ENVIRONMENTAL IMPACT ASSESSMENT FOR THE INSTALLATION OF A SOLAR PHOTOVOLTAIC POWER PLANT AT ESKOM DUVHA POWER STATION

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT
DEA REFERENCE NUMBER 14/12/16/3/3/2/759

January 2016

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CLIENT: ESKOM HOLDINGS SOC LTD.

Prepared for Eskom SOC Ltd.

E. Molepo
Sustainability Division: EIA COE

IMPORTANT PROJECT INFORMATION

Table 1 and 2 presents important information requested by the Department of Environmental Affairs.

Table 1: Project Location

Province	Mpumalanga
District Municipality	Nkangala District Municipality
Local Municipality	Emalahleni Local Municipality
Ward number(s)	19
Nearest town(s)	Emalahleni
Farm name(s) and number(s)	Duvha Kragstasie 337JS
Portion number(s)	Remainder of Portion 0
21 digit Surveyor General Code	T0JS00000000033700000
Title Deed	T10033/1978

Table 2: Alternative Site 1 Project Components, footprint and dimensions

COMPONENT	DESCRIPTION	APPROXIMATE DIMENSION (m)	APPROXIMATE FOOTPRINT (ha)
PV panels (height & width)	94,000 (c-si technology)	1.64 m x 0.982 m	35.2 ha
	235,000 (thin film technology)	1.2 m x 0.60 m	
Generation Capacity	23.5 MWp		
Mounting Structure	Fixed tilted mounting structure	Up to 3 m	
Inverter (MV) Cabins	Approximately 24		768 m^2
Transformer	Approximately 24	Located inside MV/Inverter cabins	
Substation (Switching station)	1 Building	12 m x 11 m	132 m^2
O&M Building	1 Building	11 m x 13 m	143 m^2
Construction Camp/laydown area	Located on the south east corner of the site.	50 m x 80 m	0.4 ha
Internal roads	Ring road, vertical and horizontal roads	Between 3 and 5 m in width	57,500 m^2
Transmission line	Overhead line	3000 m	27,500 m^2 considering 11m servitude
Fencing	Wire triple fencing	3 m in height	Up to 36,000 m^2 considering up to 10 m distance between first and last fence and 3,600 m of fence perimeter
Slope	Approximately 0.5 % North-East/South-West		
Position of the solar facilities	25°57'10.49"S 29°20'7.58"E		
Cable route and trench dimensions	DC cable will be connected in a string, with cable trays. The cables will be underground at a depth of 1 m and most likely will be along internal roads		
Cut and fill areas along roads and at substation /transformer sites	Approximately 1 043 m^3~ 1 100m^3 considering excavation for the MV Cabins, O&M Building and Switching Station foundation. 1 m depth		
Spoil heaps	1 043 m^3 ~ 1 100 m^3 considering that the volume excavated for the MV Cabins, O&M Building and Switching Station foundation. This will be located within the proposed area		

EXECUTIVE SUMMARY

1. *INTRODUCTION*

Eskom Holdings SOC Ltd. (Eskom) proposes to construct and operate a Solar Photovoltaic (PV) Plant within the property of Eskom's Duvha Power Station, Mpumalanga Province. The proposed PV Plant requires a footprint of 35.2 ha to generate the projected power peak of 23.5 MWp.

ILISO Consulting (Pty) Ltd, (ILISO) was appointed to undertake the necessary environmental authorisation process as required in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, on behalf of Eskom. The proposed development triggers a suite of activities in terms of NEMA, which requires authorisation from the national Department of Environmental Affairs (DEA) as Eskom is a State Owned Company.

The Environmental Impact assessment (EIA) builds on the Scoping phase of the EIA process. This Final Environmental Impact Assessment report (FEIAr) aims to provide sufficient information on whether or not the potential environmental impacts associated with the project are acceptable from a biophysical, socio-economic and heritage perspective.

2. *PROJECT DESCRIPTION*

The installation of the proposed PV Plant on the property of Eskom's Duvha power Station includes a solar field and associated infrastructure. The solar field will consist of solar panels and will require a Substation; Meteorological station; Control and Operation Buildings. Existing access roads will be upgraded and new internal roads will be constructed to gain access to the solar field and associated infrastructure.

3. *NEED AND DESIRABILITY*

The main aim of the proposed PV Plant at Eskom's Duvha Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint. Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy and climate change targets.

The concept of a solar energy project is broadly supported in local economic planning documents. Considered as a whole the Integrated Development Plan (IDP) and Spatial Development Framework (SDF) recognise the importance of integrated and diversified development. The Nkangala District Municipality (NDM) has published an extensive IDP which identifies the need to look toward renewable energy. The IDP (2013/2014) highlights that, "the Security of coal supply for some existing coal power stations is increasingly

under threat and in promoting environmental sustainability, the NDM has realized the need to explore other energy forms, which are renewable, beyond focusing on coal-generated electricity as the main supply of energy." Even though the proposed project will be used for Eskom's own consumption at Duvha Power Station it will allow Eskom to increase its electricity export to the grid. In doing so, this will enable Eskom to support the demand side management energy efficiency programme.

4. *ALTERNATIVES*

Originally ten (10) areas surrounding the Duvha Power Station were identified for possible development. During the Screening exercise eight (8) of these were eliminated as either being too small or too close to the coal deposits and wetlands. Details of the remaining two (2) alternatives are considered in this report. These are referred to as Alternative Site 1 and Alternative Site 9. As required the "No-go"/"Do nothing" option is also comparatively assessed.

4.1 *ALTERNATIVE SITE 1*

Alternative Site 1 has a footprint of 35.2 ha allowing for a projected power peak (electricity) of 23.5 MWp. It is situated on Eskom owned property within the immediate power station security fence. Power lines and a pipeline run through the middle of the site and will have to be taken into account. This site is currently occupied by game stock, the carrying capacity of the site is detailed in ***Chapter 6****.*

The proposed Solar PV plant utilises two (2) types of PV Panel technology, Polycrystalline (c-Si) technology and Thin Film (TF) technology. There is a suitable electrical point of connection for the PV Plant within the power station at the 11 kV station boards. The approximate distance to the point of connection is 1.5 km. Alternative Site 1 is located within 500 m of a wetland and will require a Water Use Licence (WUL) as highlighted in ***Chapter 2*** *and further detailed in* ***Chapter 6*** *of this report.*

4.2 *ALTERNATIVE SITE 9*

Alternative Site 9 has a footprint of 37 ha allowing for a projected power peak of 24.7 MWp. There are no power lines or visible infrastructure on this site. The proposed Solar PV plant utilises two (2) types of PV Panel technology, Polycrystalline (c-Si) technology and Thin Film (TF) technology. There is a suitable electrical point of connection for the PV within the power station at the 11 kV station boards. The approximate distance to the point of connection is 2.2 km. Alternative Site 9 is located within 32 m of a wetland and will require a WUL as highlighted in ***Chapter 2*** *and further detailed in* ***Chapter 6*** *of this report.*

4.3 *NO-GO ALTERNATIVE*

The No Project alternative assumes that the project as proposed does not go ahead. This alternative provides the baseline against which other alternatives are compared and will be considered throughout the report. The implications of the "no project" alternative are:

- *the land use remains;*
- *there is no development of solar energy facilities at this location;*
- *there is no change in the landscape;*
- *there is no renewable energy generation;*
- *CO_2 emissions are not reduced; and*
- *There is no opportunity for indirect and direct (albeit temporary) job creation in the Steve Tshwete Local Municipality where approximately 20% of the local population is unemployed (Stats SA, Census 2011).*

5. *DESCRIPTION OF THE RECEIVING ENVIRONMENT*

5.1 *CLIMATE AND RAINFALL*

South Africa experiences some of the highest levels of solar radiation in the world. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m^2. The study area displays warm summers and cold winters typical of the Highveld climate. The average maximum summer and winter daytime temperatures are 25 ^{0}C and 20 ^{0}C, respectively. Rainfall occurs mainly as thunderstorms and drought conditions occur in approximately 12 % of all years. The Environmental Potential Atlas for Mpumalanga Province places rainfall at site as ranging between 621 mm and 750 mm per year. The prevailing wind direction is north-west during the summer and east during winter. Winds are usually light to moderate.

5.2 *GEOLOGY AND SOILS*

The study area is underlain by geology consisting of sandstone of the Vryheid Formation the Ecca Group of the Karoo Supergroup contains bands of coal within the sedimentary layers.

The study area is covered by two (2) land types, namely Ba4, which is dominated by soils with high agricultural potential, with very few low potential soils, and Fa8 which has low agricultural potential soils.

5.3 *BIOMES, BIOREGION AND VEGETATION TYPE*

The study area falls within the Grassland and Azonal Vegetation biomes and the Mesic Highveld Grassland Bioregion and Freshwater Wetlands Bioregions.

The study area falls within the Rand Highveld Grassland, Eastern Temperate Freshwater Wetlands and the Eastern Highveld Grassland vegetation types (Mucina and Rutherford, 2006).

Two main habitat units were identified during the assessment, habitat considered to be transformed due to agricultural activities and alien/weed encroachment; and Wetland habitat. One wetland feature was identified within the footprint of Alternative Site 9, namely a depression wetland. Adjacent to Alternative Site 1 an artificial wetland was encountered which has formed as a result of altered topography associated with the construction of the Duvha Power Station. This has led to localised ponding and the establishment of facultative and obligate wetland floral species.

No species on the Red Data List (RDL) or floral Species of Conversational Concern (SCC) occur in the study area. However, the most likely habitat for any floral SCC, should they be present, will be the wetlands. Thus by conserving the wetland areas, possible habitat for floral SCC will also be conserved.

5.4 *FAUNA*

- *Mammals*
  No mammal SCC were observed during the site survey. Due to the disturbed nature of the habitat and the proximity to human habitation and development, the probability of any mammal SCC as listed by the Mpumalanga Province State of Environment Report (MP SoER, 2003) being observed within the study area is deemed to be very low. The presence of both Damaliscus pygargus phillipsi (Blesbok) and Equus quagga (Palins Zebra) within the Duvha Power Station boundaries is artificial, and is maintained as such.

- *Avifauna*
  According to Birdlife South Africa (BLSA), the study area does not fall within any Important Bird Areas (IBA), (Birdlife South Africa, 2015). In terms of avifaunal SCC, only Geronticus calvus (Southern Bald Ibis) was identified during the site survey (MP SoER, 2003). There is however a high probability that Circus ranivorus (African Marsh Harrier) and Tyto capensis (African Grass Owl) may possibly utilise the study area specifically for foraging purposes, especially around the wetland depression associated with Alternative Site 9.

- *Reptiles*
  One non threatened reptile species was identified during the assessment of the study area, namely Trachylepis punctatissima (Montane Striped Skink). The above mentioned reptile specie is not a SCC (Appendix 4, MP SoER, 2003) and is classified as Least Concern by the IUCN (2015).

The study area did not contain any rocky areas or structures that may be favoured by reptiles for shelter and refuge, and as such it is deemed highly unlikely that any species listed in the MP SoER (2003) will occur within the study area.

- *Amphibian*
  No threatened amphibian species were noted in the study area. The only amphibian species listed as being of conservation concern is the Giant Bullfrog (Pyxicephalus adspersus) (Appendix 3, MP SoER, 2003). No Giant Bullfrogs were identified on or within the vicinity of the study area. However Giant Bullfrogs are known to occur within and nearby riparian and wetland zones. The only suitable habitat present for this species within the study area is the wetland depression associated with Alternative Site 9.

- *Invertebrates*
  No invertebrate SCC were found during the faunal survey. Metisella meninx, commonly known as the Marsh Sylph (Butterfly) is an invertebrate which is listed as Vulnerable in the MP SoER, 2003 report and is not yet listed on the IUCN listings. The study area falls within the distribution range noted for the M. meninx however, no populations of this species were identified during the site assessments. The only suitable habitat present for this species within and around the study area is the wetland depression associated with Alternative Site 9.

- Arachnids and Scorpions
  During the assessment, specific attention was paid to the identification of suitable habitat for Trapdoor and Baboon spiders and all scorpion species from the genus; Hadogenes, Opisthacanthus and Opistophthalmus as they are protected under the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA) for South Africa. After thoroughly searching, no scorpion or spider species were observed within the study area.

  As such, it is highly unlikely that the PV Plant will impact negatively upon any spider or scorpion species within the study area.

5.5 *SURFACE WATER RESOURCES*

The study area falls within the B11G quaternary catchment in the Upper Olifants sub-Water Management Area (sub-WMA) of the Olifants Water Management Area (WMA). The subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or corridors. In addition it is not considered important in terms of translocation and relocation zones for fish. The subWMA is not listed as a fish Freshwater Ecosystem Priority Area (FEPA). No wetland features were indicated by the NFEPA wetland database layer within the study area, but there are NFEPA wetlands indicated within close proximity of the study area, especially adjacent to Alternative Site 9.

Two wetland types, namely a channelled valley bottom wetland and depression wetland were encountered in close proximity to the study area. All wetland features have been affected by historical agricultural activities and edge effects from the power station and adjacent roads such as storm water runoff, resulting in inundation, augmentation of sediment deposition and vegetation clearing within the wetlands.

The channelled valley bottom wetland feature obtained a moderately low score in terms of ecological function and service provision, as it is artificial and not fully functional as a true wetland. The depression wetland falls into an intermediate class of service provision.

The score achieved for the Ecological Importance and Sensitivity (EIS) assessment places the depression wetland within Category B and the channel valley bottom wetland feature within Category D. The results of the wetland function assessment and Index of Habitat Integrity (IHI) assessment, together with the results of the EIS assessment, were used to inform the Recommended Ecological Category (REC). A Class B (largely natural with few modifications) category for the depression wetland is recommended while for the channeled valley bottom wetland, a Class D (largely modified) category is recommended.

5.6 *HERITAGE RESOURCES*

The larger study region was subjected to farming and urbanization which would have destroyed any pre-colonial or early colonial heritage features that might have occurred in the past. The only heritage sites known from the region are cemeteries, all of which are located well outside the area of the proposed development.

5.7 *SOCIAL ENVIRONMENT*

Socially, the Municipality is found to have the following general characteristics:

- *Mining activities contribute significantly to local economic production;*
- *A large percentage of the population is living on the poverty line as a result of high unemployment rate, low levels of education and skills, and low income levels, on par with that of the country as a whole;*
- *The informal settlement, namely Speekfontein, referred as Duvha informal settlement may be relocated; and*
- *Solar energy production is supported by policy and local planning environment and the Local Municipality considers it critical to create energy that considers renewable and non-renewable energy sources.*

6. *PUBLIC PARTICIPATION IN THE SCOPING PHASE*

A letter notifying I&APs of this application for environmental authorisation, was sent to all registered stakeholders together with a Background Information Document (BID). An on-site notice, providing a brief background on the project and contact details in order for I&APs to request further information and/or to register as a stakeholder was posted on the 16th January 2015 at the Duvha

Power Station security gate. Additional Notices were erected at the Witbank Library, 28 Hofmeyer Street and at Eskom Village surrounding the Duvha Power Station. Notice of the application was advertised in the Witbank Nuus on 9th January 2015

The draft scoping report was available to I&APs for comment on the ILISO website (www.iliso.com) and hard copies were made available for perusal at the Duvha Power Station security gate and Witbank Public Library. I&APs had thirty (30) days to comment on the draft scoping report. The comment period was from the 12th March 2015 to the 15th April 2015.

Public meetings were held during the scoping phase to provide stakeholders with background information about the proposed project, and to give them the opportunity to raise issues and/or concerns that should be addressed during the project. The meetings were held on the 23rd March 2015 at the Highveld Protea Hotel in Witbank, Mpumulanga at 10:00 am and 17:00 pm. The first meeting had a good attendance of I&APs with no attendance at the second meeting. All comments, are recorded in the Issues and Responses Report (IRR).

The DSR was updated in light of the comments received and the Final Scoping Report (FSR) and Plan of Study for the Environmental Impact Assessment (PoSEIA) was submitted to DEA on the 20th April 2015. The FSR was available to I&APs for comment on the ILISO website (www.iliso.com). I&APs had twenty one (21) days to comment on the FSR. The comment period was from the 20th April 2015 to the 12th May 2015. The FSR was rejected by DEA on the 25th May 2015.

In light of the DEA requirements, the FSR was amended and called the Revised Final Scoping report (RFSR). The RFSR was made available for comment to I&APs on the ILISO website (www.iliso.com), the Witbank Library and the Duvha Power Station Security. The comment period was from the 12th June 2015 to the 13th July 2015. I&APs had thirty (30) days to comment on the RFSR. The RFSR was submitted to DEA and accepted on the 6th of August 2015. An email together with the acceptance letter was sent on the 11th August 2015 to registered I&APs.

The Draft Environmental Impact Assessment Report (DEIAr) was made available to I&APs for a 40 day comment period on the ILISO website (www.iliso.com). Hard copies were made available for perusal at the Duvha Power Station security gate, and the Witbank Library. The comment period was from the 9th October 2015 to the 17th November 2015. A notification letter informing registered I&APs of the public comment period for the DEIAr and details of the public meeting was sent via email and sms on the 5th October 2015. Notice for the DEIAr comment period was advertised in a local

newspaper, the Witbank Nuus on the 2nd October 2015. A Public meeting was held during the EIA phase to provide stakeholders with progress of the EIA process and present the findings of the specialist studies and recommendations of the EAP. The meeting was held on the 28th October 2015 at the Buthanani Home Based Care Stand No A8; Masakhane Village, Witbank Mpumalanga at 14:00pm.

The Final Environmental Impact Assessment Report (FEIAr) was made available to I&AP's for 21 day comment period on the ILISO website (www.iliso.com). Hard copies were made available on request. The comment period was from the 06 January 2016 to 26 January 2016. A notification letter informing registered I%AP's of the public comment period for the FEIAr was sent via email on the 06th January 2016.

All issues and comments raised by I&APs during the various phases of the EIA process to date have been captured in an Issues and Responses Report (IRR). The IRR summarises the issues and comments raised and provides the project teams response.

7. ASSESSMENT OF POTENTIAL IMPACTS

7.1 HERITAGE

As no sites, features or objects of cultural heritage significance have been identified within Alternative Site 1 and 9, there would be no impact as a result of the proposed PV Plant. From a heritage point of view it is recommended that the proposed PV Plant can continue on either Alternative Site 1 or 9.

7.2 FLORA, FAUNA, AVIFAUNA AND WETLAND ECOLOGY

The Faunal, Avifaunal, Floral and Wetland Ecological Assessment was done in order to evaluate impacts the proposed PV Plant might have on the following:

Floral:

- *Habitat for Floral Species;*
- *Floral Diversity; and*
- *Floral SCC*

Fauna:

- *Faunal Habitat and Ecological Structure;*
- *Faunal Diversity and Ecological Integrity; and*
- *Important Faunal SCC (Mpumalanga Province).*

Avifauna

- *Avifaunal habitat and ecological Structure;*
- *Avifaunal diversity and ecological Integrity; and*
- *Important Avifaunal SCC.*

Wetland

- Wetland habitat and Ecological Structure;
- Wetland Ecological and Socio-cultural Service Provision; and
- Wetland Hydrological Function and Sediment Balance.

The most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced from low to very low significance impacts.

There is no difference in impact on faunal, avifaunal, floral or wetland resources anticipated for any of the alternative sites associated with the proposed PV Plant. However, Alternative Site 1 is anticipated to have the least significant impact on ecological resources, due to Alternative Site 9 being in closer proximity to the depression wetland, and as such is supported from an ecological perspective.

7.3 *SOILS AND AGRICULTURAL POTENTIAL*

Alternative Site 1 and 9 potentially have soils suitable for agriculture, however the sites are both on Eskom's power station property which is a National Key Point and not available for agricultural development. Assessing agriculture as an alternative land use is therefore irrelevant.

Once the Duvha Power Station and PV Plant have been decommissioned the land can be returned to more or less a natural state following rehabilitation.

There is no significant difference in impact on soil and agricultural resources for any of the alternative sites associated with the proposed PV Plant. From a soils and agricultural point of view it is recommended that the proposed PV Plant can continue on either Alternative Site 1 or 9.

7.4 *SOCIAL IMPACT ASSESSMENT*

The purpose of the Social Impact Assessment is to analyse and provide the potential social impacts of the proposed PV Plant on the following:

- *New Business sales, multiplier effects and economic stimulation;*
- *Employment and skills transferral;*
- *In-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure and services;*
- *Health, safety, security;*
- *Nuisance, noise, other disruptions, and change in quality of living environment;*
- *Visual and land use patterns alterations impact and change in sense of special and other spatial considerations;*
- *Tourism and Aesthetics;*
- *The Duvha Primary School; and*
- *Development of clean renewable energy.*

Both positive and negative social impacts have been identified. With regards to site alternatives, for the majority of the impacts there is no difference in

impact between Alternative Site 1 and 9 as both are situated on land parcel sizes which are relatively equal in size. Therefore there will be similar capital expenditure, expected energy production, expected employment creation, etc. Alternative Site 9 is slightly preferable socially in that its location provides the least negative impacts. However, Alternative Site 9 also provides the least positive impacts.

7.5 *CONSIDERATION IN IDENTIFICATION OF PREFERRED ALTERNATIVE*

In order to identify the preferred alternative the EAP evaluated all the recommendations and impact assessments undertaken by the respective specialists. With implementation of mitigation measures recommended by the specialists' studies, the construction, operation and decommissioning phases of the PV Plant is reduced to very low impacts.

Alternative Site 1 is anticipated to have the least significant impact on ecological resources due to Alternative Site 9 being in close proximity to the depression wetland. Alternative Site 9 is slightly preferable socially as its location provides the least negative impacts. However with the implementation of the mitigation measures proposed, the difference of impact between Alternative Site 1 and 9 become negligible from a social perspective.

Based on the above, Alternatives Site 1 is recommended as the preferred site for the development of the PV facility.

8. *CONCLUSION*

The main aim of the proposed PV Plant at Eskom's Duvha Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint. Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy and climate change targets as well as enable Eskom to support the demand side management energy efficiency programme. Moreover the concept of a solar energy project is broadly supported in local economic planning documents.

As per the requirements of the NEMA (Act 107 of 1998), this EIA has identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV Plant. Alternative Site 1 is anticipated to have the least significant impact on ecological resources. Alternative Site 9 is slightly preferable socially as its' location provides the least negative impacts. However with the implementation of the mitigation measures proposed, the difference of impact between Alternative Site 1 and 9 is negligible from a social perspective.

It is therefore recommended that the proposed PV Plant be developed on Alternative Site 1 on condition that the mitigation measures proposed are adhered to.

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FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT
January 2016

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LIST OF ACRONYMS

AC	Alternating Current
BA	Basic Assessment
BBBEE	Broad Black Based Economic Empowerment
BSc	Bachelor of Science
BID	Background Information Document
BGIS	Biodiversity Geographical Information Systems
BLSA	Bird Life South Africa
CA	Competent Authority
CAGR	Compound Annual Growth Rate
CMS	Catchment Management Strategy
c-Si	Polycrystalline technology
CSP	Concentrated Solar Power
DC	Direct Current
DEA	Department of Environmental Affairs
DEIAr	Draft Environmental Impact Assessment report
DME	Department of Mineral and Energy
DMR	Department of Mineral Resources
DoE	Department of Energy
DTI	Department of Trade and Industry
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EEDSM	Energy efficiency demand-side management
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity
Eskom	Eskom Holdings SOC Ltd
EMPr	Environmental Management Programme
ERA	Energy Regulation Act 2006 (Act 4 of 2006)
FEPAs	Freshwater Ecosystem Priority Areas
FSR	Final Scoping Report
GDS	Growth and Development Strategy
GDP-R	Gross domestic product per region
GHG	Green House Gas
GIS	Geographical Information System
GLeWaP	Groot Letaba Water Project
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
HIA	Heritage Impact Assessment
IAIA	International Association of Impact Assessment
IAIAsa	International Association of Impact Assessment South Africa

I&APs	Interested and Affected Parties
IBA	Important Bird Areas
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
IHI	Index of habitat Integrity
ILISO	ILISO Consulting (Pty) Ltd
IPP	Independent Power Producer
IRR	Issues and Responses Report
IRP	Integrated Resource Plan
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature
O&M	Operations and Maintenance
MSA	Municipal Systems Act 2000 (Act 32 of 2000)
MTSF	Medium Term Strategic Framework
MTEFs	Medium Term Expenditure Frameworks
NDM	Nkangala District Municipality
NDP	National Development Plan
NEMA	National Environmental Management Act 1998 (107 of 1998)
NEMBA	National Environmental Management Biodiversity Act 2004 (10 of 2004)
NERSA	National Energy Regulator of South Africa
NFEPA	National Fresh Water Ecosystem Priority Areas
NFSD	National Framework for Sustainable Development
NHRA	National Heritage Resource Act 25 of 1999
NIRP	National Integrated Resource Plan
NSBA	National Spatial Biodiversity Assessment
NSDP	National Spatial Development Plan
NWA	National Water Act (Act 36 of 1998)
PES	Present Ecological State
PGDSs	Provisional Growth Development Strategies
PoS	Plan of Study
PPP	Public Participation Process
PRECIS	Pretoria Computer Information Systems
PV	Photovoltaic
RDL	Red Data Lists
REC	Recommended Ecological Category
SACLAP	South African Council for the Landscape Architectural Profession
SACNSP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANCOLD	South African Committee on Large Dams
SCC	Species of Conversational Concern
SDF	Spatial Development Framework
SEF	Solar Energy Plant
SIAs	Social Impact Assessments
SP	Sub-place

STDs	Sexually Transmitted Diseases
STLM	Steve Tshwete Local Municipality
Sub-WMA	Sub-Water Management Area
TF	Thin Film
ToR	Terms of Reference
VIS	Vegetation Index Score
UNFCCC	United Nations Framework Convention on Climate Change
WUL	Water Use License

ABBREVIATIONS

CO_2	Carbon Dioxide
CH_4	Methane
CFC's	Chlorofluorocarbons
GWh	Gigawatt hour
GW	Gigawatt
km	Kilometer
km^2	Square Kilometers
KWh/m^2	Kilowatt-hour per meter squared
MWh	Mega Watt hour
MWp	Mega Watt peak
m	Meters
ha	Hectare
°C	Degrees Celsius
%	Percentage
PAN	Peroxyacylnitrate

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1. INTRODUCTION

Eskom Holdings SOC Ltd. (Eskom) proposes to construct and operate a Solar Photovoltaic (PV) Plant within the property of Eskom's Duvha Power Station, Mpumalanga Province. The proposed PV Plant requires a footprint of 35.2 ha to generate the projected power peak of 23.5 MWp.

ILISO Consulting (Pty) Ltd, (ILISO) was appointed to undertake the necessary environmental authorisation process as required in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, on behalf of Eskom. The proposed development triggers a suite of activities in terms of NEMA, which requires authorisation from the national Department of Environmental Affairs (DEA) as Eskom is a State Owned Company.

The Environmental Impact assessment (EIA) builds on the Scoping phase of the EIA process. This Draft Environmental Impact Assessment report (DEIAr) aims to provide sufficient information on whether or not the potential environmental impacts associated with the project are acceptable from a biophysical, socio-economic and heritage perspective.

1.1 PROJECT LOCATION

Eskom, proposes to construct and operate a PV plant on the property of the existing Eskom Duvha Power Station, located on the farm Duvha Kragstasie 337JS in Mpumalanga **(Figure 1).** The Duvha Power Station is located approximately 15 km east of Witbank and forms part of the Emalahleni Local Municipality (ELM) in Mpumulanga. The geographical area of the ELM is approximately 2,677 km^2. The municipality consists of a number of towns, including Balmoral, Clewer, Coalville, Hlalanikahle, Kendal, Kriel, Kwaguqa, Lynnville, Matla, Minnaar, New Largo, Ogies, Paxton, Phola, Rietspruit, Thubelihle, Van Dyks Drif, Wilge, and Witbank. **Table 1** provides details regarding the project location.

Table 1: Project Location

Province	Mpumalanga
District Municipality	Nkangala District Municipality
Local Municipality	Emalahleni Local Municipality
Ward number(s)	19
Nearest town(s)	Emalahleni
Farm name(s) and number(s)	Duvha Kragstasie 337JS
Portion number(s)	Remainder of Portion 0
21 digit Surveyor General Code	T0JS00000000033700000
Title Deed	T10033/1978

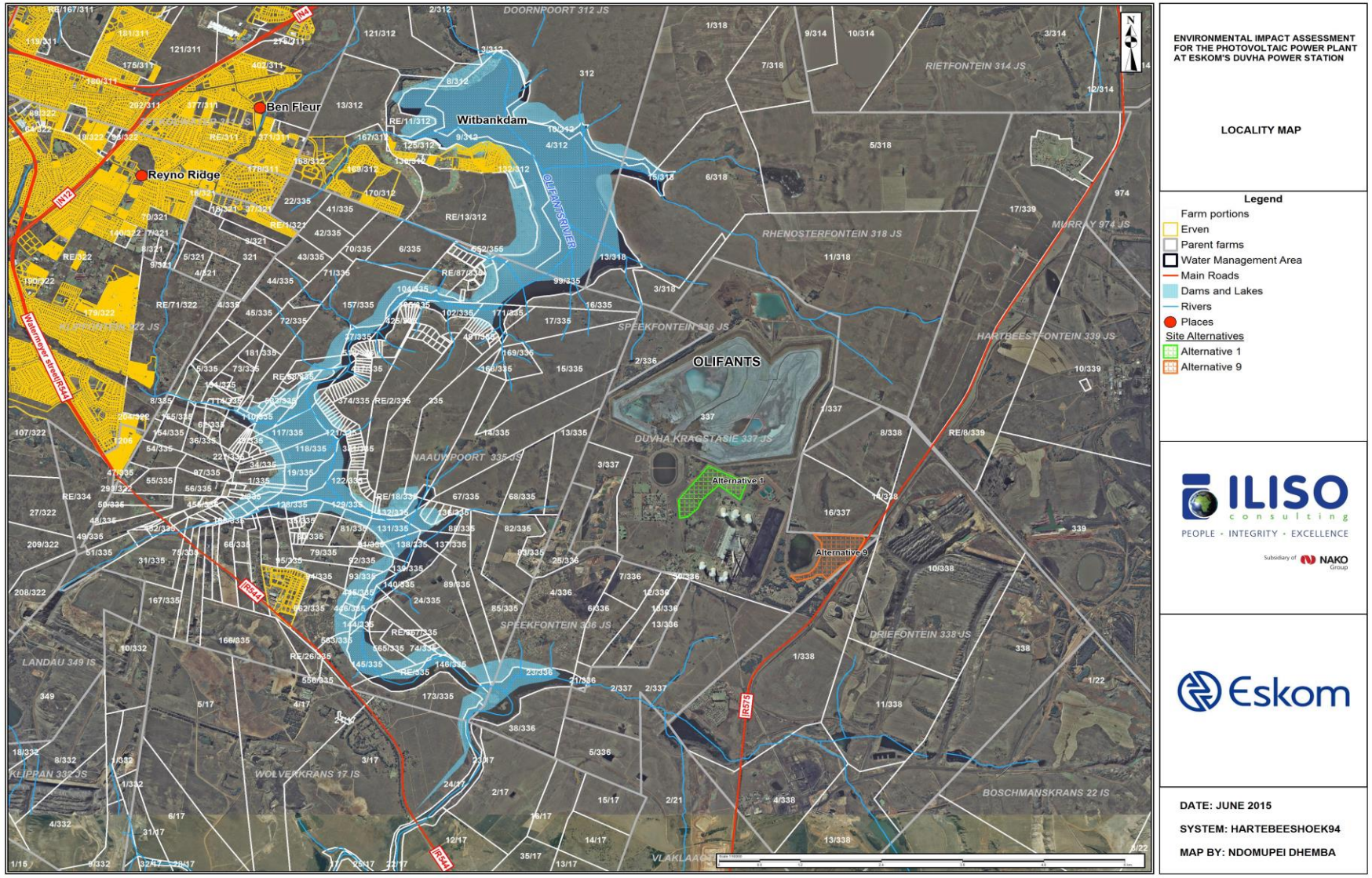

Figure 1: Locality Map for Solar PV Alternative sites at Duvha Power Station

1.2 DESCRIPTION OF THE PROPOSED PROJECT

The proposed PV Plant requires a footprint of 35.2 ha to generate the projected power peak (electricity) of 23.5 MWp, this is referred to as Site 1. An alternative site, referred to as Site 9 was also considered and has a footprint of 37 ha allowing for a projected power peak of 24.7 MWp. **Figure 2** presents an overview of the alternative sites for the proposed PV plant.

Site 1

Site 9

Figure 2: Alternative Site 1 and 9

The additional electricity generated will be used for Eskom's own consumption at Duvha Power Station allowing Eskom to increase its electricity export to the grid. This will also enable Eskom to diversify its energy mix, reduce its relative carbon footprint, and support the demand side management energy efficiency programme. The roll-out of this project will form part of the Eskom Renewables Strategy in the Eskom Renewables Energy Unit.

1.2.1 Project Components

PV technology is a method of generating electrical power by converting solar radiation using semiconductors through a process known as the photovoltaic effect. It is not the heat required from the sun but the amount of irradiation available that allows for electrical energy to be generated. The components of the PV Plant are described below.

Solar PV Panels (as shown **in Figure 3**).

The proposed PV Plant utilises two (2) types of PV Panel technology, Polycrystalline (c-Si) technology and Thin Film (TF) technology. c-Si Technology is essentially crystalline silicon cells which are connected and compressed between a transparent layer and a backing material. The TF technology is one or more thin layers, or thin film of photovoltaic material on a substrate, such as glass, plastic or metal. Both PV Panel technologies have the same components which consist of the following:

- PV Cell: A basic PV device, which generates electricity when exposed to solar radiation. All PV cells produce Direct Current (DC) electricity.

- PV Module or Panel: The smallest complete assembly of interconnected PV cells. The modules are typically mounted in a lightweight aluminium frame to form a panel.
- PV Array: A group of PV panels connected together is termed as PV Array. An interconnected system of PV modules that function as a single electricity-producing unit.

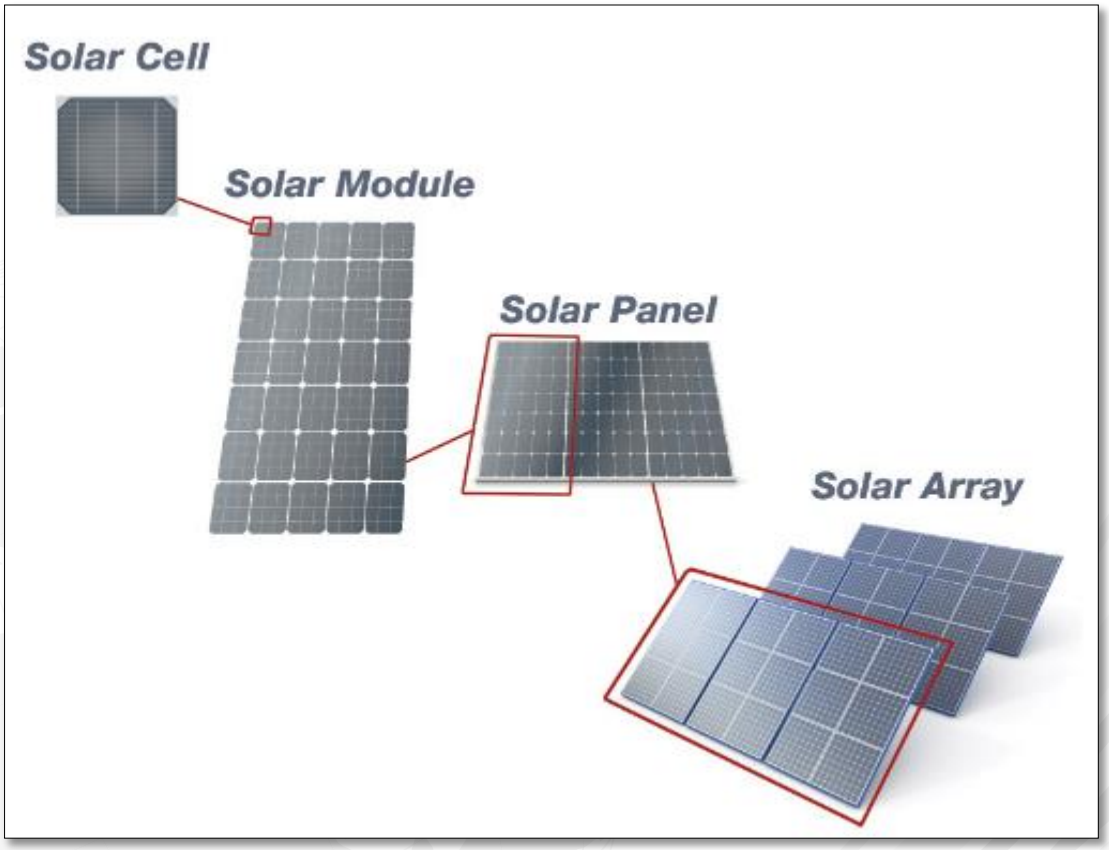

Figure 3: Solar PV Components

The proposed PV panels are approximately 1.6 m in height and 1m in width. These panels will be installed on fixed tilted mounting structures.

Mounting Structure

The fixed tilted mounting structure is 3 m in height. The mounting structure consists of steel posts which are used as structural support for the PV array. Tilt brackets are used to support the mounting structures and are placed at a 25^0 angle **(Figure 4).**

Inverter Cabins

The electricity generated from the solar panels will be transferred via combiner boxes to the inverters. These combiner boxes combine several cables that come from each string of modules into a unique pair of DC cables that is then connected to the inverter. Approximately twenty four (24) inverter cabins will be required for Alternative Site 1 and twenty-five (25) for Alternative Site 9 with a footprint of 768 m^2 and 700 m^2 respectively.

Steel Posts | Tilt Brackets | Mounting Structures | Installation of Modules

Figure 4: Fixed tilted mounting structure for PV Array (Web 4)

Wiring to Inverters/Transformers

Array enclosures are wired to inverters, where DC is converted to Alternating Current (AC). The inverters function to convert DC electricity to AC electricity at grid frequency. The voltage is then stepped-up via transformers to be distributed via the power station grid. A transmission Line will then connect the PV Plant with the connection point of the power station. The transmission line is a 22 kV overhead line approximately 3000 m.

Buildings

Buildings include a substation, an operation and maintenance (O&M) building, and a Meteorological station.

Roads

Existing access roads will be utilised. New internal roads for servicing and maintenance of the Plant will be between 3-5 m in width and cover a footprint of 57 500 m^2 at Alternative Site 1 and 60 000 m^2 at Alternative Site 9.

Fence

A triple wire fence, 3 m in height will surround the perimeter of the PV Plant and cover an area of 3 600 m^2 at Alternative Site 1 and 3 800 m^2 at Alternative Site 9.

Storm water infrastructure

The storm water infrastructure will include but not limited to, V-Drains with energy dissipaters, detention areas and apron outlets.

1.2.2 Construction Phase

The construction of the Solar PV Plant will take approximately 18 months. Based on size of employment per production from the Department of Trade and Industry (DTI, 2013), for the 23.5 and 25 MWp plant approximately 270 people can be expected to be employed during the construction period. Note however that this is total job creation (nationally and internationally) and includes, direct, indirect and induced jobs due to the multiplier effects and a job is defined as one person employed for one year. The

localisation (South African) potential of jobs, based on the Department of Trade and Industries report (2013), however assumes a potential local job creation of 5.8 person per MWp. Based on the proposed PV Plant, the total South African job creation can be assumed to be around 140 jobs during the construction period. The direct potential of jobs, based on the National Treasury report (2011), reveals an approximate 25% direct impact, which means that the direct employment is estimated at approximately 35 direct jobs. This is in line with the estimated man-days during the duration of the construction phase, namely 8100 man-days, which equates to approximately 33 man-year employment opportunities.

It is important to note that not all these employment opportunities are necessarily available for employment of local workforce within the immediate surrounds of the project. The actual number is also likely to vary based on final designs and size of the proposed project, as well as based on the level of skills and resources of the contractor. Nonetheless, even though the exact number of employment opportunities is not known, the construction of the proposed project will require a workforce, albeit limited, and therefore direct employment will be generated. This is therefore a positive social impact

In terms of skills requirements, the following employment categories are considered:

- Highly skilled or skilled labour such as engineers, technical staff and project managers will constitute about 30% of the work force;
- Semi-skilled staff would typically be required to operate machinery and this will constitute about 10% of employees; and
- While the remainder will be low skilled construction and security staff that will constitute about 60% of the work force. It is likely that the low skilled workforce could be employed from the surrounding area.

The Contractors will establish a site office to accommodate staff for the duration of the construction phase, this will not include lodging facilities. Those who are not local staff will be accommodated in suitable and established lodging facilities in close proximity to the proposed PV Plant. The site office will include designated areas for prefabricated offices, equipment, and stockpiles. The site offices will occupy an area of 0.4 ha. No natural open spaces will form part of the construction domain. Portable sewage systems will be used by the construction staff and all other facilities (water and electricity) will be provided by the Duvha Power Station.

It is estimated that an average of 50 vehicles will be operating on site during the material delivery and construction phase of the project. Abnormal loads will not be transported to site. It is therefore unlikely that external roads to the power station will have to be upgraded. Internal roads between 3 m- 5 m in width and occupying a footprint of 57 500 m^2 at Alternative Site 1 and 60 000 m^2 at Alternative Site 9 will be constructed to accommodate the project requirements.

The construction of the Solar PV Plant will consists of the following activities:

- Topsoil stripping and vegetation clearance will be undertaken within the proposed footprint to prepare the site for the installation of the PV Plant;
- Topsoil will be stockpiled accordingly and used in the rehabilitation of site;
- Terrain levelling will be undertaken to ensure flat surfaces;
- Erection of site fencing around the boundary of site;
- Construction of required driveways and internal roads;
- Excavation works for cable trenches and foundations;
- Stockpiling of excavated material;
- Preparing internal underground cable laying;
- Preparation of suitable foundation for buildings will be undertaken using ready mix concrete;
- Preparation of suitable foundations for PV mounting structure, ballast or pile foundations;
- Erection of PV mounting structures;
- Installation of internal underground cabling, combiner boxes, site surveillance facilities;
- Construction of a Control Room will be established to house control equipment and electrical switchgear;
- Installation of PV modules;
- Installation of inverters and inverter cabins; and
- Erection of transmission line (grid connection). One single line will connect the PV site with the connection point of the power station.

1.2.3 Operation Phase

The PV Plant is designed to operate up to 25 years at full productivity. After which the Plant will operate at 80 % efficiency until the end of its life-span.

The operation phase of the Project will require a very small direct workforce, and it is probable that this could all be undertaken by existing Eskom staff. Routine and corrective maintenance on electrical infrastructure will be undertaken during the operational phase. Maintenance will need to be carried out throughout the lifetime of the PV Plant. Typical activities during maintenance include washing solar panels and vegetation control. PV panels will be washed manually with water and no chemicals. Indirect and induced job creation potential, albeit very small, also exists from the increased energy production during the operation phase.

1.2.4 Decommissioning Phase

Due to the PV Plant being developed for the station's own consumption, the PV Plant will be decommissioned at the same time as the Duvha Power Station.

The PV Plant and infrastructure will be disconnected from the electricity network, the module components would be removed and recycled as far as possible. The structures would be dismantled and all underground cables would be excavated and

removed. The buildings will be demolished and all rubble will be disposed of in accordance to legislation.

The rehabilitation of the disturbed areas would form part of the decommissioning phase. The aim of the rehabilitation is to bring back the work site to a stabilised condition, as close as possible to pre-construction conditions and to the satisfaction of the landowner. The rehabilitation of the area would entail the following:

- Once the area is clear of all structures and waste, the area will be ripped and a layer of topsoil will be placed over the disturbed areas;
- Application of fertilizers will be utilized to improve soil composition; and
- Hand seeding of indigenous seed mix will be used to achieve acceptable grass cover.

1.2.5 Summary of Project Components, relevant footprint and dimensions

Tables 2 and 3 present a summary of the project components relative footprints and dimensions for Alternative Site 1 and 9.

Table 2: Alternative 1 Project Components, footprint and dimensions

COMPONENT	DESCRIPTION	APPROXIMATE DIMENSION (m)	APPROXIMATE FOOTPRINT (ha)
PV panels (height & width)	94,000 (c-si technology)	1.64 m x 0.982 m	35.2 ha
	235,000 (thin film technology)	1.2 m x 0.60 m	
Generation Capacity	23.5 MWp		
Mounting Structure	Fixed tilted mounting structure	Up to 3 m	
Inverter (MV) Cabins	Approximately 24		768 m^2
Transformer	Approximately 24	Located inside MV/Inverter cabins	
Substation (Switching station)	1 Building	12 m x 11 m	132 m^2
O&M Building	1 Building	13 m x 11 m	143 m^2
Construction Camp/laydown area	Located on the south east corner of the site.	50 m x 80 m	0.4 ha
Internal roads	Ring road, vertical and horizontal roads	Between 3 and 5 m in width	57,500 m^2
Transmission line	Overhead line	3000 m	27,500 m^2 considering 11m servitude
Fencing	Wire triple fencing	3 m in height	Up to 36,000 m^2 considering up to 10 m distance between first and last fence and 3,600 m of fence perimeter
Slope	Approximately 0.5 % North-East/South-West		

Position of the solar facilities	25°57'10.49"S 29°20'7.58"E
Cable route and trench dimensions	DC cable will be connected in a string, with cable trays. The cables will be underground at a depth of 1 m and most likely will be along internal roads
Cut and fill areas along roads and at substation /transformer sites	Approximately 1 043 m^3~ 1 100m^3 considering excavation for the MV Cabins, O&M Building and Switching Station foundation. 1 m depth
Spoil heaps	1 043 m^3 ~ 1 100 m^3 considering that the volume excavated for the MV Cabins, O&M Building and Switching Station foundation. This will be located within the proposed area

Table 3: Alternative 9 Project Components, footprint and dimensions

Component	DESCRIPTION	APPROXIMATE Dimension (m)	APPROXIMATE Footprint (ha)
PV panels (height & width)	98,800 (c-si technology)	1.64 m x 0.982 m	37 ha
	247,000 (thin film technology)	1.2 m x 0.6 m	
Generation Capacity	24.7 MWp		
Mounting Structure	Fixed tilted mounting structure	Up to 3 m	
Inverter (MV) Cabins	Approximately 25		700 m^2
Transformer	Approximately 25	Located inside MV cabins	
Substation (Switching station)	1 Building	12 m x 11 m	132 m^2
O&M Building	1 Building	11 m x 13 m	143 m^2
Construction Camp/laydown area	Located on the north Side of the site.	Approximately 50 mx 80 m	Approximately 0.4 ha
Internal roads	Ring road, vertical and horizontal roads	Between 3 and 5 m in width	Approximately 60,000 m^2
Transmission line	Overhead line	4 000 m	Approximately up to 44,000 considering 11m servitude
Fencing	Triple Wire fence	3 m in height	Approximately 38,000 up to m^2 considering 10 meters distance between first and last fence and 3,800 meters of fence perimeter.
Slope	0.5% South-North 1% East West		
Position of the solar facilities	25°57'48.63"S 29°21'16.21"E		

Foundation footprint (considering the MV Cabins, O&M Building and Switching Station)	Approximately 1 075 m^2 ~ 1 100m^2
Cable route and trench dimensions (where they are not along internal roads)	DC cable will be connected in a string with cable trays. The cables will be underground at a maximum depth of 1 m and most likely will be along internal roads
Cut and fill areas along roads and at substation /transformer sites along indicating the expected volume of each cut and fill	Approximately 1 075 m^3 ~ 1 100 m^3 considering excavation for the MV Cabins, O&M Building and Switching Station foundation 1 m depth
Spoil heaps	Approximately 1 075 m^3 ~ 1 100 m^3 considering that the volume excavated for the MV Cabins, O&M Building and Switching Station foundation. This will be located within the proposed area.

2. LEGISLATION AND GUIDELINES CONSIDERED

2.1 INTRODUCTION

This chapter describes the legal framework within which the project takes place. Other applicable policies and guidelines are also discussed.

2.2 LISTED ACTIVITIES TO BE AUTHORISED IN TERMS OF NEMA

It is acknowledged that the 2014 EIA regulations, which repeal and replace the 2010 EIA Regulations were promulgated on the 4th December 2014 and consist of the following:

- Government Notice (GN) 982: Specifies the EIA Process Regulations (excluding exemptions and appeals.);
- GN 983: Listing Notice 1 which identifies activities that would require environmental authorisations prior to commencement of that activity for which a Basic Assessment is required;
- GN 984: Listing Notice 2 which identifies activities that would require environmental authorisations prior to commencement of that activity for which a Scoping and Environmental Impact Assessment is required; and
- GN 985: Listing Notice 3 which activities that would require environmental authorisations prior to commencement of that activity in specific identified geographical areas only.

As confirmed by DEA, this EIA is being carried out under the 2010 EIA Regulations in terms of the NEMA (107 of 1998). The following Regulations promulgated in terms of NEMA therefore apply:

- GN 543 – specifies the process that must be undertaken to obtain an Environmental Authorisation;
- GN 544 – Listing Notice 1 which identifies activities that would require environmental authorisations prior to commencement of that activity for which a Basic Assessment is required;
- GN 545 – Listing Notice 2 which identifies activities that would require environmental authorisations prior to commencement of that activity for which a Scoping and Environmental Impact Assessment is required; and
- GN 546 - Listing Notice 3 which activities that would require environmental authorisations prior to commencement of that activity in specific identified geographical areas only.

Section 53 (3) of the 2014 EIA regulations reads, "*where an application submitted in terms of the pervious NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24 (2) as if it is was applied for, on condition that all impacts of the newly identified activity and requirements of these regulations have also been considered and adequately assessed*."

Based on the above listing notices, the proposed project involves several activities listed in terms of Section 24 of the NEMA (Act 107 of 1998). **Table 4** presents the listed activities applied for in terms of the 2010 EIA regulations in comparison to the 2014 EIA regulations. The comparison indicates that no additional activities in relation to the proposed project have been triggered by the 2014 NEMA Regulations. In this regard an Environmental Authorisation must be issued by the national DEA prior to commencing with the project in terms of the 2010 EIA regulations. An Application Form in terms of the 2014 regulations will be submitted with the Final Environmental Impact Assessment Report.

Table 4: List of activities to be authorised in terms of NEMA

Listed activity as described in GN R.544, 545 and 546	Listed activity as described in GN R.983, 984 and 985	Proposed Activity
GN R.545 Item 1: **The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.**	**GN R 984 Item 1** The development of facilities' or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more. Excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within the urban area.	*Alternative Site 1 has a projected power peak (electricity) of 23.5 MWp.* *Alternative Site 9 has a projected power peak (electricity) of 24.7 MWp* This property is owned by Eskom Duvha Power Station and falls outside the urban area.
GN R.545 Item 15: **Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.**	***GN R. 984 Item 15*** **The clearance of an area of 20 hectares or more of indigenous vegetation.**	*Alternative Site 1 has a footprint of 35.2 ha allowing for a projected power peak (electricity) of 23.5 MWp.* *Alternative Site 9 has a footprint of 37 ha allowing for a projected power peak (electricity) of 24.7 MWp* This property is owned by Eskom Duvha Power Station.
GN R. 544 Item 22 (ii): **The construction of a road, outside urban areas,** (ii) where no reserve exists, where the road is wider than 8 metres.	***GN R. 983 Item 56 (ii):* The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 km:** (ii) where no reserve exists, where the road is wider than	Internal roads between 3 and 5 m in width covering a footprint of 57 500 m^2 for Alternative Site 1 and 60 000 m^2 for Alternative Site 9. The new internal roads will be

	8; metres excluding where widening or lengthening occur inside urban areas.	constructed within the development footprint.
GN R.544 Item 29(i): **The expansion of facilities for the generation of electricity where:** (i) the power peak will be increased by 10 megawatts or more, excluding where such expansion takes place on the original development footprint	***GN R. 983 Item 36 (i)*** **The expansion of facilities for the generation of electricity from a renewable resource where:** (i) the electricity output will be increased by 10 megawatts or more, excluding where such expansion takes place on the original development footprint	*Alternative Site 1 has a footprint of 35.2 ha allowing for a projected power peak (electricity) of 23.5 MWp.* *Alternative Site 9 has a footprint of 37 ha allowing for a projected power peak (electricity) of 24.7 MWp* This property is owned by Eskom Duvha Power Station. The electricity generated will result in an increase in Duvha Power Station's generation capacity.
GN R. 544 Item 11(xi) ***The construction of infrastructure or structures covering 50 square metres or more where such construction occurs within a water course or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.***	***GN R 983 Item 12 (xii)(c)*** ***The development of:*** *(xii) infrastructure or structures with a physical footprint of 100 square metres or more and* *c) where such development occurs if no development setback exists, within the 32 metre of a water curse, measured from the edge of a watercourse*	*Alternative site 9 triggers the 32 metre proximity to a water course.*

2.3 CONTENTS OF THE EIA REPORT

Table 5 sets out the content requirements of an Environmental Impact Assessment Report, in accordance with regulation 31 of GN 543.

Table 5: Contents of the EIA Report

EIA Regulations requirements		Environmental Impact Assessment Report
(a)	Details of EAP and expertise to carry out an environmental impact assessment	Chapter 3
(b)	Description of the proposed activity	Chapter 1
(c)	Description of the property on which the activity is to be undertaken and the location of the activity on the property	Chapter 1
(d)	Description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 6

(e)	Details of the Public Participation Process (PPP) conducted: (i) Steps taken in accordance with the plan of study; (ii) A list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) A summary of comments and issues raised by interested and affected parties (I&APs) including response from EAP on issues; and (iv) Copies of any representations and comments received from registered I&APs. .	Chapter 3
(f)	Need and Desirability of proposed activity	Chapter 2
(g)	Description of alternatives, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Chapter 5
(h)	Methodology used in determining the significance of potential environmental impacts	Chapter 8
(i)	Description and comparative assessment of alternatives	Chapters 1; 6 and 5
(j)	Summary of the findings and recommendations of specialist reports	Chapter 6 and 9
(k)	Description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapters 6 and 9
(l)	Assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapters 9
(m)	Assumptions, uncertainties and gaps in knowledge	Chapter 7
(n)	Reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Chapter 8,9,10
(o)	Environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives	Chapter 9
(p)	Draft environmental management programme	Appendix F
(q)	Specialist reports	Appendix D
(r)	Specific information required by CA	Appendix C
(s)	Other matters required in terms of sections 24(4)(a) and (b) of the Act, i.e. NEMA section 24 (4) Procedures for the investigation, assessment and communication of the potential	

	consequences or impacts of activities on the environment- (a) must ensure, with respect to every application for an environmental authorisation- (i) coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state; (ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project; (iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application; (iv) investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and (v) public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and (b) must include, with respect to every application for an environmental authorisation and where applicable- (i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity; (ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum; (iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act; (iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information; (v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation; (vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and (vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.	Chapter 3 Chapter 8 and 9 Chapters 6 Chapter 9 Chapter 3 Chapters 9 Appendix F Chapter 7 Appendix F Chapter 8 Chapter 2

2.4 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY (CA)

The Scoping Report and Plan of Study for the Environmental Impact Assessment (PoSEIA) dated 20th April 2015 was rejected by DEA on the 25th May 2015 **(Appendix C1).** A Revised Final Scoping Report (RFSR) was generated and described the potential environmental impacts, site alternatives, and Plan of Study (PoS) for the EIA and all requirements as per **Appendix C1**. The RFSR was submitted to DEA and accepted on the 6th of August 2015. Specific Information required by the CA is detailed in **Appendix C2.** Specific Information required by the CA is detailed in **Appendix C** and a summary provided in **Table 6**.

Table 6: CA Requirements

Ref. in the DEA Acceptance letter	DEA Requirement	Environmental Impact Assessment Report
i.	Following a review of the SR and application form, the following information must form part of the EIAr as well as a separate document for ease of reference: • An amended application form with an indication of all the 2010 listed activities that are still listed; An indication of all the similarly listed activities in terms of G.N. R 982 of 04 December 2014; • An indication if there are any new activities that are listed in terms of G.N. R 982 of 04 December 2014; • An indication where in the report all the activities listed in terms of in terms of G.N. R 982 of 04 December 2014 have been assessed and mitigated for; and, • A letter/affidavit from the EAP indicating that the above is true and correct.	To be submitted with FEIAr Chapter 2 Appendix G
ii.	Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.environment.gov.za /documents/forms.	To be submitted with FEIAr
iii.	The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Appendix F Chapter 8
iv.	The listed activities represented in the EIAr and the application form must be the same and correct.	Chapter 2
v.	The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions.	Chapter 1
vi.	The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	Figure 12 and 13
vii.	The EIAr must provide the following: Clear indication of the envisioned area for the proposed solar energy facility; i.e. placing of photovoltaic panels and all associated infrastructure should be mapped at an appropriate scale. Clear description of all associated infrastructure. This description must include, but is not limited to the following: • Power lines; • Internal roads infrastructure ; • All supporting onsite infrastructure such as laydown area, guard house and control room etc. • All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	Chapter 5 Figure 12 and 13

viii.	The EIAr must also include a comments and response report in accordance with Regulation 28(m) of the EIA Regulations, 2010.	Appendix B
ix.	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation.	Chapter 3 Appendix B
x.	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies	Chapter 1
xi.	An Avifaunal Assessment must be conducted to determine the impacts that the proposed. Mitigation measures must be proposed and included in the EIAr and the EMPr.	Chapter 8 Appendix D Appendix F
xii.	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained.	Chapter 1
xiii.	The EIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Chapter 4
xiv.	A copy of the final site layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible.	Chapter 5 Figure 12 and 13
xv.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Chapter 6 Figure 18
xvi.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Chapter 6 Figure 21
xvii.	A shapefile of the preferred development layout/footprint must be submitted to this Department.	Appendix J
xviii.	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr.	Appendix F

2.5 OTHER AUTHORISATION REQUIREMENTS

2.5.1 Heritage Impact Assessment

The proposed project involves activities listed in terms of section 38 of the National Heritage Resources Act 25 of 1999 (NHRA), which require authorisation from the relevant heritage authorities.

According to section 38, the South African Heritage Resources Agency (SAHRA) requires that a Heritage Impact Assessment (HIA) is undertaken where certain activities are proposed. The activities that apply to the proposed installation of a PV Power Plant at Duvha Power Station include:

- 38(1) (a) - The construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; and
- 38(1) (c) - Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent.

A HIA has been conducted as part of the EIA process. The HIA was submitted to the SAHRA for decision-making regarding heritage resources.

2.5.2 National Water Act 1998 (Act 36 of 1998),

The National Water Act (Act 36 of 1998) (NWA) states that no diversion, alteration of bed and banks or impeding of flow in watercourses (which includes wetlands) may occur without obtaining a water use licence authorising the proponent to do so. Furthermore, Government Notice (GN) 1199 as published in the Government Gazette 32805 of 2009 as it relates to the NWA, 1998 (Act 36 of 1998) states that any activities occurring within 500m of watercourses must be authorised by the DWS.

As the proposed activity is within 32 m and 500 m of a wetland, a water use license application will be submitted separately to the Department of Water and Sanitation (DWS) to acquire a water use license (WUL).

2.6 APPLICABLE POLICIES AND LEGISLATION

The following section provides an overview of the policy and legislative framework in which the development of renewable energy projects takes place in South Africa.

- **White Paper on the Energy Policy of the Republic of South Africa (1998)**
  The White Paper on the Energy Policy of South Africa (1998) was published in response to the shifting political climate and socio-economic position of the country. It acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable resource base is extensive. The White Paper therefore commits to government's focused support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications. Specific emphasis is given to solar and wind energy sources, particularly for rural and often off-grid areas with the aim of drawing on international best practice. While considering the larger environmental implications of energy production and supply, the advantages highlighted in the White Paper include the minimisation of environmental impacts in operation in comparison with traditional supply technologies and the lower economic cost. It is with this outlook that solar energy, is seen as a viable, attractive and sustainable option to be promoted as part of South Africa's energy policy towards energy diversification.

- **White Paper on Renewable Energy (2003)**
  The White Paper on Renewable Energy supplements the White Paper on the Energy Policy of the Republic of South Africa (1998). The White Paper sets out the vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. At the outset the policy refers to the long term target of *"10 000 GWh renewable energy contribution to final energy consumption by 2013."* The aim of this 10-year plan is to meet this goal via the production of mainly biomass, wind, solar and small-scale hydro sources. It is estimated that this would constitute approximately 4 % of projected energy demand for 2013. The White Paper presents South Africa's options in terms of renewable energy as extensive and a viable and sustainable alternative to fossil fuel options. A strategic programme of action to develop South Africa's

renewable energy resources is proposed, particularly for power generation and reducing the need for coal-based power generation. The starting point will be a number of initial investments spread across both relatively low cost technologies, such as biomass-based cogeneration, as well as technologies with larger-scale application, such as solar water heating, wind and small-scale hydro. The White Paper provides the platform for further policy and strategy development in terms of renewable energy in the South African energy environment.

- **National Energy Act (2008); and the National Electricity Regulation Act (2006);**
  South Africa has two acts that direct the planning and development of the country's electricity sector:
  i. The National Energy Act (Act 34 of 2008); and
  ii. The Electricity Regulation Act (ERA) (Act 4 of 2006).

  In May 2011, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an Independent Power Producer (IPP) Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- **Integrated Energy Plan (IEP) for the Republic of South Africa (2003)**
  Commissioned by Department Mineral and Energy (DME) in 2003, now the DoE, the Integrated Energy Plan (IEP) aims to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic developments, ensuring security of supply and minimising the associated environmental impacts. The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP concluded that, based on energy resources available in South Africa, coal would be the primary fuel source in the 20 year planning horizon, which was specified as the years 2000 to 2020.

- **Integrated Resource Plan (IRP) (2011)**
  The Integrated Resource Plan (IRP) is a National Electricity Plan, which is a subsection of the Integrated Energy Plan. The IRP directs the expansion of the electricity supply over a given period.

  The outcomes and policy consideration of the IRP include:
  - The installation of renewables (solar PV, CSP and wind) in order to accelerate a local industry;
  - To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW;

- The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024); and
- Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

Developed for the period of 2010 to 2030, the primary objective of the IRP 2011, is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. While promoting increased economic development through energy security, the IRP 2011 aims to achieve a *"balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments."*

- **National Integrated Resource Plan for Electricity (NIRP) (2002)**
  The National Integrated Resource Plan (NIRP) for Electricity is a long-term electricity capacity plan which defines the need for new generation capacity for the country. The National Energy Regulator of South Africa (NERSA) published NIRP1 in 2002, which was replaced by NIRP2 in 2005. The outcome of the NIRP2 determined that coal would remain the major fuel for generating electricity over the next 20 years and that additional energy generation facilities would be required from 2007 onwards. The NIRP is replaced by the IRP (Aurecon, 2013).

- **Policies regarding greenhouse gas and carbon emissions**
  Gases that contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chlorofluorocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gasses are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation trying to leave the earth's surface. This action leads to a warming of the earth's lower atmosphere, resulting in changes in the global and regional climates, rising sea levels and extended desertification. This in turn is expected to have severe ecological consequences and a suite of implications for mankind. Electricity generation using carbon based fuels is responsible for a large proportion of CO_2 emissions worldwide. In Africa, the CO_2 emissions are primarily the result of fossil fuel burning and industrial processes, such as coal fired power stations. South Africa accounts for some 38 % of Africa's CO_2 emissions. The global per capita CO_2 average emission level is 1.23 metric tonnes. In South Africa however, the average emission rate is 2.68 metric tonnes per person per annum. The International Energy Agency (2008) estimates that nearly 50 % of global electricity supplies will need to come from renewable energy sources in order to halve CO_2 emissions by 2050 and minimise significant, irreversible climate change impacts.

The United Nations Framework Convention on Climate Change (UNFCCC) initiated a process to develop a more specific and binding agreement on the reduction of greenhouse gas (GHG) emissions. This led to negotiations with a particular focus on the commitments of developed countries, and culminated in the adoption of the Kyoto Protocol in 1997, which came into effect in February 2005. Using the above framework to inform their approach, the Kyoto Protocol has placed specific legal obligations in the form of GHG reduction targets on developed countries and countries with 'Economies in Transition'. The developed countries listed in Annex 1 of the UNFCCC are required to reduce their overall emissions of six GHGs by at least 5 % below the 1990 levels between 2008 and 2012. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly. More recently under the Copenhagen Accord 2010, countries representing over 80 % of global emissions have submitted pledges on emission reductions. South Africa's commitment is to reduce GHG emissions 34 % by 2020 and 42 % by 2025.

The Kyoto Protocol, to which South Africa is a signatory, was informed by the principles of sustainable development which resulted in related policies and measures being identified to promote energy efficiency while protecting and enhancing the 'sinks and reservoirs' of greenhouse gases (forests, ocean, etc.). Other methods/approaches included encouraging more sustainable forms of agriculture, in addition to increasing the use of new and renewable energy and the adoption/implementation of advanced and innovative environmentally sound technologies. South African policies are informed by the Kyoto Protocol and its partial successor the Copenhagen Accord 2010 and associated sustainable development principles whereby emphasis is being placed on industries for 'cleaner' technology and production (Aurecon, 2013).

3. THE ENVIRONMENTAL IMPACT ASSESSMENT AND PUBLIC PARTICIPATION PROCESS

3.1 INTRODUCTION

The NEMA (107 of 1998), aims to promote the use of appropriate environmental management tools, such as an EIA, in order to ensure the integrated environmental management of activities.

The general objective of integrated environmental management, as described in the NEMA (Act 107 of 1998), is to identify, predict and evaluate the impacts of an activity on the social, economic, bio-physical and cultural components of the environment. This assessment includes the risks associated with activities, consequences of the activities as well as considering alternatives and mitigation measures to avoid, minimise or compensate for negative impacts, maximise benefits, and promote compliance with the principles of environmental management as set out in Section 2 of the NEMA (Act 107 of 1998). This is implemented by requiring Environmental Authorisation (EA) for activities that are "listed" in the EIA Regulations, 2010, as amended.

The purpose of this EIA is to assess the components of the project that are listed activities in the NEMA (Act 107 of 1998), for which Eskom will implement. The EIA aims to provide sufficient information to DEA to make an informed decision on whether the project should be implemented or not, and if so under what conditions.

This Chapter provides an overview of the EIA process **(Figure 5),** a description of the public participation undertaken to date and the Environmental Management Practitioner (EAP) and project team details.

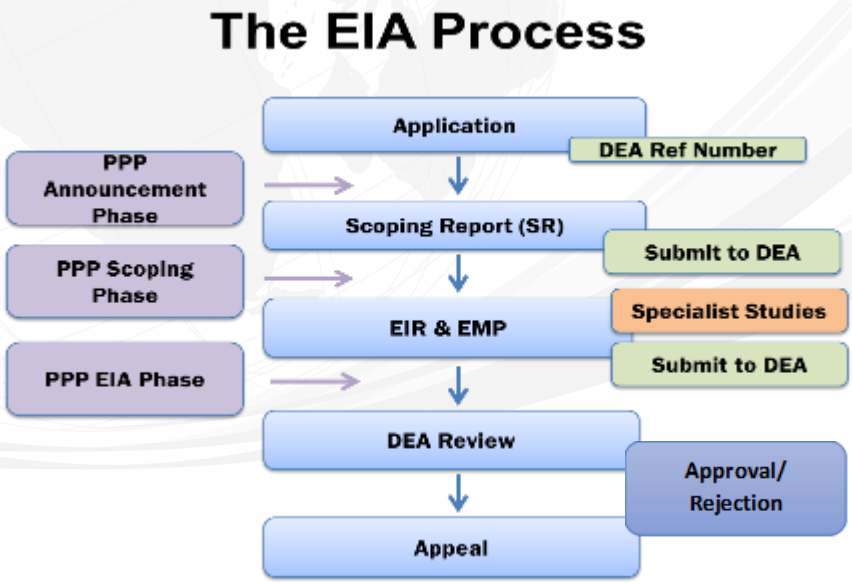

Figure 5: Overview of the EIA Process

3.2 APPLICATION PHASE

The project team undertook a site visit on the 27th October 2014 to inspect the proposed sites and their surrounding environments. The information gathered during the site visit was used to inform the Terms of Reference (ToR) for the Specialists Studies which were undertaken during the EIA phase.

The Application to undertake the proposed project was submitted on the 13th November 2014. A project reference number was received from the DEA on the 3rd December 2014 with requirements to amend the application. Amendments to the application were made and acceptance thereof was received from DEA on the 16th January 2015 **(Appendix H).** As confirmed by DEA, this EIA is being carried out under the 2010 EIA Regulations in terms of the NEMA (107 of 1998).

3.3 SCOPING PHASE

The main objectives of the Scoping Study was to:

- Describe the key biophysical and socio-economic characteristics of the affected environment;
- Identify potential environmental issues and impacts to be addressed in the EIA phase;
- Define the legal, policy and planning context for the proposed project;
- Identify Interested and Affected Parties (I&APs) and undertake a public participation process that provides opportunities for all their involvement;
- Identify feasible alternatives that must be assessed in the EIA phase; and
- Define the Plan of Study (PoS) for the EIA phase.

The Draft Scoping Report (DSR) was available to I&APs for comment from the ILISO website (www.iliso.com) and hard copies were made available for perusal at the Duvha Power Station security gate and Witbank Public Library. I&APs had thirty (30) days to comment on the DSR. The comment period was from the 12th March 2015 to the 15th April 2015.

The DSR was updated in light of the comments received and the Final Scoping Report (FSR) and Plan of Study for the Environmental Impact Assessment (PoSEIA) was submitted on the 20th April 2015. The FSR was available to I&APs for comment from the ILISO website (www.iliso.com). I&APs had twenty one (21) days to comment on the FSR. The comment period was from the 20th April 2015 to the 12th May 2015. The FSR was rejected by DEA on the 25th May 2015 **(Appendix C).** In light of the DEA requirements, the FSR was amended and called the Revised Final Scoping report (RFSR).

The RFSR was made available for comment to I&APs on the ILISO website (www.iliso.com), the Witbank Library and the Duvha Power Station Security. The comment period was from the 12th June 2015 to the 13th July 2015. I&APs had thirty (30) days to comment on the RFSR. The RFSR was updated in light of the comments

received from I&APs and was submitted to DEA for approval on the 15th May 2015. Acceptance thereof was received from DEA on the 6th August 2015 **(Appendix C).**

3.4 THE ENVIRONMNENTAL IMPACT ASSESSMENT PHASE

The Environmental Impact Assessment Phase builds on the Scoping Phase. It presents the proposed project in detail, describes the receiving environment, and provides an assessment of key impacts associated with the alternatives identified during the scoping phase. This is informed by specialist studies which were undertaken in accordance to the PoS for the EIA, as presented in **Table 7:**

Table 7: Specialist Studies Undertaken

Specialist Study	Specialist	Company
Fauna, Flora and Wetland Assessment	Mr Emile van der Westhuizen	Scientific Aquatic Services
	Stephen van Staden	
	Mr Hennie de Beer	
	Christopher Hooton	
Soil Impact Assessment and Agricultural Potential	Dr David Garry Paterson	ARC-Institute for Soil, Climate and Water
Social Impact Assessment	Mrs Nanja Churr	Kayamandi Development Services
Heritage Impact Assessment	Dr Johnny van Schalkwyk	Independent Consultant

This Final Environmental Impact Assessment report (DEIAr) aims to provide sufficient information on whether or not the potential environmental impacts associated with the project are acceptable from a biophysical, socio-economic and cultural perspective. This information together with the key issues arising from the PPP will provide a basis for informed decision making by DEA.

3.5 PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) allows for I&APs to identify their issues and concerns relating to the proposed activity, which they feel should be addressed in the EIA process. The PPP undertaken in the various stages of this EIA process thus far is detailed in the sections that follow.

3.5.1 Announcement Phase of the EIA

Database

A database of I&APs was compiled and is continually updated as new I&APs are identified throughout the EIA Process. Currently sixty (60) I&APs comprising of National Government, Provincial Government, Local Government,

Business/Commerce, industry, Local and surrounding landowners and Councillors have been registered on the database.

Advertisement

Notice of the application was advertised in a local newspaper, the Witbank Nuus on the 9th of January 2015. The content of the advertisement is included in **Appendix B.**

Notification Letter for announcement Phase and Background Information Document

A notification letter informing regsitered I&APs of the EIA application and a Background Information Document (BID) providing a brief background on the project and contact details in order for I&APs to request further information and/or to register as a stakeholder was sent via email and sms on the 14th January 2015 **(Appendix B).**

On site Notice

An on-site notice, providing a brief background on the project and contact details in order for I&APs to request further information and/or to register as a stakeholder was posted on the 16th January 2015 at the Duvha Power Station security gate **(Figure 6) (Appendix B).** An additional Notice was erected at the Witbank Library: 28 Hofmeyer Street **(Figure 7)**.

Figure 6: On-Site Notice Duvha Power Station

Figure 7: Notice outside the Witbank Library

3.5.2 PPP in the Scoping Phase

The DSR, FSR and RFSR was made available for comment to I&APs as described in **Section 3.2** of this report. The following process was adopted in the Scoping phase to ensure awareness of the proposed project and the EIA process to follow.

Notification Letter

A notification letter informing registered I&APs of the public comment period for DSR and details of the public meeting was sent via email and sms on the 23rd of February 2015. **(Appendix B).** Similarly, a notification letter informing registered I&APs of the public comment period for FSR and RFSR were sent on the 17th April 2015 and 11th June 2015 respectively **(Appendix B).**

Notice

Additional notices were erected at the and at Eskom Village surrounding the Duvha Power Station informing I&APs of the public comment period for the DSR **(Figure 8).**

Figure 8: Additional Notices and BIDS distributed at Eskom Village

Public Meetings

Public meetings were held during the scoping phase to provide stakeholders with background information about the proposed project, and to give them the opportunity to raise issues and/or concerns that should be addressed during the project. The meetings were held on the 23rd March 2015 at the Highveld Protea Hotel in Witbank, Mpumalanga at 10:00 am and 17:00 pm. The meetings were held to allow all I&AP to contribute in the public participation process. The first meeting had good attendance of I&APs with no attendance at the second meeting **(Appendix B).** All comments, are recorded in the Issues and Responses Report (IRR).

Revised Final Scoping Report (RFSR)

The RFSR was made available for comment to registered I&APs as described in Section 3.2 of this report. A letter notifying all registered I&APs of the public comment period was sent via email and SMS **(Appendix B)**. The RFSR was submitted to DEA and accepted on the 6th of August 2015 **(Appendix C).** An email together with the acceptance letter was sent on the 11th August 2015 to registered I&APs.

3.5.3 PPP in the EIA Phase

The Draft Environmental Impact Assessment Report (DEIAr) was made available to I&APs for a 40 day comment period on the ILISO website (www.iliso.com). Hard copies were made available for perusal at the, Duvha Power Station security gate, and the Witbank Library. The comment period was from the 9th October 2015 to the 17th November 2015.

The Final Environmental Impact Assessment Report (FEIAr) was made available to I&AP's for 21 day comment period on the ILISO website (www.iliso.com). Hard copies were made available on request. The comment period was from the 06 January 2016 to 26 January 2016.

Notification Letter

A notification letter informing registered I&APs of the public comment period for the DEIAr and details of the public meeting was sent via email and sms on the 5th October 2015 **(Appendix B).** Similarly a notification letter informing the registered I&AP's of the public comment period for the FEIAr was sent via email on the 06th January 2016 **(Appendix B).**

Advertisement

Notice for the DEIAr comment period was advertised in a local newspaper, the Witbank Nuus on the 2nd October 2015 **Appendix B**.

Public Meeting

A Public meetings was held during the EIA phase to provide stakeholders with progress of the EIA process and present the findings of the specialist studies and recommendations of the EAP.

The meeting was held on the 28th October 2015 at the Buthanani Home Based Care Stand No A8; Masakhane Village, Witbank Mpumalanga at 14:00pm. The minutes of this meeting are included in **Appendix B**.

3.5.4 Issues and Responses Report (IRR)

All issues and comments raised by I&APs during the various phases of the EIA process to date have been captured in an Issues and Responses Report (IRR). The IRR summarises the issues and comments raised and provides the project teams response.

3.5.5 Authority consultation

As described in section 3.1 of this report the DEA accepted receipt of the application for the proposed project and accepted the RFSR on the 6th August 2015. Refer to **Appendix C** for CA requirements with respects to the PoS for the EIA. The other authorities who have a commenting role are captured in the Project Data Base and IRR **(Appendix B).**

3.6 PROJECT TEAM

3.6.1 Details and Expertise of the Environmental Assessment Practitioner (EAP)

Ms Terry Calmeyer is a Director of ILISO Consulting Environmental Management (Pty) Ltd and a certified Environmental Assessment Practitioner (EAP). She has a Master's degree in Environmental Management and over 20 years' experience. She specialises in Environmental Impact Assessments, the environmental components of project implementation and Project Management. Terry serves on the International Association of Impact Assessment (IAIA) Council, is the past President of the South African Affiliation of the International Association of Impact Assessment (IAIAsa) and an active member of the South African Committee on Large Dams (SANCOLD), the Environmental Law Association and the International Association for Public Participation. She has been involved in a variety of EIAs including those for transmission lines, water supply projects, dams, roads, railways, waste water treatment works and airports, in South Africa, Uganda, Lesotho, Botswana, Namibia and Mozambique.

3.6.2 Details of the Project Team

In addition to the EAP, the ILISO Consulting (Pty) Ltd project team includes the following individuals: Mr Deon Esterhuizen (Project Director), Sandhisha Jay Narain (Assistant EAP), Joseph Masilela, Ruan Schoeman (Public Participation Process administrators), and Ndomupei Dhemba (GIS specialist). A summary of the project team, their roles is provided in **Table 8.** Curricula Vitae of the project team and specialist are included in **Appendix A.**

Table 8: Summary of the ILISO Project Team and their Roles

Role	Project Team Member	Company
Project Director/Leader	Deon Esterhuizen	ILISO Consulting (Pty) Ltd
Project Manager/EAP	Ms Terry Calmeyer	ILISO Consulting (Pty) Ltd
Public Participation Process Manager	Ms Terry Calmeyer	ILISO Consulting (Pty) Ltd
Assistant EAP	Ms Sandhisha Jay Narain	ILISO Consulting (Pty) Ltd
GIS	Ms Ndomupei Dhemba	ILISO Consulting (Pty) Ltd
Public Participation Process Administrators	Mr Joseph Masilela Mr Ruan Schoeman	ILISO Consulting (Pty) Ltd

A short description of the key qualifications and capabilities of the ILISO team members and Specialists are presented below.

Mr Deon Esterhuizen has a Masters degree in Environmental Management with more than 20 years of experience in water and environment related projects, which include water resource management, water quality management, water use registration and licensing of water users, including project management of multi-disciplinary studies. He has extensive experience in a wide-range of environmentally related projects, processes and applications for private, commercial and industrial clients, in addition to local, provincial and national government departments. Deon has been involved with various projects for Eskom such as the Waste Management Application Licence for Ingula and Kusile. He has also been responsible for obtaining various Environmental Authorisations for the Gautrain. He is registered as a professional natural scientist with the South African Council for Natural Scientific Professions (SACNSP).

Ms Sandhisha Jay Narain is an Environmental Consultant with an Honours degree in Environmental Management. She has 6 years on site Environmental Management and Environmental Compliance Auditing and Monitoring experience. Sandhisha has been involved in the implementation of the Environmental Management Plan for the Moses Mabhida Stadium, compliance monitoring of Transnet's New Multi-Purpose Pipeline Project and was project based at the Spring Grove Dam as the Environmental Monitor for the Engineering Consultant. She is also an accredited Green Star SA Professional.

Ms Ndomupei Dhemba has 9 years' experience and a Master's degree in GIS and Remote Sensing for Environmental Management. She has been involved in a number of EIA programmes as a Biodiversity and GIS & Remote Sensing Specialist in Zimbabwe, Botswana, Tanzania and South Africa. Ndomupei also has extensive experience in licencing of water users and the completion of Environmental Impact Assessments in support of the issuing of Environmental Authorisations. She is conversant with ArcGIS, ERDAS, ILWIS, Planet GIS, Google earth Pro, Expert GPS and ENVI.

Mr Joseph Masilela has 8 years' experience in office administration and community liaison work. This includes arranging meetings, facilitating community workshops, meeting with traditional authorities and assisting on all project related work. Joseph assists with secretarial functions for projects including the maintenance of attendance registers and databases for all projects. He also undertakes field work and data input into AutoCAD programmes.

Mr Ruan Christiaan Schoeman has 3 years' experience and an Honours Degree in Geography from the University of Johannesburg. Ruan has gained on site experience as an Eskom Environmental Officer for the Spitskop – Dinaledi 400kV Transmission Power Lines Section G and the Dinaledi Substation. He is experienced in ISO 14001 implementation and compliance monitoring applicable to environmental legislation.

Mr Stephen van Staden has a Masters degree from the University of Johannesburg in Environmental Management. Stephen has experience on over 1 000 environmental assessment projects specifically with aquatic and wetland ecological studies as well as terrestrial ecological assessments and project management. Stephen has a professional career spanning more than 10 years, most of which have been as the owner and managing member of Scientific Aquatic Services. He is registered by the South African River Health Project as an accredited aquatic biomonitoring specialist and is also registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology. Stephen is also a member of the Gauteng Wetland Forum and South African Soil Surveyors Association

Mr Emile van der Westhuizen has 9 years' experience in Ecological Assessments and has a Bachelor of Science (BSc) Botany and Environmental Management degree from UNISA and holds a BSc (Hons) Plant science degree with specialisation in terrestrial plant ecology from the University Of Pretoria (UP). Emile's skills include GIS and Wetland Delineation processes. He has extensive experience in EIA's, BA's, and Water Use Licensing, the development of Rehabilitation Plans, Landscape plans and Visual Assessments. Emile has been involved in various projects throughout Africa (including South Africa, Ghana, the DRC and Mozambique) focusing on terrestrial ecological assessments which involve phytosociological community assessments, RDL faunal and floral species assessments, alien and invasive species control methods and rehabilitation plans.

Mr Hennie de Beer has a National Diploma in Nature Conservation and extensive experience in Ground Hornbill Monitoring and Vegetation Monitoring at the Timbavati Private Nature Reserve. He has assisted members of the Agriculture Research Council doing Vegetation Condition Assessments on +/- 750 sites in the Lowveld area as well as at Gorongoza National Park. Hennie has also done work on eradicating problem aquatic plants in water canals, assisted in water quality monitoring and data analysis. He currently serves as an ecologist, specializing in avifaunal studies.

Mr Christopher Hooton obtained his National Diploma in Nature Conservation and completed his BTech Nature Conservation degree both at Tshwane University of Technology. He has gained 3 years' experience as an ecologist, specialising in faunal studies. Chris worked for the Lowveld Wild Dog Project, based in Savé Valley Conservancy, Zimbabwe where he gained invaluable field experience collaring, tracking and population management of the Wild Dogs, and assisted with a lion and leopard collaring project.

Mrs Nanja Churr has 14 years' experience and Bachelor of Science Degree in Town and Regional Planning (cum laude). She has acquired excellent skills in the field of socio-economic and economic development of rural and urban communities, inclusive of the dynamic impacts associated with socio-economic and economic impact assessments, urban frameworks, economic frameworks, development plans, feasibility studies, urban revitalisation studies, integrated development planning, local

economic development plans, socio-economic research, baseline surveys and needs assessment, rural and community development, policy analysis and formulation, macro-economic analysis, feasibility studies and business plan development. Nanja has also obtained valuable International Training in Canada on Regional Planning and Economic Investment Analysis, theory of economic development, and practice of Economic Development.

Dr David Garry Paterson has more than 30 years' work experience as a soils specialist. Dr Paterson has experience in soil classification and mapping, soil interpretations, soil survey project management environmental assessment, soil survey and land capability course presentation and ground penetrating radar.

Dr J A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 30 years. Based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape, Northern Cape, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. He has curated various exhibitions at different museums and has published more than 60 papers. During this period he has done more than 1 500 impact assessments (archaeological, anthropological and social) for various government departments and developers. Projects include environmental frameworks, roads, pipelines, power lines, dams, mining developments, water purification works, historical landscapes, refuse dumps and urban developments.

4. NEED AND DESIRABILITY

4.1 INTRODUCTION

South Africa is facing considerable shortage in the availability and stability of electricity supply. Having the highest levels of solar radiation in the world, South Africa has considerable solar resource potential for Solar PV power generation. Such renewable energy is recognized internationally as a major contributor in achieving a wide range of environmental, economic and social benefits that can contribute toward steering South Africa toward sustainability and achieving long term global sustainability. Due to concerns such as climate change and the ongoing exploitation of non-renewable resources, there is increasing international pressure on countries to increase their share of renewable energy generation. It is approximated that 1 ton of CO_2 savings will be incurred for every MWh of PV generation, making PV energy an attractive alternative to energy generated from coal (Web 3). This Chapter will demonstrate that the need for renewable energy in South Africa is well documented.

4.2 STRATEGIC CONTEXT FOR THE CONSIDERATION OF NEED AND DESIRABILITY

The Department of Environmental Affairs (DEA) draft guidelines on need and desirability in terms of the EIA Regulations, 2010 (DEA, 2010) explains that, while it is essential that growth in the economy effect national policies and strategies, it is essential that the implementation of these social and economic policies take cognisance of strategic concerns such as climate change, food security as well as the sustainability in supply of natural resources and the status of our ecosystem services.

Consistent with the National Framework for Sustainable Development (NFSD) (DEA, (2010), it is required that spending on economic infrastructure is focused in priority areas with potential for economic development that serves the broader societies needs equitably. What is needed and desired for a specific area is strategically and democratically determined during the formulation of Integrated Development Plans (IDPs), and Spatial Developmental Frameworks (SDFs).

The following sections aim show how the proposed project complements national energy planning, economic development planning and spatial development planning a national and local level.

4.2.1 National level Policy and Planning

The IRP (2011) as described in Chapter 2 and the National Development Plan (NDP) (2011-2030) emphasise the need to develop the electricity generation sector to support the growth of the national economy and reach its developmental objectives. The NDP recognises that the South African economy is “electricity intensive,” consequently the need for increased generation capacity is essential for economic growth and development. The NDP aims to avoid economy crippling situations, such as the energy crises experienced by the country in 2008 and that which is currently being experienced, by developing new power generation capacity. Furthermore, managing

the transition towards a low carbon national economy is identified as one of the nine (9) key national challenges in the NDP.
The following strategic objectives are identified in the National Strategy for Sustainable Development and Action Plan (2011):

- Enhancing systems for integrated planning and implementation;
- Sustaining our ecosystems and using natural resources efficiently;
- Building sustainable communities;
- Responding effectively to climate change; and
- Moving towards a green economy.

The Environmental sector has developed an implementation plan with nine (9) key focus areas, for contributing to the achievement of a national green economy, (DEA 2011), namely:

1. Resource conservation and management;
2. Sustainable waste management practices;
3. Water management;
4. Environmental sustainability;
5. Green buildings and the built environment;
6. Sustainable transport and infrastructure;
7. Clean energy and energy efficiency;
8. Agriculture, food production and forestry; and
9. Sustainable consumption and production.

This project is therefore in line with National objectives in achieving sustainable development as it holds the potential to both create jobs and reduce the reliance on greenhouse emitting sources of energy in favour of greener energy sources,

One of the objectives of the National Energy Act is to promote diversity of supply of energy and its sources. With regards to solar, the act states "*To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies…*".

Investment in renewable energy initiatives, such as the proposed PV Plant is supported by the White Paper on Energy Policy for South Africa (1998) which is supplemented by the White Paper on Renewable Energy (2003) as described in Chapter 3 of this report. Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels.

The key conclusions that are relevant to the renewable energy sector include:

- An accelerated roll-out of renewable energy options should be allowed in order to derive the benefits of localisation in these technologies.

- A Solar PV programme as envisaged in the IRP 2011 should be pursued (including decentralised generation).

4.2.2 National Spatial Development Plan (NSDP)

The National Spatial Development Plan (NSDP) argues that the spatial configuration of our country is not only the product of investment and growth, but also of apartheid spatial planning. The resulting spatial marginalisation from economic opportunities by large segments of the country's population is still a significant feature of South Africa's space economy and needs to be addressed to reduce poverty and inequality, ensuring shared growth.

The NSDP seeks to assist government to achieve the following development objectives and principles for the country:

- To focus fixed investment in areas with development potential. It is argued that these areas present the greatest possibility for both economic growth and poverty alleviation; and
- To ensure that citizens in areas with limited potential are provided with a package of essential public services, focusing on human resource development, labour market intelligence and social grants. It is argued that the prevalence of high poverty in an area does not mean that poverty can be more effectively addressed in that area.

In order to achieve a common platform for deliberation and decision-making around infrastructure investment and development spending decisions, there are two fundamental key components of the NSDP:

1. The defining of the space economy in terms of 'need' and 'development potential'; and
2. Utilising the set of guiding principles by all actors in government when planning, deliberating and budgeting for investment and spending.

This requires a well-coordinated and integrated system of planning in which the plans at a national, provincial and local level mutually inform each other, and in which there is agreement on the priorities for infrastructure investment and development spending. This in turn requires coordination and alignment in and between the spheres of government, notably through the alignment and harmonisation between:

- The national Medium Term Strategic Framework (MTSF);
- The national and provincial Medium Term Expenditure Frameworks (MTEFs);
- The Provincial Growth and Development Strategies (PGDSs);
- The annual budgets of national and provincial government departments, State-owned enterprises and municipalities, and
- Municipal Growth and Development Strategies (GDSs), IDPs and Spatial Development Frameworks (SDFs).

To utilise this prospect requires that intergovernmental district-wide agreements are reached on the needs and development potentials of the district space economy. Once these have been reached, these agreements then provide the base for:

- Preparing and reviewing an IDP in a district; and
- Agreements on the roles and responsibilities regarding infrastructure investment and development spending in the development of the district.

The IDPs and SDFs of the identified Local and District Municipality will be further examined to determine need and desirability of the proposed project on a provincial and local level.

4.3 INTEGRATED DEVELOPMENT PLANS AND SPATIAL DEVELOPMENT FRAMEWORKS

4.3.1 Municipal IDPs

According to the Municipal Systems Act (Act 32 of 2000) (MSA), all municipalities have to undertake an IDP process. The IDP is a legislative requirement thus it has legal status and supersedes all other plans that guide development at local government level.

An IDP is defined as an inclusive and strategic plan that:

- Links, integrates and co-ordinates a municipality's sector specific plans;
- Aligns the resource and capacity of the municipality to the overall development objectives of the municipality;
- Forms the policy framework on which annual budgets rest; and
- Informs and aligns with similar development plans at national and provincial spheres.

The Nkangala District Municipality (NDM) has published an extensive IDP which identifies the need to look toward renewable energy. The IDP (2013/2014) highlights that, "*the Security of coal supply for some existing coal power stations is increasingly under threat and in promoting environmental sustainability, the NDM has realized the need to explore other energy forms, which are renewable, beyond focusing on coal-generated electricity as the main supply of energy."*

Similarly the Emalahleni IDP (2014/15) reveals that there is still heavy reliance on electricity, paraffin and candles as sources of energy with electricity as the most popular source of energy. The IDP further indicates that "*There is very slow or no progress in terms of introducing other sources of energy that are eco – friendly like renewable energies (Solar; Wind Energy). The municipality is pursuing plans to encourage usage of solar energy systems by identifying pilot programmes that will be designed to suit and respond to the energy needs."*

Even though the proposed project will be used for Eskom's own consumption at Duvha Power Station it will allow Eskom to increase its electricity export to the grid. In doing so, this will enable Eskom to support the demand side management energy efficiency programme.

4.3.2 Spatial Development Framework

In terms of Section 26(e) of the MSA (Act 32 of 2000), every municipality is required to formulate a SDF as a part of its IDP. A SDF is a plan that seeks to guide overall spatial distribution of current and future desirable land uses within a municipality, in order to give physical effect to the vision, goals and objectives of the municipal IDP. It highlights priority investment and development areas and serves as a guide to decision-makers and investors. A SDF is thus an integral component of the corresponding IDP, its purpose being to translate the IDP into its spatial implications to provide broad, overall development guidelines. The aim of a SDF is not to control spatial development but rather to act as a framework that gives strategic guidance in respect of the location and nature of anticipated future development in a given municipality. Because land is a scarce resource, it needs to be planned in the most optimum manner.

The draft ELM SDF (2013/14) highlights the following main objectives to be adopted for the future development of the District focusing on the provision of basic needs and sustainable management practices:

- To improve living conditions through the formalisation and upgrading of informal settlements and provision of basic services;
- To enhance biodiversity conservation through environmentally sustainable development.

4.4 NEED AND DESIRABILITY OF PROPOSED SOLAR PV FACILTY

The main aim of the proposed PV Plant at Eskom's Duvha Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint. Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy, as highlighted above, and climate change targets as well as enable Eskom to support the demand side management energy efficiency programme.

Based on the analysis provided, it can be concluded that the proposed PV Plant is in accordance with national energy planning policy with respect to renewable energy which has links to climate change, environmental impact and energy security/flexibility considerations. Moreover the concept of a solar energy project is broadly supported in local economic planning documents. Considered as a whole the IDP and SDF recognise the importance of integrated and diversified development. The concept of a solar energy project is thus broadly supported.

5. ALTERNATIVES

5.1 INTRODUCTION

One of the objectives of an EIA is to avoid and minimise negative impacts wherever possible. The primary tool for avoiding impacts is to consider alternatives. An alternative is a possible course of action, in place of another, that would generally meet the same purpose and need defined by the development proposal but which would avoid or minimize negative impacts or enhance project benefits.

Alternatives must be practical, feasible, relevant, reasonable and viable. They can be in terms of:

- Activity (project) alternatives;
- Location;
- Scheduling (Timing);
- Technology (Process);
- Design;
- Different use of land;
- Demand;
- Inputs; or
- Routing.

It is also a requirement of the Regulations that the “No-go”/“Do nothing” option be comparatively assessed.

As part of the Eskom’s Ilanga PV Project Portfolio, which aims to install 150 MWp at their various power stations, offices and substations, a site screening assessment was undertaken at various Eskom Power Stations in order to better understand the constraints and opportunities of constructing PV facilities to feed Eskom’s auxiliary loads.

The site screening assessment evaluated various Eskom Power Stations based on the following criteria:

- Potential capacity;
- Land availability;
- Environmental constraints; and
- Electrical connection.

Duvha Power Station located on the farm Duvha Kragstasie 337JS in Mpumalanga was selected to construct and operate a PV Plant as part of the Eskom’s Ilanga PV Project Portfolio. Originally ten (10) areas surrounding the Duvha Power Station were identified for possible development **(Figure 9).** During the Screening exercise eight (8) of these were eliminated as either being too small or too close to the coal deposits and wetlands. Details of the remaining two (2) alternatives are considered in this report. These are referred to as Site 1 and Site 9 **(Figure 10).**

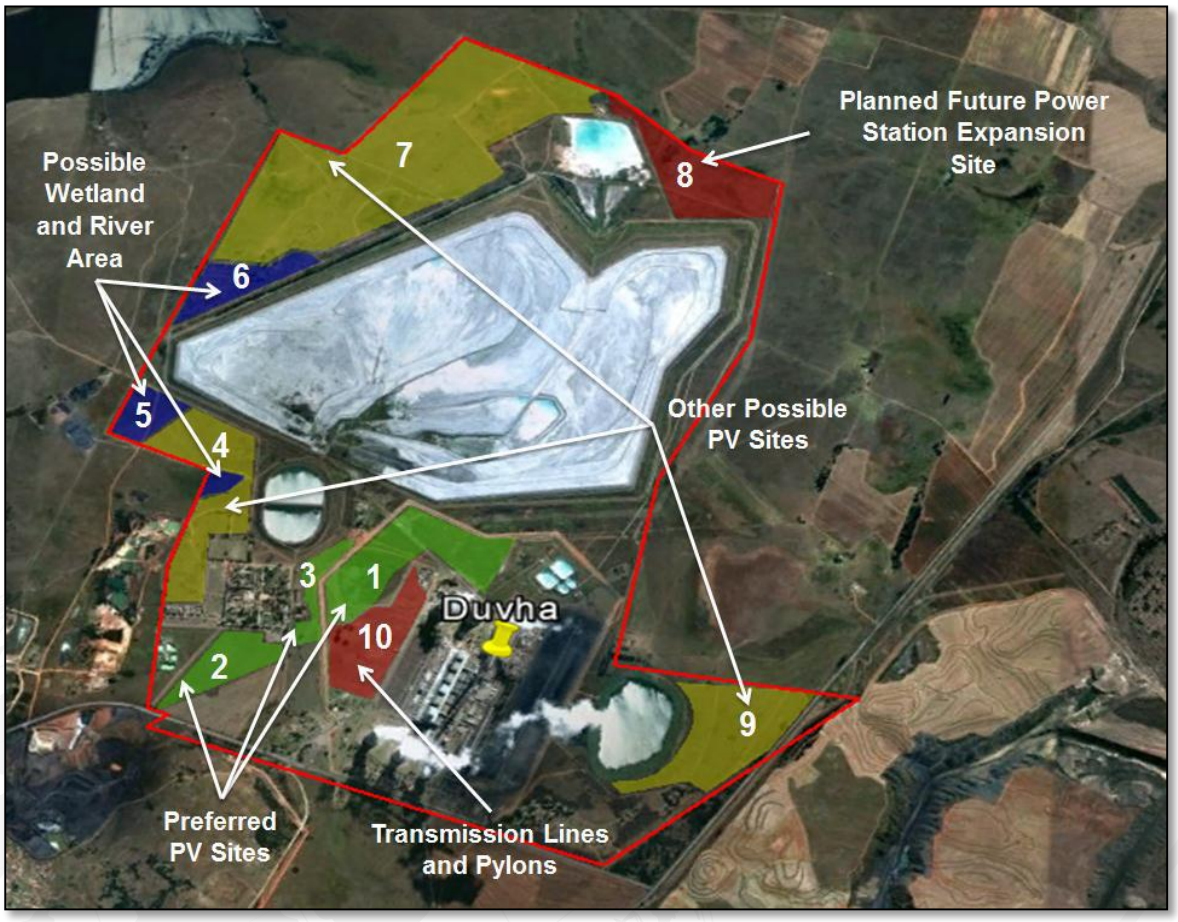

Figure 9: Duvha Power Station Site layout Alternatives (Arup, 2013)

Figure 10: Alternative Sites 1 and 9

5.2 ALTERNATIVE SITE 1

Alternative Site 1 has a footprint of 35.2 ha allowing for a projected power peak (electricity) of 23.5 MWp **(Figure 11)**. It is situated on Eskom owned property within the immediate power station security fence. Power lines and a pipeline run through the middle of the site and will have to be taken into account. The land area around Duvha Power Station is mainly flat with vegetation and serval trees in the area. This site is currently occupied by game stock, the carrying capacity of the site was determined in the fauna specialist study to assess whether the area available for grazing, after the PV plant is developed can still support the game currently located on site this is detailed in **Chapter 6**.

The proposed Solar PV plant utilises two (2) types of PV Panel technology, Polycrystalline (c-Si) technology and Thin Film (TF) technology. There is a suitable electrical point of connection for the PV Plant within the power station at the 11 kV station boards. The approximate distance to the point of connection is 1.5 km. Alternative Site 1 is located within 500 m of a wetland and will require a Water Use Licence (WUL) as highlighted in **Chapter 2** and further detailed in **Chapter 6** of this report.

5.3 ALTERNATIVE SITE 9

Alternative Site 9 has a footprint of 37 ha allowing for a projected power peak of 24.7 MWp **(Figure 12).** The topography is flat and covered with grassy vegetation. There are no power lines or visible infrastructure on this site. The proposed Solar PV plant utilises two (2) types of PV Panel technology, Polycrystalline (c-Si) technology and Thin Film (TF) technology. There is a suitable electrical point of connection for the PV within the power station at the 11 kV station boards. The approximate distance to the point of connection is 2.2 km. Alternative site 9 is located within 32 m of a wetland and will require a WUL as highlighted in **Chapter 2** and further detailed in **Chapter 6** of this report.

5.4 NO-GO ALTERNATIVE

The No Project alternative assumes that the project as proposed does not go ahead. This alternative provides the baseline against which other alternatives are compared and will be considered throughout the report. The implications of the “no project” alternative are:

- The land use remains;
- There is no development of solar energy facilities at this location;
- There is no change in the landscape;
- There is no renewable energy generation;
- CO_2 emissions are not reduced;
- There is no opportunity for indirect and direct (albeit temporary) job creation in the Steve Tshwete Local Municipality where approximately 20% of the local population is unemployed (Stats SA, Census 2011).

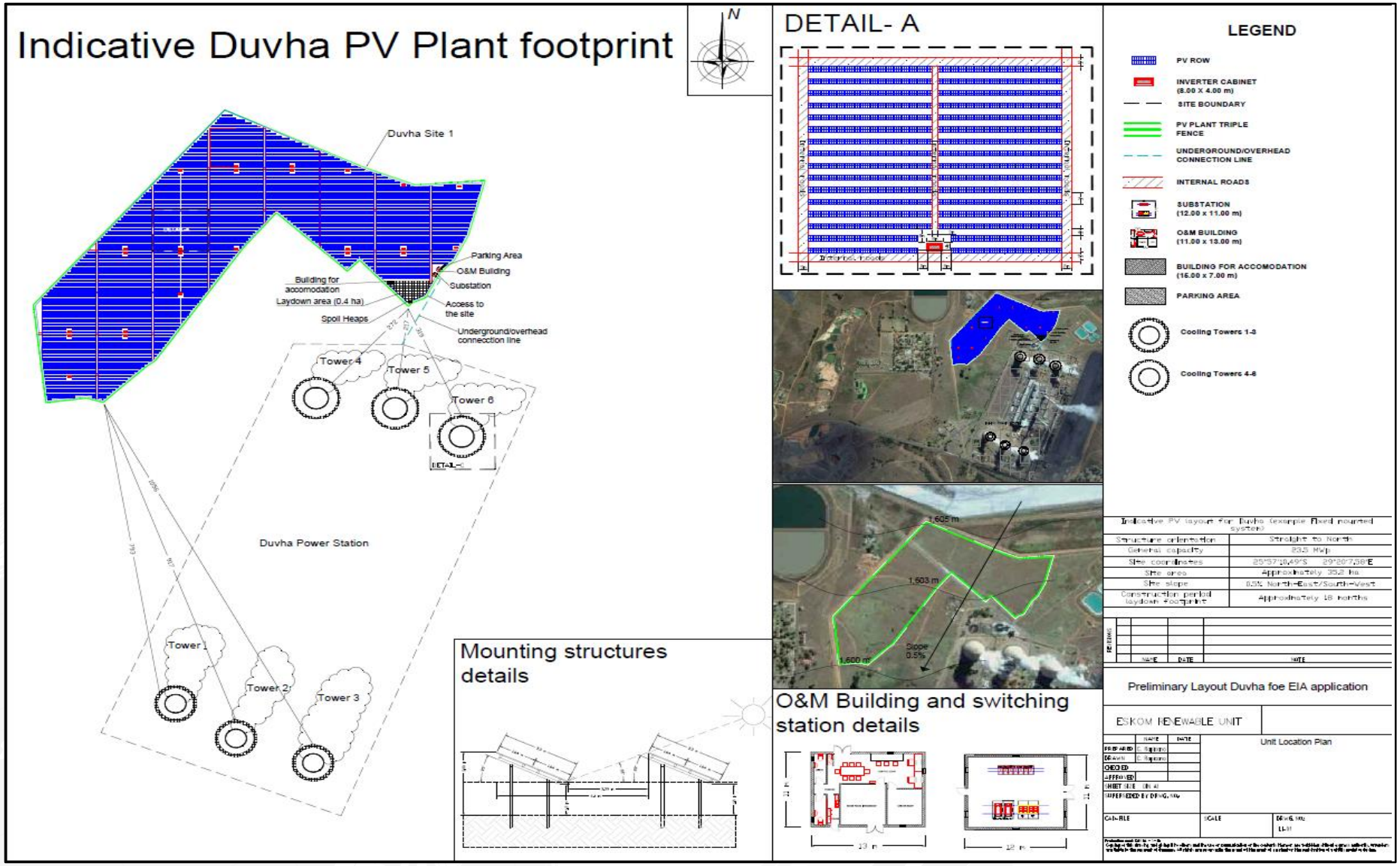

Figure 11: Alternative Site 1

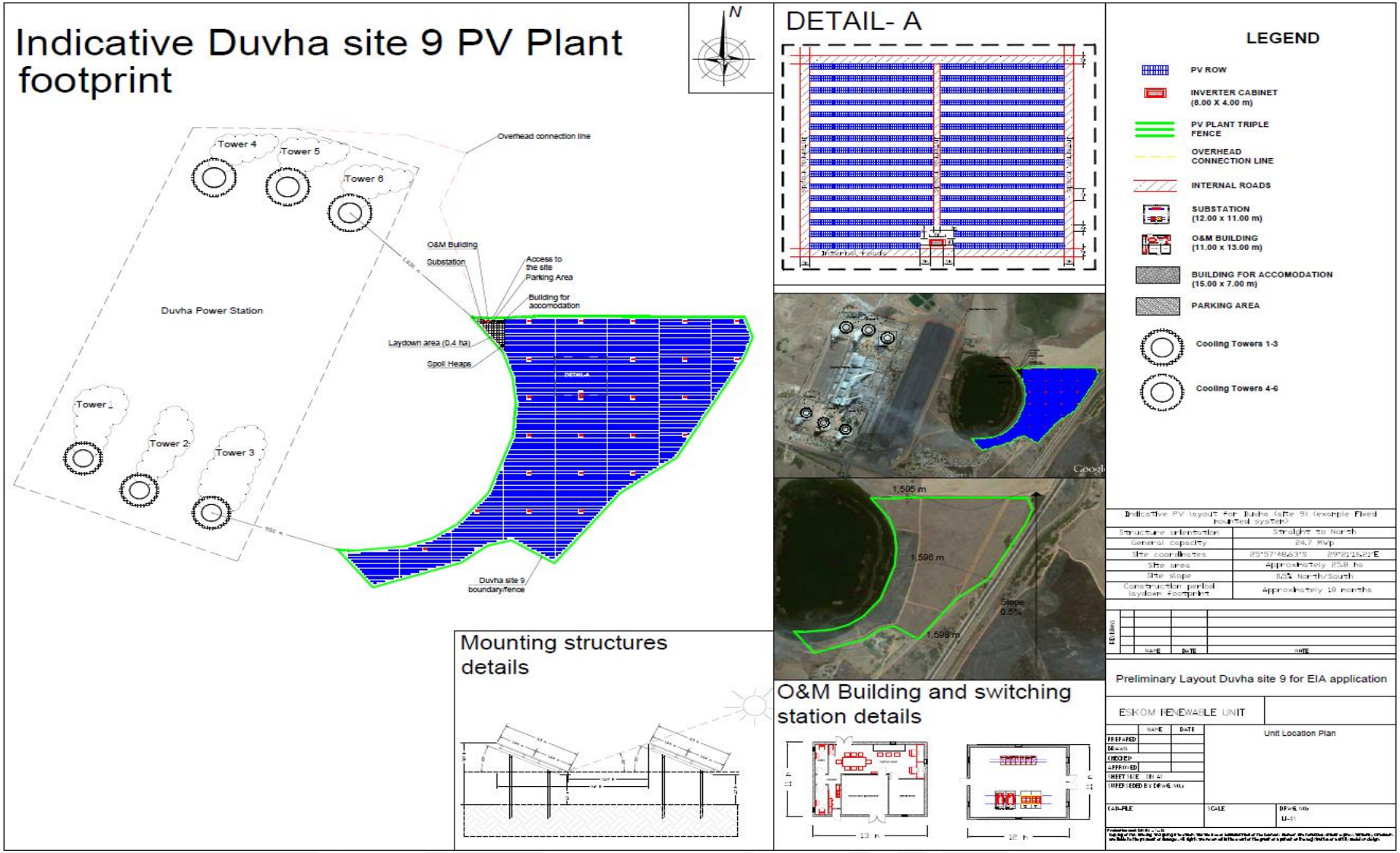

Figure 12: Alternative Site 9

6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 INTRODUCTION

This Chapter provides a description of the biophysical, socio-economic and cultural/historical environment of both Alternative 1 and 9, collectively described as the study area.

6.2 CLIMATE

South Africa experiences some of the highest levels of solar radiation in the world. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m^2 (DoE, Web 2). **Figure 13** shows the annual solar radiation for South Africa, which reveals considerable solar resource potential for solar PV power generation.

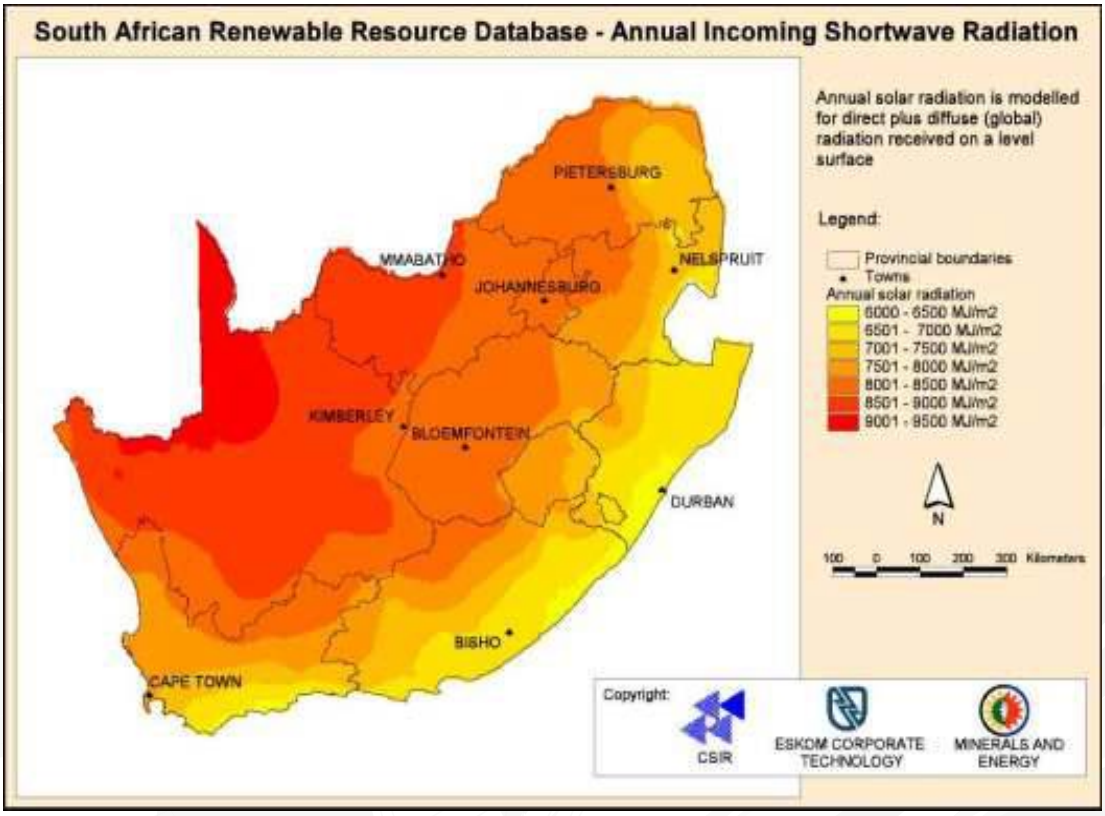

Figure 13: Annual direct and diffuse solar radiation (DoE, Web 2)

The study area displays warm summers and cold winters typical of the Highveld climate. The average maximum summer and winter daytime temperatures are 25 ^{0}C and 20 ^{0}C, respectively. Rainfall occurs mainly as thunderstorms and drought conditions occur in approximately 12 % of all years. The Environmental Potential Atlas for Mpumalanga places rainfall at site as ranging between 621 mm and 750 mm per year. The prevailing wind direction is north-west during the summer and east during winter. Winds are usually light to moderate.

6.3 GEOLOGY AND SOILS

The study area is underlain by geology consisting of sandstone of the Vryheid Formationthe Ecca Group of the Karoo Supergroup contains bands of coal within the sedimentary layers **(Figure 14).**

The soils are classified according to MacVicar et al (1977). The study area is covered by two (2) land types, namely Ba4, which can be described as red, highly weathered, structure-less plinthic soils, and Fa8, which can be described as mainly shallow soils with no lime and some rock.

The landscape represented by land type Ba4 is dominated by soils with high (occasionally moderate) agricultural potential, with very few low potential soils, However, the area covered by land type Fa8 is predominantly low potential, generally due to shallow soil depth and occasional rockiness.

6.4 FLORA

6.4.1 Biomes and Bioregion

The study area falls within the Grassland and Azonal Vegetation biomes and the Mesic Highveld Grassland Bioregion and Freshwater Wetlands Bioregions **(Figure 15).** While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area.

6.4.2 Vegetation type

Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the study area was in a pristine condition, which can then be compared to the observed floral list and so give an accurate and timely description of the ecological integrity of the assessment site. The study area falls within the Rand Highveld Grassland, Eastern Temperate Freshwater Wetlands and the Eastern Highveld Grassland vegetation types (Mucina and Rutherford, 2006). The characteristics of these vegetation types are discussed further.

Rand Highveld Grassland

Rand Highveld Grassland occurs in Gauteng, North-West, Free State and Mpumalanga Provinces. In areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as west of Krugersdorp centred in the vicinity of Derby and Potchefstroom, extending southwards and northwards from there. Altitude 1 300-1 635 m, but reaches 1 760 m in places (Mucina & Rutherford, 2006). The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrub land on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with *Protea caffra* subsp. *caffra, Protea welwitschii*, *Acacia caffra* and *Celtis africana*, accompanies by a rick suite of shrubs among which the genus *Sersia* (*S. magalismonata*) is most prominent.

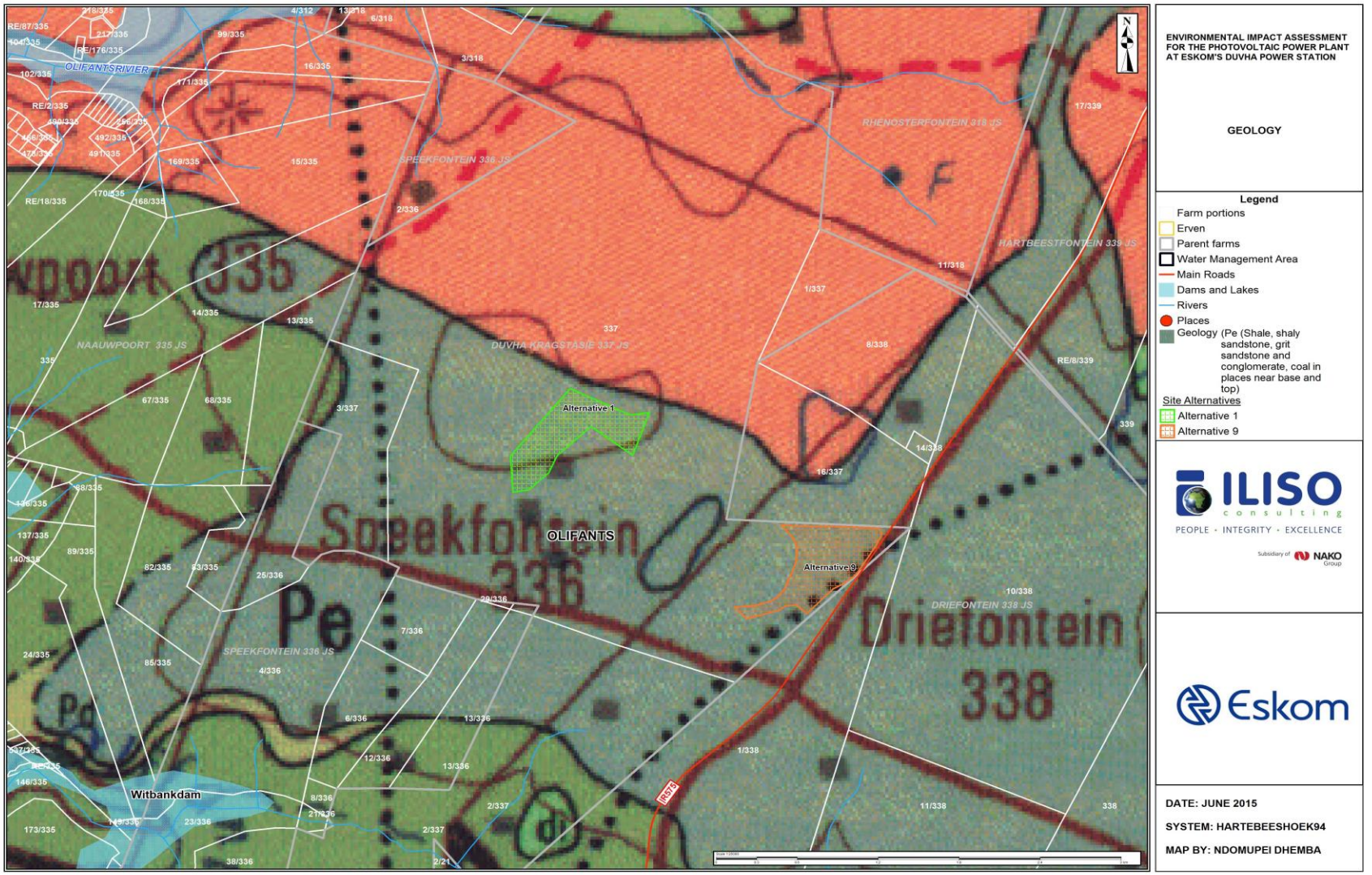

Figure 14: Geology

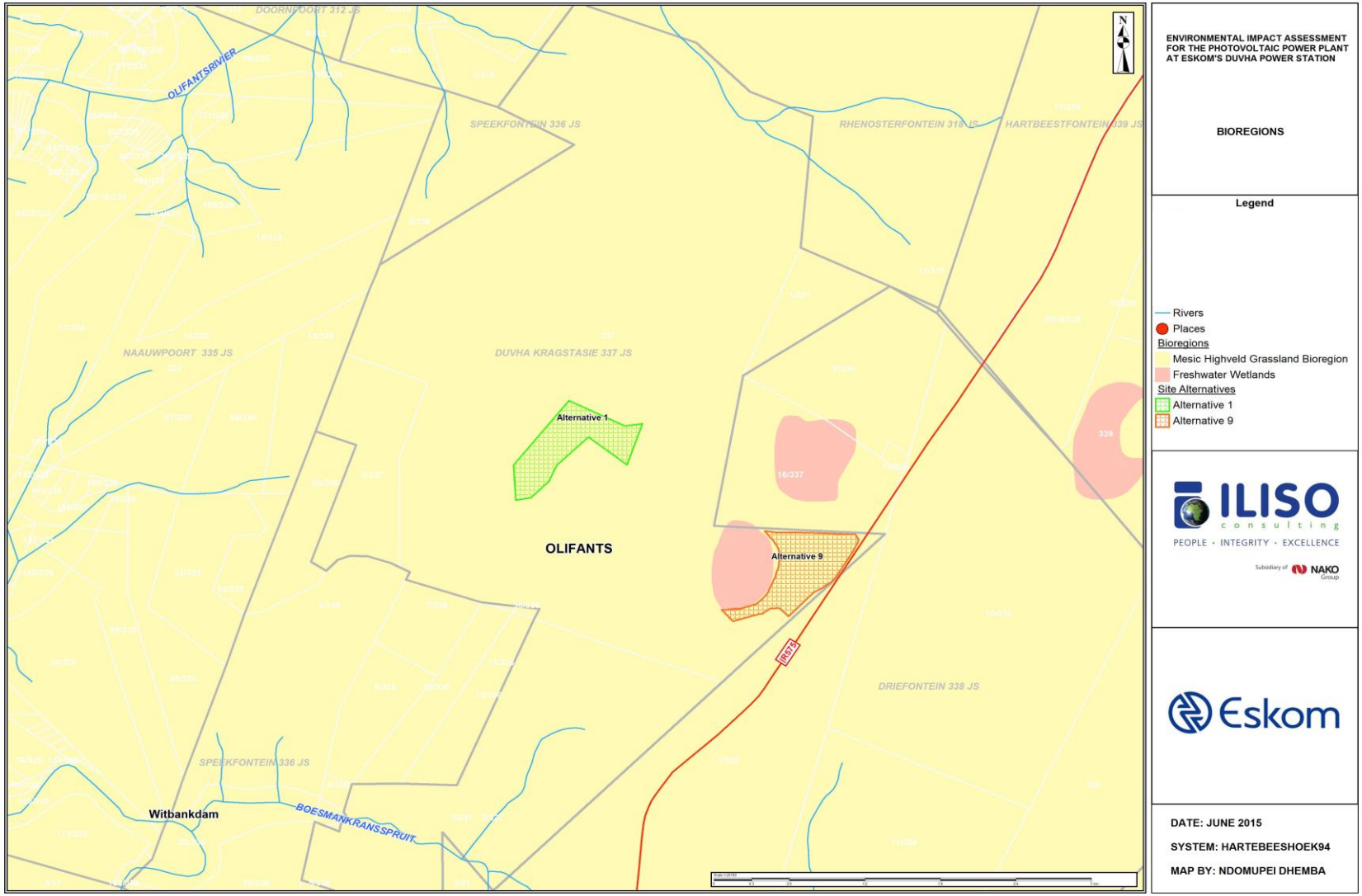

Figure 15: Bioregion

Eastern Highveld Grassland

Eastern Highveld Grassland occurs in the Mpumalanga and Gauteng Provinces: It occurs in the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. Altitude ranges from 1520 m to 1780 m, but also declines as low as 1300 m (Mucina & Rutherford, 2006). The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrub land on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with *Protea caffra* subsp. *caffra, Protea welwitschii*, *Acacia caffra* and *Celtis africana*, accompanies by a rick suite of shrubs among which the genus *Sersia* (*S. magalismonata*) is most prominent.

Eastern Temperate Freshwater Wetlands

The Eastern Temperate Freshwater Wetlands vegetation type occurs within the Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces as well as in neighbouring Lesotho and Swaziland, within areas around stagnant water with stagnant water (lakes, pans, periodically flooded vleis, edges of calmly flowing rivers) and embedded within the Grassland Biome. The altitude ranges from 750 m to 2 000 m (Mucina & Rutherford, 2006).

Taxa of Eastern Temperate Freshwater Wetlands are composed of the following:

- Megagraminoid: *Cyperus congestus* (d), *Phragmites australis* (d), *Schoenoplectus corymbosus* (d), *Typha capensis* (d), *Cyperus immensus;*
- Graminoids: *Agrostis lachnantha* (d), *Carex acutiformis* (d), *Eleocharis palustris* (d), *Eragrostis plana* (d), *E. planiculmis* (d), *Fuirena pubescens* (d), *Helictotrichon turgidulum* (d), *Hemarthria altissima* (d), *Imperata cylindrica* (d), *Leersia hexandra* (d), *Paspalum dilatatum* (d), *P. urvillei (*d), *Pennisetum thunbergii* (d), *Shoenoplectus decipiens* (d), *Scleria dieterlenii* (d), *Setaria sphacelata* (d), *Andropogon appendiculatus, A. eucomus, Aristida aequiglumis, Ascolepis capensis, Carex astro-australis, C. cernua, C. schlechteri, Cyperus cyperoides, C. distans, C. longus, C. marginatus, Echinochloa holubii, Eragrostis micrantha, Ficinia acuminata, Fimbristylis complanata, F. ferruginea, Hyparrhenia dregenana, H. quarrei, Ischaemum fasciculatum, Kyllinga erecta, Panicum schinzii, Pennisetum sphacelatum, Pycreus macranthus, P. nitidus, Setaria pallide-fusca, Xyris gerrardii;*
- Herbs: *Centella asiatica* (d), *Ranunculus multifidus* (d), *Berkeya radula, B. speciosa, Berula erecta subsp, thunbergii, Centella coriacea, Chironia palusris, Equisetum ramosissimum, Falckia oblonga, Haplocarpa lyratam, Helichrysum*

difficile, H. dregeanum, H. mundtii, Hydrocotyle sibthorpioides, H. verticillata, Lindernia conferta, Lobelia angolensis, L. flaccida, Marsilea farinosa subsp. *farinosa, Mentha aquatica, Monopsis decipiens, Pulicaria scabra, Pycnostachys reticulata, Rorippa fluviatilis* var *fluviatilis, Rumex lanceolata, Senecio inornatus, S. microglossus, Sium repandum, Tehlypteris confluens, Wahlenburgia banksiana;*

- Geophytic herbs: *Cordylogyne globosa, Crinum bulbispermum, Gladiolus papilio, Kniphoia ensifolia, K. fluviatilis, K. linearifolia, Neobolusia tysonii, Satyrium hallackii* subsp. *Hallackii;*
- Aquatic herbs: *Aponogeton junceus, Ceratophyllum demersum, Lagarosiphon major, L. muscoides, Marsilea capensis, Myriophyllum spicatum, Nymphaea lotus, N. nouchali var caerulea, Nymphoides thunbergiana, Potamogeton thunbergii;*
- Carnivorous herb: *Utriculata inflexa;*
- Biogeographically important taxon: *Rorippa fluviatilis* var *caldonica*

6.4.3 Habitat Units

Two main habitat units were identified during the assessment, which are defined below:

- Habitat considered to be transformed due to agricultural activities and alien/weed encroachment; and
- Wetland habitat.

The following sections describe the habitat units in more detail.

Transformed Habitat

The transformed habitat unit comprises areas where historical agricultural activities have occurred and where vegetation has been cleared/mowed as part of maintenance activities around the power station. Additional vegetation transformation has also taken place due to the establishment of alien and invasive floral communities, and overgrazing **(Figure 16)**. This habitat unit covers the majority of the study area and has been transformed by edge effects associated with historic agricultural activities, alien floral invasion and edge effects from roads and power station infrastructure, vegetation clearing and woody encroachment by Seriphium plumosum. This has led to the alteration of the floral community structure and the establishment of a sub-climax grass community. Ecological functioning, although not completely absent, was found to be low in most areas. Dominant grass species included *Hyparrhenia hirta, Eragrostis curvula and E. chloromelas*. These species are associated with transformation and usually grow in disturbed places such as old cultivated lands and along roadsides. Additionally, these areas have a significant

build-up of moribund material due to the natural burning regime being altered, which significantly reduces forb diversity **(Table 9).**

The likelihood of floral SCC occurring within this habitat unit is considered to be low, and none were encountered. Furthermore, the ecological functionality and habitat integrity of the transformed habitat unit is regarded as being moderate to low, and development within this habitat unit is supported. However, edge effects from any activities occurring in this habitat unit must be effectively mitigated in order to prevent adverse impacts on the surrounding wetland habitat unit.

Figure 16: Transformed habitat unit around Alternative 1.

Table 9: Dominant species encountered in the transformed habitat unit. Alien species are indicated with an asterisk (*).

Grass/sedge/reed species	Forb species	Tree/Shrub Species
Aristida bipartata	*Acalypha angustata*	*Seriphium plumosum*
Aristida congesta subsp. barbicollis	**Tagetes minuta*	**Acacia mearnsii*
Aristida congesta subsp. congesta	*Berkheya radula*	
Cynodon dactylon	**Bidens pilosa*	
Digitaria tricholaenoides	**Bidens formosa*	
Eragrostis curvula	**Plantago lanceolata*	
Eragrostis chloromelas	*Pelargonium luridum*	
Hyparrhenia hirta	*Helichrysum kraussii*	
Themeda triandra	*Monopsis decipiens*	
Tristachya leucothrix	*Senecio coronatus*	
Pogonarthria squarrosa	*Hypoxis angustifolia*	

Grass/sedge/reed species	Forb species	Tree/Shrub Species
Imperata cylindrica	*Hypoxis acuminata*	
	**Taraxacum officinale*	
	Ledebouria cooperii	
	Ledebouria ovatifolia	

Wetland habitat

One wetland feature was identified within the footprint of Alternative Site 9, namely a depression wetland. Adjacent to Alternative 1 an artificial wetland was encountered which has formed as a result of altered topography associated with the construction of the Duvha Power Station, which has led to localised ponding and the establishment of facultative and obligate wetland floral species **(Figure 17).** This feature was not considered to be a natural wetland as defined in the DWAF, 2005: "A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". However, it was still assessed as it provides habitat for faunal and floral species within the Duvha Power Station footprint.

All of the features have been affected to varying degrees by edge effects from the power station, road construction, historic agriculture and general anthropogenic activities, which has negatively affected the habitat integrity of these systems.

Dominant floral species within the wetlands include *Typha capensis, Juncus effusus, Cyperus rupestris, Leersia hexandra, Imperata cylindrica, Eragrostis plana, Schoenoplectus paludicola, Hyparrhenia tamba* and *Persicaria lapathifolia* **(Table 10)**. The depression wetland is considered to be in a largely natural state, with limited change in ecosystem processes and loss of natural habitats having taken place and the natural habitat remains predominantly intact. The artificial wetland is considered to be extensively modified, however since it provides niche habitat for faunal and floral species within the Duvha Power Station footprint, it is considered to be of importance from an ecological perspective in relation to the surrounding terrestrial areas.

Thus, where any activities or edge effects associated with the proposed project or infrastructure are likely to affect wetlands, it must be ensured that the disturbance footprint is minimised and that the duration of disturbance is limited.

Figure 17: Typical view of the wetland habitat unit with the depression Alternative site 9 (top) and artificial wetland (bottom)

Table 10: Dominant species encountered in the wetland habitat unit, alien species are marked with an asterisk (*)

Terrestrial zone	Temporary / Seasonal Zone	Permanent Zone
Hyparrhenia hirta	**Verbena bonariensis*	*Mariscus congestus*
Eragrostis curvula	*Sporobolus africanus*	*Imperata cylindrica*
Eragrostis chloromelas	*Juncus effusus*	*Kylinga alba*
Harpochloa falx	*Schoenoplectus corymbosus*	*Cyperus rupestris*
**Asclepias fruticosa*	*Imperata cylindrica*	*Typha capensis*
Cymbopogon plurinodis	*Helichrysum* species	*Juncus effusus*
**Cosmos bipinnata*	*Habenaria nyikana*	*Schoenoplectus corymbosus*
**Conyza bonariensis*	*Eragrostis plana*	*Phragmites australis*
Eragrostis plana		*Leersia hexandra*

6.4.4 Vegetation Index Score

The information gathered during the assessment of the study area was used to determine the Vegetation Index Score (VIS). Due to variation between the different habitat units within each alternative site, all habitat units were assessed separately. The table below lists the results of each habitat unit. **Table 11 and Table 12** lists the results of each habitat unit.

Table 11: Scoring for the Vegetation Index Score

VIS	Assessment Class	Description
22 to 25	**A**	Unmodified, natural
18 to 22	**B**	Largely natural with few modifications.
14 to 18	**C**	Moderately modified
10 to 14	**D**	Largely modified
5 to 10	**E**	The extensive loss of natural habitat
<5	**F**	Modified completely

Table 12: Vegetation Index Score for each habitat unit assessed

Habitat unit	Score	Class	Motivation
Transformed habitat	13	**D – Largely modified**	Transformation has occurred within this habitat unit to the degree that secondary grassland conditions prevail and alien and invader species abundance is high. Therefore, this habitat unit is classified as largely modified.
Wetland habitat	15	**C – Moderately modified**	Transformation of the wetland systems include hydrological changes, vegetation transformation and sedimentation. The wetland systems have an important ecological function in terms of habitat provision for faunal and floral species.

6.4.5 Floral Species of Conservational Concern (SCC) Assessments

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species, was undertaken. The complete PRECIS (Pretoria Computer Information Systems) red data plant list for the grid references (*2529CD*) was acquired from South African National Biodiversity Institute (SANBI) **(Table 13).**

Table 13: PRECIS plant list for the QDS 2529CD

Species	Threat status	Growth forms
Crinum bulbispermum	Declining	Geophyte, hydrophyte
Crinum macowanii	Declining	Geophyte
Pachycarpus suaveolens	Vulnerable	Herb, succulent
Ilex mitis var. mitis	Declining	Shrub, tree
Callilepis leptophylla.	Declining	Herb
Hypoxis hemerocallidea	Declining	Geophyte
Khadia carolinensis	Vulnerable	Succulent
Pavetta zeyheri subsp. middelburgensis	Rare	Dwarf shrub
Encephalartos lanatus	Near threatened	Shrub, tree

Hypoxis hemerocallidea and the two *Crinum* species are the most likely Red Data Lists (RDL) of floral species to occur in the study area, especially around the wetland depression associated with Alternative Site 9. Due to the severe vegetation transformation associated with Alternative Site 1, it is unlikely that these species will occur within this footprint.

6.4.6 Alien and Invasive Floral Species

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). The study area exhibits a moderate to high diversity of alien species, especially within the transformed areas. A list of alien species is presented in **Table 14.** Alien species located in the study area need to be removed on a regular basis as part of maintenance activities according to the National Environmental Management Biodiversity Act 2004 (Act No.10 of 2004) Alien and Invasive Species Regulations, 2014. The various category of weeds must be controlled as follows:

- Category 1 – Declared weeds. Prohibited plants, which must be controlled or eradicated.
- Category 2 – Declared invader plants with a value. “Invaders” with certain useful qualities (i.e. commercial), only allowed in controlled, demarcated areas.
- Category 3 – Mostly ornamental plants. Alien plants presently growing in, or having escaped from, areas such as gardens, but are proven invaders. No further planting or trade in propagative material is allowed (Bromilow, 2001).

Table 14: Exotic or invasive species found within the study area

Species	English name	Type or Origin	Category*
Tress/ shrubs			
Salix babylonica	Weeping willow	Invader	2
Acacia mearnsii	Black wattle	Native to Australia	2
Eucalyptus camuldulensis	Red river gum	Invader	2
Melia azederach	Syringa	Native to India	3
Forbs			
Bidens pilosa	Common blackjack	Native to S America	NA
Bidens formosa	Cosmos	Native to Central America	NA
Rumex acetosella	Sheep sorrel	Native to Europe	NA
Conyza albida	Tall fleabane	Native to America	NA
Conyza Canadensis	Horseweed fleabane	Native to America	NA
Datura stramonium	Common thornapple	Native to N America	1
Schkuhria pinnata	Dwarf marigold	Native to S America	NA
Tagetes minuta	Tall khakiweed	Native to S America	NA
Verbena bonariensis	Purple top	Native to S America	NA
Trifolium repens	White clover	Native to Europe	NA
Solanum elaeagnifolium	Silverleaf bitter apple	Native to America	1
Solanum sisymbrifolium	Dense thorned bitter apple	Weed	1
Hibiscus trionum	Wild stockrose	Native to Asia	NA
Datura ferox	Large thorn apple	Native to N America	1
Bidens formosa	Cosmos	Native to Central America	NA
Asclepias fruticosa	Shrubby milkweed	Weed	Na
Reeds/Grasses			
Cyperus esculentis	Yellow nut sedge	Unknown origin	
Bromus catharticus	Rescue grass	Native to S. America	

6.4.7 Medicinal Plant Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The medicinal species are all commonly occurring species and are not confined to the study area.

Table 15 presents a list of plant species with traditional medicinal value, (plant parts traditionally used and their main applications), which were identified during the field assessment. All of the medicinal species identified are considered to be common and widespread species and were not confined to any specific habitat unit. Therefore, the proposed development is not likely to have a significant impact on medicinal flora species conservation.

Table 15: Traditional medicinal plants identified during the field assessment.

Species	Name	Plant parts used	Medicinal uses
Gnidia kraussiana	Yellow head	Rootstock and roots	There are many medicinal uses for this highly toxic plant, ranging from the topical treatment of burns and snake bites to enemas for stomach complains and decoctions used to ensure and easy childbirth
Helichrysum nudifolium	Everlasting	Leaves and twigs	Mainly ailments are treated, including coughs, cold, fever, infections, headache and menstrual pains. It is a popular ingredient for wound dressing.
Vernonia oligocephala	Bitterbossie	Leaves and twigs	Abdominal pain and colic. Rheumatism, dysentery, and diabetes.
Asclepias fruticosa	Milkweed	Mainly leaves, sometimes roots.	Snuff is prepared from ground leaves and used for treatment of headaches, tuberculosis and a general emetic to strengthen body.
Datura stramonium	Thornapple	Leaves and rarely the green fruit.	Generally as asthma treatment and pain reduction.
Leonotis microphylla	Wild dagga	Leaves and stems, sometimes roots.	Dried parts smoked for relief of epilepsy. Leaves and roots widely used for a remedy for snake bite and other stings and bites. External decoctions used as a treatment for boils, eczema, skin diseases, itching and muscular cramps. Internal decoctions used for coughs, colds and influenza, bronchitis, high blood pressure and headaches. Leaf infusions have been used for asthma and viral hepatitis.
Plantago lanceolata	Ribwort plantain	Leaves	Anti-inflammatory and expectorant. Used to treat wounds, inflammation of skin and against catarrhs of the respiratory tract and inflammation of mouth and throat.
Conyza canadensis	Horseweed fleabane	Herb	Astringent, diarrhoea, diuretic, colds, insect repellent

6.5 FAUNA

6.5.1 Mammals

No mammal SCC were observed during the site survey. In terms of conservation, the likelihood that any threatened mammal SCC that are listed by Mpumalanga Province could be encountered is deemed low, due to the relatively small surface area and high levels of habitat transformation of the majority of the study area, as well as they proximity to the Duvha Power Station and associated anthropogenic activities. **Table 16** lists the mammal species encountered during the assessment as well as their International Union for Conservational Concern (IUCN) status.

Table 16: Mammal species recorded during the field surveys

Scientific Name	Common Name	IUCN
Damaliscus pygargus phillipsi	Blesbok	LC
Equus quagga	Palins Zebra	LC
Lepus saxatilis	Scrub hare	LC
Cryptomys hottentotus	African Mole Rat	LC
Galerella sanguinea	Slender mongoose	LC

Scientific Name	Common Name	IUCN
Rhabdomys pumilio	Four-striped Grass Mouse	LC

LC = Least Concern

Due to the transformed nature of the majority of the study area, it is unlikely that RDL or sensitive mammal species will utilise the site for habitation or foraging purposes. No Mpumalanga SoER (2003) threatened mammal species were determined to have a greater than 60% Probability of Occurrence (PoC) for the study area.

The presence of both *Damaliscus pygargus phillipsi* (Blesbok) and *Equus quagga* (Palins Zebra) within the Duvha Power Station boundaries is artificial, and is maintained as such. If Alternative Site 1 is selected as the site for the PV Plant, the numbers of both the afore mentioned species needs to be halved, as Alternative 1 comprises a large grazing portion of the property for these species. It is recommended that the genetics of the current populations also be considered, and that whilst removing excess animals, new ones are brought in to enrich the gene pool of the small populations to prevent further inbreeding.

6.5.2 Avifauna

According to Birdlife South Africa (BLSA), the study area does not fall within any Important Bird Areas (IBA), which has been highlighted as important conservation areas within South Africa (Birdlife South Africa, 2014). All avifaunal species seen or heard during the time of the assessment were recorded. Surveys were conducted across the entire study area and in the immediate surroundings. It must be noted that some migratory birds may not have been identified during the site survey period.

The majority of the study area comprises of habitat suitable for grassland and wetland birds. Several bird species were identified, primarily throughout the transformed habitat areas and in and around the wetland areas and pans located in the study area.

Favourable short grass habitat for the *Geronticus calvus* (Southern Bald Ibis), which is considered to be Vulnerable by the IUCN, is created by the high grazing impact of *Equus quagga* (Plains Zebra) and *Damaliscus pygargus phillipsi* (Blesbok). Southern Bald Ibis being present during the site visit indicates how species can adapt to environments that have been rehabilitated and favoured habitat is present.

The avifaunal species found in the study area are all commonly occurring species and are presented in **Table 17** together with their 2015 IUCN status.

Table 17: Avifaunal species recorded during the field surveys

Scientific Name	Common Name	IUCN
Upupa africana	African Hoopoe	*LC*
Threskiornis aethiopicus	African Sacred Ibis	*LC*
Saxicola torquatus	African StoneChat	*LC*
Hirundo rustica	Barn Swallow	*LC*
Elanus caeruleus	Black-shouldered Kite	*LC*

Scientific Name	Common Name	IUCN
Lamprotornis nitens	Cape Glossy Starling	*LC*
Passer melanurus	Cape Sparrow	*LC*
Streptopelia capicola	Cape Turtle Dove	*LC*
Motacilla capensis	Cape Wagtail	*LC*
Cisticola textrix	Cloud Cisticola	*LC*
Acridotheres tristis	Common Myna	*LC*
Apus apus	Common Swift	*LC*
Vanellus coronatus	Crowned Lapwing	*LC*
Pycnonotus tricolor	Dark-capped Bulbul	*LC*
Cisticola aridulus	Desert Cisticola	*LC*
Mirafra fasciolata	Eastern clapper Lark	*NYBA*
Cecropis cucullata	Greater Striped Swallow	*LC*
Ardea cinerea	Grey Heron	*LC*
Bostrychia hagedash	Hadeda Ibis	*LC*
Numida meleagris	Helmeted Guineafowl	*LC*
Passer domesticus	House Sparrow	*LC*
Streptopelia senegalensis	Laughing Dove	*LC*
Apus affinis	Little Swift	*LC*
Euplectes progne	Long-tailed Widowbird	*LC*
Cisticola fulvicapilla	Neddicky	*LC*
Columba livia	Rock Dove	*LC*
Geronticus calvus	Southern Bald Ibis	*VU*
Euplectes orix	Southern Red Bishop	*LC*
Prinia subflava	Tawny-flanked Prinia	*LC*
Ploceus cucullatus	Village Weaver	*LC*
Cisticola juncidis	Zitting Cisticola	*LC*

LC = Least concern
NYBA = Not Yet Been Assessed
VU = Vulnerable

In terms of avifaunal SCC, only *Geronticus calvus* (Southern Bald Ibis) was identified during the site survey **(Figure 18)**. There is however a high probability that *Circus ranivorus* (African Marsh Harrier) and *Tyto capensis* (African Grass Owl) may possibly utilise the study area specifically for foraging purposes, especially around the wetland depression associated with Alternative Site 9. The avifaunal SCC found in the study area are presented in **Table 18.**

Table 18: Avifauna SCC with a POC of more than 60%

Common Name	Scientific Name	Mpumalanga RDL status	IUCN Status	POC %
African Grass Owl	*Tyto capensis*	VU	LC	65
African Marsh Harrier	*Circus ranivorus*	VU	LC	63
Southern Bald Ibis	*Geronticus calvus*	VU	VU	100

Figure 18: *Geronticus calvus* (Southern Bald Ibis) encountered during the assessment close to Alternative 1

6.5.3 Amphibian

Only one amphibian species was identified during the assessment periods namely the Natal sand frog *(Tomopterna natalensis).* Other common amphibian species which are known to occur in the surrounding regions include the Plain Grass Frog *(Ptychadena anchietae),* Common Caco *(Cacosternum boettgeri),* Red toad *(Schismaderma carens),* Tremolo sand frog *(Tomopterna cryptotis),* Guttural toad *(Amietophrynus gutturalis),* and the Striped grass frog *(Ptychadena mossambica).* The above mentioned amphibians are not considered to be threatened in the Mpumalanga Province (NW SoER, 2003) and Least Concern by the IUCN.

The only amphibian species listed as being of conservation concern is the Giant Bullfrog *(Pyxicephalus adspersus)* (Appendix 3, MP SoER, 2003). No Giant Bullfrogs were identified on or within the vicinity of the study area. Giant Bullfrogs are known to occur within and nearby riparian and wetland zones, where they remain in cocoons submerged underground during the winter periods, preferably in sandy soils, and only emerge at the start of the rainy season. They breed in shallow waters and can occupy temporary floodplains and rapidly drying pool areas. Giant bullfrogs are also known to travel vast distances and may utilise wetlands as migratory corridors. The only suitable habitat present for this species within the study area is the wetland depression associated with Alternative Site 9.

6.5.4 Reptiles

One non threatened reptile species was identified during the assessment of the study area, namely *Trachylepis punctatissima* (Montane Striped Skink). This species is found in a variety of habitats, wet and dry, from grassland and savanna to shrubland. The above mentioned reptile specie is not a SCC (Appendix 4, MP SoER, 2003) and is classified as Least Concern by the IUCN (2015). Very little suitable reptile habitat

(such as rocky areas) is present in the study area, and the proposed PV Plant is unlikely to affect surface habitat. Thus, the proposed project is unlikely to have a significant impact on reptile conservation within the region.

6.5.5 Invertebrates

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the study area. As such, the invertebrate assessment will not be an indication of the complete invertebrate diversity potential of the proposed development site and surrounding area. No invertebrate SCC were found during the faunal survey. A representation of commonly encountered families in the Insecta class that were observed during the assessment is listed in **Table 19**.

Table 19: Invertebrate species recorded during the site survey.

Order	Family	Scientific Name	Common Name	IUCN 2015
Lepidoptera	Pieridae	*Belenois aurota*	Brown-veined White	NYBA
		Eurema hecabe	Common grass Yellow	NYBA
	Geometridae	*Rhodometra sacraria*	Vestal	NYBA
	Nymphalidae	*Junonia hierta*	Yellow pansy	LC
		Danaus chrysippus	African monarch	NYBA
Isoptera	Termitidae	*Odontotermes latericus*	Harvester Termites	NYBA
Diptera	Calliphoridae	*Musca domestica*	House fly	NYBA
Orthoptera	Acrididae	*Ancanthacris ruficornis*	Garden locust	NYBA
Hymenoptera	Apidae	*Apis mellifera scutellata*	African honey bee	NYBA
	Vespidae	*Belanogaster junceus*	Paper wasp	NYBA
Odonata	Gomphidae	*Ictinogomphus ferox*	Common Tigertail	LC
	Libellulidae	*Trithemus annulata*	Violet Dropwing	NYBA
		Orthetrum julia	Julia Skimmer	LC

LC = Least Concern, NYBA = Not yet been assessed by the IUCN

Metisella meninx, commonly known as the Marsh Sylph (Butterfly) is an invertebrate which is listed as Vulnerable in the MP SoER, 2003 report and is not yet listed on the IUCN listings. The study area falls within the distribution range noted for the M. meninx however, no populations of this species were identified during the site assessments. Its preferred habitat comprises of wetlands where marsh grass (Leersia hexandra) are dominant. The only suitable habitat present for this species within and around the study area is the wetland depression associated with Alternative Site 9.

6.5.6 Arachnids and Scorpions

No threatened spider or scorpion species lists for the Mpumalanga Province are as yet available (MP SoER, 2003). Therefore, a record of threatened spiders and scorpions was acquired from the most recent RDL spider and scorpion data available for South Africa using the SANBI threatened species database (http://www.speciesstatus.sanbi.org).

Trapdoor and Baboon spiders are listed as threatened throughout South Africa (Dippenaar-Schoeman, 2002). All baboon spider species form the genus; Ceratgyrus,

Harpactira and Pterinochilus are protected under the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA) for South Africa. All scorpion species from the genus; Hadogenes, Opisthacanthus and Opistophthalmus are also protected under NEMBA for South Africa.

During the assessment, specific attention was paid to the identification of suitable habitat for spiders and scorpions. After thoroughly searching, no scorpion or spider species were observed within the study area.

As such, it is highly unlikely that the PV Plant will impact negatively upon any spider or scorpion species within the study area.

6.5.7 Faunal Species of Conversational Concern (SCC) Assessment

Although no SCC were observed within the study or surrounding areas, there remains the possibility that some avifaunal SCC may utilise the study area for foraging purposes from time to time. The Species of Conservational Concern Sensitivity Index Score (SCCSIS) assessment of the study areas potential faunal SCC yielded a score of 45%, indicating a medium importance with regards to faunal SCC within the region. All species with a POC of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area. The species listed in **Table 18** are the only species that attained a POC of greater than 60%. These species are likely to occur around the wetland depression associated with Alternative Site 9. Thus, from a faunal SCC conservation perspective, Alternative Site 9 is not supported. However, should Alternative 1 be pursued, the anticipated impact on faunal SCC is likely to be low.

6.6 SURFACE WATER RESOURCES

6.6.1 Ecoregion

The site falls within the B11G quaternary catchment in the Upper Olifants sub-Water Management Area (sub-WMA) of the Olifants Water Management Area (WMA**) (Figure 19)**.

According to the SANBI Wetland Inventory (2006) National Freshwater Ecosystem Priority Areas (NFEPA) (2011), the subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or corridors. In addition it is not considered important in terms of translocation and relocation zones for fish. The subWMA is not listed as a fish Freshwater Ecosystem Priority Area (FEPA). No wetland features were indicated by the NFEPA wetland database layer within the study area, but there are NFEPA wetlands indicated within close proximity of the study area, especially adjacent to Alternative Site 9 **(Figure 20)**.

6.6.2 Wetlands

The wetlands occurring within the study area have been classed into broad Hydrogeomorphic (HGM) units according to the classification system compiled by SANBI (Ollis *et al*., 2013) **(Table 20),** namely:

- Channelled valley bottom wetland; and
- Depression Wetland.

Table 20: Classification system for wetland features identified within the study area.

Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: (HGM) unit
			HGM Type
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Highveld Aquatic Ecoregion:** The study area falls within the Highveld Aquatic Ecoregion **WetVeg**: Mesic Highveld Grassland Group (Endangered) 4	**Valley floor:** The typically gently sloping, lowest surface of a valley	**Channelled valley bottom wetland:** A valley bottom wetland with a river channel running through it.
Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Highveld Aquatic Ecoregion:** The study area falls within the Highveld Aquatic Ecoregion **WetVeg:** Mesic Highveld Grassland Group 4 (Endangered)	**Valley floor:** The typically gently sloping, lowest surface of a valley.	**Depression:** A landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.

All wetland features have been affected by historical agricultural activities and edge effects from the power station and adjacent roads such as storm water runoff, resulting in inundation, augmentation of sediment deposition and vegetation clearing within the wetlands. **Figure 17** presented typical views of the seepage and channelled valley bottom wetlands.

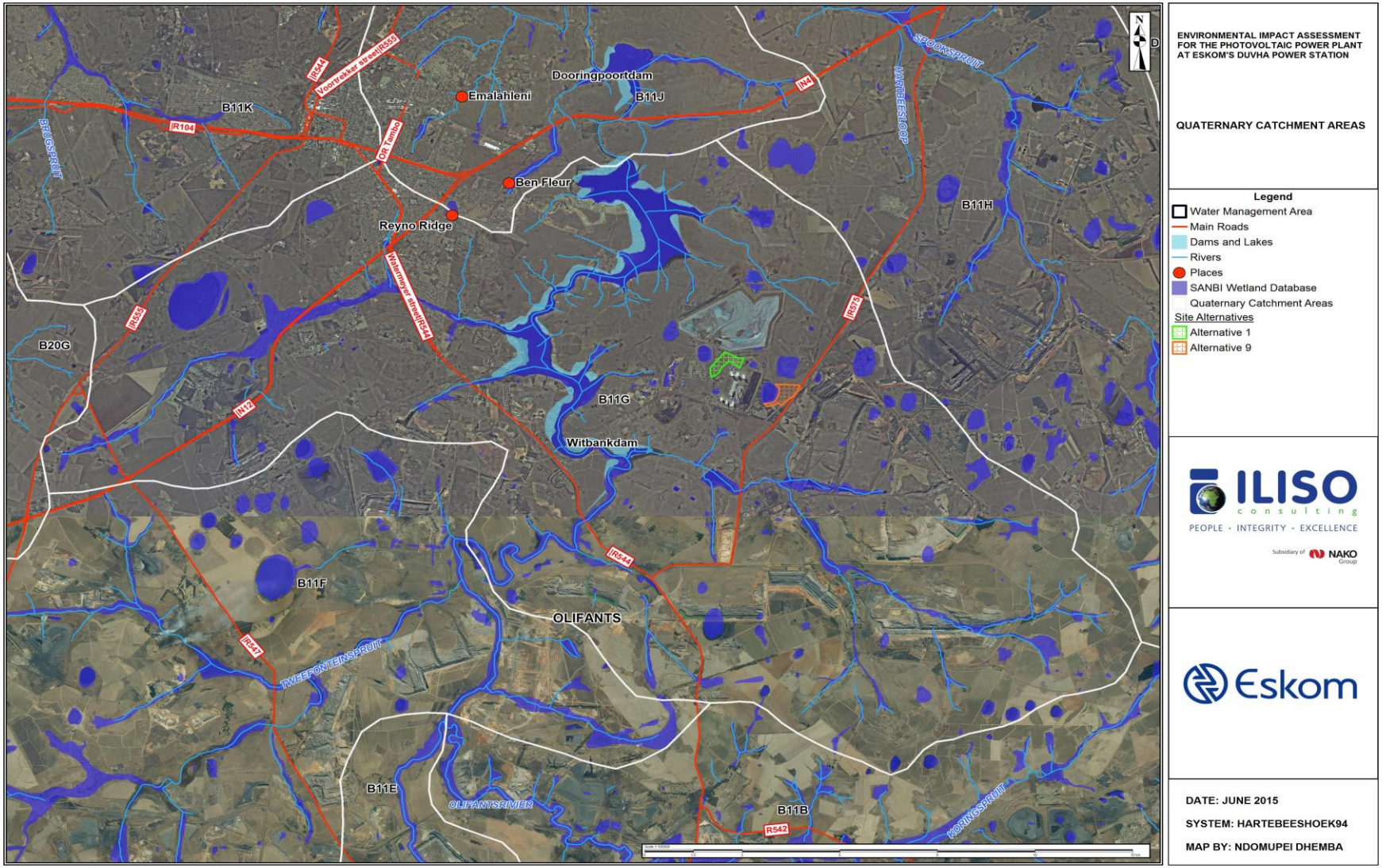

Figure 19: Quaternary Catchment Area

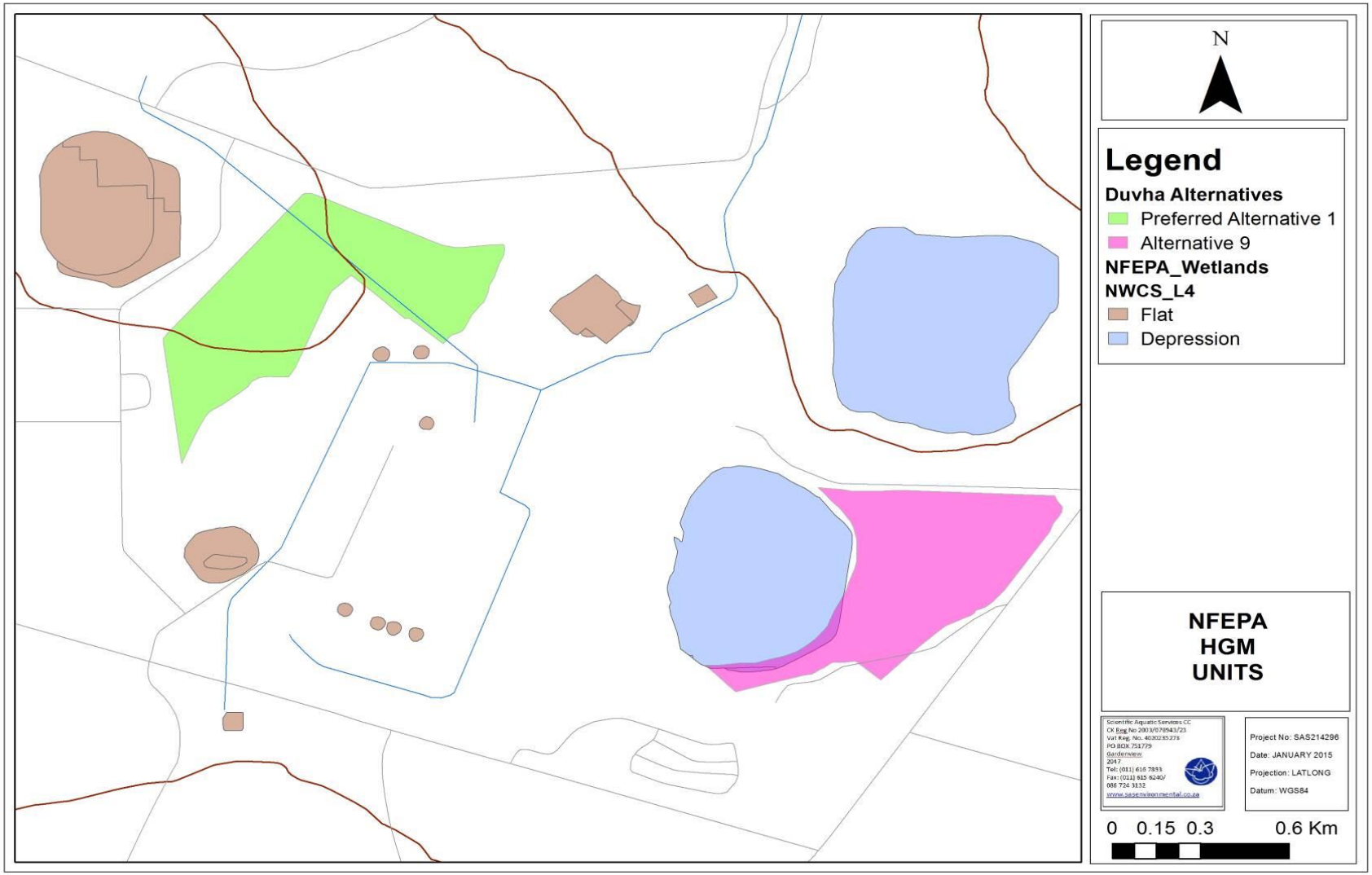

Figure 20: HGM units of the NFEPA wetlands

Wetland function and service provision were assessed for all of the wetland systems. The channelled valley bottom wetland feature obtained a moderately low score in terms of ecological function and service provision, as it is artificial and not fully functional as a true wetland. This wetland feature is the most important in terms of flood attenuation, streamflow regulation and Phosphate, Nitrate and toxicant assimilation as it is situated in an agricultural area. This system also plays an important role in erosion control, carbon storage and biodiversity maintenance.

The depression wetland falls into an intermediate class of service provision. The relatively low score for the depression wetland does not mean that it is unimportant from a service provision perspective. The opportunity for pans to attenuate floods is generally considered to be fairly limited, though some run-off is stored in pans. Some precipitation of minerals and de-nitrification is expected to take place within pans, which contributes to improving water quality. Some of the accumulated salts and nutrients can however be exported out of the system and deposited on the surrounding slopes by wind during dry periods. An important function usually performed by pans is the support of faunal and floral biodiversity which would otherwise not be supported within the study area.

Furthermore, wetlands contribute to the maintenance of biodiversity through the provision of habitat and maintenance of natural processes (Kotze, et. al. 2008). The 'vulnerable' status of the Eastern Highveld Grassland vegetation type, and the 'Critically Endangered' status of n the Mesic Highveld Grassland 4 WetVeg Group, contribute to the higher biodiversity maintenance weighting applied to the wetland system.

Hydrology, geomorphology and vegetation in the wetlands were assessed using wet health assessment. All three components have a present state of Category C (Moderately modified). Erosion and changes in runoff intensity as well as moderately modified vegetation composition contribute to these classifications.

The vegetation assemblage, which has undergone moderate to low levels of transformation as a result of surrounding agricultural activities and alien floral invasion, obtained a score which placed the module in a Category B.

The overall score for the wetland system that aggregates the scores for the three modules, namely hydrology, geomorphology and vegetation, was 2.8, falling within the Present Ecological State (PES) Category D (largely modified). The PES was then used as a benchmark for the identification of an appropriate category for the Recommended Ecological Category (REC).

The score achieved for the Ecological Importance and Sensitivity (EIS) assessment places the depression wetland within Category B (The biodiversity of these wetlands may be sensitive to flow and habitat modifications). The wetland feature is important in terms of wetland functionality and biodiversity maintenance. The channel valley bottom wetland feature falls within Category D (Wetlands that are not ecologically important or sensitive at any scale). This wetland feature did not score a high importance in terms of diversity, habitat and wetland function. However, due to the high score value (critical value) of the wetland vegetation group according to the

NFEPA protection stated, this increased the overall score and value of the EIS of the wetland feature.

The results of the wetland function assessment and IHI assessment, together with the results of the EIS assessment, were used to inform the REC. A Class B (largely natural with few modifications) category for the depression wetland is recommended while for the channeled valley bottom wetland, a Class D (largely modified) category is recommended. The depression wetland indicates intermediate levels of ecological service provision, with moderate impacts on hydrology and geomorphology observed. The channelled valley bottom wetland feature is of anthropogenic origin, however it does perform certain functions associated with natural wetlands such as biodiversity maintenance and storm water attenuation

During the assessment, various wetland vegetation components were identified. Dominant species were characterised as either wetland or terrestrial species, and were then further categorised as temporary, seasonal and permanent zone species. This characterisation is presented in the **Table 21**, and includes the terrestrial species identified near the wetland zones. Diversity and abundance of the terrestrial, temporary and seasonal zone floral species were considered uniform throughout the site with no discernible difference noted between the channelled valley bottom and the depression wetland.

Table 21: Dominant floral species identified during the wetland delineation.

Terrestrial zone	Temporary / Seasonal Zone	Permanent Zone
Hyparrhenia hirta	**Verbena bonariensis*	*Mariscus congestus*
Eragrostis curvula	*Sporobolus africanus*	*Imperata cylindrica*
Eragrostis chloromelas	*Juncus effusus*	*Kylinga alba*
Harpochloa falx	*Schoenoplectus corymbosus*	*Cyperus rupestris*
**Asclepias fruticosa*	*Imperata cylindrica*	*Typha capensis*
Cymbopogon plurinodis	*Helichrysum* species	*Juncus effusus*
**Cosmos bipinnata*	*Habenaria nyikana*	*Schoenoplectus corymbosus*
**Conyza bonariensis*	*Eragrostis plana*	*Phragmites australis*
Eragrostis plana		*Leersia hexandra*

6.6.3 Wetland Delineation and Sensitivity Mapping

It should be noted that not all indicators were collectively employed in all wetland features, since they were individually characterised by different indicators. During the assessment, the following indicators were used:

- Terrain units were used to determine in which parts of the landscape the wetland features are most likely to occur.
- The soil form indicator was used to determine the presence of soils that are associated with prolonged and frequent saturation, as well as variation in the depth of the saturated soil zone within 50 cm of the soil surface. This indicator

was used to identify gleyed soils where the soil is a greyish/greenish/bluish colour due to the leaching out of iron. Whilst mottling was not extensive, it was present in the temporary zone. These factors were utilised to aid in determining the location of the wetland zones and their boundaries. However it must be noted that the artificial wetland had very little to none of these soil characteristics as it is of anthropogenic origin.

- The vegetation indicator was used in the identification of the wetland boundary through the identification of the distribution of both facultative and obligate wetland vegetation associated with soils that are frequently saturated. Changes in vegetation density and levels of greening were also considered during the delineation process. This indicator was very useful in identifying the boundary of the temporary zone. This indicator was most useful in delineating the boundary of the artificial wetland, as localised ponding associated with altered topography has led to the establishment of facultative and obligate wetland vegetation.
- Surface water was not present in all wetland features, however, it was noted and taken into consideration in areas where it was observed.

The depression wetland associated with Alternative Site 9 is considered to be sensitive, as it provides niche faunal and floral habitat in an area characterised by transformation due to agriculture. The National Environmental Management Act (Act 107 of 1998) stipulates that no activity can take place within 32 m of a wetland without the relevant authorisation. In addition, the National Water Act (Act 36 of 1998) states that no diversion, alteration of bed and banks or impeding of flow in watercourses (which includes wetlands) may occur without obtaining a water use licence authorising the proponent to do so. Thus, a 32 m buffer was prescribed around the wetland depression associated with Alternative Site 9, and it is recommended that should this alternative be considered, that any activities fall outside of the buffer zone **(Figure 21).** This buffer zone is deemed sufficient to maintain the PES, limit any further impact that the proposed development could have and ultimately support the REC. A 500 m buffer around the wetlands is also indicated in **Figure 21** in terms of GN1199.

The channel valley bottom wetland adjacent to Alternative Site 1 was also allocated a 32 m buffer as the feature provides important faunal and floral habitat within the Duvha Power Station footprint area. However, the feature itself is considered to be of low sensitivity. From the **Figure 21**, it is clear that Alternative 1 falls outside the boundaries of the 32 m buffer but within the 500 m buffer and will require a WUL.

Figure 21: Wetland sensitivity mapping with associated buffers

6.7 HERITAGE RESOURCES

Heritage resources may be tangible, such as buildings and archaeological artefacts or intangible such as landscapes and living heritage. Their significance is based upon their aesthetic, architectural, historical scientific, social, spiritual, linguistic economic or technological values; their representation of a particular period; their rarity and their sphere of influence.

The towns of Middelburg, Belfast and Carolina were all established during the 1880s and served as regional centres for the farming community. Construction of the Duvha Power Station began in 1975. The last of six units was commissioned 1984. The surrounding areas was subjected to farming and urbanization which would have destroyed any pre-colonial or early colonial heritage features that might have occurred in the past. The only heritage sites known from the region are cemeteries, all of which are located well outside the area of the proposed development.

6.8 SOCIO- ECONOMIC ENVIRONMENT

This section provides a strategic understanding of the social profile of the study area and its surroundings.

There is only one settlement located within a 5 km radius from the study area, namely Speekfontein, situated within the Masakhane sub-place (SP). The nearest town to the study area is Witbank, which is comprised of the Emalahleni main-place (MP).
The following socio-economic indicators will be discussed:

- Demographic profile
- The economy and its structure
- The labour force and employment structure
- Status of infrastructure

6.8.1 Demographic profile

The Emalahleni Local Municipality (ELM) is the second largest Local Municipality in the Nkangala DM and covers a geographical area of 2 678 km². The municipality has the highest population among the six (6) local municipalities that form part of the Nkangala DM with 356 911 people **(Table 22).** There are 119 874 households in the ELM, which equates to one third of the district's number of households. The population of the ELM is predominantly concentrated in urban areas with Witbank (Emalahleni) and Middleburg being the largest towns in the municipality. The urbanised structure of the population is indicative of the labour concentrated around intense mining and manufacturing industries or other sources of employment.

The settlement of Speekfontein had approximately 1642 households in 2011 with an average household size of 2.3 persons. This settlement is the closest to the proposed PV power plant and is referred to as the Duvha informal settlement.

Table 22: Demographic Profile

GEOGRAPHY	DEMOGRAPHIC INDICATORS				
	Area (in km^2)	Total population	Total households	Household size	Population density (people/ km^2)
South Africa	1 220 813	51 770 560	14 450 161	3.58	42
Mpumalanga	76 495	4 039 939	1 075 488	3.76	53
Nkangala District	16 758	1 308 129	356 911	3.67	78
Emalahleni LM	2 678	1 107 028	119 874	9.23	413
Emalahleni MP	164	108 673	31 308	3.47	662
Masakhane SP	2	3 740	1 642	2.28	2 245

Since 2007, the population growth rate in the municipality has been consistently slowing down but it was still higher than the average population growth rate observed in the country. There is a clear trend of in-migration to nodes such as Emalahleni that offer services and employment opportunities that rural areas do not possess. Furthermore, inconsistencies with regard to population growth may occur due to a dramatic trend of out-migration of people from rural areas to urban areas. The type of long-term, permanent employment offered by industries in the local municipality may be the cause of migration towards its urban nodes.

Considering the concentration of manufacturing and mining activities in the ELM, one would expect the population growth rate of the local municipality to be rapidly increasing as people move into the area seeking employment opportunities. However, the population of the area is increasing at a slower rate than historically observed, which may be attributed to the declining number of employment opportunities available in the area supported by the increasing unemployment rate.

Given the above mentioned migratory trends, the disparity of negative employment growth rate and positive population growth rate within the study area is guaranteed due to the out-migration of the population in rural areas outweighing the in-migration to urban centres of the ELM.

According to the Census 2011, the ELM has a large youthful population between the age group of 0-14 constituting 25 % of the entire population. The working age between 15-64 age groups constitutes 71 % of the total population and the elderly (over 65) accounts for 4 % of the population. In terms of gender differentiation there is a slight imbalance between male and females. The Census 2011 revealed that approximately 53 % of the population are males with 47 % being females. A higher proportion of males are found in the urban areas in search of work opportunities. This trend can often be observed in mining towns where the mining industry is predominantly male orientated. **Table 23** presents the distribution of population by age and gender within the ELM.

Table 23: Distribution of population by age and gender, Emalahleni LM, 2011

AGE	Male	Female	Total
0-14 years	13%	13%	25%
15-64 years	39%	33%	71%
65+ years	2%	2%	4%
Total	53%	47%	100%

Source: Kayamandi calculations from Stats SA, Census 2011

With regards to energy usage, the share of energy use for households from Steve Tshwete in 2011 is presented in **Table 24**:

Table 24: Energy use for households from Emalahleni LM, 2011

Lighting		Heating		Cooking	
○ Electricity:	73.4%	○ Electricity:	63.1%	○ Electricity:	70.8%
○ Gas:	0.2%	○ Gas:	2.4%	○ Gas:	2.3%
○ Paraffin:	2.5%	○ Paraffin:	4.8%	○ Paraffin:	21.5%
○ Candles:	23.3%	○ Wood:	4.3%	○ Wood:	1.6%
○ Solar:	0.2%	○ Coal:	13.3%	○ Coal:	3.5%
○ None:	0.4%	○ Animal dung:	0.1%	○ Animal dung:	0.0%
		○ Solar:	0.2%	○ Solar:	0.1%
		○ None:	11.9%	○ None:	0.1%
Total:	**100%**	**Total:**	**100%**	**Total:**	**100%**

There is heavy reliance on electricity, coal, candles, wood, and paraffin as sources of energy with electricity as the most popular source of energy. There is limited use of solar power.

6.8.2 Employment Structure

The ELM consisted of 281 768 people within a working age in 2011. This accounts for 77 % of the total population, from which approximately 138 500 were employed. Compared to South Africa's labour participation rate of over 55 %, the ELM labour participation rate was higher and equal to 68 %. Essentially, just under one third of the working age population in the ELM was non-economically active, a significant portion of whom were discouraged job seekers (19%). Of the economically active population (190 662), 27 % were unemployed, which means that the unemployment rate in the municipality was lower than in the rest of the country. The number of unemployed people in the ELM, though, has been increasing since 1995 with a sharp rise in 2005, 2007, and 2011. Considering that the labour force participation rate in the ELM was greater than in South Africa, the lower unemployment rate indicates that the population of the ELM could be experiencing better socio-economic conditions compared to the rest of the country. This could also be as a result of labour in-migration in search of work in Emalahleni.

In Masakhane SP, the labour force was just less than 2000 workers in 2011 of which 32 % were unemployed. The mining industry, creates nearly a third of the employment opportunities in the ELM compared to the tertiary sector. The latter is the main employment sector nationally creating about two out of three employment opportunities in the country. In Emalahleni, the mining sector is followed by the government and community services sector that contributes 25 % to local

employment. Wholesale, retail and trade follows with 13 % of local employment. Electricity generation creates approximately 4 % of employment positions in the ELM

The figures provided for Emalahleni are almost on par with the other regions depicted. In 2013, however, only 16% of the formally employed population were highly skilled. The majority of the formal workers (45%) in Emalahleni in 2013 work in semi and unskilled jobs.

Approximately 30 % of employment in Emalahleni is in the informal economy. Informal trading activities allow for job creation and help to absorb the population in need of an income but who would otherwise be economically idle. Approximately 13 % of the households in Emalahleni earn no income, while approximately 19 % of households in Speekfontein Settlement (Masakhane SP) earn no income. Nearly half of the households (49 %) in ELM earn less than R38, 400 per annum, while for the District, Province and country these represent 60 %, 67 %, and 63 % respectively. These low income levels are largely a reflection of unemployment levels. A lower percentage of low-income earning households in the primary study area means that proportionally ELM had a greater number of households earning more than R3 200 per month in 2011 than other areas. This had a positive impact on the weighted average household income in the Local Municipality compared to that of the country or the Province.

Education plays a pivotal role in community development. It provides a set of basic skills for development, creativity and innovative abilities. The South African Constitution stipulates that everyone has a right to education. Education has a large influence on employment and income level, as it enables people through training to be more productive in the various sectors of the economy. **Table 25** provides an indication of the level of education as recorded in 2011 and reveals that approximately a third of the population aged 20 years and older that reside within Emalahleni have a matric qualification or higher. This is slightly higher than the average for the District, Province and the rest of the country. In addition to this, only 5 % of the population aged 20 years and older in ELM have no schooling, compared to 9 % of the District, and 10 % of the Province.

Table 25: Level of education of population aged 20 years and older, 2011

GEOGRAPHY	LEVEL OF EDUCATION						TOTAL
	No schooling	Some primary	Complete primary	Some secondary	Grade 12/std 10	Higher	
South Africa	7%	26%	5%	32%	21%	8%	100%
Mpumalanga	10%	27%	5%	31%	20%	6%	100%
Nkangala District	9%	25%	5%	32%	22%	7%	100%
Emalahleni LM	5%	21%	5%	34%	24%	10%	100%
Masakhane SP	8%	22%	6%	38%	24%	2%	100%

Education is an important factor to consider in a regional socio-economic analysis as it plays a crucial role in the potential rate for development, income levels of the community and the ability to begin to build a sustainable path out of poverty. Education and housing are considered to be obvious associations with asset accumulation as they equip households with vital resources to move out of chronic poverty. Employment opportunities are also necessary for a sustained development growth path for households.

6.8.3 Contribution to Gross domestic product per region (GDP-R)

The GDP-R contribution for Emalahleni between 2003 and 2013 increased from R15.8 billion to R50.3 billion. **Table 26** provides the GDP-R figures per year per area between 2003 and 2013.

Table 26: GDP-R (R billions) at current prices (2014 release), 2003-2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
South Africa	1155	1270	1401	1572	1792	2028	2180	2423	2635	2820	3030
Mpumalanga	78	85	93	105	119	143	155	172	189	205	213
Nkangala District	30	34	37	43	49	60	66	73	81	89	90
Emalahleni LM	15	17	19	22	25	33	35	40	45	50	50

Source: Quantec standardized regional data, 2011, Stats SA Census 2001 and Kayamandi calculations

Table 27 shows the average annual growth rates per region between 2003 and 2013. It can be highlighted that Emalahleni LM is experiencing a slightly lower growth rate than the other regions, with 2.6 % average growth per annum while the Province and South Africa are experiencing 2.8 %; and 3.4 % average annual growth respectively.

Table 27: Average annual GDP-R growth (at constant 2005 prices), 2003-2013

GEOGRAPHY	Average annual growth rate (2003-2013)
South Africa	3.4%
Mpumalanga	2.8%
Nkangala District	2.6%
Emalahleni LM	2.6%

Source: Quantec standardized regional data, 2011 and Kayamandi calculations.

Table 28 provides and an indication of the sectoral distribution of GDP-R and **Figure 22** indicates the GDP-R distribution per sector for ELM. Both show that in Emalahleni, the Nkangala District and the Mpumalanga Province, mining and manufacturing have the strongest GDP-R percentages. The government services sector in Emalahleni is particularly lower than in the other regions. This highlights that the local economy is fairly strong as government services play a smaller role in sustaining the economy through job creation in the public sector. The weakest sector in ELM is the agriculture sector.

Table 28: Percentage GDP-R distribution by sector at current prices, 2013

SECTOR		South Africa	Mpumalanga	Nkangala DM	ELM
Primary sector	Agriculture	2%	3%	1%	1%
	Mining	9%	30%	40%	52%
Secondary sector	Manufacturing	12%	11%	10%	8%
	Utilities	3%	7%	9%	10%
	Construction	4%	2%	3%	2%
Tertiary sector	Trade	17%	12%	8%	7%
	Transport	9%	8%	9%	6%
	Finance	22%	11%	9%	5%
	Government and community services	23%	16%	12%	9%
Total		**100%**	**100%**	**100%**	**100%**

Source: Quantec standardized regional data, 2011, Stats SA Census 2001 and Kayamandi calculations

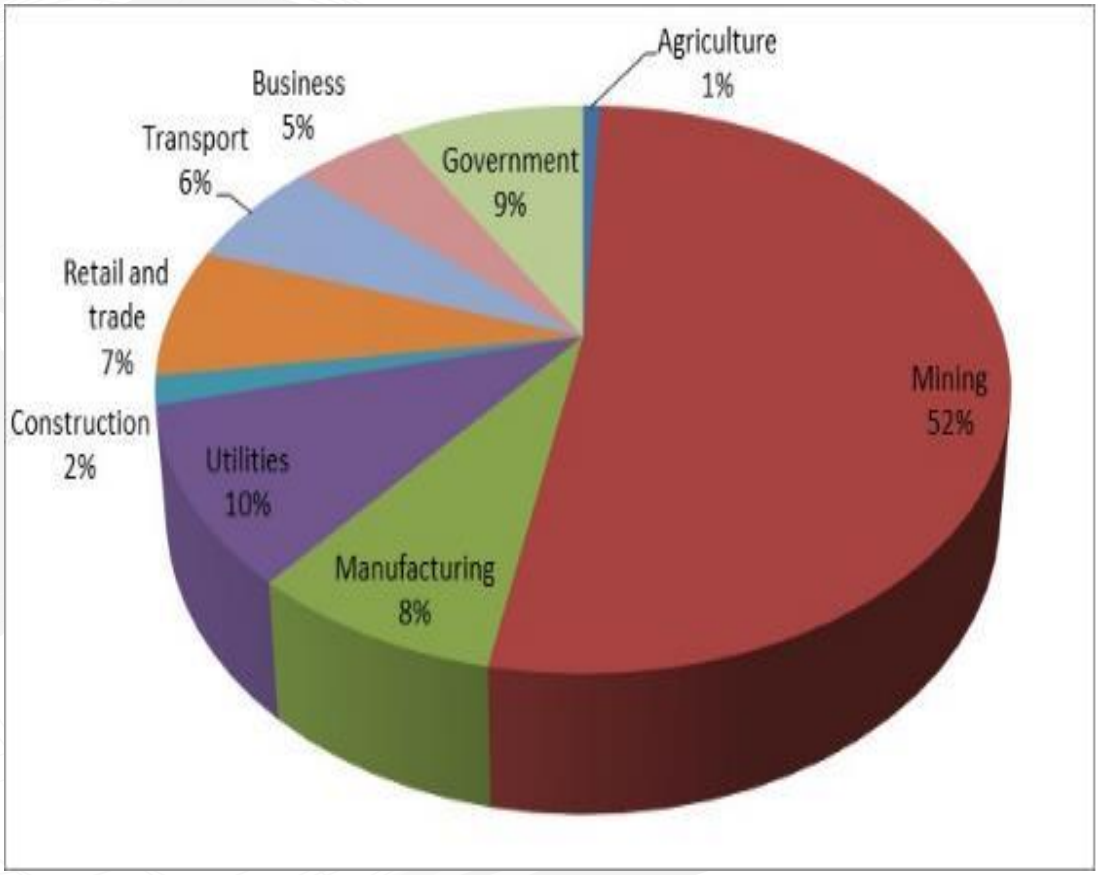

Figure 22: Sectoral GDP-R distribution at current prices for Emalahleni LM, 2013

Source: Quantec standardized regional data, 2015, and Kayamandi calculations

7. ENVIRONMENTAL IMPACT ASSESSMENT APPROACH AND METHODOLOGY

7.1 INTRODUCTION

This Chapter provides an overview of the proposed EIA approach and methodology followed by a description on the assumptions and limitations.

7.2 SCOPE OF THE EIA

7.2.1 Project Site alternatives and Components assessed in the EIA

The EIA investigates the impacts of, and recommend mitigation and enhancement measures for the following:

- Alternative Site 1 has a footprint of 35.2 ha allowing for a projected power peak (electricity) of 23.5 MWp. This will include the construction camp and all associated infrastructure.
- Alternative Site 9 has a footprint of 37 ha allowing for a projected power peak (electricity) of 24.7 MWp this will include the construction camp and all associated infrastructure.
- No-go Alternative.
- Internal roads between 3 and 5 m in width covering a footprint of 36 000 m^2 for Alternative Site 1 and 38 000 m^2 for Alternative Site 9. These new internal roads will be constructed within the development footprint proposed for each alternative site.
- The construction of infrastructure or structures covering 50 m^2 or more where such construction occurs within a water course or within 32 m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. Alternative site 9 triggers the 32 m proximity to a water course.

7.3 PROPOSED APPROACH

The EIA builds on the Scoping Report and will focus on assessing the key impacts, determining their significance, and recommending appropriate measures to mitigate negative impacts and enhance benefits.

The contents of the EIR will be as prescribed in the EIA Regulations, 2010 (Regulation 31(2)) and is presented in **Table 5**.

7.4 IMPACT ASSESSMENT METHODOLOGY

The key issues identified during the Scoping Phase informed the terms of reference of the specialist studies. Each issue consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. In the EIA the significance of the potential impacts are considered before and after identified mitigation is implemented, for direct, indirect, and cumulative impacts, in the short and long term. The specialist studies are synthesised and integrated into the overall impact assessment and recommendations for mitigation are included in the EMPr (full reports are included as Appendix D). The contents of all specialist reports include information

as prescribed in Regulation 32(3) of the EIA Regulations, 2010 and provide preference ranking of the sites.

A description of the nature of the impact, any specific legal requirements and the stage (construction / operation/ decommissioning) will be given. Impacts are considered to be the same during construction and decommissioning.

The following criteria will be used to evaluate significance:

- Nature: This is an appraisal of the type of effect the activity is likely to have on the affected environment. The description includes what is being affected and how. The nature of the impact will be classified as positive or negative, and direct or indirect.

- Extent and location: This indicates the spatial area that may be affected **(Table 29)**

Table 29: Geographical extent of impact

Rating	Extent	Description
1	Site	Impacted area is only at the site – the actual extent of the activity.
2	Local	Impacted area is limited to the site and its immediate surrounding area
3	Regional	Impacted area extends to the surrounding area, the immediate and the neighbouring properties.
4	Provincial	Impact considered of provincial importance
5	National	Impact considered of national importance – will affect entire country.

- Duration: This measures the lifetime of the impact **(Table 30).**

Table 30: Duration of Impact

Rating	Duration	Description
1	Short term	0 – 3 years, or length of construction period
2	Medium term	3 – 10 years
3	Long term	> 10 years, or entire operational life of project.
4	Permanent – mitigated	Mitigation measures of natural process will reduce impact – impact will remain after operational life of project.
5	Permanent – no mitigation	No mitigation measures of natural process will reduce impact after implementation – impact will remain after operational life of project.

- Intensity/severity: This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts **(Table 31).**

Table 31: Intensity/severity

Rating	Intensity	Description
1	Negligible	Change is slight, often not noticeable, natural functioning of environment not affected.
2	Low	Natural functioning of environment is minimally affected. Natural, cultural and social functions and processes can be reversed to their original state.
3	Medium	Environment remarkably altered, still functions, if in modified way. Negative impacts cannot be fully reversed.
4	High	Cultural and social functions and processes disturbed – potentially ceasing to function temporarily.
5	Very high	Natural, cultural and social functions and processes permanently cease, and valued, important, sensitive or vulnerable systems or communities are substantially affected. Negative impacts cannot be reversed.

- Potential for irreplaceable loss of resources: This is the degree to which the project will cause loss of resources that are irreplaceable **(Table 32).**

Table 32: Potential for irreplaceable loss of resources

Rating	Potential for irreplaceable loss of resources	Description
1	Low	No irreplaceable resources will be impacted.
3	Medium	Resources can be replaced, with effort.
5	High	There is no potential for replacing a particular vulnerable resource that will be impacted.

- Probability: This is the likelihood or the chances that the impact will occur **(Table 33).**

Table 33: Probability of Impact

Rating	Probability	Description
1	Improbable	Under normal conditions, no impacts expected.
2	Low	The probability of the impact to occur is low due to its design or historic experience.
3	Medium	There is a distinct probability of the impact occurring.
4	High	It is most likely that the impact will occur
5	Definite	The impact will occur regardless of any prevention measures.

- Confidence: This is the level of knowledge or information available, the EAP or a specialist had in his/her judgement **(Table 34).**

Table 34: Confidence in level of knowledge or information

Rating	Confidence	Description
	Low	Judgement based on intuition, not knowledge / information.
	Medium	Common sense and general knowledge informs decision.
	High	Scientific / proven information informs decision.

- Consequence: This is calculated as extent + duration + intensity + potential impact on irreplaceable resources.
- Significance: The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. consequence x probability = significance). The maximum value which can be obtained is 100 significance points **(Table 35).**

Table 35: Significance of issues (based on parameters)

Rating	Significance	Description
1-14	Very low	No action required.
15-29	Low	Impacts are within the acceptable range.
30-44	Medium-low	Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible.
45-59	Medium-high	Impacts are important and require attention; mitigation is required to reduce the negative impacts to acceptable levels.
60-80	High	Impacts are of great importance, mitigation is crucial.
81-100	Very high	Impacts are unacceptable.

- Cumulative Impacts: This refers to the combined, incremental effects of the impact. The possible cumulative impacts will also be considered.
- Mitigation: Mitigation for significant issues will be incorporated into the EMPr.

7.5 ENVIRONMENTAL MANAGEMENT PROGRAMME

Based on the findings of the DEIAr, a practical and feasible EMPr has been compiled. The draft EMPr outlines how negative environmental impacts will be managed and minimized, and how positive impacts will be maximised, during and after construction. The EMPr fulfils the GN 543 requirements and includes mitigation measures required during the construction, operational and decommissioning phases of the project as well as a framework for social and environmental monitoring. Recommendations are given with regard to the responsible parties for the implementation of the EMPr.

7.6 ASSUMPTIONS AND LIMITATIONS

In undertaking this investigation and compiling the DEIAr the following assumptions and limitations have been made:

- The scope of this investigation is limited to assessing the environmental impacts of the proposed PV Plant and associated infrastructure.

- The information provided by the applicant and specialists are accurate and unbiased.
- There is a limitation in the unpredictability of buried archaeological remains.
- Assessments of impact significance for social impact often need to be made without quantification. These are based on a consideration of the likely magnitudes of impacts and/or expert judgements, unless otherwise specified or quantified.
- The assessment only considers the impacts of the proposed project and the no-go and does not make comparisons with other solar energy projects as there are none in the area. Note that the development is on Eskom owned land and that there is no scope for aspirant competing solar energy project developments.
- A specialist visual assessment of the proposed development is not included in the Social Impact Assessment.
- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa in the study area may have been missed during the assessment.
- The wetland assessment is confined to the study area as well as areas of relevance immediately adjacent to the study area and does not include the neighbouring and adjacent properties. The general surroundings were however considered in the desktop assessment of the study area.
- The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundary based on the site condition present at the time of the assessment and limitations in the accuracy of the delineation due to disturbances created by grazing, existing development and anthropogenic disturbances are deemed possible.
- Wetland and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within the transition zone some variation of opinion on the wetland boundary may occur, however if the Department of Water and Sanitation (DWS), 2005 method is followed, all assessors should get largely similar results.

8. ASSESSMENT OF POTENTIAL IMPACTS AND MITIGATION MEASURES

8.1 INTRODUCTION

This Chapter describes the potential impacts on the biophysical, socio- economic and cultural/historical environment as described in **Chapter 6.** These include potential impacts which may arise during the construction, operation and decommissioning phases of the proposed project as described in **Chapter 1.** This assessment will therefore take into consideration the short to medium term and long term impacts associated with each phase of the proposed project.

The EIA process provides the information that the authorities require to decide whether the project should be implemented or not, and if so then under what conditions.

The Scoping phase identified various impacts on the biophysical and socio-economic environment which are anticipated to occur throughout the construction, operations and decommissioning phases. These impacts are described in the sections below in the following order:

- Impacts on Heritage;
- Impacts on Flora;
- Impacts on Fauna;
- Wetland;
- Impacts on Soils and Agriculture Potential; and
- Social Impacts.

These impacts on the biophysical, socio-economic and cultural/historical environment were assessed, in terms of the methodology outlined in the EIA approach and methodology, in **Chapter 7.** For each impact assessed, mitigation measures have been proposed to reduce or avoid negative impacts and enhance positive impacts. These mitigations were also incorporated in the EMPr to ensure that they are implemented during the various phases of the proposed project.

8.2 HERITAGE IMPACT ASSESSMENT

The following impacts, mitigations and discussion have been extracted from the Heritage Impact Assessment (HIA) **(Appendix D1).** The purpose of the HIA was to locate, identify, evaluate and document sites, objects and structures of cultural significance found within the site alternatives in which it is proposed to develop the PV Plant.

8.2.1 Impact Summary

As no sites, features or objects of cultural heritage significance have been identified within Alternative Site 1 or 9, no impact is envisaged as a result of the proposed PV Plant.

8.2.2 Comparative Assessment

From a heritage perspective it is recommend that the proposed development can continue within either site Alternative as no sites, features or objects of cultural heritage significance have been identified.

8.2.3 Mitigation Measures

- Contractors and personnel involved in clearing and earthworks should be required to participate in training and awareness programs to ensure that they are aware of work stoppage and reporting procedures should archaeological sites or graves be exposed during development activities.
- All employees and contractors are required to stop work and report any heritage or archaeological site discovered in the vicinity of the construction activity, to a heritage practitioner so that an investigation and evaluation of the findings can be made. No heritage artefacts or graves may be destroyed or moved without the necessary permits.

8.3 FLORA

The following impacts, mitigations and discussion have been extracted from Section B of the Faunal, Avifaunal, Floral and Wetland Ecological Assessment **(Appendix D2).** The purpose of the Flora impact assessment was to identify the general habitat types and ecological status of Alternative Site 1 and 9 in order to evaluate impacts the proposed PV Plant might have on the following:

- Habitat for Floral Species;
- Floral Diversity; and
- Floral Species of Conservation Concern (SCC)

The above impacts are discussed further, in the sections that follow.

8.3.1 Impact Assessment on Floral Species Habitat

Wetland Habitat Unit

Vegetation within this habitat unit has been disturbed as a result of surrounding agricultural activities and grazing of livestock, however these areas still provide habitat to support a high diversity of indigenous floral species. Development or placement of infrastructure within the wetland habitat will result in permanent removal of indigenous vegetation and will result in a low to medium-low impact significance.

Transformed Habitat Unit

The transformed habitat unit has been significantly disturbed as a result of historic agricultural activities and overgrazing of veld. The floral habitat within this habitat unit is therefore largely transformed and placement of infrastructure within this habitat unit will most likely have a low impact significance.

If Alternative Site 1 is chosen as the preferred alternative, any significant impacts are unlikely, and with implementation of mitigation measures, the impact significance may be reduced to low levels.

Table 36 serves to summarise the significance of potential impacts on floral species habitat that may result due to the proposed activities.

Table 36: Impact on Floral Species Habitat

Impacts on Flora Species Habitat during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low
Cumulative Impact Not applicable as no other PV facilities are in the area									
Impacts on Flora Species Habitat during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	3	3	2	1	1	High	8	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	3	3	2	1	1	High	8	Very low
Cumulative Impact Not applicable									
Impacts on Flora Species Habitat during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low

8.3.2 Impact Assessment on Floral Diversity

Floral diversity within both habitat units has been decreased as a result of historic and on-going disturbances. The species diversity is however higher within the depression wetland area than that associated with the transformed habitat unit. The impact significance associated with the loss of species diversity is considered to be low prior to the implementation of mitigation measures.

If Alternative Site 1 is chosen as the preferred alternative, any significant impacts are unlikely, and with implementation of mitigation measures, the impact significance may be reduced to low levels. **Table 37** summarises the significance of potential impacts on floral diversity habitat that may result due to the proposed activities.

Table 37: Impact on Floral Diversity

Impacts on Flora diversity during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	2	2	1	1	High	7	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	2	2	1	1	High	7	Very low
Cumulative Impact Not applicable									
Impacts on Flora diversity during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	8	Very low
Cumulative Impact Not applicable									
Impacts on Flora diversity during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	2	2	1	1	High	7	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	2	2	1	1	High	7	Very low
Cumulative Impact Not applicable									

8.3.3 Impact Assessment on Floral Species of Conversation Concern (SCC)

No floral SCC were recorded, however three species are likely to occur within the footprint of Alternative Site 9. Thus by conserving the depression wetland area, possible habitat for floral SCC will also be conserved. The impact on floral SCC is considered to be of low significance prior to the implementation of mitigation measures. Should Alternative Site 1 be chosen as the preferred alternative, any significant impacts are unlikely, and with implementation of mitigation measures the impact significance may be reduced to low levels.

Table 38 summarises the significance of potential impacts on floral important species that may result due to the proposed PV Plant.

Table 38: Impact on Important Floral Species of Conversation Concern (SCC)

Impacts on Floral SCC during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	9	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	9	Very low
Cumulative Impact Not applicable									
Impacts on Flora SCC during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	4	2	1	1	High	9	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	4	2	1	1	High	9	Very low
Cumulative Impact Not applicable									
Impacts on Flora SCC during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	9	Very low
Alternative Site 9									
Without Mitigation	-ve	3	4	3	1	2	High	11	Low
With Mitigation	-ve	2	3	2	1	1	High	9	Very low
Cumulative Impact Not applicable									

8.3.4 Impact Summary

Based on the above assessment it is evident that there are three possible impacts (that is, impacts on the habitat for floral diversity, floral species and floral SCC) which may affect the floral ecology within the study area.

Alternative 1 is chosen as the preferred alternative from a flora perspective as significant impacts are unlikely, and the spatial scale is anticipated to be small. This lowers the impact significance throughout all phases. However, mitigation measures

must still be responsibly implemented in order to further minimise the anticipated impact.

8.3.5 Comparative Assessment

Alternative Site 1 presents the best option for the construction of the PV Plant. Alternative Site 9 is closer in proximity to the depression wetland which may mean that floral species and avifauna in the wetlands may be affected by the proposed PV Plant.

8.3.6 Mitigation Measures

The following mitigation measures are recommended for the all phases of the proposed PV Plant.

Development footprint

- All activities must be contained within the PV Plant footprint to minimise disturbance outside these areas.
- During the construction phases erosion berms should be installed to prevent gully formation and siltation of the wetland resources. The following points should serve to guide the placement of erosion berms:
    - Where the track has a slope of less than 2%, berms every 50m should be installed;
    - Where the track slopes between 2% and 10%, berms every 25m should be installed;
    - Where the track slopes between 10%-15%, berms every 20m should be installed; and
    - Where the track has a slope greater than 15%, berms every 10m should be installed
- Vehicles must be restricted to travelling on designated roadways to limit the ecological footprint of the proposed activity.

Weed Control and Management

- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation National Environmental Management: Biodiversity Act 2004 (Act No 10 of 2004) Alien and Invasive Species Regulations, 2014.
- Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used.
- Removal of species should take place throughout the construction and operational phases.
- No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soils preservation

- No waste or spillage of effluent should be allowed to occur within or near sensitive habitat boundaries and associated buffer zones.
- A pollution control system/spill handling procedure must be implemented to limit impact of such occurrences and prevent discharge to the receiving environment.

Rehabilitation

- All disturbed habitat areas must be rehabilitated as soon as possible to ensure that floral ecology is re-instated.
- Reseeding with indigenous grasses should be implemented in all affected areas and strategic planting of grassland species should take place to re-establish microclimates and niche habitats.

Fires

- Only controlled fires in designated areas must be allowed during all development phases.

Floral SCC

- Sensitive floral species, if encountered, must be rescued and relocated. The following should be ensured:
  - If any threatened species, or nationally or provincially protected floral will be disturbed, ensure effective relocation of individuals to suitable similar habitat.
  - All rescue and relocation plans should be overseen by a suitably qualified specialist.

8.4 FAUNA

The following impacts, mitigations and discussion have been extracted from Section C of the Faunal, Avifaunal, Floral and Wetland Ecological Assessment **(Appendix D2).** The purpose of the faunal impact assessment was to identify dominant faunal communities, species and habitat diversities in order to evaluate impacts the proposed PV Plant might have on the following:

- Faunal Habitat and Ecological Structure
- Faunal Diversity and Ecological Integrity
- Important Faunal Species of Conservational Concern (SCC) (Mpumalanga Province)

The above impacts are discussed further, in the sections that follow.

8.4.1 Impact assessment on the Faunal Habitat Ecological Structure

The faunal habitat in Alternative Site 1 and 9 has already been disturbed through anthropogenic activities, as well as by the use of the grassland areas for grazing purposes. Alternative Site 1 exhibits a low diversity in terms of habitat for a variety of faunal species. Alternative Site 9 is considered to be of increased importance in terms of faunal habitat due to proximity of this site to the wetland depression. Should Alternative 1 be considered as the preferred alternative and all related maintenance impacts be contained within the footprint area, and edge effects correctly managed, the construction of the PV Plant will have a minimal impact on viable faunal habitat within the region.

Table 39 summarises the significance of potential impacts on faunal habitat ecological structure that may result from the proposed PV Plant.

Table 39: Impacts on Faunal Habitat Ecological Structure

Impacts on Faunal Habitat Ecological Structure during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Cumulative Impact Not applicable									
Impacts on Faunal Habitat Ecological Structure during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very-Low
Alternative Site 9									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact: Not applicable									
Impacts on Faunal Habitat Ecological Structure during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Cumulative Impact: Not applicable									

8.4.2 Impact assessment on the Faunal Diversity and Ecological Integrity

Due to past agricultural activities and current grazing practices in Alternative site 1, the herbaceous layer of Site Alternative 1 and 9 is short and does not contain many faunal species. Due to the disturbed nature of the faunal habitat, faunal diversity was low within Site Alternative 1. The wetland depression associated with Alternative Site 9, is

considered to be of increased importance in terms of faunal diversity. Should Alternative 1 be considered as the preferred alternative and all related maintenance impacts be contained within the footprint area, and edge effects correctly managed, the construction of the PV Plant will have a minimal impact on faunal diversity within the region.

Table 40 summarises the significance of potential impacts on faunal diversity and ecological Integrity that may result from the proposed PV Plant.

Table 40: Impacts on Faunal Diversity and Ecological Integrity

Impacts on Faunal Diversity and Ecological Integrity during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	9	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Cumulative Impact: Not applicable									
Impacts on Faunal Diversity and Ecological Integrity during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact: Not applicable									
Impacts on Faunal Diversity and Ecological Integrity during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	9	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Cumulative Impact: Not applicable									

8.4.3 Impact Assessment on Important Faunal Species of Conservational Concern (SCC) (Mpumalanga Province)

The proposed PV Plant is unlikely to have any impact on faunal SCC that occur within the Mpumalanga Province as well as on a national scale. This is mainly attributed to

the already disturbed nature of the proposed alternative sites, as well as the pre-existing anthropogenic activities and human infrastructure that already impose and restrict the habitation of sensitive faunal species within the study area.

Table 41 summarises the significance of potential impacts on faunal species of conversational concern that may result from the proposed PV Plant.

Table 41: Potential impacts on Faunal Species of Conversational Concern (SCC)

Impacts on Faunal SCC during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	6	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	6	Very Low
Cumulative Impact: Not applicable									
Impacts on Faunal SCC during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	1	1	2	High	7	Very-Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	1	4	1	1	2	High	7	Very Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact: Not applicable									
Impacts on Faunal SCC during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	7	Very Low
Cumulative Impact: Not applicable									

8.4.4 Impact Summary

From the impact assessment it is evident that impact significance vary from low to very low significance throughout the life of the project. The development therefore is deemed to have a very limited impact on faunal species in the region, as the area has already been disturbed and the faunal species are already exhibiting a preference for

more suitable habitat in the surrounding areas, where persecution from anthropogenic activities is reduced and availability of resources is greater.

8.4.5 Comparative Assessment

The presence of both *Damaliscus pygargus phillipsi* (Plains Zebra) and *Equus quagga* (Blesbok) within Alternative Site 1 boundaries is artificial, and is maintained as such. If Alternative Site 1 is selected as the site for the PV Plant, the numbers of both the afore mentioned species needs to be halved, as Alternative Site 1 comprises a large grazing portion of the property for these species. It is recommended that the genetics of the current populations also be considered, and that whilst removing excess animals, new ones are brought in to enrich the gene pool of the small populations to prevent further inbreeding.

The only amphibian species listed as being of conservation concern is the Giant Bullfrog (*Pyxicephalus adspersus*) (Appendix 3, MP SoER, 2003). Even though no Giant Bullfrogs were identified on or within the vicinity of the study area, Giant Bullfrogs are known to occur within and nearby riparian and wetland zones, where they remain in cocoons submerged underground during the winter periods. Giant bullfrogs are also known to travel vast distances and may utilise wetlands as migratory corridors. The only suitable habitat present for this species within the study area is the wetland depression associated with Alternative Site 9. Therefore, Alternative Site 9 is not supported from an amphibian conservation perspective.

Metisella meninx, commonly known as the Marsh Sylph (Butterfly) is an invertebrate which is listed as Vulnerable in the MP SoER, 2003 report and is not yet listed on the IUCN listings. The study area falls within the distribution range noted for the *M. meninx* however, no populations of this species were identified during the site assessments. Its preferred habitat comprises of wetlands where marsh grass (*Leersia hexandra)* are dominant. The only suitable habitat present for this species within and around the study area is the wetland depression associated with Alternative Site 9. Therefore, Alternative Site 9 is not supported from an invertebrate conservation perspective.

Alternative Site 1 therefore presents the best option for the construction of the PV Plant as it is unlikely to affect amphibian habitat, amphibian species, invertebrate habitat and invertebrate SCC within the area. A low significant impact is anticipated. Alternative Site 9 is closer in proximity to the depression wetland which may mean that fauna species utilising the wetlands may be affected by the proposed PV Plant.

8.4.6 Mitigation Measures

The following mitigation measures are recommended for the all phases of the proposed PV Plant:

- All activities must be contained within the PV Plant footprint to minimise disturbance outside these areas.
- Vehicles must be restricted to travelling on designated roadways to limit the ecological footprint of the proposed activity.
- Only controlled fires in designated areas must be allowed during all development phases.
- No trapping or hunting of fauna is to take place.
- If Alternative site 1 is chosen as the development site, the numbers of both *Damaliscus pygargus phillipsi* (Plains Zebra) and *Equus quagga* species (Blesbok) needs to be halved.
- Whilst removing excess animals, new ones are brought in to enrich the gene pool of the small populations to prevent further inbreeding.

8.5 AVIFUANA

The following impacts, mitigations and discussion have been extracted from Section C of the Faunal, Avifaunal, Floral and Wetland Ecological Assessment **(Appendix D2).** The purpose of the Avifaunal impact assessment was to identify Avifaunal species and habitat diversities in order to evaluate impacts the proposed PV Plant might have on the following:

- Avifaunal habitat and ecological Structure;
- Avifaunal diversity and ecological Integrity;
- Important Avifaunal species of conservational concern (SCC).

8.5.1 Impact assessment on the Avifaunal Habitat Ecological Structure

Alternative Site 1 and 9 comprise of habitat for grassland and wetland birds, respectively. Favourable short grass habitat for the *Geronticus calvus* (Southern Bald Ibis), which is considered to be Vulnerable by the IUCN, is created by the high grazing impact of *Equus quagga* (Plains Zebra) and *Damaliscus pygargus phillipsi* (Blesbok) in Alternative Site 1. Southern Bald Ibis was observed during the site visit and indicates how species can adapt to environments that have been rehabilitated and favoured habitat is present.

Table 42 summarises the significance of potential impacts on avifaunal habitat ecological structure that may result from the proposed PV Plant.

Table 42: Impacts on avifaunal habitat ecological structure

Impacts on Avifauna Habitat Ecological Structure during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Cumulative Impact Not applicable									
Impacts on Avifaunal Habitat Ecological Structure during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very-Low
Alternative Site 9									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact Not applicable									
Impacts on Avifaunal Habitat Ecological Structure during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	4	High	7	Low
Cumulative Impact Not applicable									

8.5.2 Impact assessment on the avifaunal diversity and ecological integrity

Commonly occurring avifauna species were mostly noted within the study area. Only the *Geronticus calvus* (Southern Bald Ibis) was identified during the site survey and is considered to be Vulnerable by the IUCN. The depression wetland in close proximity to Alternative Site 9 will provide more suitable habitat for avifaunal species in the area, and as such species will naturally congregate in these preferred areas.

Table 43 summarises the significance of potential impacts on avifaunal diversity and ecological Integrity that may result from the proposed PV Plant.

Table 43: Impacts on Avifaunal Diversity and Ecological integrity

Impacts on Avifaunal Diversity and Ecological Integrity during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	9	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Cumulative Impact Not applicable									
Impacts on Avifaunal Diversity and Ecological Integrity during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	1	4	2	1	2	High	8	Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact Not applicable									
Impacts on Avifaunal Diversity and Ecological Integrity during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	4	High	8	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	4	High	9	Med-Low
With Mitigation	-ve	2	3	1	1	3	High	7	Low
Cumulative Impact Not applicable									

8.5.3 Impact Assessment on Important avifaunal species of conservational concern

In terms of avifaunal SCC, only *Geronticus calvus* (Southern Bald Ibis) was identified during the site survey (MP SoER, 2003). There is however a high probability that *Circus ranivorus* (African Marsh Harrier) and *Tyto capensis* (African Grass Owl) may possibly utilise the study area specifically for foraging purposes, especially around the wetland depression associated with Alternative Site 9.

Table 44 summarises the significance of potential impacts on avifaunal species of conversational concern that may result from the proposed PV Plant.

Table 44: Potential impacts on avifaunal Species of Conversational Concern (SCC)

Impacts on Avifaunal SCC during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	6	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	6	Very Low
Cumulative Impact Not applicable									
Impacts on Avifaunal SCC during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	4	1	1	2	High	7	Very-Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	1	4	1	1	2	High	7	Very Low
With Mitigation	-ve	1	4	1	1	1	High	7	Very Low
Cumulative Impact Not applicable									
Impacts on Avifaunal SCC during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	1	2	High	8	Low
With Mitigation	-ve	1	3	1	1	1	High	7	Very Low
Cumulative Impact Not applicable									

8.5.4 Impact Summary

From the impact assessment it is evident that impact significance vary from low to very low significance throughout the life of the project. The proposed project therefore is deemed to have a very limited impact on avifaunal species in the region.

8.5.5 Comparative Assessment

With respect to avifaunal diversity and habitat intactness, Alternative Site 1 presents the best option for the construction of the PV Plant. Should Alternative Site 1 be selected, the proposed PV Plant with associated infrastructure is unlikely to pose a threat to avifaunal SCC, due to the fact that the avifaunal SCC observed selects for short cropped grasslands for foraging purposes, of which is extensive in this region. The areas surrounding the study areas provide a combination of short and tall grasslands that these above listed SCC prefer, and which are located away from anthropogenic disturbances associated with the power station.

Alternative Site 9 is not preferred from an avifaunal conservation perspective as the presence of the depression wetland is in closer proximity may mean that avifaunal species utilising the wetlands may be affected by the proposed development. If the alternative is pursued, the impact on avifaunal populations associated with the region will most likely be more significant.

8.5.6 Mitigation Measures

The following mitigation measures are recommended for the all phases of the proposed PV Plant:

- All activities must be contained within the PV Plant footprint to minimise disturbance outside these areas.
- Vehicles must be restricted to travelling on designated roadways to limit the ecological footprint of the proposed activity.
- Only controlled fires in designated areas must be allowed during all development phases.
- No trapping or hunting of avifauna is to take place.

8.6 WETLAND IMPACT ASSESSMENT

The following impacts, mitigations and discussion have been extracted from Section D of the Faunal, Avifaunal, Floral and Wetland Ecological Assessment (Appendix D2). The study was done in order to evaluate impacts the proposed PV Plant might have on the following:

- Wetland habitat and Ecological Structure;
- Wetland Ecological and Socio-cultural Service Provision;
- Wetland Hydrological Function and Sediment Balance

These are discussed in detail in the sections that follow:

8.6.1 Impact Assessment on Wetland Habitat and Ecological Structure

Any significant impacts are unlikely and with implementation of mitigation measures the impact significance may be reduced to low levels.

Table 45 summarises the significance of potential impacts on Wetland Habitat and Ecological Structure

Table 45: Impacts on Wetland Habitat and Ecological Structure

Impacts on Wetland habitat and Ecological Structure during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	2	2	2	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	2	2	2	1	3	High	7	Low
Cumulative Impact Not applicable									
Impacts on Wetland and Ecological Structure during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very Low
Cumulative Impact Not applicable									
Impacts on Wetland habitat and Ecological Structure during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	2	2	2	1	3	High	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	2	2	2	1	3	High	7	Low
Cumulative Impact Not applicable									

8.6.2 Impact Assessment on Wetland Ecological and Socio-cultural Service Provision

Wetland areas provide potential habitat and migratory connectivity for faunal species as well as the potential to host a higher diversity of floral species. Development activities could result in fragmentation of wetland habitat or even loss of this sensitive habitat altogether. Development activities expected to most likely be the cause of loss of wetland habitat and ecological structure include encroachment of infrastructure or dumping of construction waste materials into the wetland areas. However, ineffective rehabilitation may also lead to excessive erosion and the loss of wetland soils which in turn will lead to reduced wetland habitat availability and suitability for both faunal and floral species.

If Alternative Site 1 is chosen as the preferred alternative, any significant impacts are unlikely, and with implementation of mitigation measures the impact significance may be reduced to low levels.

Table 46 summarises the significance of potential impacts on Wetland Ecological and Socio-cultural Service Provision.

Table 46: Wetland Ecological and Sociocultural Service Provision

Impacts on Wetland Ecological and Socio-cultural Service during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very low
Cumulative Impact: Not applicable									
Impacts on Wetland Ecological and Sociocultural Service during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very-Low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very-Low
Cumulative Impact: Not applicable									
Impacts on Wetland Ecological and Sociocultural Service during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									

Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	4	High	7	Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very low
Cumulative Impact: Not applicable									

8.6.3 Impact Assessment on Wetland Hydrological Function and Sediment Balance

During construction, site clearing and the removal of vegetation may result in an increase in runoff from disturbed areas and an increase in the erosion and incision within the wetland. An increase in runoff from disturbed areas may also alter flow patterns and may result in the inundation of the features. In addition, sediment deposition as a result of the disturbance of soils and increased sediment runoff during the construction of the PV Plant may result in an impact on the sediment balance of the features.

Operational activities such as vegetation clearing for maintenance purposes, if left unmitigated are likely to result in a long term negative impact on the wetland features.

If Alternative Site 1 is chosen as the preferred alternative, any significant impacts are unlikely, and with implementation of mitigation measures the impact significance may be reduced to low levels.

Table 47 summarises the significance of potential impacts on Wetland hydrological function and sediment balance.

Table 47: Impacts on Wetland hydrological function and sediment balance

Impacts on Wetland Hydrological Function and Sediment Balance during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	3	1	3	High	8	Low
With Mitigation	-ve	1	1	2	1	2	High	5	Very low
Alternative Site 9									
Without Mitigation	-ve	2	2	3	1	3	High	8	Low
With Mitigation	-ve	1	1	2	1	2	High	5	Very low
Cumulative Impact: Not applicable									
Impacts on Wetland Hydrological Function and Sediment Balance during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									

Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very-Low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	1	2	High	7	Very Low
With Mitigation	-ve	1	1	1	1	1	High	4	Very-Low
Cumulative Impact: Not applicable									
Impacts on Wetland Hydrological Function and Sediment Balance during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	3	1	3	High	8	Low
With Mitigation	-ve	1	1	2	1	2	High	5	Very low
Alternative Site 9									
Without Mitigation	-ve	2	2	3	1	3	High	8	Low
With Mitigation	-ve	1	1	2	1	2	High	5	Very low
Cumulative Impact: Not applicable									

8.6.4 Impact Summary

For the duration of the construction phase, the impact on wetland habitat and ecological wetland ecological service provision and wetland hydrological function and sediment balance is considered to be of low significance prior to mitigation, however should mitigation measures be implemented the impact will be reduced to very low levels.

For the duration of the operational phase, the impact on wetland habitat and ecological structure as well as the impact on wetland hydrological function and sediment balance are considered to be very low level impacts, prior to mitigation and with mitigation.

8.6.5 Comparative Analysis

Considering the results of the above assessments, the wetland sensitivities and the locality of the proposed alternatives, it is clear that Alternative Site 9 falls within the wetland depression boundary. Thus, if this alternative is pursued, it would have a significant negative impact on the receiving wetland environment. However, Alternative Site 1 is anticipated to have the least significant impact on wetland resources associated with the study area, and as such is supported from a wetland ecological perspective.

8.6.6 Mitigation Measures

Construction and operational footprint

- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise environmental damage. Construction vehicles must use existing roads where possible;
- During construction all building materials should be kept out of the wetland areas as well as the associated buffer zones;
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction and rehabilitation phases of the development;
- Appropriate sanitary facilities must be provided during the construction phase and all waste removed to an appropriate waste Plant;
- Limit vegetation clearance during the operational phase to the absolute minimum to avoid increased silt loads and runoff velocities and volumes which may affect the hydrology of downstream wetland areas;
- In the event of a breakdown, spill prevention measures must be implemented to prevent ingress of hydrocarbons into topsoil;
- All vehicles must be regularly inspected for leaks;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- Re-fuelling must take place on an impervious area to prevent ingress of hydrocarbons into topsoil;
- All spills must be immediately removed to the point on infiltration. Contaminated soil must be disposed of at a licenced Hazardous waste disposal Plant.

Alien plant species

- Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the development footprint;
- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation National Environmental Management: Biodiversity Act 2004 (Act No 10 of 2004) Alien and Invasive Species Regulations, 2014;
- Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
- No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species.

Soils

- Monitor all systems for erosion and incision.

Rehabilitation

- Upon rehabilitation, reseeding of indigenous grasses should be implemented in all impacted areas and strategic planting of grassland species should take place;

- As much vegetation growth as possible should be promoted surrounding the PV structures in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species where hydro-seeding, wetland and rehabilitation planting (where applicable) are to be implemented.

8.7 SOILS AND AGRICULTURAL POTENTIAL

The following impacts, mitigations and discussion have been extracted from the Soils and Agricultural Potential Specialist Study **(Appendix D3).** The purpose of the Soils and Agricultural Potential Specialist Study is to obtain all existing soil information and assess the broad agricultural potential.

8.7.1 Impact Assessment on Soils and Agricultural Potential

The impact on the natural resources of the study area would be the loss of arable land due to the construction of the PV Plant, however since the property is owned and operated by Eskom, the use of the land for agricultural production is not an option so long as the Duvha Power Station is in operation. With the possibility of moderate to high potential agricultural soils in the vicinity, this impact would in all probability have a degree of significance, although local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact.

Table 48 summarises the significance of potential impacts on soil and agricultural potential during construction.

Table 48: Impact on Soil and Agricultural potential

Impacts on soil and agricultural potential during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	1	3	2	3	5	High	9	Medium-High
With Mitigation	-ve	1	3	2	3	5	High	9	Medium-High
Alternative Site 9									
Without Mitigation	-ve	1	3	2	3	5	High	9	Medium-High
With Mitigation	-ve	1	3	2	3	5	High	9	Medium-High
Cumulative Impact: Not applicable									

8.7.2 Comparative Analysis

There is no difference in significant impact on soil and agricultural potential anticipated for any of the Alternative Sites associated with the proposed PV Plant.

8.7.3 Mitigation Measures

As mentioned, the use of the land for agricultural production is not an option so long as the Duvha Power Station is in operation. The removal of structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact. No mitigation measures are required.

8.8 SOCIAL IMPACT ASSESSMENT

The following impacts, mitigations and discussion have been extracted from the Social Impact Assessment (SIA) **(Appendix D4).** The purpose of this assessment is to analyse and provide the potential social impacts of the proposed PV Plant on the following:

- New Business sales, multiplier effects and economic stimulation;
- Employment and skills transferral;
- In-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure and services;
- Health, safety and security;
- Nuisance, noise, other disruptions, and change in quality of living environment
- Visual and land use patterns alterations impact and change in sense of special and other spatial considerations;
- Tourism and Aesthetics;
- Duvha Primary School;
- Development of clean renewable energy

8.8.1 Impacts Assessment on new Business sales, multiplier effects and economic stimulation

The proposed PV Plant will lead to positive, albeit low, impacts on the economy, which will lead to increased business sales, increased employment opportunities, increased government income, and increased standards of living.

Increased employment is associated with increased income and consequently with increased buying power in the area, thus leading to new business sales.

This impact is essentially relevant to the following phases:

- **Construction Phase**

  During the construction phase, the project has the potential to have a positive impact on economic activity in the local area, region, province, nationally, and internationally given the size of the new spending injection associated. Preliminary estimates indicate that a total of approximately R425 million (2015 Rand values) will be spent on the entire construction phase representing a significant investment.

  There is also a need for imports as PV modules and inverters will probably be manufactured in China, and assembled in South Africa. Which is why new business sales and economic stimulation will have an international extent.

  There are also likely to be economic multiplier effects, albeit limited locally, from the use of national goods and services which includes, but is not limited to, construction materials and equipment and workforce essentials such as food,

clothing, safety equipment, and other goods. Off-site accommodation would also be required for those construction staff not located in the area, and there is a large amount of accommodation available Emalahleni.

Transport services to the site from town would also be required as there is limited public transport in the area. This additional spend would provide an indirect boost to the local economy. In this regard additional revenue is generated due to the multiplier effect in the different sectors of the economy.

An indicator that is used to indicate economic growth and value is the Gross Domestic Product per Region (GDP-R). The proposed development will translate to economic contribution and income generation which will result in an increase in the GDP-R. The capital investment will have a positive impact on the economy, since it will trigger other beneficial economic activities.

It is anticipated that the economy will be stimulated in the following ways:

- Increased financial spending;
- Expenditure on resources that is required for the construction of the development to take place. These include the purchasing of building material, payment of services provided and infrastructure etc.;
- Increased expenditure by construction workers; and
- The injection of income into the area in the form of wages will represent a growth opportunity for the local economy and businesses in the area.

The capital investment will thus have a positive impact to the economy, since it will trigger other beneficial economic activities, equate to additional new business turnover and GDP.

The construction phase will thus clearly have a positive impact on the economy due to increased financial spending in the economy related to increased infrastructure investment; civil construction; and increased expenditure by employees.

The local area and its activities (businesses and shops, etc.) are expected to be stimulated economically, due to the increased spending expected from the increased salaries and wages paid to employees during construction. Service industries in the region will thus benefit from this, which, in turn will have a knock-on effect on suppliers of goods and services in other areas. This positive impact is likely to be experienced in terms of the increased markets for the sale of local goods to construction staff and direct employment by construction contractors.

All of this will have a positive impact due to the increased direct employment by construction contractors, as well as stimulation of local businesses and informal traders such as tuck shops and spaza shops that will be frequented by the construction labourers during the day. This impact will be a medium term impact and will only be evident until the construction phase is complete.

The proposed development will also lead to increased government income which can be seen as an economic injection into the area. An increase in government income is generated from an increase in the tax base and an increase in economic

activity (i.e. domestic investment). The budgeted capital investment for the project would be injected into the economy, thereby causing a positive economic impact that leads to fiscal impacts. Fiscal impacts are changes in government revenues and expenditures. Economic impacts on total business sales, wealth or personal income can affect government revenues by expanding or contracting the tax base. Due to the jobs that will be created as a result of the proposed development, as well as the increased business activity levels, the salaries and wages of those jobs along with the increased turnover of the companies, can be translated into increased personal and business income tax. In this regard government income will be increased as result of the increase in tax it will receive from the proposed development. The increased government income from tax will mostly be as a result of increased economic activity. Increased tax received by the government will be in the form of company tax, unemployment insurance fund, rates and taxes, etc.

- **Operation Phase**

  During the operations phase, the economy will be stimulated although to a far smaller degree since operational expenditure is expected to be significantly lower than the construction phase. Additional energy generation has knock-on effects on economic stimulation, income generation, etc. The opportunity costs also need to be taken into consideration in this regard. The opportunity costs associated with the development of the site for solar energy can be defined as the potential foregone benefits that would be associated with the next best alternative land use. In the study area this means essentially continued no use. However, given energy requirements of Eskom, the use of renewable energy to supplement Duvha Power station energy needs, as opposed to use from potential energy for the grid from non-renewable resources is potentially key for continued operations.

The impact assessment during the construction phase is assessed to be positive; low in intensity without mitigation and moderate in intensity with mitigation; short-term in duration; local, district, provincial, national, and international in extent; and highly probable. The impact is assessed to be of a medium positive significance both without and with mitigation to the decision making process.

The impact assessment during the operation phase is assessed to be positive; minor in intensity; long-term in duration; local in extent; and medium probability. The impact is assessed to be of a low positive significance to the decision making process.

Table 49 summarise the impacts on New Business sales, multiplier effects and economic stimulation during the construction and operational phase of the PV Plant.

Table 49: Impacts on New Business sales, multiplier effects and economic stimulation

Impacts on new business, multiplier effects and economic stimulation during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	ss	Consequence	Significance
Alternative Site 1									
Without Mitigation	+ve	5	1	2	n/a	4	High	8	Med-Low
With Mitigation	+ve	5	1	3	n/a	4	High	9	Med-Low
Alternative Site 9									
Without Mitigation	+ve	5	1	2	n/a	4	High	8	Med-Low
With Mitigation	+ve	5	1	2	n/a	4	High	8	Med-Low
Cumulative Impact Not applicable									
Impacts on new business, multiplier effects and economic stimulation during operational	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	+ve	2	3	2	n/a	3	High	7	Low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alternative Site 9									
Without Mitigation	+ve	2	3	2	n/a	3	High	7	Low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cumulative Impact Not applicable									

8.8.2 Impact Assessment on Employment and Skills Transfer

The proposed employment opportunities from the development, and those that will arise from new business sales, albeit not all local, will be positive. Note that a job is defined as one person employed for one year. The construction period of this project is up to 18 months, and the peak construction period can be up to 6-8 months. In addition to employment, the proposed development also holds the potential for skills transfer. This impact is essentially relevant to the following phases:

- **Construction Phase**

  Quantification of the exact number of employment during the construction phase is difficult, as it depends on the level of skills and resources of the Contractor. Nonetheless, an indication of the possible figures are provided in order to put the size of the construction impact on employment into perspective. This is based on:

  - Previous experience in South Africa,
  - A study undertaken by the Department of Trade and Industry (which reveals an estimated 11 jobs per MW of installation (2013),

- A study undertaken by National Treasury, entitled 'Impact assessment of expenditure on 3725 MW renewable energy programme' which reveals a direct employment share of approximately 25% from PV power plants (2011), and
- Indications from Eskom regarding estimated man-days.

Based on size of employment per production from the Department of Trade and Industry (DTI, 2013), for the 25 MWp plant (Alternative Site 9), approximately 270 people can be expected to be employed during the construction period. Note however that this is total job creation (nationally and internationally) and includes, direct, indirect and induced jobs due to the multiplier effects. The localisation (South African) potential of jobs, based on the Department of Trade and Industries report (2013), however assumes a potential local job creation of 5.8 person per MWp. Based on the proposed 25 MWp plant, the total South African job creation can be assumed to be around 140 jobs during the construction period. The direct potential of jobs, based on the National Treasury report (2011), reveals an approximate 25% direct impact, which means that the direct employment is estimated at approximately 35 direct jobs. This is in line with the estimated man-days during the duration of the construction phase, namely 8100 man-days, which equates to approximately 33 man-year employment opportunities.

However, not all these employment opportunities are necessarily available for employment of local workforce within the immediate surrounds of the project. The actual number is also likely to vary based on final designs and size of the proposed project, as well as based on the level of skills and resources of the contractor. Nonetheless, even though the exact number of employment opportunities is not known, the construction of the proposed project will require a workforce, albeit limited, and therefore direct employment will be generated. This is therefore a positive social impact.

In terms of skills requirements, it is common that highly skilled or skilled labour such as engineers, technical staff and project managers will constitute about 30% of the work force; semi-skilled staff would typically be required to operate machinery and this will constitute about 10% of employees; while the remainder will be low skilled construction and security staff that will constitute about 60% of the work force. It is likely that some of the low skilled workforce could be employed from the surrounding area. The level of education in the ELM is poor which is linked to limited skills base. This is combined with a high level of unemployment. Although the more specialised tasks are likely to require skills from outside the Local Municipal area, there are potential opportunities for low skilled (construction and security workers) staff which would require associated training.

During the construction phase, the employment opportunities would be temporary in nature. The increased employment in the area will also result in increased expenditure, which will mean that more than just the proposed direct jobs required for the construction will be created due to the economic spin-offs. It is important to realise that the construction impact is experienced during the construction and development period. Thus, it is only sustainable for the duration of the development phase. Once the development phase nears its end, the construction impact will diminish.

The benefit of increased jobs can also be translated into economic terms. The additional jobs would in essence result in additional income creation. This increase in income in the area can be translated in a specific impact ranging from Broad Based Black Economic Empowerment (BBBEE) to poverty alleviation depending on the procurement policy and the construction technology applied.

In all likelihood, skills will be transferred in the form of on the job training during the construction phase. These skills will enable these individuals to seek other construction and related employment once the construction phase is complete. The construction related work opportunities could also lead to capacity building. Capacity building refers to the conscious increasing of knowledge, networking capability and the skills base.

- **Operational Phase**

  The operational phase of the Project will require a very small direct workforce, and it is probable that this could all be undertaken by existing Eskom staff. Routine activities would include operation of the solar Plant to produce power, and regular monitoring and maintenance activities to ensure safe and consistent operation. Maintenance would probably need to be carried out throughout the lifetime of the Solar Energy plant. Typical activities during maintenance include washing solar panels routinely and vegetation control and maintenance. Indirect and induced job creation potential, albeit very small, also exists from the increased energy production during the operation phase.

- **Decommissioning Phase**

  Due to the PV Plant being developed for the station's own consumption, the PV Plant will be decommissioned at the same time as the Duvha Power Station. It is anticipated that the decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning however for a limited period of time. Given the relatively small number of people to be employed during the operation phase, the social impacts at a community level associated with decommissioning are likely to be limited/negligible. In addition, potential impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme.

The impact assessment during the construction phase is assessed to be positive; low in intensity; medium in duration; national in extent; and medium or high probability depending on mitigation measures employed. The impact is assessed to be of a medium positive significance to the decision making process both with and without mitigation.

The impact assessment during the operation phase is assessed to be positive; minor in intensity; long-term in duration; national in extent; and medium probability. The impact is assessed to be of a low positive significance to the decision making process.

The impact assessment during the decommissioning phase is neutral without mitigation and positive with mitigation, minor in intensity; permanent in duration; local in extent; and medium probability. The impact is assessed to be of a low neutral significance to the decision making process with mitigation and low positive with mitigation.

Table 50 below summarise the impacts on Employment and Skills Transfer during the construction, operational and decommissioning phase of the PV Plant.

Table 50: Impacts on Employment and skills transfer

Impacts on employment and skills transfer during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	+ve	5	1	2	n/a	3	High	8	Med-low
With Mitigation	+ve	5	1	2	n/a	4	High	8	Med-low
Alternative Site 9									
Without Mitigation	+ve	5	1	2	n/a	3	High	8	Med-low
With Mitigation	+ve	5	1	2	n/a	4	High	8	Med-low
Cumulative Impact: None									
Impacts on employment and skills transfer during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	+ve	2	3	2	n/a	3	High	7	Low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alternative Site 9									
Without Mitigation	+ve	2	3	2	n/a	3	High	7	Low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cumulative Impact: None									
Impacts on employment and skills transfer during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	neutral	2	5	1	n/a	2	High	8	Low
With Mitigation	neutral	2	4	1	n/a	2	High	7	Very-low
Alternative Site 9									
Without Mitigation	neutral	2	5	1	n/a	2	High	8	Low
With Mitigation	neutral	2	4	1	n/a	2	High	7	Very-low
Cumulative Impact: None									

8.8.3 Impact Assessment on in-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure and services

Given the low employment during operations, this impact is essentially only relevant during the construction phase, which is temporary and estimated to last approximately 18 months.

The presence of the construction workers is however not expected to pose major potential risks to social networks in the area, specifically to the local community of Duvha and Speekfontein, in that the estimated workforce is not substantial. Demographic impacts include the number of new temporary residents associated with the development, the density and distribution of people and any changes in the composition of the population, (e.g. age, gender, ethnicity, wealth, income, occupational characteristics, educational level, health status, etc.). Development invites growth in new jobs in a community and draws new workers and their families into the community, either as permanent or temporary residents. When this occurs, the incoming population could affect the social environment in various ways including increased demand for housing and social services (e.g., health care, day care, education, recreational facilities).

While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves could affect the local community. An increase in population size can have a variety of social impacts, which ranges from impacts on individuals or households, to impacts on the community. These impacts, depending on the level of in-migration, can for example include:

- Impacts on individuals or households:
  - Reduced level of health;
  - Reduced mental health;
  - Increased stress, anxiety, alienation, apathy, depression;
  - Uncertainty about impacts, development opportunities, about own life as a result of social change;
  - Reduced actual personal safety, increased hazard exposure; and
  - Reduction in perceived quality of life (subjective wellbeing).
- Impacts at community level
  - Reduced adequacy of infrastructure (water supply, sewerage, services and utilities);
  - Reduced adequacy of community social infrastructure, health, welfare and education facilities;
  - Reduced adequacy of housing; and
  - Increased workload on institutions.

The impact of in-migration as a direct result of the proposed development is expected to occur on a minimal scale during the construction phases of the proposed

development. During the construction phase, it is also expected that there will be an increase of (temporary) construction workers moving into the area. It should be mentioned, however, that in environments where housing and employment opportunities are a scarce resource, it is difficult to mitigate the impact of in-migration.

The construction phase is expected to extend over a period of 18 months, and depending on the final design and contractor's appointment, is expected to create approximately 35 direct employment opportunities. Of this, slightly more than half is expected to be available for low-skilled workers (construction labourers, security staff etc.). Depending on the contractors and their use of local labour, it is reasonable to assume that some of the low skilled workers, could be sourced locally. Employing members from the local community to fill the semi and low-skilled job categories will reduce the risk posed by construction workers to local communities.

While the estimated construction workers from outside, which could be all of the required workforce, is overall likely to be low, the potential threat posed by construction workers to the community as a whole is also likely to be low. However, the impact on individual members who are affected by the behaviour of construction workers has the potential to be high, specifically if they are affected by Sexually Transmitted Diseases (STDs), etc.

The degree to which society is disrupted largely depends on the level of local employment achievable and in the case of this proposed development, a portion of the workforce could potentially be sourced locally. Nonetheless, the overall number of workforce required is not significant.

The impact assessment during the construction phase is assessed to be minor in intensity without mitigation; short-term in duration; local in extent; and a medium probability without mitigation. The impact is assessed to be of a low negative significance to the decision making process without mitigation and with mitigation low negative to neutral.

Table 51 summarises the impacts on In-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure during the construction of the PV Plant.

Table 51: Impacts on in-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure

Impacts on employment and skills transfer during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	2	n/a	3	High	5	Low
With Mitigation	-ve	2	1	2	n/a	1	High	5	Very-low
Alternative Site 9									
Without Mitigation	-ve	2	1	2	n/a	3	High	5	Low
With Mitigation	-ve	2	1	2	n/a	1	High	5	Very-low
Cumulative Impact. No other developments are planned in the area so the potential for this to be exacerbated is limited.									

8.8.4 Impact Assessment on health, safety and security

The influx of workers into the area especially non-local job seekers could lead to a temporary increase in the level of crime during the construction phase. Apart from everyday safety and security concerns, it is normal during most construction phases and construction activities to experience an increase of persons in search of employment.

An increase in traffic can be expected from the rise in construction vehicles, especially considering that with peak delivery, up to fifty (50) additional vehicles can be expected to operate on site during the material delivery and construction process. Note however that the material delivery vehicles will not be there all the time during the construction period. It can be assumed that the majority of trucks for delivering materials will run during the first 2-6 months of the construction period. Furthermore, on average approximately 10-15 trucks per day can be expected during first 2-4 months of period. After the material delivery period, 3-5 trucks per day can be expected during the remaining construction period, namely 6 to 18 months.

The proposed sites are accessible via the Old Bethal Road which is accessible from the R544 which connects up with the N12 and the N4. The movement of construction related activities along the Old Bethal Road does have the potential to impact other road users, albeit minimally so.

Other safety concerns evident during the construction phase, relate to the physical nature of the actual construction labourers as they undergo health and safety risks. These include:

- Over exposure to the sun;
- Heat stroke and exhaustion;
- Dehydration;
- Risk of slipping and falling from structures; and
- Risk of injuries while operating heavy machinery/vehicles.

The impact assessment during the construction phase is assessed to be low in intensity without mitigation; short-term in duration; local in extent; and a low probability without mitigation. The impact is assessed to be of a low negative significance to the decision making process without mitigation and with mitigation low negative to neutral.

The impact assessment during the operation phase is assessed to be minor in intensity without mitigation; long-term in duration; local in extent; and a low probability without mitigation. The impact is assessed to be of a low negative significance to the decision making process without mitigation and neutral with mitigation.

Table 52 below summarise the impacts on health, safety and security during the construction and operational phase of the PV Plant.

Table 52: Impacts on Health Safety and Security

Impacts on health, safety and security during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	2	2	n/a	2	High	6	Very-low
With Mitigation	-ve	2	2	1	n/a	1	High	5	Very-low
Alternative Site 9									
Without Mitigation	-ve	2	2	2	n/a	2	High	6	Very-low
With Mitigation	-ve	2	2	1	n/a	1	High	5	Very-low
Cumulative Impact	Opportunity to upgrade and improve knowledge and skills transfer in the area								
Impacts on health, safety and security during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	n/a	3	High	7	Very-Low
With Mitigation	-ve	2	3	1	n/a	1	High	6	Very-low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	n/a	3	High	7	Very-Low
With Mitigation	-ve	2	3	1	n/a	1	High	6	Very-low
Cumulative Impact Not applicable									

8.8.5 Impact Assessment on nuisance, noise, and other disruptions and change in quality of living environment

Social impacts experienced in the physical environment relate to exposure to dust, noise, odour, vibration, and artificial light. The impacts related to the quality of the living environment refer to how appropriate, from a social point of view, the study area is to live in. These impacts relate directly to the biophysical environment and are assessed according to both a perceived and actual dimension. This impact is essentially relevant to the construction phase. Visual impacts on the physical environment are addressed separately in section 8.8.6.

Impacts associated with construction related activities include noise, dust and disruption to adjacent properties. Noise in this regard can be described as any loud, unpleasant or disagreeable sounds that occur as a result of demolishing activities, transport and movement and construction. These noises can be of great irritation to those residing close to the proposed site.

Site clearing for the PV Plant will increase the risk of dust being generated, which can in turn impact on adjacent properties. The potential impacts can be addressed by implementing effective mitigation measures.

The movement of heavy construction vehicles during construction phase also has the potential to create noise, damage to roads and dust. The primary sources of noise during construction would be from the construction equipment and vehicles.

Generation of dust would come from construction activities. Short-term increases in the use of local roads would occur during the construction period. However, heavy equipment would most likely remain at the site for the construction period.

The noise pollution can have a nuisance impact on economic activity at Corobrik, as well as to those working and living around the construction site. The noise could also influence concentration of learners while doing homework and studying from home. Some disruptions in quality of living environment for the nearby Speekfontein residents as well as immediately surrounding farms and landowners could also be expected, albeit of a low magnitude and mostly nuisance related.

In terms of noise impact, the National Noise Regulations define an increase of 7 dB as disturbing. It is therefore advised that noise levels be kept within 7 dB. Noise reduction is essential and contractors must endeavour to limit unnecessary noise, especially loud talking, shouting, whistling, radios, sirens, hooters of vehicle revving, etc.

As such, during the construction phase, it is expected that there will be a decrease in the quality of the physical environment, albeit of a low magnitude. Noise levels, traffic volumes, dust, etc will increase as result of the construction activities.

The impact assessment during the construction phase is assessed to be low in intensity without mitigation; short-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a medium negative significance to the decision making process without mitigation and low negative with mitigation.

Table 53 summarise the impacts of nuisance, noise, and change in quality of living during the construction phase of the PV Plant.

Table 53: Impacts of Nuisance, noise and change in quality of living

Impacts of nuisance, noise, and change in quality of living during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	4	n/a	4	High	7	Low
With Mitigation	-ve	2	1	2	n/a	3	High	5	Low
Alternative Site 9									
Without Mitigation	-ve	2	1	4	n/a	4	High	7	Low
With Mitigation	-ve	2	1	2	n/a	3	High	5	Low
Cumulative Impact: none									

8.8.6 Impact Assessment on visual and land use patterns alteration and change in sense of place and others spatial consideration

The sense of place is developed over time as the surrounding community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture and heritage. Importantly though it is a subjective matter and

is dependent on the demographics of the population that resides and works in the area and their perceptions regarding trade-offs.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in and visual impact of the proposed PV Plant. Note, however, that the project is located next to an operational large coal-fired power station. This activity dominates the landscape and sense of place.

This impact is essentially relevant to the following phases:

- **Construction phase**
  The construction activities will cause noise and disruptions from vehicles and machinery. These activities will alter the existing land use patterns on the site from currently vacant no use to construction related activities which have a visual impact, but will be overshadowed by the adjacent power station activities.

  The construction phase will see a total transformation from the current setting and landscape of the proposed sites. It is inevitable that the visual impact during the construction phase will be affected by dust, peak of 50 vehicles, etc. Potential visual impacts caused by construction activities will include the visual changes brought about by clearance of vegetation for the solar field, ancillary buildings and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, power lines, increased traffic (and number of large vehicles), worker presence, and dust emissions. Other visual disturbances may include soil stockpiles (from excavation for building foundations and other structures), soil scars, as well as potential for invasive plant species to develop on disturbed soils and soil stockpiles, which may contrast with existing vegetation.

- **Operational phase**
  There are a number of components of the proposed Plant that will potentially cause visual intrusion on views of sensitive visual receptors in the area during the 25 year operational lifetime of the Plant. The solar panels will likely be the most significant of these as the area they will cover is large area. Even though the PV panels to be utilised are designed with tempered glass to transmit light, and have low reflectivity, the glint from the PV panels will still be present. The contrast between the solar field and surrounding vegetation will exist, in colour, form, line and texture. Existing vegetation will not provide much screening since it consists mostly of low bushes and shrubs, or grass.

  The following sensitive viewers or viewpoints will be exposed to the PV Plant:
  - Residents;
  - Viewpoints on surrounding farms;
  - Surrounding scholars from Duvha Primary;
  - Tourists/visitors/residents at Witbank dam; and
  - Motorists using main roads in the region.

Scholars, tourists or users of Witbank dam, and agricultural land uses have a greater risk of being affected visually during operation. With regards to residents note that the expected glint, from the low reflectivity, will be orientated north facing and fortunately residents from Speekfontein are not north of the proposed site.

With regards to motorists, high visual exposure for motorists exists. The PV panel arrays will be in full view and existing vegetation does not provide much screening for the development. However motorists are more focused on the road than the surrounding landscape. Motorists thus have a lower sensitivity due to short exposure time and the fact that their focus on landscape is reduced.

The impact associated with solar energy is relatively low due to the relatively low height of solar PV panels and associated infrastructure and the relatively low reflectivity. Note that the visual integrity of the area has also been impacted by the existing Duvha Power station and its infrastructure. At a broader level the visual integrity of the area has been negatively impacted by the power station and its associated infrastructure.

- **Decommissioning phase**
  Immediate visual impacts during decommissioning will be similar to those caused during construction of the PV Plant, but of a much shorter duration. Impacts may include road redevelopment, removal of aboveground structures and equipment, movement and activities of workers, increased traffic, dust emissions and presence of dismantled equipment. Rehabilitation of the decommissioned site could entail grading, scarifying, seeding and planting. Disturbed and rehabilitated areas may take a long time to recover to pre-project conditions, and contrast between existing and newly planted vegetation may persist many seasons.

  Decommissioning and removal of the PV Plant will include all of the structures for PV and buildings and related concrete foundations. Reversibility of the visual impact is therefore moderate to high, keeping in mind that it may take several years for the vegetation to fully recover.

The impact assessment during the construction phase is assessed to be low in intensity without mitigation; short-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a medium negative significance to the decision making process without mitigation and low negative with mitigation.

The impact assessment during the operation phase is assessed to be low in intensity without mitigation; long-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a medium negative significance to the decision making process without mitigation and low negative with enhancement. The impact is assessed as being low in intensity as much of the impact is already screened to the large number of households from Rietkuil, but there are immediate adjacent property owners impacted visually. With mitigation suggestions, the impact is only low negative.

The impact assessment during the decommissioning phase is assessed to be low in intensity without mitigation; short-term in duration; local in extent; and a medium probable without mitigation. The impact is assessed to be of a low negative significance to the decision making process without mitigation. With mitigation a permanent improvement to visual impact could results from the decrease in visual intrusion.

Table 54 summarises the impacts on visual and land use patterns alteration and change in sense of place and spatial consideration during the construction, operation, and decommissioning phase of the PV Plant.

Table 54: Impacts on visual, land use patterns alteration and change in sense of place and spatial consideration

Impacts on visual, land use patterns, change in sense of place and others spatial consideration during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	2	n/a	4	High	5	Low
With Mitigation	-ve	2	1	2	n/a	3	High	5	Low
Alternative Site 9									
Without Mitigation	-ve	2	1	2	n/a	4	High	5	Low
With Mitigation	-ve	2	1	2	n/a	3	High	5	Low
Cumulative Impact:Not-applicable									
Impacts on visual, land use patterns, change in sense of place and others spatial consideration during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	n/a	4	High	7	Low
With Mitigation	-ve	2	3	1	n/a	4	n/a	7	Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	n/a	4	High	7	Low
With Mitigation	-ve	2	3	1	n/a	4	n/a	7	Low
Cumulative Impact:None									
Impacts on visual, land use patterns, change in sense of place and others spatial consideration during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	4	2	n/a	3	High	8	Low
With Mitigation	-ve	2	4	2	n/a	3	High	8	Low
Alternative Site 9									
Without Mitigation	-ve	2	4	2	n/a	3	High	8	Low
With Mitigation	-ve	2	4	2	n/a	3	High	8	Low
Cumulative Impact: none									

8.8.7 Impact on the tourism and aesthetics

The tourism sector is regarded as one of the key economic sectors in the Mpumalanga Province. The Witbank dam and Nature Reserve (one of the main holiday resorts in the area) is located in close proximity to the proposed Solar Energy Plant which poses a potential visual risk to tourism activities. The dam is used for camping, water-sports and animal viewing, although the area has been negatively affected by degradation of facilities.

This impact is essentially relevant to the following phases:

- **Construction Phase**
  The construction activities will cause visual impact to potential tourists, as 35 ha will be subject to construction intensive activities for at least 18 months. The impact on declining tourism appeal will be higher than for other visual receptors.

- **Operation Phase**
  The visual quality of the area has already been altered by the existing power plant and related infrastructure which is visible from the Witbank dam. The PV Plant is likely to appeal to certain tourists and positive impacts are likely to be of a short term nature and of a low significance. Besides potential benefits through viewing the facility, it also has the potential to contribute to the potential to enhance the 'sustainable tourism' or 'eco-friendly' brand of the area.

  Considered as a whole, the key potential drivers of negative tourism impacts (primarily visual impacts) seem to imply a low level of risk for tourism with mitigation. In the short term, whilst novel, it is possible that this risk would be somewhat off-set by the positive attraction provided by the project, as well as by the existing visual disturbance caused by the Duvha power plant and its associated infrastructure. Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts.

- **Decommissioning Phase**
  Decommissioning would essentially result in the removal of tourism risks with adequate rehabilitation of the site resulting in an impact on tourism with a low positive significance. The short-term actions related to decommissioning could negatively impact on tourists perceptions which could be similar to construction of the facility, but of a much shorter duration.

8.8.7.1 Impact Summary

The impact assessment during the construction phase is assessed to be medium in intensity without mitigation; short-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a low negative significance to the decision making process without enhancement and very low negative with enhancement.

The impact assessment during the operation phase is assessed to be medium in intensity without mitigation; long-term in duration; local in extent; and a highly probable

without mitigation. The impact is assessed to be of a low negative significance to the decision making process without enhancement and very low negative with enhancement.

The impact assessment during the decommissioning phase is assessed to be low in intensity without mitigation; short-term in duration; local in extent; and a medium probable without mitigation. The impact is assessed to be of a low negative significance to the decision making process without enhancement and low positive with enhancement.

Table 55 summarises the impacts on tourism and aesthetics during the construction, operation, and decommissioning phase of the PV Plant.

Table 55: Impacts on tourism and aesthetics

Impacts on tourism and aesthetics during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	3	n/a	4	High	6	Low
With Mitigation	-ve	2	1	1	n/a	3	High	4	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	1	3	n/a	4	High	6	Low
With Mitigation	-ve	2	1	1	n/a	3	High	4	Very Low
Cumulative Impact: Not-applicable									
Impacts on tourism and aesthetics during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	3	n/a	3	High	8	Low
With Mitigation	-ve	2	3	2	n/a	2	n/a	7	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	3	n/a	3	High	8	Low
With Mitigation	-ve	2	3	2	n/a	2	n/a	7	Very Low
Cumulative Impact: None									
Impacts on tourism and aesthetics during decommissioning	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	2	n/a	3	High	5	Low
With Mitigation	+ve	2	4	2	n/a	3	High	8	Low
Alternative Site 9									
Without Mitigation	-ve	2	1	2	n/a	3	High	5	Low
With Mitigation	+ve	2	4	2	n/a	3	High	8	Low
Cumulative Impact: None									

8.8.8 Development of clean renewable energy

Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy and climate change targets.

Growth in the solar energy sector in the area could also introduce skills and development into the area. The development of a PV Plant could therefore add to the stability of the economy, and even though this project is small scale in comparison to the overall potential of the sector, it could contribute to the local economy.

The impact assessment during the operation phase is assessed to be moderate in intensity with mitigation not being possible, long-term in duration; international in extent; and a highly probable. The impact is assessed to be of a medium positive significance to the decision making process without mitigation.

Table 56 summarises the impacts on energy production during the operation phase of the PV Plant.

Table 56: Impacts on the energy production

Impacts on Duvha Residents during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	+ve	5	3	3	n/a	4	High	11	Med-low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alternative Site 9									
Without Mitigation	+ve	5	3	3	n/a	4	High	11	Med-low
With Mitigation	+ve	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cumulative Impact: Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming									

8.8.9 Impact assessment on the Duvha Primary School

Directly to the West of the centre of the proposed Alternative Site 1 approximately 1 km is the Duvha Primary school. The Duvha Primary School is situated to the North West of the proposed Alternative Site 9, approximately three 3 km of the proposed site.

The Duvha primary school was established in 1982 and the power station developed available facilities. The Duvha Primary School currently has approximately 465 primary school going pupils.

The Duvha Primary school is likely to be impacted during the following phases:

- **Construction phase**

  Construction activities will cause noise, nuisance, dust, visual disturbance etc which could impact the scholars. The school is located close to the proposed construction activity and construction vehicles, construction workers, and construction activities pose a threat to the safety of learners. Construction related

noise and dust pollution can have an effect on school activities as it could cause lack of concentration and as a result lack of productivity, as well as influencing concentration of learners while doing homework and studying. This impact is only temporary since safety and noise pollution will only be evident during the construction phase.

- **Operation phase**

  During operation of the proposed site, approximately 35 ha of property will be occupied by the PV plant.

  Alternative Site 1 could potentially cause disturbance to school activities from the glint, albeit that the panels are designed with low reflectivity this is a potential concern to be noted. Should the solar plant be located on Alternative Site 9, glint from the solar plant is not expected to impact on the school, although since the school is located North West from Site 9, the possibility could exist that glint could still affect scholars.

  Other than potential impact from the glint, which can be mitigated to acceptable levels, no other negative impact on the school is expected during operation. There is also the potential positive impact in that scholars are able to learn more regarding renewable energy from actual practical experience.

The impact assessment during the construction phase is assessed to be high in intensity without mitigation; short-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a low negative significance to the decision making process without enhancement and low negative with enhancement.

The impact assessment during the operation phase is assessed to be low in intensity without mitigation; long-term in duration; local in extent; and a highly probable without mitigation. The impact is assessed to be of a low negative significance to the decision making process without enhancement and very low negative with enhancement.

Table 57 summarises the impacts on the Duvha Primary School during the construction, operation, and decommissioning phase of the PV Plant.

Table 57: Impacts on Duvha Primary School

Impacts on the Duvha Primary during construction	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	1	4	n/a	4	High	7	Low
With Mitigation	-ve	2	1	3	n/a	3	High	6	Low
Alternative Site 9									
Without Mitigation	-ve	2	1	4	n/a	4	High	7	Low
With Mitigation	-ve	2	1	3	n/a	3	High	6	Low

Cumulative Impact: Not-applicable									
Impacts on the Duvha Primary during operation	Nature	Extent	Duration	Intensity	Potential for irreplaceable loss of	Probability	Confidence	Consequence	Significance
Alternative Site 1									
Without Mitigation	-ve	2	3	2	n/a	4	High	7	Low
With Mitigation	-ve	2	3	1	n/a	2	n/a	6	Very Low
Alternative Site 9									
Without Mitigation	-ve	2	3	2	n/a	4	High	7	Low
With Mitigation	-ve	2	3	1	n/a	2	n/a	6	Very Low

8.8.10 Impact Summary

From a social perspective it is concluded that both positive and negative social impacts have been identified. The proposed development is unlikely to result in any permanent damaging social impacts. It is therefore recommended that proposed r PV Plant be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the report.

8.8.11 Comparative Assessment

With regards to site alternatives, for the majority of the impacts there is no difference in impact between Alternative Site 1 and 9 as both are situated and land parcel sizes which are relatively equal in size similar capital expenditure, expected energy production, expected employment creation, etc.

From a social perspective, Site Alternative 9 is slightly preferable to Site Alternative 1 as it is less disruptive on the Adjacent Duvha Primary School during both the construction phase and during operations.

8.8.12 Mitigation Measures

The following mitigation measures are recommended to limit the negative impacts and enhance the positive impacts during all phases of the construction phase:

New business sales and economic stimulation:

- It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy;
- Eskom should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. Construction companies, security etc.) Prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;

- To source as much good and services as possible from the local area; engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible;
- It is furthermore suggested that all the employees should be motivated to spend their earned income locally. This can be achieved by ensuring that the goods and services required by the employees are provided locally (if possible), so that they do not need to spend their money elsewhere. This would be the responsibility of local shop owners, which are currently limited in the immediate surroundings;
- Eskom, or the contractors appointed, in consultation with the local municipality and local Chamber of business, should identify strategies aimed at maximising the potential benefits associated with the project.

Employment and skills transfer:

- Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area;
- Opportunities for training of workers should be maximised;
- Ways to enhance local community benefits with a focus on broad based BEE need to be explored;
- Local construction companies should be used whenever possible, especially for subcontracting work;
- Local suppliers should be used as far as possible;
- Labour based construction methods should be used whenever practically possible. It is important to follow the principles of the Expanded Public Works Programme and apply effective labour-based construction technologies in order to increase the job creation effects;
- The use of local labour should be approached in such a manner that large numbers of local residents can benefit from this action rather than only a select few;
- Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

In-migration of temporary workers and effect on social dynamics of area and increased pressure on socio-economic infrastructure and services:

- Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc);
- Local, unemployed labour should be employed as far as possible;

- Accommodation for non-local members of the workforce, should as far as practically possible be arranged so that unskilled labourers are not left to their own device in which case non-local labourers are likely to accommodate themselves in Speekfontein;
- Only semi-permanent structures should be allowed on site such as guard houses for security personnel; temporary site offices, ablution units etc.
- Where possible, Eskom should consider to make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;
- The use of existing forums of the Power Station should be used to monitor the construction phase, monitor the implementation of the recommended mitigation measures, and develop a code of conduct for the construction phase;
- The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
- Where possible the contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed.;
- An employee induction programme should be considered to issues such as HIV/ AIDS and TB as well as alcohol and substance abuse. The induction should also address a code of conduct for employees that would align with community values.

Health, safety and security phase:

- Safety at and around the construction site should be ensured by limiting any risks, fencing off the construction area to avoid unauthorised access and employing security personnel;
- Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the presence of an outside workforce and influx of people;
- Working hours should be kept between 6 am and 6 pm;
- The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction period;
- No unauthorised entry to the site is to be allowed; access control and a method of identification of site personnel are required at all times;

- Security lighting should be implemented;
- The contractor must ensure that open fires on the site for heating, smoking or cooking are not allowed except in designated areas;
- A comprehensive employee induction programme would cover land access protocols, road safety, etc;
- All vehicles must be road worthy and drivers must be qualified and made aware of the potential road safety issues and follow the speed limits;
- Risks that labourers undergo during the construction of the proposed development can be minimised by ensuring that proper safety gear are administered and safety precautions are taken. Basic concepts and information should be communicated to labourers so that they are well informed of the risks of over exposure to the sun and stay hydrated throughout the construction phase;
- To minimise the risk of petty crime and violent behaviour, proper procedures such as screening prior to hiring should be undertaken, and proper monitoring procedures should be adhered to during this phase;
- Design, implement and enforce an appropriate Safety, Health and Environment programme that includes the use of Personal Protective Equipment to ensure the well-being of workers;
- Establish a code of conduct for construction workers with strict control measures;
- Liaise with the South African Police Services in order to implement effective crime prevention strategies
- Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance.
- Aim to appoint as many locally unemployed from Speekfontein to lessen risk of unacceptable social behaviour

Nuisance, noise, disruptions, dust and change in quality of living environment:

- The contractor must ensure that damage caused by construction related traffic to access roads is repaired;
- Dust suppression measures must be implemented;
- Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.
- Residents from Speekfontein and Duvha Park in close proximity to the development site should be notified 24 hours prior to any planned activities that will be unusually noisy, such as blasting activities if undertaken.
- Existing landowners forums from the Duvha Power Station could serve as liaison between the affected stakeholders and the developer and can discuss traffic, dust, noise and other construction related concerns;

- Construction related activities should be limited to work days (Monday to Saturday daylight hours) and the impact on traffic patterns should be mitigated by instating traffic off-peak times.

Impact of visual and land use patterns alteration:

- Erosion risks should be assessed and minimised as erosion scarring can create areas of strong visual contrast which can often be seen from long distances;
- Laydown areas and stockyards should be located in low visibility areas and existing vegetation should be used to screen them from views where possible;
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency.

Tourism and aesthetics during construction:

- Night lighting of the construction sites should be minimised within requirements of safety and efficiency;
- Dust generation should be minimised as much as possible as this can also increase the visibility of the construction phase.

Impact on Duvha Primary School during the construction phase:

- Dust and noise generation should be minimised as much as possible;
- Traffic calming measures should be put in place to deter any unnecessary through-traffic through the surrounding school environs;

8.9 IMPACT ASSESSMENT ON THE NO PROJECT ALTERNATIVE

The No-go alternative will have a neutral impact on heritage, flora, fauna and wetland ecology as the status quo will remain. This will be the same for soils and agricultural potential. The impacts of pursuing the No-go alternative will have both positive and negative impacts for the Social environment, this is highlighted as follows:

- There would be an opportunity loss in terms of contributing to the renewable energy targets nationally. The impact is therefore negative.
- There would also be an opportunity loss in terms of job creation, skills development and associated economic multipliers for the local economy. The impact is therefore negative.

The no-go development option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a high negative impact. Foregoing the proposed Duvha solar PV energy Plant would not necessarily compromise the development of

renewable energy facilities in South Africa. However, the socio-economic benefits for local communities in Rietkuil and Steve Tshwete Local Municipality would be forfeited.

9. ENVIRONMENTAL IMPACT STATEMENT

While the project was assessed holistically, it is acknowledged that the impacts associated with the PV Plant have different degrees of significance. The impacts evaluated in Chapter 8 of this report will be summarised in order to assess whether the project should go ahead or not, identify key mitigation measures and the preferred alternative.

9.1 HERITAGE

As no sites, features or objects of cultural heritage significance have been identified within Alternative Site 1 or 9, there would be no impact as a result of the proposed PV Plant.

From a heritage point of view it is recommended that the proposed PV Plant can continue on either Alternative Site 1 or 9.

9.2 FLORA

There are three possible impacts on flora within the Alternative Site 1 and 9. The most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced to low to very low significance impacts. **Table 58** present a summary of anticipated ecological impacts for Alternative Site 1 and 9.

Table 58: Summary of floral impact assessment

Construction phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Low	Very Low
2: Impact on floral diversity	Low	Very Low
3: Impact on floral SCC	Low	Very Low
Operational phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Low	Very Low
2: Impact on floral diversity	Low	Very Low
3: Impact on important species	Low	Very Low
Decommissioning phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Low	Very Low
2: Impact on floral diversity	Low	Very Low
3: Impact on important species	Low	Very Low

There is no difference in impact floral resources anticipated for any of the alternative sites associated with the proposed PV Plant. However, Alternative Site 1 is anticipated to have the least significant impact on ecological resources, due to Alternative Site 9 being in closer proximity to wetlands, and as such is supported from an ecological perspective.

9.3 FAUNA

There are three possible impacts fauna a within the Alternative Site 1 and 9. The most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced to low to very low significance impacts. **Table 59** present a summary of anticipated ecological impacts for Alternative Site 1 and 9.

Table 59: Summary of faunal impact assessment

Construction phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on faunal habitat and ecological structure	Med-Low	Low
2: Impact on faunal diversity and ecological integrity	Med-Low	Low
3: Impact on potential faunal SCC	Low	Very Low
Operational phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on faunal habitat and ecological structure	Low	Very Low
2: Impact on faunal diversity and ecological integrity	Low	Very Low
3: Impact on potential faunal SCC	Very Low	Very Low
Decommissioning phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on faunal habitat and ecological structure	Med-Low	Low
2: Impact on faunal diversity and ecological integrity	Med-Low	Low
3: Impact on potential faunal SCC	Low	Very Low

There is no difference in impact on faunal resources anticipated for any of the alternative sites associated with the proposed PV Plant. However, Alternative Site 1 is anticipated to have the least significant impact on ecological resources, due to Alternative Site 9 being in closer proximity to wetlands, and as such is supported from an ecological perspective.

9.4 AVIFAUNA

There are three possible impacts on avifauna within the Alternative Site 1 and 9. The most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced to low to very low significance impacts. **Table 60** present a summary of anticipated ecological impacts for Alternative Site 1 and 9.

Table 60: Summary of avifauna impact assessment

Construction phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on avifauna habitat and ecological structure	Med-Low	Low
2: Impact on avifauna diversity and ecological integrity	Med-Low	Low
3: Impact on potential avifauna SCC	Low	Very Low
Operational phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on avifauna habitat and ecological structure	Low	Very Low
2: Impact on avifauna diversity and ecological integrity	Low	Very Low

3: Impact on potential avifauna SCC	Very Low	Very Low
Decommissioning phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on avifaunal habitat and ecological structure	Med-Low	Low
2: Impact on avifaunal diversity and ecological integrity	Med-Low	Low
3: Impact on potential avifauna SCC	Low	Very Low

There is no difference in impact on avifaunal resources anticipated for any of the alternative sites associated with the proposed PV Plant. However, Alternative Site 1 is anticipated to have the least significant impact on ecological resources, due to Alternative Site 9 being in closer proximity to wetlands, and as such is supported from an ecological perspective.

9.5 WETLAND ECOLOGY

There are three possible impacts on the wetland ecology within the Alternative Site 1 and 9. The most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced to low to very low significance impacts. **Tables 61** present a summary of anticipated ecological impacts for Alternative Site 1 and 9.

Table 61: Summary of the wetland impact assessment

Construction phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on the loss of wetland habitat and ecological structure	Low	Low
2: Impact on the changes to wetland ecological service provision	Low	Very-Low
3: Impact on wetland hydrological function and sediment balance	Low	Very-Low
Operational phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on the loss of wetland habitat and ecological structure	Very Low	Very-Low
2: Impact on the changes to wetland ecological service provision	Very Low	Very-Low
3: Impact on wetland hydrological function and sediment balance	Very Low	Very-Low
Decommissioning phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
1: Impact on the loss of wetland habitat and ecological structure	Low	Low
2: Impact on the changes to wetland ecological service provision	Low	Very-Low
3: Impact on wetland hydrological function and sediment balance	Low	Very-Low

There is no difference in impact on wetland resources anticipated for any of the alternative sites associated with the proposed PV Plant. However, Alternative Site 1 is anticipated to have the least significant impact on ecological resources, due to Alternative Site 9 being in closer proximity to wetlands, and as such is supported from an ecological perspective.

9.6 SOILS AND AGRICULTURAL POTENTIAL

Although the sites under investigation both potentially have soils suitable for agriculture, the sites are both on Eskom's power station property which is a National

Key Point and not available for agricultural development. Assessing agriculture as an alternative land use is therefore irrelevant.

Once the Duvha Power Station and PV Plant have been decommissioned the land can be returned to more or less a natural state following rehabilitation.

There is no significant difference in impact on soil and agricultural resources for any of the alternative sites associated with the proposed PV Plant. From a soils and agricultural point of view it is recommended that the proposed PV Plant can continue on either Alternative Site 1 or 9.

9.7 SOCIAL IMPACT ASSESSMENT

With regards to site alternatives, for the majority of the impacts there is no difference in impact between site 1 and 9 as both are situated and land parcel sizes which are relatively equal in size similar capital expenditure, expected energy production, expected employment creation, etc.

The following aspects however count more favourably for Alternative Site 1:

- Alternative Site 1 could pose slightly less visual disruptions to Witbank dam users as it is situated in between the cooling towers and the slimes dams in terms of the visual line of sight from Bakenveld and will thus not visually widen the area already disturbed. Comparatively, Alternative Site 9 will add to the size of the area visually disturbed.
- To immediate north of Site Alternative 1 is the slimes dams which will curb some glare effects during operation.

The following aspects however count more favourably for Alternative Site 9:

- Alternative Site 9 might require additional security as it is not situated within the already fenced off area of the Duvha Power Station.
- Alternative Site 9 poses slightly less visual disruptions to scholars than compared to Alternative Site 1 which is nearby scholars and Corobrik.
- Site 9 is situated slightly further away from Witbank dam
- With regard to the impact on Duvha Park Primary, site 9 is preferred as the site is located further away than site 1 from the school.

Table 62 presents a summary of anticipated social impacts for Alternative Site 1 and 9.

Table 62: Summary of the Social Impact Assessment

Construction phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
Impact on new business sales, multiplier effects and economic stimulation	Med-Low	Med-Low
Impact on employment and skills transferal	Med	Low

Impact on in-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure	Low	Very Low
Impacts on health, safety and security	Very Low	Very Low
Impacts on nuisance, noise, other disruption and change in quality of living environment	Low	Low
Visual and land use patterns alteration impacts and change in sense off special and other spatial considerations	Low	Low
Impacts on Tourism and Aesthetics	Low	Low
Impacts on Duvha Primary School	Low	Very Low
Development of Clean renewable energy	Med-Low	n/a
Operational phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
Impact on new business sales, multiplier effects and economic stimulation	Low	n/a
Impact on employment and skills transferal	Low	n/a
Impact on in-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure	Low	Very Low
Impacts on health, safety and security	Very Low	Very Low
Impacts on nuisance, noise, other disruption and change in quality of living environment	Low	Low
Visual and land use patterns alteration impacts and change in sense off special and other spatial considerations	Low	Low
Impacts on Duvha Primary School	Very Low	Very Low
Development of Clean renewable energy	Med-Low	n/a
Decommissioning phase: Alternative Site 1 and 9		
Impact	Unmanaged	Managed
Impact on new business sales, multiplier effects and economic stimulation	Med-Low	Med- Low
Impact on employment and skills transferal	Low	n/a
Impact on in-migration and effect of temporary workers on social dynamics and increased pressure on socio-economic infrastructure	n/a	n/a
Impacts on health, safety and security	Low	n/a
Impacts on nuisance, noise, other disruption and change in quality of living environment	n/a	n/a
Visual and land use patterns alteration impacts and change in sense off special and other spatial considerations	Low	Low
Impacts on Duvha Residents	n/a	n/a
Development of Clean renewable energy	n/a	n/a

From a social perspective, Alternative Site 9 is slightly preferable to Site Alternatives 1 as it is less disruptive on the Adjacent Duvha Primary School during both the construction phase and during operations. Both positive and negative social impacts have been identified. The site alternatives have different land sizes with consequent different capital expenditure, employment creation and different energy generation.

9.8 CONSIDERATION IN IDENTIFICATION OF PREFERRED ALTERNATIVE

In order to identify the preferred alternative the EAP evaluated all the recommendations and impact assessments determined by the respective specialists. With implementation of mitigation measures recommended by the specialists'

studies, the construction, and operation and decommissioning phases of the PV Plant is reduced to very low impacts.

Alternative Site 1 is anticipated to have the least significant impact on ecological resources due to Alternative Site 9 being in close proximity to the depression wetland. Alternative Site 9 is slightly preferable from a social perspective as its location provides the least negative impacts. However with the implementation of the mitigation measures proposed, the difference of impact between Alternative Site 1 and 9 become negligible from a social perspective.

Based on the above, Alternatives Site 1 is recommended as the preferred site for the development of the PV Plant.

10. CONCLUSION

The main aim of the proposed PV facility at Eskom's Duvha Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint. This is regarded as an important contribution to meeting national renewable energy and climate change targets. The concept of a solar energy project is also supported in local economic planning documents.

As per the requirements of the NEMA (Act 107 of 1998), this EIA has identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV facility. Alternative Site 1 is anticipated to have the least significant impact on ecological resources due to Alternative Site 9 being in close proximity to the depression wetland. Alternative Site 9 is slightly preferable socially as its location provides the least negative impacts. However with the implementation of the mitigation measures proposed, the difference of impact between Alternative Site 1 and 9 become negligible from a social perspective.

Based on the above, Alternatives Site 1 is recommended as the preferred site for the development of the PV facility.

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