone tools do occur in the study area regardless of their limited number and/or isolated nature.

A scheduled watching brief performed by a suitable qualified person is therefore recommended during the bush clearing and construction phases of the projects. This person should act and recommend on any possible open air Late Stone Age sites which could possibly be associated with the current isolated finds of Late Stone Age stone tools across the study area.

The proposed developments of the Manlenox Expansion Solar Park and the Manlenox Expansion Solar Park and their associated infra-structures in the indicated areas can continue from a heritage point of view if the recommendations as outlined in this report are adhered to.

Figure 10: Vegetation Map of the project site

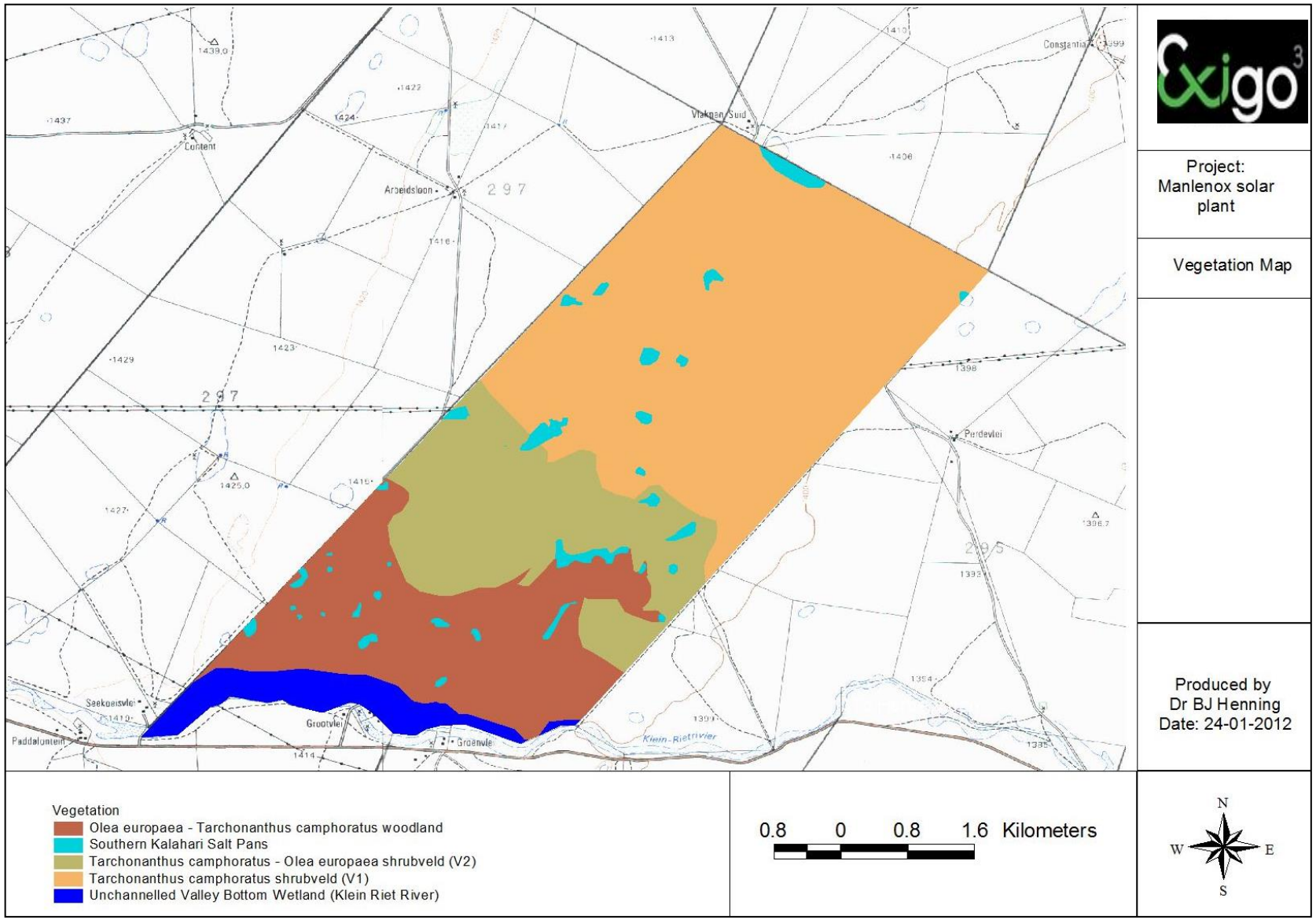
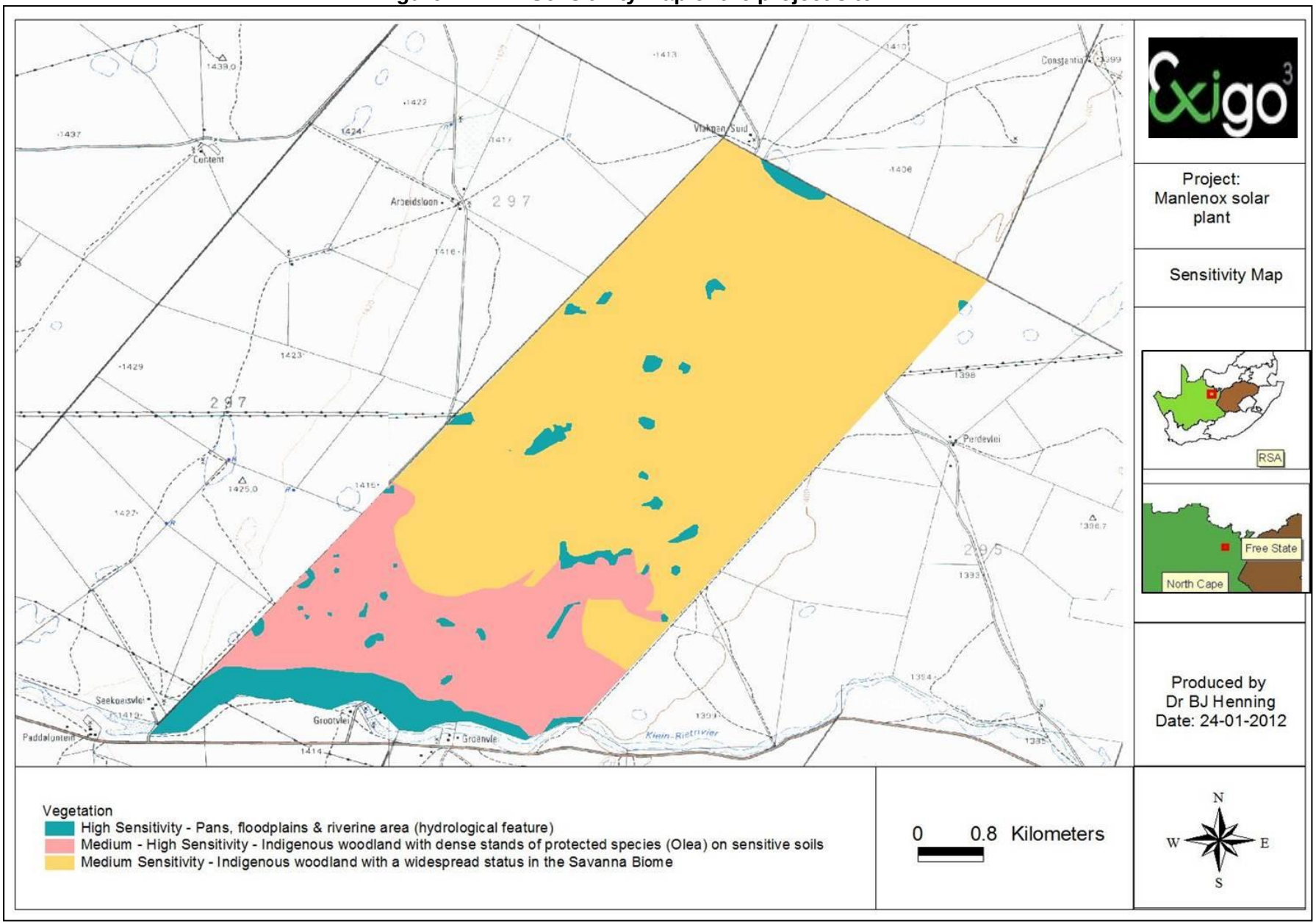


Figure 11: Sensitivity Map of the project site



7. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS AND PUBLIC PARTICIPATION PROCESS (PPP)

The environmental impact studies can be summarized in a two-phased approach:

- Phase 1: Environmental Scoping Study (ESS)
- Phase 2: Environmental Impact Assessment (EIA) and Environmental Management Program (EMP)

The scope of the EIA procedure is to provide an assessment of all impacts related to the proposed project in compliance with the EIA Regulations 2014.

7.1. SCOPING PHASE

The Scoping Phase aims to produce the following:

- a description of the proposed activity, the property and the receiving environment;
- the identification of potential significant positive and negative impacts;
- the identification of opportunities and constraints, alternatives and mitigation measures which need to be evaluated and investigated during the successive EIA phase, especially in order to prevent environmental fatal flaws and sensitive or “no-go” areas.

The Scoping Phase included the Public Participation Process. The PPP has the aim to identify concerns and issues by the interested and affected parties (I&AP’s).
Issues and concerns raised by the I&AP’s and key stakeholders during the Public Participation Process have been collected, processed and addressed in the Comments and Response Annexure which formed a part of the Final Scoping Report.

All issues and concerns identified during the Scoping Phase were documented in the Final Scoping Report which was submitted to the DEA together with a Plan of Study for EIA. Scoping approval was obtained on 27 July 2016.

7.2. EIA PHASE

The next (current) step of the EIA process is the development of guidelines for execution of the impact assessment and the compilation of an Environmental Impact Assessment Report.

The database of the stakeholders and I&AP’s developed during the scoping process is used as a reference to ensure that stakeholders are involved and participate in this second phase of the EIA process. All relevant issues considered during the Scoping Phase are further investigated and assessed during the EIA Phase of this project. The EIA involves various specialist studies and should provide an overall assessment of the biophysical, social and economic environment affected by the proposed project.

A detailed assessment is carried out in terms of environmental criteria and rating of significant impacts of all options identified in the scoping phase. Appropriate mitigation measures are identified and recommended for all significant impacts. These measures have been included in the Environmental Management Programme (EMPr) submitted together with the Environmental Impact Assessment Report (EIAR) to the DEA.

During the EIA phase stakeholders and I&AP’s were notified in writing of the continuation of the project to the EIA Phase and were informed as to the way forward. Comments from the stakeholders and I&AP’s on the EIA and the Draft EMPr are incorporated into the Final EIAR. The stakeholders and I&AP’s will furthermore be informed of the final decision regarding the Environmental Authorization and the appeal process.

7.3. PUBLIC PARTICIPATION PROCESS (PPP)

All relevant I&AP's have been identified and involved in the public participation process from the beginning of the project as per the EIA regulations 2014. The public participation process offers the opportunity to become actively involved through constant sharing of information. The main purposes of the public participation process are to ensure that:

- all relevant information in respect of the application is made available to I&AP's for their evaluation and review;
- reasonable opportunity is given to I&AP's to comment and to submit queries related to the proposed project;
- comments and queries by the I&AP's to the Draft Scoping and to the EIA Reports are submitted and evaluated in a reasonable timeframe and in predetermined terms.

The initial informative stage of the public participation was done from 22 July 2015 until 24 August 2015. The public was informed of the proposed development and a database of Interested and Affected parties was compiled. In the enclosed Annexure C there is the list of all components of the public participation process. The public was informed of the project by means of:

- Site notices;
- Background Information Documents (BID) sent to all adjacent land owners;
- Notices in a local newspaper; and
- Sending of BID to other possible interested and affected parties/stakeholders.

A data base of registered I&AP's has been established to date and will be maintained and added to as required.

Site notices were put up on site on the fence surrounding the proposed development area on 22 July 2015.

A data base of registered I&AP's has been established to date and will be maintained and added to as required. Site notices were put up on site on the fence surrounding the proposed development area. After a Deed Search was done on the surrounding properties a Background Information Document was sent to each of the adjacent landowners. Proof of this is attached in Annexure C. A number of these documents was also distributed to the relevant governmental departments including **inter alia** Department of Water Affairs, Agriculture Land Reform & Rural Development **etc**. Other identified interested and/or affected parties/stakeholders include Eskom, the Local municipality, the District municipality **etc**. Proof of all correspondence is included in Annexure C. A newspaper advertisement was published in the 22 July 2015 edition of the Stellalander, which is a local newspaper, which is distributed in the nearby towns and surrounds.

A scoping report was distributed in draft format and was sent to registered interested and/or affected parties as well as I&APs who did not register just to be thorough. The Final Scoping report was submitted to the Department of Environmental Affairs on June 2016 and Scoping approval was received on 27 July 2016.

The Draft EIA Report was made available for public comments from 5 October 2016 until 5 November 2016.

7.3.1. Further steps in Public Participation Process

To ensure a transparent and complete public participation process the following steps are still to be taken during the rest of the EIA process:

- Registered I&APs will be notified that the Final EIA Report was submitted to the DEA.
- All I&APs and governmental organizations will be notified about the final decision of the DEA (Environmental Authorisation granted or not).

7.3.2. Results of the public participation process

A small number of registrations were received during the public participation process thus far. The most significant comments were received from the Department of Environmental Affairs from the Biodiversity Conservation directorate. Comments were received on the scoping report dated 19 September 2016. A letter dated 21 September 2016 was sent from AGES acknowledging receipt of these comments.

7.3.2.1. Comments from DEA - Biodiversity

Recommendations in the comments from Biodiversity Conservation directorate include the following, including implementation of recommendations in this report:

- **Reference to the generating capacity of the PV power plant, being 75MW instead of 120MW.**

All specialist's reports were revised and amended to include the new specifications for the Manlenox Expansion Solar Park.

- **Locality and development area maps must show the proposed calculated footprint figure.**

New and updated maps with more information and detail is included in Annexure A.

- **Sensitive areas must be demarcated and regarded as no-go zones.**

Sensitive areas include wetlands and pans and are clearly indicated on the sensitivity map as included in Annexure A as well as the ecological report. The demarcation and management thereof will be included in the EMPr.

- **A 30m buffer zone on the wetlands must be applied and regarded as no-go areas and be shown in maps in the EIA Report.**

Buffer zones have been implemented and is indicated on lay out plans included in Annexure A.

- **The Ecological and Avifauna report must be submitted with a full layout plan overlaid with the development footprint and sensitive areas to allow for informed decisions to be made by the directorate.**

Sensitive areas were avoided as a whole but the maps as requested by the directorate will be forwarded in addition to the Draft EIA Report.

- **A walk through must be done to confirm any other sensitive habitats on the site and to confirm species of conservation concern and results must be include in the final EIA Report.**

This will be arranged during the Draft EIA stage of the EIA process.

- **The Northern Cape DENC must be consulted.**

The Northern Cape DENC will be sent a copy of the draft EIA Report and they will have 30 days to furnish comments.

- **The sensitivity map must show all sensitive areas with buffer zones and must indicate no-go areas.**

The sensitivity map is included in Annexure A of this Draft EIA Report.

- **A site inspection must be arranged between the directorate: Integrated Environmental Authorisations and directorate: Biodiversity Conservation during the Draft EIA report.**

Arrangements will be made for a site visit to include both directorates.

7.3.2.2. Comments from DENC

Northern Cape Department of Environment and Nature Conservation sent comments on the Draft EIA Report, dated 1 November 2016. AGES sent a letter in response to these comments, dated 7 November 2016. Herewith is the comments from DENC and the responses from AGES.

1. The name of the district municipality has changed from Siyanda District Municipality to ZF Mgcawu District Municipality.
   This will be amended in the Final EIA Report.

2. There is a discrepancy between the sizes of the buffer zone as included on the different maps.
   The maps will be checked and the necessary changes will be made.

3. Check if the revised General Authorisation for sections 21(c) and (i) in terms of the National Water Act, 1998 (Act No. 36 of 1998) are applicable to the pans/wetlands on site.
   If the buffer zones are adhered to, there will be no impact on the wetlands and pans because of the proposed solar park developments.

4. Transportation of hazardous substances must follow best transportation practice (SANS: 102333) as well as the National Roads Act.
   This will be incorporated into the EMPr to ensure the contractors on site adheres to this.

5. Permits and licenses must be submitted to DAFF and DENC for the removal of protected plant species.
   The only protected plant species found on site was the Olea europaea, which is protected in terms of the Northern Cape Nature Conservation Act, 2009 (Act. No. 9 of 2009). An application for a permit for the removal of these trees will be submitted to the Northern Cape Department of Environment and Nature Conservation if and/or when the project is awarded preferred bidder status, by the Department of Energy in terms of the IPP Program.

6. Reduction in soil infiltration capacity and increased soil erosion must be prevented.
   This will be included in the EMPr and will be emphasized for the contractor to adhere to.

7. Contamination of water resources must be prevented.
   This will be included in the EMPr and will be emphasized for the contractor to adhere to.

8. Exposed topsoil stockpiles must be protected and covered.
   This will be included in the EMPr and must be implemented by the contractor.

9. Waste on-site must be identified, classified and disposed of accordingly at a licensed landfill.
   This will be included in the EMPr and will be emphasized for the contractor to adhere to.

10. Amount of local and non-local people to be employed during the construction and operational phases of the project.
    Approximately 100 people are to be employed during construction phase, but it can increase to 150 during peak periods. The number can be higher if the timeframe is less than 15 months (330 working days). If reduced to 132 working days, number of workers required on site during construction is 250.
    Approximately 35-40 people will be employed during the operational phase of the PV power plant. Most employees will be local people but skilled and specialised positions will be available to non-local people.

11. Locally employed workers to be made aware of the social health risk related to temporary projects.
    The Contractor shall conform to the Occupational Health and Safety act (Act 85 of 1993) and regulations applicable. The Act requires a Health and Safety representative when more than 20 employees are employed. It will be the Health and Safety Officer who will be responsible for educational programs which will endeavour to curb incidences detrimental to the health and well-being of workers. This will also be included in the EMPr and must be implemented and managed by the contractor.

12. Construction material to be sourced locally.
    As much as possible construction material will be sourced locally as far as is practical and available. This will be included in the EMPr and the contractor should adhere to this condition.

Receipt of the letter from AGES was acknowledged by DENC in an e-mail dated, 7 November 2016 and it was indicated that the DENC is satisfied with the given responses to their concerns.

All the above-mentioned correspondence is included in Annexure C.

8. METODOLOGY USED FOR THE IDENTIFICATION AND ASSESSMENT OF THE IMPACTS

The potential environmental impacts identified in the study have been quantified and the significance of the impacts has been assessed according to the criteria set out below. Each impact has been assessed and rated. The assessment of the data, where possible, has been based on broadly accepted scientific principles and techniques. In defect, judgements and assessments are necessarily based on the consultant's professional expertise and experience.

8.1. PROJECT PHASING

For the purpose of assessing these impacts, the project has been divided into phases from which impacting activities can be identified:

- **Planning**
- **Site clearing & construction phase**
- **Operational phase**

The phases have been carefully examined in relation to the PV plant and in relation to the connection infrastructure. Indeed, as already described, in this document all impacts and mitigations are defined also for the connection infrastructure, although this part of the project may be executed, owned and operated by Eskom.

As far as the **decommissioning** phase is concerned, it is important to specify that this phase will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 31 of R983 of 4 December 2014).

This phase is important because it states the **reversibility of the development** and has to be carefully planned and executed, in order to enable the natural re-growth of indigenous vegetation and fauna re-population as well as the reuse of the area for agricultural and grazing purposes. For this reason, in the Draft Environmental Management Plan the decommissioning phase has been included and carefully analyzed, in order to anticipate activities and actions to be taken in order to minimize the relevant impacts.

The decommissioning phase, as described in Chapter 10, is similar to the commissioning phase but all possible care must be considered for the recycling of the materials and for the re-establishment of the site as it was the **status quo – ex ante** the development.

8.2. ASSESSMENT CRITERIA

The terms of reference for the study include criteria for the description and assessment of environmental impacts. These criteria are drawn from the Integrated Environmental Management Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the Department of Environmental Affairs and Tourism in terms of the Environmental Impact Assessment. These criteria include:

Table 6: Impact Assessment Criteria

Nature of impact This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The description should include what is being affected, and how.		
Extent The physical and spatial size of the impact.	**Site**	The impact could affect the whole, or a measurable portion of the above-mentioned properties.
	Local	The impacted area extends only as far as the activity, e.g. a footprint.
	Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
Duration The lifetime of the impact; this is measured in the context of the lifetime of the proposed base.	**Short term**	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the phases.
	Medium term	The impact will last up to the end of the phases, where after it will be entirely negated.
	Long term	The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
	Permanent	The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	**Low**	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
	Medium	The affected environment is altered, but function and process continue, albeit in a modified way.
	High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.	**Improbable**	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
	Probable	There is a possibility that the impact will occur to the extent that provisions must be made therefore.
	Highly probable	It is most likely that the impacts will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
	Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.

Determination of significance. Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	**No significance**	The impact is not substantial and does not require any mitigation action.
	Low	The impact is of little importance, but may require limited mitigation.
	Medium	The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
	High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

The general approach to this study has been guided by the principles of Integrated Environmental Management (IEM). In accordance with the IEM Guidelines issued by the DEA, an open, approach, which encourages accountable decision-making, has been adopted. The underpinning transparent principles of IEM require:

- informed decision-making;
- accountability for information on which decisions are made;
- a broad interpretation of the term “environment”;
- an open participatory approach in the planning of proposals;
- consultation with I&APs;
- due consideration of alternatives;
- an attempt to mitigate negative impacts and enhance positive impacts of proposals;
- an attempt to ensure that the social costs of development proposals are outweighed by the social benefits;
- democratic regard for individual rights and obligations;
- compliance with these principles during all stages of the planning, implementation and decommissioning of proposals; and
- the opportunity for public and specialist input in the decision-making process.

The study is also guided by the requirements of the EIA Regulations in terms of the NEMA. The NEMA EIA Regulations, which are more specific in their focus than the IEM principles, define the detailed approach to the EIA process.

9. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

9.1. POTENTIAL IMPACTS

Potential impacts associated with the construction and operational phases of the Manlenox Expansion Solar Park together with its connection infrastructure are outlined and evaluated hereinafter.

As previously described, **construction activities** for the establishment of PV power plant include:

- land clearing activities necessary for preparation of the site and access routes;
- excavation and filling activities;
- transportation of various materials;
- construction of the storage structures;
- installation of the PV modules and construction of associated structures and infrastructure;
- construction of the on-site high-voltage substation;

Environmental impacts associated with the **operational phase** of a solar energy facility may include visual and other impacts.

The **decommissioning activities** of the PV plant mainly include the removal of the project infrastructure and the restoring of the site **status quo ante**.

The identification of impacts will be based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- specialist studies;
- issues raised during the public participation process.

Potential impacts may include:

- Impacts on soils & agricultural potential;
- Impacts on ground water;
- Impacts on the road system and traffic;
- Impacts on air quality and potential emissions;
- Geological, soil and erosion impacts;
- Impacts on avifauna;
- Impacts on vegetation;
- Impacts on heritage resources;
- Noise impacts;
- Impacts on tourism;
- Social impacts;
- Visual impacts.

9.2. CUMULATIVE IMPACTS

There are no other similar facilities within a 30km radius of the proposed development site. The cumulative impacts that were assessed is based on the fact there are two application for EA for two solar parks adjacent to each other. However, all the specialists' reports considered the two development sites as one development site and assess the impacts cumulatively and did not assess the impacts of each solar park in isolation. Therefore, if only one of the two solar parks are authorized the impacts will only be less than what is projected here. Further possible cumulative impacts of each of the possible impacts are also assessed hereunder.

9.3. SPECIALIST STUDIES

Due to the nature of the project, a number of specialist studies are required in the EIA process in order to investigate the potential environmental impacts associated with the proposed development. During a previous application process all specialist's studies were conducted. However, these reports have been re-assessed and updated for the new application.

Detailed studies on potentially significant impacts have been carried out to address these impacts throughout the EIA process. The public participation process provides valuable information in the identification of issues requiring further and specific investigation throughout the EIA process.

The specialist studies which have been conducted and amended reports, attached to this EIA Report are the following:

- Ecological Impact Assessment (Annexure D)
- Avifauna Impact Assessment (Annexure E)
- Agricultural Potential Assessment (Annexure F)
- Wetland and Riparian Delineation Report (Annexure G)
- Heritage Impact Assessment (Annexure H1)
- Palaeontological Desktop Study (Annexure H2)
- Geo-technical and Geo-Hydrological Report (Annexure I)
- Visual Impact Assessment (Annexure J)
- Socio-economic Impact Assessment (Annexure K)
- Services Report (Annexure L)

9.4. IMPACTS & MITIGATION MEASURES

9.4.1. Construction & operational phases impacts and mitigation measures

All the possible impacts that can be predicted in both the construction and operational phases of the PV plant are addressed. Specific mitigation measures are proposed and the significance of these impacts is described with and without the mitigation measures.

Furthermore, considering that all or part of the construction infrastructure may be owned and/or operated by Eskom, the mitigation measures described in the following paragraphs and in particular in the attached Environmental Management Plan can be, accordingly, of the responsibility of Eskom or of the developer.

9.4.1.1. Atmospheric pollution and noise

Construction Phase
During this phase there will be a concentration of earthmoving equipment and construction vehicles that will level the area, clear vegetation for construction purposes and in the process will create dust and exhaust smoke that will impact on air quality. There will also be more noise created by the vehicles during this phase. Burning of waste and fires at construction sites may also create smoke.

Operational phase
The increased traffic volumes and people will lead to increased levels of air pollution and noise. Smoke from burning of waste can cause air pollution.

Project Phase	Impact :Atmospheric Pollution and noise								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and Vegetation clearance	Air pollution : Dust	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Dust	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Burning of cleared vegetation, solid waste & veld fires	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	Medium	Medium	Low-medium	Medium
	Cooking fires of workers	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Fireplaces and veldt fires	Air pollution caused by smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Burning of vegetation refuse and solid waste	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
Cumulative impacts	Pollution & Noise	Increase in release of smoke and increase in noise levels	Low	Medium-high	Low-medium	Medium	Medium	Low	Medium

Mitigation measures - Construction Phase

- Vehicles must be well serviced so that it does not produce excessive smoke and noise.
- Speed of construction vehicles should be kept as low as possible to reduce the generation of dust and noise.
- Construction areas must be damped to prevent excessive dust formation.
- The clearing of the site should be done in phases as the construction progresses.
- Construction should only take place during day light hours on weekdays and Saturdays.
- Contractors must comply with Provincial noise regulations. The construction machinery must be fitted with noise mufflers and be maintained properly.
- Vegetation cleared from the site and solid waste generated by the construction teams may not be burned on site or the surrounding areas, but be regularly removed to the municipal waste disposal site.
- Fire belts must be made around the development according to the regulations of the Veld and Forest Fire Act.
- The cleared vegetation stock-piled and should be removed to a licensed waste disposal site on a regular basis.

Mitigation Measures - Operational Phase

- Speed of vehicles on roads should be controlled e.g. speed bumps and speed restrictions.
- All roads should preferably be sealed to eliminate dust formation caused by strong winds and vehicle movement.
- Solid waste should not be burned on the project area.
- Fire belts around the development must be made according to the regulations of the Veld and Forest Fire Act.
- Vegetation refuse should be composted if possible and re-used.

9.4.1.2. Groundwater and surface water pollution

Construction Phase

- Lack of sanitation could result in ground water pollution and associated health risks.
- Construction vehicles will be refuelled at the construction camp.
- Spillage of fuel and lubricants from construction vehicles could occur. Storm water contamination by solid waste could lead to groundwater and surface water pollution.
- In this phase the soil cover as well as the vegetation is removed and storm water over the area could cause erosion as well as siltation of watercourses. Road construction will also increase the possibility of erosion and the siltation/sedimentation of surface water streams, because of increased storm water run-off.

Operational Phase

- Pollution by sanitation leakages, solid waste and erosion may lead to water pollution. Storm water run-off over open areas can cause erosion as well as the washing of soil into the surface water streams.
- Storm water flowing over sealed and/or paved areas could lead to ground and surface water pollution. Chemicals from the vehicle wash area could negatively impact on the quality of surface and groundwater resources.
- Fertilizers, pesticides and herbicides used at the project during operation can create pollution if not handled and applied correctly.

Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spillage of fuel and lubricants from construction vehicles	Water Pollution	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Clearing of vegetation	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low-medium	Medium
	Solid waste disposal freshwater resources	Pollution of freshwater resources	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Sanitation seepage from chemical toilets and/or from the temporary sanitation system	Water Pollution	Medium	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Spillage of fuel and lubricants from vehicles	Water Pollution	Medium	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Solid waste disposal-freshwater resources	Water Pollution	Low	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Leakage from the permanent Sanitation system	Water Pollution	Medium-high	High	Medium	Medium	Medium-high	Low-medium	Medium-high
	Use of fertilizers, insecticides and herbicides	Pollution of streams & rivers	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium
	Storm water runoff	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low	Medium
Cumulative impacts	Water pollution and increased water run-off	Increased potential for water pollution and increased water run-off	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium

Mitigation measures - construction phase

The following precautionary measures are recommended to prevent surface or groundwater pollution:

- Clearance of vegetation should be restricted to 250 ha footprint and access road.
- Construction activities should be restricted to the proposed 250 ha footprint.
- The wetland and pan areas should be avoided and 32m buffer zone strictly adhered to.
- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- Berms to limit the flow of water over cleared areas will limit erosion and the siltation of surface streams. Preference should be given to plant species indigenous to the area.

- Drip pans should be used during re-fuelling and servicing of construction vehicles. Used parts like filters should be contained and disposed of at a site licensed for dumping of these waste products.
- Oil traps must be installed in the vehicle wash bay to prevent pollution. Oil traps must be serviced on a regular basis by an approved service agent.
- Diesel storage must be less than 80 000 litres at construction camps. Diesel tanks and other harmful chemicals and oils must be stored within a bunded area.
- The vehicle maintenance yard and construction storage area should be placed at least 100m away from watercourses. This area should have bund walls and lined with impermeable material to prevent ground and surface water pollution.
- Chemical sanitation facilities and the temporary sanitation system in the construction site should be regularly serviced by appropriate companies to ensure that no spills or leaks to surface and groundwater take place. Chemical toilets and the temporary sanitation system should not be placed within 100m from any watercourse.
- Solid waste must be kept in adequate waste bins. Building rubble and various waste products should be removed on a regular basis to a licensed landfill site.
- If all possible soil pollution is restricted and prevented, there would be no cumulative impacts as a result of the establishment of the Manlenox Expansion Solar Park.

Mitigation measures - operational phase

- Solid waste to be kept in adequate waste bins and removed regularly to waste disposal site.
- The use of eco-friendly products e.g. Organic Compost, herbicides and insecticides should be promoted.
- The permanent sanitation system should be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.
- All possible pollution can be prevented and therefore there would be no cumulative impacts where soil pollution is concerned.
- A section 21(g) water use will be applied for the permanent sanitation system on site.

9.4.1.3. Water use / water quantity

Construction phase

During this phase, water consumption will be the highest because it will be utilized for gravel roads and building constructions. The water needed for the construction activities will be provided from a new on-site borehole, or current boreholes, close to the project site.

Operational phase

Water use will be limited except for short periods(twice per year) when the PV modules are cleaned. The water needed for the operational phase will be provided from a new on-site borehole, or current boreholes, close to the project site.

Project Phase	Impact: Water use								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction process	Depletion of water resources: Water consumption	Low-medium	Medium-high	Medium-high	High	High	Medium	Medium-high
Operational	Water use & cleaning of panels	Depletion of water resources: Water consumption	Low	High	Medium	High	High	Low-Medium	Medium
Cumulative impacts	Water use	Increased pressure on local water resources	Medium	Medium - High	Very Low	Low	Low-Medium	Low-Medium	Medium

Mitigation measures – Construction Phase

- Water should be used sparingly and it should be ensured that no water is wasted.
- Roads should be treated with chemicals to lower the use of water.
- Washing of construction vehicles should be limited to once or twice a month and must be done with high-pressure sprayers to reduce water consumption.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

Mitigation measures - Operational Phase

- Cleaning of panels should be done only when necessary, twice per year.
- Roads should be treated with chemicals to lower the use of water.
- Washing of vehicles should be limited to once a week and must be done with high-pressure sprayers to reduce water consumption.
- Care must be taken not to waste any water. In the offices, half-flush systems in the toilets as well as water aerators in all taps must be installed to reduce water consumption.
- The workers should be educated on the value of water and how to use it sparingly.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.
- A section 21a water use should be applied for, to abstract water from a borehole for use at the facility

9.4.1.4. Land and soils

Planning phase

There will be no impacts during the planning phase.

Construction phase

During construction, the vehicles used have the potential to spill diesel and lubricants that can pollute the soil. The storage of solid waste before it can be disposed of has the potential to pollute the soil and becomes a nuisance. Sedimentation and erosion might occur during the construction phase.

Operational phase

Solid waste can be a nuisance and has the potential to pollute the soil if not managed correctly. The use of conventional fertilizers, herbicides and insecticides should be limited as far as possible. Wastewater from activities can pollute the soil.

Project Phase	Impact: Land and soils								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spilling of oil/diesel by construction machines	Contamination of soil	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Solid waste disposal	Soil pollution + nuisance	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Storm water over roads and cleared areas	Erosion and Sedimentation	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Medium	Medium-High
	Trenches for electric cables and water and sewerage pipes	Erosion and Sedimentation	Low-Medium	Medium-high	Low	Medium	Medium-High	Medium	Medium-High
Operation	Solid waste	Soil pollution + nuisance	Low	High	Low-Medium	Medium-High	High	Low	Medium
	Storm water from paved areas and roofs	Erosion	Low-medium	High	Low-medium	Medium	Medium-high	Low	Medium
	Use of fertilizers, insecticides and herbicides	Pollution	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium
Cumulative impacts	Increased potential for negative impacts on soil resource	Increased potential for erosion and soil pollution	Low-medium	High	Low-medium	Medium	Medium-high	Low-medium	Medium-High

Mitigation measures - Construction Phase

- Clearance of vegetation should be restricted to 250 ha footprint and access road.
- Construction activities should be restricted to the proposed 250 ha footprint.
- The areas close to the wetland area and pans should be avoided.
- Construction vehicles must be well maintained and serviced to minimise leaks and spills.
- Spill trays must be used during refuelling of vehicles on site.
- Diesel storage must be less than 80 000 litres at construction camp. Diesel tanks and other harmful chemicals and oils must be within a bunded area.
- Solid waste must be kept in containers and disposed of regularly at licensed dumping site.
- Any building rubble must be removed to a licensed disposal site on a regular basis during construction.
- Trenches that are dug for the supply of services and electrical cables must be filled up and compacted well and slightly higher than the areas around it to avoid erosion and sedimentation.
- The clearing of the site should be done in phases as the construction progresses.
- Slopes produced by removing soil must be kept to a minimum to reduce the chances of erosion damage and sedimentation to the area.

Mitigation measures - Operational Phase

- Solid waste must be kept in adequate waste bins and removed on a weekly basis to the waste disposal site.
- The surface drainage system should be monitored after storms and storm water damage should be repaired. The maintenance of the roads must be kept up to standard to prevent and reduce the incident of erosion next to the roads.
- The use of eco-friendly products e.g. organic compost, herbicides and insecticides should be promoted.

9.4.1.5. Archaeological, Cultural and Social Features

Construction phase

The clearing of the site may have a negative impact on the archaeological features of the site. Care must be taken in the excavations and moving of soil to observe any archaeological feature of importance, which must be left and reported to the archaeological consultant for comments and actions.

Operational phase

The operational phase will not have any negative impact on the archaeological features of the site, if the recommendations of the Heritage Impact Assessment and Paleontological Desktop Study (Annexures H1 and H2) to be undertaken will be adhered to.

Project Phase	Impact: Loss of Archaeological, Cultural and social features								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earth moving and soil clearance	Destroy archaeological evidence and heritage and graves	Low-medium	Medium-high	Low	Low	Low-medium	Low	Low-medium
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium
Cumulative impacts	Activities on site during construction and operational	Increase in potential to unearth archaeological evidence and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium

Mitigation measures – Construction and operational phases

Care must be taken during the construction process that anything of archaeological value that is unearthed must be recorded. Please refer to the Heritage Impact Assessment, Annexure H1. The archaeologist or SAHRA must be notified whenever anything of importance is discovered.

Also, a scheduled watching brief performed by a suitable qualified person is recommended during the bush clearing and construction phases of the projects. This person should act and recommend on any possible open air Late Stone Age sites which could possibly be associated with the current isolated finds of Late Stone Age stone tools across the study area.

According to the Palaeontological Desktop Study (Annexure H2), there is a slight, but unlikely, possibility that the sands of the Kalahari Group could contain fossils of Quaternary age. If, in the extremely unlikely event that fossils are exposed in the aeolian sand deposits in the process of development activities, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented

9.4.1.6. Impact of the development on the ecology (fauna & flora) of the area

Planning and construction phase

The removal of natural vegetation and destruction of habitat will have a negative effect on the biodiversity. The specific mitigation measures included in the Ecological and Avifauna Impact Assessment (Annexures D & E) should be adhered to.

The wetland and pan areas should remain undeveloped - in compliance with the requirements highlighted in the Ecological Impact Assessment (Annexure D) and in the Geo-technical and Geo-Hydrological Study (Annexure I).

Operational phase

The operation of the development can have a negative impact on the bio-diversity if not managed correctly. Exotic invasive plant species can have a negative impact on the indigenous vegetation.

Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and vegetation clearance at construction site	Loss of indigenous plant species & disturbance to sensitive habitat	Medium	Medium	Low-Medium	Medium	Medium-High	Low-medium	Medium
	Vegetation clearance and the use of herbicides to control re-growth at the different development areas	The eradication and control of exotic invasive plant species Loss of indigenous plant species	Medium	Medium	Medium	Low-Medium	Medium-High	Low-Medium	Medium
	The occurrence of veldt fires on site	Destruction of flora/habitats Loss of indigenous fauna	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high
	Littering (e.g. cans and plastics) along access road and at construction site	Public nuisance and loss/death of indigenous fauna	Low-Medium	Medium	Medium	Medium-High	Medium	Low	Medium

Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	The control of animals on site Killing, poisoning or hunting of animals	Loss of indigenous fauna to the area	Medium-High	Medium	Medium	Medium	Low-Medium	Low-Medium	Medium
Operation	Rehabilitation of cleared areas	The spreading of exotic invasive plant species Loss of habitat and indigenous flora	Medium	High	Medium	Low-Medium	Medium	Low-Medium	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	High	Medium	Medium-high
	The functioning of the permanent sewage treatment systems – treated sewage outflow	Deterioration in the habitat for avifauna and aquatic life	Medium-High	High	Medium	Medium-High	Medium	Low-Medium	Medium-High
	Disposal and storage of solid waste and littering	The death/loss of indigenous fauna e.g. raptors, mammals and reptiles	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium
	The control of pests and vermin	Killing and poisoning of fauna feeding on the poisoned vermin or pest	Low-Medium	High	Low-Medium	Medium-High	Medium	Low	Medium
	The feeding of fauna e.g. birds &small mammals	Disturbance to bio-diversity and the natural movement of the animals through the site The death/loss of indigenous fauna	Low-Medium	High	Low-Medium	Medium-High	Low-Medium	Low	Medium
	Catching of wild animals e.g. reptiles, bids and small mammals as pets	Disturbance to bio-diversity and decline in indigenous faunal numbers	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	Birds colliding with power line and panels	Electrocution of birds	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	The erection of fences and the construction of roads with a kerb	The fragmentation of available habitat and the restriction of movement of small mammals, reptiles and amphibians	Low-Medium	High	Low-Medium	High	Medium	Low	Medium
Cumulative Impacts	Increased potential of negative impacts on ecology of the area	Increase in natural vegetation to be removed.	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium

Mitigation measures – Construction phase

- Clearance of vegetation should be restricted to 250 ha footprint and access road.
- Construction activities should be restricted to the proposed 250 ha footprint.
- The areas close to the wetland and pan areas, should be avoided.
- No unnecessary clearance of vegetation should be allowed. Where possible, natural vegetation must be retained.
- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.

- The herbicides used to control the invasive plant species should be chosen in consultation with an ecologist, as some of the agents might be detrimental to the surrounding indigenous fauna and flora e.g. Roundup is for example extremely toxic to frogs.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Fires should only be allowed in designated places within the construction camp and extra care should be taken to prevent veldt fires of occurring.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- The cleared vegetation should not be burned on site. The cleared vegetation should be stockpiled and taken to the closest available landfill site.
- Solid waste must be kept in adequate animal proof waste bins at the construction camp and construction sites. Building rubble and various wastes should be removed on a regular basis to the closest available landfill site.
- Regular clean-up programs should be put into effect along the access road and throughout the premises to limit the impact of littering caused by construction activities.
- The stockpiled topsoil and construction material should be managed in such a way that the material is not transported by wind or rain. This can be done by restricting the height of the stockpiles, sandbagging and avoiding steep slopes.
- No animals may be killed, captured or hunted on site by construction workers. Do not feed any wild animals on site.
- Where trenches pose a risk to animal safety, they should be cordoned off to prevent animals falling in and being trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
- Existing game on developed area will be relocated when the solar park is developed. The relocation of the game will be executed according to relevant legislation.
- Cumulative impacts on the ecology of the area can be significant. However, with the mitigation measures in place, the potential is very low for significant negative impacts on the ecology of the area.
- The EMPr must be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Manlenox Expansion Solar Park.

Mitigation measures – Operational phase

- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.
- An ecologist should be consulted on the use of herbicides/eco-friendly products to control exotic tree and shrub species.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides, apply in accordance with label and application directions and stipulations for terrestrial and aquatic applications.
- The high-risk sections of the power line should be marked with a suitable anti-collision marking device on the earth wire as per the Eskom guidelines.

- Solid waste must be kept in animal proof waste bins.
- A monitoring program should be compiled and implemented to ensure that the sewage treatment system is functioning properly and that the treated wastewater conforms to the standards set by the Department of Water Affairs.
- Staff members should be discouraged from attempting to catch or kill any wildlife for use as food, pets or to feed any wild animals.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- The impact on the flying invertebrates will be minimized through the use of sodium vapour (yellow) lights as outside lighting.
- The use of eco-friendly products e.g. Organic Compost and/or Effective Microorganisms (EM), which reduces the frequency of application of conventional fertilizers, herbicides and insecticides, should be promoted.
- The EMPr will have to be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Manlenox Expansion Solar Park.

9.4.1.7. Visual impacts

Construction phase

The natural aesthetic character of the site will be changed although the two Eskom power lines crossing the project site, have already changed the visual characteristics of the site.

Operational phase

Buildings and the solar modules have a **visual impact** and lights at night can be a **nuisance.**

Project Phase	Impact: Visual disturbance								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Buildings& panels	Visual	Low	High	Low-Medium	High	High	Low-Medium	Medium
	Lights	Visual	Low	Medium	Low-medium	Medium-high	High	Low-Medium	Medium
Operation	Buildings and panels	Visual	Medium	High	Medium	High	High	Medium	Medium
	Lights	Nuisance	Low	High	Low-medium	Medium-High	High	Low-Medium	Medium
	Electrical lines	Visual	Low	High	Low	High	High	Low-Medium	Low-Medium
Cumulative Impacts	Increased in visibility of another solar park in the area	Increased visual intrusion and nuisance	Medium-High	Medium	Medium	Low-Medium	High	Low-Medium	Low-Medium

Mitigation measures

- Earth works should be executed in such a way that only the footprint and a small “construction buffer zone” around the proposed components are exposed. In all other areas, the natural occurring vegetation, more importantly the indigenous vegetation should be retained.

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the project site.
- Minimise the amount of light fixtures to the bare minimum and connecting these lights to motion sensors can also be considered in reducing light pollution.
- A video-surveillance system using infrared or microwave video cameras, which do not need a switched on lighting system, is recommended.
- Cumulative impacts will be low as it was possible to mitigate the visual impact at Manlenox Expansion Solar Park successfully as a result of the natural characteristics of the area.

9.4.1.8. Safety, security and fire hazards

Construction phase

Construction activities such as excavating of foundations and trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site further increases the risk of injury. The activities of construction personnel on site may contribute to an increase in the level of crime in the area and may also contribute to an increase in the risk for fires.

Operational phase

Fires and criminal activities pose a significant risk during the operation of the development.

Project phase	Impact: Safety, security and fire hazards								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction activities – excavation of foundations, trenches etc.	Loss or injury to human life	Low-medium	Medium-high	Low	High	Medium	Low	Medium
	Security	Crime	Medium	Medium-high	Low-medium	Medium	Medium-high	Low - medium	Medium
	Fire hazards	Loss of human life and construction equipment etc.	High	Medium-high	Medium	Low	Low-Medium	Low-Medium	Medium
Operation	Security	Crime	Medium	High	Medium	Medium	Medium-high	Medium	Medium-high
	Fire hazards	Loss of human life, bio-diversity, buildings, infrastructure etc.	High	Medium	Medium -High	Low	Low	Low	Medium
Cumulative Impacts	Higher number of people in the area increases safety risks	Potential for an increase in criminal activity	High	Medium	Medium -High	Low	Low	Low	Medium

Mitigation measures

- The Contractor shall conform to the Occupational Health and Safety act (Act 85 of 1993) and regulations applicable. The Act requires the designation of a Health and Safety representative when more than 20 employees are employed.
- Open trenches or excavations must be marked with danger tape.
- The number of construction workers to stay on site should be limited to the minimum.

- Proper access control (I.D. cards) should be enforced to ensure that no authorised persons enter the site.
- No solid waste or vegetation may be burnt on the premises or surrounding areas.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to prepare and maintain firebreaks).
- Fire extinguishers and fire-fighting equipment must be available.
- A fence should be constructed along the boundary of the development.
- The cumulative impacts of this impact can be successfully mitigated if managed properly.

9.4.1.9. Socio-economic impact

Construction phase

The construction and operation phases of the development will have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Operational phase

A number of permanent jobs will be created for local people during this phase.
Manlenox Expansion should identify a local Community for the purpose of entering into a partnership for the Project, as required by the rules of the IPP Procurement programme.

Project phase	Impact: Job creation								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Operation	Job creation	Job Creation	High +	High +	Medium-high +	High +	High +	N/A	High +
Operation	Local Community development	Local Community development	High +	High +	high +	High +	High +	N/A	High +
Cumulative impacts	Increased potential for job creation.	Increased potential for local Community development	High +	High +	high +	High +	High +	N/A	High +

Mitigation measures

- During the construction and operational phases, jobs must be created for unemployed local people and skills must be transferred to them.
- Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.
- The cumulative impact of this impact can just be positive. As one of the poorest provinces in South Africa, the Northern Cape is definitely in need of more job opportunities.

9.6. POTENTIALLY SIGNIFICANT IMPACTS

Impacts with a rating of Medium-high or High are impacts which are regarded as potentially significant, rated without any mitigation measures. In this impact assessment, the following impacts were regarded as potentially significant impacts:

i. Water pollution by the inadequate functioning of the sanitation system.
ii. Water consumption and depletion during construction phase.
iii. Soil Erosion and Sedimentation
iv. The occurrence of veldt fires.
v. Security impact-increase in crime in the area

These impacts (i-iv) will now briefly be discussed.

9.6.1. Cumulative impacts

i. The effect of water pollution (surface and groundwater) by a malfunctioning of the sanitation system will have a cumulative effect only if it is not detected by a regular monitoring and if it takes place on a regular basis.
ii. This effect is cumulative only if care is not taken to conserve water and if water usage and the water levels of boreholes are not monitored regularly.
iii. This effect is cumulative if erosion and sedimentation is not limited and/or prevented.
iv. This can have a cumulative effect if preventative measures are not followed.
v. Can be cumulative if more of the solar parks are authorized to operate in the area.

9.6.2. Nature of impact

i. This is pollution of a renewable resource.
ii. Usage of a resource, a negative impact that affects water quantity available for use in the area.
iii. This is a negative impact on the soil conservation and functioning of ecosystems in the area.
iv. Damage to property, ecology and safety of people.
v. Negative impact on well-being of people in the area.

9.6.3. Extent and duration of impact

i. The extent could potentially be within the farm of the proposed development and the surrounding farms.
ii. The extent could potentially be within the area of the proposed development and the surrounding farms. The duration is only during construction.
iii. The extent is only within the farm boundaries.
iv. The extent is potentially on the development area as well as surrounding properties and even regional. The duration is for the life of the development.
v. Socio-economic impact

9.6.4. Probability of occurrence

i. The probability is unlikely.
ii. The probability is possible.
iii. The probability is possible.
iv. The probability is infrequent or seldom.
v. Probability is likely if good mitigation measures are not implemented.

9.6.5. Degree to which impact can be reversed

i. Impact is reversible if mitigated in time.
ii. This impact is reversible because the higher abstraction will only be during the construction period.
iii. Impact is reversible, but at great cost, should rather be prevented.
iv. If the development is not continuing there will be no guarantee that veldt fires will not occur on the property. This impact must therefore be managed accordingly.
v. With good security the impact is reversible.

9.6.6. Degree to which impact can cause irreplaceable loss of resource

i. If this impact takes place over a very long time and there is gross negligence, the water resource can be damaged to a point where it will take very long to recover and where it could almost be seen as being irreplaceable.
ii. The recovery of the water resource is linked to rainfall and will recover accordingly. The negative impact is during the construction period.
iii. Erosion and sedimentation can lead to the loss of soil resource.
iv. Veldt fires can create such damage that it will take a long time for the veldt to recover but the fact is that the vegetation has been subjected to veldt fires ever since. Loss of property (buildings) can be replaced.
v. Will not cause an irreplaceable loss of resource.

9.6.7. Degree to which impact can be mitigated

i. Successful mitigation is possible
ii. Successful mitigation is possible
iii. Successful mitigation is possible
iv. Successful mitigation is possible
v. Successful mitigation is possible.

10. DECOMMISSIONING PHASE

Decommissioning activities of the PV plant mainly include removal of project infrastructure and restoring of the site's **status quo ante**.

The decommissioning phase will start at the end of the PV power plant lifetime (25 - 30 years) and will last approximately 6 months, involving a team of 50 workers.

Decommission will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 31 of R983 of 4 December 2014).

10.1. SITE PREPARATION

In order to ensure a correct decommissioning of the site, the first step of the process will include adequate site preparation. Integrity of access points and of laydown areas will be confirmed and eventually re-established in order to accommodate equipment and to load vehicles.

10.2. DISASSEMBLE AND REPLACEMENT OF EXISTING COMPONENTS

All components will be disassembled. Silicon of the PV modules will be recycled, as well as mounting structures (aluminium or zinced steel frames and piles) and cables (copper and/or aluminium conductor).

Non-recyclable components of inverter, transformers and electrical devices will be disposed in appropriate way, in compliance with applicable laws and international standards.

10.3. RESTORATION OF THE SITE

Adequate measures will be undertaken in order to restore the site by re-planting of indigenous plant species.

10.4. ALTERNATIVE OPTION: UPGRADING THE SOLAR PARK

At the end of the PV power plant lifetime (25 ÷ 30 years), as alternative option to the decommissioning, it will be evaluated the feasibility of upgrading the solar park with the most appropriate technology/infrastructure available at that time.

11. CONCLUSIONS AND RECOMMENDATIONS

The Final EIA Report describes the activities undertaken for the development of the Manlenox Expansion Solar Park.

The purpose of this report is to provide the relevant authorities and interested and affected parties with sufficient information regarding the potential impacts of the development to render meaningful comments. Potential impacts were identified in consultation with I&AP's and technical specialists (where applicable) and were assessed using a matrix and by applying professional knowledge.

The potentially significant negative impacts that have been identified should be mitigated through the implementation of the mitigation measures highlighted in this report. It is submitted that the proposed mitigation measures, will effectively lower the impacts to acceptable levels. Given the socio-economic imperatives of the development, the residual impacts are not of sufficient importance to thwart the development.

It is the professional opinion of AGES that the proposed development does not present any fatal flaws in terms of negative impacts to the environment and therefore will not have any significant detrimental impacts to render the project unfeasible.

It is proposed that the following conditions must be included in the Record of Decision if the project is authorised:

- The mitigation measures contained in this report must be implemented.
- The management and or mitigation measures contained in the Environmental Management Plan must be implemented.
- The responsibilities to obtain any further authorisations and/or licenses will rest on the proponent of the project, PRIOR to any activities on site.