BIOTHERM ENERGY (PTY) LTD

PROPOSED CONSTRUCTION OF THE HELENA 3 SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

Heritage Assessment Report

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Executive Summary

PGS Heritage was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment (HIA) Study that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of Helena 3 Solar 75MW solar photovoltaic (PV) energy facilities near Copperton, Northern Cape Province.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the proposed Helena Solar projects may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (**Figure 13**). The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 5**.

Table 1: Landform to heritage matrix

LAND FROM TYPE	**HERITAGE TYPE**
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA, MSA and ESA
Farmsteads	Historical archaeological material

The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

A total of a 110 find spots were logged of which 13 (9 in proposed power line corridors and 4 in Helena 3 footprint area) can be described as archaeological sites.

1.1 Find spots

A total of 97 findspots were marked over the extent of the fieldwork. The findspots were mostly characterised by three types of setting, deflated red sands, and exposed pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The findspots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

All these site have a low significance, however the possibility of subsurface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

1.2 Sites

During the fieldwork 13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.

Power line sites - *Mitigation:*

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required these site will then need mitigation measures developed that will need to be completed before construction can commence;

- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

PV footprint - *Mitigation:*

- All four site will require mitigation work before construction can commence
- The mitigation work will be at a minimum:
  - a controlled surface collection of the material,
  - excavation should be considered at 092-093
  - analysis of material and final report;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

1.3 Impact Summary

Table 15 provides a summary of the projected impact rating for this project on heritage resources.

Table 2: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	51		24	
			High Negative Impact		Low Negative Impact

1.4 Comparative Assessment for Helena Solar 3

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Substation Site Alternative 1	NO PREFERENCE	No heritage resources identified
Substation Site Alternative 2	NO PREFERENCE	No heritage resources identified
INTERNAL ROADS		
Internal Road Alternative 1	FAVOURABLE	Some heritage resources identified close by
Internal Road Alternative 2	PREFERRED	No resources identified in close vicinity
POWER LINES		
Power Line Corridor Alternative 1	FAVOURABLE	More heritage sites identified in this corridor
Power Line Corridor Alternative 2	PREFERRED	Less heritage sites identified in this corridor

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HERITAGE ASSESSMENT REPORT

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1 INTRODUCTION

PGS Heritage was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment (HIA) Study that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of Helena 3 Solar 75MWsolar photovoltaic (PV) energy facilities near Copperton, Northern Cape Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites, finds and sensitive areas that may occur in the study area for the EIA study. The Heritage Impact Assessment (HA) aims to inform the Environmental Impact Assessment in the development of a comprehensive Environmental Management Plan to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

PGS Heritage (PGS) compiled this Heritage Impact Assessment Report.

The staff at PGS has a combined experience of nearly 70 years in the heritage consulting industry. PGS and its staff have extensive experience in managing the HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, Project manager for this project, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation, as well as being accredited as a Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP).

1.3 Assumptions and Limitations

Not detracting in any way from the fieldwork undertaken, it is necessary to realise that the heritage sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.

The survey was conducted over 3 days over the extent of the total footprint area. It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. National Environmental Management Act (NEMA) Act 107 of 1998
   a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
   b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
   c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
   d. Environmental Management Plan (EMP) – Section (34)(b)
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
   a. Protection of Heritage Resources – Sections 34 to 36; and
   b. Heritage Resources Management – Section 38
iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
   a. Section 39(3)

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “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…”. The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA legislation. In the latter cases, the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Sections of these Acts relevant to heritage (Fourie, 2008).

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage".

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

Refer to **Appendix A** for further discussions on heritage management and legislative frameworks

1.5 Terminology

Archaeological resources

This includes:

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history, which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age, between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance, such as the caves with archaeological deposits identified close to both development sites for this study.

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 20 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 20-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

1.6 Abbreviations

Acronyms	***Description***
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
CCS	Cryptocrystalline silicate
DEA	Department of Environmental Affairs
DoE	Department of Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HV	High Voltage
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act

PHRA	Provincial Heritage Resources Agency
PSSA	Palaeontological Society of South Africa
PV	Photovoltaic
ROD	Record of Decision
SPV	Special Purpose Vehicle
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

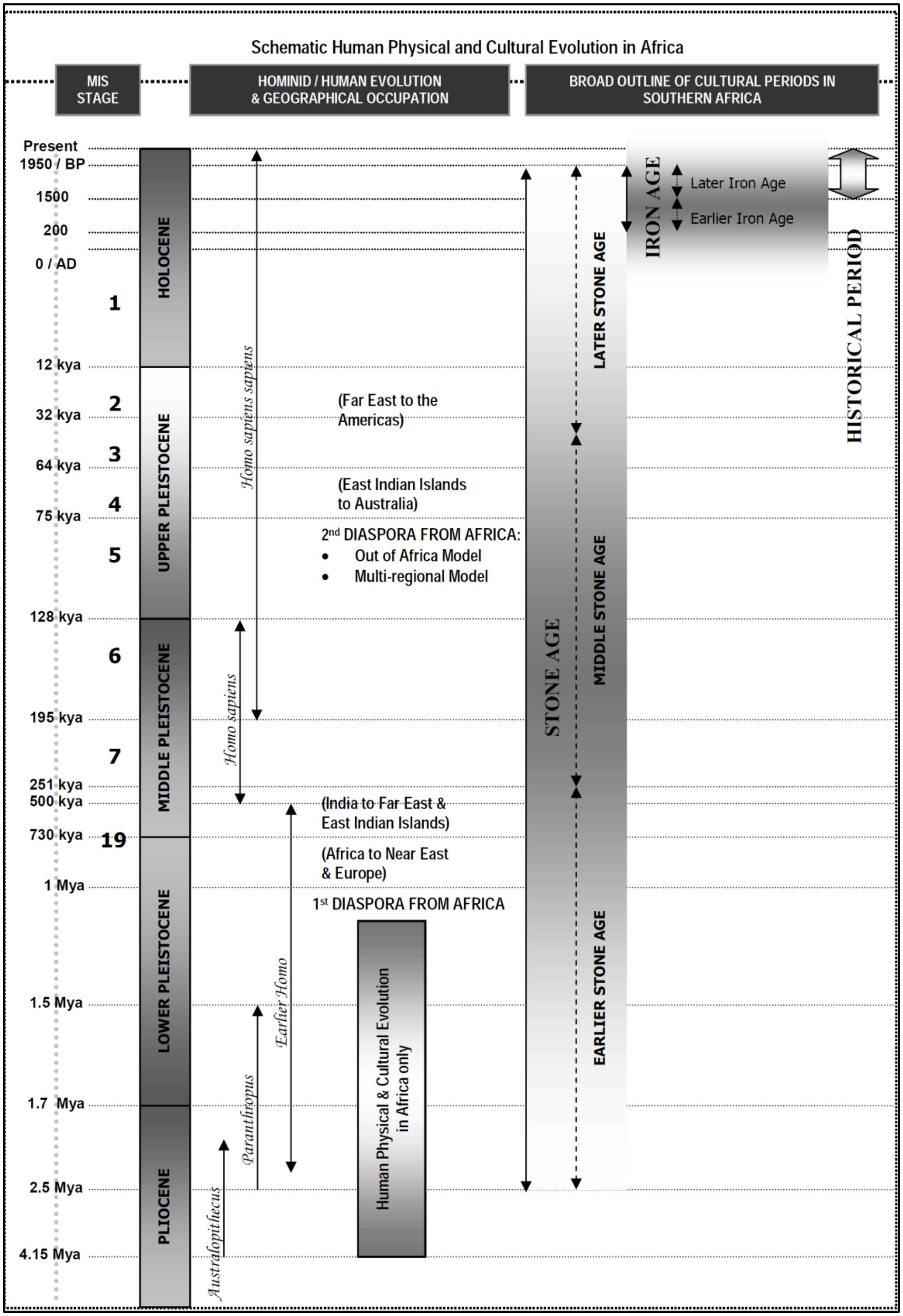


Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DESCRIPTION

The proposed project will encompass the installation of a solar PV field and associated components, in order to generate electricity that is to be fed into the Eskom grid. The facility will have a maximum export capacity of 75MW. The proposed development area is approximately 530 ha, however it is envisaged that the 75MW energy facility layout will only require approximately 250 ha. The voltage of the connection lines from the solar PV energy facility substation to the grid is likely to be 132kV.

2.1 PV Project Components

This proposed PV energy facility forms one of three PV energy facilities with a 75MW export capacity that BioTherm are proposing to develop on Portion 3 of the farm Klipgats Pan No 117 (Figure 2). In order to accommodate the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. However, the possibility to allow shared associated infrastructure will be considered.

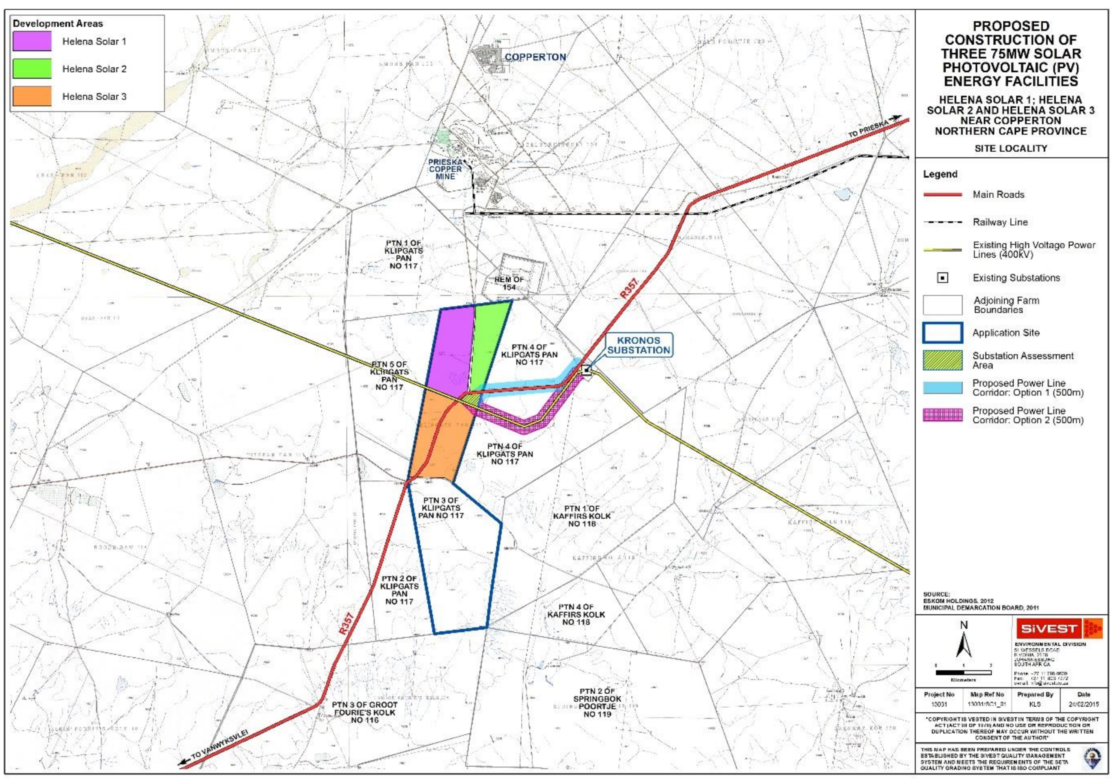


Figure 2: Proposed solar PV energy facility study area

The key technical details and infrastructure required is presented in the table below (Table 3).

Table 3: Helena Solar 3 phase summary

Phase Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for each phase
Helena Solar 3	14/12/16/3/3/2/767	Portion 3 of Klipgats Pan No 117 (PV site) and Portion 4 of Klipgats Pan No 117 (power lines) PV Site Area: 527.20 ha	▪ Approximately 300 000 **solar PV panels** with a total export capacity of 75MW; ▪ Panels will be either **fixed axis mounting or single axis tracking solutions**, and will be either crystalline silicon or thin film technology; ▪ Onsite **switching station**, with the transformers for voltage step up from medium voltage to high voltage; ▪ The panels will be connected in strings to inverters, approximately **43 inverter stations** will be required throughout the site. Inverter stations will house 2 x 1MW inverters and 1 x 2MVA transformers; ▪ DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22-33kV (medium voltage) in the transformers. ▪ The **22-33kV cables** will be run underground in the facility to a common point before being fed to the **onsite substation** where the voltage will typically be stepped up to 132kV. ▪ Grid connection is to the Kronos substation. A **power line** with a voltage of up to 132kV will run from the onsite substation to the Kronos substation. The distance will be about 4km. ▪ A **laydown area** for the temporary storage of materials during the construction activities; ▪ **Access roads and internal roads**; ▪ Construction of a **car park and fencing** around the project; and ▪ **Administration, control and warehouse buildings**

2.2 Solar Field

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays will likely need to be entirely cleared or graded. Where tall vegetation is present, this vegetation will be removed from the PV array area.

Approximately 300 000 solar PV panels will be required per project for a total export capacity of 75MW. Support structures will be either fixed axis mounting or single axis tracking solutions and the modules will be either crystalline silicon or thin film technology. The solar PV panels are variable in size, and are affected by advances in technology between project inception and project realisation. The actual size of the PV panels to be used will be determined in the final design stages of the project. The PV panels are mounted onto metal frames which are usually aluminium. Rammed or screw pile foundations are commonly used to support the panel arrays (Figure 3).

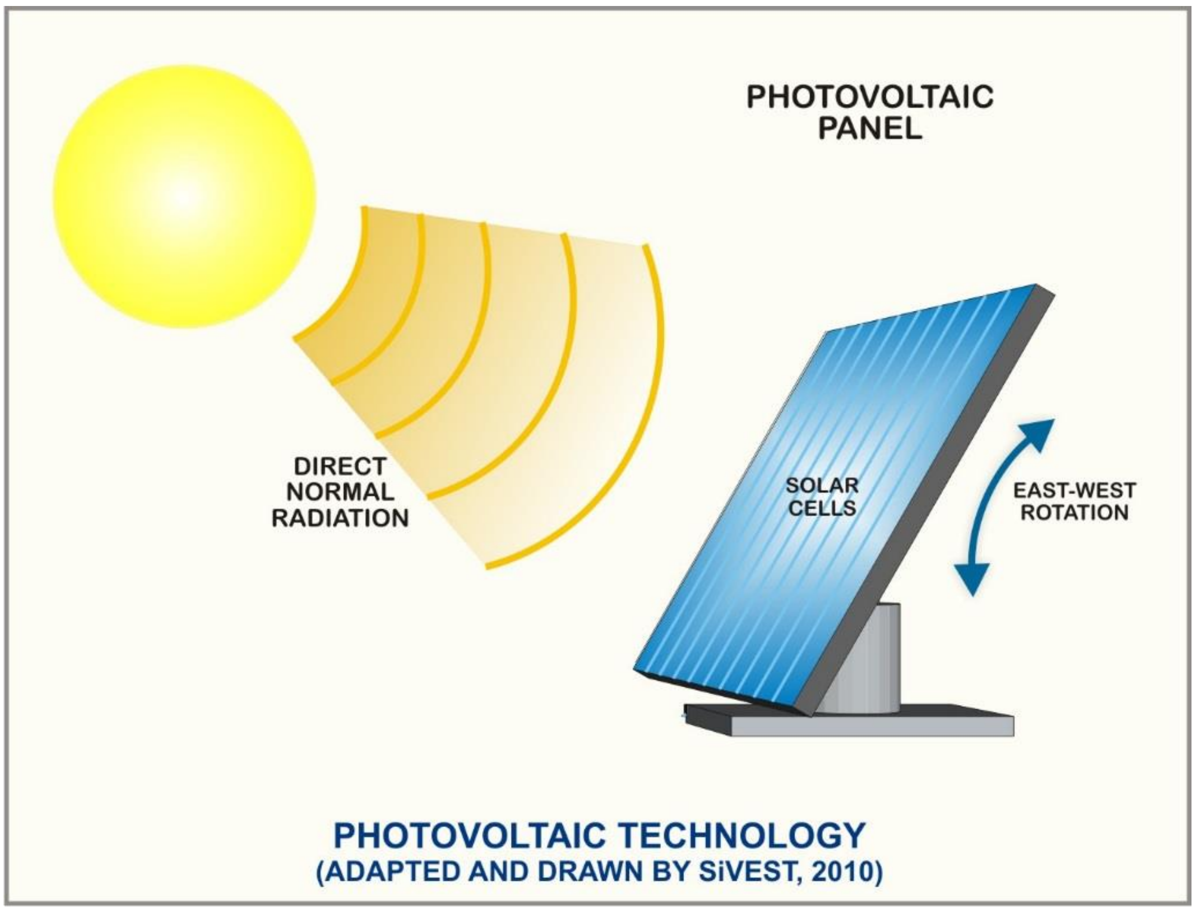


Figure 3: Example of a Photovoltaic Panel with tracking capability.

2.3 Associated Infrastructure

2.3.1 Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings, which are in turn connected to inverters. For a 75MW size facility, typically 2MW inverter stations which are containerised stations housing 2x1MW inverters and 1x2MVA transformers will be used; therefore approximately 43 inverter stations will be required throughout the site for the proposed solar PV energy facility (Figure 4). DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22-33kV (medium voltage) in the transformers. The 22-33kV cables will be run underground in the facility to a common point before being fed to the onsite substation and switching station where the voltage will typically be stepped up to 132kV. A Power line with a voltage of up to 132kV will run from the onsite substation to the existing Kronos substation. The distance will be about 4km.

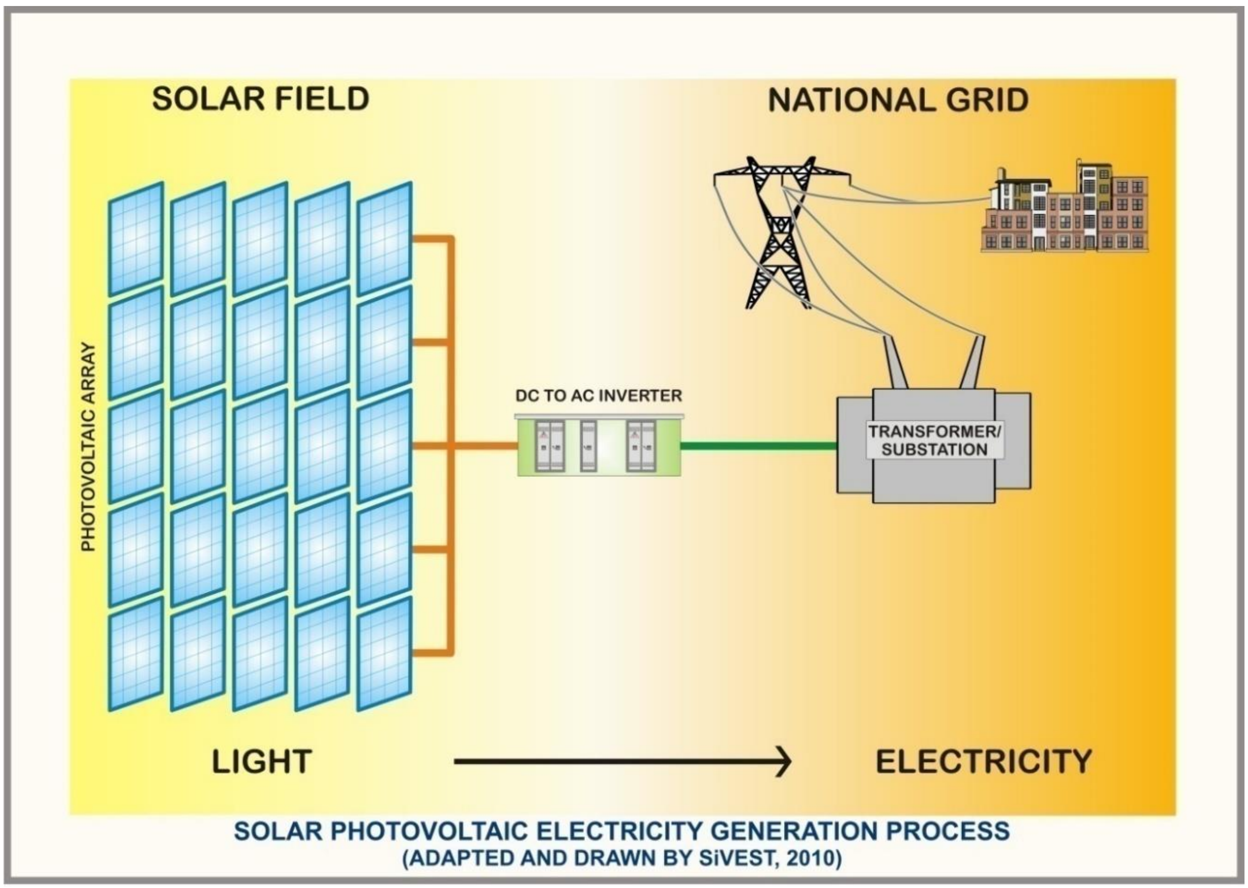


Figure 4: PV process

2.3.2 Buildings

The solar field will require onsite buildings which will be used in the daily operation of the plant and includes an administration building (office). The buildings will likely be single storey buildings which will be required to accommodate the following:

- Control room
- Workshop
- High Voltage (HV) switchgear
- Mess Room
- Toilets
- Warehouse for storage
- Car park and fencing around the project

2.3.3 Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV energy facility. The size of this area is yet to be determined, but 3 to 5 hectares is likely.

2.3.4 Other Associated Infrastructure

Other associated infrastructure includes the following:

- Access roads and internal roads;
- A car park; and
- Fencing around the project.

2.4 Alternatives

Due to the limited space available as well as the constraints of the sensitive areas, no alternative PV panel layouts were identified. It was felt that it would be environmentally preferable to assess one viable panel layout rather than two panel layouts that are not technically or environmentally viable. Other design or layout alternatives have been identified. Two alternative site locations for the substation were also proposed, as well as two alternative route corridors for the proposed power line. Additionally, two road and cabling layout alternatives were identified. Based on the scoping phase specialist findings the substation assessment area was eliminated as an appropriate area for the proposed substation as most of this site was found to be potentially sensitive by the specialists. As such, two alternative substation sites that cover an area of 3 ha each were proposed to be assessed in the EIA phase. Should the other two PV projects that are being proposed by BioTherm on the same farm also be granted EAs and be awarded preferred bidder status by the DoE the possibility of sharing the substation site to reduce the environmental impact will be considered.

These layout for the proposed PV facility is presented in Figure 5.

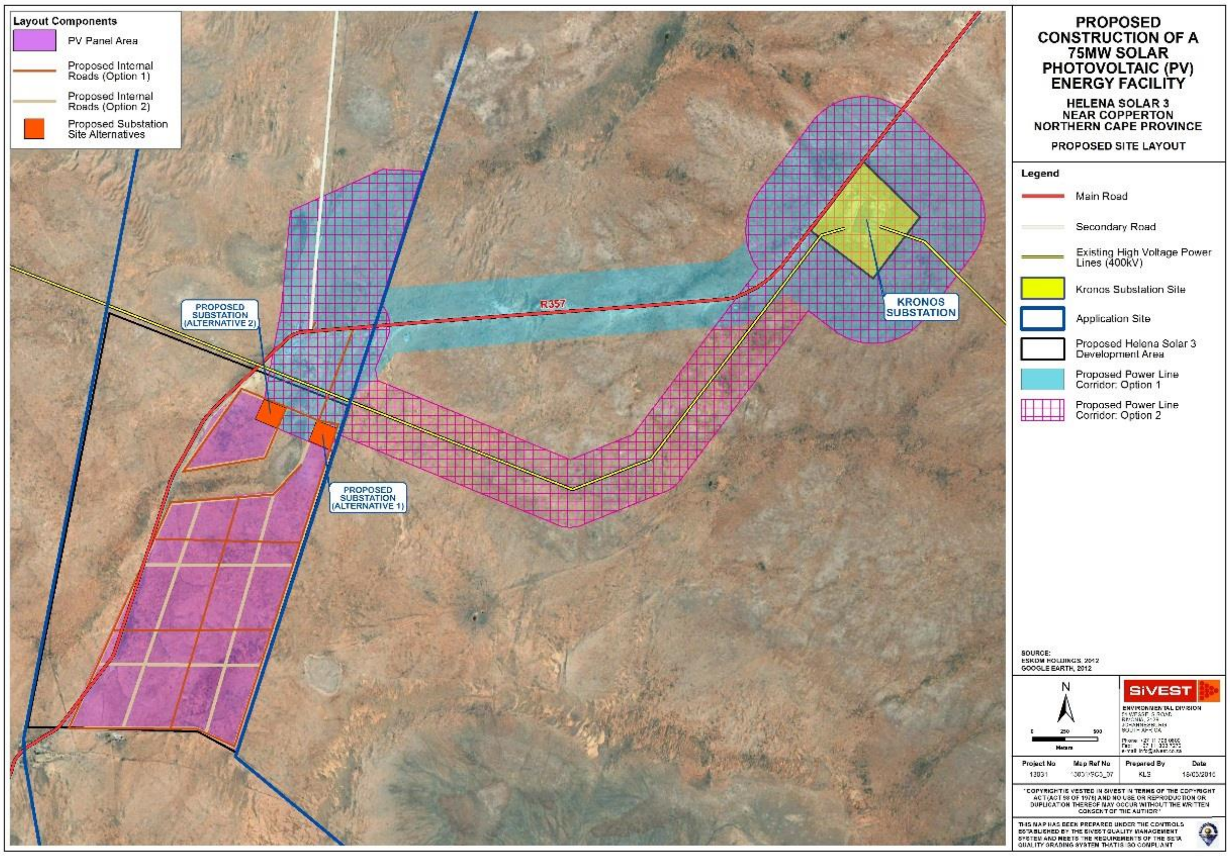


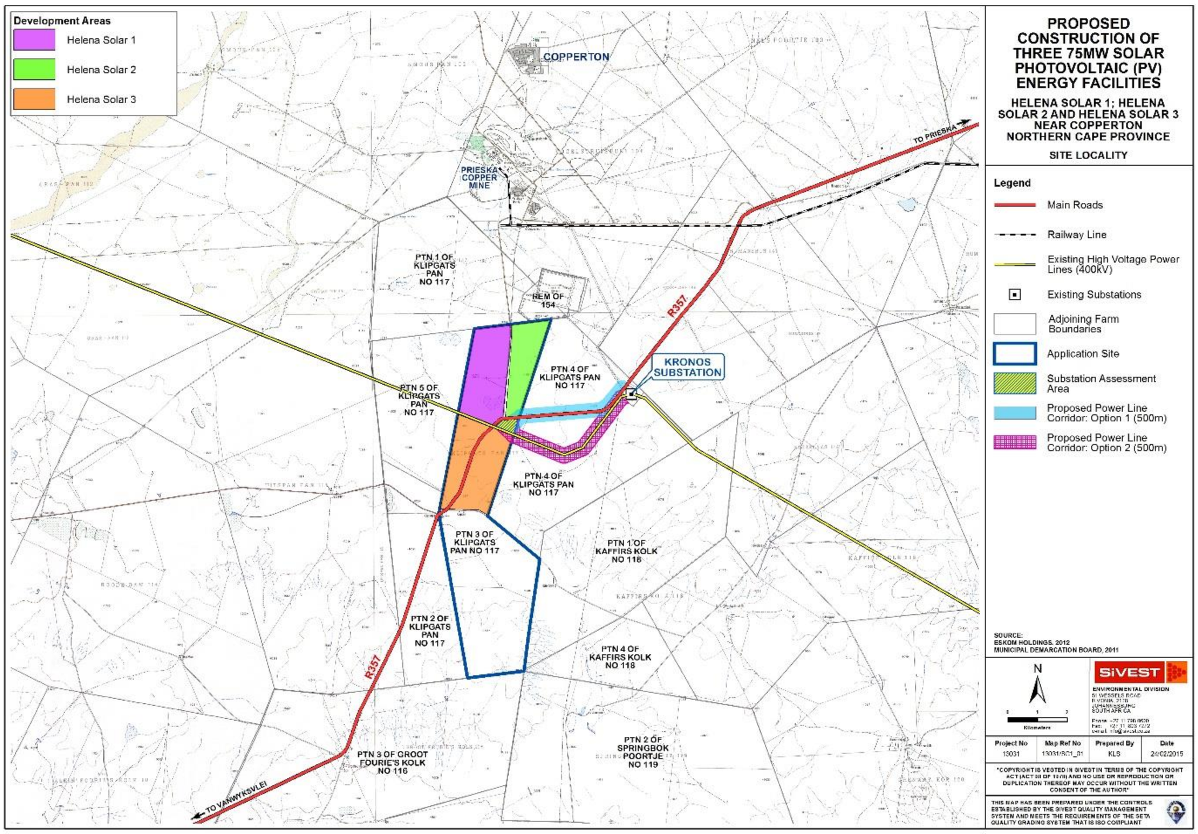
Figure 5: Proposed Layout Alternatives

3 TECHNICAL DESCRIPTION

The proposed project will encompass the installation of a solar PV field and associated components, in order to generate electricity that is to be fed into the Eskom grid. The facility will have a maximum export capacity of 75MW. The proposed development area is approximately 530 ha, however it is envisaged that the 75MW energy facility layout will only require approximately 250 ha. The voltage of the connection lines from the solar PV energy facility substation to the grid is likely to be 132kV.

3.1 PV Project Components

This proposed PV energy facility forms one of three PV energy facilities with a 75MW export capacity that BioTherm are proposing to develop on Portion 3 of the farm Klipgats Pan No 117 (Figure 2). In order to accommodate the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. However, the possibility to allow shared associated infrastructure will be considered.



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3.2 Solar Field

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays will likely need to be entirely cleared or graded. Where tall vegetation is present, this vegetation will be removed from the PV array area.

Approximately 300 000 solar PV panels will be required per project for a total export capacity of 75MW. Support structures will be either fixed axis mounting or single axis tracking solutions and the modules will be either crystalline silicon or thin film technology. The solar PV panels are variable in size, and are affected by advances in technology between project inception and project realisation. The actual size of the PV panels to be used will be determined in the final design stages of the project. The PV panels are mounted onto metal frames which are usually aluminium. Rammed or screw pile foundations are commonly used to support the panel arrays (Figure 3).

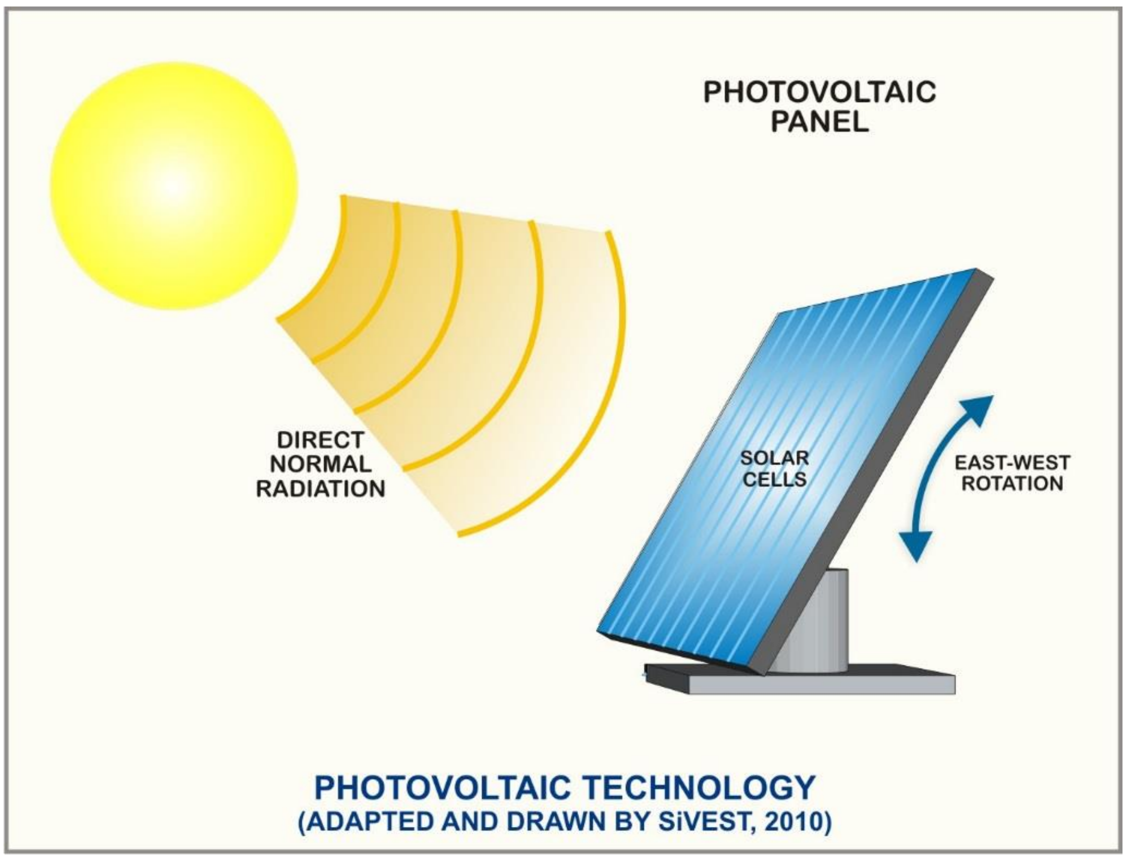

Figure 7: Example of a Photovoltaic Panel with tracking capability.

3.3 Associated Infrastructure

3.3.1 Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings, which are in turn connected to inverters. For a 75MW size facility, typically 2MW inverter stations which are containerised stations housing 2x1MW inverters and 1x2MVA transformers will be used; therefore approximately 43 inverter stations will be required throughout the site for the proposed solar PV energy facility (Figure 4). DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22-33kV (medium voltage) in the transformers. The 22-33kV cables will be run underground in the facility to a common point before being fed to the onsite substation and switching station where the voltage will typically be stepped up to 132kV. A Power line with a voltage of up to 132kV will run from the onsite substation to the existing Kronos substation. The distance will be about 4km.

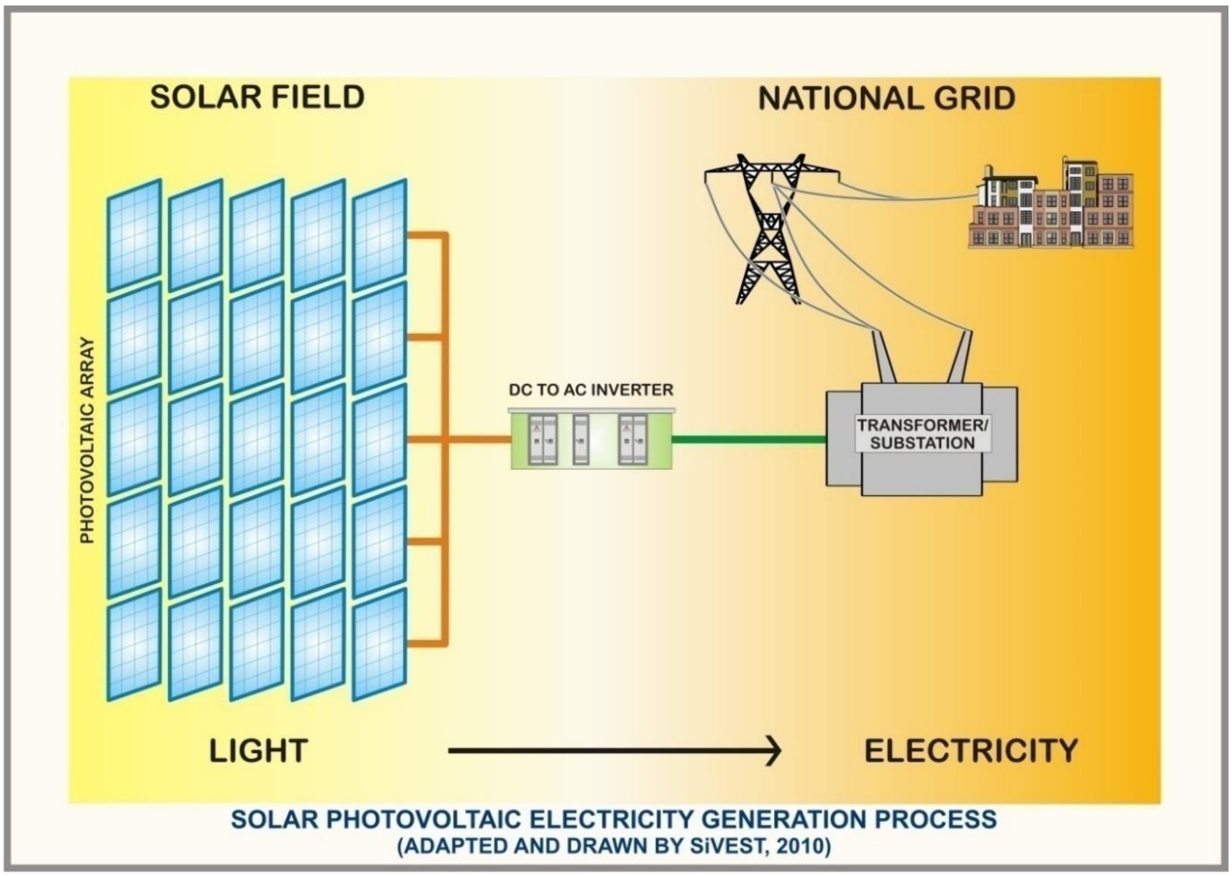

Figure 8: PV process

3.3.2 Buildings

The solar field will require onsite buildings which will be used in the daily operation of the plant and includes an administration building (office). The buildings will likely be single storey buildings which will be required to accommodate the following:

- Control room
- Workshop
- High Voltage (HV) switchgear
- Mess Room
- Toilets
- Warehouse for storage
- Car park and fencing around the project

3.3.3 Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV energy facility. The size of this area is yet to be determined, but 3 to 5 hectares is likely.

3.3.4 Other Associated Infrastructure

Other associated infrastructure includes the following:

- Access roads and internal roads;
- A car park; and
- Fencing around the project.

3.4 Alternatives

Due to the limited space available as well as the constraints of the sensitive areas, no alternative PV panel layouts were identified. It was felt that it would be environmentally preferable to assess one viable panel layout rather than two panel layouts that are not technically or environmentally viable. Other design or layout alternatives have been identified. Two alternative site locations for the substation were also proposed, as well as two alternative route corridors for the proposed power line. Additionally, two road and cabling layout alternatives were identified. Based on the scoping phase specialist findings the substation assessment area was eliminated as an appropriate area for the proposed substation as most of this site was found to be potentially sensitive by the specialists. As such, two alternative substation sites that cover an area of 3 ha each were proposed to be assessed in the EIA phase. Should the other two PV projects that are being proposed by BioTherm on the same farm also be granted EAs and be awarded preferred bidder status by the DoE the possibility of sharing the substation site to reduce the environmental impact will be considered.

These layout for the proposed PV facility is presented in Figure 5.

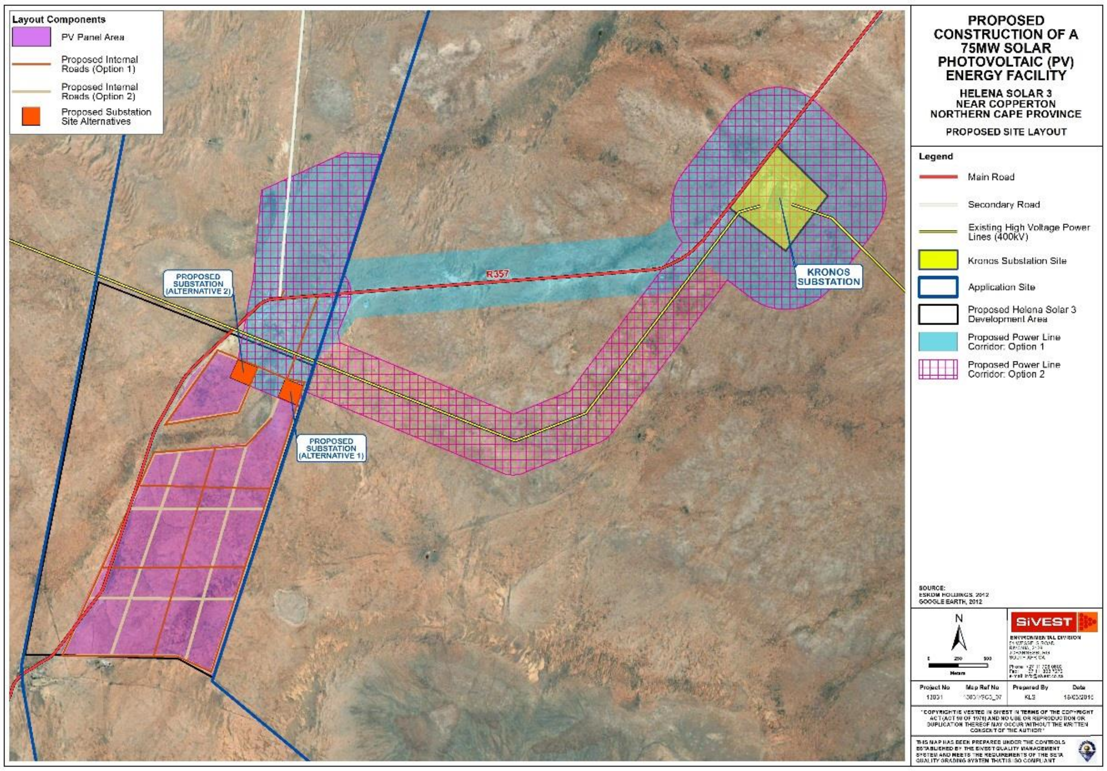

Figure 9: Proposed Layout Alternatives

4 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

4.1 Methodology for Assessing Heritage Site significance

PGS Heritage (PGS) compiled this Heritage Assessment Document as part of the Heritage Impact Assessment (HIA) report for the proposed Helena 3 Solar facilities. The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

4.1.1 *Scoping Phase*

Step I – Literature Review: The background information to the field survey relies greatly on the Heritage Background Research.

4.1.2 *Impact Assessment Phase*

Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by a qualified archaeologist, which aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant archaeological resources, the assessment of resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

Appendix B, outlines the Plan of study for the Heritage Impact Assessment process, while **Appendix C** provides the guidelines for the impact assessment evaluation that was used during the EIA phase of the project.

5 BACKGROUND RESEARCH

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore an Internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

5.1 Previous Studies

Researching the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area listed in chronological order below:

VAN RYNEVELD, K. 2006. Phase 1 Archaeological Impact Assessment - Vogelstruisbult 104, Prieska District, Northern Cape, South Africa. National Museum Bloemfontein

KAPLAN, J.M. 2010. Archaeological Scoping Study and Impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape. Agency for Cultural Resource Management

KAPLAN, J.M. & WILTSHIRE, N. 2011. Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba municipality, Northern Cape. Agency for Cultural Resource Management

ATWELL, M. 2011. Heritage Assessment Proposed Wind Energy Facility And Related Infrastructure, Struisbult: (Farm 103, Portions 4 And 7), Copperton, Prieska, Atwell & Associates

ORTON, JAYSON. 2012a. Heritage Impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town

ORTON, JAYSON. 2012b. Heritage Impact Assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town

ORTON, J & WEBLEY, L. 2013. Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on the Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape

ORTON, J. 2014. Archaeological Mitigation of Later Stone Age Sites on the Remainder of Portion 4 of Klipgats Pan 117, Prieska Magisterial District, Northern Cape. ASHA Consulting (Pty) Ltd

Van der Walt, Jaco. 2012. Archaeological Impact Assessment Report for the proposed Garob Wind Energy Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)

FOURIE, W. 2012. Heritage Impact Assessment for the proposed Eskom Cuprum to Kronos Double Circuit 132kv Power line and Associated Infrastructure, Prieska, Northern Cape.

ALMOND, J.E. 2011. Palaeontological Specialist Assessment: Combined Desktop & Field Assessment Study. Proposed Photovoltaic Energy Plant on Farm Klipgats Pan (Portion 4 of Farm 117) near Copperton, Northern Cape Province

5.1.1 Findings from the studies

Palaeontology

The following map (**Figure 10**) is an extract from the palaeontological desktop study completed by Almond (2012) for the proposed solar project on the farm Klipgatspan, bordering to the study area. The map indicates the main geological units as:

The main geological units mapped within the PV4 study region are:

1. Precambrian (Mid Proterozoic / Mokolian) basement rocks (igneous / metamorphic): Reddish-brown (Mg) = granitic and associated intrusive rocks

2. Late Carboniferous / Early Permian Karoo Supergroup sediments:
   Grey (C-Pd) = Mbizane Formation (Dwyka Group)
3. Early Jurassic dolerite intrusions
   Pink (Jd) = Karoo Dolerite Suite
4. Cretaceous kimberlite intrusions
   Black line (Kk) = kimberlite dykes (not all mapped)
5. Late Caenozoic (Quaternary to Recent) superficial deposits:
   Pale yellow with flying bird symbol = Quaternary to Recent alluvium, pan sediments (N.B. calcrete hardpan extensively present in the subsurface and superficial soils gravels are not mapped at this scale)

Almond (2012), indicated that the, "*poorly-exposed upper Dwyka Group bedrocks in the Klipgats Pan study area do not contain rich trace fossil assemblages, petrified wood or other fossil material, and are therefore of low palaeontological sensitivity. The only fossils recorded from the Dwyka succession here are ice-transported erratic boulders of Precambrian limestone or dolomite that contain small stromatolites (microbial mounds or columns). The study area is largely mantled by Pleistocene to Recent superficial sediments (soils, alluvium, calcretes, gravels etc) that are likewise generally of* ***low palaeontological sensitivity***."

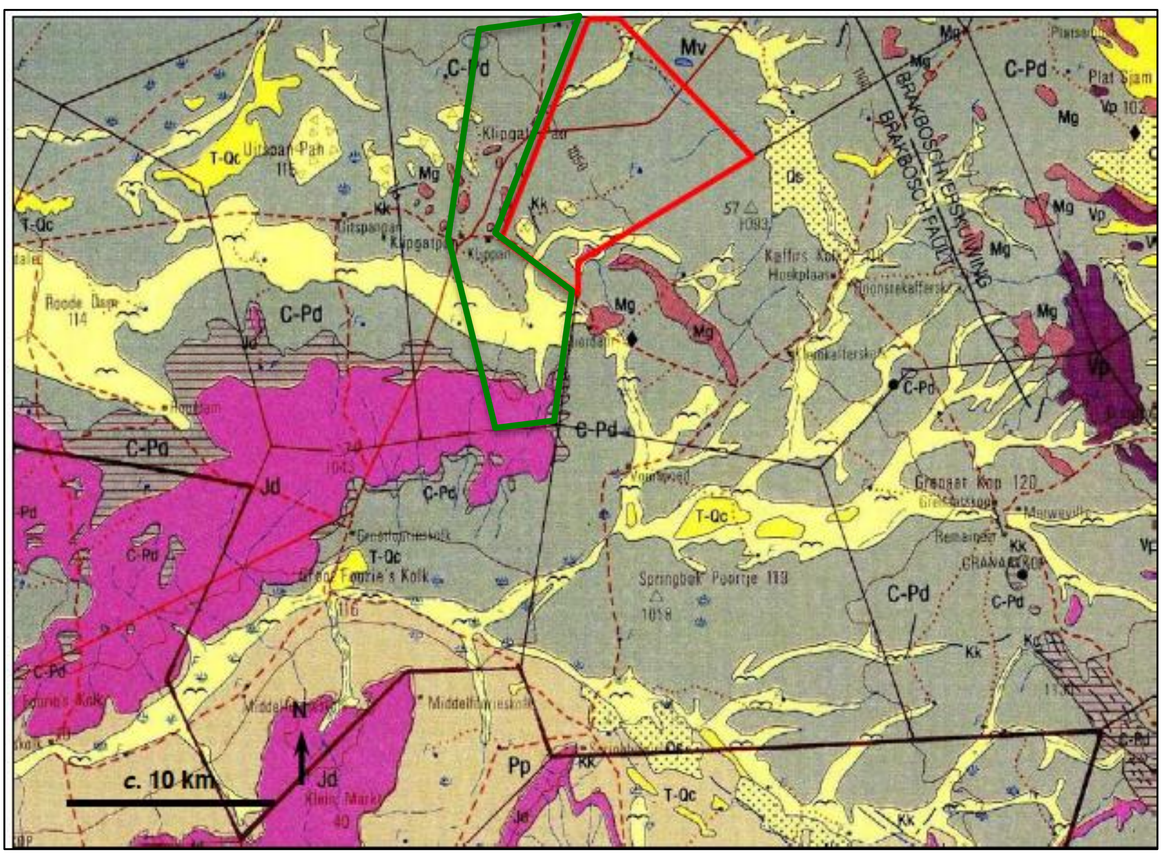

Figure 10 – 1: 250 000 geology sheet 3022 Britstown (Council for Geoscience, Pretoria). The Outline of the current study in green

5.1.2 Archaeology

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003). Evaluation of the alignment has identified possible sensitive areas.

The areas marked in blue and red (Figure 13**)** shows drainage lines and pans in the proposed development areas.

Since Sept 2011 a large number of Heritage and Archaeological Impact Assessments were completed in the vicinity of the proposed development area **(**Figure 13**)**. Most notably the work of Orton (2011, 2012 and 2013), Kaplan (2010) and Kaplan and Wiltshire (2011) and Van der Walt (2012), has confirmed the statement by Parsons (2003), as noted earlier.

Figure 11: Early Stone Age stone tools found close to Kronos substation, just east of the study area

Orton (2012) notes that literature has shown that the Bushmanland area is littered by low density lithic scatters, with well weathered Early (ESA) and Middle Stone Age (MSA) artefacts dominating the assemblages. Orton's (2012 and 2013) and Fourie's (2012) work on the Klipgats Pan and

Hoekplaas, that was done in the closest proximity to the study area has produced numerous find spots as well as clusters of site located on elevated terraces overlooking pan-like areas (identified as the drainage area as indicated in (Figure 13**)**, noted by Orton as being of LSA origin.

Figure 12: Close-up view of quartzite flakes and debitage at Kr_Cu/2012/003 (Debitage and lithics indicate by dots) a site situated some 500 meters to the east of the study area (Fourie, 2013)

Kaplan and Wiltshire's (2011) work to the north of the study area has confirmed the presence of Stone Age Sites with a high local significance rating with the sites at Modderpan and Saaipan covering ESA, MAS and LSA finds. A number of knapping occurrences and find spots were also made during the fieldwork.

5.1.3 Historical structures and history

Some structures (green areas in Figure 13) identified during map analysis was investigated during the fieldwork and found to be watering holes for livestock and of no significance.

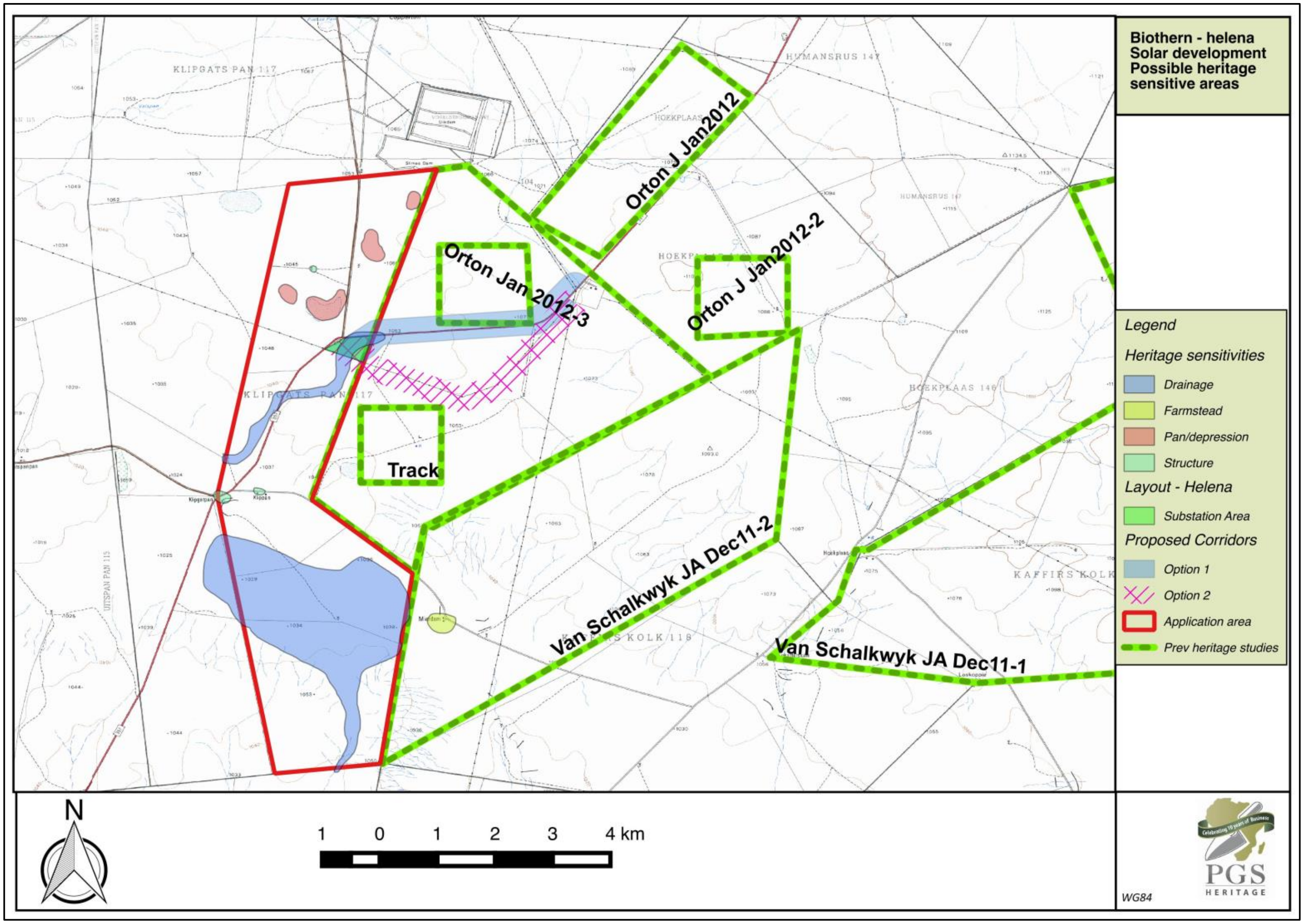

Figure 13 – Possible heritage sensitive areas

5.1.4 Possible finds

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (**Figure 13**). The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 5**.

Table 5: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA, MSA and ESA
Farmsteads	Historical archaeological material

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA.

- Archaeological walk through of the areas where the project will be impacting;
- Palaeontological desktop assessment of the area will not be required based on the findings of other palaeontological studies (Almond, 2011) in the same area, with the

6 IMPACT ASSESSMENT

6.1 Field work findings

6.1.1 Methodology

Fieldwork was conducted on the three proposed PV developments of the Helena Project from 22-24 July 2015. The methodology focused of a tracked walkthrough of the foot print areas of proposed PV projects as well as the two proposed power line corridors from the site to the Kronos substation. An accredited professional archaeologist, Mr Wouter Fourie, completed the fieldwork. All the fieldwork was done on foot and consisted of 60 kilometres of tracked field walking through the proposed development areas.

It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

A total of a 110 find spots were logged of which 13 can be described as archaeological sites.

The numerous Stone Age artefacts (lithics) occurring over the extent of the area, required a refinement of the methodology and the defining of what constitutes an archaeological site as appose to a findspot.

It was decided to use the density of lithics present on the ground to be the guiding rule towards elaborating on a findspot and defining it as an archaeological site. A findspot was classified as and area containing a density of more than 10 lithics per square meter, while a density of or than 20 lithics per square meter was deemed to be the trigger mechanism for converting a findspot to an archaeological site.

6.1.2 Description of area

The study area and surrounds is characterised by low vegetation growth dispersed over fairly flat terrain. Dominating the surface area are vast exposed pebble layers usually associated with low rises in the landscape. Drainage lines and flat surface are characterised by red sand cover in between the exposed pebble layers.

Figure 14 – General view of southern power line corridor

Figure 15 – General landscape of Helena 3

Figure 16 – Characteristic deflation between pebble scatters

Figure 17 – View of northern corridor alignment with the Kronos substation in background

6.1.3 Finds

A total of 93 findspots were marked over the extent of the fieldwork. The findspots were mostly characterised by three types of setting, deflated red sands, and pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The findspots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

All these site have a low significance, however the possibility of sub-surface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

Figure 18 – Heavily weathered ESA material

Figure 19 – MSA lithics (jasper, silcrete and quartzite)

Figure 20 – Backed flake with retouch (jasper)

Figure 21 – Heavily weathered ESA lithics (radial core: top)

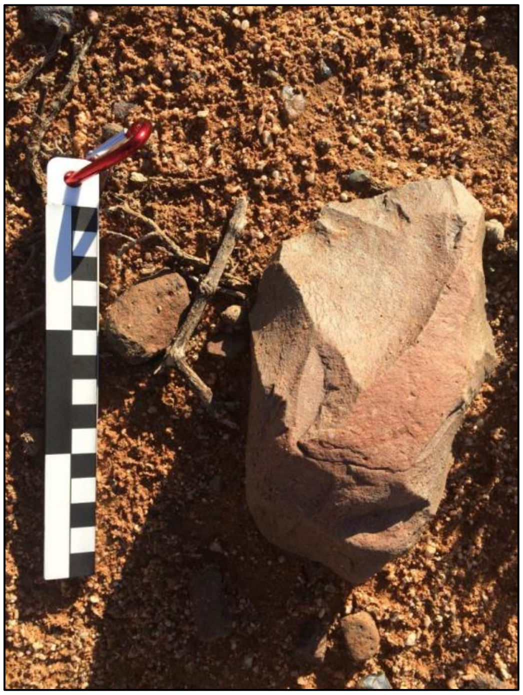

Figure 22 – ESA core with flaking scars (silcrete)

Figure 23 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 24 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 25 – Late ESA lithic (quartzite)

6.1.4 Sites

During the fieldwork 13 archaeological sites were identified (Table 6 **and** Table 7**).** Refer to Appendix D for distribution map

Table 6: Sites – Power line corridor

Site number	**Type**	**Longitude**	**Latitude**	**Description**	**Heritage Significance**	**Alternative**
001-004	MSA site	22.33514	-30.02119	Medium density scatter of ESA and MSA lithics over an area of approximately 20 $m^{2.}$ The site is characterised by a large pebble concentration. The lithics assemblage is characterised by a large number of flakes and chips, while a small percentage of the material on site can be described as cores.	Grade 3C	**Northern Alignment**
014	ESA/MSA site	22.32953	-30.02752	Medium density scatter of heavily weathered (rolled) ESA artefact. The site is characterised by low vegetation growth and a red soil matrix with little or no pebble deposit. Site size is approximately 5 m^2.	Grade 3C	**Northern Alignment**
016	ESA site	22.32890	-30.02798	Medium density scatter of heavily weathered (rolled) ESA artefact. The site is characterised by low vegetation growth and a red soil matrix with little or no pebble deposit. Site size is approximately 10 m^2. Most of the material utilised is coarse-grained quartzite.	Grade 3C	**Northern Alignment**
017	Structure	22.32866	-30.02785	Site is characterised b y a small stone packed pile. No associated artefacts could be seen. The possibility does exist that it could be a Stone Age grave.	Grade 3C	**Northern Alignment**

Site number	Type	Longitude	Latitude	Description	Heritage Significance	Alternative
029	ESA/MSA site	22.30943	-30.02943	The site is situated in a deflated area of approximately 50m^2. The site consists of a medium density scatter of heavily weathered ESA cores and hand axes. A few MSA silcrete cores and flakes also occur in the deflation.	Grade 3C	**Northern Alignment**
032	MSA site	22.30197	-30.03105	The site is situated in a deflated area of approximately 20m2. The site consists of a medium density scatter of MSA silcrete and quartzite cores with a low density of flakes in the deflation.	Grade 3C	**Northern Alignment**
036	MSA site	22.30114	-30.02586	The site is situated in a deflated area of approximately 40m2. The site consists of a medium density scatter of predominantly MSA flakes. Some of the flakes do show traces of usage and retouch.	Grade 3C	**Northern Alignment**
037a and b	MSA site	22.30147	-30.02546	The site is situated in a deflated area of approximately 40m2. The site consists of a medium density scatter of predominantly MSA flakes. Some of the flakes do show traces of usage and retouch.	Grade 3C	**Northern Alignment**
045	MSA site	22.29749,	-30.02695	Site can be described as knapping site, characterised by a large number of flakes and chips as well as large quartzite cores occurring around the site. The site is however small not more than 5m^2.	Grade 3	**Northern Alignment**

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Figure 26 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 27 –Stone structure at site 017

Figure 28 –ESA site 018

Figure 29 – ESA lithics in situ

Figure 30 – Worked material at site 045

Table 7: Sites – Helena 3 Solar footprint

Site number	Type	Longitude	Latitude	Description	Heritage Significance	Alternative
085	MSA site	22.28661	-30.03999	Medium density scatter of MSA and LSA lithics over an area of approximately 20 m2. The lithics assemblage is characterised by a large number of flakes and chips of CCS and quartzite, while a small percentage of the material on site can be described as cores.	Grade 3B	**PV footprint area**
092-093	MSA site	22.29413	-30.04238	Medium density scatter of MSA lithics over an area of approximately 20 m2. The lithics assemblage is characterised by a large number of flakes, blades and some retouch, chips of CCS and quartzite, while a small percentage of the material on site can be described as cores. The rest of the MSA site is characterised by a quartzite outcrop with defined utilisation scaring on it.	Grade 3B	**PV footprint area**
095	Historic	22.28941	-30.04638	Low density scatter of historic artefacts including glass pieces, porcelain, metal objects such as fish cans	Grade 4A	**PV footprint area**
100	Structure	22.28678	-30.04845	A stone cluster occurs in this area. Can possibly be a grave?	Provisional Grade 4 B	**PV footprint area**

Mitigation:

- All four site will require mitigation work before construction can commence;
- The mitigation work will be at a minimum:
  - a controlled surface collection of the material;
  - excavation should be considered at 092-093:
  - analysis of material and final report;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Figure 31 – View of pan at site 085 toward the east

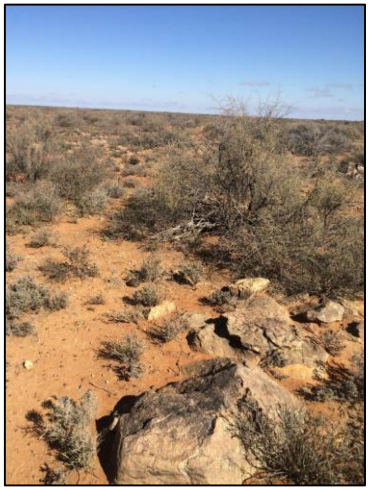

Figure 32 – View of pan at site 093 toward the east

Figure 34 – MSA material associated with the site 085

Figure 35 – View of pan at site 085toward the east

Figure 33 – Historic artefacts present at site 95

Figure 36 – Stone cluster at site 100

6.2 Assessment

The fieldwork findings have shown that the study area is characterised by a background scatter of Stone Age artefact. The methodology utilised in the identification and classification of finds between find spots and sites enable a clear distinction between groupings.

It must be kept in mind that the fieldwork could in no way identify all archaeological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering other Stone Age archaeological site is extremely high.

The following set of tables provide an assessment of the impact on heritage resources within the development foot print

Table 8: Rating of impacts – Chance finds

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified heritage resources and specifically Stone Age archaeological sites. As well as the impact on the identified archaeological sites*
Extent	*Will impact on the footprint area of the development*
Probability	*The fieldwork has shown that such a predicted impact will definitely occur*
Reversibility	*Due to the nature of archaeological sites the impact is seen as irreversible, however mitigation could enable the collection of enough information to preserve the data from such a site*
Irreplaceable loss of resources	*The development could lead to significant losses in unidentified and unmitigated site*
Duration	*The impact on heritage resources such as archaeological sites will be permanent*
Cumulative effect	*As the type of development impact on a large area, and other similar development in the area will also impact on archaeological sites the cumulative impact is seen as having a medium negative impact.*

Intensity/magnitude	*The large scale impact on archaeological sites and will require mitigation work.*	
Significance Rating	*The overall significance rating for the impact on heritage resources is seen as high pre-mitigation. This can be attributed to the very definite possibility of encountering more archaeological sites as shown through fieldwork. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-51 (high negative)	-24 (low negative)
Mitigation measures	*Monitoring during construction by and archaeologist* *Mitigation through archaeological excavations and collection* *Walkdown of final power line route*	

6.3 Cumulative Assessment

A large number of solar projects are proposed and some have been approved and is currently in construction around the study area. Section 4 identified finds and conclusions made by other HIA's from other project that has shown the vast distribution of Stone Age sites over the larger area around Copperton. Although some studies has proposed mitigation work only one report on mitigation work (Orton, 2014) for the Mulilo Prieska PV (Pty) Ltd development just east of the study area, has been completed at this stage.

The need for the implementation of the recommended mitigation measures is of great importance and must be seen in the context of the large areas to be impacted by the construction activity. By implementing the mitigation measures the cumulative effect will be reduce from a Medium to a Low negative impact rating.

6.4 Impact Summary

Table 9 provides a summary of the projected impact rating for this project on heritage resources.

Table 9: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	51		24	
			High Negative Impact		Low Negative Impact

6.5 Comparative Assessment for Helena Solar 3

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Substation Site Alternative 1	NO PREFERENCE	No heritage resources identified
Substation Site Alternative 2	NO PREFERENCE	No heritage resources identified
INTERNAL ROADS		
Internal Road Alternative 1	NO PREFERENCE	Some heritage resources identified close by
Internal Road Alternative 2	NO PREFERENCE	No resources identified in close vicinity
POWER LINES		
Power Line Corridor Alternative 1	FAVOURABLE	More heritage sites identified in this corridor
Power Line Corridor Alternative 2	PREFERRED	Less heritage sites identified in this corridor

7 MANAGEMENT GUIDELINE

7.1 Heritage Management Plan for EMP implementation

No.	Mitigation Measures	Phase	Timeframe	Responsible Party For Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)	Cost
A	Include section on possible heritage finds in induction prior to construction activities take place – Refer to Section 9 of this report	Planning /Pre-Construction	Prior to construction	Applicant ECO Heritage Specialist	ECO (Monthly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	No legal directives Legal compliance audit scores (Legal register) (ECO Monthly Checklist/Report)	**R5 000**
B	Implement chance find procedures in case where possible heritage finds area made	Construction	During construction	Applicant ECO Heritage Specialist	ECO (weekly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35and 38 of NHRA	ECO Monthly Checklist/Report	**Possibly R10 000**
C	Implement walk down of final alignment on power line alignment	Pre-Construction	Pre-Construction	Applicant ECO Heritage Specialist	Once off	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	Completion and development of mitigation measures	**R30 000**

No.	Mitigation Measures	Phase	Timeframe	Responsible Party For Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)	Cost
D	Monitoring of construction activities by archaeologist	Construction	During constructio n	Applicant ECO Archaeologist	Archaeologist (weekly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	Archaeologist Monthly Checklist/Report	**Monthly R40-50 000**
E	Implement mitigation for identified sites	Pre-construction	Pre-Constructio n	Applicant ECO Archaeologist	Once off	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	Completion of mitigation measures and obtain destruction permit	**Approximate ly R300 000**

8 HERITAGE MANAGEMENT GUIDELINES

8.1 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
   - (a) the construction of a road, wall, transmission 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 50m in length;
   - (c) any development or other activity which will change the character of a site-
     - (i) exceeding 5 000 m^2 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 m^2 in extent; or
   - (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

   This survey and evaluation must include:
   - (a) The identification and mapping of all heritage resources in the area affected;
   - (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;
   - (c) An assessment of the impact of the development on such heritage resources;
   - (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   - (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:

   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

   Possible finds include:

   a. Open air Stone Age scatters, disturbed during vegetation clearing. This will include stone tools.
   b. Palaeontological deposits such as bone, and teeth in fluvial riverbank deposits.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
7. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
9. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

Table 10: Roles and responsibilities of archaeological and heritage management when heritage resources are discovered during operations

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites, when discovered.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into the employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites (when discovered). The client with the specialist needs to agree on the scope and activities to be performed	The client	Environmental Consultancy and the Archaeologist
When a specialist/archaeologist has been appointed for mitigation work on discovered heritage resources, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

8.2 All phases of the project

8.2.1 Archaeology

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the prospecting phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological monitoring programme.

In the case where archaeological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological material, a buffer of at least 20 meters should be implemented.
- If archaeological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the material permit must be applied for from SAHRA under Section 35 of the NHRA.

8.2.2 Graves

In the case where a grave is identified during construction the following measures must be taken:

- Upon the accidental discovery of graves, a buffer of at least 50 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA (Section 36 of the NHRA) and other relevant authorities (National Health Act and its regulations). The local South African Police Services must immediately be notified of the find.
- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation;
iii. Newspaper notices indicating the intent of the relocation;
iv. A permit from the local authority;
v. A permit from the Provincial Department of Health;
vi. A permit from the South African Heritage Resources Agency, if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. The whole process must be done by a reputable company that is well versed in relocations;
ix. The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

9 CONCLUSIONS AND RECOMMENDATIONS

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the proposed Helena Solar projects may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (**Figure 13**). The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 5**.

Table 11: Landform to heritage matrix

LAND FROM TYPE	**HERITAGE TYPE**
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

A total of a 110 find spots were logged of which 13 (9 in proposed power line corridors and 4 in Helena 3 footprint area) can be described as archaeological sites.

9.1 Find spots

A total of 110 findspots were marked over the extent of the fieldwork. The findspots were mostly characterised by three types of setting, deflated red sands, and exposed pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The findspots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

All these site have a low significance, however the possibility of subsurface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

9.2 Sites

During the fieldwork 13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as medium to low local heritage significance. Al the sites will require mitigation prior to construction.

Power line sites - *Mitigation:*

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

PV footprint - *Mitigation:*

- All four site will require mitigation work before construction can commence
- The mitigation work will be at a minimum:
    - a controlled surface collection of the material,
    - excavation should be considered at 092-093
    - analysis of material and final report;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

9.3 Impact Summary

Table 12 provides a summary of the projected impact rating for this project on heritage resources.

Table 12: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	51		24	
			High Negative Impact		Low Negative Impact

9.4 Comparative Assessment for Helena Solar 3

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Substation Site Alternative 1	NO PREFERENCE	No heritage resources identified
Substation Site Alternative 2	NO PREFERENCE	No heritage resources identified
INTERNAL ROADS		
Internal Road Alternative 1	FAVOURABLE	Some heritage resources identified close by
Internal Road Alternative 2	NO PREFERENCE	No resources identified in close vicinity
POWER LINES		
Power Line Corridor Alternative 1	FAVOURABLE	More heritage sites identified in this corridor
Power Line Corridor Alternative 2	PREFERRED	Less heritage sites identified in this corridor

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Appendix A

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the new legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources are integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the developer's cost. Thus, developers will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection, to all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix C

Heritage Assessment Methodology

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report compiled by PGS Heritage (PGS) for the proposed Helena 3 Solar projects will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consists of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by qualified archaeologists, aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
  - Density of scatter (dispersed scatter)
    - Low - $<10/50m^2$
    - Medium - $10\text{-}50/50m^2$
    - High - $>50/50m^2$
- **uniqueness** and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate pylon position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 13: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	Grade 4C	Low Significance	Destruction

Appendix C

Impact Assessment Methodology to be utilised during EIA phase

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

10.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 3.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

10.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

10.2.1 Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.

4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.

2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive

		effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report.

IMPACT TABLE FORMAT		
Environmental Parameter	*A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water*	
Issue/Impact/Environmental Effect/Nature	*A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water*	
Extent	*A brief description of the area over which the impact will be expressed*	
Probability	*A brief description indicating the chances of the impact occurring*	
Reversibility	*A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity*	
Irreplaceable loss of resources	*A brief description of the degree in which irreplaceable resources are likely to be lost*	
Duration	*A brief description of the amount of time the proposed activity is likely to take to its completion*	
Cumulative effect	*A brief description of whether the impact will be exacerbated as a result of the proposed activity*	
Intensity/magnitude	*A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily*	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	*Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures*	

	have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMP.

Table 14: Rating of impacts

10.3 Impact Summary

The impacts will then be summarized and a comparison made between pre and post mitigation phases as shown in Table 4 below. The rating of environmental issues associated with different parameters prior to and post mitigation of a proposed activity will be averaged. A comparison will then be made to determine the effectiveness of the proposed mitigation measures. The comparison will identify critical issues related to the environmental parameters.

The table below is to be represented in the Executive Summary of the report.

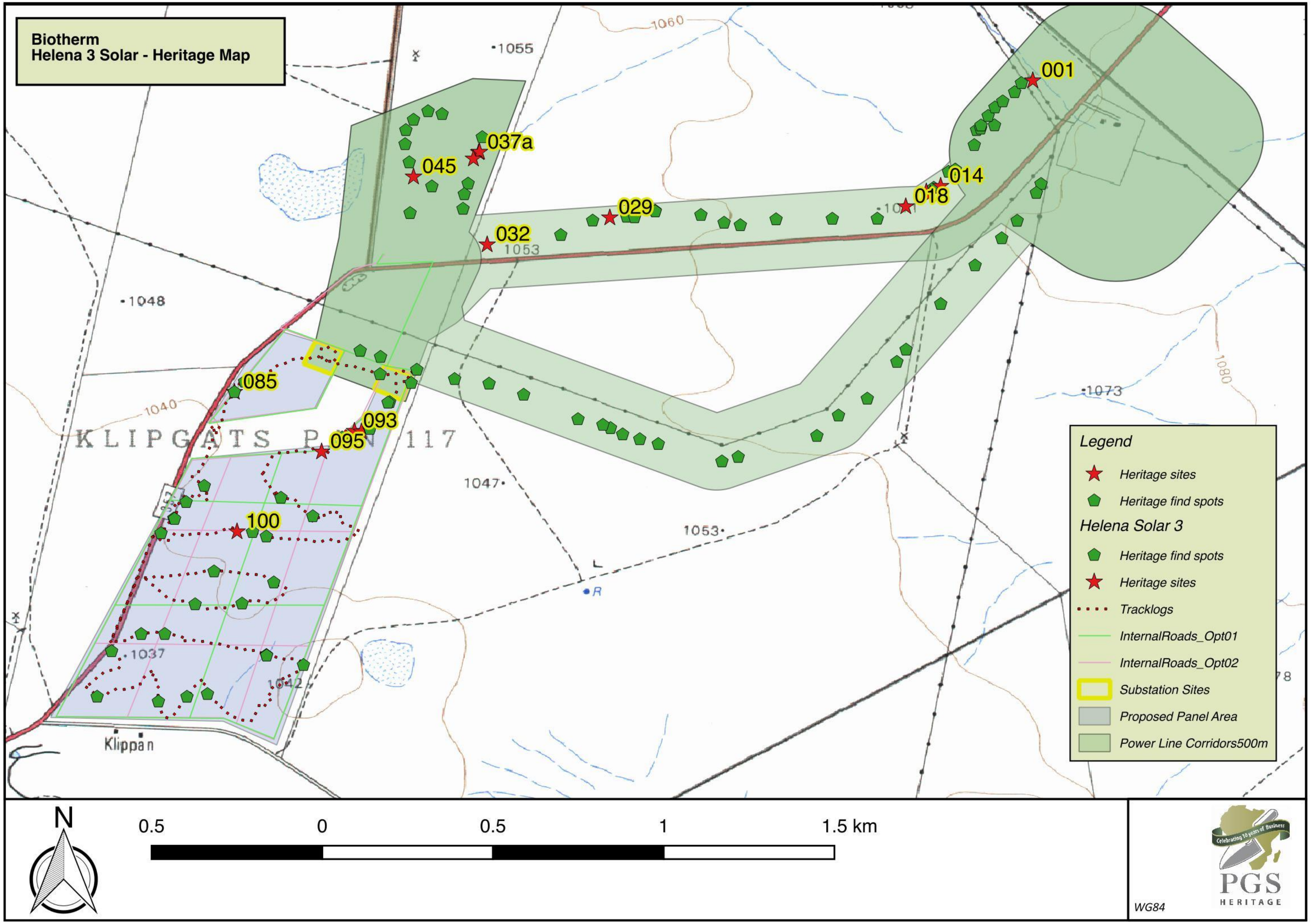
Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Surface water	Erosion	43		16	
	Oil spills	22		22	
	Alteration of aquatic biota	16		3	
			- 0,0		**-0,0**
			Low Negative Impact		Low Negative Impact

Table 15: Comparison of summarised impacts on environmental parameters

Finally, the 2010 regulations also specify that alternatives must be compared in terms of impact assessment. Hence all alternatives will need to be comparatively assessed.

Appendix D

Heritage Maps


Biotherm
Helena 3 Solar - Heritage Map
001
014
018
029
032
037a
045
085
093
095
100
KLIPGATS PAN 117
Klippan
Legend
Heritage sites
Heritage find spots
Helena Solar 3
Heritage find spots
Heritage sites
Tracklogs
InternalRoads_Opt01
InternalRoads_Opt02
Substation Sites
Proposed Panel Area
Power Line Corridors500m
N
0.5
0
0.5
1
1.5 km
WG84
PGS
HERITAGE