



EON Consulting

Waterval Solar Park:

Draft Environmental Impact
Assessment Report

DEA #: 14/12/16/3/3/2/825

20 March 2016

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1. Executive Summary

This Draft Environmental Impact Assessment Report (EIAR) has been compiled by EON Consulting on behalf of TFS Solar (Pty) Ltd, in response to the undertaking of the proposed construction of facilities for a renewable energy plant consisting of 200 Ha of photovoltaic panels as well as a manufacturing plant for solar panels. The proposed development site is located on Farm Waterval 150-IR, Portion 6 near Meyerton, is situated within the Midvaal Local Municipality in the Sedibeng District, south of the Gauteng Province (**Refer to Figure 1**). The area of development falls within an industrial complex, and one portion of the site is currently characterised as vacant\derelict land previously used for agricultural purposes.

The project entails the following production units:

- a) The construction of a production plant for the manufacturing of solar panels through the use of a Fluidized Bed Reactor (FBR) to manufacture poly-silicon through the application of hydrochloric acid to silica. The plant will produce 6 000 tons of solar grade poly-silicon per annum.
- b) The construction of a solar energy plant for the generation of 100MW of electric power
- c) The construction of a float glass manufacturing plant (65 000 tons per annum)
- d) Production units referred to above (a-c) will be constructed on Portion 6 of the Farm Waterval 150-IR, Meyerton, Gauteng. The total size of the farm is 438Ha. The buildings, in which the manufacturing units will be housed, will consist of 40 Ha and the solar energy plant will consist of 200 Ha of land.

The legislative regulations followed for this document represents the EIA Report (EIAR) as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998): Environmental Impact Assessment Regulation R982, dated 4 December 2014. These regulations define the aspects of the legislation required for certain listed activities, which may be detrimental to the environment as a whole.

The objectives of the EIA process are as follows:

- To identify issues/ concerns that should be included into the scope of the Environmental Impact Assessment process;
- To inform stakeholders about the proposed project and provide them with an opportunity to raise their concerns that will contribute towards the EIA process; to establish/confirm the scope and

contents of the Scoping and EIA Report and to identify possible specialist studies to be conducted to address significant issues;

- To understand and thoroughly document the issues/concerns and comments submitted raised by stakeholders in such a way that delay due to misunderstanding will be prevented at all costs;
- To assess the relevant biophysical environmental components of the site to an appropriate level of detail. This includes the physical, biological, and socio-economic components;
- To identify/ describe possible environmental issues associated with the construction and operational phases of the training facilities and its associated infrastructure; and
- To reflect all the required information/ findings in a logical and systematic way in order to assist the DEA with the evaluation of the proposed activity in terms of the requirements of the National Environmental Act, 1998 (Act No. 107 of 1998) as amended.

The following listed activities are triggered by the proposed development:

<p>R984 Listing Notice 2: Activity 15: The clearing of indigenous vegetation more than 20Ha</p>	<p>An area in excess of 300Ha will be cleared for the building of the manufacturing plant and solar PV farm</p>
<p>R 984 Listing Notice 2: Activity 28: The commencement of an activity for which an air emission license is required</p>	<p>The manufacturing of poly-silicon from silica by the application of heat and the Manufacturing of Glass in terms of the NEMAQA: R893: Activity Subcategory 4.15 and 5.8 : (Listed Activities and associated emission standards identified in terms of Section 21 of the national Environmental management: Air Quality Act, 2004 (Act No 39 of 2004)</p>
<p>R 984 Listing Notice 2: Activity 6: The development of infrastructure for a process which will require a permit of the release of emissions</p>	<p>The manufacturing of poly-silicon from silica through the application of heat will result in air emissions as well as the manufacturing of glass</p>
<p>R 983 Listing Notice 1: Activity 25: The treatment of effluent of more than 2 000m³ but less than 15 000m³ daily throughputs.</p>	<p>The effluent stream from the Fluidized Bed Reactor (FBR) will be cleaned to remove Silicon fines and impurities like metal chlorides.</p>
<p>R 984 Listing Notice 2: Activity 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.</p>	<p>A photo-voltaic solar plant will be erected comprising 200Ha on the project site to generate 100MW of electricity</p>
<p>R 985 Listing Notice 3: Activity 10: The storage of dangerous goods (hydrochloric acid) with a combined capacity of more than 30m³ but less than 80m³ on a site identified as high agricultural potential as well as located within an ecological support area as per the Gauteng Conservation Plan 3.</p>	<p>The site of the proposed project is classified as agricultural potential as well as an ecological support area. More than 30m³ of hydrochloric acid and other dangerous substances will be stored on site</p>

An application was submitted to DEA with respect to the above. The application was accepted and the following Reference Number provided: 14/12/16/3/3/2/825. The draft and final scoping report was also accepted.

This document represents the EIAR as required by the National Environmental Management Act, 1998 (Act no. 107 of 1998): Environmental Impact Assessment Regulations, 2014 R 982 of 4 December 2014.

All environmental impacts are being investigated during the EIA phase and appropriate mitigation will have to be adhered to as governed by the above Regulation.

Following which all stakeholders and registered I&APs will be informed of the proposed development and consulted on an on-going basis during the EIA process. This will give them an opportunity to provide comments and/or raise issues. The Draft EIAR is made available for public review and comment from Thursday **22 March 2016 to 27 April 2016**. After the public comment period, the report will be updated. Subsequent to these findings the Final EIAR will be submitted to the DEA.

Public Review of the Draft EIAR:

Registered Interested and Affected Parties (I&AP's) have been provided via email with a copy of the draft EIAR. A copy of the report was also made available at the Meyerton Library. The report was also made available on the EON Consulting Website: www.eonconsulting.co.za

The comments received during the public participation process will be included in the final EIAR.

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DEFINITIONS

Environment: The surroundings (biophysical, social and economic) within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth
- ii. microorganisms, plant and animal life
- iii. any part or combination of (i) and (ii) and the interrelationships among and between them
- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Aspects: Elements of an organisation's activities, products or services that can interact with the environment.

Environmental Degradation: Refers to pollution, disturbance, resource depletion, loss of biodiversity, and other kinds of environmental damage which may be the result of accidental or intentional human activities.

Environmental Impacts: Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

ABBREVIATIONS

BID	Background Information Document
CRR	Comments and Response Report
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
GN	Government Notice
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
NEMA	National Environmental Management Act, Act 107 of 1998 as amended
NEMWA	National Environmental Management Act: Waste Management Act
PM	Particulate Mater
PPP	Public Participation Process
R	Regulation
SANBI	South African National Biodiversity Institute
SPP	Schmidt Polysilicon Production

CHAPTER 1: PROJECT DETAILS

1. Project Details

Reference No.: 14/12/16/3/3/2/825. National Department of Environmental Affairs (DEA)

Project Title: Waterval Solar Park situated in Meyerton, Gauteng

Applicant: TFS Solar (Pty) Ltd.

Compiled by: EON Consulting, Adri Venter

Date: 22 March 2016

The project has applied to be classified as a Strategic Infrastructure project (SIP), but the application is still pending with the relevant authority.

2. EIA Report content: legal requirements and report roadmap

<p>3. An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-</p> <p>(a) details of-</p> <p>(i) the EAP who prepared the report; and</p> <p>(ii) the expertise of the EAP, including a curriculum vitae;</p>	<p>Section 4.2 Annexure C</p>
<p>(b) the location of the activity, including:</p> <p>(i) the 21 digit Surveyor General code of each cadastral land parcel;</p> <p>(ii) where available, the physical address and farm name; and</p> <p>(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;</p> <p>a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-</p> <p>(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;</p> <p>(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;</p>	<p>Chapter 1</p>
<p>(d) a description of the scope of the proposed activity, including-</p>	<p>Chapter 2</p>
<p>(i) all listed and specified activities triggered and being applied for; and</p>	<p>Chapter 1</p>
<p>(ii) a description of the associated structures and infrastructure related to the development;</p>	<p>Chapter 2</p>
<p>a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;</p>	<p>Chapter 3</p>
<p>(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;</p> <p>(g) a motivation for the preferred development footprint within the approved site;</p>	<p>Chapter 5</p>

(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered;	Chapter 6
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Chapter 8
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Chapter 8
(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Chapter 7
positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 7
(viii) the possible mitigation measures that could be applied and level of residual risk;	Chapter 7
(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and	Chapter 5
(x) a concluding statement indicating the preferred alternative development location within the approved site;	Chapter 5

<p>(l) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-</p>	Chapter 5
<p>(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and</p>	Chapter 5
<p>(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures; (j) an assessment of each identified potentially significant impact and risk, including-</p> <ul style="list-style-type: none"> (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; <p>and</p> <ul style="list-style-type: none"> (vii) the degree to which the impact and risk can be mitigated; 	Chapter 5
<p>(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;</p>	Chapter 5
<p>(l) an environmental impact statement which contains-</p> <ul style="list-style-type: none"> (i) a summary of the key findings of the environmental impact assessment; (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives; based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as 	Chapter 5

well as for inclusion as conditions of authorisation;	
(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	Annexure E
(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Chapter 7
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation (q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Chapter 7
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Chapter 2
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Chapter 7
(s) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where	Chapter 9

<p>relevant; and</p> <p>(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;</p>	
<p>(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;</p> <p>(u) an indication of any deviation from the approved scoping report, including the plan of study, including-</p> <p>(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and</p> <p>(ii) a motivation for the deviation;</p> <p>(v) any specific information that may be required by the competent authority; and</p> <p>(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.</p>	<p>Not applicable</p>

3. Introduction

3.1. Applicant

Applicant name:	Waterval Solar Park		
Registration number (if applicant is a company)	2012/054808/07		
Trading name (if any)	TFS Solar PTY Ltd		
Responsible person name (if the applicant is a company):	Tom Lombard		
Responsible position, e.g. Director, CEO, etc.:	Managing Director		
Physical address:	466 Ketton Road, Wadeville		
Postal address:	PO Box 5107, Meyersdal		
Postal code:	1447	Cell:	082 410 7598
Telephone:	011 902 9070	Fax:	086 425 3078
E-mail:	tlombard@tfssolar.co.za	BBBEE status	B-BBEE Level 4

3.2. Appointed Environmental Assessment Practitioner

Environmental Assessment Practitioner (EAP):	EON Consulting		
Contact person:	Adri Venter		
Postal address:	PO Box 12389, Vorna Valley, Midrand		
Postal code:	1686	Cell:	0823728186

Telephone:	011 564 2300	Fax:	011 564 2371
E-mail:	adri.venter@eon.co.za		
Qualifications & relevant experience	MSc (Geography and Environmental Studies), 10 years		
Professional affiliation	SACNASP (Pr. Sc. Nat.:400062/14)		

3.3. Proposed Locality

The locality of the proposed project on Farm Waterval 150-IR, portion 6, near Meyerton, Gauteng is provided in the map below.



The Surveyor General (SG) code is indicated below:

T	O	I	R	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	6
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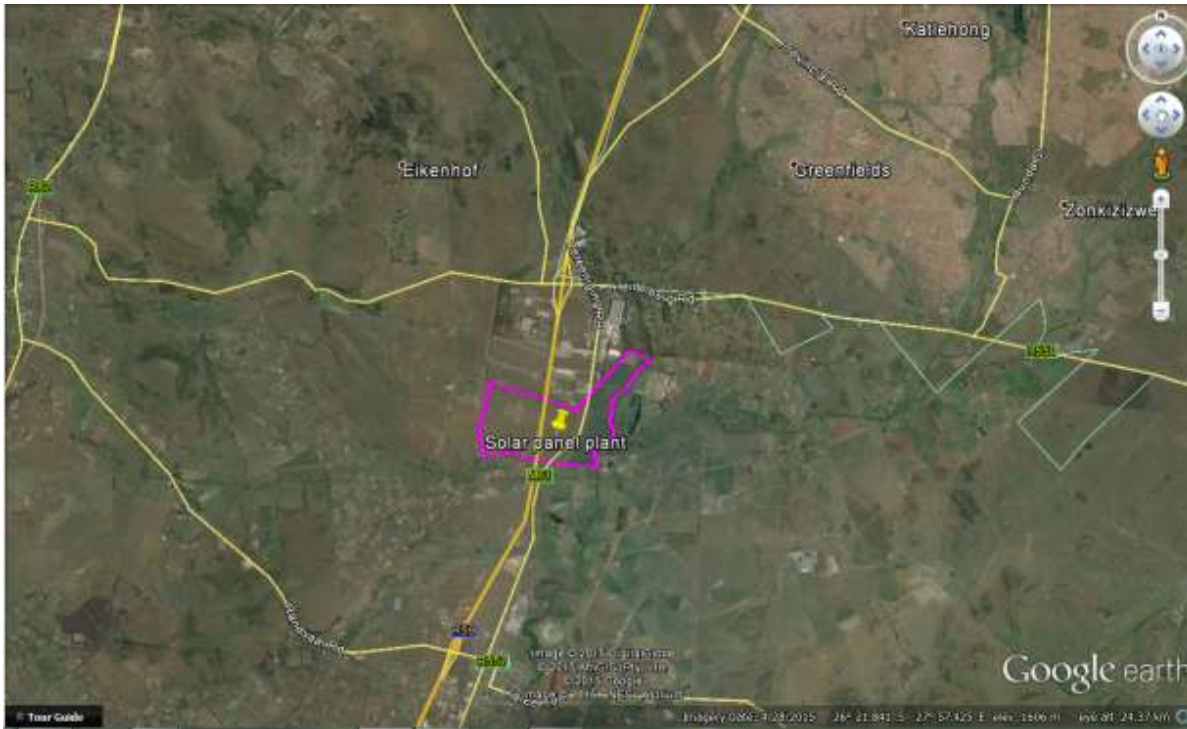


Figure 1: The location of the Waterval Solar Plant Plant

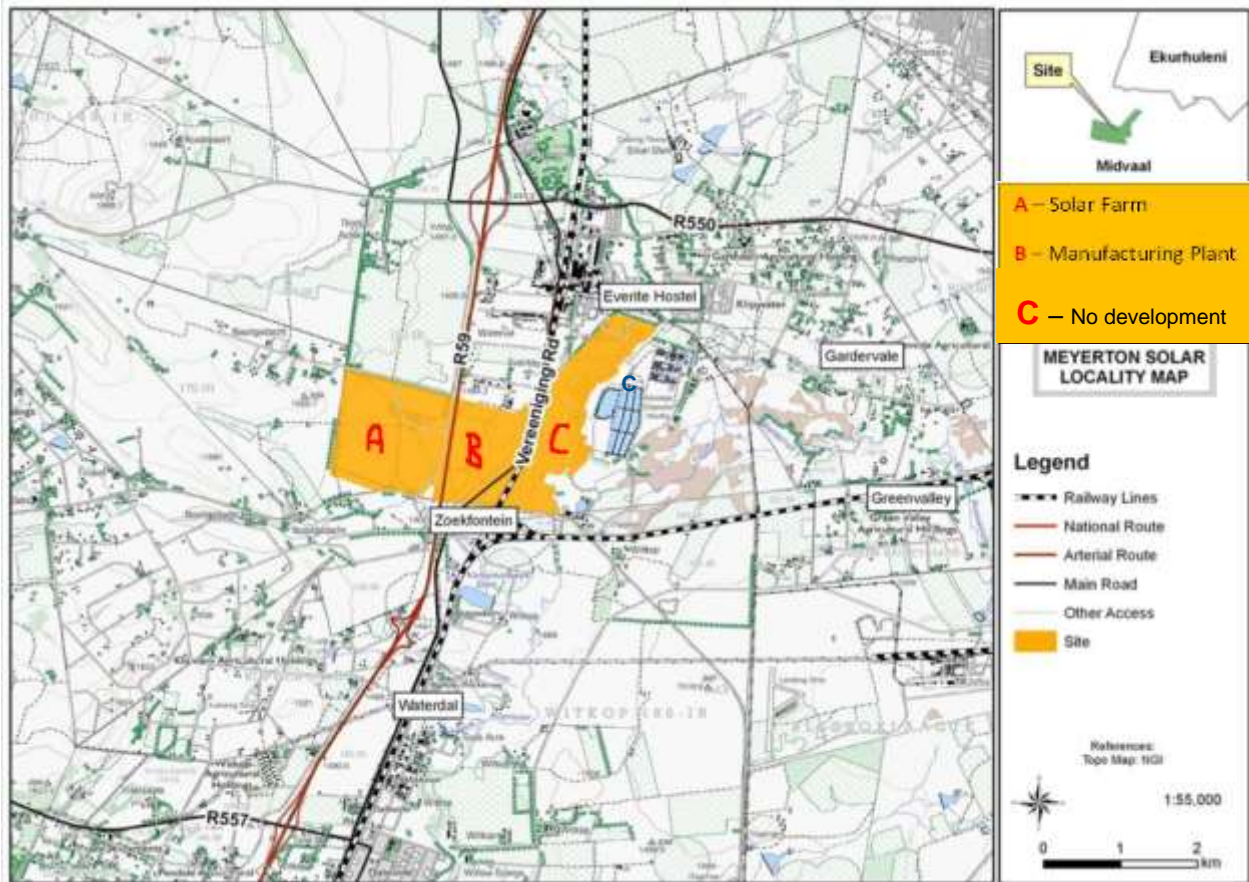


Figure 2: The location of the Waterval Solar Farm

The proposed TFS Solar Site comprises the remainder of Portions 6 of the Farm Waterval 150-IR, and is located on the Eastern side of R59 Old Vereeniging Road and to the South-East of the Kliprivier off-ramp.

The R59 forms the Western boundary with the town of Daleside located to the South and the town of Walkerville towards the West. The site is located to the west of Klipwater, in the northern part of the Midvaal District Municipality. The total property is 446 Hectares in extent, with the specific portion with Industrial zoning appropriate of 90 Hectares in extent.

The coordinates are as follows:

PV Manufacturing Facility: -26.439903, 28.074058; -26.441615, 28.081003; -26.439398, 28.083184; -26.452466, 28.078159; -26.451907, 28.072155

Part of 100MW Solar Farm (1) -26.436765, 28.060644; -26.439851, 28.073428; -26.451943, 28.071462; -26.450675, 28.065885; -26.448173, 28.058943

Part of 100MW Solar Farm (2) -26.438913, 28.083863; -26.430199, 28.092125; -26.431575, 28.097056; -26.454585, 28.087737

TOWN PLANNING ENQUIRY: PROPOSED MANUFACTURING AND ASSEMBLING OF SOLAR PANELS IN RESPECT OF PORTION 6 OF THE FARM WATERVAL 150-IR.

Portion B and C is zoned as Industrial 1

Your letter dated 18th September 2015 refers.

The above mentioned enquiry was discussed at our Planners Permission Meeting held on 21 September 2015 and it was resolved as follows;

In terms of the Randvaal Town Planning Scheme, 1994, the subject site has a split zoning of "Agriculture" and "Industrial 1".

It is hereby commented that from a Town Planning point of view that the proposed "Manufacturing and assembling of solar panels" on the site that is zoned for industrial use is supported as a primary right, however the use should not constitute any noxious activities as it will not be in line with the use zone as stipulated above.

It must be stated that the views/ opinions and information herewith contained is provided without prejudice to whatever information may in future be provided to or attained by Council, and that Council would be at liberty to later amend or review its stance related hereto.

Should you require any further information please do not hesitate to contact Fusi Puthini @ tel: 016 360 7589.

Yours faithfully



F. Puthini
Town Planner
Enquiry No: 061

3.4. Activities Applied for the Purposes of an Environmental Authorisation

The following listed activities are triggered by the proposed development:

<p>R984 Listing Notice 2: Activity 15: The clearing of indigenous vegetation more than 20Ha</p>	<p>An area in excess of 300Ha will be cleared for the building of the manufacturing plant and solar PV farm</p>
--	---

<p>R 984 Listing Notice 2: Activity 28: The commencement of an activity for which an air emission license is required</p>	<p>The manufacturing of poly-silicon from silica by the application of heat and the Manufacturing of Glass in terms of the NEMAQA: R893: Activity Subcategory 4.15 and 5.8 : (Listed Activities and associated emission standards identified in terms of Section 21 of the national Environmental management: Air Quality Act, 2004 (Act No 39 of 2004)</p>
<p>R 984 Listing Notice 2: Activity 6: The development of infrastructure for a process which will require a permit of the release of emissions</p>	<p>The manufacturing of poly-silicon from silica through the application of heat will result in air emissions as well as the manufacturing of glass</p>
<p>R 983 Listing Notice 1: Activity 25: The treatment of effluent of more than 2 000m³ but less than 15 000m³ daily throughputs.</p>	<p>The effluent stream from the Fluidized Bed Reactor (FBR) will be cleaned to remove Silicon fines and impurities like metal chlorides.</p>
<p>R 984 Listing Notice 2: Activity 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.</p>	<p>A photo-voltaic solar plant will be erected comprising 200Ha on the project site to generate 100MW of electricity</p>
<p>R 985 Listing Notice 3: Activity 10: The storage of dangerous goods (hydrochloric acid) with a combined capacity of more than 30m³ but less than 80m³ on a site identified as high agricultural potential as well as located within an ecological support area as per the Gauteng Conservation Plan 3.</p>	<p>The site of the proposed project is classified as agricultural potential as well as an ecological support area. More than 30m³ of hydrochloric acid and other dangerous substances will be stored on site</p>

An application was submitted to DEA with respect to the above. The application was accepted and the following Reference Number provided: 14/12/16/3/3/2/825.

The Final Scoping Report was submitted on the 7th of October 2015. Eon Consulting received the acceptance of the final scoping report on 12 November 2015. A revised plan of study was indicated to be submitted and the letter stated that the EIAR may not commence before the revised plan of study is not accepted/approved by the Department. The revised plan of study was accepted by the Department on 21 January 2016. This document represents the EIA Report as required by the NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998): ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 R 982 of 4 December 2014 as well as the requirements in the approved Plan of Study.

CHAPTER 2: PROJECT DESCRIPTION

1. Description of the Proposed Activity

The proposed activity will consist of 3 aspects, namely:

- 1) Glass manufacturing
- 2) Silicon manufacturing
- 3) Photovoltaic installation to generate electricity

The aluminium frames and silver grid which forms part of the PV cells is pre-manufactured on another site.

The complex will include an office building and ablution facilities for workers. Water will be directly obtained from Rand Water (main pipeline runs along the property boundary and a connection will be made which will be below the thresholds for an environmental authorisation).

In terms of sanitation services no sewage connection is available and therefore an onsite treatment facility (mobile package plant) will be installed and all effluent from the treatment facility will be re-used in the manufacturing plant.

Office waste will be disposed of at a registered landfill site.

1.1. Glass manufacturing

Glass will be manufactured onsite as part of the parts of the photovoltaic panels that will be manufactured onsite.

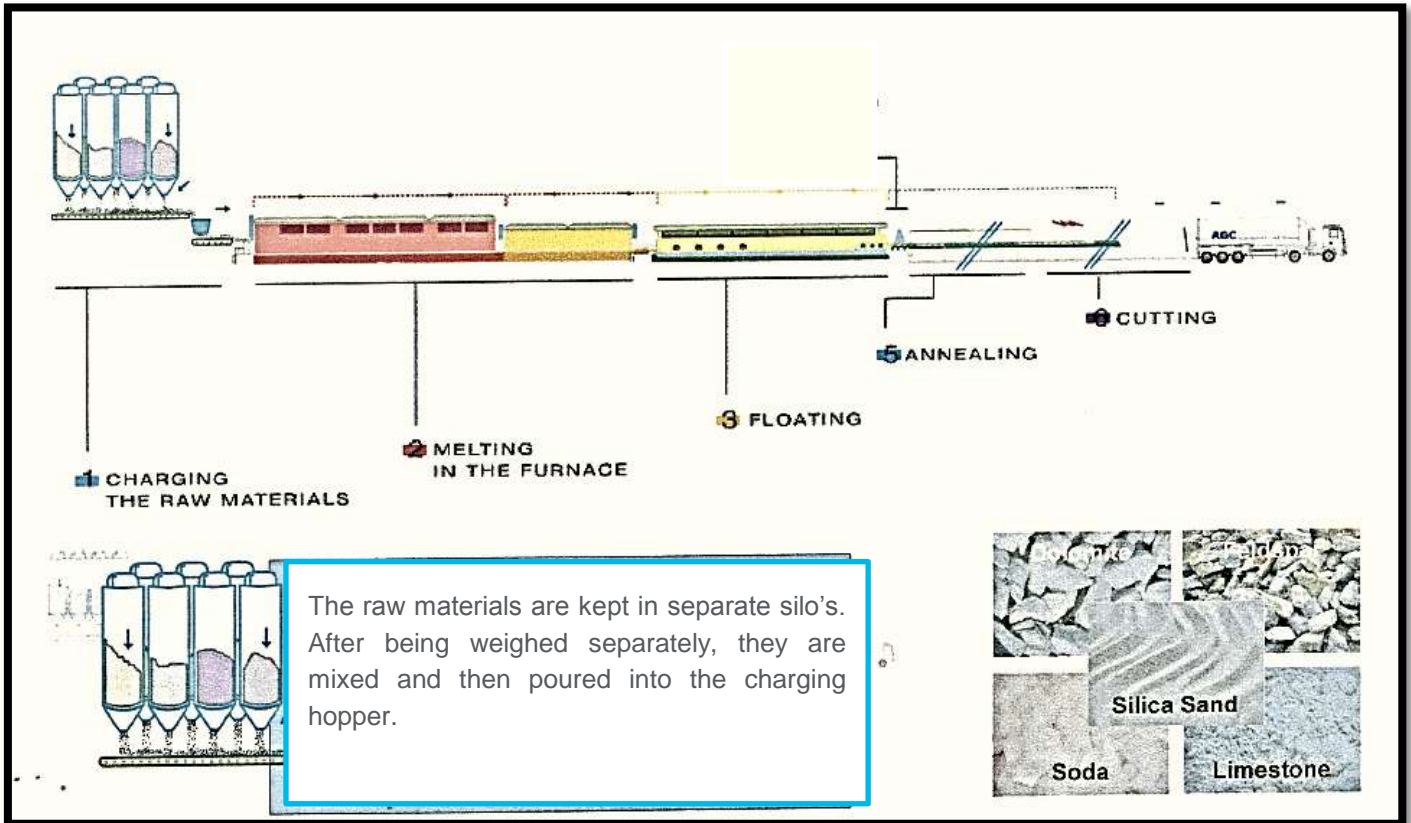
1.1.1. Raw materials:

The following raw materials are used to produce glass:

- Silica
- Soda (Na_2CO_3)
- Lime Stone
- Dolomite
- Feldspar
- Filter cake – originating from the treatment of gaseous emissions and returned to the raw materials used in the melting process
- Waste Glass – from the production process is returned as raw materials to the melting process

Raw materials will be delivered via enclosed cylinder tankers and will be transferred to on-site silos via a vacuum pump.

1.1.2. Process steps for floating glass



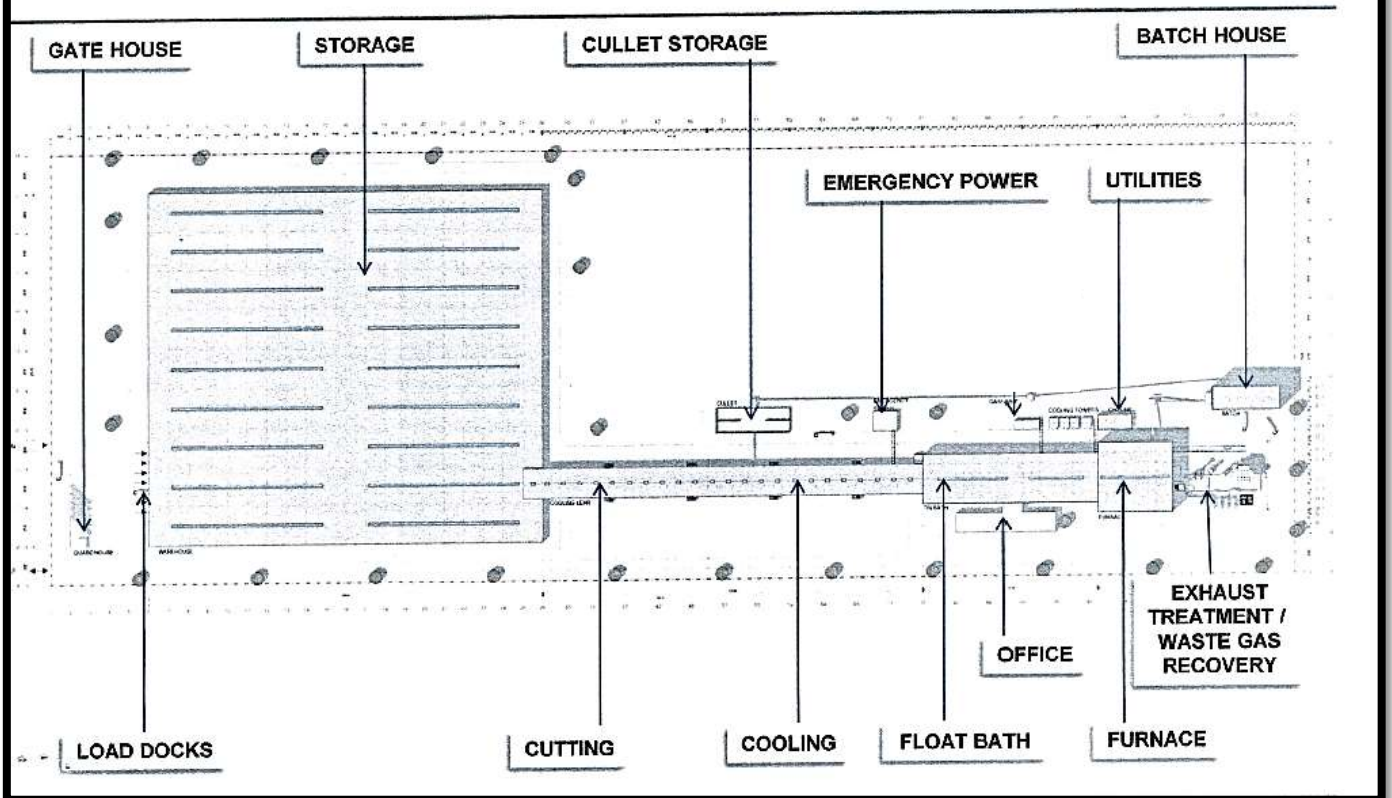
Melting in the furnace: Temperatures are 1550°C. The molten glass is kept at high temperature for several hours, allowing bubbles of trapped air to escape.

Floating: As the product comes out of the furnace, the molten glass is poured onto a bath of liquid, where a sheet of glass is formed by flotation. Rollers on either side of the bath draw out the glass to roll it into the required thickness and width.

Annealing: Once the glass emerges from the floating bath it is led by a roller conveyor to an annealing tunnel where the glass is gradually cooled to ensure the glass remain perfectly flat and ready for cutting at ambient temperature.

Cutting: After annealing, the glass strip is inspected by an optical laser and then automatically cut into the required sizes.

Float Glass Plant Layout FUNCTIONAL ELEMENTS



Gas will be used to heat the melting furnace. Gas will be obtained directly from a Sasol gas pipeline on the edge of the property. The gas pipeline will be inside the industrial complex, and will not exceed 1000 metres in length.

Potential Environmental impacts associated with glass manufacturing process:

- Air quality impacts from loading and mixing of raw materials as well as from the furnace, and float bath.
- Noise impacts from the mixers, roller conveyers and cutting
- Air quality impacts in the case of emergency venting from the pipeline
- Clearing of vegetation for the construction of the plant

1.2. Silicon manufacturing

The process consists of three main production units:

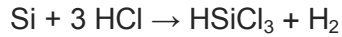
- Hydro chlorination unit
- Monosilane Disproportionation Unit
- CVD Polysilicon Deposition

The process is characterized by a process structure which leads to reduced energy consumption in comparison to conventional Polysilicon production technologies like, for example, the Siemens process. This provides manufacturers with remarkable operating cost saving.

Monosilane gas (SiH_4) is a basic feedstock for the photovoltaic industry. It is used as an anti-reflective for solar cell coatings, as basis material for thin film solar cells, flat-screen displays (TFT) and semiconductors for the electronics industry. The monosilane-based process facilitates purification to the degree of electronic-grade high purity polysilicon. In the hydrochlorination in two parallel reactions, both STC (Tetrachlorsilane) and metallurgical silicon respectively are converted into TCS (Trichlorosilane). Then the TCS is fed to a disproportionation reactor, where purified TCS is processed to monosilane gas. The monosilane gas is then directly fed to the CVD reactor, where polysilicon deposition finally occurs on heated slim rods. The monosilane process makes possible an unprecedented silicon conversion rate of 98%.

For example, the oxidation of monosilane is strongly influenced by moisture, since SiH_4 is relatively easily hydrolyzed: $\text{SiH}_4 + 2\text{H}_2\text{O} > \text{SiO}_2 + 4\text{H}_2$; high humidity will reduce the risk of ignition. On the other hand, there is a positive aspect about silane leaks for any plant operating with monosilane: there are no “hidden leaks”. Almost every silane leak is found quickly, because even most tiny silane leaks make a “popping” sound, or are disclosed by a small flame and a dust cloud instantly. That means, silane leaks are unlikely to accumulate, which prevents vapor clouds that would explode with large impact (as would happen with CH_4 or H_2). The risk of delayed ignition is higher, the larger the difference between line pressure and ambient pressure is, or when abrupt changes in pressure occur. Then, there is the point of air flow: the most dangerous places for monosilane are small, confined spaces like gas cabinets in buildings. The best location for monosilane operating is outdoors, or in large buildings like polysilicon CVD rooms if they have appropriate air flow. Sources of monosilane incidents were in most cases corroded cylinder caps or physically stressed/ incorrectly used material. Most significant silane industrial accidents have occurred in this context, and not in monosilane production plants. These risks can be managed by good design of equipment and proper handling by trained operators. Toxicity: Silane is not as highly a toxic gas as TCS, STC, DCS, HCl, or Cl_2 . The byproducts of a silane leak and fire would be SiO_2 (dust) and H_2O – all not toxic or harmful gases. In contrast, the byproducts of a TCS, STC, DCS, HCl, or Cl_2 release to the atmosphere include highly toxic hydrochloric acid. While such a release of chlorine containing gas can create a toxic cloud that might travel far with the wind and have negative impacts outside plant boundaries, the hazards of monosilane are typically confined to the production facility itself, and provide no risk to the environment. (*Schmid Silicon Technology GmbH Robert-Bosch-Str. 32-36 Phone: 0049 7441 538-454 Fax: 0049 7441 538-260 72250 Freudenstadt Germany info@schmid-silicon.com www.schmid-silicon.com, undated*)

Monosilane is produced from metallurgical grade silicon in a two-step process. In the first step, powdered silicon is reacted with *hydrogen chloride* at about 300 °C to produce *trichlorosilane*, HSiCl_3 , along with *hydrogen* gas, according to the *chemical equation*:




At room temperature, silane is a gas, and is pyrophoric — it undergoes spontaneous combustion in air, without the need for external ignition.

Above 420 °C, silane decomposes into silicon and hydrogen; it can therefore be used in the chemical vapor deposition of silicon.

Silane is fairly toxic: the lethal concentration in air for rats (LC_{50}) is 0.96% (9,600 ppm) over a 4-hour exposure. In addition, contact with eyes may form *silicic acid* with resultant irritation. In Japan, in order to reduce the danger of silane for amorphous silicon solar cell manufacturing, several companies began to dilute silane with *hydrogen* gas. This resulted in a symbiotic benefit of making more stable *solar photovoltaic* cells as it reduced the *Staebler-Wronski Effect*.

In regards to occupational exposure of silane to workers, the US *National Institute for Occupational Safety and Health* has set a *recommended exposure limit* of 5 ppm (7 mg/m^3) over an eight-hour time-weighted average.

Properties	
Chemical formula	H ₄ Si
Molar mass	32.12 g·mol ⁻¹
Appearance	Colourless gas
Odor	repulsive ^[1]
Density	1.342 g dm ⁻³
Melting point	-185 °C (-301.0 °F; 88.1 K)
Boiling point	-112 °C (-170 °F; 161 K)
Solubility in water	Reacts slowly
Vapor pressure	>1 atm (20°C) ^[1]
Structure	
Molecular shape	tetrahedral r(Si-H) = 1.4798 angstroms
Dipole moment	0 D
Thermochemistry	
Std molar entropy (S ^o ₂₉₈)	204.6 J mol ⁻¹ K ⁻¹
Std enthalpy of formation (Δ _f H ^o ₂₉₈)	34.31kJ/mol
Hazards	
Main hazards	Extremely flammable, pyrophoric in air
Safety data sheet	ICSC 0564 ↗
EU Index	Not listed
NFPA 704	
Flash point	Not applicable, pyrophoric gas.
Explosive limits	1.37–100%
US health exposure limits (NIOSH):	
PEL (Permissible)	none ^[1]
REL (Recommended)	TWA 5 ppm (7 mg/m ³) ^[1]

Hydrochloric acid is used in the reactor to generate silicon from metallurgical silica. Hydrochloric acid is a clear, colorless, highly pungent solution of hydrogen chloride (HCl) in water. It is a highly corrosive, strong mineral acid. The main risk associated with HCL is its high corrosivity and causing chemical burns during contact. Exhaust ventilation or other engineering



controls are required to keep the airborne concentrations of vapors below their respective threshold limit value

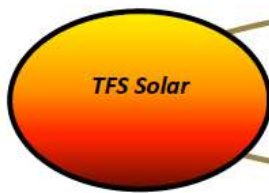
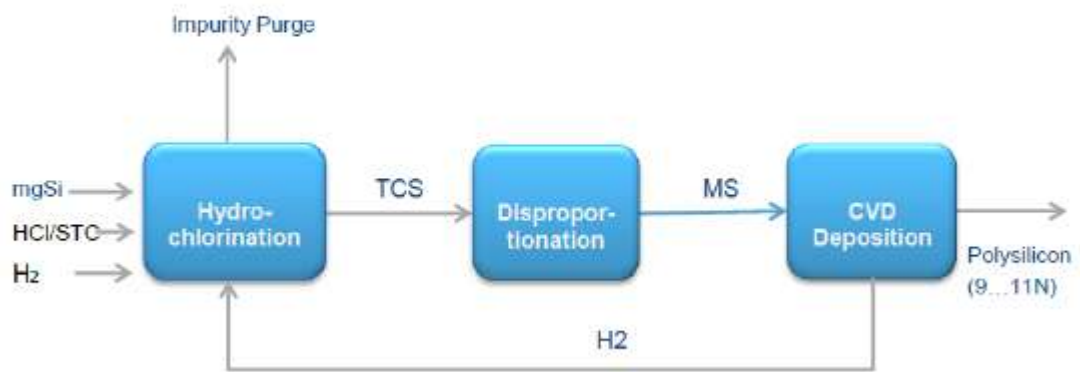
(Source: Wikipedia, 2016)

Storage facilities of all hazardous materials will have to comply with SANS 310-1:2007, Storage tank facilities for hazardous chemicals: Part 1: Above-ground storage tank facilities for non-flammable chemicals.

Silica raw material will be delivered by a rotary truck (similar to a ready mix cement truck) and pumped with air pressure directly into the silo. From the silo, raw material will be pumped directly to the reactor by means of air pressured pipes. As such, during normal operations no silica will be released into the environment as part of this process.



SST Process Overview



Poly Silicon
production line
Technology

Terminal Hydrochlorination Storage area Disproportionation Deposition Office/Laboratory



Figure 1: The Schmid "Schwarze Pumpe" polysilicon plant Schmid Polysilicon Production (SPP)



Figure 3: An example of a CVD Reactor Installation

1.2.1. Process description - Hydrochlorination Unit

The SST Hydrochlorination Unit combines four individual process steps in one unit.

Step 1:

A highly sophisticated fluidized bed reactor is employed for Hydrochlorination of metallurgical Silicon with hydrogen and STC. The product of Hydrochlorination which is also called conversion, is TCS.

Chemical reaction inside the FBR:

- (1) Hydrogenation of STC (SiCl_4): $\text{SiCl}_4 + \text{H}_2 \rightarrow \text{SiHCl}_3 + \text{HCl}$
- (2) Chlorination of mg-Si: $\text{mg-Si} + 3 \text{HCl} \rightarrow \text{SiHCl}_3 + \text{H}_2$

Typically no external HCl is required for the SST Hydrochlorination. HCl forms only as an intermediate product inside the FBR, wherein HCl is fully converted into TCS. High processing temperature ensures the maximum conversion rate of $\geq 25\%$ (this number represents the concentration of TCS in mol-% in the liquid phase stream emerging from the FBR).

Step 2:

The SST Quench System downstream of the FBR is cooling down the product stream emerging from the FBR and removing traces of Si-fines and impurities like metal chlorides. Thus, fouling in the downstream equipment can be eliminated.

Step 3:

In the following SST Condensation System the gaseous STC/TCS mixture coming from the Quench system is condensed and fed to the STC/TCS –split column.

Step 4:

The STC/TCS –split column removes the non-converted STC from the TCS-product stream. The separated STC is recycled back to the FBR.

The reactor is fitted with a silicon dust filter.

1.2.2. SST Disproportionation Technology

The SST Disproportionation Units shows the state of the art for converting Trichlorosilane to Monosilane of highest purity based on so called reactive distillation. Within a wide operation window this technology utilizes only about 10% of the energy compared to the conventional two step disproportionation process.

The SST Disproportionation Technology provides Monosilane Gas which can be fed via the monosilane buffer storage either to the MS Deposition Unit or to a Monosilane filling and loading station.

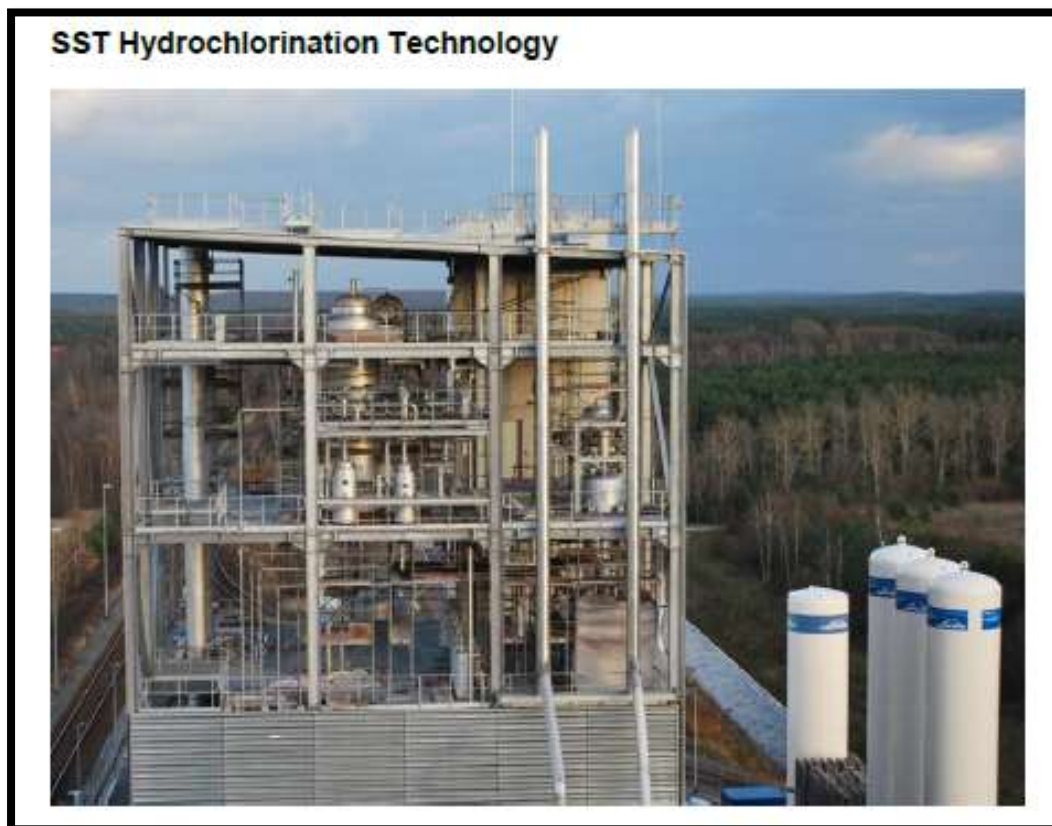
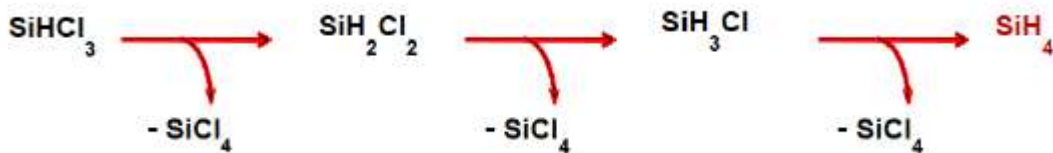
In comparison to the common TCS-Purification Process using a multiple stage Distillation Unit, the SST Disproportionation is easy to operate and guarantees a consistently high product quality of Monosilane Gas as well as Polysilicon. Because Dichlorosilane gets converted in the

disproportionation to Monosilane there is no need for an extra Dichlorosilane recovery and conversion unit. Adding an additional Monosilane Purification Unit to the Disproportionation Unit UHP (UHP = Ultra High Purity) - Monosilane Gas can be produced.

The SST Hydrochlorination unit features the state-of-the-art technology of the Hydrochlorination process utilized at advanced Polysilicon production plants. Operated at a low pressure and high temperature level it achieves an outstanding conversion rate of $\geq 25\text{mol } \%$. (STC \Rightarrow TCS).

1.2.3. Process description – Disproportionation Unit

SST's combination of TCS via hydrochlorination and Monosilane via disproportionation creates the lowest number of impurities and makes them easier to remove. Pure Monosilane can be obtained most easily through the disproportionation reaction of Trichlorosilane in the presence of a catalyst.



The manufacturing area (inclusive of glass and silica manufacturing will have a footprint of 74Ha.

Potential Environmental impacts associated with the silicon manufacturing process:

- Air quality impacts from loading and mixing of raw materials as well as from the reactor, storage area and disproportion unit in the event of an incidence
- Noise impacts from the roller conveyers
- Clearing of vegetation for the construction of the plant
- Accidental spillages from the chemical tank farm leading to ground and water pollution
- Waste water generation from the SST Quench system containing impurities
- Accidental releases from HCL vapour clouds and Monosilane causing air pollution and human health hazards
- Disposal of dust filters
- Disposal of material used to clean up spillages

1.3. Photovoltaic installation to generate electricity

The footprint of the PV panels onsite will be 154Ha.

The ground slope is usually kept below 5%, by grading, if necessary. Given the relative flatness of the site grading will not be required. After installation of the solar panels, the vegetation will be periodically cut to prevent shading of the panels, which limits vegetation height to below 1 m height. Inverters, transformers, and collector boxes are built for every 1 MW of panels, and are placed on concrete pads sized at roughly 5 × 5 m.

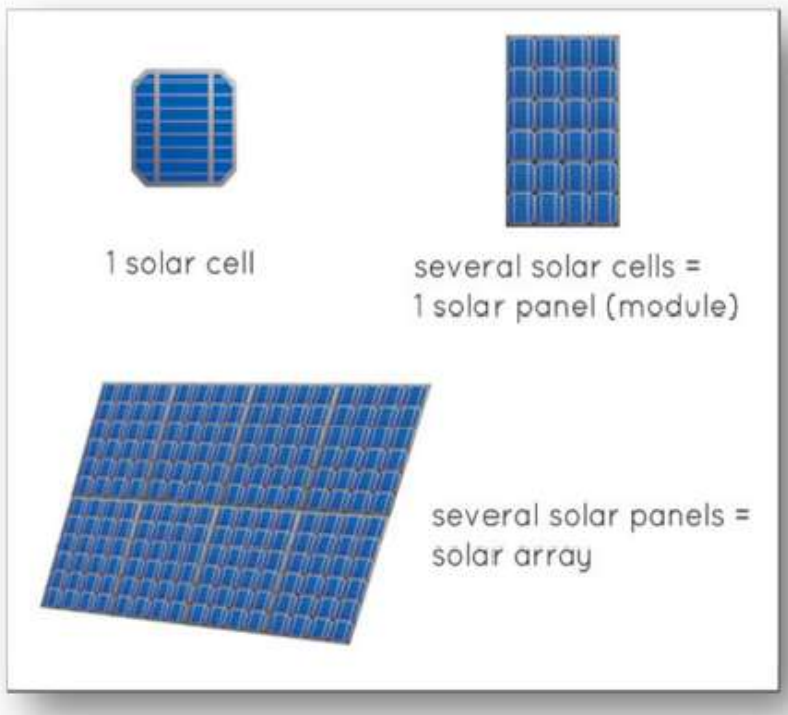


Figure 4: The generic composition of the solar panel arrays

1.3.1. Mounting system

The height of the arrays will be 4m high. Single axis tracking system will be used. The tracking system follows the sun to ensure maximum exposure to sunlight leading to efficient energy generation

Trenching for electrical and communications cables is required.

The panels require washing, which uses water at a rate of roughly 500–1000 gallons per MW of panels per year. Rainfall events will reduce the need for washing. No soap will be used, only pure water. Wash water will therefore not create any environmental impacts but will infiltrate into the soil and evaporate from the panels. Maintenance vehicles travel the access roads between the panels for washing and mowing. Dust suppression measures will be implemented on dirt roads.

Redox Flow Batteries will be used and will be stored in a normal store building. Redox flow batteries, and to a lesser extent hybrid flow batteries, have the advantages of flexible layout (due to separation of the power and energy components), long cycle life (because there are no solid-to-solid phase transitions), quick response times, no need for "equalisation" charging (the overcharging of a battery to ensure all cells have an equal charge) and no harmful emissions. They offer easy state-of-charge determination (through voltage dependence on charge), low maintenance and tolerance to overcharge/over discharge.

Flow batteries are rather complicated in comparison with standard batteries as they may require pumps, sensors, control units and secondary containment vessels.

Potential environmental impacts associated with the PV plant:

- Land-use
- Water use for washing
- significant alteration to the vegetation onsite due to construction and the creation of shadows by the panels
- erosion of topsoil, increase of sediment load or turbidity in local streams,
- the reduction of groundwater recharge due to the creation of impermeable surfaces
- fencing around the site will limit the movement of animals
- Flow batteries require secondary containment to prevent spillages
- Dust from vehicles travelling on dirt roads between the panels for maintenance purposes
- Avifaunal disturbance

1.4. Description of the associated structures and infrastructure related to the development

1.4.1. Power lines:

No new power line is required because the Eskom power line is already running close by. A substation will be installed to draw power from the existing line. This will only serve as a back-up in the event of

inadequate energy provision from the solar farm due to long term overcast weather. Several 1MW substations will be installed on the solar farm.

1.4.2. Roads

No internal roads will be built - Only an access road from Joan Avenue. The roads are less than 8m wide and will be surfaced to prevent dust generation.



Figure 5: Position of the access roads

1.4.3. Fencing

A 6m high concrete fence will be built around the site for safety and reduced visual impact reasons.

1.4.4. Sanitation facilities

A mobile package waste water treatment works will be used on-site.

The Bannow Boxer is a pre-fabricated package sewage treatment plant suitable for population equivalents of 5 - 50 domestic residents. The Boxer can be used for single houses, small buildings, construction sites, small housing developments, hotels, golf courses, holiday resorts and leisure developments in areas that are not connected to mains sewers. The Boxer has been designed specifically for nutrient removal as that has become increasingly important in many areas.

The Boxer system is one of the most compact “all in one” systems available and is manufactured to ISO 9002 quality standard. The civil works are minimal, consisting of a flat concrete support slab the plan area of the unit which can be at ground level if the Boxer is installed on grade or roughly 2m below ground if the Boxer is to be buried. The Boxer is completely enclosed with manhole access for maintenance. It is a modular unit that lends itself to future expansion or relocation.

The Bannow Boxer comprises the following 5 sections all of which are accommodated within one Fibre Reinforced Plastic (FRP) tank which is built on a steel frame:

- Primary Settlement & Sludge Storage

- Anaerobic Treatment
- Anoxic Zone
- Aerobic Biological Treatment

a. Primary Settlement & Sludge Storage

Raw effluent flows into the primary settlement zone where 75% of solids are removed using lamella (parallel) plates for more efficient settlement. This is also the sludge storage area. It incorporates lamella or parallel plates to enhance efficiency and utilisation of space. This zone is maintenance free and contains no moving mechanical or electrical devices. Lockable FRP covers with easy man access and sufficient ventilation are provided.

All-in-one package

Quick to install and commission - no long lead times and minimal civil works

Compact

Takes up the least amount of room

Unobtrusive

No unsightly open tanks or lagoons - normally buried to deck level with locked lids

Simple to Operate

Can be operated by non-technical staff.

Nutrient Removal

All important nowadays.

Easy Maintenance

Simple maintenance functions

Modular

Additional units can be installed as required if the usage increases

Relocatable

The investment is not locked in concrete - the Boxer can be traded in for a larger size or moved to another site at a later date if necessary

b. Anaerobic zone

The settled effluent entering the treatment plant mixes with recycled flow from the aeration zone. The recycle ratio can vary and is variable depending on the effluent discharge standards and the incoming flow strength (usually between 2 and 4 times incoming flow). This combined flow enters the Anaerobic zone. The anaerobic zone provides sufficient residence time for any residual dissolved oxygen to dissipate. It also provides a surface area on which anaerobic bacteria propagate. This results in the digestion of some of the solids in the effluent.

c. Anoxic zone

Effluent from the Anaerobic Zone enters the Anoxic zone from above. The Anoxic Zone is composed of plastic media that provides a surface on which the denitrifying bacteria adhere. The denitrifying bacteria convert the Nitrate (NO₃) from the recycled flow to Nitrogen (N₂) Gas. The BOD in the incoming effluent provides the carbon that is required for the bacteria to grow. This also has the advantage of reducing the BOD load to the aeration zone by approximately 20%.

d. Aerobic Treatment

An air lift pumps feeds effluent from the Anoxic Zone to the Aerobic Zone at a constant rate. Air is supplied to the Aeration zone from a small air blower. The air is fed to the base of the tank via special diffusers. Small media balls are provided in the Aeration Zone. These media balls enhance the area available on which the bacteria can grow and provides a highly efficient means of oxygen transfer. This results in a smaller aeration reactor while minimizing the power requirements. An aeration spurge cycle is activated on a timer a number of times a day to ensure there is no sludge build-up within the aeration zone.

e. Final Settlement

The clarifier or final settlement area uses lamella plates for efficient removal of solids, with a Saran filter and sludge return.

The Final Settlement or Humus Tank is a discrete compartment denying ingress of untreated or partially treated liquor. The design is similar to the Primary Settlement Tank on an upward flow basis. This zone has frequent automatic removal of sludge to sludge storage by means of a timed submersible pump.

To cater to low BOD₅, TSS & COD effluent requirements, an optional Saran Membrane Filter can be fitted on top of the lamella plates in this Final Settlement Tank. The Saran Filter entraps finely divided particles and eliminates any sludge carry-over which can, in the absence of the filter, occur naturally from time to time.

f. Sludge Storage

Sludge Storage is provided in the base of the units. Depending on the load applied there is approximately 12 weeks capacity provided. Normally desludging is carried out by suction-tanker.

4. Materials and Construction

The Bannow Boxer is a single tank system supplied in multiple modules if necessary. The outside of the tank is steel reinforced FRP and can be free standing or buried up to deck level without the necessity of a concrete surround. All internal surfaces in contact with sewage are FRP. Lifting hooks are provided. The tank and internal components are accessed by a series of lockable FRP covers capable of being lifted by one person. These can be manufactured in a colour of the client's choice to enhance the visual impact of the location.

a. Electrical

In order to minimise power consumption and maintenance, the Boxer unit has two small blowers. The Boxer 40 has a 160W and a 54W Blower.

b. Control Panels & Alarms

The Bannow Boxer is supplied with a separate control panel with all the necessary starters and controls. The panel can be mounted on the Boxer or supplied loose to be installed mounted in a separate housing. The system comes with the Bannow Pumpwatch monitoring system which will Optional alarms can be fitted in the form of volt free contacts in the control panel, which can be wired to the building management system. High level float switches in the pump sump tank and the Blivets will provide a simple yet effective warning which will indicate any malfunction or overloading of the system.

d. Quality Control

The Bannow licensed factory in China is certified to ISO 9002 quality standard. All watertight compartments are hydraulically tested before leaving the factory. Quality certificates can be provided with each unit. Copies of certificates of conformity for all major component materials are available for inspection.

5. Installation & Civil Works

The required civil works consist simply of providing a suitable base support slab in 20N reinforced concrete for the Boxer. Installation consists of lifting the plant onto the slab and making one inlet & one outlet pipe connection and one electrical power supply connection per unit. The Boxer can be above ground or buried in the ground to deck level such that only the lockable covers are showing.

a. Supervisor & Training:

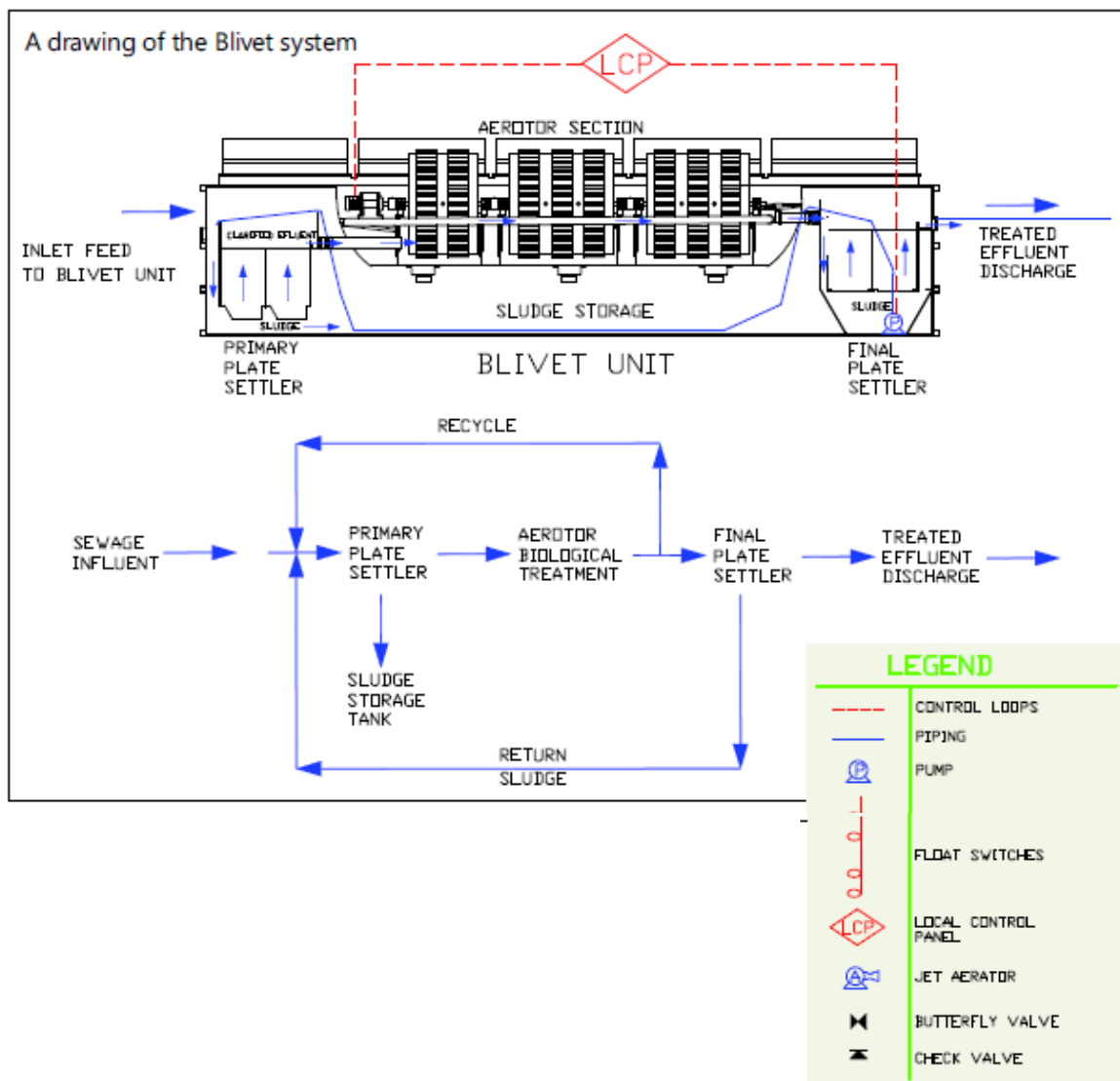
Bannow or their distributors can provide an engineer who will supervise the installation, commission the plant and train the client's operators. The client's staff can be fully trained in operation and maintenance of the plant during the commissioning period.

7. Operation & Maintenance Requirements

The Bannow Boxer requires very little routine maintenance and supervision compared to other plants. All the maintenance tasks (and operation) can be carried out by a maintenance operator and do not need a highly skilled technician. A maintenance contract can be offered by our local representative.



Figure 6: The package plant, which has been operating at the Nedbank Olwazini Training Centre in Muldersdrift for the past eight years, received a Green Drop award in 2012



The treated effluent will be re-used onsite in the manufacturing process. The effluent will be fed into the demineralization plant. No effluent will be released into the environment. The re-use of the effluent will support water conservation onsite.

In terms of environmental impacts, the only potential impacts are leaking pipes which may lead to ground, water and ground water pollution. Safe disposal of sewage sludge is also required.

1.4.5. Storage of Dangerous Goods

Input	Storage facilities description	Transport and onsite utilization description	Quantities/Volume
Metallurgical Silicon	MgSi will be stored in Concrete Silos, similar to current cement storage silos. Totally enclosed with opening at the bottom with an auto / manual feed control mechanism.	<p>Transportation from the supplier will be with trucks, similar to the concrete delivery trucks. Upon arrival it will be unloaded directly into the concrete silo from the top via automated / manual feed control access / belt conveyor.</p> <p>To access the MgSi it will simply be loaded again with smaller loading vehicles / or with dedicated automatic belt conveyors. This method will only be decided once final design engineering has been agreed.</p>	<p>7200 tons per annum :</p> $7200/365\text{days} = 19.72 \text{ tons per day}$
			<p><i>(Est. Conversion fig)</i> $1\text{m}^3=2.41\text{T}$</p> <p>8m³ per day</p>
Hydrochloric acid	Hydrochloric acid will be stored in specially Vertically Hydrochloric acid storage tanks, and according to Industrial standards and properly vented. These hydrochloric acid storage tanks	Hydrochloric acid will be transported with the suppliers' specified Hydrochloric acid tank trucks carrying this Hydrochloric acid in tightly sealed	<p>3250 tons per annum: $3250 / 365\text{days} = 8.9 \text{ tons per day}$</p>
			<p><i>(Est. Conversion fig)</i> $1\text{m}^3=2.41\text{T}$</p>

	<p>are made using quality HDPE & PP and are acknowledged for durability, resistance to corrosion and decay from concentrated chemicals. A pressure / vacuum relief device will be in place to regulate pressure. All requirements on storage of Hydrochloric acid will be strictly complied with. These storage area and storage facilities / drum containers will be properly barricaded with all the necessary health and safety regulations in place and as per the necessary requirements and the requirements as per the Suppliers MSDS (Material Safe Data Sheet). Proper PPE (Personal Protective clothing) shall be worn in these storage areas, and all necessary requirements, including signs, information, requirements, MSDS will be adhered to and all necessary requirements will be complied with.</p> <p>These steel containers / drums will have proper release valves and pipes for loading and off-loading</p> <p>Hydrochloric acid will be kept in tightly closed containers and stored in chemical area that is compatible with other chemicals. It will also be stored in a secure, well-ventilated area, that is well marked, and away from the general work population.</p>	<p>containers. An automated pump system or compressed air system will be used and a pipeline and joint will be used from the truck container to the storage container with valves. An automatic transferring system will be implemented whereby the transferring process is simplified by simply connecting the pipe to the tank.</p> <p>When liquid is withdrawn from the tank, an equal volume of air will be regulated by valve system.</p> <p>A pipe system will be fixed to the tank in order to feed the MgSi Plant.</p>	<p>5 to 8m³ per tank truck</p> <p>3.69m³ per day</p>
<p>Nitrogen</p>	<p>Nitrogen will be stored in specially Nitrogen storage vessels, specifically a cryogenic storage tank, one or</p>	<p>Nitrogen will be supplied with a dedicated Nitrogen pipe line to the</p>	<p>12 200 tons per annum: 12200/365days = 33.42 tons per day</p>

	<p>more vaporizers, and a pressure and temperature control system. The cryogenic tank is constructed like, in principle, a vacuum bottle. It is designed to keep heat away from the liquid that is contained in the inner vessel. Vaporizers convert the liquid nitrogen to its gaseous state classed as pressure vessels and meet the industrial requirements and according to SABS</p>	<p>property and directly to the point of storage (vessel). The usage of Nitrogen will be automated and released as per A pressure control manifold which controls the pressure air which the gas is fed to the process. In other words, a liquid transfer line is used to safely remove liquid product (Nitrogen). For cryogenic liquid cylinders, the transfer line is connected to the cylinder's liquid withdrawal valve. Liquid product is typically removed through insulated withdrawal lines to minimize the loss of liquid product to gas. Insulated flexible or rigid lines are used to withdraw product from storage tanks.</p>	<p><i>(Est. Conversion fig)</i> <i>1m³=2.41T</i></p> <p>in 40m³ vertical liquid nitrogen vessels</p> <p>13.8m³ per day</p>
Hydrogen	<p>Metal hydride tank is a container loading with hydrogen storage alloy powder, heat exchange parts, and gas transport components. The container body materials are generally aluminium alloy or stainless steel. Our hydrogen storage vessels will be based on AB5 metal hydride alloys. Hydrogen being stored at low pressure in the vessel, they provide a safe and reliable energy storage, particularly for portable applications, in-house and in-board storage. An indoor storage facility will be available for this Hydrogen.</p>	<p>Hydrogen will be supplied by the Hydrogen supplier, in these high pressure containers, similar to Oxygen and Acetylene containers, by road transport.</p> <p>Where these small quantities will be required it will be transported by LDV to the required point. A connection will be made directly to the container, and the Hydrogen is then released by means of</p>	<p>0.053 tons per annum: 0.053/365 days = 0.0001452 tons per day</p> <p><i>(Est. Conversion fig)</i> <i>1m³=2.41T</i></p> <p>0.0000602m³ per day</p>

		a valve.	
Argon	<p>Since argon is inert, special materials of construction are not required. However, materials of construction will be selected to withstand the low temperature of liquid argon. Vessels and piping will be designed to. A typical system will consists of the following components: a cryogenic storage tank, one or more vaporizers, a pressure control system, and all of the piping required for fill, vaporization. The cryogenic tank is constructed, in principle, like a vacuum bottle. It is designed to keep heat away from the liquid that is contained in the inner vessel. Vaporizers convert the liquid argon to its gaseous state. A pressure control manifold controls the pressure at which the gas is fed to the process.</p>	<p>Although used more commonly in the gaseous state, argon will commonly be stored and transported as a liquid, affording a more cost-effective way of providing product supply.</p> <p>By means of a valve a direct pipe line will be connected to the tank for usage and as required by the process.</p>	<p>3.110 tons per annum: $3.110/365 \text{ days} = 0.0085 \text{ tons per day}$</p> <p><i>(Est. Conversion fig)</i> $1\text{m}^3=2.41\text{T}$</p> <p>0.0035m³ per day</p>

The main potential impacts associated with the storage of dangerous goods are spillages and accidental releases of gas and dust which may lead to ground, ground water, surface water and air pollution.

2. PROJECT PHASES AND ASSOCIATED ACTIVITIES

The project can be divided into three main phases:

- i. Construction Phase
- ii. Operational Phase
- iii. Decommissioning Phase.

Each activity undertaken as part of the above phases may have environmental impacts and has therefore been assessed by the specialist studies. In addition, management and mitigation measures required to address all the impacts are included in the EMPr. The Environmental Authorisation is required for the construction and operational phases of the project.

2.1. Construction Phase

Construction is planned to start in 2016 as soon as the Environmental Authorisation has been obtained. It will take up to 6 months due to the fact that most units are mobile units that will be installed in the buildings that are to be erected.

The main activities that will form part of the construction phase are:

- i. Vegetation clearing in the areas required for building infrastructure and brush cutting in the solar field area where the panels will be installed;
- ii. Excavations for infrastructure and associated infrastructure;
- iii. Establishment of a laydown area for equipment;
- iv. Construction of internal gravel access roads;
- v. Stockpiling of soil and vegetation removal;
- vi. Traffic generation from construction trucks delivering materials to site and workers coming to site
- vii. Construction of buildings

2.2. Operational Phase

The main activities to be undertaken during the operational phase include:

PV panel manufacturing

The manufacturing plant will manufacture silicon and glass which will be used to build PV panels. The PV panels will be sold and some will be used to create energy on-site.

Energy generation

The operational phase of the facility includes the operation of the solar facility whereby power is generated from the sunlight. The electricity generated will be stored in the flow batteries and used in the manufacturing plant.

Panel maintenance and cleaning

The accumulation of dust on the panels affects the productivity of the proposed solar power facility, and as a result, the panels require regular cleaning. It is planned that cleaning will take place on a monthly basis using only water.

The duration of the Environmental Authorisation is required for the total operational period which does not have a final date at this stage. Closure is not foreseen.

2.3. Decommissioning Phase

Decommissioning will involve removing the solar panels, manufacturing plant and associated infrastructures, and covering the concrete footings with soil to a depth sufficient for natural vegetation re-growth.



Buildings will not be demolished, but may be utilized for other purposes such as offices or housing or other manufacturing facilities.

Decommissioning however is not foreseen as part of the project phases.

Chapter 3: LEGISLATION

1. Legislation and guidelines that have been considered in the preparation of the EIA report

2.1. Overarching/Framework legislation

2.1.1. Constitution of the Republic of South Africa (Act No 108 of 1996)

According to Section 24 of the Constitution: *“Everyone has the right to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.*

The proposed development can be considered as sustainable use of renewable natural resources whilst providing employment opportunities and promoting economic development.

2.1.2. National Environmental Management Act (Act No 107 of 1998)

The National Environmental Management Act 107 of 1998 (NEMA) establishes a set of principles, which all authorities have to consider when exercising their powers during the granting of permits. The principles underpinning environmental management contained in the NEMA, as stated in Section 2 are that sustainable development requires the consideration of all relevant factors including the following:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That the development, use and exploitation of renewable resources and the ecosystems of which they are a part do not exceed the level beyond which their integrity is jeopardised;
- That negative impacts on the environment and on people’s environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- Development must be socially, environmentally and economically sustainable.

- Environmental management must be integrated and acknowledge that all elements of the environment are linked and interrelated, and it must pursue the best practicable environmental option.
- People and their needs must be placed at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

Section 28(1) states that “every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring”. If such degradation/pollution cannot be prevented, then appropriate measures must be taken to rectify or minimise such pollution. These measures may include, but are not limited to:

- Assessing the impact of the project or development on the environment;
- Informing and educating employees about the environmental risks of their work and possible ways of minimising such risks;
- Ceasing, adapting or controlling actions which cause pollution/degradation;
- Preventing movement of pollutants;
- Eliminating the pollution source; and
- Remedying the effects of the pollution.

For this reason Regulations have been published which lists activities for which environmental impact assessments are required. The Environmental Impact Assessment Regulations in terms of Chapter 5 of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) were promulgated on 4 December 2014 and include Regulations R983, R984 and 985.

- **Regulation GN R982:** Environmental Impact Assessment Regulations: provides for activities that may impact detrimentally on the environment to require prior environmental authorisation. The Regulations describes the procedures that are to be followed in order to obtain an environmental authorisation.
- **Regulation GN R983 and R984:** sets out lists of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the basic assessment or full scoping EIA procedure as provided for in the NEMA EIA Regulations.
- **Regulations GN 985:** sets out activities in specified regions of the country, for which an environmental authorization will be required.

The proposed project requires a full scoping EIA in terms of R984.

2.2. Biodiversity

2.2.1. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

This Act gives effect to ratified international agreements affecting biodiversity to which South Africa is a party, and which bind the Republic. Furthermore, the Minister may list ecosystems and species that are threatened or in need of protection. The Minister may also list threatening processes and activities in listed ecosystems and related to protected species. The Act also makes provision for the rehabilitation of ecosystems. The Minister may also promulgate a list of invasive species and the required measures associated with these.

Given the location of the proposed project on the existing footprint of a brownfield site, zoned for agricultural and industrial use, it is not foreseen that any protected species will be affected.

In terms of **Regulation 507 of 19 July 2014** (Publication of National List of Invasive Species) invader species are categorised as follows:

Category 1a Listed Invasive Species

- Take immediate steps to combat, or eradicate where possible.

Category 1b Listed Invasive Species

- Control the listed invasive species.

Category 2 Listed Invasive Species

- Utilization allowed under Permit conditions.
- Control outside of the Permit conditions.

Category 3 Listed Invasive Species

- Subject to certain prohibitions (e.g. sell)
- Category 3 plant specimens in riparian areas are treated as Category 1b.

The Environmental management programme (EMPr) will make provision for the control of all listed invasive species.

2.2.2. National Environmental Management: Protected Areas Act (Act 57 of 2003)

The intention of the Act is to protect and conserve ecologically viable areas as well as their natural landscapes.

The proposed site is not within or close to a formally protected area. The site is however close to several conservancies.

2.2.3. National Veld and Forest Fires Act (Act No 101 of 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic and provides for a variety of institutions, methods and practices for achieving the purpose. Chapter 4 places a duty on owners to prepare and maintain firebreaks. The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with. Chapter 5 places a duty on all owners to acquire equipment and have available personnel to fight fires.

The location of the proposed plant amidst extensive grasslands will require specific measures that will be included in the environmental management Programme (EMP) to prevent fires.

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

The Act sets out measures to prevent the spread of alien vegetation. The legislation includes a list of alien and invasive species and the required measures to be taken in relation to these. The Act also provides for the regulation of control over the utilisation of agricultural resources in SA in order to promote the conservation of soil, water and vegetation (including wetlands). In accordance with the Act, authorisation is required to:

- i. drain or cultivate any vlei, marsh or water sponge
- ii. cultivate any land within the flood area of a water course or within 10 m outside the flood-area of a water course
- iii. divert run-off from a water course, or
- iv. burn veld, including wetland vegetation.

Regulation GNR 1048 of 24 May 1984 (as amended): makes provision of land through various measures, such as the prevention of soil erosion, the prevention of the disturbance of natural flow patterns and run-off, prevention of bush encroachment and makes provision for the restoration of land resources.

Measures will be included in the EMP to curb the spread of declared weeds and to prevent soil erosion.

2.3. Water

2.3.1. National Water Act (Act No 36 of 1998)

Water use is controlled by the National Water Act (Act no 36 of 1998) (NWA) and the enforcing authority is Department of Water Affairs (DWA). The NWA recognises that water is a scarce resource in South Africa and its provisions are aimed at achieving sustainable use of water to the benefit of all users. The provisions of the Act are thus aimed at discouraging pollution and waste of water resources.

Water use is defined broadly, and includes:

- a. Taking water from a water resource;
- b. Storing water;
- c. Impeding or diverting the flow of water in a water course;
- d. Engaging in a stream flow reduction activity reduce stream flow;
- e. Engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);
- f. Discharging waste or water containing waste into a water resource through pipe, canal, sewer, sea outfall or other conduit;
- g. Disposing of waste in a manner which may detrimentally impact on a water resource;
- h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- i. Altering the beds, banks, course or characteristics of a watercourse;
- j. Removing, discharge or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

A water use must be licensed unless it is listed in Schedule I as an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a license.

The Act also makes amongst others, provision for the prevention and remediation of pollution, the handling and emergency incidences and the registration of dams with a safety risk.

The proposed project does not require a water use licence. Water will be supplied by Rand Water and waste water will be disposed of into the on-site conservancy tank sewer system – no water will be disposed of into the environment and no wetlands or water courses will be affected during construction or operation. Measures will however be included in the EMP related to the prevention of the pollution of storm water run-off, the prevention of water resource pollution and the handling of emergency incidences.

2.4. Waste

2.4.1. National Environmental Management Waste Act (Act 59 of 2008) and amendment R449 dated 2 June 2014.

In July 2009, the National Environmental Management Waste Act (Act 59 of 2008) came into effect. This Act requires that any holder of waste must take all reasonable measures to –

- avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
- re-use, recycle or recover waste;
- where waste must be disposed of, to ensure that the waste is treated and disposed of in an environmentally sound manner;
- manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
- within that person's power, prevent any other person from contravening a provision of this Act in respect of the waste; and
- take reasonable measures to prevent the waste from being used for an unauthorised purpose.

The Minister published a list of waste management activities which require authorization under the Act. Government Notice R921 of 29 November 2013 lists Category A and Category B waste activities which requires any person undertaking such activities to perform a Basic Assessment Process or Scoping / EIA Process respectively. No person may commence, undertake or conduct a waste management activity listed in the GN R718 unless a license is issued in respect of that activity.

There are no activities associated with the proposed project that requires a Waste Management License Application. Any waste that will be generated during construction and operation will be disposed of in a manner compliant with the Act.

2.5. Atmospheric emissions

2.5.1. National Environmental Management: Air Quality Act (Act No 39 of 2004)

The Act provides for the protection of air quality in South Africa. Amongst others, no person may without a provisional atmospheric emission license or an atmospheric license conduct an activity that is listed in the Act. The Act also makes provision for ambient air quality standards related to criteria air pollutants in SA.

The proposed project requires an air emission license given that activities as listed under the Act will be conducted. The manufacturing of poly-silicon from silica through the application of heat will result in air emissions as well as the manufacturing of glass. An air quality assessment will be done as part of the impact study associated with the application for environmental authorization.

2.5.2. National Dust Control Regulations, 2013: No R 827

The Regulations makes provision for the control of dust as well as to prescribe acceptable dust fall levels (as indicated in the table below).

Restriction Areas	Dustfall rate (D) (mg/m²/day, 30-days average)	Permitted frequency of exceeding dust fall rate
Residential area	D < 600	Two within a year, not sequential months.
Non-residential area	600 < D < 1200	Two within a year, not sequential months.

Dust will be generated by the proposed activities during construction. Adequate dust control measures will have to be instituted to ensure that the fall-out rates do not exceed the standards. Dust control measures will be included in the EMPr.

2.6. Declaration of the Vaal Triangle Air Shed Priority Area

The Vaal Triangle and surrounding areas has been declared in Regulation 365 of 21 April 2006 as a priority area) in terms of Section 18 (1) of the National Environmental Management: Air Quality Act 2004 (Act No. 39 of 2004) (AQA). The Midvaal Municipal area falls within this priority air shed.

Special interventions are now being made by the National Department of Environmental Affairs and Tourism (DEAT) to improve the air quality in the Vaal Triangle Airshed Priority Area. These interventions include a Priority Area Air Quality Management Plan (AQMP).

The EMPr will include measures to ensure that air quality in the region is not further deteriorated and to ensure compliance with the National Ambient Air Quality Standards

2.7. National Ambient Air Quality Standards

In terms of R 1210 of 24 December 2009, National Ambient Air Quality Standards were promulgated. The standards include those for Nitrogen dioxides (NO₂), Sulphur Dioxide (SO₂), Ozone (O₃), lead, benzene and Particulate matter (PM 10) and Carbon Monoxide (CO).

In terms of R 486 of 29 June 2012, National; Ambient Air Quality standards for particulate matter with an aerodynamic diameter less than 2.5 microns (PM 2.5) were promulgated.

The EMPr will include measures to ensure that air quality in the region is not further deteriorated and to ensure compliance with the National Ambient Air Quality Standards

2.8. Government Notice, R. 533 National Environmental Management: Air Quality Act (39/2004): Regulations regarding Air Dispersion Modeling, page 3 in Government Gazette 37804, 11 July 2014

The Regulations dictates the methodology for air dispersion modeling.

The air quality impact assessment modeling study will have to comply with the Regulations

2.9. Draft: National Environmental Management Air Quality Act, Act No. 39 of 2004, Declaration of Greenhouse Gases as Priority Air Pollutants, 14 March 2014

A person conducting an activity set out in Annexure I to this Notice which involves the emission of greenhouses declared as priority air pollutant in paragraph 2 in excess of 0.1 Megatons (109 kg) (Mt) or more annually or measured as CO₂-eq is required to submit a pollution prevention plan.

The following greenhouse gases or any other gases are declared priority air pollutants in terms of section 29(1)(a) of this Act: (a) Carbon dioxide (CO₂); (b) Methane (CH₄); (c) Nitrous oxide (N₂O); (d) Hydrofluorocarbons (HFCs); (e) Perfluorocarbons (PFCs); and (f) Sulphur hexafluoride (SF₆).

During the air quality assessment, the amount of CO₂ released during the operations (glass manufacturing, will have to be calculated in order to determine if a pollution prevention plan under this Regulations have to be submitted provided the draft regulations is formally promulgated during this time. The Draft Regulations is still not promulgated.

2.10. National Environmental Management Act: Air Quality Act, 2004 (Act No 39 of 2004): Declaration of small boilers as a controlled emitter and establishment of emission standards, 1 November 2013

In terms of these regulations, small boilers have to comply with specified emission standards Small boilers are those with a design capacity equal to 10MW but less than 50MW net heat input from any fuel type. Operators have to submit emission reports to the relevant authorities.

No boiler onsite.

2.10.1. Environment Conservation Act, 1989 (Act No 73 of 1989) – Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989: GN 154 of January 1992

The Regulations makes provision for the control of disturbing and nuisance noise.

A noise *disturbance or nuisance* as defined in the national and provincial legislation means any sound which disturbs or impairs the convenience of any person. The Regulations describe a *disturbing noise* as noise that exceeds the ambient noise by more than 7 dB. This difference is usually measured at the location of the person experiencing the noise as disturbing. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7 dB, the noise can be construed as a disturbance.

The most applicable standard for use relevant to the proposed project is SANS 10103:2008 which provides typical rating levels for noise in various types of districts, as described in Table 1 below. SANS 10103:2008 defines daytime as between 06:00 to 22:00 hours and night time as between 22:00 to 06:00 hours. The rating levels in the table above indicate that in industrial districts the ambient noise.

Table: 1. Typical rating levels for noise in various types of districts (SANS 10103:2008)

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Noise levels in industrial areas should not exceed 60 dB (A) at night and 70 dB (A) outdoors during the day. The day / night (24hour) rating limit is 70 dB (A). These levels can thus be seen as the maximum target levels for any noise pollution sources.

The site of the proposed project has been zoned as “industrial” and is adjacent to many other sources of industrial and transport noise. It is not foreseen that the proposed project will contribute to the ambient noise levels in the area but noise control measures will be included in the EMP. Once the site is operational, a noise impact assessment will have to be done, and should noise levels exceed the relevant noise standards, engineering controls will have to be implemented to reduce noise impacts beyond the site boundaries.

2.11. Heritage resources

2.11.1. National Heritage Resources Act No 25 of 1999 (Act No 25 of 1999 as amended)

No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- (b) the construction of a bridge or similar structure exceeding 50 m in length;
- (c) any development or other activity which will change the character of a site—
 - (i) exceeding 5 000 m² in extent; or
 - (ii) involving three or more existing erven or subdivisions thereof; or
 - (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- (d) the re-zoning of a site exceeding 10 000 m² in extent; or
- (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

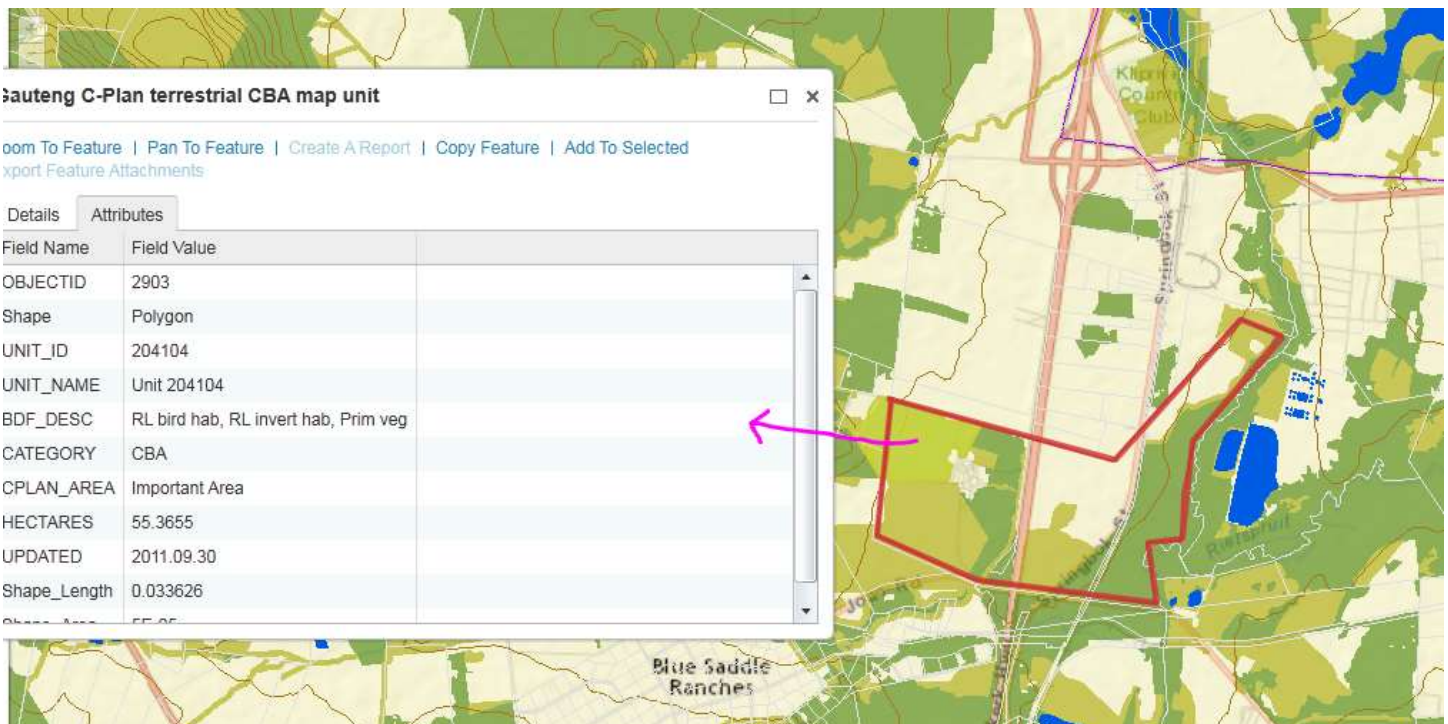
A heritage impact assessment study was executed during 2007 and no heritage objects of significance were found.

2.12. Policies, Plans, Guidelines, spatial tools and municipal development frameworks and instruments

2.12.1. Gauteng Conservation Plan

C-Plan version 3.3 became available in October 2011. The main purposes of C-Plan 3.3 are:

- to serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process;
- to inform protected area expansion and biodiversity stewardship programs in the province;
- to serve as a basis for development of Bioregional Plans in municipalities within the province.



Critical Biodiversity Areas (CBAs): CBAs include natural or near-natural terrestrial and aquatic features that were selected based on an areas biodiversity characteristics, spatial configuration and requirement for meeting both biodiversity pattern and ecological process targets. CBAs include irreplaceable sites where no other options exist for meeting targets for biodiversity features, as well as best-design sites which represent an efficient configuration of sites to meet targets in an ecologically sustainable way that is least conflicting with other land uses and activities. These areas need be maintained in the appropriate condition for their category. Some CBAs are degraded or irreversibly modified but are still required for achieving specific targets, such as cultivated lands for threatened species. Refer to Section 2 for the biodiversity features that represent the Critical Biodiversity Areas and Section 5.2.1 for a summary of the CBA criteria

The proposed site contains Important areas and Ecological support areas as per Gauteng C Plan 3. There are wetlands present on site close to the water course. The site is adjacent to a water course, but the development will not encroach on the flood line/32m buffer zone nor on the 500m buffer zone of the wetland. Listing Notice 3 is therefore relevant in terms of this application.

2.13. Municipal Biodiversity Summaries

(As per Sanbi: BGIS, 2015) Municipalities have a significant role to play in biodiversity conservation as part of their mandate to provide a safe and healthy environment for residents. In support of this role, the Department of Environmental Affairs (DEA) and the South African National Biodiversity Institute (SANBI) identified the need to provide municipalities with good quality biodiversity information that is easily accessible. The Municipal Biodiversity Summary project aims to make biodiversity information, including spatial data, available to municipalities to support them in their reporting responsibilities such as the drafting of State of Environment Reports. In addition, the project also provides municipalities with generic land-use planning and decision-making implications in terms of listed threatened ecosystems and other biodiversity features.

A municipal biodiversity summary has been developed for each municipality in South Africa. The summary provides a standard, national set of biodiversity information for each municipality which includes the following:

- Statistics for a selection of biodiversity features
- A terrestrial biodiversity summary map
- Shapefiles of biodiversity features for downloading
- Access to an interactive map to produce your own map of biodiversity features within a municipality
- A series of fact sheets related to the project

The main focus of the Municipal Biodiversity Summary Project is not as a land-use planning and decision-making tool as there are other tools, namely biodiversity sector plans and bioregional plans, which provide this role. Municipal biodiversity summaries are primarily a reporting tool providing biodiversity statistics, based on the best available national data, for municipalities. However, in those municipalities where there is no biodiversity sector plan or bioregional plan the municipal biodiversity summary for the municipality can provide some guidance in terms of

land-use planning and decision-making as it provides information on the location of threatened ecosystems and other biodiversity features within the municipality.

The Municipal Biodiversity Summary Project used national data generated as of December 2009, unless otherwise indicated. Additional finer-scale biodiversity information is available on BGIS for some municipalities in the country. It is important to note that when this is the case, the finer-scale information should be used for land-use planning and decision-making purposes.

Gauteng Conservation Plan 3.3 2011 is the most relevant biodiversity conservation plan for Midvaal Municipality and its information should be used for land use decision support. LUDS Map: Gauteng C-Plan 3.3 (Terrestrial CBA map) is the appropriate map in which to assess the LUDS for the Midvaal Municipality

The proposed site contains Important areas and Ecological support areas as per Gauteng C Plan 3. There are wetlands present on site close to the water course. The site is adjacent to a water course, but the development will not encroach on the flood line/32m buffer zone nor on the 500m buffer zone of the wetland. Listing Notice 3 is therefore relevant in terms of this application.

2.14. Gauteng Environmental Management Framework

The Gauteng Provincial Environmental Management Framework is a legal instrument in terms of the Environmental Management Framework Regulations, 2010

The objectives of the EMF are to:

- To protect Critical Biodiversity Areas (CBAs as defined in C-Plan 3.3) within urban and rural environments
- To facilitate the optimal use of current industrial, mining land and other suitable derelict land for the development of non-polluting industrial and large commercial developments
- To ensure the proper integration Ecological Support Areas (ESAs as defined in C-Plan 3.3) into rural land use change and development
- To use ESAs as defined in municipal bio-regional plans in spatial planning of urban open space corridors and links within urban areas
- To focus on the sustainability of development through the implementation of initiatives such as:
 - Energy efficiency programmes, plans and designs;
 - Waste minimisation, reuse and recycling;
 - Green infrastructure in urban areas; and
 - Sustainable Drainage Systems (SuDS).

CHAPTER 4:

Description of

environment

1. A Description of the Environment that may be affected by the Proposed Activity

1.1. Geographical

The spatial structure of the Midvaal municipal area is predominantly rural with extensive farming constituting approximately 50% of the total area of jurisdiction. Several natural features, which present significant tourism opportunities, occur in the area, of which the Suikerbosrand Nature Reserve, the Klip River and the Vaal River are the most prominent. The Suikerbosrand Nature Reserve is a formal nature reserve protected by law.

The region also falls within the Grassland Biome, which includes approximately one-third of the mammal species of South Africa. The Klip River is an important habitat for birds and small animals.

The map below provides an overview of the immediate location of the proposed project. As can be seen, the different land-uses in the area are mainly associated with industrial use, road and railway networks as well as residential areas. Informal houses occur on the site.

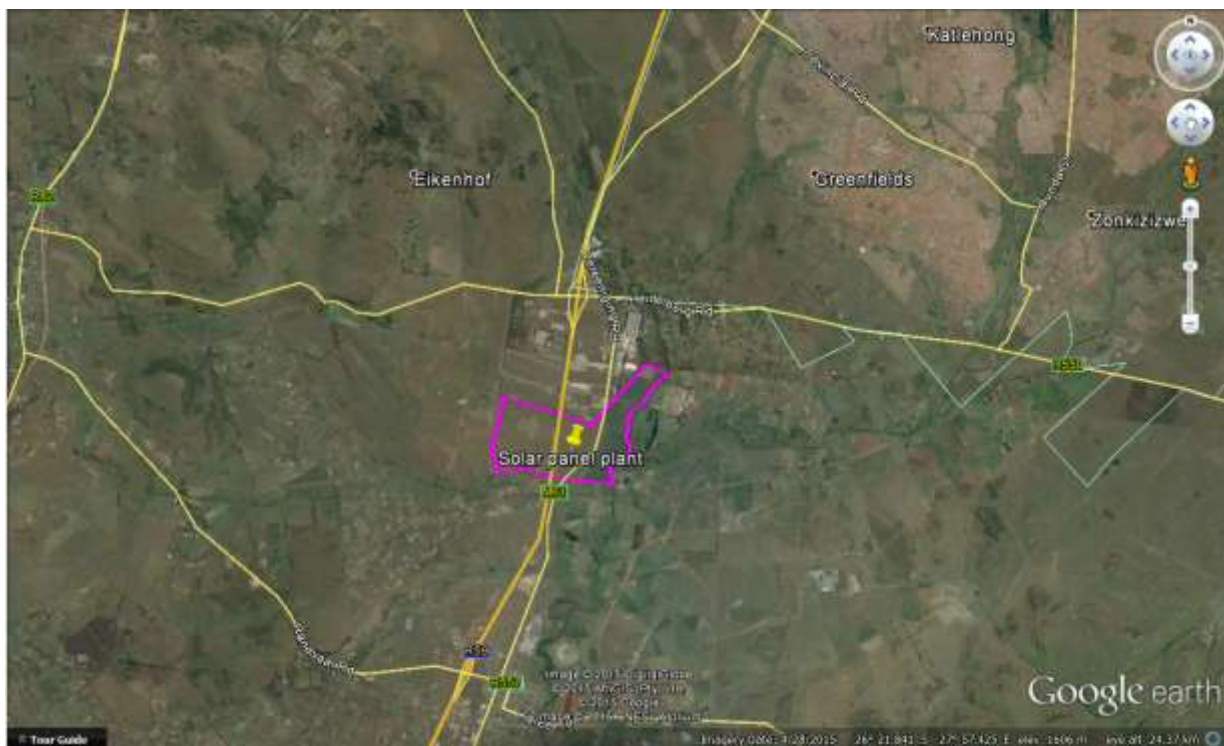


Figure 7: The location of the proposed activity

The Land Cover map below (obtained from BGIS, SANBI, 2015) indicates the land uses associated with the whole of the farm Waterval (of which the relevant Portion has been indicated by the red polygon). The land classes associated with the project area is “Cultivation, urban built –up and waterbodies”.

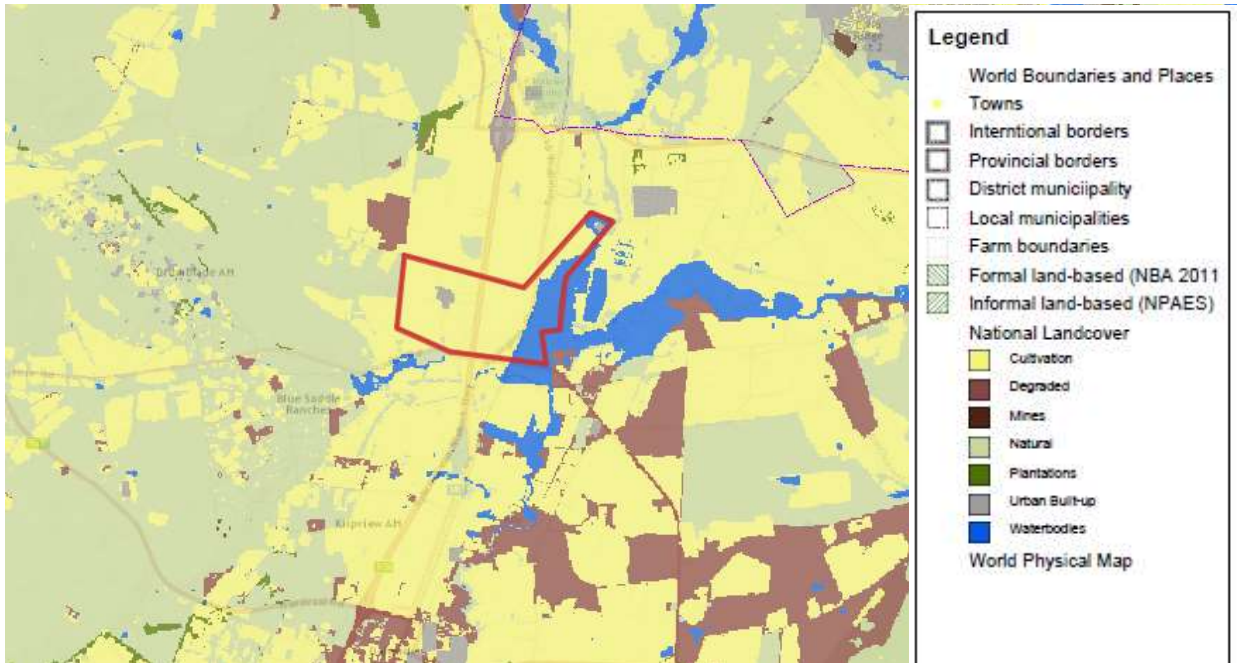


Figure 8: Land cover classes associated with the region (Data from SANBI, 2012)

1.2. Physical

Relief on the site varies around 1500 mamsl. The site is fairly flat with the highest point towards the western side of the site.



Figure 9: 20 meter contours associated with the project site, indicating the relative flatness of the site (SANBI, 2015).

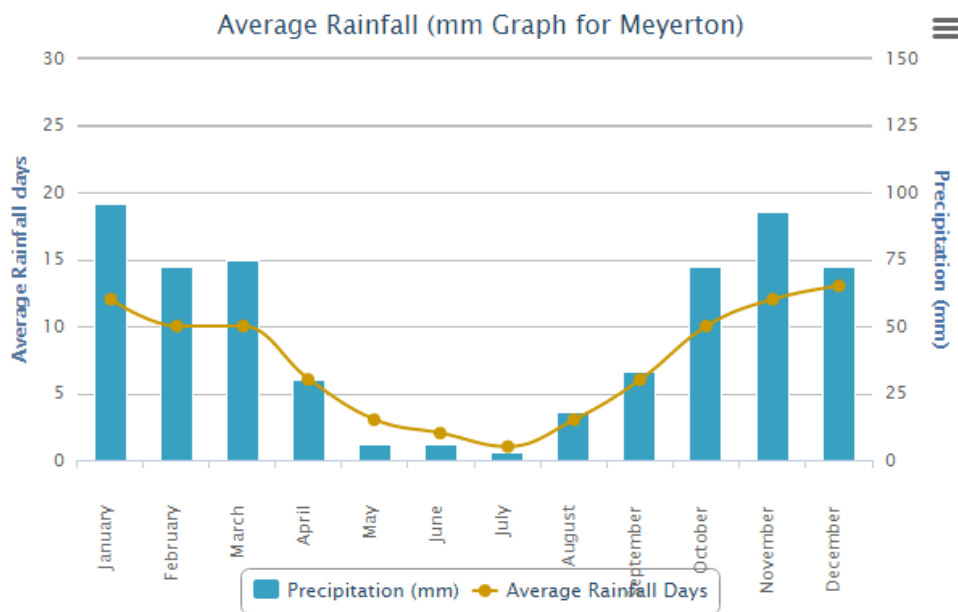
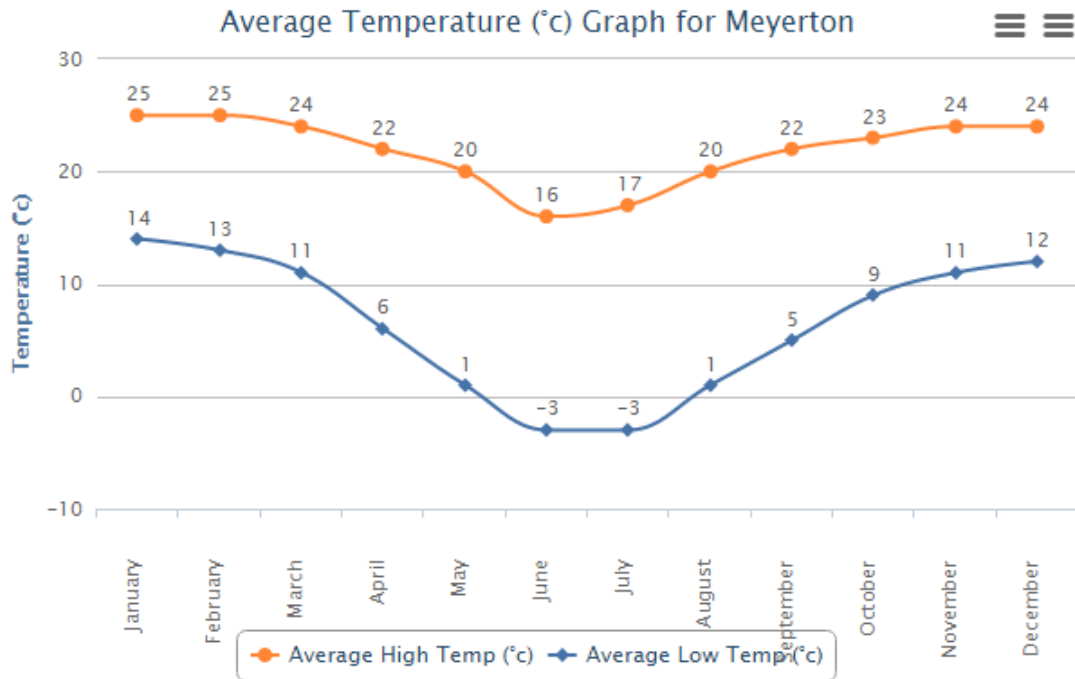
1.2.1. Electromagnetic interference

The detailed electricity plan onsite is however not available yet and as such the nature of electromagnetic interference will not be able to be determined currently.

A condition will be recommended for inclusion in the environmental authorisation that electromagnetic tests should be executed once all electricity infrastructure has been installed on site and the test results be submitted to the Competent Authority. Should the test results indicate electromagnetic interference for surrounding recipients, mitigation and management measures have to be implemented until electromagnetic interference is no longer significant/problematic.

1.2.2. Climate

The site falls within the summer rainfall area of South Africa. Daily summer temperatures range between 14°C and 25°C. Winter temperatures range between 1°C and 20°C. Spring temperatures range between 5°C and 22°C, while autumn temperatures range between 6°C and 22°C.



Note: The data for charts above are taken from year 2000 to 2012.

Figure 10: Average Temperature and rainfall for the Meyerton Area (from 2000 to current) (<http://www.worldweatheronline.com>)

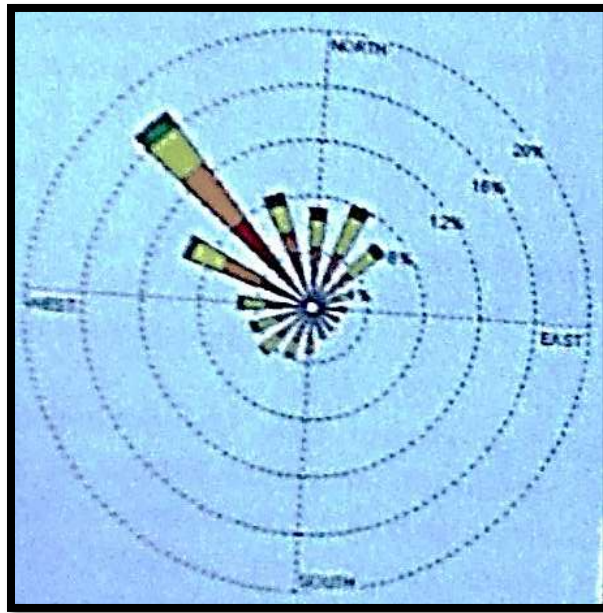


Figure 11: Annual average wind speed and direction – (Bohlweki Environmental, 2007)

Winds are predominantly north westerly. Strongest wind speeds are recorded in late winter, during the period July / August. More than half the data shows periods of calm (wind <0.5 m.s-1).

1.2.3. Geology

The site is underlain by Dolomite as per the figure below.

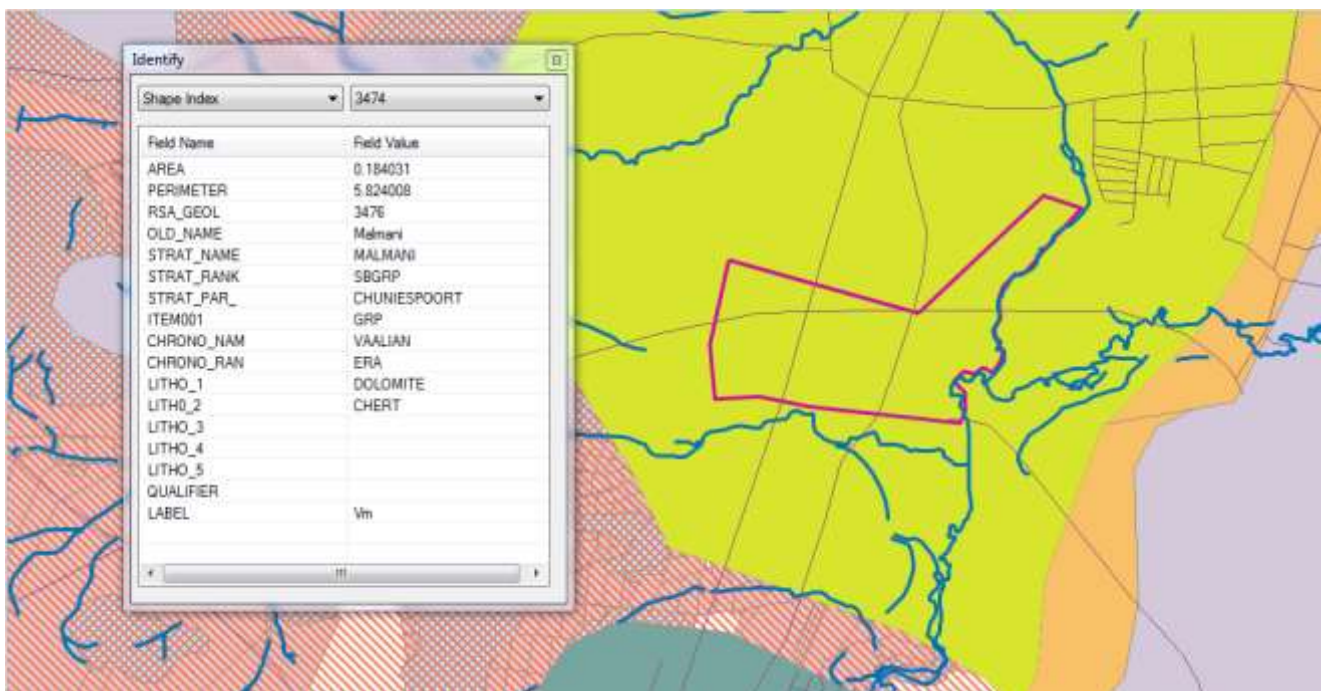


Figure 12: The geology associated with the Project Site

The presence of weathered or fractured dolomite onsite is not known at present. However, the presence of dolomite onsite will have implications for risk management related to the storage of hydrochloric acid onsite due to the ability of acids to dissolve the dolomitic elements of calcium magnesium carbonate.

Storm water control measures have to be implemented to avoid standing water onsite.

1.3. Soils

The soil on site is classified as Hutton soils with a fairly high percentage of sand content.

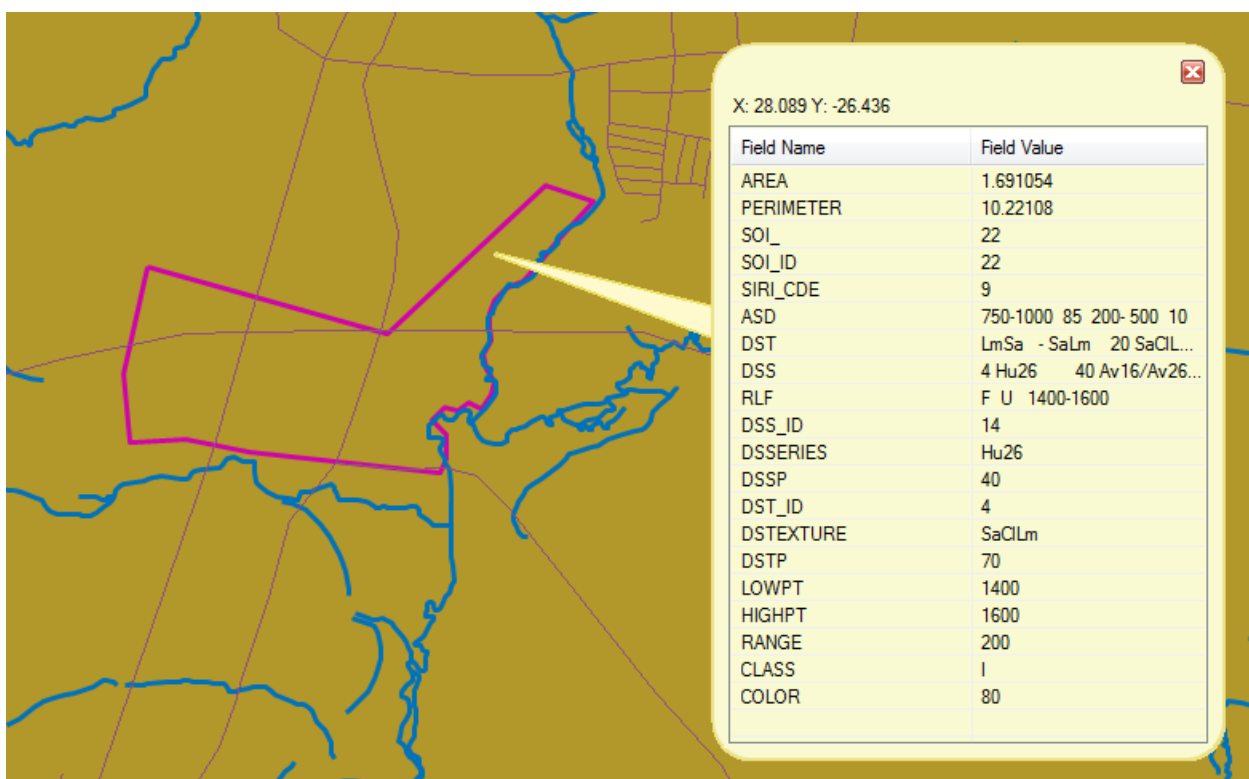


Figure 13: The soil onsite consist of Hutton Soils

1.3.1. Agricultural potential

Report: SOIL INFORMATION FOR PROPOSED WATEVAL SOLAR PARK, NEAR MEYERTON,

GAUTENG PROVINCE By D.G. Paterson, M.N Mushia, S.D. Mkula: Full report attached as Appendix of specialist studies

At the time of the field survey visit (February 2015), most of the study area comprised natural grassland, with occasional rock outcrops. The area between the railway line and the Klip River was under partial

cultivation (maize), with an adjoining strip of fallow land, where remains of the previous seasons' maize crop could be seen. Finally, two areas, one in the west and one in the extreme north-east, were occupied by informal residential settlements.

The soils are generally light to medium-textured, weakly structured red soils of the Hutton soil form. The main variation between the map units concerns the soil depth (to the underlying rock), combined with the presence/absence of surface stone or rock outcrops.

Along the lower-lying parts adjacent to the Klip River, the soil changes to a dark brown, heavier-textured sandy clay with signs of wetness in the subsoil. These soils will be prone to flooding in times of heavy rainfall and will often remain saturated even into the drier winter months.

The agricultural potential varies with soil depth. The shallower soils (**sHu** and **Hu/R** units) are not suitable for arable cultivation due to the restricted depth to the underlying rock, coupled with the stone/rock content. In contrast, the deeper soils (**mHu** and **dHu** units) have a greater soil volume and rooting depth available to any crops, so will have a higher potential.

Due to the wetness situation mentioned in Section 4, the wetter soils close to the river (**Ka** unit) are not recommended for cultivation, although they can be valuable soils for grazing of livestock in most seasons when there is not excessive rainfall.

During the soil survey, it was noticed that the area between the railway line and the river had been cultivated and was partially planted to maize at that time. However, especially in the areas no longer cultivated, the stony nature of the soil could easily be observed, which would probably lead to reduced yields. In addition, within the maize area, significant differences in crop height (varying from around 0.6 m to over 2.0 m) could clearly be observed. It is confidently predicted that these variations will correspond well with variations in soil depth, so that the poorer growth will occur on the shallower patches of soil.

1.3.1.1. Erodibility

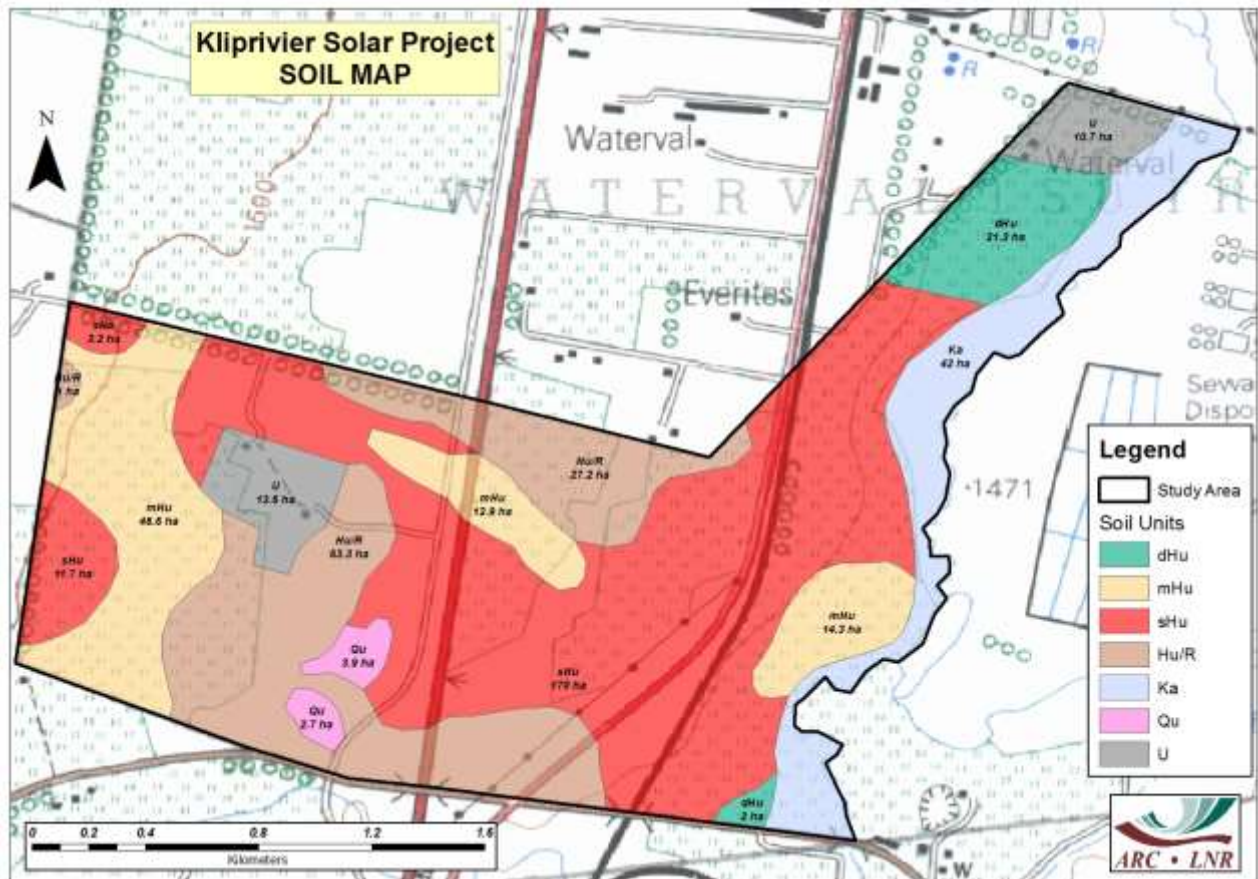
The soils in the study area have a light to moderate topsoil texture, and cannot be regarded as being exceptionally susceptible to soil erosion, either by water or wind. They will also not be likely to suffer from surface compaction, due mainly to the medium clay content and stable clay mineralogy.

However, any soil will have the tendency to erode if the topsoil is disturbed and exposed, for example by construction works, so normal soil conservation measures, such as contouring, culverts where necessary, cut-off drainage channels and geotextiles to aid re-vegetation, should be considered. The area does not have steep slopes which could exacerbate surface flow, but any measures should be supplied by the construction engineers.

Agricultural Potential Class	Map Unit(s)	Limitations	Area (ha) & % of study area
High	dHu	Virtually none. Deep, freely-drained, friable soil, suitable for most crops	23.3 ha <i>(5.1%)</i>
Moderate	mHu	Restricted soil depth in places. Occasional stone/gravel content. Reduced yields expected.	73.8 ha <i>(16.2%)</i>
Low	sHu	Very restricted soil depth, usually stony/gravelly soil. Poor yields expected	184.9 ha <i>(40.5%)</i>
Very Low	Hu/R, Qu, Ka	Little available soil with rock (<i>Hu/R</i> & <i>Qu</i>); significant flood hazard and wet soils (<i>Ka</i>)	150.1 ha <i>(32.9%)</i>
None	U	Land occupied by informal settlements	24.3 ha <i>(5.3%)</i>
			456.4 ha <i>(100%)</i>

Map Unit	Dominant Soil Form(s)	Depth (mm)	Soil Characteristics	Agric. Potential	Area (ha)
dHu	Hutton	1000-1500+	Red to reddish brown, structureless, sandy loam to sandy clay loam topsoil on reddish-brown to red, structureless to weakly structured, loamy sand to sandy loam subsoil. Underlying material is hard to weathered rock.	High	23.3
mHu	Hutton	500-900	Red to reddish brown, structureless, sandy loam to sandy clay loam topsoil on reddish-brown to red, structureless to weakly structured, loamy sand to sandy loam subsoil, occasionally gravelly. Underlying material is hard to weathered rock.	Moderate	73.8
sHu	Hutton	100-500	Red to reddish brown, structureless, sandy loam to sandy clay loam topsoil, often stony/gravelly on reddish-brown to red, structureless to weakly structured, loamy sand to sandy loam subsoil, usually stony/gravelly. Underlying material is hard to weathered rock, and occasional rock outcrops and/or surface stones occur.	Low	184.9
Hu/R	Hutton, Mispah	100-200	Red to reddish brown, structureless, sandy loam to sandy clay loam topsoil, occasionally gravelly. Underlying material is hard to weathered rock and regular to common rock outcrops and/or surface stones occur.	Very low	101.5
Ka	Katspruit, Sepane	200-600	Greyish to brown, weakly structured, sandy loam to sandy clay loam topsoil on brown to dark brown, weakly to moderately structured subsoil, on gleyed, mottled clayey material with signs of wetness. The underlying material is usually wet. Occurs close to Klip River, with water table closer to the surface along the river course.	Very low	42.0
Qu	Rehabilitated quarries: slightly uneven and lower-lying land surface with disturbed soil and some surface rock/stone			Very low	6.6

U	Informal settlement areas, with housing and other basic infrastructure. Area unavailable for agriculture in present situation.	None	24.3
Total area			456.4



According to the norms of the South African Land Capability classification (Schoeman *et al.*, 2002), the various mapping units would both be classed as arable, as follows:

- **dHu – Class 1** (land that can be used for a variety of crops with no limitations)
- **mHu- Class 2** (land that can be used for a variety of agricultural crops, with only minor limitations)
- **sHu – Class 4** (land that has very significant limitations that reduce the choice of crops. Limitations may include: depth, texture, fertility, wetness, terrain etc. Agriculture is possible, but very problematic)
- **Ka – Class 5** (land with limitations that make cultivation impractical, such as flood hazard or wetness)
- **Hu/R – Class 6** (land with permanent restrictions in land use options, such as rockiness)

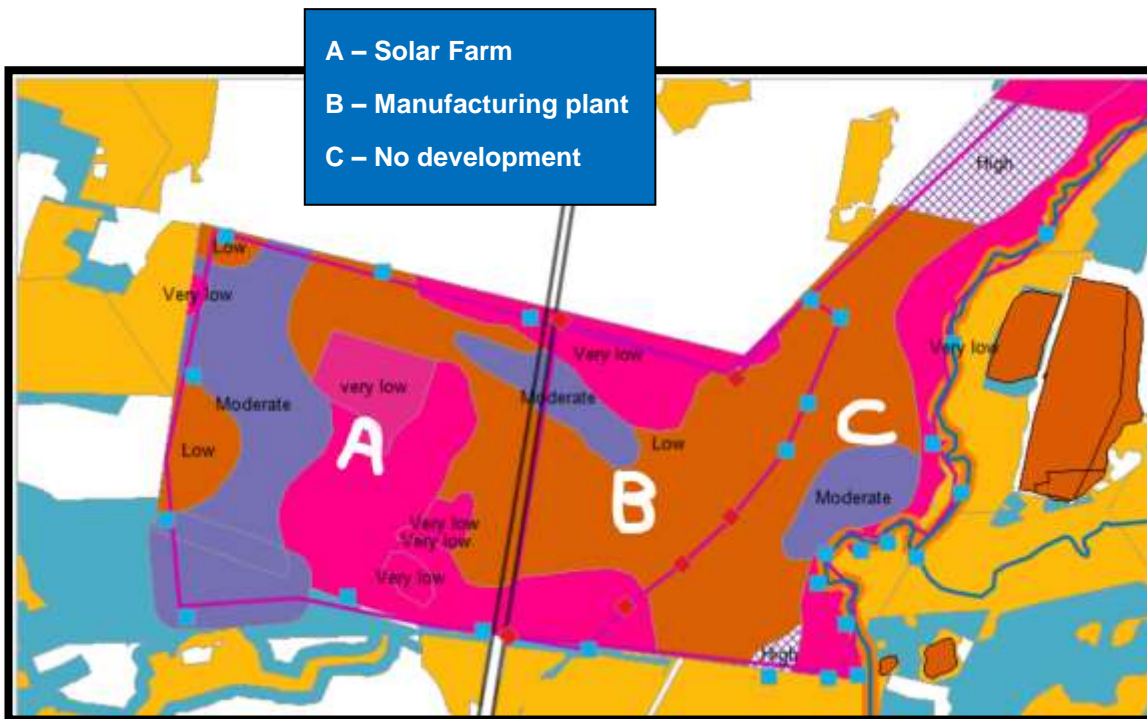


Figure 14: The agricultural potential areas in terms of the use of the land for the proposed project

As can be seen in Figure 14 – high potential agricultural land will not be affected by the development.

1.3.1.2. CONCLUSION

The loss of agriculturally productive land in and around Gauteng can have a negative effect on food production and food security, especially as, compared to its area, Gauteng has the highest proportion of high potential land of any province in South Africa (Paterson, 2012). However, the converse of this is that where low potential land exists, it should be able to be used for non-agricultural uses (with appropriate mitigation, where relevant) without any significant impacts.

The study area, as investigated for this report, consists of a variety of soils, with varying degrees of agricultural potential. However, the areas with deep, high potential soils are relatively small, occurring in the area close to the Klip River. The rest of the property has moderately deep to shallow soils. In addition, the moderately deep soils will have a degree of depth variation, which makes their cultivation somewhat problematic (as observed in the variation in the maize land), and these areas to the west of the railway line are not being cultivated at present, or apparently in the recent past.

For these reasons, as long as development on the high potential soils is avoided, there should be no objection, from the point of view of soils and agricultural potential, to the construction of the proposed facility.

1.4. Water

1.4.1. Water Courses

The site falls within quaternary catchment C22E. The Klipspruit (a perennial river) forms the eastern boundary of the site. No surface water will be abstracted and no effluent will be returned to the environment.

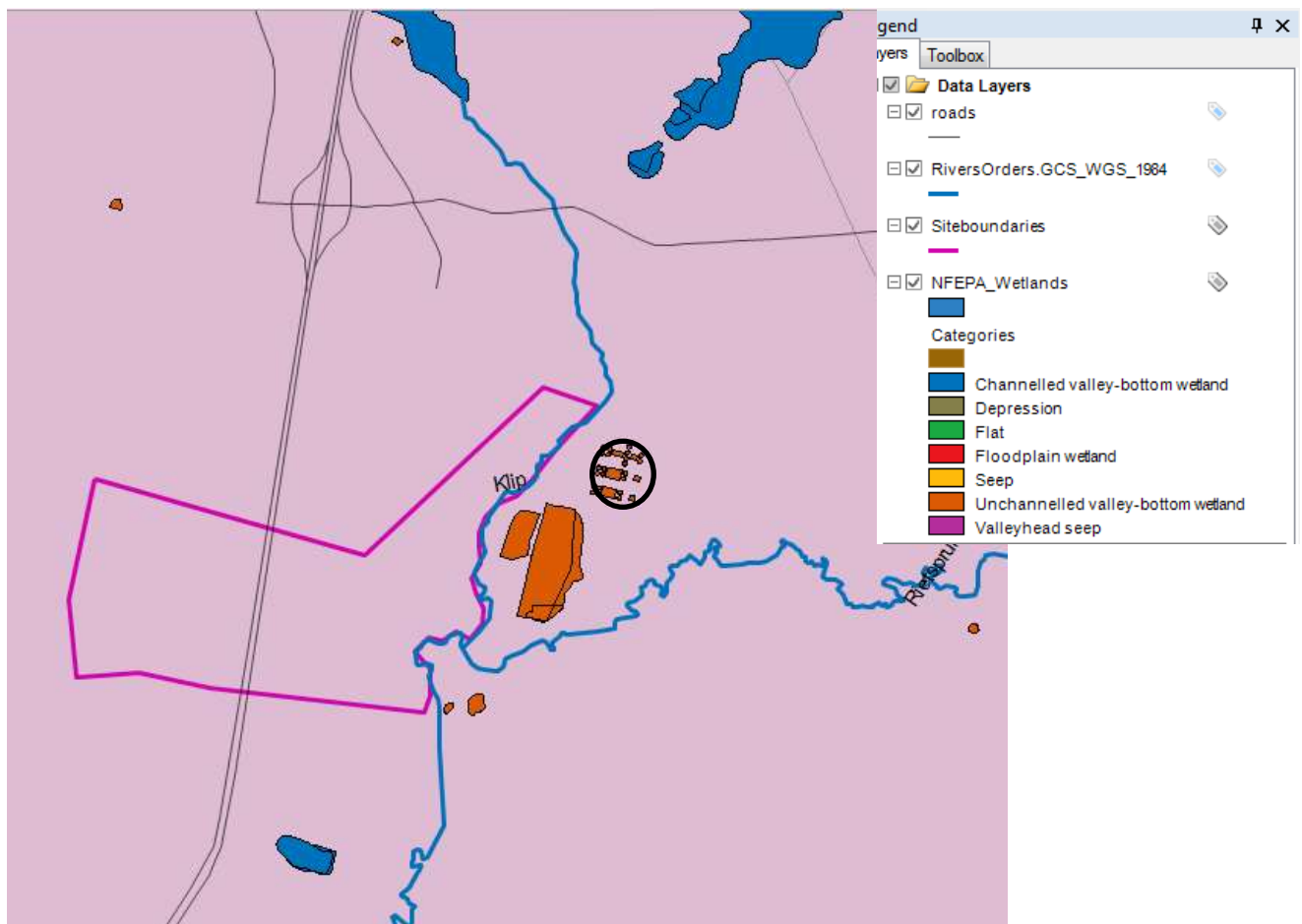


Figure 15: Water Courses and wetlands in the region of the Project Site (data from DWA, 2013 and NFEPA, Sanbi)

Due to the proximity of the Klip River, stormwater run-off has to be managed to prevent siltation as well as contaminated run-off (from site operations) to negatively affect water quality of the surrounding water resources.

No Development will be taking place in the area next to the Klipriver.

1.4.2. Wetlands

No evidence of existing wetland vegetation could be found on site portions A and B, especially since the site has been completely transformed due to agricultural activities on-site. Channelled valley bottom wetlands are found upstream of the site as well as un-channelled valley bottom wetlands.

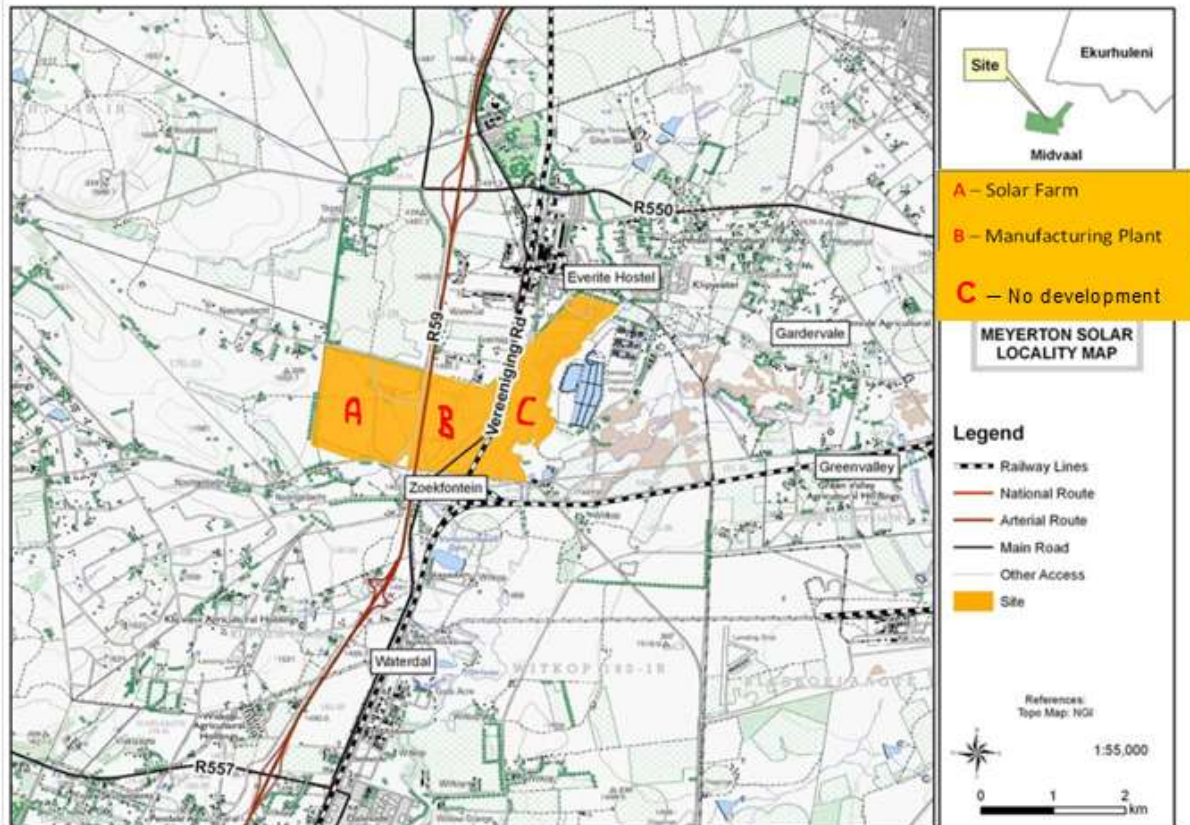


Figure 16: Site lay-out

A flood plain wetland is located along the Klip River (Portion C) as well as wetland mosaic. Figure 10 above also refers to wetlands which are in fact maturation ponds of a nearby waste water treatment works (black circle around un-channelled valley bottom wetlands)

No activities will take place within 500meters of any wetland. Before construction commences, wetlands and riparian zones have to be fenced off as no-go areas.

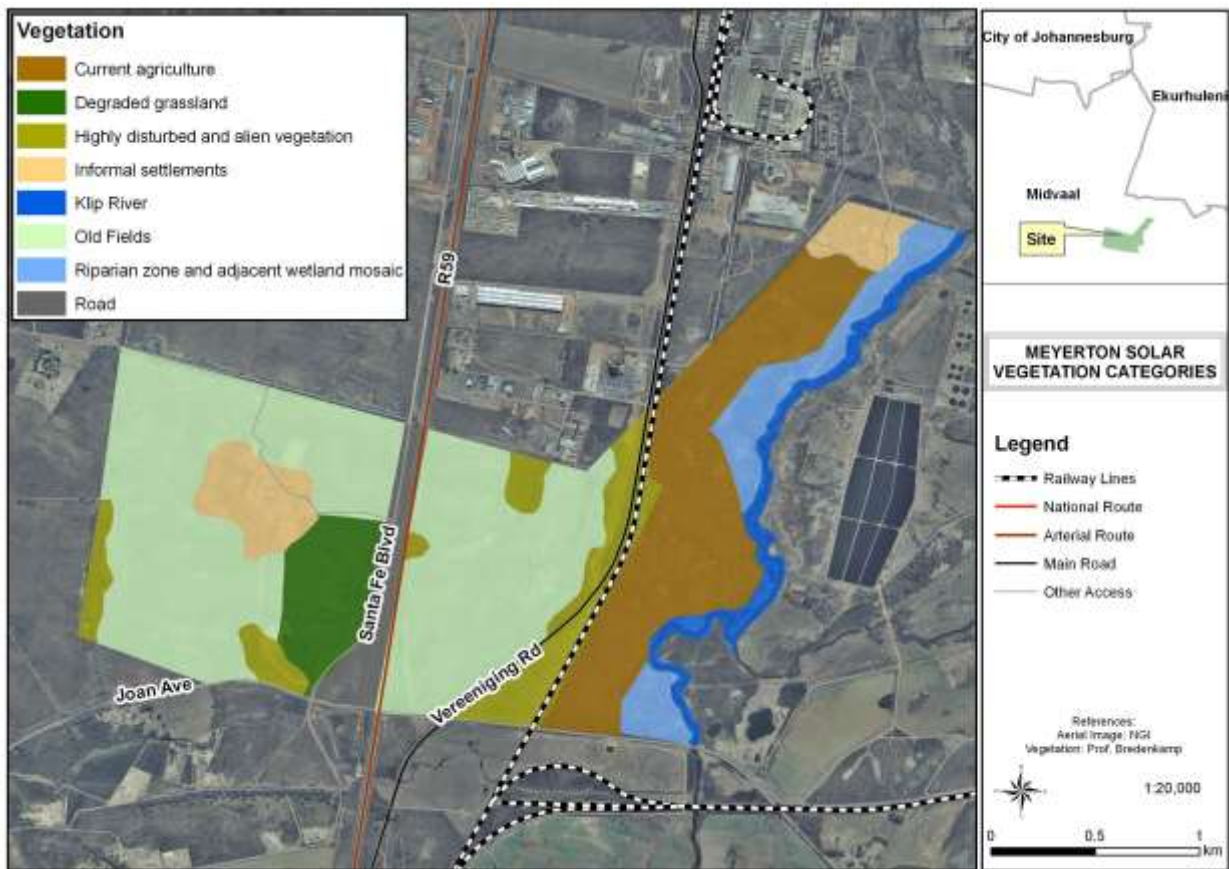


Figure 17: A vegetation map of the site including riparian and wetland zones

The Klip River forms the Eastern Boundary of the Solar Park site. The Klip River meanders in a flood plain wetland. Typical of floodplains, the river banks form levees which are slightly raised above the level of the general floodplain (Figure 6-4). The mechanism forming these levees is that when the river overtops the bank the velocity decreases and part of the sediment load is deposited on the bank.



Figure 18: The floodplain behind the river levee on which the riparian vegetation is growing.

The meandering of the course of the river means that at certain points the river is very close to the floodplain edge and the seasonal and temporary wetland zones are virtually absent. When the meander takes the river to the other side of the floodplain then the temporary and seasonal wetland zones are wide.

The floodplain's temporary edge was delineated from Joan Avenue in the South to the edge of the informal settlement in the North (Figure 6-5). The temporary edge of the floodplain could not be delineated in the informal settlement itself as the terrain is highly transformed. In some cases the parts of the floodplain on the Solar Park property have been cultivated, as may be seen in the Google Earth image.

There are a small number of temporary drainage lines entering the flood plain from the cultivated area to the west of the river.

There is a vehicle track running along the eastern edge of the cultivated land which tracks the flood plain edge fairly closely for some of the length of the eastern edge of the site.



Figure 19: The temporary edge and buffer zone of the floodplain of the Klip River on the Solar Park property

The flood plain has, in many areas, been heavily grazed and in some places the cultivation has gone right up to the river bank (Photos below)



A. Cultivation on the river bank



B. Cattle grazing on the flood plain

Figure 20: Impacts of activities on the flood plain

Cultivation or heavy grazing on the river bank removes the riparian vegetation which would naturally armour the bank against erosion. This increases the risk of erosion at times of high flood.

Overall assessment of the PES (From the Table below): (Seriously modified)

IMPACT/SEVERITY CLASS	DESCRIPTION	RATING
None: reference	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are very small.	0.5-1.0
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are limited.	1.5-2.0
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are not influenced.	2.5-3.0
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	3.5-4.0
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	4.5-5.0

Note that no development will take place in this area.

1.4.3. Ground Water

The site is underlain by geology with a high rate of transmissivity (average of 3000m² per day). As such, the potential for groundwater pollution is high in the event of spillages should the geology on site be weathered or fractured. The ground water levels are currently not determined.



Figure 21: Transmissivity levels of the on-site geology

Bunding around potential pollutant substances will be required. A Risk management plan has to be developed that will include incident management, monitoring and rehabilitation.

1.5. Ecological

The site contains important areas (yellow) and Ecological Support areas (blue) as per the Gauteng C Plan Version 3. The site is adjacent to a water course, but the development will not encroach on the riparian zone/32m buffer zone.

The map below indicates the extent of the areas referred to above. The cross on the map indicates the maturation ponds of the Waste Water Treatment Works of the Midvaal Municipality.

- The site does not fall within a conservancy, but is surrounded by certain conservancies.
- The site does not fall within a protected area.
- The Klip River and associated flood plains form the eastern boundary of the site
- No natural ridges occur on the site.



Figure 22: The waste water treatment plant and maturation ponds (indicated by the red cross) in the vicinity of the site

Vegetation Types

The site is situated in Bankenveld, as described by Acocks (1988). Low & Rebelo (1996) described the vegetation of the area as Rocky Highveld Grassland. In the new vegetation map of South Africa (Mucina & Rutherford 2006) the area falls within the Carleton Dolomite Grassland (Gh 15, Mucina & Rutherford 2006).

Most of the site is old field or current agriculture. Some of these old fields is quite old, currently covered with secondary grassland containing many pioneer and early successional plant species. The only remaining significant natural vegetation area is the Klip River area and adjacent flood plain areas. There is, however, no plan to develop within or close to the River or the flood plain wetlands.

The vegetation of most of the site is degraded / transformed, with low plant species richness and with no red data plant species present, and development can be supported.

However, the Klip River and associated flood plain wetland vegetation represent sensitive ecosystems, protected by legislation (National Water Act (NWA), Act 36 of 1998, National Environmental Management Act (NEMA), Act 107 of 1998, Government Notice Regulation 982, 983, 984 and 985 of 4 December 2014 (NEMA) and regulation (GDARD 2014) and this area,



including the 32 m buffer zone, should be conserved. This implies that the entire area east of the currently maize cultivated area should be conserved.



Figure 23: The results of the C-Plan and National Freshwater Priority Areas (NFEPA) wetlands with reference to the site

During March 2007, a specialist faunal consultant assessed the site (a portion of the total Farm Waterval) as per the red diagram in the figure below.



Figure 24: The study area of the 2007 assessments

The study found that the site is dominated by *Eragrostis curvula* (Teff pastures) and fallow weeds (*Tagetes minuata*, *Acacia mearsnii* etc.) that invaded the agricultural lands. Remaining grassland is relic patches and in various stages due to poor land management and overgrazing. Evidence of illegal hunting and snaring were found onsite, as well as extensive littering.

The study found that no sensitive habitats were observed onsite with the exception of the riparian area and the floodplain wetlands alongside the river and that the current condition of the site offers limited suitable habitat and low conservation potential for animals and threatened animal species. The specialist recommended that drainage lines be fenced off as no-go areas during construction. The study concluded that the loss of this site would have a medium-low impact as a local scale and a low significance impact on a provincial scale. The old agricultural lands and surrounding grasslands have little or no conservation or biodiversity value. A rescue and recovery operation should however be implemented prior to construction with reference to remnant grass patches, termite mounds (harlequin snake) and rock outcrops.

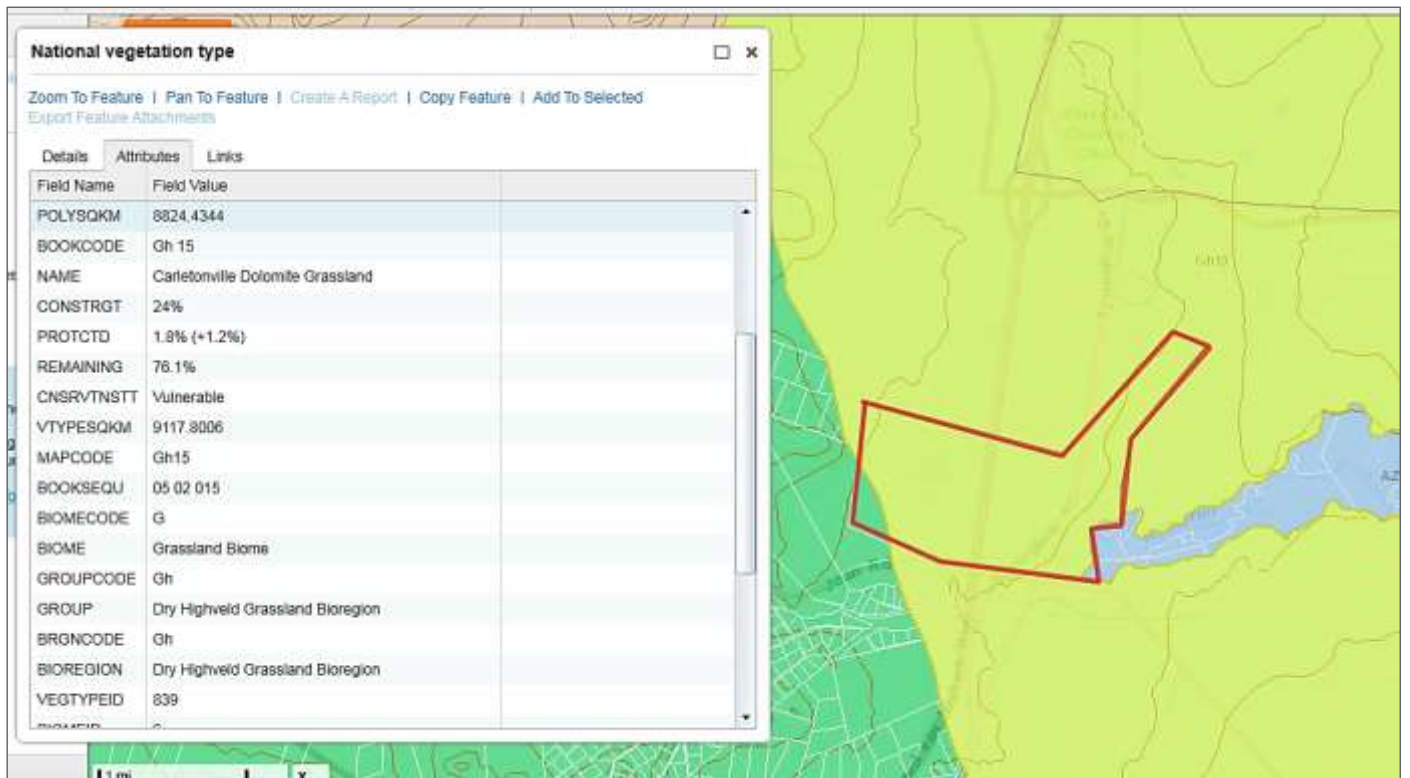


Figure 25: The vegetation on-site is Carletonville Dolomite Grassland in the Dry Highveld Grassland Bioregion (SANBI, 2015). The green corner of the site consists of Soweto Highveld Grassland.

A vegetation study by Dr GJ Bredenkamp and Dr. LR Brown undertaken during June 2007 also found that the area is degraded due to agricultural practices onsite and that very little natural



vegetation remains intact. The area is regarded as having a low/low-medium conservation value. *Boophane distichia*, a medicinal plant was found onsite and it was recommended that these be relocated before construction commences.

Figure 26: Boophane distichia

In terms of invertebrate, a study was undertaken by CA du Toit and VC van der Merwe during April 2007. The assessment found that no invertebrates of conservation value were found in the transformed areas and that the area has a low conservation value.

An ecological study was executed by Professor George Bredenkamp, a professional ecological scientist (DSc PrSciNat) during August 2015 as part of the environmental impact assessment. Due to the fact that the study found that the area where development will take place, is severely degraded, the study concluded that a follow-up study during summer is not required.

A screening for vegetation and faunal habitats was done for the project site (located on Portions of the Farm Waterval 150IR). Although this assignment is basically in accordance with the EIA Regulations (R982-985, Department of Environmental Affairs and Tourism, 4 December 2014), it should be emphasized that the field survey was done during the winter (August 2015), and is therefore considered as an ecological screening only, and does not contain a detailed biodiversity assessment. Although plant communities could be mapped, and ecological sensitivity assigned to the plant communities, no detailed plant or faunal species survey could be done.

Seven plant communities (mapping units) were identified.

The vegetation of most of the site is degraded / transformed, with low plant species richness and with no red data plant species present, and development can be supported. However, the Klip River and associated flood plain wetland vegetation represent sensitive ecosystems, protected by legislation (National Water Act (NWA), Act 36 of 1998, National Environmental Management Act (NEMA), Act 107 of 1998, Government Notice Regulation 982, 983, 984 and 985 of 4 December 2014 (NEMA) and regulation (GDARD 2014) and this area, including the 32 m buffer zone, should be conserved. This implies that the entire area east of the currently maize cultivated area should be conserved.

No detailed field survey was done of the fauna of the site, though the suitability of the faunal habitats was assessed. Data of previous faunal surveys on or in the vicinity of the site were used. It is concluded that the proposed development will have a low impact on possible fauna species that could occur on the site.

The following species of conservation concern were previously recorded from the Grid 2628AC (SANBI, POSA website):

Family	Species	Status	Habitat on site
Apocynaceae	<i>Stenostelma umbelluliferum</i> (Schltr.) S.P.Bester & Nicholas	NT	No
Asphodelaceae	<i>Trachyandra erythrorrhiza</i> (Conrath) Oberm.	NT	No
Mesembryanthemaceae	<i>Lithops lesliei</i> (N.E.Br.) N.E.Br. subsp. <i>lesliei</i>	NT	No
Orchidaceae	<i>Habenaria bicolor</i> Conrath & Kraenzl.	NT	No
Asteraceae	<i>Cineraria longipes</i> S.Moore	VU	No
Apiaceae	<i>Alepidea peduncularis</i> A.Rich.	DDT	No

The habitat at this site (excluding the Klip River flood plain wetland) is not suitable for any of these species, as it is too degraded and totally transformed

No NEMBA plant species or nationally protected trees occur on the area.

According to the GDARD minimum requirement only High and Low sensitivity must be indicated. No development will be allowed on High sensitive areas.

In terms of sensitivity the following criteria applies:

- High:** High and Medium-High conservation priority categories mentioned above are considered to have a High sensitivity and development should not be supported.
- Low:** Medium, Medium-Low and Low conservation priority categories mentioned above are considered to have a Low sensitivity and development may be supported. Portions of vegetation with a Medium conservation priority should be conserved.

Seven mapping units were identified (Figure 19):

Mapping Unit	Sensitivity
1. Informal settlements	Low
2. Highly disturbed and alien vegetation	Low
3. Old Fields	Low
4. Current agriculture	Low
5. Degraded Grassland	Low
6. Klip River	High
7. Riparian zone and adjacent wetland mosaic	High

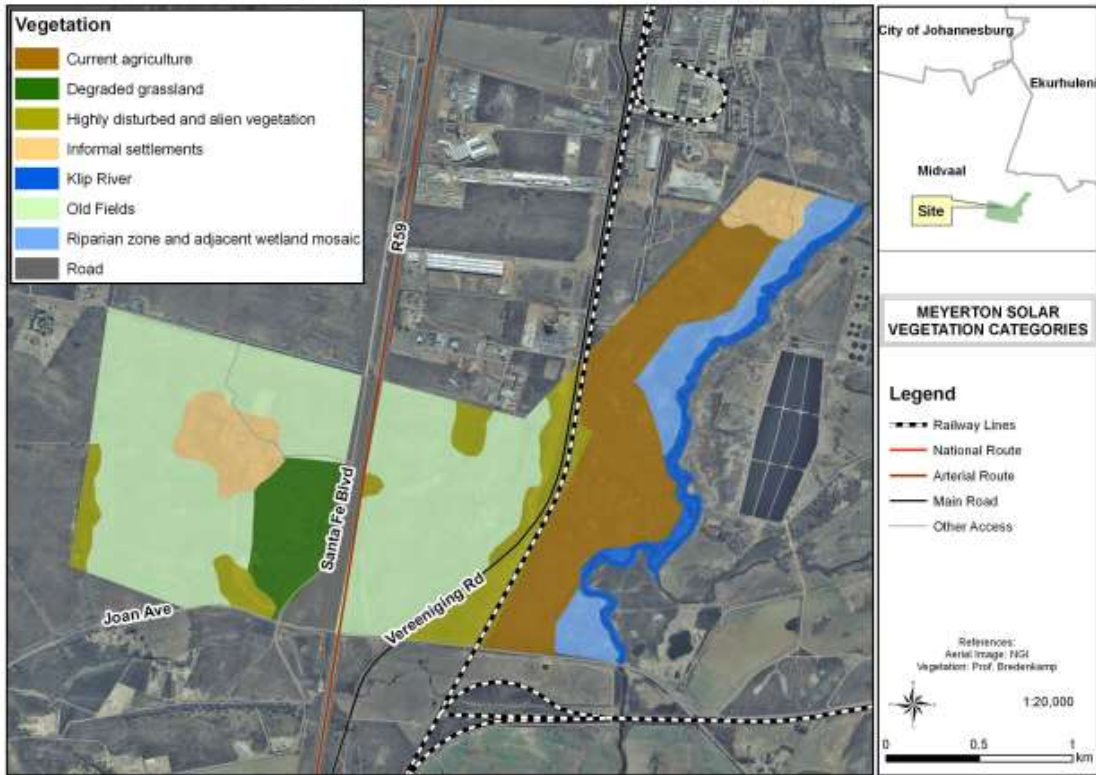


Figure 27: Mapping units of the site based on the ecological assessment

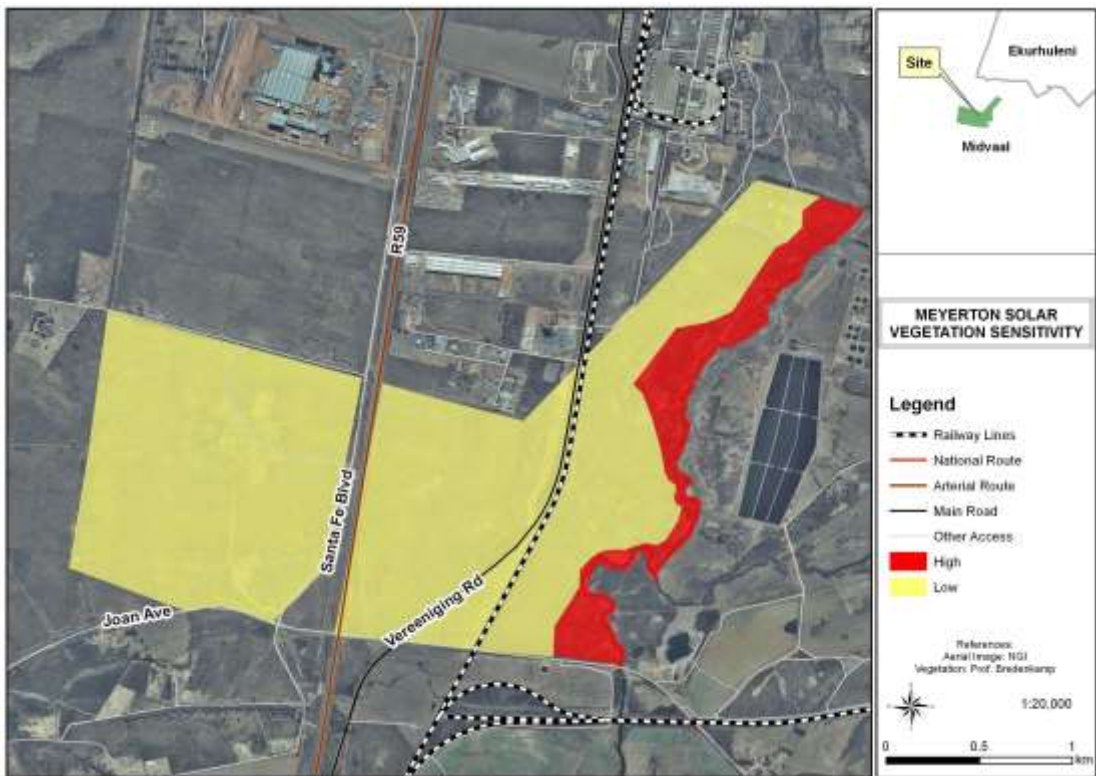


Figure 28: The sensitivity map of the site

The only woody alien species that occurs on the site are *Acacia mearnsii* and *Eucalyptus*, occurring scattered over the site (Figure 3). Any woody alien species should be removed and controlled (The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)). Some annual weeds do occur on the site, these are listed in the description of the plant communities.

Based on the status of the vegetation habitat, no negative impacts on fauna are foreseen, due to the degraded nature of the site (with the exception of the sensitive area indicated in Figure 19)

Professor George Bredenkamp concluded that the proposed development can be supported provided the highly sensitive area of the site remains untouched. This implies that the entire area east of the currently maize cultivated area should be conserved. Due to the fact that the study found that the area where development will take place, is severely degraded, the study concluded that a follow-up study during summer is not required.

The full specialist report is attached as Annexure E.

1.6. Avifaunal

A specialist study was conducted by Conducted by: The Wildlife and Energy Programme (WEP) of the Endangered Wildlife Trust. *The full specialist report is attached as Annexure E.*

The findings are indicated below:

A total of 19 threatened bird species can be expected to occur within the general area. The likelihood of these birds occurring on the proposed development site is, however, deemed to be low as more natural habitat is to be found elsewhere in the area (e.g. Suikerbosrand Nature Reserve). The site is predicted to have a low impact on bird species of particular conservation concern, however an on-site assessment of 3-5 days is recommended in order to confirm the absence of certain species, with particular reference to the African Grass-Owl and Secretarybird. Waterbird flightpaths are also to be determined during the on-site assessment and monitoring. Apart from the outstanding on-site assessment, the proposed development already conforms to some of the guidelines to minimising the impact on birds of Solar Facilities and associated infrastructure, as proposed by Birdlife South Africa.

The closest formal protected area is the Suikerbosrand Nature Reserve, which is situated 8 km to the east of the proposed Waterval Solar Farm site (Figure 3). Suikerbosrand NR is the flagship provincial nature reserve of the Gauteng Department of Agriculture and Rural

Development (GDARD), and it supports many threatened and endemic bird species (see section 7.1.1. for a more detailed description of the avifauna). While Suikerbosrand NR is relatively far from the proposed development, it is still within the forage and/or dispersal range of a few of the threatened species that occur there, and as such it requires further investigation in reference to this particular study.

The next closest protected area is the Klipriviersberg Municipal Nature Reserve, which is 14.5 km north of the site. Verreauxs' Eagles regularly visit this reserve, and as such it also requires further investigation.

The Suikerbosrand Nature Reserve Important Bird and Biodiversity Area, IBA no. SA022 (Marnewick, et al., 2015) is the only IBA close enough to the proposed development that it warrants inclusion in this report.

The informal settlement in the north-eastern part of the proposed solar farm, is likely to not currently be occupied by any of the 19 regionally threatened species recorded for the area. Once the solar photovoltaic panels have been erected, however, certain waterbirds may be attracted to the site when flying at night, as light reflecting from the moon often make solar arrays appear like waterbodies (Smit, 2015). The potential risk is that these species may collide with the PV panels when attempting to land. Maccoa Duck (NT) and Pink-backed Pelican (VU) are infrequent visitors to the waterbodies in the area, and as such the potential impact on this species is deemed not to be severe. Both Greater and Lesser Flamingos are frequently recorded in the area, and the likelihood of these species flying over the site is moderate to high, especially in light of the proximity of the Klip River to the east of the proposed development which may be used by waterbirds to navigate.

Highly disturbed and alien vegetation

As with the informal settlements, highly disturbed and alien vegetation is likely to not be important for any threatened bird species. The Eucalyptus trees could act as roost sites for Red-footed Falcon (NT), although this species is an infrequent visitor and the removal of these trees would not severely impact the species.

Secretarybird (VU) and African Grass-Owl (VU) are known to forage and hunt over old fields. In March 2011 an African Grass-Owl nest was found in a patch of *Hyparrhenia hirta* in the north-western section of Suikerbosrand Nature Reserve, approximately 9 km from the proposed Waterfal Solar Park development (Pretorius, 2016). The use of this grass species by African Grass-Owls cannot be ruled out prior to an on-site field investigation and Grass-Owl survey. Dispersing immature African Grass-Owls also sometimes roost in less suitable habitat comprising of grass species such as *Themeda triandra* and *Eragrostis curvula* following the breeding season (Pretorius, 2016). If Grass-Owls are found to be roosting in the old fields on site then the removal of this vegetation by the proposed development may have an impact on the local population, should it be found that alternative habitat patches are not available on the adjacent properties.

As this vegetation is prevalent in the area to be covered by the solar farm, the following potential impacts on waterbirds are:

Once the solar photovoltaic panels have been erected, however, certain waterbirds may be attracted to the site when flying at night, as light reflecting from the moon often make solar arrays appear like waterbodies (Smit, 2015). The potential risk is that these species may collide with the PV panels when attempting to land. Maccoa Duck (NT) and Pink-backed Pelican (VU) are infrequent visitors to the waterbodies in the area, and as such the potential impact on this species is deemed not to be severe. Both Greater and Lesser Flamingos are frequently recorded in the area, and the likelihood of these species flying over the site is moderate to high, especially in light of the proximity of the Klip River to the east of the proposed development which may be used by waterbirds to navigate.

Current agriculture

Cultivated maize fields attract certain species such as kestrels, falcons and cranes. This artificial habitat is, however, readily available off site and as such the removal of these fields to make way for the proposed development is deemed not to have a significant impact on any of the threatened species found in the area.

Degraded Grassland

As this vegetation is prevalent in the area to be covered by the solar farm, the same potential impact on waterbirds applies as highly disturbed and alien vegetation and alien vegetation.

Old Fields

Secretarybird (VU) and African Grass-Owl (VU) are known to forage and hunt over old fields. In March 2011 an African Grass-Owl nest was found in a patch of *Hyparrhenia hirta* in the north-western section of Suikerbosrand Nature Reserve, approximately 9 km from the proposed Waterfal Solar Park development (Pretorius, 2016). The use of this grass species by African Grass-Owls cannot be ruled out prior to an on-site field investigation and Grass-Owl survey. Dispersing immature African Grass-Owls also sometimes roost in less suitable habitat comprising of grass species such as *Themeda triandra* and *Eragrostis curvula* following the breeding season (Pretorius, 2016). If Grass-Owls are found to be roosting in the old fields on site then the removal of this vegetation by the proposed development may have an impact on the local population, should it be found that alternative habitat patches are not available on the adjacent properties.

As this vegetation is prevalent in the area to be covered by the solar farm, the same potential impact on waterbirds applies as the section on highly disturbed and alien vegetation

A 5-day site visit was undertaken by the avifaunal specialist and no endangered/threatened or species were observed onsite. **The site visit study has the following conclusion:**

The proposed Waterfal Solar Park should not have a significant impact on the avifauna of the area. The potential presence of sensitive species that were flagged in the desktop assessment was investigated,

and none were found during the preliminary and full-protocol site assessments. The Red-listed species that were found on-site, namely Black-winged Pratincole and Greater Flamingo, were recorded passing overhead and are not associated with the disturbed grassland habitat on site. The greatest potential loss of habitat is for Melodius Lark, a regional endemic species, although there is deemed to be sufficient alternative habitat nearby. The specialist recommended that the project may proceed, as no impact on avifaunal species are foreseen, provided that the solar panels do not face 90 degrees at night, but no more than 15 degrees (related to the ground surface).

The direct impacts of solar photovoltaic developments are not yet well understood in South Africa. As such it is recommended that during and post-construction monitoring of bird collisions be implemented at the Waterfal Solar Park, should the development be approved.

1.7. Noise

A noise *disturbance or nuisance* as defined in the national and provincial legislation means any sound which disturbs or impairs the convenience of any person. The Regulations describe a *disturbing noise* as noise that exceeds the ambient noise by more than 7 dB. This difference is usually measured at the location of the person experiencing the noise as disturbing. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7 dB, the noise can be construed as a disturbance.

The most applicable standard for use relevant to the proposed project is SANS 10103:2008 which provides typical rating levels for noise in various types of districts, as described in Table 7 below. SANS 10103:2008 defines daytime as between 06:00 to 22:00 hours and night time as between 22:00 to 06:00 hours. The rating levels in the table above indicate that in industrial districts the ambient noise.

Table: 2. Typical rating levels for noise in various types of districts (SANS 10103:2008)

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Noise levels in industrial areas should not exceed 60 dB(A) at night and 70 dB(A) outdoors during the day. The day / night (24hour) rating limit is 70 dB(A). These levels can thus be seen as the maximum target levels for any noise pollution sources. Noise levels outside the boundaries of the site towards residential and rural areas may not exceed the levels as indicated in the table above.

The figure below indicates the general land-uses in the vicinity of the project site. Noise measurements have to be taken on the site boundaries to ensure that noise levels does not exceed the district limits as indicated in the table above.

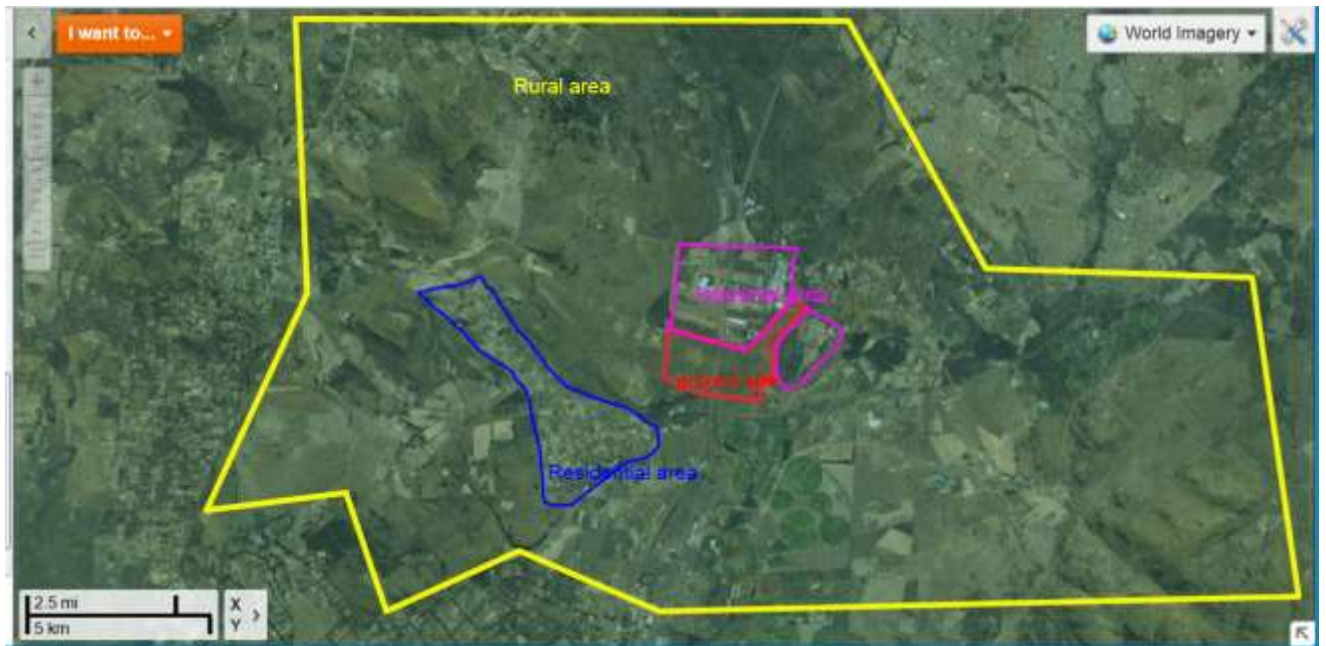


Figure 21. The different districts in terms of noise levels surrounding the project site

Based on feedback from the equipment manufacturers, noise in the immediate vicinity of the plant will not exceed 85 dB(A). It will however be required to execute a noise assessment study once the plant is operational, to determine whether noise impact thresholds will be breached. A noise baseline survey will have to be carried out (by switching of noise sources associated with the new plant). In the case of a breach, noise generating equipment will have to be screened off to prevent a noise nuisance.

1.8. Air Quality

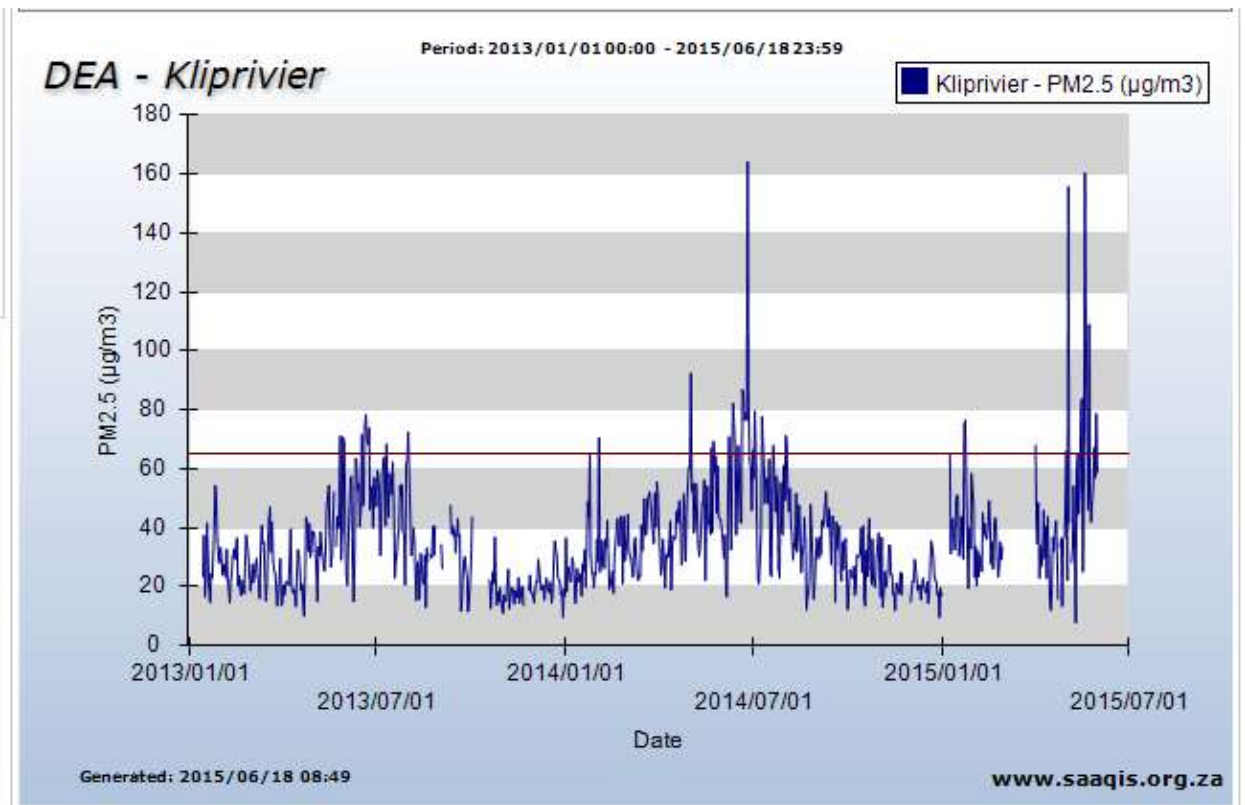
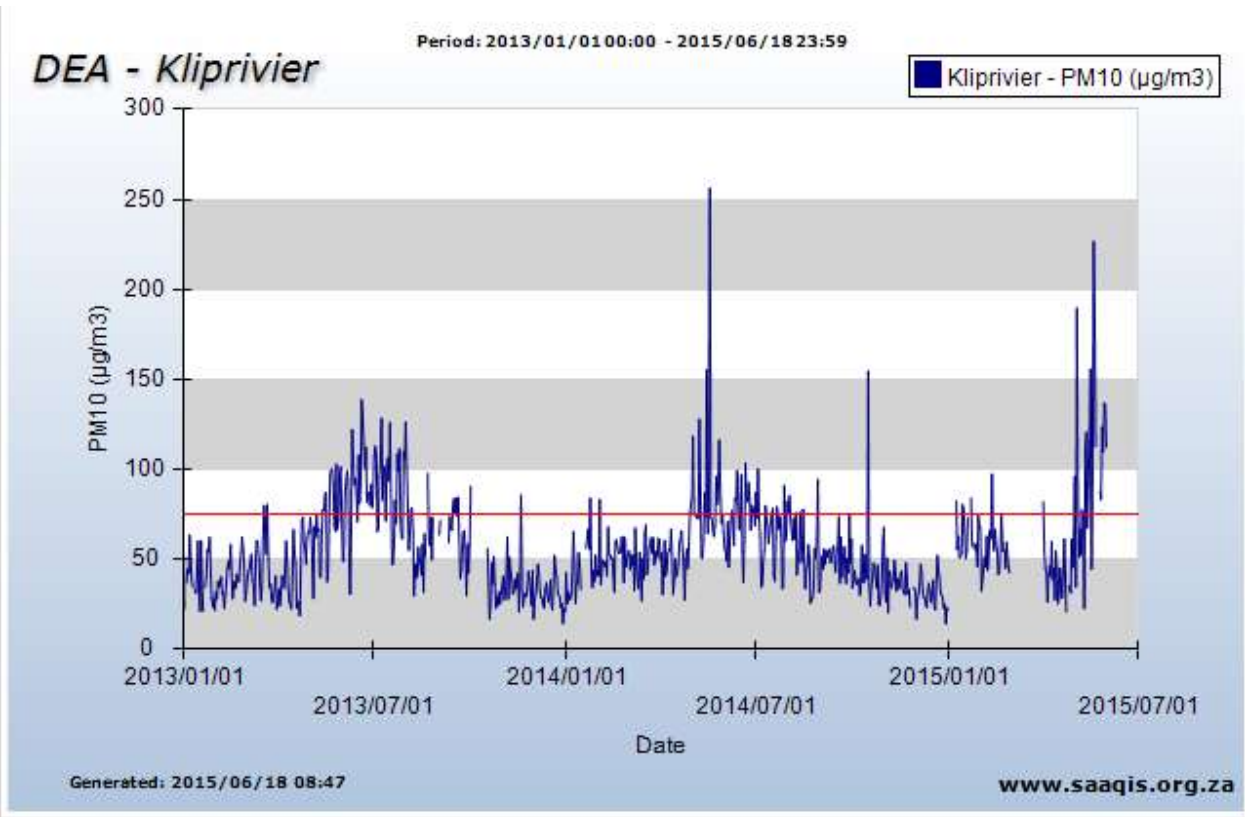
The Midvaal Municipality is located within the Vaal Triangle Priority Area. The Air Quality Management Plan (AQMP) promulgated on 18 May 2009. The information below has been taken from the AQMP, 2009.

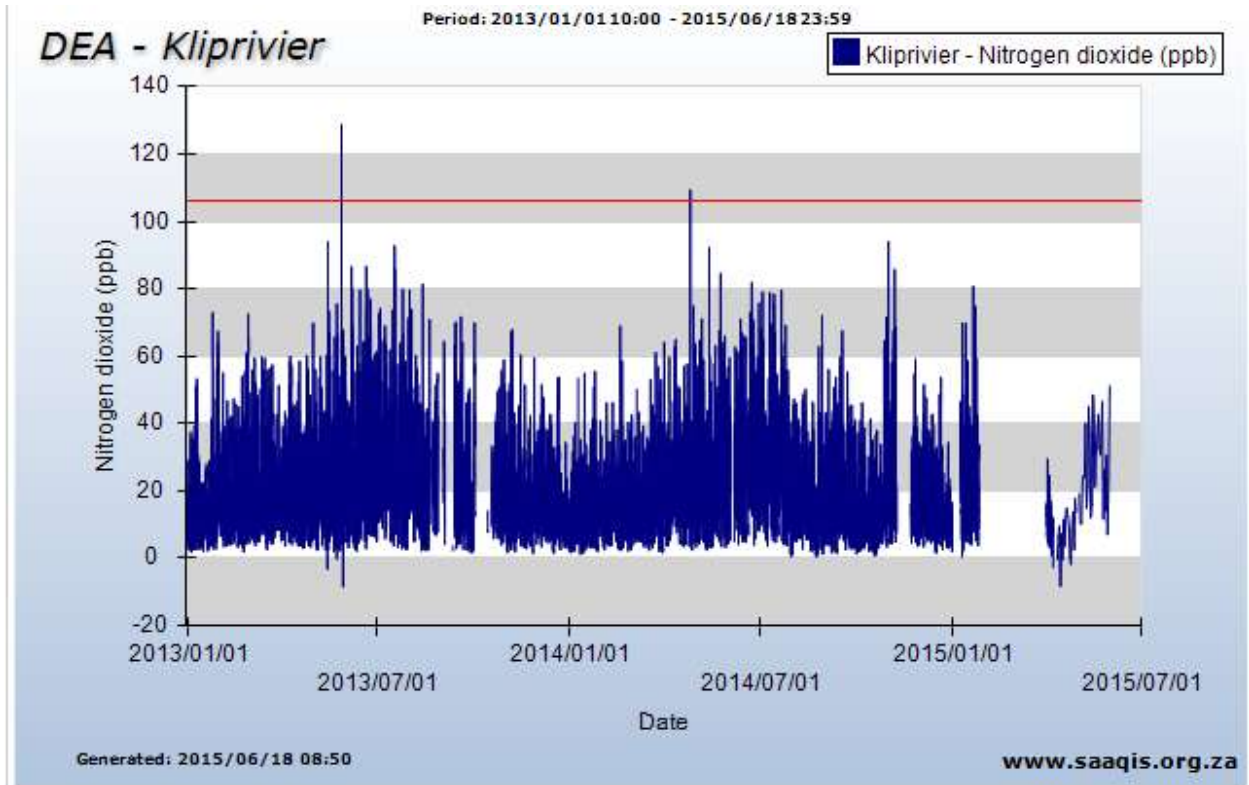
The Vaal Triangle is a highly industrialised area housing numerous industries, a coal fired power station, and various smaller industrial and commercial activities in addition to a few collieries and quarries giving rise to noxious and offensive gasses. The Vaal Triangle is also home to a number of large informal settlements mainly using coal and wood as fuel source. This in return impacts directly on the health and wellbeing of the people residing there. Other sources of concern contributing to the pollution mixture within the area include vehicle tailpipe emissions, biomass burning, water treatment works and landfill areas, agricultural activities and various other fugitive sources.

Priority Pollutants within the VTAPA: based on the available monitoring data, the major findings of the air quality assessment indicated that:

- Particulate (PM_{10}) concentrations are elevated over most areas of the VTAPA, particularly in residential areas where domestic coal burning is occurring and areas neighbouring major industrial operations.
- Sulphur dioxide (SO_2) concentrations are generally below the VTAPA air quality objectives in both the residential and industrial stations, although exceedances were recorded on several occasions at Jabavu and Orange Farm and in Sasolburg.
- Nitrogen dioxide (NO_2) concentrations are low in the VTAPA, although a seasonal signature is observed in NO_2 concentrations. Nitrogen dioxide concentrations have a regional impact within the Vaal Triangle.
- Carbon monoxide (CO) concentrations are not considered to be significant in the VTAPA.
- Ozone (O_3) concentrations are elevated in areas surrounding major industrial operations with exceedances of the one-hour average target recorded on numerous occasions. Ozone concentrations measured at Makalu are representative of known background concentrations in South Africa.

Simulated ground level concentrations, verified with ambient monitored data, indicated that the main pollutant of concern within the VTAPA is inhalable particulates (PM_{10}). Six priority areas were identified within the VTAPA based on highest PM_{10} concentration zones or "hotspots". The areas were also selected to correspond with impact zones due to acute exposures to SO_2 and NO_2 . Meyersdal forms part of the identified hotspot zone. The graphs below were obtained from the SAQIS website, measured at the Kliprivier monitoring station. The results indicate that PM_{10} and $PM_{2.5}$ are problematic (the data referred to are daily averages).





No long term weather dataset was available for the site in question so OR Tambo International Airport, Johannesburg, Gauteng Province was selected as an acceptable proxy. The wind rose below refers to the prevailing wind direction and wind speed.

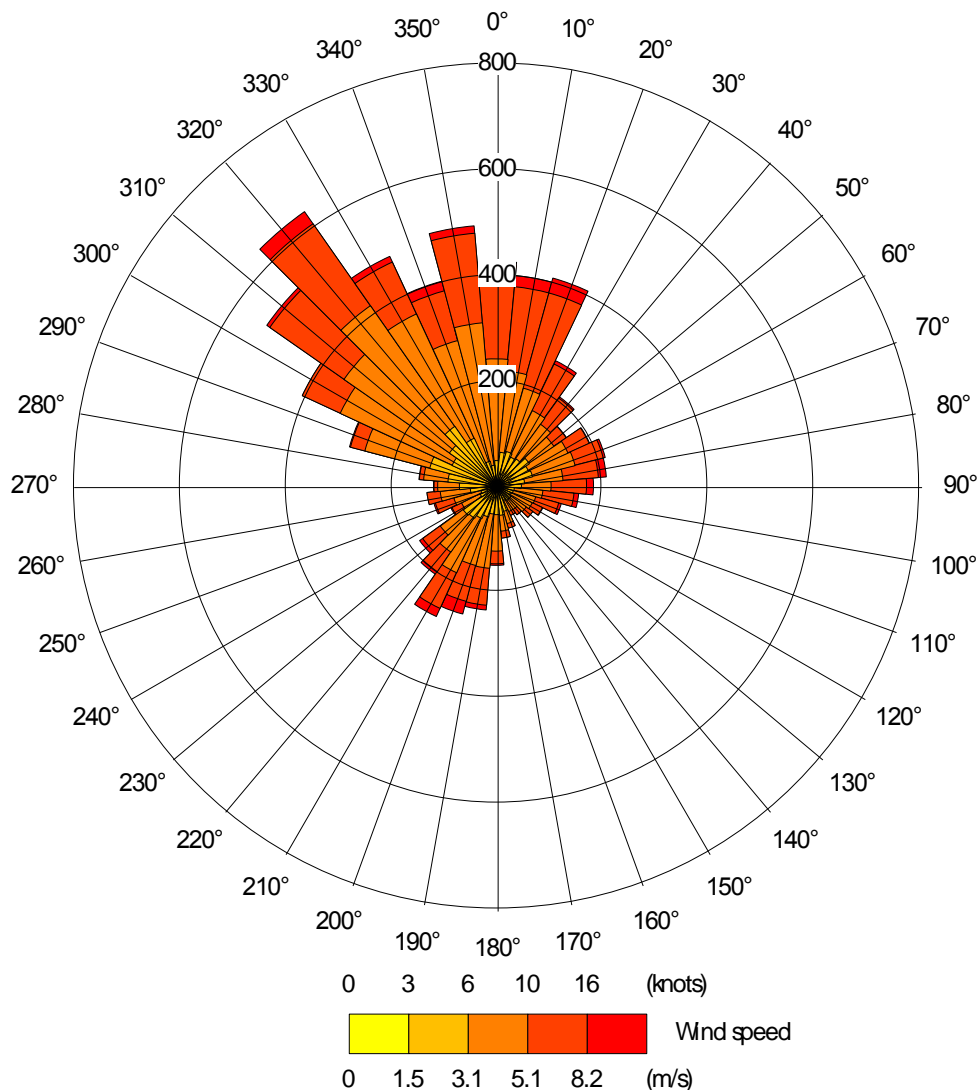


Figure 22. Annual wind rose for Johannesburg (OR Tambo International Airport), Gauteng Province, South Africa (SAWS, 2013).

1.9. Environmental specialist study by Kijani Green Energy

The full specialist study is appended to the EIAR

There are two primary activities proposed for this site, namely, the manufacturing of solar photovoltaic (PV) materials including the manufacture of polysilicon for use in that process; and the manufacture of glass to encase these materials. PV manufacture is generally not an inherently strong emitter to air with most emissions occurring in the construction phase. Construction related emissions are primarily dust related through the disturbance of the soil surface and increased vehicular activity in the area.

The production of polysilicon is effectively emission free and was not considered in the modeling of emissions from the site.

Pollutants to air from glass and polysilicon manufacturing site under normal operations, such as is proposed are likely to include:

- Dust from materials handling
- Sulphur dioxide (SO₂)
- Oxides of nitrogen (NO_x)
- Particulate matter

1.9.1. Oxides of nitrogen (NO_x)



Figure 23. Modeled representation of NO_x dispersion from the proposed Waterval PV manufacturing plant. Long term averages, 1 hour averaging period, levels indicated in µg/m³

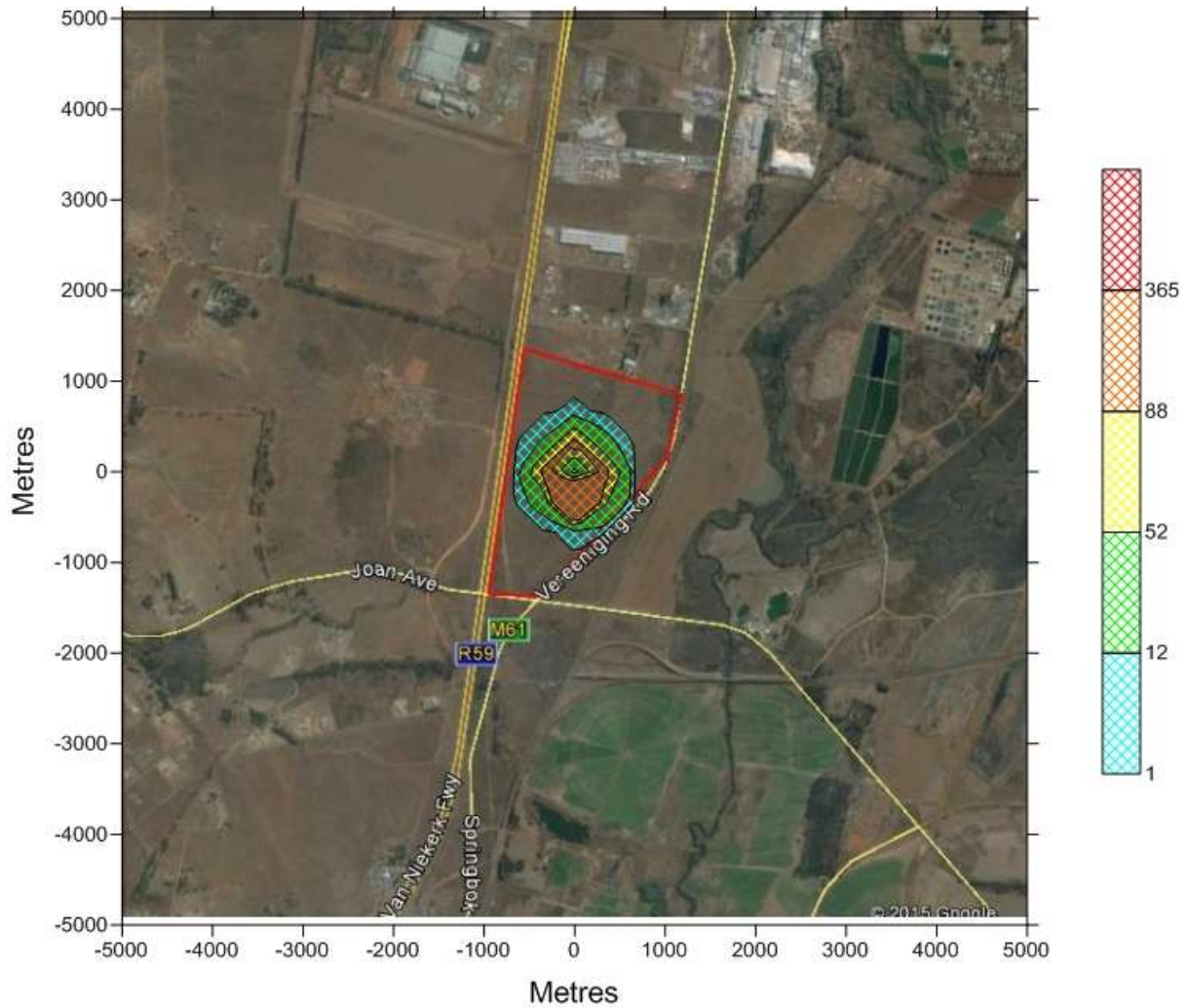


Figure 24. Modeled representation of incidences of ambient NO_x levels from the proposed Waterval PV manufacturing plant exceeding the 200µg/m³ level, averaging period of one hour(exceedances per annum)

Ambient levels of NO_x were found to average below 20µg/m³ for the normal, single flare run with occasional exceedances of the 200ug/m³ level in the immediate vicinity of the stack with no exceedances expected to occur beyond the site boundary.

1.9.2. Sulphur dioxide (SO₂)

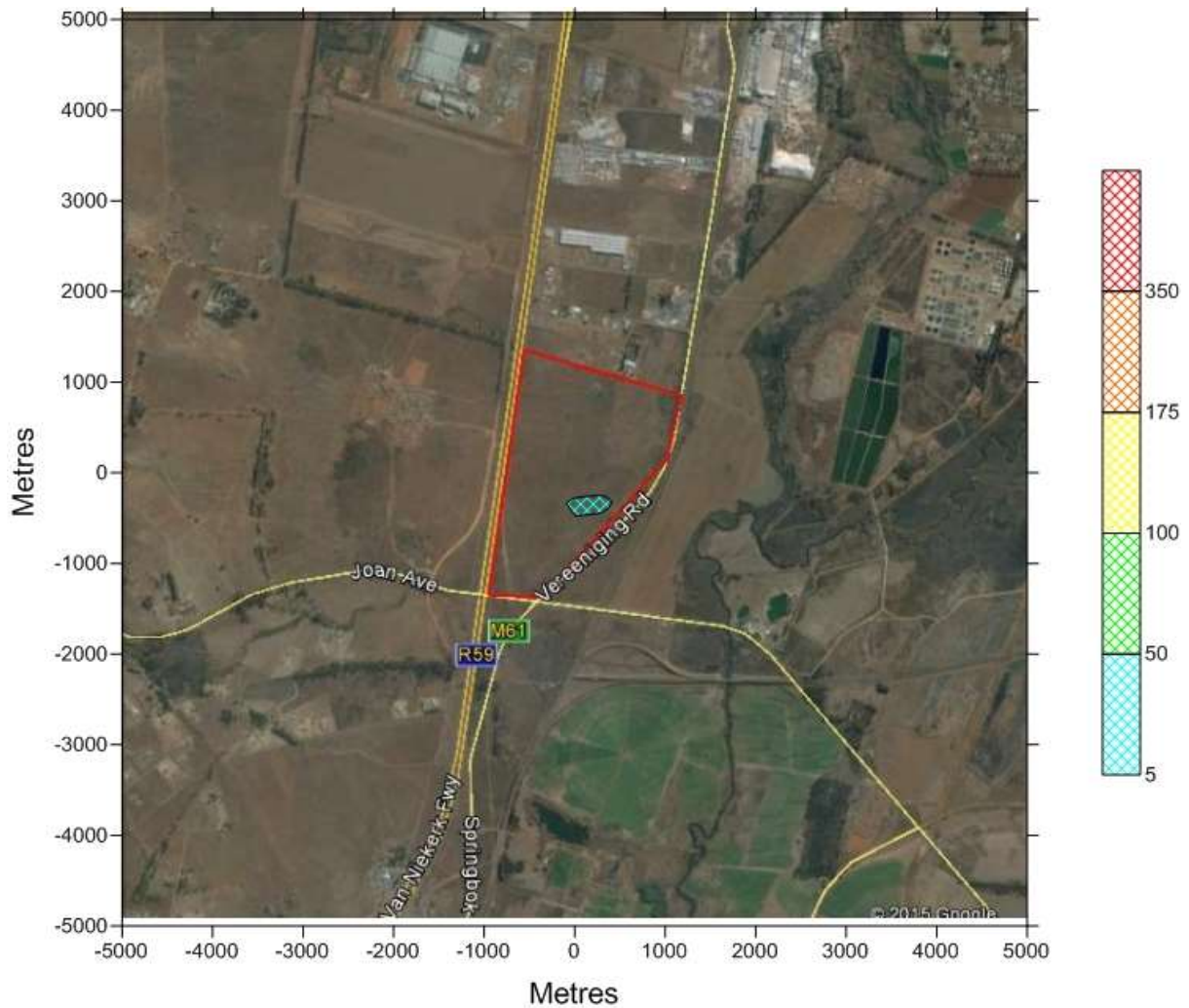


Figure 25. Modeled representation of SO₂ dispersion from the proposed Waterval PV manufacturing plant. Long term averages, 1 hour averaging period, levels indicated in µg/m³

The facility is not expected to significantly impact the surrounding area in terms of SO₂ levels. No exceedances of the 350µg/m³ level are expected to result from the facility.

1.9.3. Particulate matter (PM₁₀)



Figure 26. Modeled representation of PM₁₀ dispersion from the proposed Waterval PV manufacturing plant. Long term averages, 1 hour averaging period, levels indicated in µg/m³

The facility is not expected to significantly impact the surrounding area in terms of particulate matter levels. No exceedances of the 120µg/m³ level are expected to result from the facility.

1.9.4. Conclusions and recommendations

From the modeled results it appears that the proposed plant is unlikely to have a significant effect on the surrounding airshed. This is before considering the existing pollutants in the environment but the added pollutant load from the glass manufacturing plant is unlikely to materially affect the surrounding air quality.

It is recommended that best engineering practice in terms of emissions mitigation be followed in the design and operation of the plant. Monitoring should be as per the requirements of the AEL with some attention paid to the potential for fugitive dust emissions that could arise from materials handling on the site. These emissions are unmodelled here but should be easily mitigated with appropriate handling procedures.

2. Cultural and Heritage

Professor TN Huffman from the Archaeological Resources Management from the University of the Witwatersrand visited the Farm Waterval 150 IR during February 2007 for the purposes of an EIA for the establishment of an Industrial Park. The findings of the site visits as per the March 2007 report were as follows:

As part of agricultural activities, farmers have cleared surface stones from the fields and placed them in piles. Some of the piles contained Earlier Stone Age, Middle Stone Age Artefacts. Due to fact that the artefacts were not in their original in situ position, the archaeologist concluded that they have a low significance. The recommendations of the report are as follows: "The sites have no research value beyond their present recording because they are not in primary context, and artefact numbers are low. Further investigation is therefore not required. If in-situ deposits are uncovered in the course of development, the South African heritage Resource Agency must be notified so that the material can be examined." The study concluded that the development can proceed given that there are no archaeological reasons why it should not be allowed to proceed.

However, the project is located in an area completely disturbed by recent farming activities. Therefore it is expected that the area are unlikely to contain any heritage features.

Dr. Anton van Vollenhoven indicated that the project may be exempted from doing a Heritage Impact Assessment (HIA). The following is applicable:

The site was visited and an Archaeological Impact Assessment was done by Prof. Tom Huffman of Archaeological Resources Management of the School of Geography & Environmental Management at the University of the Witwatersrand in 2007 (Appendix A).

- i. Even then he realised that the site had no large potential for containing heritage sites.
- ii. Although he did report identifying stone tools, these were all found out of context as a result of the farming activities in the area.
- iii. He recommended that the development may continue.
- iv. It therefore is clear that no further heritage work is needed.
- v. It is therefore noted that the entire area has been disturbed and the chances therefore of finding any heritage related features are indeed extremely slim. The farming activities undoubtedly would have demolished any possible signs of earlier human activities and what may remain are out of context and therefore of low significance.

Resultantly all possible signs of heritage resources would have been demolished. Therefore it is very unlikely that any archaeological or cultural historical site or occurrence will be or was disturbed.

It is therefore believed that an additional Heritage Impact Assessment (HIA) is not needed for this project. This letter serves as an exemption request, which should be submitted to the South African Heritage Resources Agency (SAHRA).

The developer should however note that due to the nature of archaeological material, such sites, objects or features, as well as graves and burials may be uncovered during construction activities on site. In such a case work should cease immediately and an archaeologist should be contacted as a matter of urgency in order to assess such occurrences.

It is therefore recommended that the Waterval Solar Park project need not undergo another heritage assessment, given that the location is on the same site referred to above. However, comments from SAHRA indicated the requirement for a heritage assessment. The EAP has been in contact with Dr. Anton van Vollenhoven, an archaeologist registered with SAHRA indicating that he does not agree with their finding. The correspondence from Dr. van Vollenhoven will be sent to SAHRA to finalise the matter in terms of whether another heritage assessment is required. (See Public Participation section for further details)

3. Socio-economic Overview of the Midvaal Region

The following information has been obtained from the Midvaal Integrated development Plan (IDP) of 2015/2016.

3.1. Social features

The Midvaal Municipality has an estimated population of 83 443 people, which constitutes approximately 8% of the Sedibeng District population and 0.7% of the Gauteng population. The 83 443 people represent an estimated 31 102 households of which, approximately 4 172 families reside in informal structures. The average annual population growth since 1996 has been around 4.27%. The table below (Midvaal IDP 2015/2016) provides an overview of the qualification levels of the Midvaal residents.

Qualification levels	GENDER	2011 ()
1. No schooling	Male	4,95
	Female	5,02
2. Grade 0 - 7	Male	24,69
	Female	24,07
3. Grade 8 - 11	Male	32,18
	Female	32,20
4. Grade 12	Male	25,01
	Female	26,87
5. NTC1 – 6	Male	3,93
	Female	1,11
6. Certificate/Diploma	Male	5,59
	Female	7,15
7. Bachelor's or Higher Degree	Male	3,67
	Female	3,60

3.2. Visual impact assessment

Visual specialist study (EON Consulting, Thuledu Ntshingila) is attached as an Annexure

The area of development falls within an industrial complex, and is currently characterised as vacant/derelict land previously used for agricultural purposes.

- Northern: Industrial area (Heineken-Sedibeng Brewery, Everite Building).
- Centre: Informal Settlement (Peace Farm)
- Eastern: R59, M61 vacant/derelict land, Transnet Railway. Further east the Suikerbosrand Provincial Nature Reserve.
- The site does not fall within a conservancy.
- The site does not fall within a protected area.
- The Klip River and associated flood plains form the eastern boundary of the site

No natural ridges occur on the site

Relief on the site varies around 1500 mamsl. The site is fairly flat with the highest point towards the western side of the site.

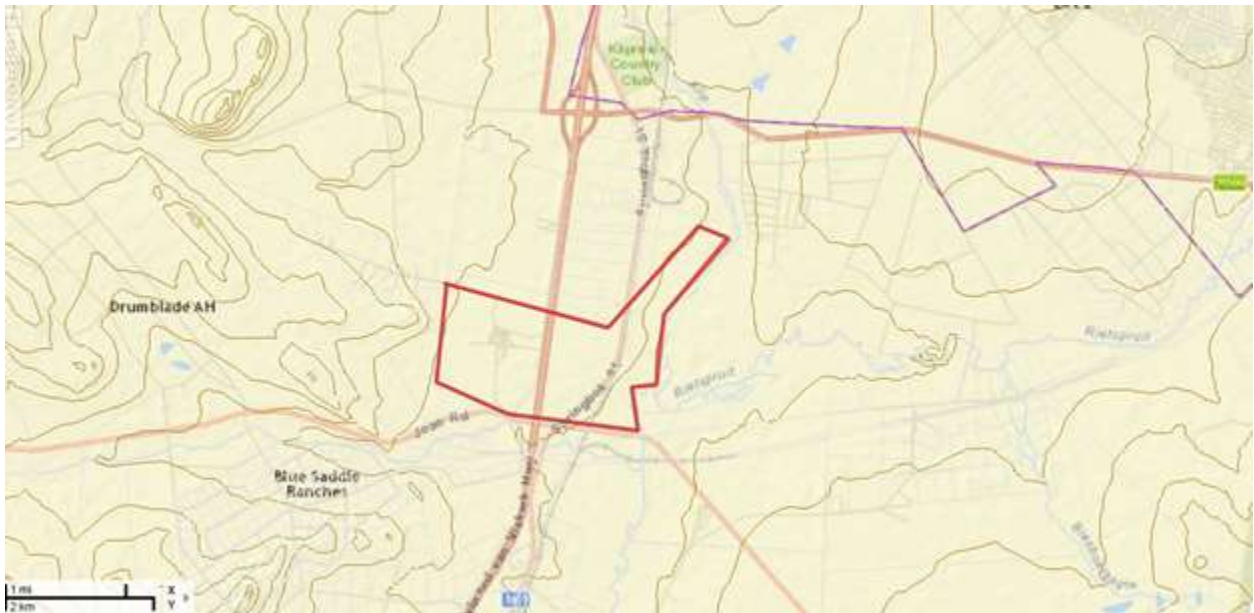


Figure 27. 20 meter contours associated with the project site, indicating the relative flatness of the site (SANBI, 2015)

The proposed development will be designed is to have a 6m high wall.

This will serve in two folds:

- i. Security for the solar panels; and
- ii. Minimise glare onto the R59 for vehicles passing in the project boarder, which may cause distraction to road users.

Furthermore, the colour of the wall should not have a high contrast to its surrounding area as not to affect the idea of “sense of place” or Genus Loci, the general identity of the area.

The receiving environment of the project has a great capacity to absorb the proposed development. This is due to the fact that the area is surrounded by industrial area. The potential impacts of glare and glint on the road users of the R59 if adequately investigated and mitigated will not be an area of concern. Due to the small number of receptors, the visual recommendation is that project could proceed. The preferred CSP technology alternative with tilt panel structures will generate less potential for glint and glare.

3.3. Socio-economic features

The Midvaal community is a relatively young (and growing) population, which will result in a larger labour force during the next five to ten years.

The majority of households earn between R6 000 – R30 000 per annum.

In comparison with the other local municipalities within the Sedibeng District Municipality, Midvaal has the highest Human Development Index and thus a better balanced society.

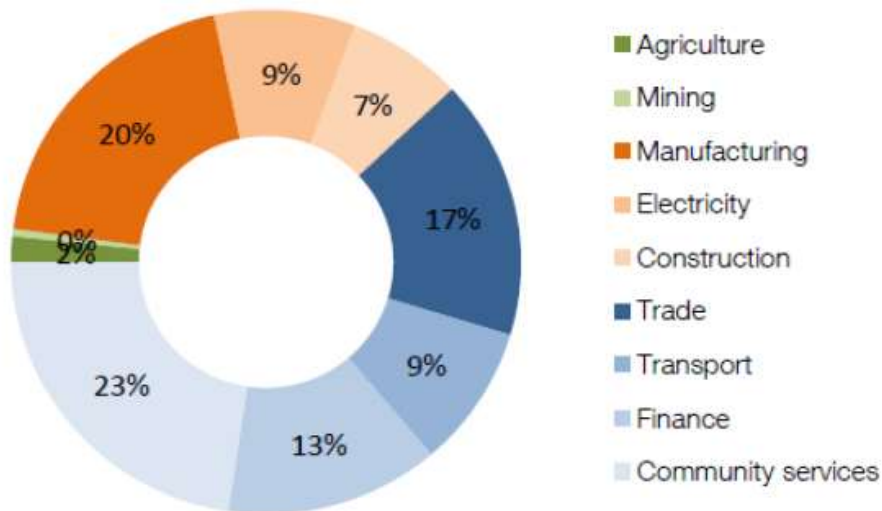
Several new businesses have invested in the Midvaal region during the last few years, creating employment opportunities for the local community. The unemployment level in the Midvaal region is approximately 18.8% and there has been a consistent decline recorded in the unemployment rate since 2002.

The major employment sector is services, followed by manufacturing, whilst the following sectors contribute to the GDP of the municipality:

- Mining (0.4%)
- Agriculture (2.6%)
- Electricity (5.7%)
- Construction (5.7%)
- Manufacturing (25.1%)
- Services sector (60.4%).

According to IHS Global Insight, Social Services, followed by Manufacturing and Trade, is the largest contributors to the Midvaal economy, see figure below.

Sector composition



It is evident from the information above, that the area is in great need for the creation of additional job opportunities for unskilled and low level skilled workers to address the levels of unemployment. The proposed project will contribute to the creation of job opportunities.

3.3.1. Informal Settlement

There are 2 informal settlements onsite. The one is in the area where no development will take place. The other one is located in the area where the PV panels will be erected. A wall will be built around the PV solar farm to prevent access to the solar farm. The access road to the informal settlement will be retained.

The EAP had a meeting with the community in the informal settlement on 1 February 2016. The following matters were discussed:

- 1) **Where do they work**
 - a. No-one is permanently employed
- 2) **Do they utilize the area around the informal settlement for animal grazing and planting of agricultural products**
 - a. No.
- 3) **What services are provided?**
 - a. The Midvaal Municipality provides water in a tank, provides mobile clinic services once a week and removes waste once a week. The settlement however does not have any electricity
 - b. The Midvaal municipality is in the process of developing RDP housing with a view to remove the community to the new housing development.

The community indicated that they do not have a problem with the proposed development and they are hoping that employment opportunities will be created.

The Plan of study: *The study must identify all people affected by the project and all adverse impacts on their livelihoods associated with the relocation. Typical effects include breakup of communities and social support networks; loss of dwellings, farm buildings, agricultural land, trees, and standing crops; impeded or*

lost access to community resources such as water sources, pasture, medicinal plants, fishing opportunities, loss of business, and reduced income resulting from these losses.

Consultation with officials of local government, community leaders, and other representatives of the affected population will be essential to gain a comprehensive understanding of the types and degrees of adverse project effects. The project sponsor must discuss plans for a census and registration program with local leaders and representatives of community-based organizations. Census and asset inventory enumerators may be the first project-related personnel that affected people will encounter. Enumerators must be thoroughly briefed on the objectives and timetable of the project and what is being planned in terms of physical relocation, compensation for lost assets, and restoration of livelihood.

Socioeconomic Studies—a substantial amount of household-level socioeconomic data will be collected during the census and inventories of assets. Low income households typically have diversified livelihood strategies that combine agriculture with wage labor and small-scale enterprise. Therefore, it is important to survey all income sources in order to calculate income loss from the relocation.

For these reasons, the socioeconomic studies are needed to collect additional quantitative (supported by qualitative) information in two important areas: 1) household-level income streams and livelihood strategies that were not identified in the census and inventories of assets; and 2) the structure, organization, and economic inter-dependencies within the larger community affected by the project. Analysis of these data will help identify those households most at risk from physical or economic displacement. However, income stream analysis is not required in cases where relocation does not affect the income-earning capacity of a household (for example, in cases where only dwellings are displaced and the affected people can be relocated to near-by sites).

The socioeconomic studies should be linked closely with the census and inventory of assets to provide comprehensive information on household economic resources, including common property resources. The census and inventory of assets should have already identified the basic social unit of production or economic organization.

It must be noted that the informal settlement is illegally developed on this property. The project developer will build a wall around the informal settlement to protect the solar panels from crime. The informal settlement will still have an access road to the main road. No impacts from the development will be on the settlement. Negotiations with relevant authorities regarding the relocation of the informal settlement will continue. The project developer also stated that his lawyer indicated that a legal process will be followed to resolve the issue of illegal occupancy.

The project developer has since confirmed that the Midvaal Municipality is not willing to confirm that they will manage the relocation of the informal settlement.

As such, the plan of study was not executed given that relocation by the project developer is no longer relevant.

CHAPTER 5: Need and desirability of project

1. Need and Desirability of the Proposed Activity

The proposed project has several benefits that are aligned with local, regional, national and international initiatives. It will also impact positively on several key issues of concerns. The benefits and positive impacts are described below.

In terms of the **2014 Guidelines on the need and desirability** (DEA), the following questions are answered below:

1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	Not significantly as the habitat is already disturbed
How were the following ecological integrity considerations taken into account?:	
<ul style="list-style-type: none"> Threatened Ecosystems, 	No development will take place on threatened ecosystems
<ul style="list-style-type: none"> Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure 	No development will take place on sensitive areas
<ul style="list-style-type: none"> Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs") 	No development will take place on CBA's
<ul style="list-style-type: none"> Conservation targets 	No impact
<ul style="list-style-type: none"> Ecological drivers of the ecosystem 	No impact
<ul style="list-style-type: none"> Environmental Management Framework 	No impact
<ul style="list-style-type: none"> Spatial Development Framework 	No impact – it supports the local framework
<ul style="list-style-type: none"> Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change etc. 	Supports efforts to reduce climate change
2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity?	The site is currently experiencing extensive illegal dumping and burning of waste – the project will prevent entry to

<p>What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts?</p>	<p>the site for dumping. The site will be cleared of all illegally dumped waste</p>
<p>3. What measures were explored to enhance positive impacts?</p>	<p>The inclusion of biodiversity corridors in the lay-out plan</p>
<p>4. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?</p>	<p>No negative impact</p>
<p>1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>The manufacturing of glass may lead to air pollution, but the furnace will be fitted with air quality control equipment to prevent air pollution. Storm water run-off might cause erosion and siltation of water bodies, but the development of a storm water management plan and an artificial wetland will prevent siltation, erosion and elevated run-off volumes as well as improved water quality.</p>
<p>1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?</p>	<p>Black water waste will be generated originating from sanitation facilities, but these will be treated onsite and re-used in the manufacturing process</p>
<p>1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>No cultural heritage are present onsite</p>
<p>1.6 .How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to</p>	<p>The development will use silica sand to manufacture glass and silicon but the manufacturing of PV panels will lead to the avoidance of coal burning to generate electricity. The use of non-renewable resources will lead to a long life time of the products as opposed to</p>

<p>minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>the constant use of coal. Generating energy from sunlight implies the use of renewable resources.</p>
<p>1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?</p>	<p>Generating energy from sunlight implies the use of renewable resources. The manufacturing plant will not use non-renewable energy sources, but will use renewable energy resources (generated on-site)</p>
<p>1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)</p>	<p>The manufactured PV panels will be used to provide private households and RDP housing with electricity. The development will support economic growth by supporting local mining industry (silica mines)</p>
<p>1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources for the proposed development alternative?)</p>	<p>Generating energy from sunlight implies the use of renewable resources. The manufacturing plant will not use non-renewable energy sources, but will use renewable energy resources (generated on-site)</p>
<p>1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?</p>	<p>Yes</p>
<p>1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>Generating energy from sunlight implies the use of renewable resources. The manufacturing plant will not use non-renewable energy sources, but will use renewable energy resources (generated on-site)</p>

<p>1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?</p>	<p>This development will not impact on ecosystem integrity due to the use of already disturbed land and land which forms part of industrial zoning. By utilising the industrial site for the support of renewable energy, it prevents the erection of other heavy industries which might create pollution and consumption of non-renewable resources and energy use from the national grid.</p> <p>Generating energy from sunlight implies the use of renewable resources.</p> <p>The manufacturing plant will not use non-renewable energy sources, but will use renewable energy resources (generated on-site)</p> <p>The use of silica and locally designed PV panels will contribute to longer life-cycles of PV panels as opposed to those imported from China – leading to conservation of resources and prevention of the generation of waste.</p>
<p>1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts?</p>	<p>The sensitive area next to the Klipriver will not be developed.</p>
<p>1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?</p>	<p>Refer to Section 3 of chapter 5</p>
<p>1.8.2. What is the level of risk associated with the limits of current knowledge?</p>	<p>Refer to Section 3 of chapter 5</p>
<p>1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?</p>	<p>Sensitive areas are not part of the development. Biodiversity corridors form part of the lay-out plan.</p>
<p>1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following:</p>	
<p>1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is</p>	<p>No negative impacts on people's environmental rights</p>

not possible, to minimise, manage and remedy negative impacts?	
1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc.	Due to the prevention of illegal dumping on this site, air quality in the area will be improved. Plastic etc. are burnt causing air quality problems in the area such as particulate matter, dioxins and furans (that are carcinogenic)
1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	No livelihood dependencies are present on this site. The informal settlement on the site will be moved to RDP housing and the people will significantly improve their quality of live.
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	Positive impact
1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	The avoidance of the area next to the Klip River for development will maintain the ecological integrity of a longitude system
1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to Chapter 5 of this document
2.1. What is the socio-economic context of the area based on, amongst other considerations, the following considerations?	
2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	Support the IDP through economic development and job creation
2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated or segregated communities, need to upgrade informal settlements, need for densification, etc.),	Informal settlement will be upgraded through the move of the community to municipal housing development
2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	Support, yes

<p>2.1.4. Municipal Economic Development Strategy ("LED Strategy").</p>	<p>Support, yes</p>
<p>2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development {and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?</p>	<p>Support, yes</p> <p>Opportunities will be offered to all the segments of the community that is consistent with the priority needs of the local area. In order to address this matter, various job opportunities will be available during the construction period of the Project, thereafter continuous jobs will be available for good performers during the construction period observed, and affected parties will be employed if they have the required qualifications and necessary skills.</p>
<p>2.2.1. Will the development complement the local socio-economic initiatives {such as local economic development {LED) initiatives), or skills development programs?</p>	<p>By creating local job opportunities</p>
<p>2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?</p>	<p>By creating local job opportunities</p>
<p>2.4. Will the development result in equitable {intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?</p>	<p>Yes</p>
<p>2.5.1n terms of location, describe how the placement of the proposed development will:</p> <p>2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other,</p>	<p>Job opportunities will be created</p>
<p>2.5.2. reduce the need for transport of people and goods,</p>	<p>No – increased need for transport of goods and people</p>
<p>2.5.3. result in access to public transport or enable non-motorised and pedestrian transport {e.g. will the development result in densification and the achievement of thresholds in terms public transport),</p>	<p>No</p>
<p>2.5.4. compliment other uses in the area,</p>	<p>Yes, due to the provision of PV panels that are suitable for the SA climate and longer life cycles</p>

2.5.5. be in line with the planning for the area,	yes
2.5.6. for urban related development, make use of underutilised land available with the urban edge,	Yes
2.5.7. optimise the use of existing resources and infrastructure,	Yes – local Rand Water pipeline
2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas {e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No
2.5.9. discourage "urban sprawl" and contribute to compaction/densification,	Not applicable
2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	Not applicable
2.5.11. encourage environmentally sustainable land development practices and processes	Yes
2.5.12. Take into account special locational factors that might favour the specific location {e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	Not applicable
2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns {i.e. an area with high economic potential),	Yes, several billion rand will be pumped into the SA economy
2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	No
2.5.15. In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Not applicable
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	Agreements with the local municipality to provide housing for the informal settlement
2.7. How will the socio-economic impacts resulting from this development impact on people's	

environmental right in terms following:	
2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Promotion of renewable energy will result in climate change prevention as well as improved air quality due to reduction in coal-based energy
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?	No environmental injustice
Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered? 2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	The provision of PV panels for the SA market will contribute to social development and reduced environmental impacts
2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	EMPr
2.13. What measures were taken to: 2.13.1. ensure the participation of all interested and affected parties,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.13.3. ensure participation by vulnerable and disadvantaged persons,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.

2.13.5. ensure openness and transparency, and access to information in terms of the process,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.13.7. Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was being promoted?	Public participation process in line with legislative requirements. People were also met to discuss and explain issues.
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g... a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Opportunities will be offered to all the segments of the community that is consistent with the priority needs of the local area. In order to address this matter, various job opportunities will be available during the construction period of the Project, thereafter continuous jobs will be available for good performers during the construction period observed, and affected parties will be employed if they have the required qualifications and necessary skills.
What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	EMPr will include measures as well as environmental training and awareness. Occupational health and safety measures will be implemented once the plant is operational as well as during the construction period related to health and safety for construction workers.
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1. the number of temporary versus permanent jobs that will be created,	1200 new jobs will be created

<p>2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),</p> <p>2.16.3. the distance from where labourers will have to travel,</p>	<p>Basic workers will be employed from the area</p> <p>Limited travel due to employment of local people</p>
<p>2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and</p>	<p>Limited local impacts and when compared to job creation, the project will have a positive socio-economic impact</p>
<p>2.16.5. The opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).</p>	<p>The current land is poorly utilised in terms of agriculture – this project will create more job opportunities versus utilising the land for agricultural purposes</p>
<p>2.17. What measures were taken to ensure:</p> <p>2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and</p>	<p>All relevant organs of state were asked to comment on the proposed development</p>
<p>2.17.2. That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?</p>	<p>No conflict</p>
<p>2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?</p>	<p>The provision of PV panels will support renewable energy</p>
<p>2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?</p>	<p>Yes</p>
<p>What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment??</p> <p>2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different</p>	<p>EMPr include measures to prevent and control environmental impacts.</p>

<p>elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?</p>	<p>Refer to Chapter 3</p>
<p>2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?</p>	<p>Positive impacts due to job creation, improving the quality of life of the informal settlement and prevention of illegal dumping and burning of waste onsite, as well as trapping birds and other fauna in the area next to the Klip River</p>

1.1. STRATEGIC CONTEXT FOR THE CONSIDERATION OF NEED AND DESIRABILITY

1.1.1. Energy supply

South Africa is currently experiencing an energy crisis, as are many other countries within Africa particularly. The energy sector plays a key role in the South African economy, accounting for approximately 15% of the gross domestic product ('GDP') and employing about 250,000 people. The South African Government has considered a wide range of measures regarding the integration of renewable energy into the mainstream energy economy. Various policy documents have been drafted to increase the renewable energy capacity and improve opportunities for energy trade in the country.

At the forefront of drafting policies is the Department of Energy ('DoE'), which published the Integrated Resource Plan ('IRP') in 2010, which maps the addition of over 41,346MW of energy generation by 2030. This is an increase of more than 100% on existing installed capacity. Critically it is proposed that 42% is to be sourced from renewable energy assets, such as PV farms, wind and hydro. This is again reiterated in the revision of the IRP, published in November 2013. Appendix 1 has TFS Solar Market Surveys and excerpts from the DoE IRP. The most recent report of March 2015 discusses the particular target markets of TFS Solar in the future, namely primarily the small and medium power user, roof top installations, and thereafter, any further large or mega PV farm installations that may be in construction at the time.

With an average of more than 2 500 hours of sunshine every year, South Africa has the perfect climate for the development of the PV solar panels manufacturing industry. The country's solar radiation output is over twice that of Europe - making it one of the highest in the world. This immense energy resource creates the opportunity for the country's solar-equipment industry to grow significantly. Notwithstanding a number of companies in already established in South Africa that are selling solar panels and other solar energy harvesting products, as mentioned mostly imported components.

Currently five companies assemble solar panels in South Africa, and these have a total production capacity of 380 MW per annum. The base material manufacturing plant envisioned by TFS Solar will support these local companies and improve their local content considerably.

The long term opportunities within the PV sector in South Africa are estimated to be in the order of 48,000 MW. The size of this market will be strongly dependent on the success of this technology to be accessible to all sectors of industry at competitive prices. It will be important for this sector to influence future government policies that will encourage the use of the technology on a widespread basis.

The renewable energy market in South Africa has increased significantly from 2013 onwards primarily driven by the following:

- The REIPPPP allocated 8 400MW towards PV technology and 631.5MW (from round 1 of bidding) of PV utility-scale projects have reached financial closure, some are under construction and the first are being commissioned and connected to the grid.
- Small-scale renewable energy programme launched by Eskom, which is based on a rebate scheme and targets to procure 10MW from small-scale renewable energy solutions in the initial pilot phase
- The development of the world's largest solar park in the Northern Cape of South Africa, near Prieska, is being built in stages. The first phase is targeted for completion in 2018 and will provide 1GW of capacity. The goal is to complete the entire project by 2022, with a potential output of 5GW
- Potential launch of the Small Projects IPPPP that targets utility-scale projects ranging between 1-5MW of installed peak power capacity
- Increased need to create employment through localisation of manufacturing processes by prescribing higher localisation thresholds (increasing from the current 37% threshold)
- Further Increases in electricity prices by 8% per annum since 2013, April 2015 increase is 12.69% (NERSA), and submission by Eskom to reopen past determinations to account for losses to date
- The pending introduction and promulgation of carbon tax in 2015.

Overall, the PV industry is on the growth path, driven by policies that support investment in the sector. South Africa's power sector is growing and has sustainable growth prospects over the next ten to twenty years. The Government is strengthening the regulatory environment as it is refining its procurement processes to attract the requisite investment in the sector. Growth-oriented policies such as the new-build (power generation capacity) programme and the implementation of the REIPPPP are being actively implemented, and are factors that are set to increase infrastructure development and set the electricity sector on an exponential growth path over the long-term. This presents a vast suite of opportunities to investors in an array of power technologies and related infrastructure.

The market analysis conducted by TFS Solar shows that the proposed PV Manufacturing facility as envisaged in the project, will dovetail perfectly with sustainable energy policies, and well positioned to make an impact on the local supply of solar energy and related products and applications.

As can be seen the current and future demand for solar PV is large and certainly provides a sustainable business model for the TFS Solar PV manufacturing plant.

South Africa Job Creation, as all PV Modules are imported, we are able to manufacture PV modules at much cheaper as all required materials are locally available.

Solar Farm is necessary for OWN power supply to the TFS Solar PV Manufacturing facility.

The project is desirable as it will provide jobs for the greater community, as currently electricity supply crisis; this is a solution for South Africa as well as the rest of the world.

Location is perfect for this application, as area big enough to accommodate the intended facilities.

1.1.2. Electricity Generation

The project will supply its own electricity for the manufacturing plant and would therefore not place a further burden on the National Grid.

The project will also supply locally manufactured solar panels which will support the drive for renewable energy in South Africa, supporting the national targets for the generation of renewable energy.

The solar panels that will be manufactured are more efficient than the currently available solar panels.

1.1.3. Creating job opportunities

The proposed project will create 1200 jobs. Furthermore it will create nearly one million jobs through the provision of solar panels which will be provided amongst others to low cost housing initiatives and housing supplied by Government.

1.2. Economic benefits

TFS Solar (Pty) Ltd ('TFS') over the past four years has been investigating processes and developing a project for a production facility to produce integrated solar photovoltaic ('PV') panels. The facility will beneficiate locally produced Silicon and other raw materials to final product wafer cells installed in panels ready for deployment and installation in PV farms, or home and other industrial applications.

Currently all PV panel components are fully imported from China or other countries and assembled in facilities within South Africa. The proposed project will be the only such complete PV manufacturing plant in Southern and Sub-Saharan Africa, beneficiating from raw materials and feedstock produced in South Africa, to final product.

The proposed manufacturing facility will have an annual capacity of 6 000-ton of MgSi and 1200MW of solar PV panels per annum. It will be a first-of-its-kind plant that utilises local raw materials (typically exported) and beneficiates the feedstock from these raw materials through to

the finished panel product in South Africa. In terms of Government body proposed legislation change from “Locally Produced” to “Locally Manufactured”, the TFS plant business will have a competitive advantage over the existing local panel suppliers that primarily assemble imported components. In addition to TFS will have an enhanced quality and lower cost product.

The PV panel manufacturing plant market is to produce panels for both on and off-grid (Eskom grid in SA), for use in the Renewable Energy Independent Power Producer Procurement Programme (‘REIPPPP’), the industrial, domestic and international sectors.

The Project Sponsors, who are the shareholders in TFS Solar, initially investigated PV panels and associated uses and off shoot products some 4 years ago, however soon realised the potential for a fully integrated manufacturing facility in South Africa. Consequently researched various processes and technology suppliers, determining that the Schmid Silicon Technologies (SST) for MgSi production and Schmid for the wafer and panel production from Germany to be the best and most efficient. As a result close co-operation was engendered with both and the project is now based on the selected technologies supplied by Schmid and SST.

1.2.1. The PV Market

The current energy crisis in South Africa is well known, constantly in the national news, with industry, business and general public being affected by the Eskom load shedding program. The shortage of power will prevail for many years until full implementation of the published Government “Integrated Resources Plan” (IRP). This plan maps the addition of 41GW of energy generation by 2030 (current capacity 36GW), hence more than double to be added, of which 42% is to be renewable energy sources from PV, wind farms and hydro. Thus an enormous +17GW is to be supplied from PV and other renewable energy sources, indicating a huge gap in the local market for South African beneficiated commodities right through the value chain to the final product.

There are 5 companies assembling Solar PV panels in South Africa - the PV panel and most other components are imported. Their capacity is in total 380MW/annum, a large shortfall relative to IRP requirements, however will be supported by TFS and a focus market segment.

As can be seen the current and future demand for solar PV is large and certainly provides a sustainable business model for the TFS Solar PV manufacturing plant.

South Africa Job Creation, as all PV Modules are imported, we are able to manufacture PV modules at much cheaper as all required materials are locally available.

Solar Farm is necessary for OWN power supply to the TFS Solar PV Manufacturing facility.

1.3. Economic benefits:

1.3.1. Green Economy

*“South Africa views green economy as a sustainable development path based on addressing the interdependence between economic growth, social protection and natural ecosystem. The South African approach is to ensure that green economy programmes are to be supported by practical and implementable action plan therefore importance of building on existing best processes, programmes, initiatives and indigenous knowledge in key sectors **“Towards a resource efficient, low carbon and***

pro-employment growth path” and that government alone cannot manage and fund a just transition to a green economy, that the private sector and civil society must play a fundamental role.” (DEA, 2016)

Nine key areas identified in the green economy programmes

The nine key focus areas are identified in the green economy programs that include:

- **Green buildings and the built environment:** program includes greening private and public buildings
- **Sustainable transport and infrastructure:** program includes promoting non-motorised transport
- **Clean energy and energy efficiency:** program includes -
 - Expanding off-grid options in rural and urban
 - REFIT optimisation for large scale renewable and localisation and
 - Up-scaling Solar Water Heater rollout
- **Resource conservation and management:** program includes -
 - National payments for ecosystem services
 - Up-scale “Working for” programs
 - Infrastructure resilience and ecosystems
 - Offset program
 - Wildlife management
- **Sustainable waste management practices:** program includes -
 - Waste beneficiation
 - Zero waste community program for 500 000 households
- **Agriculture, food production and forestry:** program includes integrated sustainable agricultural production
- **Water management:** program includes -
 - Water harvesting
 - Alternative technology for effluent management
 - Comprehensive municipal water metering (Demand side management)
 - Reduce water losses in agriculture, municipalities and mining
- **Sustainable consumption and production:** program includes -
 - Industry specific production methods
 - Industrial production technology changes
- **Environmental sustainability:** program includes -
 - Greening large events and legacy (2010 Soccer World Cup, COP17 flagship & Tourism) and
 - Research, awareness and skills development and knowledge management.

The proposed project will support this program 100%

The project will furthermore support the following municipal initiatives:

Midvaal Spatial Development principles: Development Principle 7. To promote the development of a diverse range of industrial and commercial activities in the Midvaal area with specific focus along the R59-Corridor and at the designated nodal points.

KPA 8 (Economic growth and development): To facilitate and promote local economic growth and develop the skills capacity of the local community



The World Bank provided a loan of 26 Billion Rand for the proposed project. This will have a significant positive impact on the South African Economy.

CHAPTER 6:

Project alternatives

Identified Alternatives to the Proposed Activity

ASSESSMENT OF ALTERNATIVES: Sections 24(4) (b) (i) and 24(4A) of the National Environmental Management Act, 1998 (Act 107 of 1998, as amended) require an EIA to include investigation and assessment of impacts associated with alternatives to the proposed project. In addition, Section 24O (1)(b)(iv) also requires that the competent authority, when considering an application for environmental authorisation, takes into account any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment.

Alternatives investigated as part of the proposed project are:

- i. No-go alternative
- ii. Land use alternative
- iii. Site alternatives
- iv. Technology alternatives
- v. Layout alternatives.

1. Solar Power Generation

1.1. NO-GO ALTERNATIVE

The no-go alternative assumes that the proposed project does not go ahead i.e. it is the option of not constructing the proposed PV power generation facility. This alternative would result in no environmental impacts on the site or surrounding local area, as a result of this PV facility. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

At present the proposed site is zoned for agricultural land-use and is not used for agricultural purposes. A Soil and Agriculture Potential Study was undertaken to determine the impact of the proposed project on the current land-use.

In terms of the “no-go” alternative, the following environmental benefits will be:

- i. The land-use will remain agricultural although the study area, as investigated for this report, consists of a variety of soils, with varying degrees of agricultural potential. However, the areas with deep, high potential soils are relatively small, occurring in the area close to the Klip River – where no disturbance or development will take place. The rest of the property has moderately deep to shallow soils. In addition, the moderately deep soils will have a degree of depth variation, which makes their cultivation somewhat problematic (as observed in the variation in the maize land), and these areas to the west of the railway line are not being cultivated at present, or apparently in the recent past.

In terms of the “no-go” alternative, the following disadvantages will be:

- i. No additional power will be generated or supplied by renewable energy resources by this project and the South African government's target of 17 800 MW of renewable energy capacity by 2030 will be disadvantaged;
- ii. Additional power will be required to operate the proposed manufacturing facility, placing additional strain on the national grid and electricity supply
- iii. Coal-based power generation is associated with high levels of greenhouse gas, air pollutants and high levels of water consumption. Renewable energy is more environmentally sustainable.
- iv. There is no opportunity for additional employment.
- v. The positive socio-economic impacts likely to result from the project such as increased local spending, the creation of local employment opportunities and the proposed implementation of an Economic Development Plan will not be realized
- vi. Illegal dumping will continue to happen onsite due to no control
- vii. An agreement has been reached with the Midvaal Municipality to relocate the informal settlement onsite once an Environmental Authorisation (AE) has been received for the project. The current informal settlement does not have adequate services or housing quality and should the project not go ahead, the socio-economic difficulties will remain for the people in the informal settlement

1.2. LAND USE ALTERNATIVE

No other renewable energy technologies are feasible for the site. The implementation of a solar energy facility at the proposed project site is more favourable than other alternative energy facilities because of the following:

The solar resources available across the proposed project site are better and represent a higher yield than the biomass, hydro or wind resources available across the same site.

Wind energy facilities require that wind turbines are spaced a significant distance from one another. Due to the fact that there is a limited area of land available for development, the implementation of a wind energy facility would not make optimum use of that land which is available. Wind energy facilities have a significant impact on bird life, creates noise and significant visual impacts.

The loss of agriculturally productive land in and around Gauteng can have a negative effect on food production and food security, especially as, compared to its area, Gauteng has the highest proportion of high potential land of any province in South Africa (Paterson, 2012). However, the converse of this is that where low potential land exists, it should be able to be used for non-agricultural uses (with appropriate mitigation, where relevant) without any significant impacts. The study area, as investigated for this report, consists of a variety of soils, with varying degrees of agricultural potential. However, the areas with deep, high potential soils are relatively small, occurring in the area close to the Klip River. The rest of the property has moderately deep to shallow soils. In addition, the moderately deep soils will have a degree of depth variation, which makes their cultivation somewhat problematic (as observed in the variation in the maize land),

and these areas to the west of the railway line are not being cultivated at present, or apparently in the recent past. Only 5.1% of the site falls within the High Agricultural potential class.

As such, continual use of the land for agricultural purposes is not the preferred option.

Agricultural Potential Class	Map Unit(s)	Limitations	Area (ha) & % of study area
High	dHu	Virtually none. Deep, freely-drained, friable soil, suitable for most crops	23.3 ha (5.1%)
Moderate	mHu	Restricted soil depth in places. Occasional stone/gravel content. Reduced yields expected.	73.8 ha (16.2%)
Low	sHu	Very restricted soil depth, usually stony/gravelly soil. Poor yields expected	184.9 ha (40.5%)
Very Low	Hu/R, Qu, Ka	Little available soil with rock (Hu/R & Qu); significant flood hazard and wet soils (Ka)	150.1 ha (32.9%)
None	U	Land occupied by informal settlements	24.3 ha (5.3%)
			456.4 ha (100%)

A portion of the land is already zoned as industrial and the implications are that industries might be constructed on this area which might contribute to air pollution and energy consumption as opposed to the solar farm which will contribute to sustainable energy for South Africa.

1.3. Technology Alternatives

There is a growing need for renewable energy technologies, such as solar and wind, to be able to supply a reliable source of electricity to the grid. Since solar and wind technology depend on whether the sun is shining or the wind is blowing, respectively, these technologies are only efficient when these sources are available.

Solar energy is clean and renewable. It doesn't emit carbon dioxide during operation. The major material of photovoltaic panel which is the most commonly used today is silicon. Silicon is abundant and environmentally safe.

Multi-junction photovoltaic cells, can achieve relatively higher energy converting efficiency than commonly used silicon cells, are however made with poisonous materials like gallium arsenide (GaAs) or cadmium telluride (CdTe) that can cause harm to the environment if leaked.

Source of information: Review and Comparison of Different Solar Energy Technologies: August 2011, Yinghao Chu, Research Associate, Global Energy Network Institute (GENI) charlie0586@address.com

1.3.1. Solar Thermoelectricity

Solar thermoelectricity uses parabolic disc technology to capture thermal energy based on the thermoelectric effect. Electricity is produced through a concentrator thermoelectric generator (CTEG) a thermoelectric device is divided into two (2) parts - it produces energy by converting differences in temperatures in the two parts into volts using a semi-conductor.

Conversely, when a voltage is applied to the device, it creates a temperature difference. At the atomic scale, an applied temperature gradient causes charged carriers in the material to move from the hot side to the cold side. The concentrator collects the sun light and focuses the irradiation on a small area that can increase the temperature of the receiver to very high temperature depends on the concentration ratio. Then, the heat flow from the hot side to the cold side through the thermoelectric material and generates voltage between the two ends at the efficiency

The efficiency of the thermoelectric materials is still very low, the recently achieved figure of merit is only 1.3~2.0.

Like most of the other solar technologies with concentration requirements, this system is unable to collect diffuse irradiation and must rely on direct radiation only. In order to have sufficient output, high temperatures are needed to make it work efficiently (~200° C based on Carnot or thermal efficiency), which lead to higher concentration ratio of the collector (10~100 suns) and more precise tracking systems.

Disadvantages of this system are:

- i. Higher concentration collector will increase capital cost and maintenance cost.
- ii. Thermoelectric material like Bismuth telluride is toxic and expensive.
- iii. Cooling systems are required to decrease the temperature of the cold side in order to increase to total efficiency.

1.3.2. Dye Sensitized Solar Cell (DSSC)

A dye-sensitized solar cell (DSSC, DSC or DYSC) is based on a semiconductor formed between a photo-sensitized anode and an electrolyte, a photo electrochemical system.

Sunlight enters the cell through the transparent cover, striking the dye on the surface of the TiO₂. This creates an excited state of the dye, from which an electron is injected into the conduction band of the TiO₂. From there, it moves by diffusion (as a result of an electron concentration gradient) to the clear anode on top. The dye molecule loses an electron and will decompose if another electron is not provided. The dye strips one from iodide in electrolyte

below the TiO_2 , oxidizing it into trioxide. This reaction occurs quickly compared to the time required for the injected electron to recombine with the oxidized dye molecule. Preventing this recombination reaction is essential as it would effectively short-circuit the solar cell. The trioxide then recovers the missing electron by mechanically diffusing to the bottom of the cell, where the counter electrode re-introduces the electrons after flowing through the external circuit.

The injection process used in the DSSC does not create a hole in the TiO_2 , only an extra electron. Although it is possible for the electron to recombine back into the dye, the rate at which this occurs is slow compared to the rate at which the dye regains an electron from the surrounding electrolyte. Recombination directly from the TiO_2 to species in the electrolyte is also possible although, for optimized devices this reaction is rather slow. On the contrary, electron transfer from the platinum coated electrode to species in the electrolyte is necessarily very fast.

Current efficiency is still relatively low compare with traditional semiconductor solar cells.

Disadvantages of this system are:

- i. Dyes will degrade when exposed to ultraviolet radiation that limits the lifetime and stability of the cells adding a barrier layer will increase the cost and may lower the efficiency.
- ii. Generally, DSSC technology uses liquid electrolyte that has temperature stability problems. At low temperatures, the electrolyte can freeze, stopping power production and potentially leading to physical damage. Higher temperatures cause the liquid to expand, making sealing the panels a serious problem.
- iii. The electrolyte solution contains volatile organic solvents and must be carefully sealed. This, along with the fact that the solvents permeate plastics, precludes large-scale outdoor application and integration into flexible structures.
- iv. Although the dye is highly efficient at converting absorbed photons into free electrons in the TiO_2 , only photons absorbed by the dye will produce electric current. The rate of photon absorption depends on the absorption spectrum of the sensitized TiO_2 layer and upon the solar flux spectrum. The overlap between these two spectra determines the maximum possible photocurrent. Typically, dye molecules have poorer absorption in the red part of the spectrum compared to silicon, which means that fewer of the photons in sunlight can be used for electrical current generation.

1.3.3. Concentrated photovoltaic technology (CPVT) and Concentrated solar power systems (CSP)

Concentrated photovoltaic technology uses optics, such as lenses to concentrate a large amount of sunlight onto a small area of solar photovoltaic materials to generate electricity. Concentrated photovoltaic and thermal (CPVT), also called combined heat and power solar (CHAPS), is a co-generation or micro-cogeneration technology used in concentrated photovoltaic that produces both electricity and heat in the same module. The heat may be employed in district heating, water heating and air conditioning, desalination or process heating.

Concentrated solar power systems use mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area. Electrical power is produced when the concentrated light is converted to heat which drives a heat engine (usually a steam turbine) connected to an electrical power generator. Heat energy is used generate steam that runs heat engines to produce electricity.

At present there are four principal CPVT/CSP technologies, which are categorised by the method in which the technology focuses the sun's rays and receives the sun's energy:

- Parabolic Trough
- Linear Fresnel Reflector - This technology is a line focus system, similar to parabolic troughs in which solar radiation is concentrated on an elevated inverted (downward facing) linear receiver/absorber using arrays of flat or slightly curved mirrors/reflectors. Water flowing through the absorbers/receivers is heated and converted into steam. The steam is used to generate electricity by means of a steam turbine and electric generator.

Disadvantages of this system are:

- i. For CPVT techniques, coolant and lubricant can be a problem if leaked.
- ii. Water is used in boilers to generate electricity
- iii. The mirrors cause significant visual impacts
- iv. The mirrors may cause collisions with birds and may kill birds flying through the concentrated energy stream
- v. Concentrator systems collect little diffuse radiation depending on the concentration ratio.
- vi. Some form of tracking system is required so as to enable the collector to follow the sun.
- vii. Solar reflecting surfaces may lose their reflectance with time and may require periodic cleaning and refurbishing.
- viii. CSP farms potentially have greater impacts on birds than PV farms because of the associated central receiver tower, standby focal points and heliostats.
- ix. The need exists for waste water evaporation ponds to separate out sludge or solids containing hazardous chemicals from the chemical waste water, cycle water blow down and cleaning liquids. Such materials are removed from the ponds by a licensed waste company. Hazardous waste should be disposed at a hazardous waste site.
- x. Reflective surfaces such as heliostats and parabolic trough panels represent a form of light pollution also brought by roadways, wet runways, windows, artificial light and cars.
- xi. Reflective surfaces act as attractants for approaching birds. These surfaces may be confused for large water bodies (with similar effects as windows) and can cause disorientation of flying birds, resulting in injury and/or death. Not applicable to Photovoltaic panels because they are less reflective**

1.3.4. Tracking systems

Tracking systems are required for collectors to follow the sun in order to concentrate the direct solar radiation onto the small receiver area. High concentration ratio collectors cannot work without a tracking system. Various forms of tracking mechanisms, varying from simple to complex, have been proposed. They can be divided into two broad categories –mechanical and

electrical/electronic systems. The electronic systems generally exhibit improved reliability and tracking accuracy. These can be further subdivided into the following:

- i. Mechanisms employing motors controlled electronically through sensors that detect the magnitude of the solar illumination
- ii. Mechanisms using computer controlled motors with feedback control provided from sensors measuring the solar flux on the receiver.

There are four categories of concentration collectors, each of which is discussed below:

- i. Parabolic trough collectors (PTC)
- ii. Linear Fresnel collectors (LFR)
- iii. Solar towers (Heliostat field collectors)
- iv. Parabolic dish reflectors (PDR)

Parabolic trough collectors (PTC) are made by bending a sheet of reflective material into a parabolic shape. A metal black tube, covered with a glass tube to reduce heat losses, is placed along the focal line of the receiver. It is sufficient to use a single axis tracking of the sun thus producing long collector modules. The collector can be orientated in an east–west direction, tracking the sun from north to south.

Over the period of one year, a horizontal north–south through field usually collects slightly more energy than a horizontal east–west collector. However, the north–south field collects a lot of energy in summer and much less in winter. The east–west field collects more energy in the winter than a north–south field and less in summer, providing a more constant annual output. Therefore, the choice of orientation depends on the application and whether more energy is needed during summer or during winter. PTCs can effectively produce heat at temperatures between 50 and 400 °C and they are the most mature solar technology to generate heat at temperatures up to 400 °C for solar thermal electricity generation or process heat applications. However, use of oil-based heat transfer media restricts operating temperatures today to 400°C, resulting in only moderate steam qualities.

Linear Fresnel Reflector (LFR) technology relies on an array of linear mirror strips that concentrate light on to a fixed receiver mounted on a linear tower. The LFR field can be imagined as a broken-up parabolic trough reflector. The main advantage of this type of system is that it uses flat or elastically curved reflectors which are cheaper compared to parabolic glass reflectors. Additionally, these are mounted close to the ground, thus minimizing structural requirements.

However, LFRs are less efficient than troughs in converting solar energy to electricity and it is more difficult to incorporate storage capacity into their design.

A Parabolic Dish Reflector is a point-focus collector that tracks the sun in two axes, concentrating solar energy onto a receiver located at the focal point of the dish. The dish structure must track fully the sun to reflect the beam into the thermal receiver.

The receiver absorbs the radiant solar energy, converting it into thermal energy in a circulating fluid. The thermal energy can then either be converted into electricity using an engine-generator

coupled directly to the receiver, or it can be transported through pipes to a central power-conversion system. Parabolic dish systems can achieve temperatures in excess of 1500° C.

Parabolic dishes have several important advantages:

- i. Because they are always pointing at the sun, they are the most efficient collector systems.
- ii. Typically, they have a concentration ratio in the range of 600–2000 and are highly efficient at thermal-energy absorption and power conversion systems.
- iii. They have modular collector and receiver units that can either function independently or as part of a larger system of dishes.

Parabolic-dish systems that generate electricity from a central power converter collect the absorbed sunlight from individual receivers and deliver it via a heat-transfer fluid to the power-conversion systems. The need to circulate heat transfer fluid throughout the collector field raises design issues, such as piping layout, pumping requirements, and thermal losses. The Stirling engine is the most common type of heat engine used in dish-engine systems. For this system, certain level of reliability and mass production still need to be achieved.

Solar Tower (Heliostat field collector) can be used for extremely high inputs of radiant energy to reflect their incident direct solar radiation onto a common target as shown in Figure

This is called the heliostat field or central receiver collector. By using slightly concave mirror segments on the heliostats, large amounts of thermal energy can be directed into the cavity of a steam generator to produce steam at high temperature and pressure.

The concentrated heat energy absorbed by the receiver is transferred to a circulating fluid that can be stored and later used to produce power.

Central receivers have several advantages:

- i. They collect solar energy optically and transfer it to a single receiver, minimizing thermal-energy transport requirements.
- ii. They typically achieve concentration ratios of 300 –1500 and are highly efficient, both in collecting energy and in converting it to electricity.
- iii. They can conveniently store thermal energy.
- iv. They are quite large (generally more than 10 MW) and thus benefit from economies of scale.

The average solar flux impinging on the receiver has values between 200 and 1000kW/m². This high flux allows working at relatively high temperatures of more than 1500° C and integrates thermal energy into more efficient cycles. Central receiver systems can easily integrate in fossil fuelled plants for hybrid operation in a wide variety of options and have the potential to operate more than half the hours of each year at nominal power using thermal energy storage.

Central receiver systems have potential for mid-term cost reduction of electricity compared to parabolic trough technology since they allow many intermediate steps between the integration in a conventional Rankine cycle up to the higher energy cycles using gas turbines at temperatures above 1000° C. This subsequently leads to higher efficiencies and larger

throughputs. The Rankine cycle is a closed loop cycles that converts heat into energy; for example converting water the steam. Another alternative is to use Brayton cycle turbines, which require higher temperatures than the ones needed for in Rankine cycle. Projected annual performance values, investment and operating costs still need to be proven in commercial operation.

A PV tracking system's performance is greater than the performance of the fixed PV system – approximately 20 percent more energy produced on a yearly basis.

2. Battery storage systems alternatives

Battery storage systems allow for fluctuating renewable energy sources to be as stable as conventional systems and also provide a means to decouple generation of electricity from its use (i.e. provide electricity to the grid during peak demand) and therefore minimising supply and demand related issues¹. Different battery storage technologies are used all over the world for grid stabilisation, load leveling and to provide uninterrupted power supply.

2.1. Environmental risks and impacts

The main environmental risks or impacts associated with battery storage facility are outlined below and discussed in detail in this section:

- i. Leaking of battery and/or spillage of electrolytes.
- ii. Risk of fire, explosion or release of toxic gas.
- iii. Visual impact.
- iv. Replacement of materials and waste generation.

2.1.1. Redox Flow Battery

2.1.1.1. Replacement of materials and waste generation

The Redox Flow Battery tanks hold their charge virtually indefinitely because no phase change or plating occurs in a Redox Flow Battery (such as an ICB flow battery) and thus the electrolyte is a capital cost and permanent asset. Since the lifetime of the project is expected to be 20 years, the flow battery and/or electrolytes would not need to be replaced.

When decommissioning a vanadium redox system, the solid ion exchange cell membranes may be highly acidic or alkaline and therefore toxic. They should be disposed of in the same manner as any corrosive material. If possible, the liquid electrolyte is recycled.

2.1.1.2. Risk assessment

Compared to the first three types of battery, flow type battery has little environmental concerns as it requires stringent operating condition which separates them from the general environment at the first place. And it is fully recycle-capable due to its solution alike property.

Vanadium redox batteries have two main advantages over other flow battery chemistries.

- i. First, the positive and negative electrolytes are the same when the battery is in a discharged state. This has several implications for cost, manufacture, and efficiency. Costs to ship, store, and manage electrolyte are low and the electrolytes will not contaminate each other should they be mixed (the battery will only self-discharge).
- ii. Second, the sulfuric-based electrolyte does not release poisonous or corrosive vapours like other flow batteries using halide-based electrolyte

VRBs do not require emissions or fuel handling permits as part of siting costs. The ion exchange membrane, however, is toxic. During decommissioning, the vanadium electrolyte is recycled and does not face the same environmental and restrictions as lead-acid and cadmium disposal.

2.1.2. Lithium Ion Battery

They are able to store more power in a more compact space, as well as promising a longer lifespan and higher efficiency. They are capable of completing 7,000 full cycles of charge and discharge cycles before they can experience loss

Disadvantages: A notorious disadvantage of Li-ion battery will be the cost. They are more expensive than the lead-acid batteries. Another big issue is safety—providing protection needs to be well considered when using Li-ion battery.

Safety is a serious issue in lithium ion battery technology. Most of the metal oxide electrodes are thermally unstable and can decompose at elevated temperatures, releasing oxygen which can lead to a thermal runaway. To minimize this risk, lithium ion batteries are equipped with a monitoring unit to avoid over-charging and over-discharging. Usually a voltage balance circuit is also installed to monitor the voltage level of each individual cell and prevent voltage deviations among them. Lithium ion battery technology is still developing, and there is considerable potential for further progress. Research is focused on the development of cathode materials.

2.1.3. Sodium Ion Battery

The normal operating temperature regime of NaS cells during discharge/charge cycles is in the range of 300°C to 350°C. The NaS batteries use hazardous materials including metallic sodium, which is combustible if exposed to water. Therefore, construction of NaS batteries includes airtight, double-walled stainless-steel enclosures that contain the series-parallel arrays of NaS cells. Each cell is hermetically sealed and surrounded with sand both to anchor the cells and to mitigate fire.

The sodium, sulphur, beta- alumina ceramic electrolyte, and sulphur polysulfide components of the battery are disposed of by routine industrial processes or recycled at the end of the NaS battery life.

Other safety features include fused electrical isolation and a battery management system that monitors cell block voltages and temperature.

2.1.4. Lead Acid Battery

Lead Acid Batteries are reliable and cheap. Multiple deep-cycle lead-acid batteries can provide a steady current over a long time period. They are connected together to form a battery bank. They can provide up to 1MW power to backup wind farm power generation.

Disadvantages: One disadvantage of lead acid battery is that during discharge, the acid will react with electrodes to form lead sulphate, and when the chemical process is reversed during recharging, some of the lead sulphate does not re-dissolve. This will weaken the battery. The greater the depth of discharge, the more the battery is weakened.

Lead-acid batteries contain sulphuric acid and large amounts of lead. They are highly corrosive and can produce a range of adverse health effects particularly in children.

The harmful substances can permeate into the soil, ground water and surface water through landfills.

The importance of recycling the used lead acid battery is big, and the process is among the most complicated.

For solid state batteries, the replacement would mean the removal of a container and replacement with a new battery. The operational lifetime of the solid state battery is 3-12 years for a lead-acid battery

Disposal of lead-acid batteries is an important part of the life cycle. The environmental and safety hazards associated with lead require a number of regulations concerning the handling and disposal of lead-acid batteries. Lead-acid batteries are among the most recycled products in the world. Old batteries are accepted by lead-acid manufacturers for recycling. Batteries are separated into their component parts. The lead plates and grids are smelted to purify the lead for use in new batteries. Acid electrolyte is neutralized, scrubbed to remove dissolved lead, and released into the environment. Other component parts such as plastic and metal casings are also recycled. Any materials that are replaced should be appropriately handled and sent to a registered hazardous landfill site.

ADVANTAGES

DISADVANTAGES

POTENTIAL ENVIRONMENTAL IMPACTS

Redox Flow Battery= this is the chosen option

Flow batteries are emerging energy storage devices that can serve many purposes in energy delivery systems. They can respond within milliseconds and deliver significant quantities of power. They operate much like a conventional battery, storing and releasing energy through a reversible electrochemical reaction with an almost unlimited number of cycles. The active chemicals are stored in external tanks, and when in use are continuously pumped in a circuit between the reactor and tanks. The great advantage is that electrical storage capacity is limited only by the capacity of the tanks. Also, it has a safety advantage that comes from storing the active materials separately from the reactive point source. They have the advantages of flexible layout (due to separation of the power and energy components), long cycle life (because there are no solid-to-solid phase transitions), quick response times, no need for "equalisation" charging (the overcharging of a battery to ensure all cells have an equal charge) and no harmful emissions. They offer easy state-of-charge determination (through voltage dependence on charge), low maintenance and tolerance to overcharge/over discharge

- RFBs have long cycle lives since the chemical reactions typically involve liquid phase reactions only and avoid the reactions that cause degradation in solid state batteries.
 - The power and energy capacity can be scaled independently. This enables specific system design that can be optimised for each application.
 - Low maintenance.
 - No emissions.
 - No risk of overcharge or over discharge.
 - Positive benefits to SA economy as a large portion of the system can be built using locally procured components.
 - These batteries have a 25-year life cycle
- Relatively new technology.
 - Lower efficiency ~ 70%.
 - Low energy density.
 - Requires electrolyte reconditioning.
- Leaking battery and/or spillage of electrolytes

Solid State Batteries

Lithium-ion

Typically, solid or polymer-based electrolyte that results in limited risk of spillage or leakage. Lithium is flammable, resulting in relatively high fire risk in the event of overcharge or catastrophic failure conditions

- Mature technology.
- High efficiency ~84%.
- High energy density.
- High cost.
- Requires temperature control.
- Requires overcharge and undercharge control.
- Requires state of charge balancing.
- Safety is a serious issue in lithium ion battery technology. Most of the metal oxide electrodes are thermally unstable and can decompose at elevated temperatures, releasing oxygen which can lead to a thermal runaway.

Sodium-ion

This is also a type of molten-salt battery (constructed from liquid sodium and Sulphur) with a high energy density, high efficiency of charge/discharge and long cycle lifetime. However, there have been some recent safety management concerns because of the corrosive nature of the components

- Minimal maintenance.
- No thermal management required.
- No flammable or toxic components.
- Long cycle life.
- New technology.
- Low energy density.
- The NaS batteries use hazardous materials including metallic sodium, which is combustible if exposed to water.

Lead-acid

These use lead plates in an electrolyte of sulphuric acid. They have a relatively good efficiency and are low cost. The lead and sulphuric acid are toxic and so present safety and environmental concerns for both normal operation and in the event of leakage.

- Most mature technology.
- Low cost.
- Low cycle life.
- Requires maintenance.
- Contains toxic materials.
- One disadvantage of lead acid battery is that during discharge, the acid will react with electrodes to form lead sulphate, and when the chemical process is reversed during recharging, some of the lead sulphates do not re-dissolve. This will weaken the battery. The greater the depth of discharge, the more the battery is weakened.

Lead-acid batteries contain sulphuric acid and large amounts of lead. They are highly corrosive and can produce a range of adverse health effects particularly in children.

- The harmful substances can permeate into the soil, ground water and surface water through landfills

For solid state batteries, the replacement would mean the removal of a container and replacement with a new battery. The operational lifetime of the solid state battery is 3-12 years for a lead-acid battery

3. Site Alternatives

No site alternatives have been provided for the proposed project. The reason for the selection of the specific site is guided by the following:

- The site is already owned by the developer and is the only portion of land owned by the developer that is big enough to accommodate the development
- The site has specific infrastructure in the vicinity that would support the development, namely a gas pipeline from which gas can be obtained, a water pipeline from which water can be obtained, a sewer line to which a connection can be made, an electrical substation to which a connection can be made (to supply additional electricity to the site and to allow for an opportunity to put additional energy generated from the PV plant into the national grid).
- A large portion of the site is zoned as industrial
- The site is fairly level which is an important criteria for the installation of solar panels for the generation of energy. Sloping sites will reduce the amount of sunshine available per day.

Site alternative however included the establishment of the development on the different portions of the site. Due to the investigation related to Area C (next to the Klipriver, Figure 2) this area was then excluded from the development.

3.1. Lay-out alternatives

The site lay-out has to avoid any sensitive areas onsite. Now that all specialised studies have been concluded, a map of the site will indicate which areas onsite have to be left intact in terms of its current state and no development will take place on these portions as well as no access by workers or machinery vehicles.

Access roads will also have to be considered in terms of avoiding sensitive areas.

The site lay-out has been changed so that the sensitive areas next to the Klipriver will remain unchanged – no development will take place in that area.

3.2. Technology Alternatives

Fluidized bed reactors have excellent heat and mass transfer characteristics and can be utilized for Silane decomposition to overcome the energy waste problem in Siemens process. The energy consumption is reduced because the decomposition operates at a lower temperature and cooling devices are not required. In addition fluidized beds have high throughput rate and operate continuously reducing further capital and operating costs. The final product consists of small granules of high purity silicon that are easy to handle compared to powder produced by free space reactor (Odden et al., 2005).

The MG-Si, which costs about US\$1/kg, is produced by the reduction of natural quartzite (silica) with coke (carbon) in an electric arc furnace. This method of polysilicon production is very energy intensive [13], and it produces large amounts of wastes, including a mix of environmentally damaging chlorinated compounds. About 80% of the initial metallurgical-grade silicon material is wasted during the process

Energy consumption is the main cost driver for poly-silicon production process which is highly energy intensive.

Technological solutions exist to the discharges that occur in PV production. For instance, in polysilicon production, discharge of SiCl_4 , a hazardous chemical, has been a huge cause of concern. The use of cold hydrogenation technology increases conversion rates of SiCl_4 .

The developers of the proposed project have already chosen the following technologies to minimize environmental impacts associated with the project:

- Closed circuit use of water leading to zero liquid effluent
- Reduction in the use of electricity from the national grid
- Low cost due to custom designed plant with effective melting technology for the manufacturing of glass
- Flexibility due to the modular nature of the technology
- Environmentally friendly due to less energy consumption due to combined gas and electricity melt (electricity will be supplied by the PV plant)
- Waste glass from the production process will be collected and returned to the production plant, thus zero waste from this process
- The silicon technology which will be used is the leading edge technology providing a higher silicon yield at comparable product quality
- Hydrochlorination is much less energy intensive than direct chlorination and thermal converters
- Any waste comes in the form of non-hazardous neutral salts
- No vent gasses
- Simple and clear process allows for faster ramp-up to target and operational stability

As such, no technology alternatives are available in terms of performance and environmentally friendly.

4. Alternative Design

The proposed project has been designed to fit on the available site. Sensitive areas will be avoided and construction will take place on the degraded areas. As such, no alternative designs have to be considered. A stormwater management plan will be compiled and alternative designs such as reduction of impervious surfaces in clean water areas will be designed. Storm water attenuation ponds and artificial wetlands will be considered to reduce impacts from surface water run-off in terms of erosion and pollution.

5. Scheduling Alternatives

No detailed information regarding the proposed time frame for the project is available yet, however it is anticipated that construction will start as soon as possible after all the necessary approvals have been obtained. Given that the project footprint will be placed on an existing brownfields site and that all associated infrastructure is required for the operation of the proposed plant, few viable scheduling alternatives is available.

6. Input Alternatives

No input alternatives are available, as photovoltaic cells can only be manufactured from silica and glass to ensure optimum efficiency.

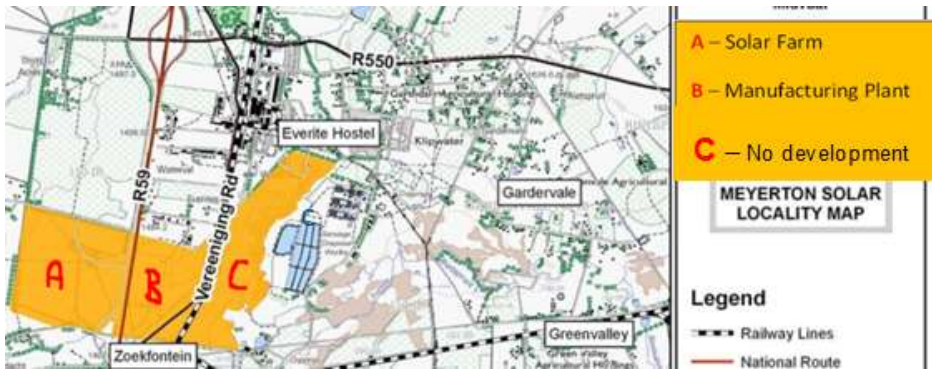
Water will be obtained from Rand Water and all input materials, such as silica sand, will be obtained locally, therefore supporting the local economy.

The glass furnace will be heated by gas, which is a more environmentally friendly option than diesel or solid fuels – leading to reduced air emissions.

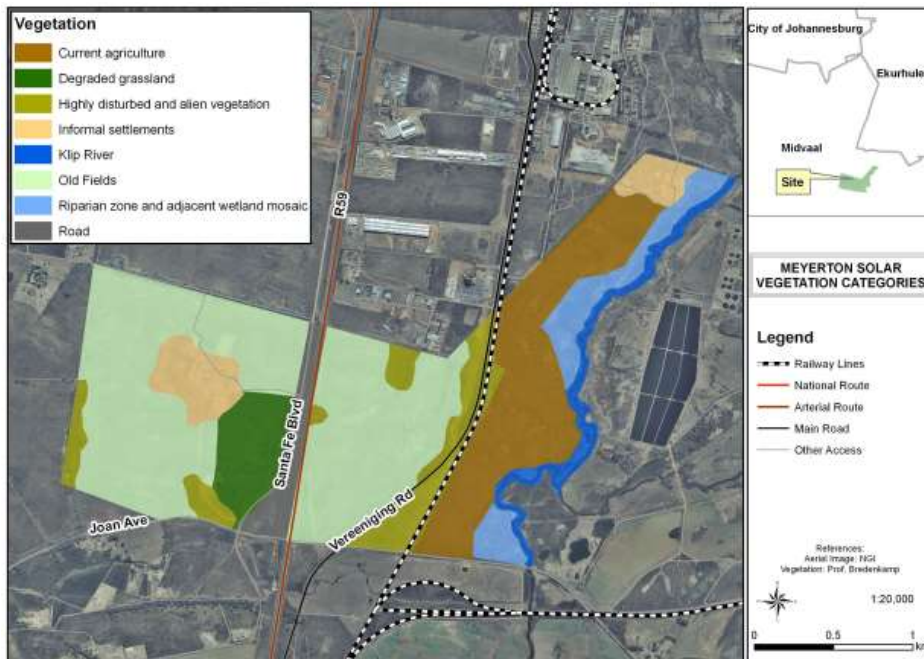
7. Site lay-out plan

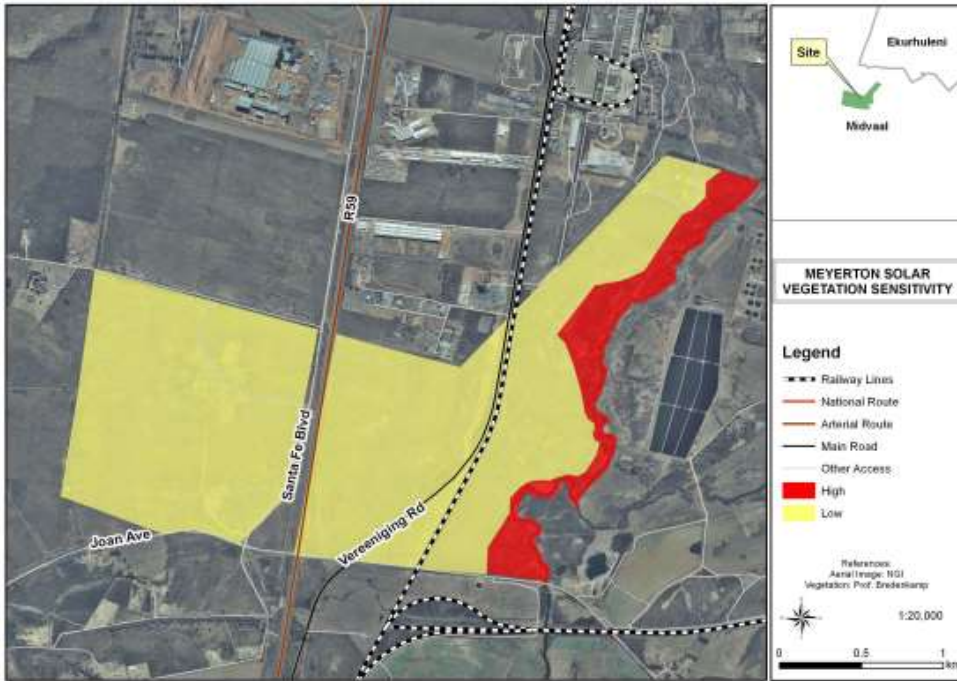
The figures below indicate the various sensitive areas overlain by the solar farm and the manufacturing plant.

Due to the sensitive of the area next to the KlipRiver – this area will not be developed.



Portion A and B is overlain over agricultural potential (no impact) and Gauteng C-Plan – no impact on irreplaceable areas. According to the map the ecological support and important areas will be affected, however it is important to note that due to specialist studies, these areas are not of ecological importance due to being disturbed already and no indigenous species are present on site – the maps below are placed here for ease of reference (copied from Chapter 3, section 1.5)





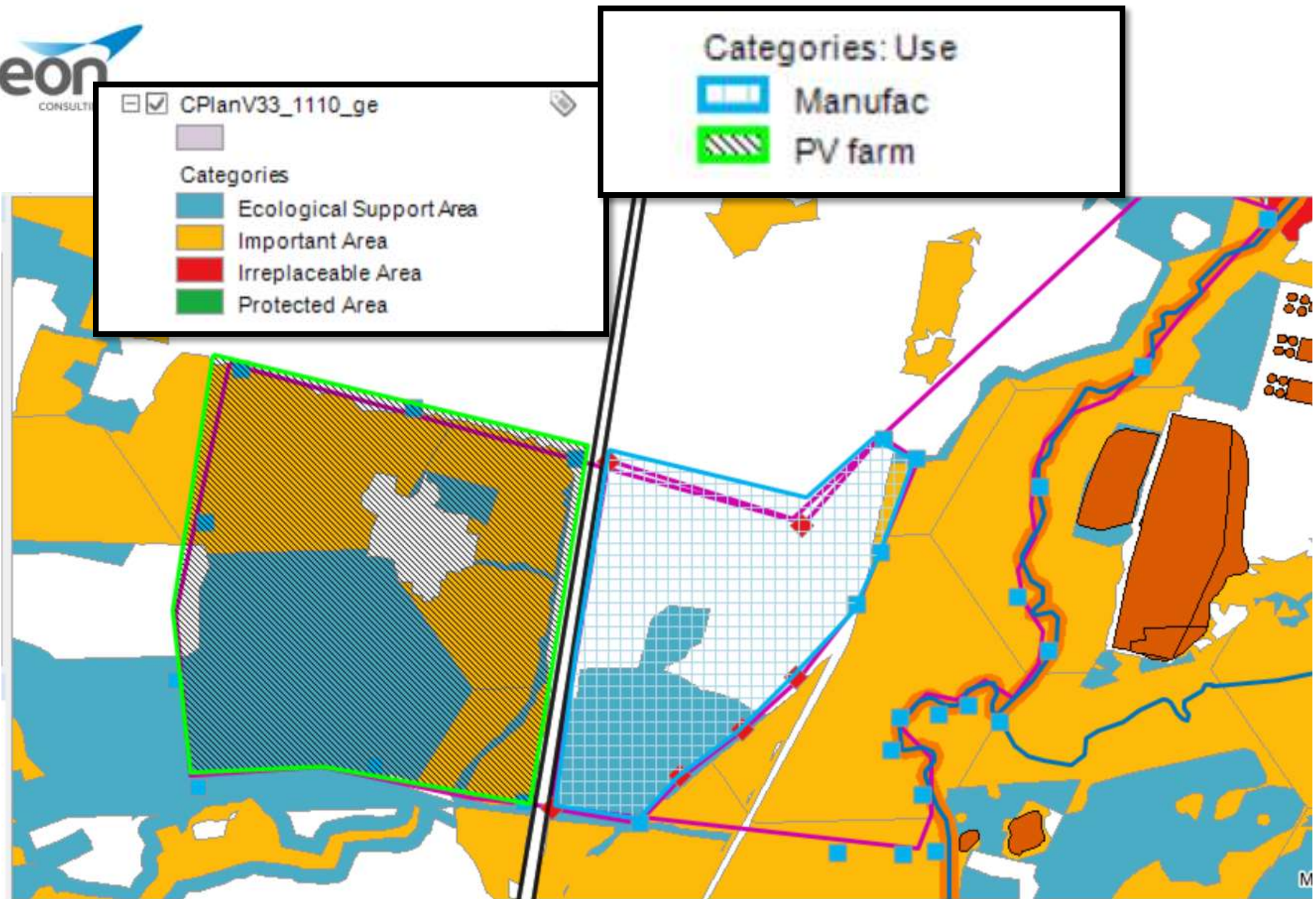


Figure 29: Lay-out plan overlain over Gauteng C_Plan

Agricultural potential

Categories

- High
- Low
- Moderate
- very low
- Very low

Categories: Use

- Manufac
- PV farm

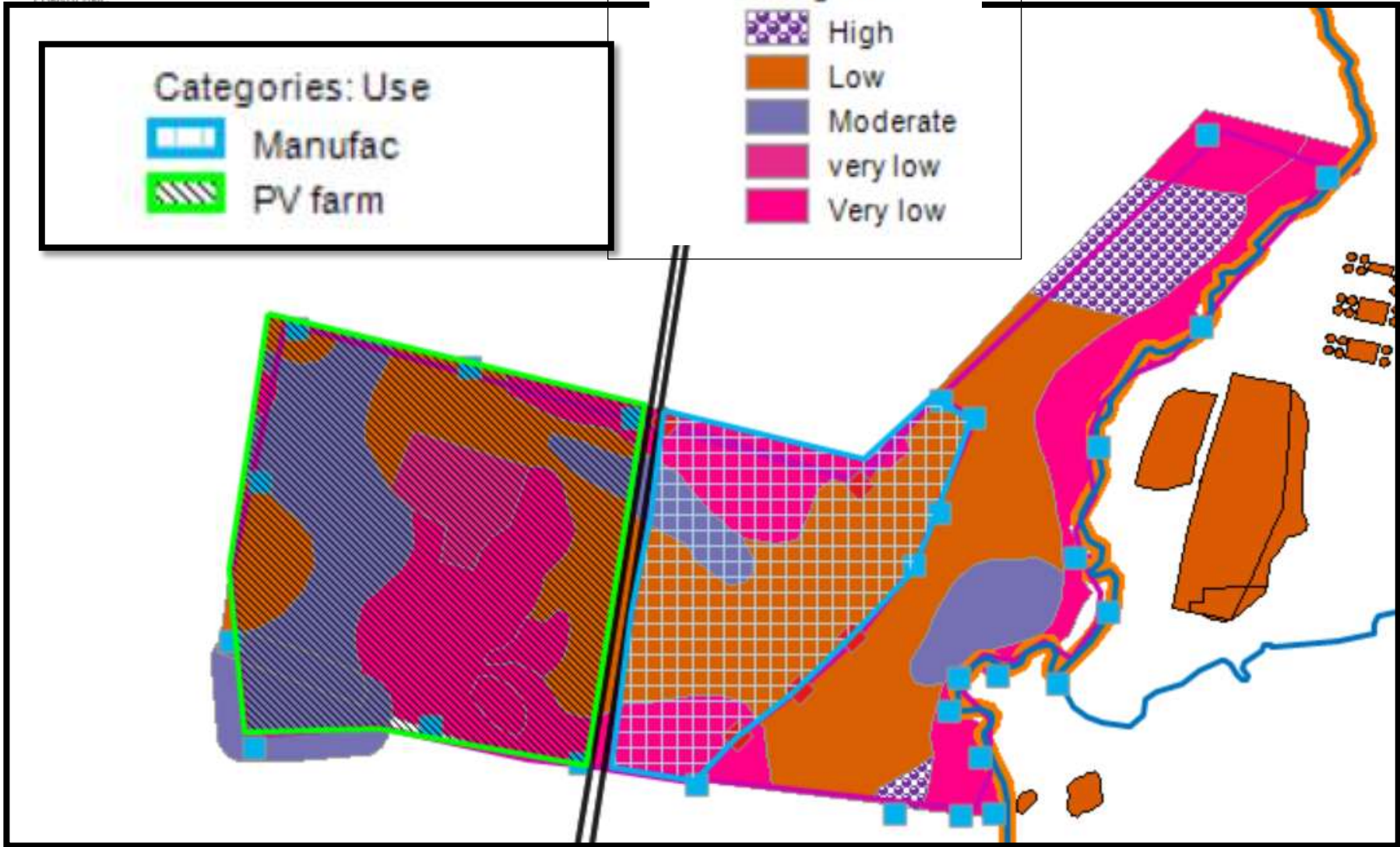


Figure 30: Lay-out plan overlain on Agricultural potential

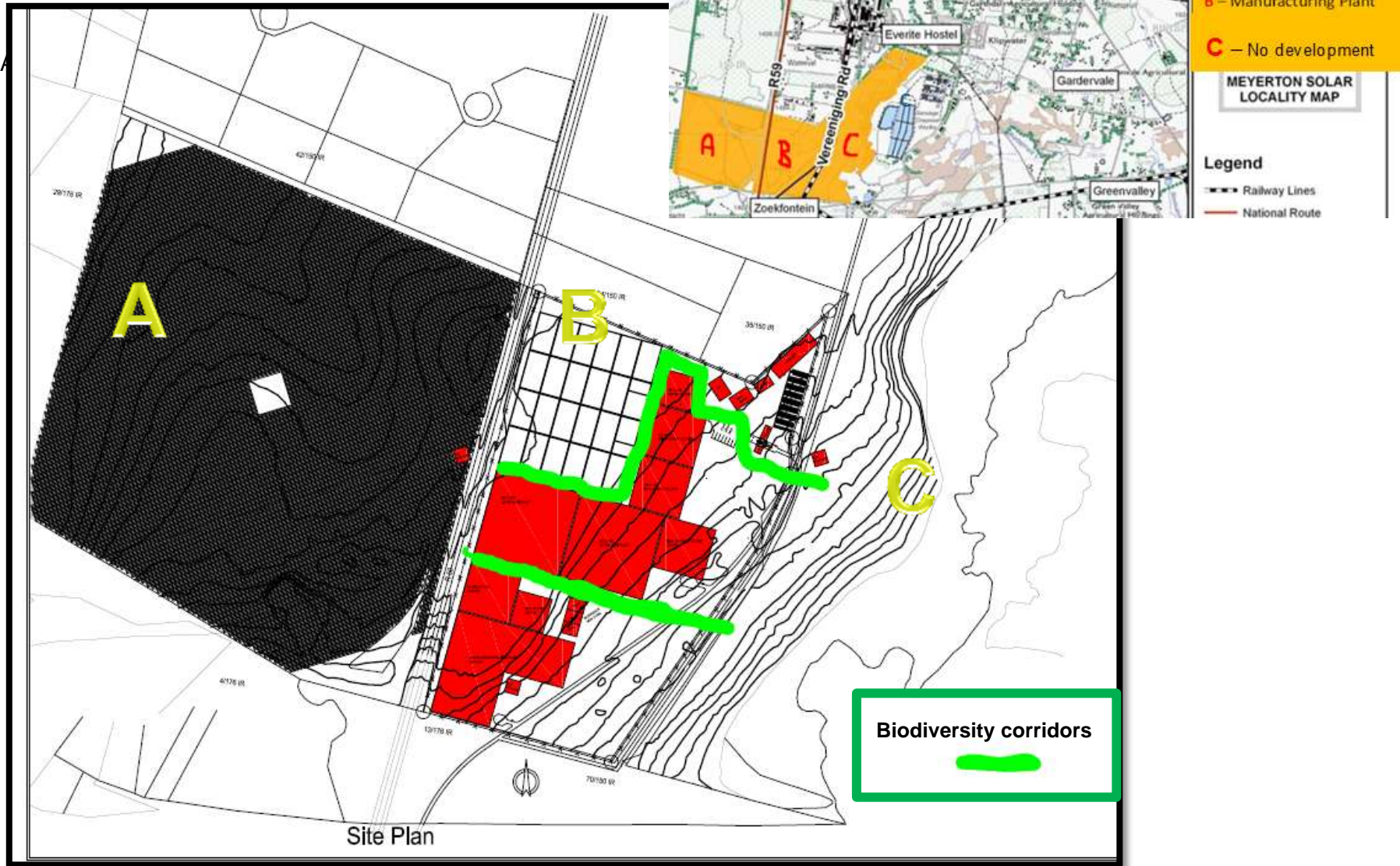


Figure 31: Provision of biodiversity corridors

CHAPTER 7:

Impact

Assessment

1. Methodology used to determine and rank potential environmental impacts

The results of the specialist studies and other relevant project information were synthesised and integrated into the Draft EIA. The Draft EIA will be released for a 30-day I&AP and authority review period. All registered I&APs on the project database will be notified in writing of the release of the Draft EIA for a 30-day commenting period.

The Draft EIA includes a Draft Environmental Management Programme (EMPr), which was compiled in compliance with the relevant regulations. Actions in the EMPr are being drawn from the management actions identified in the specialist studies and impact assessment for the construction and operational phases of the project. If the facilities are decommissioned or re-developed, this will need to be done in accordance with the relevant environmental standards and cleanup/remediation requirements applicable at the time and contained in the EMPr.

1.1. AUTHORITY CONSULTATION DURING THE EIA PHASE

Authority consultation is integrated into the PPP. The competent authority (DEA) as well as other lead authorities will be consulted at various stages during the EIA process. The following authorities have been identified for the purpose of this EIA process:

- i. National Department of Environmental Affairs
- ii. Department of Water and Sanitation
- iii. Department of Mineral Resources
- iv. Eskom Holdings SOC Ltd
- v. National Department of Agriculture, Forestry & Fisheries
- vi. Department of Agriculture, Land Reform & Rural Development
- vii. Department of Public Works, Roads and Transport
- viii. South African Heritage Resource Agency
- ix. South African Civilian Aviation Authority
- x. South African National Road Agency Limited
- xi. Midvaal Local Municipality
- xii. Sedibeng District Municipality

1.2. Assessment of impacts

The identification of potential environmental impacts includes impacts that may occur during the construction, operational and decommissioning phases of the development. The assessment of impacts includes direct, indirect as well as cumulative impacts. In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed projects is well understood so that the

impacts associated with the projects can be assessed. The process of identification and assessment of impacts will include:

- i. Determining the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- ii. Determining future changes to the environment that will occur if the activity does not proceed.
- iii. An understanding of the activity in sufficient detail to understand its consequences
- iv. The identification of significant impacts which are likely to occur if the activity is undertaken.

As per the DEA Guideline 5: Assessment of Alternatives and Impacts, the following methodology has been applied to the predication and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. The cumulative impacts will be assessed by identifying other activities in the local area which may have similar impacts on the local environment.

1.3. With respect to the Management Actions and Monitoring of the Impacts (EMPr):

Where negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated. Where positive impacts are identified, augmentation measures will be identified to potentially enhance and support positive impacts.

1.4. Methodology to Rate and Assess Significance

Significance is the product of probability and severity rating divided by the mitigation potential:

$$\textit{Significance} = \frac{\textit{Probability} \times \textit{Severity}}{\textit{Mitigation}}$$

Probability and Severity will be determined based on the following:

1.4.1. Determining the Severity of an Impact

Determination of the severity of an impact is a function of intensity, duration and extent, divided by the extent to which mitigation can successfully be applied:

$$\text{Severity} = \text{intensity} + \text{duration} + \text{extent}$$

Each of the 4 factors used to determine the severity of an impact, are described below:

1.4.1.1. Intensity factor

The level of intensity is the sum of volume, toxicity, social impact and ecological impacts.

Note that either Volume A or Volume B is used (refer to the description) but never both at the same time.

Table: 3. Intensity factor rating and description

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
Volume (A) (refers to process input and output substances/ material or products)	Less than 80 m ³ at any one time (or low volumes relative to industry/commercial standards)	Between 80 and 300 m ³ at any one time (or medium volumes relative to industry/ commercial standards)	In excess of 300 m ³ at any one time (or high volumes relative to industry/ commercial standards)	
Volume (B) (refers to natural resources)	Relatively small	Medium	Large	
Toxicity	Toxicity is on par with everyday goods in wide-spread use and is biodegradable.	Toxicity can be compared to those that have to be handled with some caution and are non-biodegradable.	Toxicity is on par with toxic/dangerous/ flammable substances that are non-biodegradable.	
Social	No or very limited impact	Some impact on immediate communities, but cannot be considered as disruptive	Major disruptive impact on surrounding communities	
Ecological	Natural functions not affected or negligible.	Environment affected but natural functions and processes continue (Some damage or wildlife	Environment affected to the extent that natural functions are altered to the extent	

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
		injury may occur). Impact is reversible or irreplaceable loss will not occur	that it will permanently or over the long term cease (Major damage or wildlife injury could occur). Irreplaceable loss will occur.	
Total				

1.4.1.2. Duration

Duration is assessed and a factor awarded in accordance with the following:

Table: 4. Duration factor rating and description

	Duration of Impact	Duration factor
Short term	The duration of the is impact is 1 Year or less	Factor 1
Medium term	The duration of the is impact is 1-5 Years	Factor 3
Long term	The duration of the is impact is 5 to 25 years	Factor 4
Permanent	The duration of the is impact is longer than 25 years and can be considered as permanent	Factor 5

1.4.1.3. Extent

Describes the physical extent the impact and factors are awarded according to the following:

Table: 5. Extent factor rating and description

	Extent of the impact	Extent factor
Site	The impact only exists within the activity's footprint	Factor 1
Local	The impact could impact on the whole or a considerable portion of the properties on which the activity is undertaken as well as neighbouring properties	Factor 3
Regional	The impact could affect the area, neighbouring as well as other areas further away than the immediate neighbours	Factor 5

1.4.2. Probability

Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Table: 6. Probability factor rating and description

	Possibility that impact will occur	Rating
Improbable	Low possibility of impact occurring due to design or history	1
Probable	Distinct possibility that impact will occur	2
Highly probable	Most likely that impact will occur	3
Definite	Impact will definitely occur	5

1.4.3. Significance Rating

Following from the above, the Significance rating can now be determined as follows:

$$\text{Significance} = \text{severity} \times \text{probability}$$

The significance rating thus determined should influence the proposed project as described below:

Negligible (calculated Significance Rating < 25)

- *Positive and negative impacts of negligible significance are unsubstantial and should have little or no influence on the proposed development project.*

Low (calculated Significance Rating 25 < 50)

- *The impact is limited and should not have a material effect on the decision to continue. Management intervention is required.*

Moderate (calculated Significance Rating 50 < 90)

- *Positive impact: Should weigh towards a decision to continue, should be enhanced in final design.*
- *Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to a low significance rating.*

High (calculated Significance Rating > 90)

- *Positive impact: Continue*
- *Negative impact: If mitigation cannot be implemented effectively (into the moderate category), proposal should be terminated.*

The table below provides an example of how the unmitigated significance ratings are calculated:

Table: 7. Calculating of Significance Ratings (Unmitigated)

Probability	Severity					Severity Rating	Significance Rating (Probability x Severity rating)		
	Intensity	+	Duration	+	Extent		=		
Probable 2	Low	4	Short Term	1	Local	2	7	14	Negligible
Probable 2	Low	4	Medium Term	3	Regional	3	10	20	Low
Definite 5	Medium	12	Medium Term	3	Local	2	19	85	Moderate
Definite 5	High	20	Permanent	5	Site	1	26	180	High

1.4.4. Mitigation

Mitigation will be calculated as follows:

Table: 8. Mitigation factor rating and description

Description	Factor Allocated
Mitigation is not possible or positive impact of mitigation is negligible. Impact remains irreversible.	1
Mitigation is possible to some extent with moderate levels of positive impact. Impact is largely reversible with only a small portion that remains as irreversible.	2
Mitigation is possible with moderate to high levels of positive impact. Impact is reversible.	3
Mitigation is possible to such an extent that all negative impacts are reduced significantly or eliminated. Impact is completely reversible.	4

$$\text{Significance} = \frac{\text{intensity} + \text{duration} + \text{extent}}{\text{Mitigation potential}}$$

2. Description and Assessment of Impacts Associated with the Proposed Project

Nature of impact column = **colored** column refers to nature of impact

Significance Rating (Probability x Severity rating)	
14	Negligible
20	Low
85	Moderate
180	High

P = Positive impact

Category of environment	Description of environmental issues and risks: leading to environmental impacts	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating	Mitigation description	Nature of impact		
															Reversible	irreplaceable loss of resources	avoided/ mitigated / managed
Hydrology	The increase in concrete and impermeable surfaces will increase runoff from the site and increase erosion	5	1	1	3	10	5	5	20	5	100	4	25	Storm water management plan and artificial wetland to attenuate flow and increase ground water infiltration			
	Excavation and construction may lead to soil washing away and increasing sediment loads in surface runoff during construction	3	1	1	3	8	1	3	12	3	36	4	9	Stormwater management plan for construction activities			
Noise	Increase in ambient noise levels in the area due to construction activities, increase in traffic and operations	5	1	5	3	14	5	3	22	3	66	4	17	Construction timing limited to between 7 and 18:00 per day			

	Accidental releases of HCL vapors and Monosilane	3	5	5	5	18	3	3	24	2	48	2	24	Engineering control measures and health and safety measures as well as identification of potential problems			
	Emissions from the manufacturing process of glass (furnace, floating bath, metal oxide coatings) and silicon (reactor, disproportionation and deposition units).	3	3	5	5	16	5	5	26	3	78	4	20	Emission control equipment			
	Reduced carbon emissions associated with energy from a renewable source					0			0		0		P				
	Storage of raw materials	3	3	3	3	12	5	5	22	3	66	4	17	storage and utilisation in an enclosed environment (vacuum pumping)			
Solid and liquid Waste	Waste produced during construction may impact on the surrounding land	3	1	1	3	8	1	1	10	2	20	4	5	Waste management plan and measures to be compiled and approved by ECO			
	Increase in the volumes of general office waste generated on site due to the increased number of people present on site	3	1	1	1	6	5	1	12	5	60	4	15	Waste management plan , recycling and removal of waste to registered landfill site			
	Increase in the volumes of sewage generated on site due to the increased number of people present on site	3	3	3	3	12	5	3	20	5	100	4	25	Local package plant to be installed and waste water			

Flora	Alien species may establish due to disturbance during construction and operation of the solar farm																		
	Removal of vegetation during construction	2	3	1	1	7	5	3	15	3	45	4	11	risk abatement plan to be compiled. Participation in Green Drop certification					
	Presence of medicinal plants on site which may be disturbed during construction	3	1	1	5	10	5	1	16	5	80	4	20	Search and rescue					
Fauna	Presence of fauna on site may be disturbed or killed during construction	3	1	1	3	8	1	1	10	2	20	3	7	Search and rescue plus environmental awareness					
	Restricted movement of animal species due to fencing of the site	3	1	1	3	8	5	3	16	3	48	2	24	biodiversity corridors onsite					
Avifauna	Collision with PV panels at night	3	1	1	3	8	5	1	14	3	42	3	14	Panels to be faced downwards at night					
	Disturbance of red data species	1	1	1	1	4	5	1	10	1	10	1	10	No red data species currently onsite. Monitoring will continue during construction and operation					
Ecological integrity	Impacts on the wetland area and sensitive ecological area	1	1	1	1	4	1	1	6	1	6	4	2	No activities in this area.					

Heritage	Destruction of heritage objects	1	1	1	1	4	1	1	6	1	6	2	3	Environmental awareness and training							
Employment	Increase in local employment opportunities.					0			0		0		P								
Economic	Positive impacts on local economic development through the increase in regional domestic product					0			0		0		P								
Electricity supply	Positive impact on the amount of electricity available in SA					0			0		0		P								
Renewable energy	Positive impact on the availability of renewable energy					0			0		0		P								
						0			0		0		P								
						0			0		0		P								
Visual impact	Visual impacts on motorists and surrounding residential areas	3	1	3	1	8	5	3	16	3	48	2	24	High boundary wall, buildings constructed in a manner to reduce visual							

														impact			
Use of non-renewable resources	The use of non-renewable resources during construction	5	1	1	3	10	1	3	14	5	70	2	35	Minimise wastage			
Spills	Pollutants such diesel fuel and hydrochloric acid may lead to soil pollution and infiltrate groundwater.	3	3	1	5	12	5	3	20	2	40	3	13	Bunding and engineering controls plus emergency management plan			
Emergencies	Leakages of monosilane, HCL vapours and exposure of monosilane to ambient temperatures may lead to explosions	3	5	5	5	18	1	3	22	2	44	2	22	Engineering controls and early detection measures			
Agricultural potential	Reduction in availability and utilisation of soils with high agricultural potential	1	1	3	1	6	5	1	12	2	24	4	6	In terms of the specialist study, limited impacts. The largest area with high potential agricultural soils will not be affected			
Waste water	Waste water from the manufacturing plant to pollute soil, surface and ground water	3	3	1	3	10	5	1	16	5	80	4	20	Waste water will be recycled. Effluent during the cleaning of filter membranes will be stored in bunded containers and removed by a registered waste handler to a licensed disposal site			

	Waste water from the sewage package plant pollute soil and ground water	2	3	3	2	10	5	3	18	3	54	4	14	Waste water from the package plant will be recycled into the manufacturing process			
Sewage sludge	Sludge from the package plant to pollute soil and ground water	1	3	3	3	10	5	3	18	5	90	4	23	To be removed by a suction truck and disposed of at a sewage plant			
Flow batteries	Soil and ground/surface water pollution during spillage incidences	1	5	3	5	14	1	1	16	2	32	3	11	Bunding around batteries. Situated on impermeable surfaces. Emergency management pan. Spill prevention procedure during re-filling.			
Cleaning of PV panels	Water use	1	1	1	1	4	1	1	6	5	30	1	30	Panel cleaning procedure will be compiled to limit wastage of water. No soap will be used			
Fire	Burning of surrounding areas due to starting of fire on site	3	3	3	3	12	1	3	16	2	32	3	11	Fire management plan to be compiled. Firefighting equipment to be stored and readily accessible on site. Training			



														of employees to do firefighting on site. Engineering controls to prevent fires			
Electromagnetic interference		1	1	1	1	4	5	1	10	1	10		4	3 Due to the low voltage and isolation of substations, no electromagnetic interference. During the operational phase, a specific study will be undertaken.			

“In considering the impact summary it must be remembered that ultimately the aim of EIA is to identify, predict and evaluate the actual and potential risks for and impacts on the geographical, physical, biological, social, economic and cultural aspects of the environment, in order to find the alternatives and options that best avoid negative impacts altogether, or where negative impacts cannot be avoided, to minimise and manage negative impacts to acceptable levels, while optimising positive impacts, to ensure that ecological sustainable development and justifiable social and economic development9 outcomes are achieved.”

After mitigation measures have been applied, it is evident that none of the identified negative impacts are of a high or even moderate significant rating. Six positive impacts have been identified. The benefits of the project will have positive regional and country-wide impacts in terms of renewable energy, climate change and availability of electricity via solar panels to rural areas and housing developments that does not have access to electricity distribution network.

2.1. Summary of impacts as per Appendix 3 of R982, Section 3h (vii)

Impact category	Nature of impact	Rating	Mitigation measures can be successfully applied
Geographical	Limited visual impact. Limited Storm water impacts due to storm water by means of the creation of an artificial wetland for storm water attenuation and ground water infiltration.		Yes
Physical	Noise and air quality” limited impacts. Significant positive impact on reduction of greenhouse gasses due to creation of renewable energy sources (as opposed to coal burning for the generation of electricity) No Electromagnetic interference due to low voltage. Limited traffic impacts		Yes

	No impacts on water quality		
Biological	Limited impact due to avoidance of important ecological areas. No impact on water resources. By mounting the PV panels on a tracking system, the system will look downwards at night to avoid avifaunal collisions The lay-out plan will include biodiversity movement corridors.		Yes
Social	Positive impact due to creation of job opportunities. The land owner will not relocate the informal settlement. The Midvaal Municipality is planning to provide RDP housing for this community in the near future. The provision of solar panels suitable for the SA climate will enable access to renewable energy for large parts of society which do not have access to electricity.		Yes
Economic	Positive impact due to creation of job opportunities, adding value to the value chain of mining products and investing several million Rands in the area. Limited impact in terms of agricultural potential		Yes
Heritage and cultural	No impact given that no heritage or cultural resources are onsite		Yes

Based on the above summary, it is recommended that the proposed activity should be authorised based on the conditions contained in the EMPr as well as the fact that the area next to the Klipriver not be developed, but left as is in its current state.

The proposed authorisation includes the construction and operational phase of the development and the environmental authorisation is therefore not limited to a conclusion of activities.

There will be no residual risks emanating from the construction and operational phase of the project.

2.2. Summary of impacts of listed activities

Listed Activity	Description	Potential Environmental impacts – refer to impact assessment table
R984 Listing Notice 2: Activity 15: The clearing of indigenous vegetation more than 20Ha	An area in excess of 300Ha will be cleared for the building of the manufacturing plant and solar PV farm	Flora, Fauna, hydrology, erosion, dust generation, ecological integrity, avifauna, alien invasive species, agricultural potential
R 984 Listing Notice 2: Activity 28: The commencement of an activity for which an air emission license is required	The manufacturing of poly-silicon from silica by the application of heat and the Manufacturing of Glass in terms of the NEMAQA: R893: Activity Subcategory 4.15 and 5.8 : (Listed Activities and associated emission standards identified in terms of Section 21 of the national Environmental management: Air Quality Act, 2004 (Act No 39 of 2004)	Air quality, noise
R 984 Listing Notice 2: Activity 6: The development of infrastructure for a process which will require a permit of the release of emissions	The manufacturing of poly-silicon from silica through the application of heat will result in air emissions as well as the manufacturing of glass	Air quality
R 983 Listing Notice 1: Activity 25: The treatment of effluent of more than 2 000m³ but less than 15 000m³ daily throughputs.	The effluent stream from the Fluidized Bed Reactor (FBR) will be cleaned to remove Silicon fines and impurities like metal chlorides.	Surface water and ground pollution, waste generation
R 984 Listing Notice 2: Activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20	A photo-voltaic solar plant will be erected comprising 200Ha on the project site to generate 100MW of electricity	Flora, Fauna, hydrology, erosion, avifauna, electromagnetic interference, visual impact, alien invasive species



megawatts or more.		
R 985 Listing Notice 3: Activity 10: The storage of dangerous goods (hydrochloric acid) with a combined capacity of more than 30m ³ but less than 80m ³ on a site identified as high agricultural potential as well as located within an ecological support area as per the Gauteng Conservation Plan 3.	The site of the proposed project is classified as agricultural potential as well as an ecological support area. More than 30m ³ of hydrochloric acid and other dangerous substances will be stored on site	Air, water, soil, ground water pollution, agricultural potential impacts, spillages, emergencies, air quality, fauna and flora impacts

2.3. Cumulative Impacts

Two of the impacts identified could have cumulative impacts when considering impacts emanating from activities in the vicinity of the site and in the broader region. These are related particulate matter emissions.

The area falls within the Vaal Triangle Priority Area and several other large scale sources are located within the region. The Vaal Triangle is a highly industrialised area housing numerous industries, a coal fired power station, and various smaller industrial and commercial activities in addition to a few collieries and quarries giving rise to noxious and offensive gasses. The Vaal Triangle is also home to a number of large informal settlements mainly using coal and wood as fuel source. Other sources of concern contributing to the pollution mixture within the area include vehicle tailpipe emissions, biomass burning, water treatment works and landfill areas, agricultural development activities and various other fugitive sources.

The contribution of the proposed project to the particulate matter load in the air shed is negligible.

3. Assumptions, Uncertainties and Gaps in Knowledge

This report has been compiled based on the following assumptions, uncertainties and gaps in knowledge:

- a) Due to noise generating equipment not being available on site to measure future noise levels, it is recommended that a study in this regard be executed during full operation and that the required engineering controls are instituted is required. Full mitigation of any noise impacts will be possible and as such it is recommended that environmental authorization not be declined based on the absence of this data
- b) In terms of air quality, the closest sampling site has been used. It might not be 100% representable of the site, but no other sampling records are readily available.
- c) In terms of meteorological data used to model air quality impacts, data from ORT airport was used.
- d) It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed housing development does not thus necessarily mean that a visual impact would be experienced.
- e) The fact that detailed electricity planning is not completed; the electromagnetic interference study could not be conducted.
- f) The future status of the illegal informal settlement on site is still not determined
- g) Due to the fact that the vegetation onsite in the area that will be developed, is already severely disturbed, a further assessment during the summer months was determined not to be required.

4. Environmental Impact Statement and Recommendations by the EAP

With adequate mitigation and management measures in place, the project can be expected to have a low negative impact during the construction phase on the surrounding social and natural environment.

The project will furthermore have a positive impact on the region in terms of job creation and economic stimulation during the construction phase. These positive impacts benefits can be maximised through preference in procurement processes for local firms and employment of local labourers where viable.

Once in operation, the proposed project will continue to impact in a positive way on the local job creation and therefore indirectly, on the local economy. The local manufacturing of photovoltaic panels will make solar energy more available locally as well as cost effective. The increased use locally of renewable energy will have a significant positive impact on electricity availability, reduced pollution and reduced generation of greenhouse gasses.

Based on the outcomes of the environmental impact assessments as contained in the relevant sections of this document, the overall negative impact of the project is of Medium Significance, which can be reduced to a Low Significance through the implementation of cost-effective mitigation measures that are fairly easy to implement, maintain and monitor.

Based on the aforementioned, the EAP makes the following recommendations:

- a) The project should be approved and allowed to proceed.
- b) The mitigation measures proposed in the impact assessment section have been incorporated into the EMPr in more detail and must be implemented during the final planning of and construction as well as operational phases of the project
- c) A communications pathway must be established that would allow a designated person to deal with any concerns and complaints that may arise during construction and operation.
- d) Strict monitoring and enforcement of the conditions and requirements of the EMP must be undertaken by the developer to ensure that all contractors and operators adhere to the requirements and that the monitoring regime is followed without fail.
- e) Studies during the operational phase mentioned in the report and EMPr must be done to finalise relevant mitigation measures should significant impacts be identified.




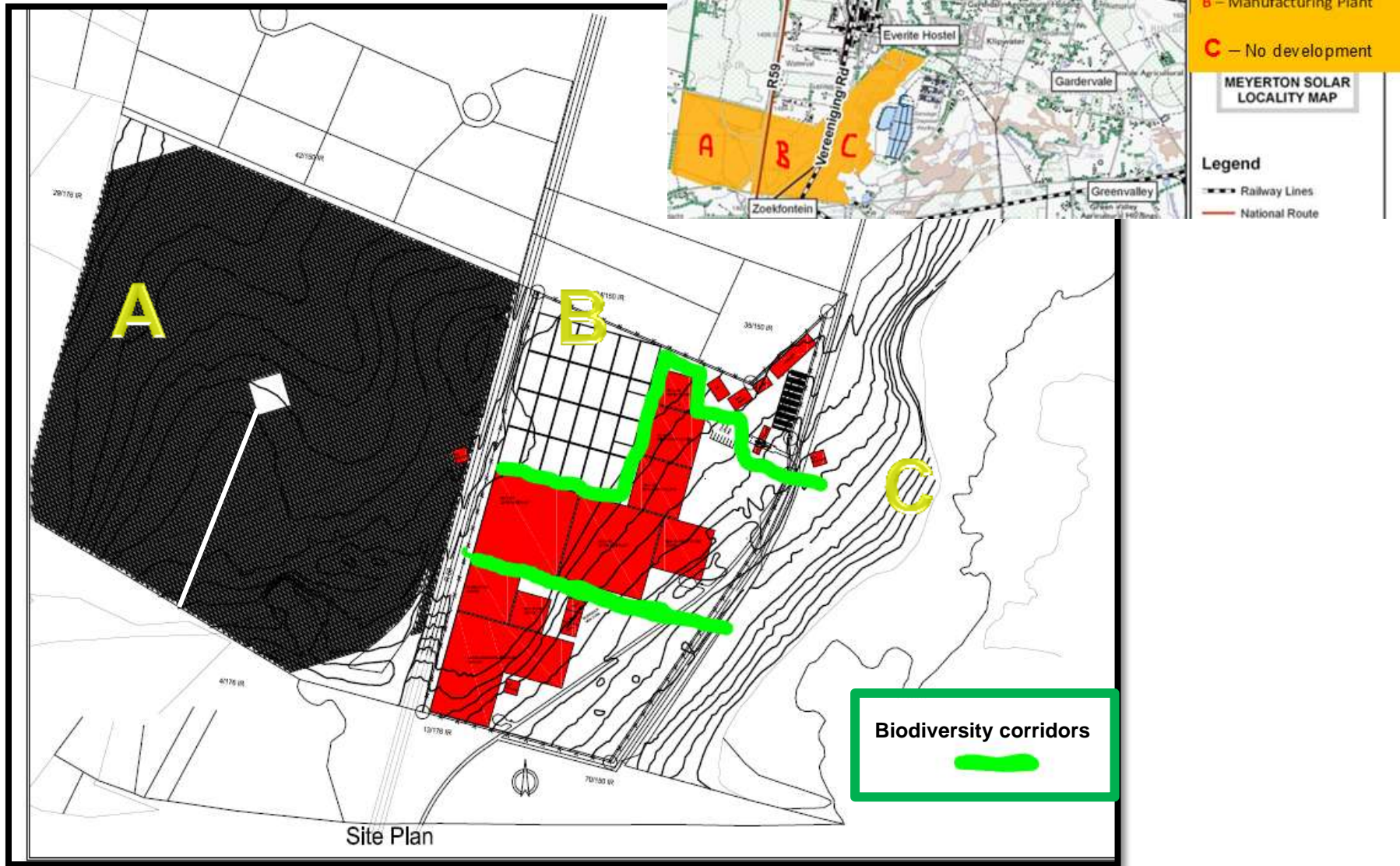
The 2 maps below indicate the lay-out of the project infrastructure overlaid on the sensitive area. In terms of the assessment results, Area C is the most sensitive – this area is excluded from all developments and will remain as is.

Biodiversity corridors will be created by leaving the natural vegetation as is in order to connect areas to the undeveloped area in Section C.

Adri Venter, as the EAP, hereby confirms in terms of the draft EIAr report:

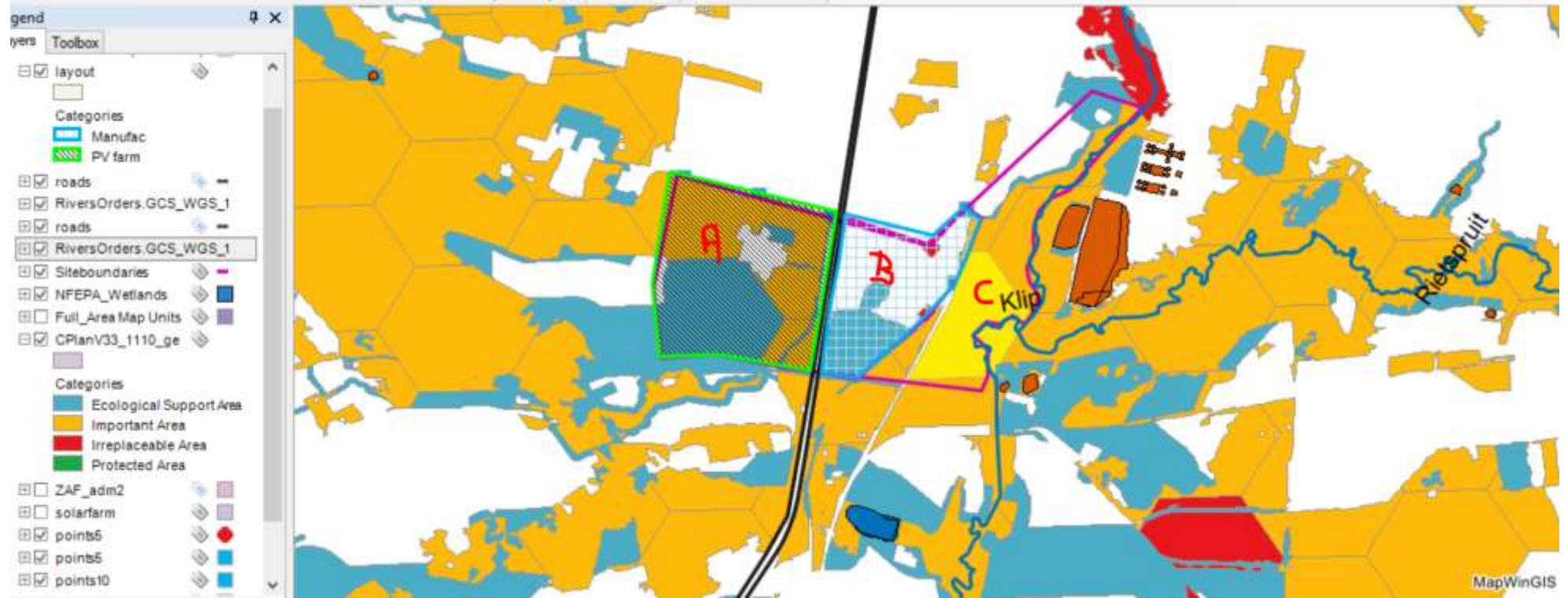
- i. The correctness of the information provided in this report
- ii. That all comments and inputs from stakeholders and I&AP's are included in this report
- iii. That all information provided by the EAP to I&AP's and responses by the EAP to comments or inputs are included in this report

Signature... Date.....24 March 2016.....



The red blocks in area B represent the manufacturing plant. The black grid in Area A represent the solar panels and the white block the informal settlement and the white line the access road to the road outside of the site.

Final



CHAPTER 8:

Public

Participation

1. Details of the Public Participation Process Conducted

The Public Participation Process (PPP) for this project is conducted by Eon Consulting according to the guidelines as published in the Department of Environmental Affairs (2010), Public Participation 2010, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs, Pretoria, South Africa and the relevant regulations. This section of the document provides detail of the public participation process (PPP) undertaken up to this point in time. Note that the PPP is still in process.

1.1. Steps that were taken to notify potentially interested and affected parties of the proposed application

The following PPP was performed for the proposed project:

- Potential I&APs were identified by review of the site and consultation with the client
- These potential I&APs were informed of the process and invited by letter to be registered I&APs. The letter was accompanied by additional basic information and a registration form
- A notice in the local newspaper, The Vaal Ster, was printed in the 23 June 2015 edition, and informs the public of the public participation process
- Two site notices were displayed near the site
- The local Councillor was contacted telephonically and a copy of the scoping report was e-mailed.
- The local municipality was contacted telephonically and information and reports were sent via e-mail
- The neighbouring land owners were served with hand delivered notices.
- A meeting was held with the Suikerboschrand Conservancy as well as the Drumblade4 Conservancy (see Public participation annexure for meeting minutes)
- Copies of the scoping report was e-mailed to registered I&AP's
- A hard copy of the draft scoping report was made available at the Meyerton Municipal Library
- A hard copy was provided to Catherine Sinclair
- A copy of the scoping report and draft EIAr were loaded on the EON website

1.2. Proof of notice boards, advertisements and notices

1.2.1. Notification to I&AP

The municipal parties were contacted telephonically and it was agreed that they prefer to be e-mailed. Emails were sent which included a personal letter, Basic Information Document and registration form as attachments. If no reply is received as requested, the documents will be delivered by hand. Copies of the confirmation emails (or then signed hand delivery notices) is included in the Annexure.

1.2.2. Notice in the newspaper

A notice of the PPP was printed in the local newspaper, The Vaalster during June 2015.

A copy of the notice and photo of the publication is shown below:

24
WEDNESDAY
23 June - 25 June 2015

MTN SA Foundation hands over 170 school shoes to Vaal learners



This year's first project in the MTN 21 Days of Yello Care Campaign focused on empowering learners.

MTN SA Foundation through the 21 Days of Yello Care Campaign partnered with the Lawrence Kieble Foundation, a local community NPO (Non-Profit Organisation), Mutual Foundation, The IM&C of Health and Social Development from Enslinam Local Municipality, as well as the Department of Education in Sediberg West District 6, to hand over 170 pairs of school shoes to learners in need, just in time to keep the winter chill at bay. The handover took place at the Letaba Primary School based in Potchefstroom where 170 learners from 8 neighbouring schools were gifted with a brand new pair of South African-made, leather school shoes.

From Letaba Primary, the MTN Foundation team, the IM&C and representatives from the Sediberg West, drove to Barnsville High, (a farm school situated just off the N1 South, close to Vanderbijlpark) where 50 learners from schools in and around the area, got the surprise of their lives when they each received a light yellow bicycle, a safety helmet, a bicycle lock and chain as well as a raincoat set and five pump.

These privileged learners have to walk distances of well over 10km from their homes to attend the nearest school in their region on a daily basis. The investment of these bicycles will definitely encourage them to not only attend school but to also arrive on time. Without the added stress of making it to school on time they will now have more time to focus on their studies, friends and families. And without the constant physical exhaustion, these 50 learners can now put their energy and focus into their schooling!

The MTN 21 Days of Yello Care cam-

Regkenningswings **STER** **Legal Notices**

IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT 107 OF 1989 (NEMA) AND ASSOCIATED EIA REGULATIONS AND RELATED ACTIVITIES: PUBLIC PARTICIPATION NOTICE TO REGISTER AS AN INTERESTED AND AFFECTED PARTY

DEA: Ref No: 14/2014/3/2/912

PROPOSED CONTRIBUTION OF A production plant for the manufacturing of solar panels through the use of a Plutonium Reactor (PR) to manufacture polycrystalline through the application of hydrochloric acid to silica. The plant will produce 6 000 tons of solar grade polycrystalline per annum

1) The construction of a solar energy plant for the generation of 1000MW of electric power; 2) The construction of a fuel gas manufacturing plant (55 000 tons per annum)

PROJECT NAME: Maseko Solar Park
APPLICANT: TFS Solar (Pty) Ltd
LOCATION AND SIZE: Portion 6 of the Farm Maseko 150R, Meyerton, Gauteng. The total size of the farm is 63ha. The buildings in which the manufacturing units will be housed, will consist of 40 ha and the solar energy plant will consist of 200 Ha of land.
APPLICATION FOR ENVIRONMENTAL AUTHORIZATION TO UNDERTAKE THE FOLLOWING EIA ACTIVITIES:
A.M. Section 24 is required to be undertaken for the proposed project, in terms of sections 24(5) and 24(6) of the National Environmental Management Act, Act 107 of 1989 (NEMA), as read with the GEA Regulations of GN R502 of 4 December 2014:

R504 Listing Notice 2: Activity 16: The clearing of indigenous vegetation more than 20ha	An area in excess of 300ha will be cleared for the building of the manufacturing plant and solar PV farm
R504 Listing Notice 2: Activity 18: The commencement of an activity for which an emission license is required	The manufacturing of polycrystalline from silica for the application of heat, and the Manufacturing of Glass in terms of the MEM&CA, Sub-Activity Subcategory A 17 and S.5. (Listed Activities and associated emission elements identified in terms of Section 21 of the national Environmental Management Act, Act 107 of 1989 (NEMA) (Act 107 of 1989))
R504 Listing Notice 1: Activity 6: The development of infrastructure for a process which will require a permit of the release of emissions	The manufacturing of polycrystalline from silica through the application of heat will result in air emissions as well as the manufacturing of glass emissions
R504 Listing Notice 1: Activity 26: The treatment of effluent of more than 2 000m ³ but less than 10 000m ³ daily throughputs	The effluent stream from the Plutonium Reactor (PR) will be cleaned to remove Silicon free and impurities like metal oxides.
R504 Listing Notice 2: Activity 11: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more	A photovoltaic solar plant will be erected comprising 200ha on the project site to generate 1000MW of electricity
R504 Listing Notice 1: Activity 10: The storage of dangerous goods Hydrochloric acid with a combined capacity of more than 1000 but less than 10000 m ³ in a site identified as high agricultural potential as well as located within an ecological support area as per the Gauteng Conservation Plan 3	The site of the proposed project is classified as agricultural potential as well as an ecological support area. More than 3000 m ³ of hydrochloric acid and other dangerous substances will be stored on site

INDEPENDENT ENVIRONMENTAL CONSULTANT: EON Consulting
 Persons who wish to participate by contributing comments to the scoping report and environmental impact assessment report, or who would like to obtain more information, should please contact EON Consulting: Aids Vermaak, no later than 23 July 2015 in order to register as interested and/or affected parties. Please provide name, contact details, address to one of the following EON contact details:
 Postal Address: P.O. Box 12339, Vorna Valley
 Fax: +27 (0)11 564 2800
 Tel: +27 (0)11 564 2800
 E-Mail: aids.vermaak@eon.co.za or info@eon.co.za

Registered Interested and Affected Parties will be contacted and informed of the manner in which the draft Scoping Report can be accessed in order to provide comments.

Successful Two Ball Trips Tournament

SASOUBURG - For the last 22 years Sasouburg Bowling Club have given the Sediberg District bowlers the opportunity to participate in a different bowls game by playing in the "Two Ball Trips" held over four weeks. This tournament is operated by Warwick and Marianne other companies and has become a household name in the Sediberg society calendar. Their sponsors make it possible to offer a tournament of such an overwhelming high standard. The prizes for first prize were the biggest ever, making the competitors even more nervous. As usual the ladies of the Sasouburg Bowling Club again looked the late trials with lively food and a variety that suited everybody. The games played well and nobody had anything to complain about. Every year the teams that participate lift the standard of this tournament, leaving the organizers with the feeling that it just can't get better. This year proved to be no different and there was no match enjoyment that every participant who did not participate must feel that they are really missing out. The power against power format really fitted every

team to be on high alert throughout the four weeks. The greatest surprise however was the total of new bowlers entering this year and the fact that they played extremely well. Just shows you that you don't have to be an old pro to learn new tricks. This year the bowlers went to the following places in first place was Johnny Pienaar, Kevin Jonsson and Vukob Miller. In second place was Raymond Houtnik, Lawrence Palkner and Nelsie Cock, and in third place was Lantika Hanley, Anna Meyer and Vukob Miller. The club would like to specially thank the Sasouburg Bowling Club Committee for all their hard work with the organizing of the tournament. Special thanks to Robby Dugard whose hard work in getting sponsorship ensured that after 4 days of play each and every team received a prize and felt satisfied with their participation. Thanks to Jimmy Stewart who organized each days play and collated the scores so each team knew their ranking at the end of each day. Because the water was contaminated on the last day of play Pinaar had a very hard day before the tournament.



Figure 32: Copy of Print Notice

Content of the advertisement and content of the notice board is provided below:



**In terms of the National Environmental Management Act, Act 107 of 1998 (NEMA) and associated EIA regulations and listed activities:
Public Participation Notice to register as an Interested and Affected Party**

DEA: Ref No: 14/12/16/3/3/2/812

PROPOSED CONSTRUCTION OF: a production plant for the manufacturing of solar panels through the use of a Fluidized Bed Reactor (FBR) to manufacture polysilicon through the application of hydrochloric acid to silica. The plant will produce 6 000 tons of solar grade polysilicon per annum .b) The construction of a solar energy plant for the generation of 100MW of electric power c) The construction of a float glass manufacturing plant (65 000 tons per annum)

PROJECT NAME: Waterval Solar Park **APPLICANT:** TFS Solar PTY Ltd

LOCATION AND SIZE: Portion 6 of the Farm Waterval 150IR, Meyerton, Gauteng. The total size of the farm is 438Ha. The buildings, in which the manufacturing units will be housed, will consist of 40 Ha and the solar energy plant will consist of 200 Ha of land.

APPLICATION FOR ENVIRONMENTAL AUTHORISATION TO UNDERTAKE THE FOLLOWING EIA ACTIVITIES:

A full Scoping EIA is required to be undertaken for the proposed project. In terms of sections 24(5) and 24(M) of the National Environmental Management Act, Act 107 of 1998 (NEMA), as read with the EIA Regulations of GN R982 of 4 December 2014:

R984 Listing Notice 2: Activity 15: The clearing of indigenous vegetation more than 20Ha	An area in excess of 300Ha will be cleared for the building of the manufacturing plant and solar PV farm
R 984 Listing Notice 2: Activity 28: The commencement of an activity for which an air emission license is required	The manufacturing of poly-silicon from silica by the application of heat and the Manufacturing of Glass in terms of the NEMAQA: R893: Activity Subcategory 4.15 and 5.8 : (Listed Activities and associated emission standards identified in terms of Section 21 of the national Environmental management: Air Quality Act, 2004 (Act No 39 of 2004)
R 984 Listing Notice 2: Activity 6: The development of infrastructure for a process which will require a permit of the release of emissions	The manufacturing of poly-silicon from silica through the application of heat will result in air emissions as well as the manufacturing of glass
R 983 Listing Notice 1: Activity 25: The treatment of effluent of more than 2 000m ³ but less than 15 000m ³ daily throughputs.	The effluent stream from the Fluidized Bed Reactor (FBR) will be cleaned to remove Silicon fines and impurities like metal chlorides.
R 984 Listing Notice 2: Activity 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.	A photo-voltaic solar plant will be erected comprising 200Ha on the project site to generate 100MW of electricity
R 985 Listing Notice 3: Activity 10: The storage of dangerous goods (hydrochloric acid) with a combined capacity of more than 30m ³ but less than 80m ³ on a site identified as high agricultural potential as well as located within an ecological support area as per the Gauteng Conservation Plan 3.	The site of the proposed project is classified as agricultural potential as well as an ecological support area. More than 30m ³ of hydrochloric acid and other dangerous substances will be stored on site

INDEPENDENT ENVIRONMENTAL CONSULTANT: EON Consulting

Persons who wish to participate by contributing comments to the scoping report and environmental impact assessment report , or who would like to obtain more information, should please contact EON Consulting: **Adri Venter**, (no later than 23 July 2015) in order to register as Interested and/or Affected parties. Please provide name, contact details, address to one of the following EON contact details:

Postal Address: P.O. Box 12389, Vorna Valley. **Fax** +27 (0)86 674 3516. **Tel:** +27 (0)11 564 2300 **E-Mail:** adri.venter@eon.co.za or info@eon.co.za

Registered Interested and Affected Parties will be contacted and informed of the manner in which the draft Scoping Report can be accessed in order to provide comments.

1.3. Draft EIAR

Public participation related to the draft EIAR:

- i. All registered interested and affected parties will be notified via e-mail that comments must be provided within 30 days - copy of the documents will be e-mailed
- ii. A copy of the EIAR, EMPr and specialist studies will be available on the EON website (www.eon.co.za)
- iii. A hard copy of the above documents will be made available at the Meyerton Municipal Library
- iv. Hard copies and soft copies (on a CD) will be provided to all relevant organs of state:
 - a. National Department of Environmental Affairs
 - b. Department of Water and Sanitation
 - c. Department of Mineral Resources
 - d. Eskom Holdings SOC Ltd
 - e. National Department of Agriculture, Forestry & Fisheries
 - f. Department of Agriculture, Land Reform & Rural Development
 - g. Department of Public Works, Roads and Transport
 - h. South African Heritage Resource Agency
 - i. South African Civilian Aviation Authority
 - j. South African National Road Agency Limited
 - k. Midvaal Local Municipality
 - l. Sedibeng District Municipality









1.4. Registration of I&APs and Comments

The following persons registered as I&AP's

Ralph Ellis
(neighbor)

BLOCKHOUSE ONE STOP

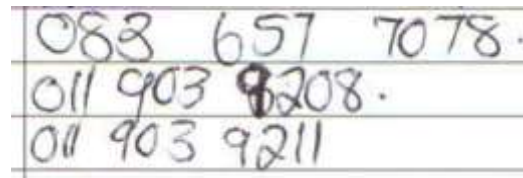
(016) 366 0335

083 266 9132

blockralph@peg.co.za

• Johan Sonnekus
(neighbor)

rocklite@onlinemail.co.za



• Alwyn Botha
(neighbor)

Mobile: 083 676 2102

Fax: 086 502 3172

E-mail: alwyn@metafix.co.za

GPS: S 26.494205 * E 28.059918

91 Springbok Road

Randvaal, Gauteng

1873

Midvaal Municipality

- Jaco Verster

Jako Verster <jakov@midvaal.gov.za>

Midvaal Councillor

- Rob Jones

MMC Community services

Ward 5 Midvaal

Cell: (27-82)4105633

Tel: (27-11)6958136 (OH)

Tel: (27-82)4105633 (AH)

Fax: 0866555049

E Mail rjones@midvaal.gov.za or

ward5@midvaal.info



Sedibeng District Municipality

Mr Mahlatji: Air Quality Officer Sedibeng

musam@sedibeng.gov.za

Drumblade Conservancy

Chairman: Elaine Potgieter

Elaine Potgieter
Ann Clarke

Chairman
Secretary

011 837 9656
011 887 8885

082 573 2780
083 785 4966

info@drumblade.co.za
ann@optionsit.co.za

Apostolic Church: Meyerton

John Welman

Email: ds@gd.oldapostolic.com
Johnwelman15@gmail.com

Cell no: 082 333 1656

Klipriver-Suikerboschrand Conservancy

Chairperson:Roxy du Toit

Roxy du Toit
Chairperson
Klipriver-Suikerboschrand Conservancy
082 515 2884
du Toit <propprojects@vodamail.co.za>

Catherine Sinclair, Chairperson: Klipriver
Ratepayers and Residents Association

Catherine Sinclair <glenf1fairings@gmail.com>

Ivan Parkes Chairman Thorntree Conservancy

Chairman Gauteng Conservancy and Stewardship
Association
Liaison (IUCN) National Association of
Conservancies Stewardship of South Africa

0845902312

Office 016 590 4228

www.thorntree.co.za



1.5. Issues raised by the I&AP's

Name	Comment	Response from EAP and or client
Alwyn Botha	We have no objection and actually welcome this project.	Thank you
Jaco Verster	<p>Noise pollution aspects from:</p> <ul style="list-style-type: none"><li>• The building site during day and night times caused by people staying on site.<li>• The operation of equipment during operational time.<li>• Trucks and vehicles used on site for construction purposes.<li>• Trucks and vehicles leaving the demarcated sites need to be monitored for noise pollution. <p>Air pollution:</p> <ul style="list-style-type: none"><li>• No burning of waste, building waste and rubble will be allowed on the demarcated sites. <p>Dust pollution:</p> <ul style="list-style-type: none"><li>• Dust pollution in and around the demarcated sites.<li>• Transportation of sand and building materials (dust pollution) needs to be controlled at all times to prevent pollution.<li>• Trucks and vehicles leaving the demarcated sites transporting sand loads need to be monitored for dust pollution. *This needs to be done especially while exiting	<p>The matters raised will be included in the EMPr</p> <p>The client will consult with the relevant departments related to the approval of building plans.</p> <p>Mr. Verster was requested to arrange a meeting with all relevant departments but a meeting could not be arranged in time due to the municipality being busy with close-out of their financial year. Another meeting will be arranged to present the draft EIAR</p>

the site moving through the adjacent town ships.

- On and off loading of sand and building materials in the demarcated sites.

Diesel pollution:

- Diesel pollution caused by trucks and vehicles working at the demarcated sites.
- Trucks and vehicles leaving the demarcated sites need to be monitored for diesel pollution. *This needs to be done especially while exiting the site moving through the adjacent town ships.

Waste pollution:

- Waste management systems need to be in place to prevent pollution during construction.
- All waste to be disposed according to procedures to prevent health nuisances during construction.
- No burning of waste will be allowed on the demarcated sites.
- No waste will be buried and covered with soil on the demarcated or adjacent sites.

Water pollution:

- No underground, nearby rivers, bore holes and channels shall be polluted during construction of the church.
- Routine sampling must be done to ensure clean and safe water.
- No waste water shall be pumped/discharges into rivers, channels, sewer system, open spaces and bore holes before, during and after construction of the project.

Ground pollution:

- No pit latrines will be allowed on and around the sites.
- No chemicals, diesel, oils and toxic materials shall be stored on the demarcated site without approved documentation and permit's.

General:

- Public participation between relevant parties to be conducted.
- Daily inspections to be conducted by the site manager or appointed person.
- Violation of the above mentioned shall be reported **immediately** in writing to the relevant Town Council Departments in the Midvaal Region.
- Management, workers and contractors **shall** adhere to all the Safety Regulations and procedures as indicated in the Occupational Health and Safety Act, Act 85 of 1993.
- Rehabilitation needs to be done on all polluted areas before new development/s start.

***The following Departments need to be consulted at the Midvaal Town Council regarding the development:**

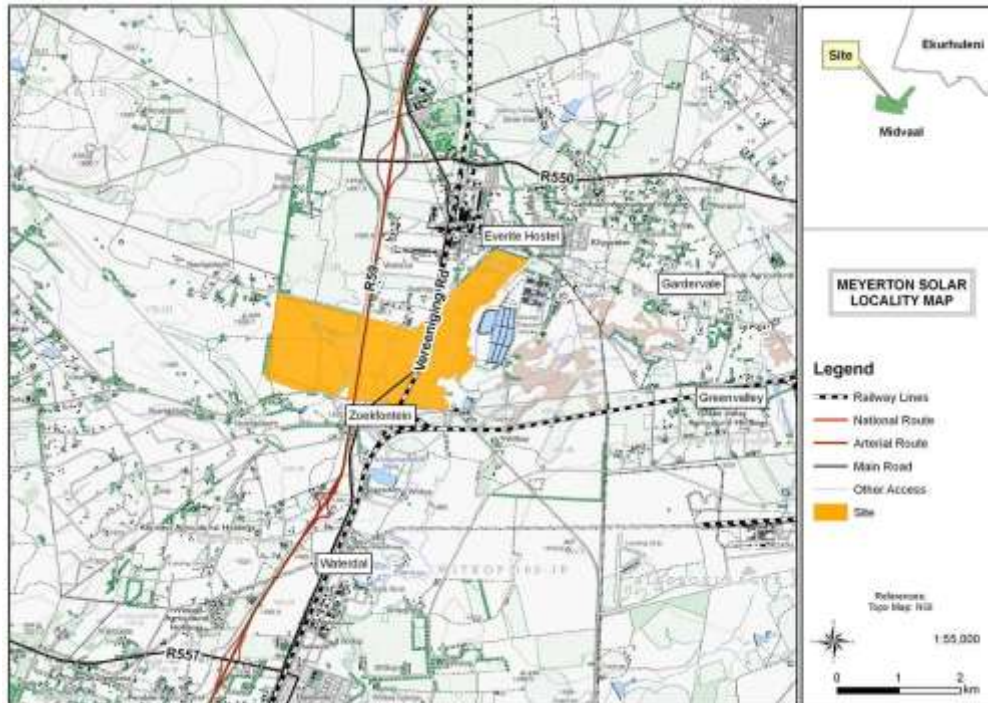
- **Building Section**
- **Town Planning Section**
- **Fire Section**
- **Engineering Section**

- Traffic Section
- Finance Section

Drumblade Conservancy

Is it at all possible to get a better map of the area as none of those in your report are particularly clear? We would like to get a better idea of how close this comes to Drumblade Agricultural Holdings and Blue Saddle Ranches.

A map was sent - see the column to the left (to ensure enough space)





Catherine Sinclair

She requested hard copies for the informal settlement onsite

Due to the late response after the 30 public participation period ended, the EAP indicated that a hard copy of the draft EIAR will be made available for comments

John Welman

I refer to the Draft Scoping Report dated 6 July 2015.

As suggested I submit the following:

- 1. Please indicate the exact positioning of the envisaged project.*
- 2. Will the project in any way affect the informal settlement in the area?*
- 3. What is the alternative arrangement for the involved families?*
- 4. What is the planning in respect of the road network for the project and surrounding areas?*
- 5. Will this type of industry not impact on the agricultural environment in the area?*
- 6. Will the development of such a plant not be a hazard in the environment resulting in property values being negatively impacted in areas such as Blue Saddle Ranches?*
- 7. What are the different phases of the project and the planned time frames?*

The applicant and the EAP responded as follows:

1. Please indicate the exact positioning of the envisaged project.

The farm Waterval has been bought from Mr. J. Piel for development into a solar manufacturing plant. On the railway side of the R59 will be the solar factory that produces the solar panels. On the Heineken side of the highway will be the solar farm producing 400MW of power for the plant's own use and to supply extra power to the grid.

2. Will the project in any way affect the informal settlement in the area?

Yes, they have to move for development for South Africa and our further planning

3. **What is the alternative arrangement for the involved families?**

The matter has been discussed with Mr Baloyi of Meyerton Municipality and there are plans in place for the resettlement of the settlement.

4. **What is the planning in respect of the road network for the project and surrounding areas?**

The current road network is in place and adequate. No additional roads required, other than an access road to the site.

5. **Will this type of industry not impact on the agricultural environment in the area?**

Not at all it is a green energy plant with no impact on the surrounding's and the areas between the railroad and the Kliprivier will still be used as farmland. All potential environmental impacts will be assessed by a professional environmental scientist and contained in a formal report. The report will again be made available for comments. The development will be issued with an environmental management plan (EMP) to limit any potential negative impacts. The EMP will be audited to ensure compliance.

6. **Will the development of such a plant not be a hazard in the environment resulting in property values being negatively impacted in areas such as Blue Saddle Ranches?**

Not at all in fact it is a massive boost for the area and will charge house and property prices through the roof. There will be plus minus 1400 people working at the plant. The Blue Saddle Ranches is approximately 4km away and as such no direct impact is foreseen.

7. **What are the different phases of the project and the planned time frames?**

Will start in 3 months' time and production in May 2016. It is registered at the DTI as a strategic project for South Africa and receives all the attention that is necessary.

Comments received from the Thorntree conservancy

Comments from the EAP are indicated
in blue

RE: Waterval Solar Park - Draft Scoping Report - Ref.14/12/16/3/3/2/825

The **Gauteng Conservancy & Stewardship Association** is a registered I&AP with regards to this application.

Without compromising our right to object to the project should we wish to at some time in the future, we want to bring the following concerns to your attention.

Alternatives:

The property is situated adjacent to a water body and between two registered conservation areas. Namely GCA018 Kliprivier Suikerboschrand Conservancy and GCA065 Drumblade Conservancy. Therefore the proposed site is "within or close to a formally protected area".

That the developer has chosen to purchase the property before confirmation that such a project would be authorized on the site is not an acceptable mitigating factor.

Please note that the property is not proposed as a mitigating factor but is mentioned under the Alternatives section. In terms of Regulation R982, alternatives include property or the location on the property, type of activity, design or lay-out of the activity, technology to be used or operational aspects or not implementing the activity.

Given that no alternative property is available for the developer, this issue is stated that no alternative here is available. Other alternatives are being investigated.

Job Creation:

It is our opinion that only temporary jobs will be created during the construction phase. Once the plant is in production it will most likely be an automated plant with a mainly skilled workforce required.

The people most likely to benefit from job creation for unskilled and semi-skilled labour are the residents of the informal settlement that currently occupy the site. As they are to be relocated (according to your document) it is therefore highly unlikely that any of them will benefit from this project.

Due to the potentially hazardous nature of the processes during production we also wish to raise a concern about the adequate protection and training of the unskilled employees on the site.

The number of the jobs being able to source locally will depend on the availability of suitable skills and the skills development that is required will determine the need for training. This can only be determined once the recruitment process is instituted.

The requirements of the Occupational Health and Safety Act will have to be adhered to by the developer once the plant is operational. Automated processes do not contribute to resolving unemployment in SA.

Economic Benefit for the area:

A reference is made to 26 billion rand being made available by the World Bank and this would have “a significant positive impact on the South African economy”. We find this statement to be rather vague and it gives no indication of what the benefits for Midvaal will be, or over what period of time said benefits will occur.

The nature of the investment is related to the promotion of the local manufacturing of solar panels versus having to import it. The economy in the value chain is stimulated in that it will create opportunities for businesses supplying and transporting raw materials as well as delivering and retailing of final products. This will create job opportunities and/or business opportunities in the value chain. The most important aspect however is that the locally manufactured solar panels will be of a high quality and suitable to the SA climate in terms of heat impacts on the electronics of the panels. The PV panels will enable South Africa to expand its renewable energy supply and therefore have a positive impact on bridging the electricity supply gap currently being experienced in SA. Indirect positive benefits will be experienced by the Midvaal area in that the Midvaal municipality will receive property tax benefits and due to the potential relocation of employees of the plant to the area, their salaries will be spend in the local economy and thereby supporting the local economy. The creation of employment opportunities at the plant will in general provide economic and social benefits, especially with relation to the high number of unemployment in SA.

The Activity:

We wish to emphasise in the strongest manner our concerns with regards to the health and environmental risks associated with this type of plant and the related manufacturing and production processes.

We believe this application is too close to established residential areas and the very mention of the danger of carcinogens, silicosis, lupis, rheumatoid arthritis, pulmonary diseases, eye and renal diseases will likely cause panic amongst residents of the area.

Recent studies recommended that “Solar PV parks are generally built on brownfield sites or low-grade agricultural land”. According to the Guardian “research carried out so far into both wind farms and solar parks suggests that these types of changes in land-use could result in micro-climate changes”

There is no doubt that PV panels will cause shading and changes to wind flow, which could then affect temperature, rainfall distribution and the wind flow over the land. “All of which will impact on the soil, plants and wildlife in areas where ground mounted PV parks are constructed” (The Guardian).

Birdlife International states the following: Change in a bird’s natural behaviour may lead to disorientation and increase energy use. Large arrays of panels may resemble water bodies attracting some bird species. One study indicated that insects were attracted to laying eggs on panels as they confused them with water, while the shading provided by panels can also attract birds. Disturbance during construction and maintenance may also be an issue. Other possible issues relate to increasing access to otherwise inaccessible areas; (<http://migratorysoaringbirds.undp.birdlife.org/en/sectors/energy/solar-energy-toc>)

In terms of the above, it must be noted that birds will be attracted to the area during the operational phase. The water resources on to the site will be retained and will be screened off to prevent access and disturbance.

Large-scale solar power plants are being developed at a rapid rate, and are setting up to use thousands or millions of acres of land globally. The environmental issues related to the installation and operation phases of such facilities have not, so far, been addressed comprehensively in the literature. Here we identify and appraise 32 impacts from these phases, under the themes of land use intensity, human health and wellbeing, plant and animal life, geohydrological resources, and climate change. Our appraisals assume that electricity generated by new solar power facilities will displace electricity from traditional U.S. generation technologies. Altogether we find 22 of the considered 32 impacts to be beneficial. Of the remaining 10 impacts, 4 are neutral, and 6 require further research before they can be appraised. None of the impacts are negative relative to traditional power generation. We rank the impacts in terms of priority, and find all the high-priority impacts to be beneficial. In quantitative terms, large-scale solar power plants occupy the same or less land per kW h than coal power plant life cycles. Removal of forests to make space for solar power causes CO₂ emissions as high as 36 g CO₂ kW h⁻¹, which is a significant contribution to the lifecycle CO₂ emissions of solar power, but is still low compared to CO₂ emissions from coal-based electricity that are about 1100 g CO₂ kW h⁻¹. (Source: *Environmental impacts from the installation and operation of large-scale solar*

power plants, Damon Turney, Vasilis Fthenakis, National Photovoltaic Environmental Research Center, Brookhaven National Laboratory, Bldg. 130, 32 Lewis Rd, Upton, NY 11973, United States: Elsevier, Renewable and Sustainable Energy Reviews 15 (2011) 3261– 3270*

We do believe the area has already experienced a reduction in rainfall since the introduction of an industrial node along the R59 corridor. No further influences should be allowed.

Research undertaken by the Columbia University concluded that: The field data and our simulations show that the annual average of air temperatures at 2.5 m of the ground in the center of simulated solar farm section is 1.9°C higher than the 18 m heights. The field data also show a clear decline of air temperatures as a function of distance from the perimeter of the solar farm, with the temperatures approaching the ambient temperature (within 0.3°C), at about 300 m away. Analysis of 18 months of detailed data showed that in most days, the solar array was completely cooled at night, and, thus, it is unlikely that a heat island effect could occur. Our simulations also show that the access roads between solar fields allow for substantial cooling, and therefore, increase of the size of the solar farm may not affect the temperature of the surroundings. (Reference: *Analysis of the Potential for a Heat Island Effect in Large Solar Farms: Vasilis Fthenakis^{1,2} and Yuanhao Yu¹ 1 Center for Life Cycle Analysis, Department of Earth and Environmental Engineering, Columbia University, New York, NY 2 PV Environmental Research Center, Brookhaven National Laboratory, Upton, NY,*)

Bulk Services and Roads:

We do not believe the current infrastructure, including the roads are able to cope with another large project. Erwat is at maximum capacity and unable to cope. The M61 is crumbling under the heavy traffic load and Joan Road has been under strain for some time due to high numbers of vehicles using the road as an access to the R59.

Current engagement is taking place with representatives of ERWAT to determine the options for receiving and treating of sewage effluent. The EAP will require written confirmation that adequate capacity is available to receive effluent from the proposed plant. If no capacity is available, the plant will install container systems which will be emptied by vacuum pump trucks and removed to an appropriate licensed treatment works with adequate capacity. During construction, use will be made of chemical toilets.

Once the final site-lay-out plan is available, the indication and determination of access road will be made available. The main roads will be used to deliver raw material. Delivery of raw material will only take place once or twice a week and as such, no significant impact on local traffic is foreseen.

Environmental Concerns:

The potential for air and water pollution, light and noise pollution, groundwater pollution, large volumes of refuse, accidental release of harmful gasses and toxins and human health hazards are of great concern.

The generation of waste water containing 'impurities'. The storage of hydrochloric acid and other dangerous substances, the potential for spillages and run-offs. Storm water and rain water - the list of concerns seems to have no end. Any potential for further damage or pollution to the Klip River must be avoided at all costs. That the property directly borders the Klip is of great worry.

Reference is made to an "ecological support area". From our experience these offers to appease the environmentally conscious are usually forgotten as soon as the application is granted or conveniently changed to suit the developer's future requirements or lack of funds to do so.

We strongly oppose the denuding of the site of all vegetation and recommend that measures be put in place to retain as much vegetation as possible. The project must be required to manage vegetation on site in an environmentally effective way and to rehabilitate the site to eliminate dust and top soil erosion.

We do not agree with your comment that "with adequate mitigation and management measures in place, the project can be expected to have a low negative impact during the construction phase on the surrounding social and natural environment."

Furthermore we are very uneasy that "strict monitoring and enforcement of the conditions and requirements of the EMP must be undertaken by the developer to ensure that all contractors and operators adhere to the requirements and that the monitoring regime is followed without fail" will be adhered to or enforced.

A stormwater management plan will be compiled and will form part of the EMP. Bunding around chemicals is a requirement and management plans will have to be implemented to reduce spillage risks.

Adequate control measures will be included in the EMP. The EMP will also include a requirement for the development of an environmental management system in accordance with ISO 14001.

An air quality specialist has already been appointed to execute an impact study and the study found that no significant impacts are expected and that the atmospheric standards will not be exceeded.

Prof. George Bredenkamp, a registered ecologist has already assessed the site and the report findings will form part of the impact assessment report.

Clearing of vegetation will indeed be kept to a minimum to reduce dust settlement on the PV panels.

The new Regulations (R982 of 4 December 2014) require the execution of external compliance audits regarding adherence to the EMPr and submission of audit reports to the Environmental Department. The Environmental Authorisation will specify the required frequency of the environmental audits.

Ivan Parkes

Chairman Gauteng Conservancy & Stewardship Association

Chairman Thorntree Conservancy

Comments received from the Drumblade conservancy

Comments from the EAP are indicated
in blue

THE PROPOSED DEVELOPMENT

1.6. The property

The property is split into three sections.

Part A lies to the west of the R59 in an area locally known as Piel's Farm, and is currently home to an informal settlement.

Part B is situated east of the R59 and west of the railway line.

Part C is situated east of the railway line running northwards towards the Everite Property. The eastern boundary of Part C is adjacent to the Klip River and most of this portion of the property is classed as 'waterbodies'.

This matter has been identified in the scoping report and will be comprehensively addressed in the impact assessment report.

Total size is 438HA. The property is currently classified as having agricultural potential as well as being an ecological support area.

This matter has been identified in the scoping report and will be comprehensively addressed in the impact assessment report.

1.7. The Project

240HA are to be developed for the construction of two production plants (40HA) and a solar energy plant (200HA). No note is made regards future plans for expansion.

No expansion is planned for

1.8. Midvaal Spatial Development Framework

The current Spatial Development Plan states that the western side of the R59 will remain agricultural holdings with a minimum area of 1 hectare with no industrial development and

shows the proposed site of Part A of Waterval Solar Plant as being “Rural development: agriculture and tourism focus areas”.

The scoping report has been submitted to the Midvaal Municipality for comments. The Midvaal municipality has the authority to approve spatial development in their area of jurisdiction.

1.9. What benefit to the community?

Are the 1200 jobs mentioned in the Draft Scoping Report permanent jobs and what portion will be sourced locally? Given the lack of skills of local people, will the Developer be willing to institute training schemes? Furthermore, please refer to the health and safety risks referred to further in our document which refers to the automation of processes in such plants in order to limit human exposure to the health risks.

The number of the jobs being able to source locally will depend on the availability of suitable skills and the skills development that is required will determine the need for training. This can only be determined once the recruitment process is instituted.

The requirements of the Occupational Health and Safety Act will have to be adhered to by the developer once the plant is operational. Automated processes do not contribute to resolving unemployment in SA.

It is our understanding that the current residents in the informal settlement (including those of foreign nationality that have resident / work permit status) had been assured that they would not be relocated until such time as alternate housing becomes available. This matter is not referred to in the Draft Scoping Report.

Meetings have been held with the local municipality and agreements have been reached regarding the provision of housing for the informal settlers on the site. This matter will be addressed in the impact assessment report.

1.10. Sustainability

What guarantees are there that the mitigation detailed in the Draft Scoping Report (pages 66 - 70) will be adhered to and enforced on an on-going basis?

The new Regulations (R982 of 4 December 2014) require the execution of external compliance audits regarding adherence to the EMPr and submission of audit reports to the Environmental Department. The Environmental Authorisation will specify the required frequency of the environmental audits.

1.11. Public Participation

The requisite public participation procedures, as required by law, must be adhered to.

The legal process is adhered to as specific in Section 39 to 44 of the Regulations

1.12. Scoping Reports

Many of the reports referred to were commissioned a long time ago (as far back as 2007) and should be re-visited in order to ensure that any of the issues of concern are adequately addressed.

The objective of a scoping report is stated in Appendix 2 of the Regulations. The primary objective is related to identify key issue that is to be addressed in the assessment phase, provide information regarding the proposed process, define the consultation process and

compile a plan of study for the assessment phase. The scoping report does make provision for the re-assessment of the findings of the past studies.

1.13. Objection to the project

At this point we are not raising an objection to the proposed project and we reserve the right to do so at any stage if we feel that our comments and concerns have not been adequately addressed.

A meeting has been held with representatives from the conservancy on 23 September and in accordance with the Regulations, registered interested and affected parties will be part of the consultation process going forward. The comments received will form part of the final scoping report and will be investigated and addressed in the final impact assessment report.

1.14. Bulk Services

Whilst the Draft Scoping Report states that municipal services are readily available, is there sufficient capacity for a project of this magnitude? No mention is made of plans being in place should the existing bulk services not be sufficient.

ERWAT cannot currently cope with the quantities of sewerage/effluent it receives and is not coping, with complaints of spillage into the river and surrounding wetlands. We have been informed that they are “currently refusing to take any additional flow, and won’t commit as to when they will be able to take additional flow”.

The proximity of the Klip River and potential for environmental damage due to spillage is a grave concern.

Current engagement is taking place with representatives of ERWAT to determine the options for receiving and treating of sewage effluent. The EAP will require written confirmation that adequate capacity is available to receive effluent from the proposed plant. If no capacity is available, the plant will install container systems which will be emptied by vacuum pump trucks and removed to an appropriate licensed treatment works with adequate capacity. During construction, use will be made of chemical toilets.

1.15. Roads

We are concerned that there is no Traffic Impact Assessment (TIA) in the Draft Scoping Report. Will existing roads, which are not coping with the current traffic in the area, be upgraded? We are referring to both Joan Road (access point for portion A) and the M61 (access points for portions B&C)

There are also several established gravel roads within the site but there is no indication of which of these roads will remain access roads, or how this would be remedied, for the local community and property owners to the north of the site.

Once the final site-lay-out plan is available, the indication and determination of access road will be made available. The main roads will be used to deliver raw material. Delivery of raw material will only take place once or twice a week and as such, no significant impact on local traffic is foreseen.

1.16. The Environmental Management Plan

The residents of the area want input on all aspects of the EMP in order to ensure that concerns are adequately addressed. We also request that copies of the monthly ECO report be communicated to an elected representative of the I&APs.

The draft EMPr will be made available for comments to all I&AP's. Copies of the ECO report can be made available

1.17. Storm Water

Whilst we are concerned about storm and rain water run-off and insist storm water attenuation should keep the run off to pre-development flows, of greater concern is the storage of large amounts of hydrochloric acid and the potential damage to surrounding dolomite formations. Building and maintenance of bund walls is essential.

Hardscaping must be kept to a minimum, to minimize storm water effects. All buildings should be encouraged to collect rain water.

A stormwater management plan will be compiled and will form part of the EMPr. Bunding around chemicals is a requirement and management plans will have to be implemented to reduce spillage risks. The minimum hardscaping is agreed with as well as the rain water collection.

1.18. Refuse & Rubbish Removal

We note that the Draft Scoping Report indicates that all NEMWA regulations will be adhered to and request that these are addressed in the EMP.

Yes, it will be.

1.19. Security

There would naturally be security concerns, specifically during the construction phase and the utmost care must be taken to ensure the safety of residents in the area.

We also have a concern regards security once the panels are installed as we think they might be broken into to steal the recyclable metals.

The project developer will apply strict security and access control to the site to prevent crime.

During construction, use will only be made of workers which have been verified as not having a criminal record. A Security guard and security systems will be also be appointed and implemented to prevent crime onsite and in neighboring areas by appointed workers.

1.20. Loss of Flora & Fauna habitat

An up-dated flora and fauna report is required. The western boundary of the property is close to a registered Conservancy – GCA 065 – an area known to have a diversity of wildlife. Species lists for the Conservancy are attached.

Clearing of vegetation should only take place on the construction footprint. This will reduce the incidence of rescue/recovery and relocation of fauna and flora.

Prof. George Bredenkamp, a registered ecologist has already assessed the site and the report findings will form part of the impact assessment report.

Clearing of vegetation will indeed be kept to a minimum to reduce dust settlement on the PV panels.

1.21. Wetlands and Waterbodies

The SANBI map clearly indicates a large area of “waterbodies” on the eastern boundary of the property, adjacent to the Klipriver and this matter has not been adequately addressed in the Draft Scoping Report.

The matter is addressed in the scoping report in terms of identification of potential impacts. The matter will be fully addressed in the impact assessment report.

1.22. The Effects of Solar Parks / Panels on Birdlife

SAPAB2 confirmed 185 birds in the Drumblade Conservancy in July 2015 – the 13th highest pentad in the country.

Birdlife South Africa has issued a Position Statement on the effects of solar power facilities on birds (copy attached) We specifically refer you to BLSA’s recommended mitigation of avifaunal impacts by:

- Not constructing plants in formally or informally protected areas (in this case situated between two registered conservancies and a water-body)
- Build plants outside of known water-bird flight paths
- Construct solar plants in already degraded areas
- Avoid construction near drainage lines with trees, or large trees that serve as nesting or roosting sites
- Use mowing or grazing instead of chemicals and pesticides for the maintenance of vegetation within the site area
- Keep evaporation ponds clear of pollutants
- Use bird friendly designs when constructing fences and powerlines i.e. appropriate wire marking devices.
- Deconstruction of the plant when it has reached its life span

The above measures will be investigated and where applicable included in the assessment report and the site lay-out plans as well as in the EMP.

1.23. Air/Noise Quality Studies

The EMP must ensure that air emissions/air quality do not exceed permissible levels. Residents of Drumblade are currently affected by ERWAT and we feel that air pollution from

African Products, Heineken and this project will increase the probability of severe chest ailments.

Noise generating equipment to be screened off in an environmentally friendly and aesthetically pleasing manner if noise assessment studies indicate thresholds have been breached.

An air quality specialist has already been appointed to execute an impact study and the study found that no significant impacts are expected and that the atmospheric standards will not be exceeded.

A noise impact study will have to be conducted once the plant is in operation and should noise levels exceed the local standards, engineering controls will be implemented.

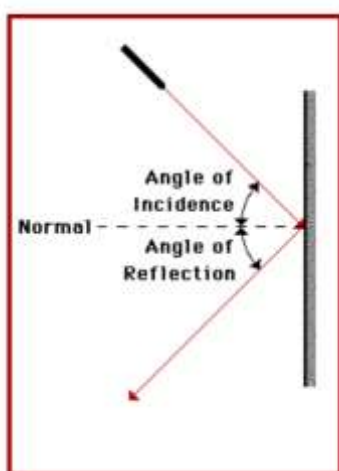
1.24. Glimmer / Glare Factors

With growing numbers of solar energy systems being proposed and installed throughout the country, the potential impact of glint and glare from photovoltaic modules, concentrating solar collectors, receivers, and other components is receiving increased attention as a potential hazard or distraction for pilots, motorists, and nearby residents.

Hazards from reflection of solar radiation from solar power plants include the potential for permanent eye injury (e.g., retinal burn from concentrated sunlight) and temporary disability or distractions (e.g., after -image).

The border of part A of the solar park runs along the R59. We understand the panels will face northwards. Motorists travelling south on the R59 and the M61 would be affected by these factors if careful planning is not considered.

Visual impairment can be mitigated by thoughtful application of analytical tools. Traditionally, glare hazards are analyzed in terms of the geometry of the proposed solar installation relative to key observation points. However, such geometric methods fail to provide an indication of the intensity of the reflected light or the potential ocular impacts. A company, Sandia, has developed a web-based tool and methodology to evaluate potential glint/glare hazards associated with solar energy installations.



According to the law of reflection, when light is reflected from a smooth plane surface, the angle of incidence equals the angle of reflection (Applied physics: Dr Arthur Beiser, 1971). The figure below illustrates the law. Given that the PV panels are directed towards the sun to optimise energy gain from the sunlight, the angle of reflections will be towards the sun. As such, ground level reflections will not be experienced.

1.25. Health & Safety Matters

We are concerned about the health matters with regards to silica dust, metallurgical grade silicon, fume silica, polysilicon, kerf dust, solvents production and the various processes used to obtain the end product. Research on the subject indicates we should be aware of the potential for silicosis, carcinogens, chronic obstructive pulmonary disease, rheumatoid arthritis, scleroderma, Sjogern's syndrome, lupus and renal disease. Also of concern are skin burns, chemical burns, eye and respiratory irritants.

The irresponsible dumping of silicon tetrachloride and solvents, spontaneous ignition, explosions, release of toxic or hazardous fumes and gases.

It is reported that western countries, which are subject to stricter environmental controls, use a 'closed loop process' that captures system byproducts. It is noted that developing countries or countries where safeguards may not exist or be enforced, may not be as compliant.

ISO 14001 certification is required in addition to the adoption of industry best management guidelines in order to minimize both health and safety factors.

Adequate control measures will be included in the EMPr. The EMPr will also include a requirement for the development of an environmental management system in accordance with ISO 14001.

Comments received from SAHRA

The draft scoping report was submitted to SAHRA via their website (SAHRIS) and the following comments were received:



CaseReference: **Waterval Solar Park**

HeritageAuthority: SAHRA

Committee: **APM**

DecisionStatus: **Letter**

DecisionDate: Monday, August 17, 2015 - 09:00

NHRA: **38**

Thank you for your notification regarding this development.

In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that prior to development it is incumbent on the developer to ensure that a **Heritage Impact Assessment** is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.

The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.

The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.

Where bedrock is to be affected, or where there are coastal sediments, or marine or river terraces and in potentially fossiliferous superficial deposits, a Palaeontological Desk Top study must be undertaken to assess whether or not the development will impact upon palaeontological resources - or at least a letter of exemption from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary. Please note that a nationwide fossil sensitivity map is now available on SAHRIS to assist with this.

If the property is very small or disturbed and there is no significant site the heritage specialist may choose to send a letter to the heritage authority to indicate that there is no necessity for any further assessment.

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

Comments received from Dr. Anton van Vollenhoven, registered archaeologist regarding the above:

Archaetnos



Culture & Cultural Resource Consultants

CC 1998 / 09854/23

✉ 55, GROENKLOOF, 0027

Tel: 083 459 3091

Fax: 086 520 4173

E-mail: antonv@archaetnos.co.za

27 August 2015

Attention: Adri Venter
EON Consulting

Dear Ms Venter

HERITAGE STATEMENT AND LETTER FOR HIA EXEMPTION REQUEST: Waterval Solar Park, Gauteng Province.

The above mentioned project refers. It is noted that SAHRA requested a Heritage Impact Assessment to be done. However, the project is located in an area completely disturbed by recent farming activities. Therefore it is expected that the area are unlikely to contain any heritage features.

It is my opinion that the project may be exempted from doing a Heritage Impact Assessment (HIA). The following is applicable:

- The site was visited and an Archaeological Impact Assessment was done by Prof. Tom Huffman of Archaeological Resources Management of the School of Geography & Environmental Management at the University of the Witwatersrand in 2007 (Appendix A).*
- Even then he realised that the site had no large potential for containing heritage sites.*
- Although he did report identifying stone tools, these were all found out of context as a result of the farming activities in the area.*
- He recommended that the development may continue.*
- It therefore is clear that no further heritage work is needed.*

It is therefore noted that the entire area has been disturbed and the chances therefore of finding any heritage related features are indeed extremely slim. The farming activities undoubtedly would have demolished any possible signs of earlier human activities and what may remain are out of context and therefore of low significance.

Resultantly all possible signs of heritage resources would have been demolished. Therefore it is very unlikely that any archaeological or cultural historical site or occurrence will be or was disturbed.

It is therefore believed that an additional Heritage Impact Assessment (HIA) is not needed for this project. This letter serves as an exemption request, which should be submitted to the South African Heritage Resources Agency (SAHRA). Please quote the Case Reference (see Appendix B) indicating it as 'Waterval Solar Park'.

The developer should however note that due to the nature of archaeological material, such sites, objects or features, as well as graves and burials may be uncovered during construction activities on site. In such a case work should cease immediately and an archaeologist should be contacted as a matter of urgency in order to assess such occurrences.

I trust that you will find this in order.

Yours faithfully

A rectangular box containing a handwritten signature in dark ink. The signature is cursive and appears to read 'Dr AC van Vollenhoven'.

Dr AC van Vollenhoven: Director

APPENDIX A – ARCHAEOLOGICAL IMPACT ASSESSMENT

**ARCHAEOLOGICAL IMPACT ASSESSMENT FOR THE GRACEVIEW
INDUSTRIAL PARK, GAUTENG**

A Phase I report prepared for Seaton Thompson and Associates
P.O. Box 936, IRENE, 0062

Professor T.N. Huffman

Archaeological Resources Management
School of Geography, Archaeology & Environmental Management
University of the Witwatersrand
Johannesburg

May 2007

ARCHAEOLOGICAL IMPACT ASSESSMENT FOR THE GRACEVIEW INDUSTRIAL PARK, GAUTENG

EXECUTIVE SUMMARY

There are no sites of archaeological significance, and therefore mitigation is not required.

INTRODUCTION

Dr R. Graca, trading as Blue Rose Developments, intends to establish an Industrial Park on portions of the Farm Waterval 150 IR south of Johannesburg (Fig. 1). The environmental coordinators for the project, Seaton Thompson and Associates, commissioned Archaeological Resources Management (ARM), to examine the area for sites of archaeological and historical interest. It was ARM's task to assess the significance of any sites in terms of Sections 35 and 38 of the National Heritage Resources Act (Act No. 25 of 1999).

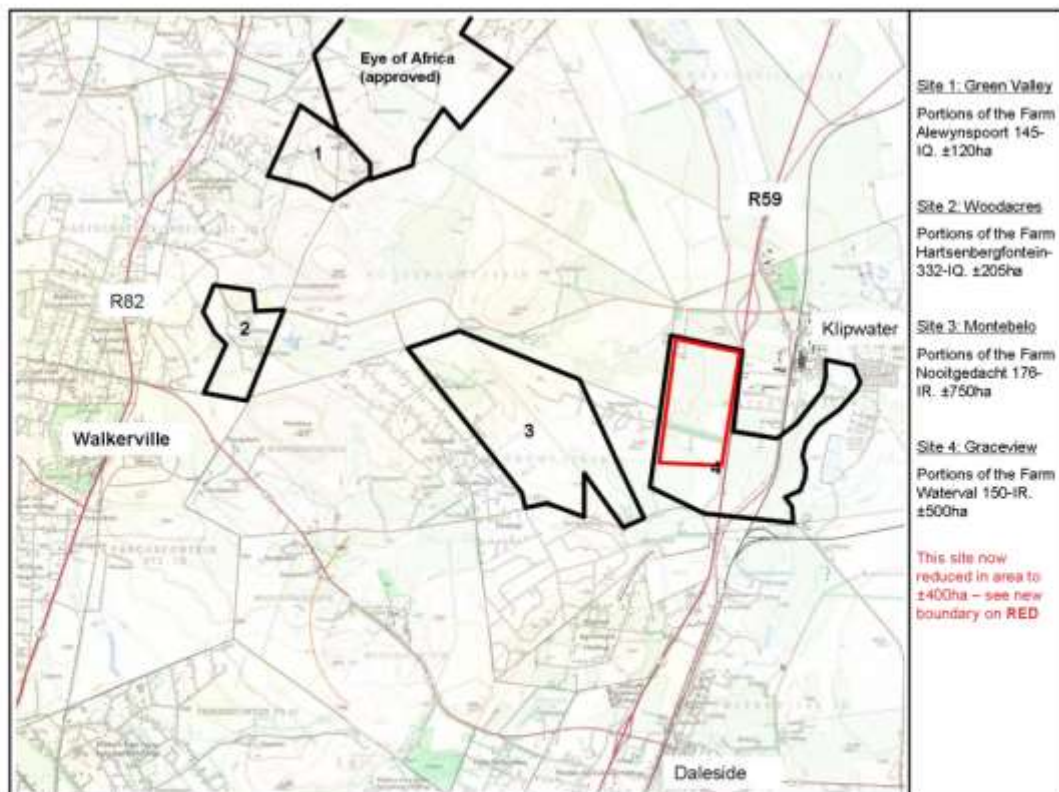


Fig. 1. Location of project area number 4.

BACKGROUND

There has been little previous archaeological investigation near the project area. In the larger district, Stone Age and Historic sites are on record in the Archaeological Survey files at the University of the Witwatersrand. For the Stone Age, some Earlier Stone Age (about 1 million to 400 000 years ago) artefacts, such as handaxes, cleavers and other bifaces, occur in river gravels of the Vaal system, while Middle Stone Age (400 000 to 40 000 years ago) sites with points and blades are more common. Later Stone Age (40 000 to 1000 years ago) sites cluster in areas, such as the Magaliesberg, that have rock shelters. A British blockhouse still stands just to the south of the project area.

METHOD

Two ARM staff visited the project area on 18 February 2007. The team traversed the ground on foot. Sites were recorded with a hand-held GPS instrument calibrated to WGS 84, and then transferred to the 1: 50 000 map sheet 2628AC Alberton.

Site significance is based on five main criteria: (1) primary versus secondary context; (2) amount of deposit; (3) number and variety of features; (4) uniqueness; and (5), potential to answer present research questions. Sites with no significance do not require mitigation, low to medium sites may require limited mitigation, high significance requires extensive mitigation, while outstanding sites should not be disturbed at all. Recognizable graves have high social value regardless of their archaeological significance.

RESULTS

Cultivated grass covered most of the ground, and visibility was poor. Nevertheless, we are satisfied with the results (Fig. 2).

As part of agricultural activities, farmers have cleared surface stone from the fields and placed them in piles. Two piles (**Site 1**: 26 25 27.8S 28 04 31E & **Site 2**: 26 26 S 28 03E) contained a few Earlier Stone Age artefacts. The field itself lies on the ancient floodplain of the Kliprivier, and these artefacts were probably not *in situ* even before they were removed. Consequently, they have *no significance*.

In contrast, a few Middle Stone Age artefacts lay around the edge of a small drainage in an unploughed zone (**Site 3**: 26 26 03.4S 28 04 24.9). Quartzite flakes were scattered among

outcrops of laterite and conglomerates. These few artefacts were probably discarded in the general area, but they are probably not in their original position. Consequently they have *low significance*.

A few MSA artefacts also lay around an outcrop of dolomite (**Site 4: 26 26 21.5S 28 04 06.4**) next to another drainage. Because they now lay on the surface, natural forces have probably shifted them from their original position of discard. They have *low significance*.

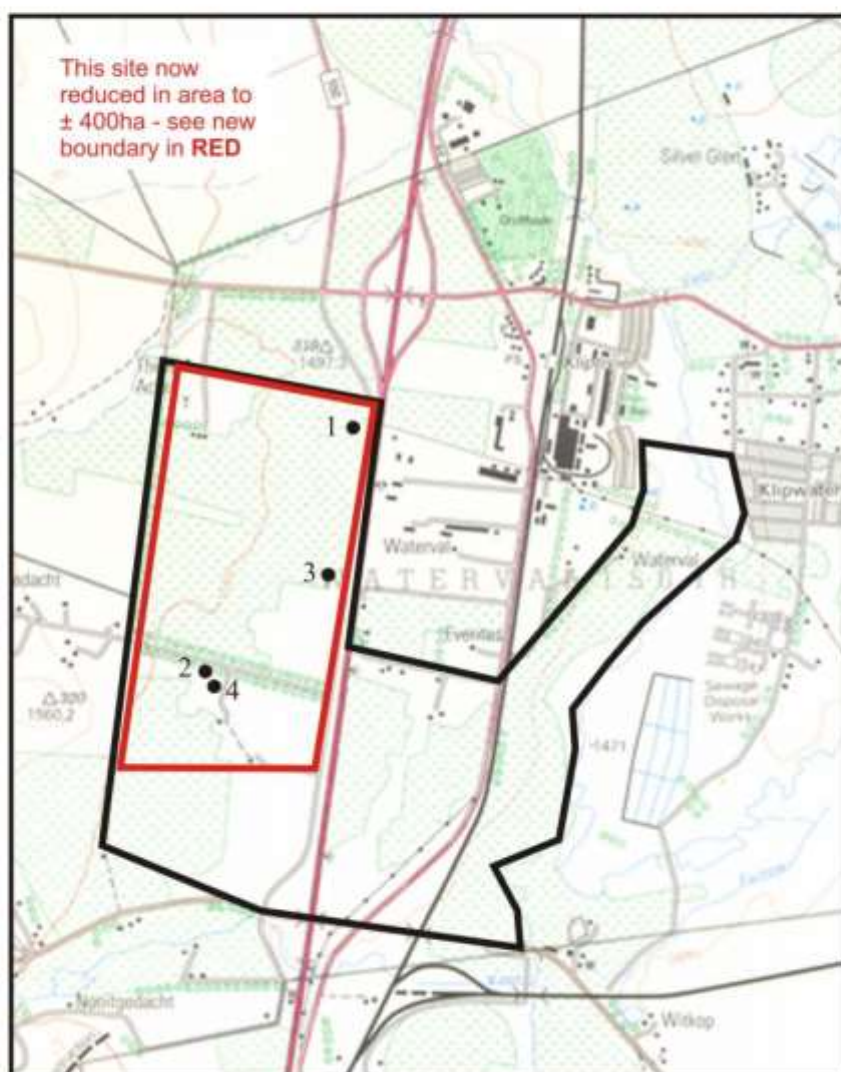


Fig. 2. Location of Sites inside the project area.

RECOMMENDATIONS

The sites have no research value beyond their present recording because they are not in primary context, and artefact numbers are too low. Further investigation is therefore not required. Blue Rose Development must remember, however, that if *in situ* deposits are uncovered in the course of development, the South African heritage Resource Agency must be notified so that the material can be examined.

With this proviso, there are no archaeological reasons why the development should not proceed.

APPENDIX B – SAHRA COMMENTS

The draft scoping report was submitted to SAHRA via their website (SAHRIS) and the following comments were received:

SAHRIS

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CaseDecisions

CaseReference: [Waterval Solar Park](#)
HeritageAuthority: SAHRA
Committee: [APM](#) **DecisionStatus:** [Letter](#)
DecisionDate: Monday, August 17, 2015 - 09:00
NHRA: [38](#)

Thank you for your notification regarding this development.

In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that prior to development it is incumbent on the developer to ensure that a **Heritage Impact Assessment** is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.

The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.

The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.

Where bedrock is to be affected, or where there are coastal sediments, or marine or river terraces and in potentially fossiliferous superficial deposits, a Palaeontological Desk Top study must be undertaken to assess whether or not the development will impact upon palaeontological resources - or at least a letter of exemption from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary. Please note that a nationwide fossil sensitivity map is now available on SAHRIS to assist with this.

If the property is very small or disturbed and there is no significant site the heritage specialist may choose to send a letter to the heritage authority to indicate that there is no necessity for any further assessment.

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

In terms of the above comments, a heritage impact assessment is required.

The comments from Dr. van Vollenhoven were sent to SAHRA and the following feedback was received from Clinton Jackson:

Good morning

Comments can be sent to the heritage officer that is assigned to your case. I have included him (Andrew Salomon) on this email.

The comment issued by the heritage officer called for Heritage Impact Assessment to be conducted; if this has been conducted it will need to be uploaded to the existing case on SAHRIS. To do this the original author (Adri Venter) will need to edit the case and navigate to page 4 where the first option on the page will be for the creation of a heritage report on SAHRIS.

If you would like to have the authorship of the case transferred into your name in order to make the edits I will require a written directive from the case author.

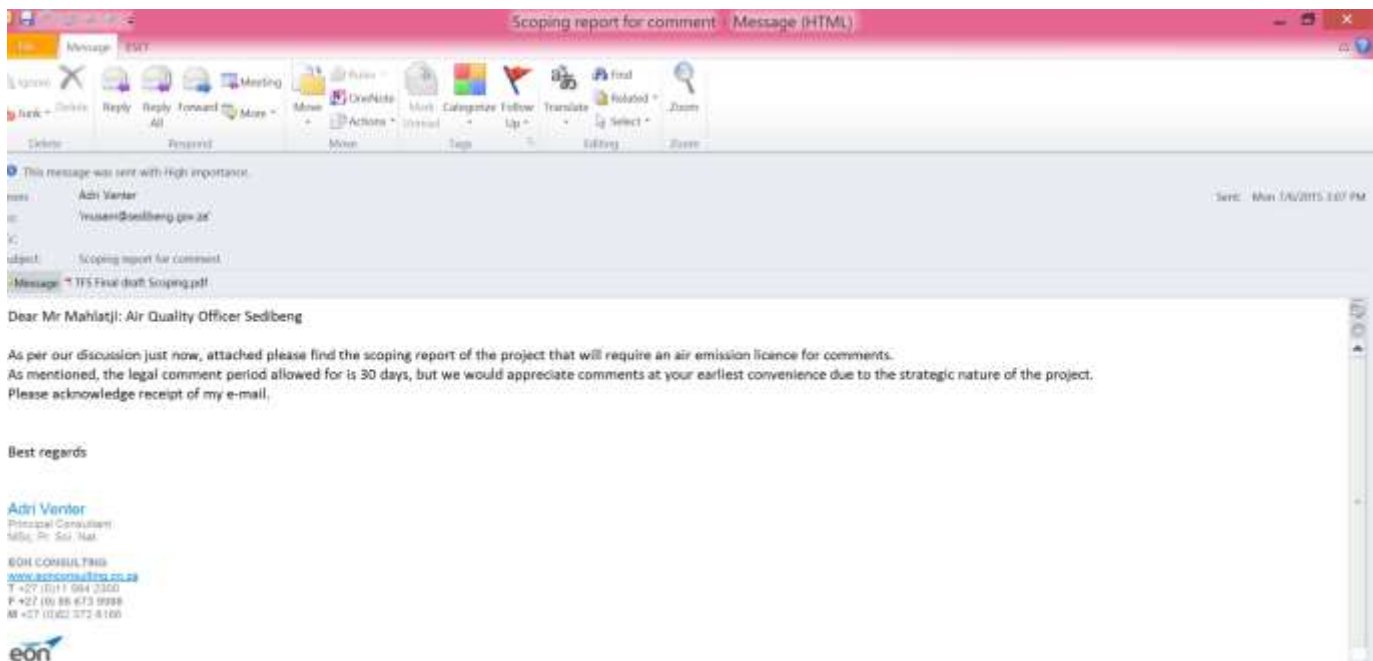
Should you require any assistance with the upload of an HIA please feel free to contact me and I will be happy to assist?

*Regards,
Clinton Jackson*

The heritage report as received from Dr, van Vollenhoven (the Annexure) has been reloaded on the SAHRIS website.

Air Quality Officer Sedibeng

The scoping report was e-mailed to Mr Mahlatji but no comments were received.





CHAPTER 9:

Plan of Study

2. Plan of Study for the Impact Assessment Study

Deviations from the plan of study are indicated in the relevant sections highlighted in green.

2.1. Manufacturing Alternatives to be considered

Based on Section 9 of the Report, no alternatives will be assessed. The chosen technology will render high quality products and is the most environmentally friendly methodology in comparison with other methods. The project applicant is the owner of the site and no other site is available (which belongs to the project proponent). The silicon manufacturing technology chosen, renders the highest silicon returns in comparison with other older technology.

2.2. Solar Panel Installation Alternatives to be considered

In terms of the Solar Energy Plant, no other technology will be used, given the fact that the project proponent will be manufacturing solar panels onsite, and will therefore use its own manufacturing products. The use of solar panels is the most sustainable option when viewed against potential environmental impacts associated with the alternatives listed below:

Possible alternative renewable energy sources include Biomass, Hydro Energy and Wind:

- a) **Biomass Energy:** Biomass energy will create additional air quality impacts in the Vaal Triangle Air Quality Priority Area and is therefore a less sustainable option.
- b) **Hydro Energy:** The proposed project site lacks any large inland water bodies which precludes the possibility of renewable energy from small/large scale hydro generation.
- c) **Wind Energy:** Wind energy requires consistent lateral air movement which Gauteng area does not have across all seasons. Furthermore, wind energy has more noise impacts as well as impacts on bird life and greater visual impact due to the height of the wind turbines. As such, wind energy when compared to solar energy has more severe environmental impacts and is therefore a less sustainable option.
- d) **Concentrated Solar Panels (CPV):** Due to the larger volume of water required for Concentrated Solar Panels (CPV) compared to PV this technology is also a less sustainable option.

2.2.1. Relevant Alternatives related to the PV System

- a) **Mounting system:** Solar panels can be mounted in various ways to ensure maximum exposure of the PV panels to sunlight. The two main mounting systems are:
 - Single axis tracking PV systems; and
 - Fixed axis tracking PV systemsIn a fixed axis tracking system the panels cannot move, whereas in a tracking system the panels follow the sun to ensure maximum exposure to sunlight. Both the mounting systems will be considered during the EIA phase to inform the detailed design of the solar facility.

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- b) **Battery facility:** Alternative battery facility options that could potentially be utilised on site include, Thermal Batteries, Solid State Batteries such as, Lithium-ion Iron-Phosphate Battery or Lead-acid Battery systems or Flow Batteries. During the EIA phase, a battery technology alternative assessment will be undertaken to determine what technology is the best practicable and environmental option and best suited for the project.
- c) **Solar Panel Layout alternatives:** To date, no potential layouts have been proposed for the alternative sites as this would only be available during the EIA phase. Alternative power plant layouts will be informed by the findings and recommendations of the detailed specialist studies to be undertaken during the EIA phase of the project. A number of layout alternatives will thus be identified within the proposed project sites. The findings of the specialist studies will be used to inform the site layout and to ensure that those layouts with the least negative environmental impacts and that are financially practical are selected.

2.2.2. No-go alternative

South Africa currently relies almost completely on fossil fuels as a primary energy source (approximately 90%) with coal providing 75% of the fossil fuel based energy supply. Coal combustion in South Africa is the main contributor to carbon dioxide emissions, which is the main greenhouse gas that has been linked to climate change.

The White Paper on Renewable Energy (2003) has set a target of 10 000GWh of energy to be produced from renewable energy sources (mainly from biomass, wind, solar and small-scale hydro) by 2013. The White Paper's target of 10 000GWh renewable energy contribution to final energy consumption by 2013 was confirmed to be economically viable with subsidies and carbon financing. Achieving the target will add about 1.667MW new renewable energy capacity, with a net impact on GDP as high as R1.071-billion a year and contribute to water savings of 16.5-million kiloliters, which translates into a R26.6-million saving.

Solar energy, like all other renewable energies, is very safe and environmentally friendly. There are no emissions as the source of fuel is the sun, unlike coal-powered stations. Most areas in South Africa average more than 2 500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5kWh/m² in one day.

The southern African region, and in fact the whole of Africa, has sunshine all year round. The annual 24-hour global solar radiation average is about 220 W/m² for South Africa, compared with about 150 W/m² for parts of the USA, and about 100 W/m² for Europe and the United Kingdom. This makes South Africa's local resource one of the highest in the world.

The use of solar energy is the most readily accessible resource in South Africa. It lends itself to a number of potential uses and the country's solar-equipment industry is developing (Department of Energy, 2015).

The no-go option is therefore not in line with the White Paper on Renewable Energy (2003) and will not contribute to the energy reserve in South Africa as well as water savings (when compared to coal fired energy generation)

2.3. Description of aspects to be assessed: Manufacturing Plant

The following aspects will be assessed:

2.3.1. Gas furnace

The furnace for melting raw materials for the manufacturing of glass is a potential source of air emissions (PM₁₀, PM_{2.5} and NO₂). The energy source is gas, and as such no significant SO₂ emissions is expected.

Emissions from the furnace will be routed through air quality control equipment. The effectiveness of the control equipment and the emissions from the stack will be modelled to determine the impact on ambient air quality.

2.3.2. Floating bath

Emissions from the floating bath cooling down molten glass will be assessed in terms of impact on ambient air quality.

2.3.3. Annealing

The coating of float glass with metal oxides will be assessed in terms of impact on ambient air quality.

2.3.4. Storage of raw materials for the manufacturing of silicon and glass

Dust and particulate matter from the storage of silica sand, soda, limestone, dolomite and feldspar will be investigated to determine the impact on dust levels on the environment.

2.3.5. Storage of Hydrochloric Acid

Venting of HCL will be modelled to determine the impact on ambient air quality. Storage of HCL will be assessed in terms of the probability for soil and ground water pollution by reviewing the proposed storage vehicles, loading and transport methodology. Venting of gas clouds containing HCL will also be investigated by assessing the aforementioned aspects.

2.3.6. Hydrochlorination Reactor, Disproportion Unit and Deposition Unit

The units are a potential source of chlorine/chloride gas as well as silica particulate matter and Monosilane and Trichlorosilane. Emissions from the units will be routed through air quality control equipment. The effectiveness of the control equipment and the emissions from the equipment will be modelled to determine the impact on ambient air quality

Accidental releases of monosilane and trichlorosilane will be modelled to determine the levels of risks to surrounding communities in terms of ambient air quality levels.

2.3.7. Clearing of vegetation for construction

Although previous studies found that very little natural vegetation remained on the site, the current levels of significant fauna and flora species will be determined.

2.3.8. Storm water run-off

Storm water run-off from paved areas has the potential to cause soil erosion and pick up pollutants from non-point sources on the site. This may lead to polluted run-off entering the nearby water courses.

The extent of storm water run-off and potential NPS pollution sources will be assessed based on a storm water management plan that will be compiled by the design engineers.

2.3.9. All manufacturing units

The noise levels from all manufacturing units will be assessed based on the levels as certified by the manufacturers.

2.3.10. Waste water

Control and management of waste water emanating from the floating bath, cooling equipment for glass emerging from the furnace as well as from the disproportionate unit will be assessed in terms of pollutants, management of waste water and removal of sludge from waste water control equipment.

2.3.11. Buildings and manufacturing units

The final site lay-out plan will be assessed in terms of encroachment on sensitive areas: buffer zones around water courses and wetlands as well as important patches of remnant natural vegetation.

2.3.12. Access roads and vehicular movement

The above will be assessed in terms of dust generation during construction and operation.

2.3.13. Construction

The timing of construction, construction activities and control over no-go areas will be assessed to prevent accidental damage to no-go areas, dust nuisances, noise nuisances, oil spillages, storm water contamination, waste management, fire risks and sanitation services for workers. A complete EMPr will be compiled to control all construction related aspects.

2.3.14. Sanitation facilities

Once it has been confirmed that no sewage connection is available to a municipal waste water treatment plant, the safe disposal or onsite treatment of grey and black water will be assessed. Potential environmental impacts associated with onsite waste water treatment include surface and ground water and soil pollution as well as creating of nuisances by means of bad odours. The design and capacity of an onsite system will be assessed to determine whether a waste management and water use licence will be required.

2.4. Proposed methodology to assess impacts related to the manufacturing plant

2.4.1. Air quality impacts

The Scope of Work will include the following:

- i. Identify all legislation and guidelines that should be considered;
- ii. Describe the approach and methodology used for the assessment;
- iii. Obtain all relevant data, including meteorological data and current air quality data
- iv. An emissions inventory for dust, total suspended particulates, PM₁₀ and emissions from all project-related activities are quantified (during construction and operational phase)
- v. A dispersion potential model of the area must be produced based on Government Notice, R. 533 National Environmental Management: Air Quality Act (39/2004): Regulations regarding Air Dispersion Modeling, page 3 in Government Gazette 37804, 11 July 2014
- vi. Scenario modeling must be produced: The prediction of ambient air pollutant concentrations and dust fallout in terms of dispersion modeling
- vii. The assessment of the impacts based on comparisons of the resulting concentration against the approximated pre-construction/construction/operational and rehabilitated ambient conditions, as well as against relevant standards and guidelines
 - The identification of emission reduction opportunities and cost-effective emission abatement strategies
 - Mitigation measures for worst case, most probable and best case scenarios must be identified
 - Provision of recommendations regarding the optimum air quality monitoring positions and the establishment of an air quality monitoring programme
 - The cumulative effect of existing air pollution levels must be clearly identified and measured against the approximated cumulative effect of the proposed operation.
 - Highlight potential impacts that should be investigated and assess their importance within local, provincial and national context;
 - Suggest feasible alternatives based on the above;

2.4.2. Clearing of vegetation for construction: Ecological Impacts

Although previous studies found that very little natural vegetation remained on the site, the current levels of significant fauna and flora species will be determined.

An ecologist will be appointed to do a site visit.

The aim of the Assessment is to provide an overview of the Ecological Sensitivity on site. During Scoping, the study will focus on fieldwork and culminate in the generation of a Baseline Site Sensitivity Map, aimed at identifying potential environmentally sensitive areas / red flags, in particular, to be avoided during site development. The Sensitivity Map will be accompanied by a Summary Report, containing the results of field investigations, providing recommendations in terms of site establishment and identifying additional studies that should be undertaken during Phase 2 of the project. This study may, for example, confirm the extent of wetland and aquatic ecological assessment required. Preliminary impacts will be identified however, detailed impact identification and identification of mitigation measures will occur during the EIA Phase of the project.

2.4.3. Heritage impact assessment

Based on feedback from SAHRA on the comments from Dr. Van Vollenhoven indicating that a heritage impact is still required, the following will be the scope of work:

A phase 1 archaeological assessment will be executed by a registered heritage practitioner:

The expected heritage impact assessment should identify all archaeological, spiritual and heritage sites via detailed site investigations and community consultation and to document and assess their importance within local, provincial and national context.

The Scope of Work will include the following:

- Identify all archaeological and heritage sites by physically surveying the area on foot or by vehicle and mapping the site for all identified heritage sites all the while ensuring that the correct protocol is adhered to regarding community consultation when associated with community grave locations;
- Identify all legislation and guidelines that should be considered;
- Describe the approach and methodology used for the assessment;
- Assess the following criteria:
 - i. **site integrity** (i.e. primary vs. secondary context),
 - ii. **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
 - iii. **uniqueness**
 - iv. **potential** to answer present research questions.
 - v. **site significance**
 - vi. **assumptions** and **limitations** of assessment
- Highlight potential impacts that should be investigated and assess their importance within local, provincial and national context;
- Based on the above, provide possible mitigation measures to minimise negative impacts;

If SAHRA is satisfied with the original heritage assessment they will indicate that no further assessment is required, this study will not be required.

2.4.4. Construction

The timing of construction, construction activities and control over no-go areas will be assessed to prevent accidental damage to no-go areas, dust nuisances, noise nuisances, oil spillages, storm water contamination, waste management, fire risks and sanitation services for workers. A complete EMPr will be compiled to control all construction related aspects.

2.5. Description of aspects to be assessed: Solar Panel Plant

The identification of potential impacts should include impacts that may occur during the construction, operational and decommissioning phases of the development. The assessment of impacts is to include direct, indirect as well as cumulative impacts.

With respect to the Management Actions and Monitoring of the Impacts (to be included within the EMP) the following will be addressed in the impact assessment studies:

- I. If negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated.
- II. Quantifiable standards for measuring and monitoring mitigatory measures and enhancements will be set. This will include a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.

ENVIRONMENTAL IMPACTS

In Accordance with the EIA GUIDELINE FOR RENEWABLE ENERGY PROJECTS, 2013, DEA:

The potential environmental impacts associated with solar power (land use and habitat loss, water use, and the use of hazardous materials in manufacturing) vary greatly depending on the technology to be used. In broad terms the range of potential impacts could include:

Land use: Depending on their location, larger utility-scale solar facilities can raise concerns about land degradation and habitat loss. Total land area requirements estimates for utility-scale PV systems range from 1.5 to 4 ha per megawatt.

Water use: Solar PV cells do not use water for generating electricity. However, as in all manufacturing processes, some water is used to manufacture solar PV components.

Other impacts in terms of noise, visual issues, electromagnetics and aircraft interference.

The following indicates the potential Environmental impacts associated with the full range of solar energy project development, together with the applicable and relevant legislation and its reference location within Part B of this Guideline. It is stipulated that these are (under normal circumstances) the main impacts, but other impacts may be relevant depending on project specifics.

Table 4: Potential Environmental Impacts of Solar Energy Projects

Impact Description	Relevant Legislation	Reference (Part B)
Visual Impact	NEMA	B1, B2
Noise Impact (CSP)	NEMA	B1, B2
Land Use Transformation	NEMA, NEMPAA, NHRA, DFA, PPA	B1, B2, B6, B11, B12, B14
Impacts on Cultural Heritage	NEMA, NHRA	B1, B2, B11
Impacts on Water Resources	NEMA, NEMICMA, NWA, WSA	B1, B2, B9, B10
Hazardous Waste Generation (CSP and PV)	NEMA, NEMWA, HAS	B1, B2, B7, B8
Electromagnetic Interference	NEMA,	B1, B2

Impact Description	Relevant Legislation	Reference (Part B)
Aircraft Interference	NEMA, PPA, MSA	B1, B2

NB: The constitution is couched within all South African legislation and will apply to any activity related to renewable energy

2.5.1. Agriculture study

The site will be assessed in terms of agricultural potential in order to determine the most sustainable option (PV versus agricultural activities).

2.5.2. Flow batteries

The storage and maintenance of flow batteries will be investigated with a view toward soil, surface and ground water pollution. Battery technology alternative assessment will be undertaken to determine what technology is the best practicable and environmental option and best suited for the project.

2.5.3. Photovoltaic installations

The installation of PV panels for the generation of electricity will be assessed in terms of the probability to allow for the proliferation of alien vegetation in the area, stormwater run-off resulting in sedimentation of nearby water courses. The study must also address cumulative impacts.

2.5.4. Site Lay-out

The final site lay-out plan will be assessed in terms of encroachment on sensitive areas: buffer zones around water courses and wetlands as well as important patches of remnant natural vegetation.

2.5.5. Access roads and vehicular movement

The above will be assessed in terms of dust generation during construction and operation.

2.5.6. Construction

The timing of construction, construction activities and control over no-go areas will be assessed to prevent accidental damage to no-go areas, dust nuisances, noise nuisances, oil spillages, storm water contamination, waste management, fire risks and sanitation services for workers. A complete EMPr will be compiled to control all construction related aspects.

2.5.7. Sanitation facilities

Once it has been confirmed that no sewage connection is available to a municipal waste water treatment plant, the safe disposal or onsite treatment of grey and black water will be assessed. Potential environmental impacts associated with onsite waste water treatment include surface and ground water and soil pollution as well as creating of nuisances by means of bad odours. The design and capacity of an onsite system will be assessed to determine whether a waste management and water use licence will be required.

2.5.8. Electromagnetic interference

Electromagnetic interference from electricity transformers and distribution lines will be assessed based on the proximity of sensitive receptors. Electromagnetic impacts will depend on the equipment that will be used on site as well as the supplier specifications. This information is not currently available but will be investigated during the impact assessment study. The study must also address cumulative impacts.

Deviation from plan of study:

Due to the fact that a plan for the electrical infrastructure is not currently available nor that this infrastructure is available for testing, it is recommended that a condition be added to the Environmental Authorisation that once the electrical infrastructure is installed onsite, that an electromagnetic field test be executed by relevant specialist and the test results be submitted to the Competent Authority. Should the study find that recipients in the surrounding environment will be affected by electromagnetic interference, mitigation and management measures in terms of SANS guidelines will be implemented. After implementation of the SANS measures, the site must be tested again to confirm the effectiveness of the measures implemented.

2.5.9. Visual Impact

The visual impact of the solar panels will be investigated in terms of visual disturbance to traffic and aeroplanes as well as surrounding residential areas. The study must also address cumulative impacts.

2.5.10. Hazardous waste generation

When solar panels are damaged and have to be disposed of, electronic and hazardous waste will be created. However, all materials from damaged solar panels will be recycled onsite. Materials will be added to raw materials during the construction cycle. As such – no hazardous waste will be created and no need for disposal is present.

2.6. Solar Panel Environmental Impacts to be assessed by specialists

The following aspects will be assessed by specialists:

- a) Ecological impacts as a result of the clearing of vegetation: Vegetation on site to determine if detailed fauna studies are required based on the presence of natural vegetation of high conservation value
- b) Avifaunal assessment
- c) Heritage impact assessment
- d) Wetland and riparian zone delineation
- e) Visual impact assessment
- f) Agricultural study

2.6.1. Clearing of vegetation for construction: Ecological Impacts

Although previous studies found that very little natural vegetation remained on the site, the current levels of significant fauna and flora species will be determined.

An ecologist will be appointed to do a site visit.

The aim of the Assessment is to provide an overview of the Ecological Sensitivity on site. During Scoping, the study will focus on fieldwork and culminate in the generation of a Baseline Site Sensitivity Map, aimed at identifying potential environmentally sensitive areas / red flags, in particular, to be avoided during site development. Habitat fragmentation: Continuous development leads to greater habitat fragmentation, with progressively smaller patches of habitat created as a result. As the proportion of suitable habitats decreases, area and isolation effects start influencing the population size of resident species. Habitat fragmentation also has the potential to affect plant reproduction, for example, by affecting pollinators, the neighbourhood of potential mates, the availability of resources, and microclimate. The fragmentation of sensitive habitats which contain threatened, protected and/or endemic species further reduces the area they are able to occupy as well as their population sizes. As a result fragmentation leads to a decline in the numbers of these species and an eventual loss of biodiversity.

The Sensitivity Map will be accompanied by a Summary Report, containing the results of field investigations, providing recommendations in terms of site establishment and identifying additional studies that should be undertaken during Phase 2 of the project. This study may, for example, confirm the extent of wetland and aquatic ecological assessment required. Preliminary impacts will be identified however, detailed impact identification and identification of mitigation measures will occur during the EIA Phase of the project. The study must also address cumulative impacts.

2.6.2. Avifaunal impact assessment

In terms of Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa (Smit, Hanneline A.1 (Reviewed by Dr Phoebe Barnard², Dr Andrew Jenkins³, Tania Anderson⁴, Jon Smallie⁵ and Samantha Ralston⁶):

The displacement or the exclusion of species, particularly threatened, endemic and range-restricted species, are potentially the most significant impacts SEF facilities can have on birds. As the introduction of this technology could result in a rapid alteration of large areas of habitat, this represents a potentially new threat to species. BirdLife South Africa therefore recommends that an avifaunal specialist be consulted for all proposed solar energy facilities.

The specialist assessment should follow a two-phased approach:

1. A desktop analysis of existing literature and data (e.g. SABAP1, SABAP2, CWAC, CAR, distance to formal protected areas, wetlands and Important Bird Areas).
2. The desktop analysis should be followed by a site assessment of approximately 3-5 days.
 - a. The site assessment will be designed to confirm the presence, abundance, habitat preferences and flyways of priority species (Priority species will include nationally and/or globally threatened, rare, endemic, or range-restricted bird species, or large numbers of other bird species).
 - b. The duration of the site visit will be informed by information gaps for the area in question, as well as the sensitivity of the area and the species likely to be present.

The specialist will assess the significance of the likely impacts of the proposed facility and its associated infrastructure on the avifauna of priority and at highest risk, help identify alternative locations or layouts for the facility and recommend other mitigation measures that would help reduce the significance of negative impacts on birds. The study must also address cumulative impacts.

2.6.3. Heritage impact assessment

Based on feedback from SAHRA on the comments from Dr. Van Vollenhoven indicating that a heritage impact is still required, the following will be the scope of work:

A phase 1 archaeological assessment will be executed by a registered heritage practitioner:

The expected heritage impact assessment should identify all archaeological, spiritual and heritage sites via detailed site investigations and community consultation and to document and assess their importance within local, provincial and national context.

The Scope of Work will include the following:

- Identify all archaeological and heritage sites by physically surveying the area on foot or by vehicle and mapping the site for all identified heritage sites all the while ensuring that the correct protocol is adhered to regarding community consultation when associated with community grave locations;
- Identify all legislation and guidelines that should be considered;
- Describe the approach and methodology used for the assessment;
- Assess the following criteria:
 - i. **site integrity** (i.e. primary vs. secondary context),
 - ii. **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
 - iii. **uniqueness**
 - iv. **potential** to answer present research questions.
 - v. **site significance**
 - vi. **assumptions and limitations** of assessment
- Highlight potential impacts that should be investigated and assess their importance within local, provincial and national context;

-
- Based on the above, provide possible mitigation measures to minimise negative impacts;

If SAHRA is satisfied with the original heritage assessment they will indicate that no further assessment is required, this study will not be required.

2.6.4. Clearing of vegetation for construction

Although previous studies found that very little natural vegetation remained on the site, the current levels of significant fauna and flora species will be determined. The study must also address cumulative impacts.

2.6.5. Wetland and riparian zone delineation

A wetland and riparian delineation are required in order to inform the proposed development layout of hydrologically, and ecologically sensitive areas associated with wetland and riparian systems on the site.

In 2005 the Department of Water Affairs and Forestry published a manual entitled “A practical field procedure for identification and delineation of wetland and riparian areas” (DWAF, 2005). The “...manual describes field indicators and methods for determining whether an area is a wetland or riparian area, and for finding its boundaries.” The definition of a wetland in the guidelines is that of the NWA and it states that wetlands must have one or more of the following attributes:

- *“Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation”*
- *“The presence, at least occasionally, of water loving plants (hydrophytes)”*
- *“A high water table that result in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.”*

The guidelines further list four indicators to be used for the finding of the outer edge of a wetland. These are:

Terrain Unit Indicator. The terrain unit indicator does not only identify valley bottom wetlands but also wetlands on steep and mild slopes in crest, midslope and footslope positions.

Soil Form Indicator. A number of soil forms (as defined by MacVicar et al., 1991) are listed as indicative of permanent, seasonal and temporary wetland zones. Wetland Soils

According to DWAF (2005), the permanent zone of a wetland will always have either Champagne, Katspruit, Willowbrook or Rensburg soil forms present, as defined by the Soil Classification Working Group (1991), The seasonal or temporary zones of wetlands have one or more of the following soil forms present: Kroonstad, Longlands, Wasbank, Lamotte, Estcourt, Klapmuts, Vilafontes, Kinkelbos, Cartref, Witfontein, Sepane, Tukulu, or Montagu.

Soil Wetness Indicator. Certain soil colours and mottles are indicated as colours of wet soils. The guidelines stipulate that this is the primary indicator for wetland soils. (Refer to the guidelines for a detailed description of the colour indicators.) In essence, the reduction and removal of (Iron) Fe in the form of “bleaching” and the accumulation of Fe in the form of mottles are the two main criteria for the identification of soils that are periodically or permanently wet.

Vegetation Indicator. This is a key component of the definition of a wetland in the NWA. It often happens though that vegetation is disturbed and the guidelines therefore place greater emphasis on the soil form

and soil wetness indicators as these are more permanent whereas vegetation communities are dynamic and react rapidly to external factors such as climate and human activities.

Use will be made of 1:50 000 topographical maps, 1:10 000 orthophotos and Google Earth Imagery to create digital base maps of the study area onto which the wetland boundaries and its buffer zones will be delineated using geographic information system software. A desktop delineation of suspected wetland areas will be undertaken by identifying rivers and wetness signatures on the digital base maps. All identified areas suspected to be wetlands were then further investigated in the field. The delineated wetlands will then be classified using a hydro-geomorphic classification system.

The wetland guidelines of the relevant authorities will be used.

For the purposes of impact assessment, it will be required to understand the proposed project lay-out and associated infrastructure as well as construction methodology and how these will impact on the wetland itself, as well as its hydrological regime.

The project team will consist of 2 specialists, a wetland ecologist and a wetland botanist. The study must also address cumulative impacts.

2.6.6. Agriculture study

- Detailed soil assessment of the site in question, incorporating a radius of 50 m surrounding the site, on a scale of 1:10 000 or finer. The assessment should include the following:
 - The identification of the soil forms present on site
 - The size of the area where a particular soil form is found
 - GPS reading of soil survey points
 - The depth of the soil at each survey point
 - Soil colour
 - Limiting factors
 - Clay content
 - Slope of the site
 - A detailed map indicating the locality of the soil forms within the specified area.
 - The size of the site
- Exact locality of the site
- Current activities on the site, developments, buildings
- Surrounding developments/ land uses and activities in a radius of 500m of the site
- Access routes and the condition thereof
- Current status of the land (including erosion, vegetation and a degradation assessment)
- Possible land use options for the site
- Water availability, source and quality (if available)
- Detailed descriptions of why agriculture should or should not be the land use of choice
- Impact of the change of land use on the surrounding area
- A shape file containing the soil forms and relevant attribute data as depicted on the map.

2.6.7. Visual impact assessment

Key issues during the construction phase are:

Potential visual intrusion of construction activities on the existing views of sensitive visual receptors in the rural landscape.

Potential visual intrusion of a large area cleared of vegetation on the existing views of sensitive visual receptors.

Potential visual impact of night lighting during the construction phase on the nightscape of the region.

Key issues related to the operational phase of the development are:

Potential visual intrusion on the existing views of sensitive visual receptors

Potential impact of night lighting of the development on the surrounding nightscape.

2.6.8. Socio-economic impact assessment

Given the presence of an informal settlement onsite and the proposed relocation of the settlement, a socio-economic impact assessment will be required to determine the required mitigation measures and assistance with respect to the relocation. **It is important to understand that in this occurrence, settlement will provide opportunities to the affected community to improve housing, public infrastructure, and services and to engage in land use planning that contributes to the long-term development objectives. The location of the informal settlement next to an asbestos waste dump will also improve the public health status of this community.**

The study must identify all people affected by the project and all adverse impacts on their livelihoods associated with the relocation. Typical effects include breakup of communities and social support networks; loss of dwellings, farm buildings, agricultural land, trees, and standing crops; impeded or lost access to community resources such as water sources, pasture, medicinal plants, fishing opportunities, loss of business, and reduced income resulting from these losses.

Consultation with officials of local government, community leaders, and other representatives of the affected population will be essential to gain a comprehensive understanding of the types and degrees of adverse project effects. The project sponsor must discuss plans for a census and registration program with local leaders and representatives of community-based organizations. Census and asset inventory enumerators may be the first project-related personnel that affected people will encounter. Enumerators must be thoroughly briefed on the objectives and timetable of the project and what is being planned in terms of physical relocation, compensation for lost assets, and restoration of livelihood.

Socioeconomic Studies—A substantial amount of household-level socioeconomic data will be collected during the census and inventories of assets. Low income households typically have diversified livelihood strategies that combine agriculture with wage labor and small-scale enterprise. Therefore, **it is important to survey all income sources in order to calculate income loss from the relocation.**

For these reasons, the socioeconomic studies are needed to collect additional quantitative (supported by qualitative) information in two important areas: 1) household-level income streams and livelihood strategies that were not identified in the census and inventories of assets; and 2) the structure, organization, and economic inter-dependencies within the larger community affected by the project. Analysis of these data will help identify those households most at risk from physical or economic displacement. However, income stream analysis is not required in cases where relocation does not affect the income-earning capacity of a household (for example, in cases where only dwellings are displaced and the affected people can be relocated to near-by sites).

The socioeconomic studies should be linked closely with the census and inventory of assets to provide comprehensive information on household economic resources, including common property resources. The census and inventory of assets should have already identified the basic social unit of production or economic organization.

Deviation from plan of study:

Due to the fact that the landowner will no longer re-locate the informal settlement, this impact assessment is not required. The project applicant had a meeting with the Midvaal Municipality and the local Councilor indicated that the municipality will provide RDP houses for the community in future. The formal housing will provide services and will improve the quality of life of the residents. The proposed site is only 1kilomtre away from the current location.

However, when requested that the local Councilor provide proof of this discussion, he did not agree to this request.

Due to the fact that the informal settlement is an illegal settlement this study is not required.

2.6.9. Construction

The timing of construction, construction activities and control over no-go areas will be assessed to prevent accidental damage to no-go areas, dust nuisances, noise nuisances, oil spillages, storm water contamination, waste management, fire risks and sanitation services for workers. A complete EMPr will be compiled to control all construction related aspects.

2.6.10. Cumulative impacts

The cumulative impacts will be assessed by considering impacts that the proposed solar facilities will have during construction, operational and decommissioning phases on the receiving environment consisting of the biophysical, heritage and socio-economic environment. Cumulative negative impacts associated with these types of projects include amongst others:

- I. Avifaunal disturbance and potential mortality
- II. Habitat destruction and fragmentation
- III. Loss of agricultural land
- IV. Removal of vegetation
- V. Increase in stormwater run-off and erosion
- VI. Increase in water requirements

2.7. Methodology to assess significance and duration

Significance is the product of probability and severity rating divided by the mitigation potential:

$$\text{Significance} = \frac{\text{Probability} \times \text{Severity}}{\text{Mitigation}}$$

Probability and Severity will be determined based on the following:

2.7.1. Determining the Severity of an Impact

Determination of the severity of an impact is a function of intensity, duration and extent, divided by the extent to which mitigation can successfully be applied:

$$\text{Severity} = \text{intensity} + \text{duration} + \text{extent}$$

Each of the 4 factors used to determine the severity of an impact, are described below:

2.7.1.1. Intensity factor

The level of intensity is the sum of volume, toxicity, social impact and ecological impacts.

Note that either Volume A or Volume B is used (refer to the description) but never both at the same time.

Table: 9. Intensity factor rating and description

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
Volume (A) (refers to process input and output substances/material or products)	Less than 80 m ³ at any one time (or low volumes relative to industry/commercial standards)	Between 80 and 300 m ³ at any one time (or medium volumes relative to industry/commercial standards)	In excess of 300 m ³ at any one time (or high volumes relative to industry/commercial standards)	
Volume (B) (refers to natural resources)	Relatively small	Medium	Large	
Toxicity	Toxicity is on par with everyday goods in wide-spread use and is biodegradable.	Toxicity can be compared to those that have to be handled with some caution and are non-biodegradable.	Toxicity is on par with toxic/dangerous/flammable substances that are non-biodegradable.	
Social	No or very limited impact	Some impact on immediate communities, but	Major disruptive impact on surrounding	

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
		cannot be considered as disruptive	communities	
Ecological	Natural functions not affected or negligible.	Environment affected but natural functions and processes continue (Some damage or wildlife injury may occur). Impact is reversible or irreplaceable loss will not occur	Environment affected to the extent that natural functions are altered to the extent that it will permanently or over the long term cease (Major damage or wildlife injury could occur). Irreplaceable loss will occur.	
Total				

2.7.1.2. Duration

Duration is assessed and a factor awarded in accordance with the following:

Table: 10. Duration factor rating and description

	Duration of Impact	Duration factor
Short term	The duration of the is impact is 1 Year or less	Factor 1
Medium term	The duration of the is impact is 1-5 Years	Factor 3
Long term	The duration of the is impact is 5 to 25 years	Factor 4
Permanent	The duration of the is impact is longer than 25 years and can be considered as permanent	Factor 5

2.7.1.3. Extent

Describes the physical extent the impact and factors are awarded according to the following:

Table: 11. Extent factor rating and description

	Extent of the impact	Extent factor
Site	The impact only exists within the activity's footprint	Factor 1
Local	The impact could impact on the whole or a considerable portion of the properties on which the activity is undertaken as well as neighbouring properties	Factor 3
Regional	The impact could affect the area, neighbouring as well as other areas further away than the	Factor 5

	immediate neighbours	
--	----------------------	--

2.7.2. Probability

Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Table: 12. Probability factor rating and description

	Possibility that impact will occur	Rating
Improbable	Low possibility of impact occurring due to design or history	1
Probable	Distinct possibility that impact will occur	2
Highly probable	Most likely that impact will occur	3
Definite	Impact will definitely occur	5

2.7.3. Significance Rating

Following from the above, the Significance rating can now be determined as follows:

Significance = severity x probability

The significance rating thus determined should influence the proposed project as described below:

Negligible (calculated Significance Rating < 25)

- *Positive and negative impacts of negligible significance are unsubstantial and should have little or no influence on the proposed development project.*

Low (calculated Significance Rating 25 < 50)

- *The impact is limited and should not have a material effect on the decision to continue. Management intervention is required.*

Moderate (calculated Significance Rating 50 < 90)

- *Positive impact: Should weigh towards a decision to continue, should be enhanced in final design.*
- *Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to a low significance rating.*

High (calculated Significance Rating > 90)

- *Positive impact: Continue*

- *Negative impact: If mitigation cannot be implemented effectively (into the moderate category), proposal should be terminated.*

The table below provides an example of how the unmitigated significance ratings are calculated:

Table: 13. Calculating of Significance Ratings (Unmitigated)

Probability	Severity						Severity Rating	Significance Rating	
	Intensity	+	Duration	+	Extent	=		(Probability Severity rating)	
Probable 2	Low	4	Short Term	1	Local	2	7	14	Negligible
Probable 2	Low	4	Medium Term	3	Regional	3	10	20	Low
Definite 5	Medium	12	Medium Term	3	Local	2	19	85	Moderate
Definite 5	High	20	Permanent	5	Site	1	26	180	High

2.7.4. Mitigation

Mitigation will be calculated as follows:

Table: 14. Mitigation factor rating and description

Description	Factor Allocated
Mitigation is not possible or positive impact of mitigation is negligible. Impact remains irreversible.	1
Mitigation is possible to some extent with moderate levels of positive impact. Impact is largely reversible with only a small portion that remains as irreversible.	2
Mitigation is possible with moderate to high levels of positive impact. Impact is reversible.	3
Mitigation is possible to such an extent that all negative impacts are reduced significantly or eliminated. Impact is completely reversible.	4

Significance = intensity + duration + extent

Mitigation potential

2.7.5. Authorities to be consulted during the EIA process:

- I. National Authorities
- II. Eskom Holdings SOC Ltd
- III. National Department of Agriculture, Forestry & Fisheries
- IV. National Department of Environmental Affairs
- V. National Energy Regulator of South Africa (NERSA)
- VI. South African Civilian Aviation Authority
- VII. South African Heritage Resource Agency
- VIII. Provincial Authorities (Gauteng)
- IX. Department of Agriculture and Rural Development
- X. Department of Water Affairs (Gauteng)
- XI. Local Authorities (Municipalities)
- XII. Midvaal Municipality
- XIII. Sedibeng District Municipality

Authority communication schedule:

- I. During the EIA process: Site visit by authorities, if required.
- II. During preparation of Draft EIA Report and EMPr: Communication with the DEA on the outcome of Specialist Studies and EMPr.
- III. Submission of the Final EIA Report and EMPr: Meetings with dedicated departments, if requested by the DEA, with jurisdiction over particular aspects of the project (e.g. Local Authority) and potentially including relevant specialists.

2.8. Public participation process

The Public Participation Process (PPP) is an integral and critical part of the environmental process and careful attention is given to fulfilling the legislated requirements, ensuring that all directly affected parties have access to information and the opportunity to participate meaningfully in the project. The second phase of the PPP would entail notification of the public review period of the draft Environmental Impact assessment Report (EIAR) by using the database of Interested and Affected Parties (I&APs). As per the first PP round, the draft EIAR will be e-mailed, made available on the EON website and a hard copy will be made available at the Meyerton Municipal Library. Review and commenting periods of I&AP's are prescribed in the legislation.

- *Public Participation Report*

The final Public Participation Report will be included into the Draft and Final Assessment Report. The issues and concerns that were obtained through the entire process will form the basis of this report. The report will inter alia consist of the following:

- A description of the PP process followed (with proof, e.g. copies of the newspaper advertisement, written correspondences with I&APs);
- List of registered I&APs;
- Proof of meeting proceedings;
- Public Participation map, indicating adjacent landowner consultation and
- Issues and Response Report.

- *Authorisation notification letter*

All registered stakeholders will be informed of the outcome of the authorisation and the right to appeal the decision.

2.9. Tasks that will be undertaken during the impact assessment process

The following tasks will be undertaken:

- i. Management of the public participation process
- ii. Management of the appointed specialists
- iii. Engagement with the competent authority, local government and Sedibeng Municipality who is responsible for the Air Emission License Process
- iv. Engagement with the Ward Councillor
- v. Review of specialist reports
- vi. Review of site lay-out plans
- vii. Review of engineering design reports
- viii. Review of geotechnical assessment
- ix. Assessment of aspects and impacts in terms of the assessment methodology contained in this scoping report

2.10. Measures to avoid, reverse, mitigate or manage identified impacts and the determination of residual risks that need management and monitoring

All aspects and impacts will be assessed against the proposed mitigation measures. The risks associated with failures of the mitigation measures will be assessed and further mitigation and emergency procedures will be proposed.

The EMPr will include emergency procedures, monitoring and measurement of impacts.

No-go areas will be mapped by the EAP based on a site visit and specialist reports and the applicant will be advised to prevent accessing of no-go areas as defined.

2.11. Affirmation by the EAP in relation to the level of agreement between the EAP and I&AP's on the plan of study for undertaking the environmental impact assessment

The report will include a register of I&AP's, as well as their comments and inputs with the response of the EAP. The EAP hereby affirms that all comments and inputs from I&AP's will be objectively assessed, responded to and taken into account in terms of impact assessment, mitigation and management measures.

2.12. Specific information required by the competent authority

The CA responded to the draft scoping report as follows:

The draft Scoping Report (SR) dated 02 September 2015 and received by this Department on 04 September 2015, and the acknowledgement letter of the application form issued by this Department on 09 September 2015 refer.

This Department has the following comments on the abovementioned application:

- i. Please ensure that all relevant listed activities are applied for, are specific and that it can be linked to the development activity or infrastructure as described in the project description.
- ii. If the activities applied for in the application form differ from those mentioned in the final SR, an amended application form must be submitted. 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>.
- iii. Please ensure that all issues raised and comments received during the circulation of the SR from registered I&APs and organs of state which have jurisdiction (including this Department's Biodiversity Section) in respect of the proposed activity are adequately addressed in the Final SR. Proof of correspondence with the various stakeholders must be included in the Final SR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. The Public Participation Process must be conducted in terms of Regulation 39, 40 41, 42, 43 & 44 of the EIA Regulations 2014.
- iv. Please provide a description of any identified alternatives for the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity as per Appendix 1 (2) (e) and 3 (1) (h) (i) of GN R.982 of 2014. Alternatively, you should submit written proof of an investigation and motivation if no reasonable or feasible alternatives exist in terms of Appendix 1.
- v. In accordance with Appendix 1 (3) (1) (a) of the EIA Regulations 2014, the details of—
 - (i) the EAP who prepared the report; and
 - (ii) the expertise of the EAP to carry out Scoping and Environmental Impact assessment procedures;

-
- must be submitted.
- vi. You are further reminded that the final SR to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of Scoping reports in accordance with Appendix 2 and Regulation 21(1) of the EIA Regulations, 2014.
 - vii. Further note that in terms of Regulation 45 of the EIA Regulations 2014, this application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of the these Regulations, unless an extension has been granted in terms of Regulation 3(7).

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.

2.13. Matters in terms of Section 24(a) and (b) of the Act

The draft scoping report has been submitted to the South African Heritage Resource Agency (SAHRA) for comments.

In terms of the Act, the following will be included in the assessment report:

- Investigation of the potential impacts, including cumulative effects, of the activity and its alternatives on the environment, socio-economic conditions and cultural heritage, and assessment of the significance of that potential impact;
- Investigation of mitigation measures to keep adverse impacts to a minimum, as well as the option of not implementing the activity;
- Public information and participation, independent review and conflict resolution in all phases of the investigation and assessment of impacts;
- Reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;
- Investigation and formulation of arrangements for the monitoring and management of impacts, and the assessment of the effectiveness of such arrangements after their implementation.

2.14. Stages during which the competent authority will be consulted

The competent authority will be consulted:

- i. When the draft EIA report is submitted
- ii. When comments are received from the competent authority on the draft EIA report
- iii. During the compilation of the draft impact assessment report
- iv. When the final impact assessment report is submitted


-
- v. When comments are received from the competent authority on the final impact assessment report
 - vi. Notification of the I&AP's regarding the final decision of the competent authority – evidence will be provided.

3. Undertaking by the EAP

- (j) an undertaking under oath or affirmation by the EAP in relation to—
 - (i) the correctness of the information provided in the report;
 - (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties;
and
 - (iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;

Adri Venter, as the EAP, hereby confirms:

- iv. The correctness of the information provided in this report
- v. That all comments and inputs from stakeholders and I&AP's are included in this report
- vi. That all information provided by the EAP to I&AP's and responses by the EAP to comments or inputs are included in this report

Signature... Date.....24 March 2016.....

4. REFERENCES

Department of Agriculture, 2013: Agricultural GIS. <http://www.agis.agric.za/agisweb/agis.html>

SANBI, 2013: Biodiversity Geographical Information System. www.sanbi.org

SANS 10103, 2008: The measurement and rating of environmental noise with respect to annoyance and to speech communication

South African Government, 2011: The Vaal Triangle Priority Area Air Quality Management Plan

Presented at 13th CIRP Intern. Conf. on Life Cycle Engineering, Leuven, 31 May- 2 June 2006:
Environmental Impacts of Crystalline Silicon Photovoltaic Module Production. Erik A. Alsema¹,
Mariska J. de Wild-Scholten².; Copernicus Institute of Sustainable Development and
Innovation, Utrecht University, The Netherlands. Energy research Centre of the Netherlands
(ECN), Petten, The Netherlands

Potential Health and Environmental Impacts Associated with the Manufacture and Use of
Photovoltaic Cells. Final Report, November 2003. Co-sponsors: Public Interest Energy
Research Program (PIER), California Energy Commission 1516 Ninth Street Sacramento,
California 95814 PIER Project Manager L. ten Hope

Silane Safety Data Sheet P-4649 according to U.S. Code of Federal Regulations 29 CFR
1910.1200, Hazard Communication. Date of issue: 01/01/1980 Revision date: 03/19/2015
Supersedes: 09/01/2014

Schmid Silicon Technology GmbH Robert-Bosch-Str. 32-36 Phone: 0049 7441 538-454 Fax:
0049 7441 538-260 72250 Freudenstadt Germany info@schmid-silicon.com www.schmid-silicon.com, undated)

Midvaal Integrated development Plan (IDP) of 2015/2016

5. Annexure A: Public Participation Evidence

Each neighbouring land owner received a hand delivered notification regarding the EIA and providing them with detail regarding registering as an I&AP.

Minutes to the TFS Waterval Solar Park Public Participation Meeting with the Suikerbosrand Conservancy

Date 12 August 2015

Venue Plaas Kombuis

Present		
Adri Venter	EAP (EON Consulting)	On file
Pinky Mokwena	Intern (EON Consulting)	On file
Jarrod Piel	Client TFS	On file
Tom Lombard	Client TFS	On file
Roxy Du Toit	Kliprivier-Suikerbosch Conserv.	On file
Fanus Weyes	ERWAT	On file
Wimpie Beetge	Kliprivier	On file
Isaac Matsoge	Councilor (WARD 12)	On file
Apologies		
None		

Agenda – Public Participation Meeting

Agenda Item	Resp	Time
1. Open and Welcome		
2. Introduction to Project		
a. Q & A Session (I&AP Concerns)		
3. Other Business		
4. Remarks and Conclusion		
5. Close		

Action Items

1. Formal acknowledgement of Meeting opening done by Adri Venter. It was agreed during the meeting that the written comments submitted will be discussed during the meeting and that no response to the written comments are required – thus the meeting minutes represents the response to the comments.

2. Introduction to Project by Tom Lombard
 - Purpose of proposed Solar Park Development
 - Extent and parameters that the Solar Park will cover
 - Origins of supplies and the designs for the Solar Park
 - Brief discussion of Solar Parks Pro's and its advantage to the community of Waterval and areas within surrounding vicinity
 - Projects' approval by the government
 - Power, Water and Waste plans for Solar Park

Q & A Session with I&APs

The following are some of the concerns that were raised by the Interested and Affected Parties, and the responses and clarifications that were provided for them:

Question

- ❖ What are the project's power plans? Will it be powered by Eskom or will it be generating its own electricity?

Answer: Yes, the project will be powered by Eskom, although the proposed project will enable the South African society to reduce their reliance on coal fired energy, by extending the of solar energy (renewable energy).

Question

- ❖ Will the project's outputs pollute the air (even more than it already is), affecting the rainfall patterns in the area through the rate of condensation? And also, what of the probability of the production of acid rain though that?

Answer: This project is a completely Green Project, and thus there will not be any outputs, let alone chemical by-products that will pollute the air or affect the rainfall patterns of the area. Please provide scientific evidence that the reduction in rainfall is due to additional buildings and not due to external factors such as climate change or the El Nino effect.

Question

- ❖ Going green doesn't necessarily mean the process to getting there is green. So how is this project aiming to achieve that status without leaving other remnants that may contradict the green purposes?

Answer: Due to the higher conversion ratios of this technology, least amounts of hazardous chemicals are produced. Any hazardous materials formed as part of the production process, will be kept in a secure concrete bunded area (to prevent any environmental pollution) and will be disposed of at a licensed landfill site and removed by a registered hazardous waste conveyor. Safe disposal certificates will be kept on file and will accompany audit reports.

Question

- ❖ Will the project cause even more traffic congestions and/ or impacts in and around area?

Answer: No, not at all.

Question

- ❖ From where will the project workers come?

Answer: Project is aiming to create ways to combat unemployment in South Africa (specifically this area) by hiring some of the locals to work there. A great fraction of laborers is expected to be employed from area.

Question

- ❖ The Waste Water Treatment Works of the area are already absolutely incapable of allowing or handling any more inflows, what is the plan with the disposal of waste water produced at the site of development?

Answer: As part of the Environmental Management Plan, there will be installed containers at the site, to which all waste water will be recycled and treated on the premises, thus no residue will be released out into the environment.

Question

- ❖ What is the plan with the current inhabitants of the land which is to be developed? Will they be moved somewhere or are they to make their own accommodation plans?

Answer: We have arranged with the government that the people be moved to Graceland. We will help out where and with what we can. We have been informed that only 30% of the people living in that area are South Africans, and the rest are of other nationalities. And so, unfortunately we can only provide alternative lodgings for that 30% only. And Mr. Baloyi (The Mayor) will hopefully have a plan for the immigrants.

Question

- ❖ What is the security plan for the project site?

Answer: The site will be protected by electric fencing all round.

3. Other Business

- Final scoping process
- Draft EIA still under process

4. Remarks and Conclusion

The I&APs that were present are looking forward to the project, and are very well pleased that the developers have taken their time to include them in the plans for the development of their community.

5. Close

Minutes

Minutes compiled by: P. Mokwena

The meeting was adjourned at 11:35 am.

These minutes are accepted as a true reflection of the meeting

Signed by:

A handwritten signature in black ink, appearing to read 'A. Mokwena'.

Date: 14 August 2015

6. Annexure B: Site photos



A portion of the site is under cultivation for maize



View towards the Western side of the site



View towards the Southern part of the site: Degraded grasslands



View towards the Southern part of the site: Themeda triandra grass



View towards an eastern part of the site: A portion of the site is severely degraded due to illegal dumping



View towards the southern part of the site



Eastern part of the site: Termite mound on site: The presence of harlequin snakes need to be determined and if found on site, must be relocated



View towards the eastern part of the site: Eragrostis

7. Annexure C: EAP CV

Curriculum Vitae of Adri Venter

Position:	Principal Consultant	
First Name:	Adri	
Last Name:	Venter	
Qualifications:	MSc (Masters in Geography and Environmental Studies with specialization on Environmental Management, Air and Water Quality) B.Ed. (Adult Education) National and National Higher Diplomas in Public Health	
Specialisation:	Environmental Management Environmental Health Education and Training	
Nationality:	South Africa	
Citizenship:	South Africa	
Date of Birth:	18 August 1964	
Languages:	English, Afrikaans	
International Experience:	Singapore and Algeria	

7.1. Professional Associations

SACNASP: Professional Natural Scientist (Pr. Sc. Nat.:400062/14)

IAIA (International Association for Impact Assessors)

Education

Qualification: MSc (Masters in Geography and Environmental Studies: Air and Water Quality)

Institution: WITS

Year Completed: 2007

Certification: Environmental Management Inspector (as defined in the National Environmental Management Act) - University of Pretoria. Obtained with Distinction

Year Obtained: 2007

Certification: Wetland Training Course - University of Pretoria

Year Obtained: 2006

Certification: Environmental Accounting - Tshwane University of Technology

Year Obtained: 2005

Certification: Urban Environmental Management Singapore -Environmental Institute - Singapore

Year Obtained: 2003

Certification: SABS ISO 14001: Environmental Management Systems: Environmental Law - SABS - Obtained with Distinction

Year Obtained: 2002

Certification: SABS ISO 14001: Environmental Management Systems - South African Bureau of Standards (SABS) Obtained with Distinction

Year Obtained: 2002

Certification: SABS ISO 14001: Environmental Management Systems Auditing - SABS - Obtained with Distinction

Year Obtained: 2002

Qualification: B.Ed. (Adult Education). Obtained with Distinction

Institution: WITS

Year Completed: 2001

Certification: Certificate in Advanced Project Management - University of Pretoria

Year Obtained: 2000

Certification: Certificate Senior Management - University of Stellenbosch - Directors Award for Best Student

Year Obtained: 1999

Qualification: Certificate in Management of Change and Organisational Development:
Institution: Louw du Toit and Associates in conjunction with University Of Pepperdine (USA) Obtained with Distinction
Year Completed: 1999

Certification: Environmental Management Programmes - University of Johannesburg
Year Obtained: 1998

Certification: People Centered Development - University of South Africa
Year Obtained: 1995

Qualification: National Higher Diploma in Public Health
Institution: Tshwane University of Technology
Year Completed: 1990

Qualification: National Diploma in Public Health
Institution: Tshwane University of Technology
Year Completed: 1987

Summarized Experience

Company	Sector / Industry	Position	Years of Experience
EON Consulting(Pty) Ltd	Consulting Services	Principal Consultant	4 years
MSA	Consulting Services	Operations Manager: Environmental, Legal and Mining Services	2 Years
Arup	Consulting Services	Senior Environmental Manager	1 Year
City of Tshwane	Local Government	Acting Executive Director: Environmental Management	6 months
City of Tshwane	Local Government	Manager/Director: Environmental Policy and Resource Management	7 Years

City Council of Pretoria	Local Government	Director: Health Education and Training	4 Years
Tshwane University of Technology	Academic	Part time lecturer and moderator	8 Years
City Council of Pretoria	Local Government	Health Education and Training Officer	6 Years
City Council of Pretoria	Local Government	Senior Environmental Health Officer	5 Years

Key Knowledge and Competency Areas

Adri Venter has had a varied career across several sectors that have produced a multi-skilled individual able to identify and integrate multi-disciplinary aspects of large and complex environmental projects. Her knowledge and understanding of environmental impacts are broad ranging and include air and water quality as well as human health. Adri has undertaken environmental projects across several industries, which include mining, construction, government and large corporations. Adri has a Master of Science degree in Geography and Environmental Studies, with specific reference to environmental management, air and water quality. She also holds a B(Ed) Adult Education which has supported her career in environmental education, lecturer and Education and Training Development Practitioner.

- Over 15 years' experience in a senior management position as well as in Environmental Management
- Wide environmental management experience across several sectors.
- **Environmental Auditing and due diligence assessments** (supported by formal training in environmental auditing, environmental law, environmental management programs and Environmental Management Inspector).
- In-depth understanding and knowledge of all South African environmental legislation based on experience and relevant training.
- Extensive experience in **Environmental Impact Assessments and Water Use License Applications**
- **Site Environmental Control Officer (ECO)** experience
- Extensive experience in the **policy and strategy environment**, especially in large corporations and government across a wide range of issues.
- Extensive experience with the Mineral and Petroleum Resources Development Act, mining and large construction projects as well as **water use licensing**.
- Implementation of **environmental management systems** (ISO 14001)
- Multi-skilled individual ensuring an integrated and advanced understanding of companies and challenges (advanced degrees in Adult Education and Environmental Health).
- Excellent presentation skills sharpened by years of formal lecturing and training.
- Extensive experience in dealing with stakeholders, government departments, communities, NGOs and politicians.

Software Skills

Software	Skill Level	Years of Experience
MS Word	Advanced	20
MS Excel	Standard	20
MS PowerPoint	Advanced	20
MS Project	Advanced	12
MS Visio	Basic	7
SAP	Basic	7
MS Access	Basic	7
MS Outlook	Advanced	20
GIS	Basic	3

Key Achievements

Year	Achievement
2013	Adri was acknowledged by EON Consulting as one of the top performers in the company during the year 2013.
2012	Adri was one of 4 nominees for Principal Consultant of the year
2010	Received award for second best paper at the IAIA National Conference 2010 for a paper on Environmental Management.
2006	Adri was nominated as one of 3 individuals in the organisation in the individual category for the Innovation Award, in the Municipal Managers Service Excellence Awards for a project related to wetlands.
2004	The environmental section headed up by Adri received an award in the Municipal Managers Service Excellence Awards. The team was awarded in the category of Team service excellence for exceptional contribution to the goals of the organisation.
2000	The division headed up by Adri received the award for the best cooperative training institution from the Tshwane University of Technology on two consecutive years
1999	Adri received the Directors Award for Best Student in the Senior Management Programme at the University of Stellenbosch in 1999.

Employment History (Current first)

Employer: EON Consulting(Pty) Ltd

Position: Principal Consultant

Duties & Responsibilities:

- Provide technical expertise on water and environmental projects
- Business development and project management
- Waste water risk abatement plans
- Water Research
- Fatal Flaw Analysis and Due Diligence Assessments
- Water quality modeling
- Water use licensing
- Environmental Impact Assessments (EIAs)
- Supportive environmental frameworks and strategies

Date From: 01 March 2011

Employer: MSA

Position: Operations Manager: Environmental, Legal and Mining Services

Duties & Responsibilities: Overview of various duties provided below

Operational management of a team of environmental consultants in the Environmental Division. The MSA Group offered a full suite of environmental services, from legal compliance, environmental

authorisations, and specialist services such as waste and water management as well as due diligence assessments across a range of industries.

Duties include project management of complex projects, compilation of complex proposals (with budgets in excess of R 3million) providing technical advice to project teams, directing specialist studies and reviews of specialist studies and the review of environmental impact assessment reports. As the operations manager of the division I was responsible for financial management (including invoicing, debtor management, income forecasting), managing and tracking project budgets (which amounts in some cases to several million rand), human resource management and development, resource planning, business development, quality and risk management as well as client liaison. I am also responsible for maintenance of ISO 9000 and occupational health and safety within the division. I was also responsible for reporting on key business indicators to group management.

Examples of large projects managed: Pre-feasibility and feasibility studies for iron, gold and platinum mines. Mining Right Applications and full suite of environmental authorisations for new mines, EIA for regional waste water treatment works, housing developments (50 000 houses), the compilation of the environmental component of Kumba's asset development management (ADM) system as well as the compilation of an Environmental Regulatory and Enforcement Strategy for the City of Johannesburg. I have also reviewed and updated the environmental risk registers of two shafts and executed a regulatory waste management audit for Impala Platinum. Mine water projects for Kumba and Mogale Gold.

Several projects were successfully completed and environmental authorizations issued.

Date From: 01 May 2009

Date To: 31 February 2011

Employer: Arup

Position: Senior Environmental Manager

Duties & Responsibilities: Environmental consulting, environmental impact assessments, water use licensing, auditing, training and mentoring, environmental sustainability

Date From: July 2008

Date To: April 2009

Employer: City of Tshwane

Position: Director: Environmental Resource Management

Duties & Responsibilities: Responsible for the management of the environmental resource management section of the Metropolitan Municipality.

My role was focused on **a)** setting the sustainability agenda for the City by developing and implementing capacity building programs and through the development of integrated policies and strategies and **b)** ensuring corporate environmental responsibility and compliance.

With respect to a) above:

The development of **environmental policy, strategies and frameworks** as well as best practices. Linking environmental agendas with the City's Integrated Development Plan. The following policies and strategies were compiled:

- Tshwane integrated Environmental Policy
- Biodiversity Framework
- Green Building guidelines
- Water resource protection framework

- Education and awareness strategy for employees
- Community education and awareness strategy
- Urban agriculture guidelines
- Green construction guidelines
- Generic EMP for construction projects
- Best practice guidelines for water and energy use, waste management and green procurement
- Compilation of a wetlands inventory for the City.

Training and Education. Development and implementation of employee and community environmental education programs was a critical aspect of my duties. Based on a strategic needs analysis, a training and development strategy was developed for municipal employees, councilors and the community of Tshwane. The strategy was implemented by the development of training programs and courses and the delivering of targeted training programs and courses. Several large community education events were managed through the involvement of community forums.

Inter-Governmental Liaison: Synchronisation of the City's policies and strategies with Provincial and National Government.

Management Information: **Reporting on corporate environmental compliance** and progress towards targets, environmental indicator development and environmental risk analysis was an integral part of my duties. The development of **Management Information Systems (MIS)** in support of evaluation, monitoring and reporting was required.

I was also responsible for **environmental due diligence, legal compliance** and **the implementation of ISO 14001** related to the operations of the City. Examples of operations include: 2 coal fired power stations, several landfill sites, several waste water treatment works, the fresh produce market, several large workshops and the Bon Accord Quarry. All new infrastructure developments of the City were screened for legal implications pertaining to all relevant environmental legislation. My division was also responsible for auditing of waste management service providers for the City.

Setting and management of compliance targets. Reviewing the City's capital projects for environmental implications and compliance requirements.

Environmental Risk Management: Implementation of Risk Assessment and Risk Management Plans for municipal operations

Date From: June 2001

Date To: June 2008

Employer:	City of Tshwane
Position:	Acting Executive Director: Environmental Management
Duties & Responsibilities:	Responsible for the management of the Environmental Management Department of the Metropolitan Municipality. These included the City Waste Removal and Waste Management Services, Parks and Horticulture Services, Cemetery Services, Environmental Resource Management, Environmental Planning and Open Space Management as well as Nature Conservation and Resorts.
Date From:	01 October 2007
Date To:	30 December 2007

Employer	City Council of Pretoria
Position	Acting Director: Health Education and Training
Duties & Responsibilities	Oversee the training department Responsible for continued professional development of nursing and medical staff, Environmental Health Practitioners Experiential learning of health professionals

Career development plans
Management training and development
Community education, training and awareness
Management of the activities of 3 regional Aids Information, Training and Counseling Centers

Date From March 1999

Date To September 2001

Employer: Tshwane University of Technology

Position: Part time lecturer and moderator

Duties & Responsibilities: Lecturing in various subjects in the department of Environmental Health and Occupational Health Nursing

Date From: 01 January 1994

Date To: 31 December 2002

Employer: City Council of Pretoria

Position: Health Education and Training Officer

Duties & Responsibilities:

- Health and environmental education, training and awareness programmes
- Present training courses
- Training needs analysis
- Career development plans
- Develop training courses
- Aids Counseling and training

Date From: 01 January 1992

Date To: 31 December 2001

Employer: City Council of Pretoria

Position: Senior Environmental Health Officer

Duties & Responsibilities: Food safety, Environmental pollution control, education and awareness, law enforcement

Date From: 01 January 1986

Date To: 31 December 1992

Project History

Company: EON Consulting (Pty)Ltd

Project Name: Gautrain Independent Environmental Consultant (IEC)

Project Description: Review Gautrain environmental progress, express independent opinions, review EMP and annual reports, oversee expert consultants on behalf of Gautrain management

Project Duration: 2013 - 2015

Project Value: R 550 000

Designation on Project: SME and project manager

Responsibilities: Subject matter expert, auditing and assessment

Company: EON Consulting (Pty)Ltd

Project Name: R21/Pomona Environmental Control Officer (ECO)

Project Description: ECO for a water pipeline project

Project Duration: 2014 to 2015

Project Value: R 124 000

Designation on Project: ECO

Responsibilities: Review construction activities for legal compliance

Company: EON Consulting (Pty)Ltd

Project Name: Ekurhuleni EIA's

Project Description: Obtaining environmental authorisations and water use licenses for the Water and Sanitation department of the City of Ekurhuleni for a period of 3 years.
Screening studies to determine authorisations required.
Wetland studies.

Project Duration: 2014 to 2016

Project Value: R 4 000 000

Designation on Project: Principal Consultant and Environmental Assessment Practitioner (EAP)

Responsibilities: Screen all projects, apply and manage authorisations, act as site Environmental Control officer

Company: EON Consulting(Pty)Ltd

Project Name: Catchment Profiles

Project Description: Catchment risk profiles for 5 catchments in which Eskom operates for the purposes of compiling a Water Safety Plan

Project Duration: 2013

Project Value: R 130 000

Designation on Project: Project leader and SME
Responsibilities: Catchment mapping, profile and risk assessment

Company: EON Consulting(Pty)Ltd
Project Name: Wynberg Dam
Project Description: Environmental Fatal Flaw Analysis of a proposed dam and hydro-electric scheme
Project Duration: 2013
Project Value: R 50 000
Designation on Project: Project leader and SME
Responsibilities: Pre-feasibility fatal flaw analysis

Company: EON Consulting(Pty)Ltd
Project Name: Arnot Power Station water use license audit
Project Description: Auditing of all conditions attached to the water use license of the Arnot Power Station
Project Duration: 2013
Project Value: R 60 000
Designation on Project: Project leader and SME
Responsibilities: Documentation review and site inspection

Company: EON Consulting(Pty)Ltd
Project Name: Sasol Water Quality Offsetting
Project Description: Determination of Secunda Complex mass loadings and investigating offsetting opportunities in the Waterval catchment
Project Duration: 2013
Project Value: R 1 000 0000
Designation on Project: Project leader
Responsibilities: Project management and SME

Company: EON Consulting(Pty)Ltd

Project Name: Busby EIA and WULA
Project Description: Obtaining a water use license and NEMA authorization for a renewable energy project
Project Duration: May 2012 – Present
Project Value: R 350 000
Designation on Project: Project leader and SME
Responsibilities: Advising the client and managing of the legal process to obtain the relevant environmental authorisations

Company: EON Consulting(Pty)Ltd
Project Name: Lazy Bend EIA and WULA
Project Description: Obtaining a water use license and NEMA authorization for a renewable energy project
Project Duration: May 2012 – Present
Project Value: R 350 000
Designation on Project: Project leader and SME
Responsibilities: Advising the client and managing of the legal process to obtain the relevant environmental authorisations

Company: EON Consulting(Pty)Ltd
Project Name: Ekurhuleni Environmental Authorisations
Project Description: Obtaining all environmental authorisations for the Water and Sanitation Division
Project Duration: April 2014 to April 2016
Project Value: R 4 000 000
Designation on Project: Project leader and SME
Responsibilities: Basic Assessments, Water use licensing, project screening, environmental amendments

Company: EON Consulting(Pty)Ltd
Project Name: Water Research Commission: Framework for the management of Eskom wetlands
Project Description: Research and pilot project on wetland management
Project Duration: January 2013 to June 2014
Project Value: R 1 000 000

Designation on Project: Project leader and SME
Responsibilities: Researcher and project lead

Company: EON Consulting
Project Name: CSIR Sediment Modeling
Project Description: Modeling of the land-water linkages related to bacterial and sediment loads
Project Duration: August 2012 to present
Project Value: R 120 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise

Company: EON Consulting
Project Name: Public Investment Company
Project Description: Environmental Due Diligence of a manufacturing plant
Project Duration: November 2012
Project Value: R87 000
Designation on Project: Project Leader and Subject Matter Expert
Responsibilities: The investigation of the status of environmental and occupational health and safety legal compliance, due diligence and compliance to the Equator principles

Company: EON Consulting
Project Name: Randfontein Local Municipality
Project Description: Waste Water Risk Abatement Plan (WWRAP).
Project Duration: 01 August 2012 – Present
Project Value: R87 000
Designation on Project: Project Leader and Subject Matter Expert
Responsibilities: The compilation of a WWRAP for the Randfontein waste water treatment works. All risks have been identified, rated and a management plan as well as incident management plan compiled
Project successfully completed in September 2012. Received high accolades (100% in satisfaction survey) from client

Company: EON Consulting(Pty)Ltd
Project Name: Tzaneen Waste Water Risk Abatement Plan
Project Description: Waste Water Risk Abatement Plan (WWRAP).
Project Duration: January 2013
Project Value: R 50 000
Designation on Project: Subject Matter Expert
Responsibilities: The update of the WWRAP for the Tzaneen waste water treatment works. All risks have been identified, rated and a management plan as well as incident management plan compiled. Once again this project scored 100% from a feedback survey from the client.

Company: EON Consulting
Project Name: Environmental Risk Assessment and environmental screening of Energy Crops and associated combustion and biogas installation for the generation of electricity
Project Description: Analyse water and environmental risks associated with the proposed planting and harvesting of biomass
Project Duration: August 2012 to present
Project Value: R 28 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise on legal environmental requirements

Company: EON Consulting(Pty)Ltd
Project Name: Water Conservation Water Demand Management (WCWDM) for Eskom
Project Description: Implementation of WC/WDM program
Project Duration: 01 March 2011 – Present
Project Value: R6 m
Designation on Project: Subject Matter Expert
Responsibilities: The compilation of a water trading study to investigate the feasibility of trading water through the promotion of improved agricultural efficiencies.

Strategic support related to strategic planning over a 5-year period, of key water and environmental initiatives in the Primary Energy Division.

Company: EON Consulting

Project Name: Environmental Risk Assessment and environmental screening of Energy Crops

Project Description: Analyse water and environmental risks associated with the proposed harvesting and generation of electricity from biomass by a local gold mine.

Project Duration: 1 month

Project Value: R 15 000

Designation on Project: Subject Matter Expert

Responsibilities: Subject matter expertise

Company: EON Consulting

Project Name: Water Sector Skills Inventory

Project Description: Analyse the skills levels in the water sector.

Project Duration: 01 March 2011 – Present

Project Value: R 60 000

Designation on Project: Subject Matter Expert

Responsibilities: Subject matter expertise

Company: MSA

Project Name: Environmental legal compliance of Sishen, Sishen South and Thabazimbi iron ore mines and beneficiation plant

Project Duration: 01 August 2009 - 31 August 2010

Project Value: R600 000

Designation on Project: Project Manager and Lead Auditor

Responsibilities:

- Lead site visits
- Audit against legal requirements pertaining to air, water and other requirements as well as EMPR and various RoD's
- Compile and present report on findings. Make rectification recommendations. Present report to top management.
- Successfully completed. Completed August 2010

Company: MSA

Project Name: Environmental legal compliance of Mogale Gold Mine and beneficiation plant

Project Duration: February 2010 - 31 July 2010

Project Value: R200 000

Designation on Project: Project Manager and Lead Auditor

Responsibilities:

- Lead site visits
- Audit against legal requirements pertaining to air, water and other requirements as well as EMPR and various RoD's. Investigate lawfulness of various historic activities.
- Compile and present report on findings. Make rectification recommendations. Present report to top management.
- Successfully completed. Completed August 2010

Company: MSA

Project Name: Feasibility Study of the Pan African Parliament in Salvokop, Pretoria

Project Duration: 01 April 2009 - Present

Project Value: R80 000

Designation on Project: Oversee the environmental feasibility study

Responsibilities:

- Ensure that all environmental risks are investigated and quantified. Make recommendations.
- Successfully completed

Company: MSA

Project Name: Land-use management strategy for Kumba Iron Ore

Project Duration: 01 December 2008 - 31 December 2009

Project Value: R800 000

Designation on Project: Project Manager

Responsibilities:

- Develop a policy and strategy for Kumba Iron Ore to manage their land. Develop and apply assessment criteria to compile best management plans and practices for the respective pieces of land with reference to future use and rehabilitation requirements
- Successfully completed and project accepted by the board.

Company: MSA

Project Name: Scoping study, mining right application and environmental impact assessment for Veremo Iron Ore Mine

Project Duration: 01 October 2008 - 31 January 2009

Project Value: R4 m

Designation on Project: Project Manager

Responsibilities: Oversee the impact studies, specialist studies and compilation of the environmental impact assessment report. Liaise with the mining engineers and interpret mining methods with respect to projected environmental impacts and legislative requirements

Company: MSA

Project Name: Due Diligence: Afrisam
Project Duration: September 2009
Project Value: R85 000
Designation on Project: Environmental Auditor
Responsibilities:

- Review of all plant operations and associated mining operations against legal requirements and the identification of environmental risks. Quantification of risks and corrective measures in financial terms
- Successfully completed

Company: MSA
Project Name: Due Diligence: Kgalagadi Manganese Mine and beneficiation plant
Project Duration: June 2009
Project Value: R60 000
Designation on Project: Environmental Auditor
Responsibilities:

- Review proposed mining operations against legal requirements and current approvals obtained and the identification of environmental risks. Quantification of risks and corrective measures in financial terms
- Successfully completed

Company: Arup (Pty)Ltd
Project Name: Water use license for Transnet's New Multi-purpose Pipeline
Project Description: Managing the water use authorizations associated with the 550km long petroleum pipeline.
Project Duration: 01 January 2008 - 31 December 2009
Project Value: R 800 000
Designation on Project: Senior Environmental Manager
Responsibilities:

- Assess water uses and water resource impacts on the 550 km long pipeline, which included in excess of 2000 river and wetland crossings.
- Compile impact and significance tables, write technical reports, oversaw the compilation of GIS maps and data tables. Compile environmental management plans and emergency management plans
- Water use license issued in record time

Company: Arup (Pty) Ltd
Project Name: Gautrain Construction
Project Description: Independent Environmental Certifier
Project Duration: 01 July 2008 - 31 July 2009
Project Value: R 10 billion (total value and not related to my role)
Designation on Project: Independent Certifier

Responsibilities:

- Environmental auditing of various construction sites to certify environmental compliance related to legislative requirements.

Company: Arup (Pty) Ltd

Project Name: Gauteng Freeway Improvement Project (SANRAL)

Project Description: Environmental legal compliance and ECO

Project Duration: 01 September 2008 - 31 July 2009

Project Value: R 1 million

Designation on Project: Oversee the Environmental Control Officer

Responsibilities:

- Environmental auditing of various construction sites to certify environmental compliance related to legislative requirements.
- Quality control of the work of the ECO
- Review audit reports as compiled by the ECO to the authorities

Company: City of Tshwane

Project Name: City Legal Compliance

Project Duration: 2002 - 2008

Project Value: N/a

Designation on Project: Project Leader

Responsibilities:

- Roll-out of a quarterly environmental audit program for all City operations. This included: Coal fired power stations, waste water treatment works, landfill sites, workshops, batching plants, Wonderboom Airport, stone quarries and asphalt plants etc.
- Compilation of audit protocols and checklists
- Verification of corrective measures
- Reporting on legal compliance to the municipal manager and Council

8. Annexure D: Pre-application Consultation meeting with DEA

9. ANNEXURE E: SPECIALIST STUDIES:

9.1. Vegetation study

9.2. Avifaunal study

9.3. Wetland study

9.4. Air Quality Study

10. Annexure F: EMPr



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