
HERITAGE IMPACT ASSESSMENT REPORT

BASIC ASSESSMENT PHASE

Proposed establishment of the Tutwa Solar Energy Facility located West of Upington on a Portion 4 of the Farm Narries 7, Northern Cape Province.

Prepared By:



Credit Sheet

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Disclaimer; Although all possible care is taken to identify all sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. G&A Heritage and its personnel will not be held liable for such oversights or for costs incurred as a result of such oversights.

Statement of Independence

As the duly appointed representative of G&A Heritage, I Stephan Gaigher, hereby confirm my independence as a specialist and declare that neither I nor G&A Heritage have any interests, be it business or otherwise, in any proposed activity, application or appeal in respect of which the Environmental Consultant was appointed as Environmental Assessment Practitioner, other than fair remuneration for work performed on this project.

Signed off by S. Gaigher

A handwritten signature in black ink, appearing to read 'S. Gaigher', with a stylized flourish at the end.

Site name and location: Proposed establishment of the Tutwa Solar Energy Facility, on Portion 4 of the Farm Narries 7, located west of Upington, Northern Cape Province.

Municipal Area: Kai Garib District Municipality.

Developer: Flint Ridge Trading (PTY) Ltd

Consultant: G&A Heritage, PO Box 522, Louis Trichardt, 0920, South Africa. 38A Voster Str. Louis Trichardt, 0920

Date of Report: 07 May 2012

Management Summary

The purpose of the management summary is to distil the information contained in the report into a format that can be used to give specific results quickly and facilitate management decisions. It is not the purpose of the management summary to repeat in shortened format all the information contained in the report, but rather to give a statement of results for decision making purposes.

This study focuses on the development of the Tutwa Solar Energy Facility. This will entail the construction of a 10MW solar generation plant as well as a power line for grid integration.

This study forms part of the Basic Assessment (BA) phase of the environmental management process and is described as a First Phase Heritage Impact Assessment.

The purpose of this phase of the study is to determine the possible occurrence of sites with cultural heritage significance within the study area and the evaluation of the heritage significance of these sites as well as the possible impacts on such sites by the proposed developments.

Findings

Quartzite artefacts associated with the Stone Age were identified on the site. These do however not constitute an occupational or manufacturing site due to the lack of flakes and cores.

Recommendations

No site specific recommendations are necessary.

Fatal Flaws

No fatal flaws were identified.

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| Figure 5. Quartzite Stone Tools | Error! Bookmark not defined. |

List of Abbreviations

| | |
|--------|---|
| Bp | Before Present |
| EIA | Early Iron Age |
| ESA | Early Stone Age |
| GPS | Geographic Positioning System |
| HIA | Heritage Impact Assessment |
| LIA | Late Iron Age |
| LSA | Late Stone Age |
| MYA | Million Years Ago |
| MSA | Middle Stone Age |
| NHRA | National Heritage Resources Act no 22 of 1999 |
| SAHRA | South African Heritage Resource Agency |
| S&EIR | Scoping & Environmental Impact Reporting |
| WGS 84 | World Geodetic System for 1984 |

Heritage Impact Assessment Report for the Proposed Tutwa Solar Energy Project

Introduction

Legislation and methodology

G&A Heritage was appointed by Savannah Environmental cc to undertake a heritage impact assessment for the proposed Tutwa Solar Energy Project. Section 27(1) of the South African Heritage Resources Act (25 of 1999) requires that a heritage study is undertaken for:

- (a) construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- (b) construction of a bridge or similar structure exceeding 50 m in length; and
- (c) any development, or other activity which will change the character of an area of land, or water –
 - (1) exceeding 10 000 m² in extent;
 - (2) involving three or more existing erven or subdivisions thereof; or
 - (3) involving three or more erven, or subdivisions thereof, which have been consolidated within the past five years; or
 - (d) the costs of which will exceed a sum set in terms of regulations; or
 - (e) any other category of development provided for in regulations.

A heritage impact assessment is not limited to archaeological artefacts, historical buildings and graves. It is far more encompassing and includes intangible and invisible resources such as places, oral traditions and rituals. A heritage resource is defined as any place or object of cultural significance i.e. of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This includes the following:

- (a) places, buildings, structures and equipment;
- (b) places to which oral traditions are attached or which are associated with living heritage;
- (c) historical settlements and townscapes;
- (d) landscapes and natural features;
- (e) geological sites of scientific or cultural importance;
- (f) archaeological and paleontological sites;
- (g) graves and burial grounds, including –
 - (1) ancestral graves,
 - (2) royal graves and graves of traditional leaders,
 - (3) graves of victims of conflict (iv) graves of important individuals,
 - (4) historical graves and cemeteries older than 60 years, and
 - (5) other human remains which are not covered under the Human Tissues Act, 1983 (Act No.65 of 1983 as amended);
- (h) movable objects, including ;
 - (1) objects recovered from the soil or waters of South Africa including archaeological and paleontological objects and material, meteorites and rare geological specimens;
 - (2) ethnographic art and objects;
 - (3) military objects;
 - (4) objects of decorative art;
 - (5) objects of fine art;
 - (6) objects of scientific or technological interest;
 - (7) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings; and
 - (8) any other prescribed categories, but excluding any object made by a living person;
- (i) battlefields;
- (j) traditional building techniques.

A **'place'** is defined as:

- (a) A site, area or region;

(b) A building or other structure (which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure);
(c) a group of buildings or other structures (which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures); and
(d) an open space, including a public square, street or park; and in relation to the management of a place, includes the immediate surroundings of a place.

'Structures' means any building, works, device, or other facility made by people and which is fixed to land and any fixtures, fittings and equipment associated therewith older than 60 years.

'Archaeological' means:

(a) material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
(b) rock art, being a 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 is older than 100 years including any area within 10 m of such representation; and
(c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land or in the maritime cultural zone referred to in section 5 of the Maritime Zones Act 1994 (Act 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which are older than 60 years or which in terms of national legislation are considered to be worthy of conservation;
(d) features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

'Paleontological' means 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.

'Grave' means a place of interment and includes the contents, headstone or other marker of and any other structures on or associated with such place. The South African Heritage Resources Agency (SAHRA) will only issue a permit for the alteration of a grave if it is satisfied that every reasonable effort has been made to contact and obtain permission from the families concerned.

The removal of graves is subject to the following procedures as outlined by the SAHRA:

- Notification of the impending removals (using English, Afrikaans and local language media and notices at the grave site);
- Consultation with individuals or communities related or known to the deceased;
- Satisfactory arrangements for the curation of human remains and / or headstones in a museum, where applicable;
- Procurement of a permit from the SAHRA;
- Appropriate arrangements for the exhumation (preferably by a suitably trained archaeologist) and re-interment (sometimes by a registered undertaker, in a formally proclaimed cemetery);
- Observation of rituals or ceremonies required by the families.

The limitations and assumptions associated with this scoping study are as follows;

- Sites were evaluated by means of description of the cultural landscape and analysis of written sources and available databases.
- It was assumed that the power line and solar facility alignment/placement as provided by Savannah Environmental cc is accurate and that the power line alignment could still be changed during a walk-down phase.
- We assumed that the public participation process performed as part of the Scoping and Environmental Impact Reporting (S&EIR) process will be sufficiently encompassing not to be repeated in the Heritage Scoping Phase.

Table 1. Impacts on the NHRA Sections

| Act | Section | Description | Possible Impact | Action |
|--|---------|--|-----------------|--------|
| National Heritage Resources Act (NHRA) | 34 | Preservation of buildings older than 60 years | No impact | None |
| | 35 | Archaeological, paleontological and meteor sites | Possible Impact | HIA |
| | 36 | Graves and burial sites | No Impact | HIA |
| | 37 | Protection of public monuments | No impact | None |
| | 38 | Does activity trigger a HIA? | Yes | HIA |

Table 2. NHRA Triggers

| Action Trigger | Yes/No | Description |
|--|--------|---|
| Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length. | Yes | Various distribution power lines and access roads |
| Construction of a bridge or similar structure exceeding 50m in length. | No | N/A |
| Development exceeding 5000 m ² | Yes | Tutwa Solar Energy Facility |
| Development involving more than 3 erven or sub divisions | No | N/A |
| Development involving more than 3 erven or sub divisions that have been consolidated in the past 5 years | No | N/A |
| Re-zoning of site exceeding 10 000 m ² | No | N/A |
| Any other development category, public open space, squares, parks or recreational grounds | No | N/A |

Background Information Proposed Tutwa Solar Facility

Project Description

An independent power developer of concentrating solar power plants is in the process of investigating the possible establishment of the Tutwa Solar Facility, using concentrating solar generation technology, on a site located on the Portion 4 of the Farm Narries 7 in the Kai Garib Municipality in the Northern Cape.

The electricity that will potentially be generated by these dishes will be distributed from the site and integrated with the existing power infrastructure through the construction of new 132 kV lines that will connect to the existing Sub-station located approximately 7.5km west of the proposed solar site.

This project is located in the Northern Cape

The site under investigation is around 20ha in size.

Site Location

The proposed sites are located in an area approximately 80km west of the town of Kakamas just south of the Augrabies National Park in the Northern Cape Province. The following farm sections might be affected

- Portion 4 of the Farm Narries 7

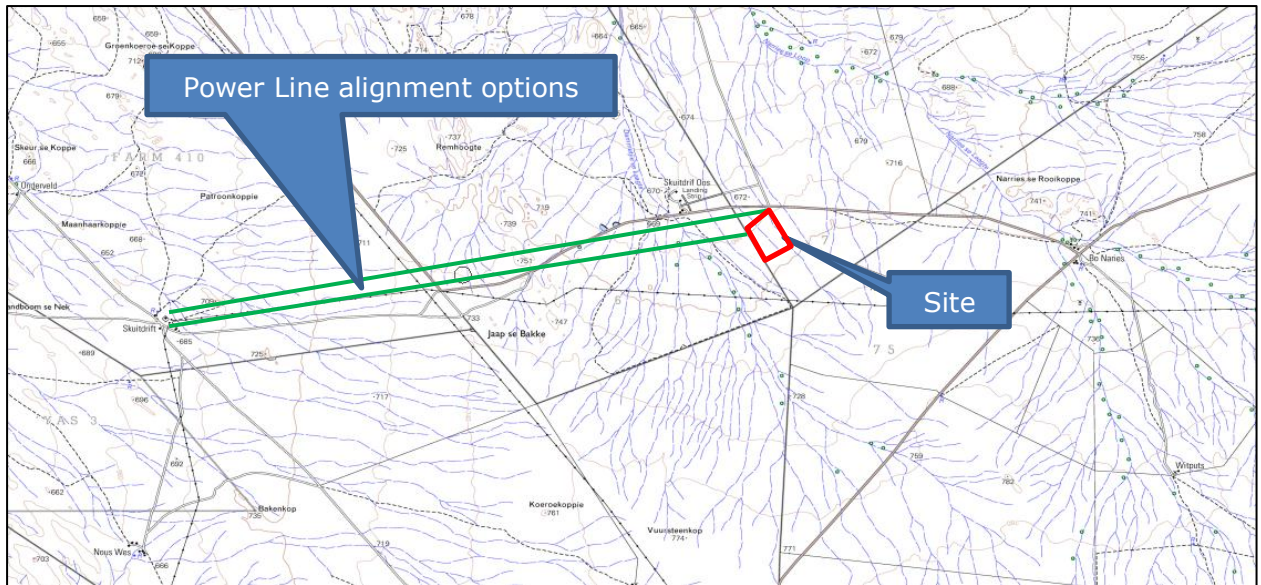


Figure 1. Proposed Tutwa Solar Plant Location

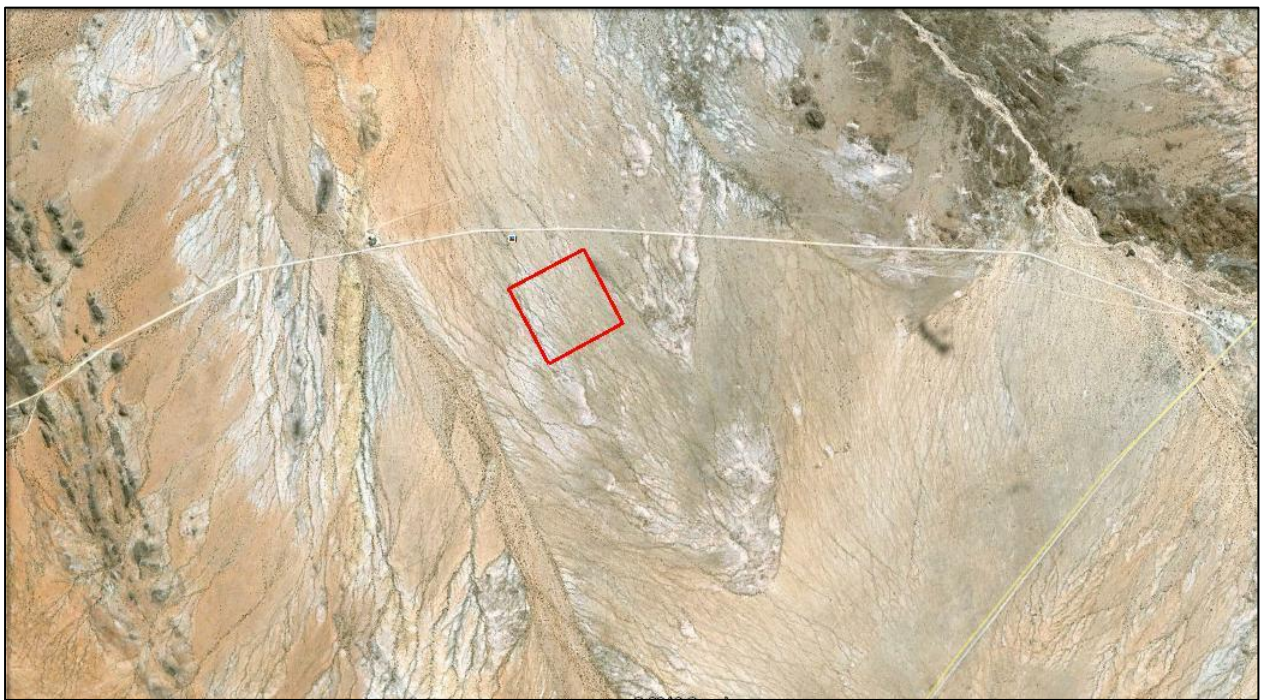


Figure 2. Aerial view of the proposed site at Tutwa Solar Park



Figure 3. General Landscape

Alternatives Considered.

No alternatives were considered.

Methodology

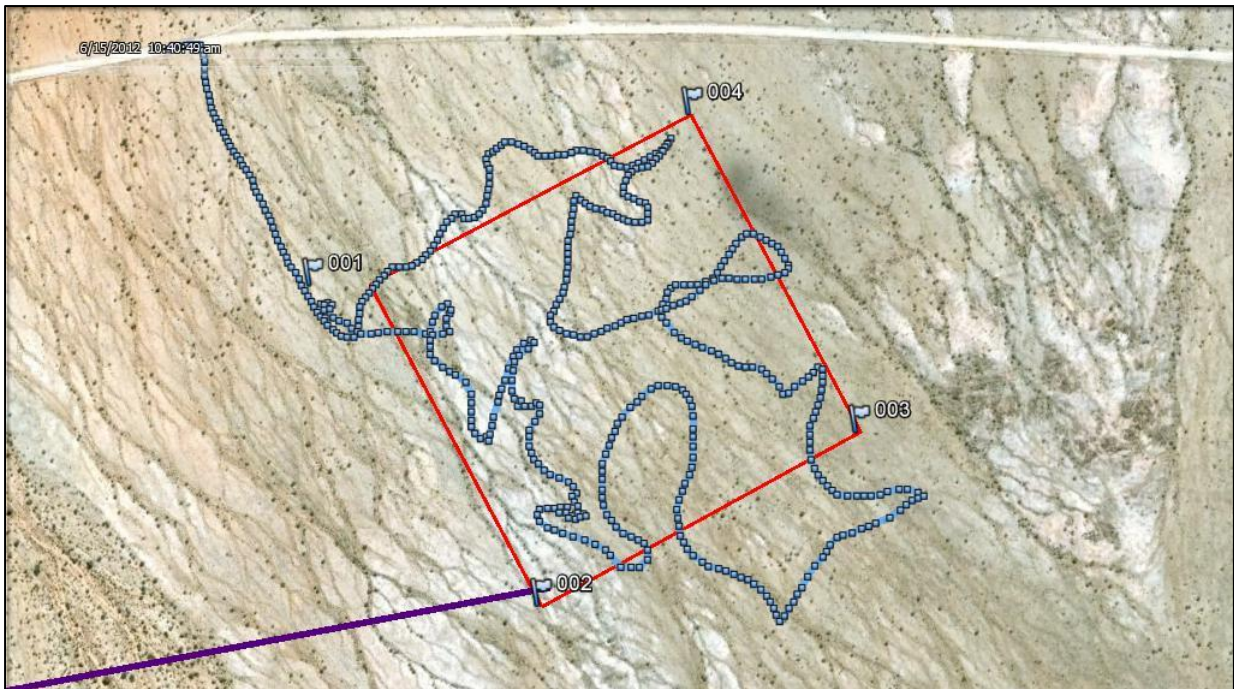
This study defines the heritage component of the Basic Assessment process being undertaken for the Proposed Tutwa Solar Energy Project. It is described as a Heritage Impact Assessment. This report attempts to evaluate the accumulated heritage knowledge of the area as well as the heritage sensitivity of proposed development areas.

Evaluating Heritage Impacts

This Heritage Impact Assessment (HIA) relies on the analysis of written documents, maps, aerial photographs and other archival sources combined with the results of site investigations and interviews with effected people. Site investigations are not exhaustive and often focus on areas such as river confluence areas, elevated sites or occupational ruins.

The following documents were consulted in this study;

- South African National Archive Documents
- SAHRA Database of Heritage Studies
- Upington Museum Information
- Internet Search
- Historic Maps
- 1936 and 1952 Surveyor General Topographic Map series
- 1952 1:10 000 aerial photo survey
- Google Earth 2011 & 2003 imagery
- Published articles and books



GPS Tracks of field survey

Assessing Visual Impact

Visual impacts of developments result when sites that are culturally celebrated are visually affected by a development. The exact parameters for the determination of visual impacts have not yet been rigidly defined and are still mostly open to interpretation. CNdV and DEAP (2006) have developed some guidelines for the management of the visual impacts of wind turbines in the Western Cape, although these have not yet been formalized. In these guidelines they recommend a buffer zone of 1km around significant heritage sites to minimize the visual impact.

Similar studies have determined that power lines 132 kV and above are visible but not intrusive in daylight from 5km away. Power lines are however not seen as intrusive until they are 450m or closer to the observer. This aspect will vary especially in cases of cultural landscapes rather than cultural sites. In the case of cultural landscapes the sense of thoroughfare created by the power lines can be seen as detrimental to the landscape character and can significantly influence the "sense of place". The solar generation plant itself, due to its high levels of reflectivity could be visually intrusive to larger distances.



Figure 4. Solar Plant design

Assumptions and Restrictions

- It is assumed that the SAHRA database locations are correct
- It is assumed that the social impact assessment and public participation process of the Basic Assessment phase will result in the identification of any intangible sites of heritage potential.
- It is assumed that the visual impact assessment performed as part of the BA phase will be encompassing enough not to be repeated in the HIA.

Heritage Indicators within the Receiving Environment Regional Cultural Context

Stone Age

This area is home to all three of the known phases of the Stone Age, namely: the Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are less common in this area, however rock-art sites and Late Stone Age sites are much better known.

During the Middle Stone Age, 200 000 years ago, modern man or Homo sapiens emerged, manufacturing a wider range of tools, with technologies more advanced than those from earlier periods. This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time.

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and Khoi Khoi. Stone Age hunter-gatherers lived well into the 19th century in some places in SA. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past decades especially associated with the town of Upington.

A limited number of Rock-Art sites are located in this area, mostly due to the lack of suitable shelter sites.

The Historic Era

Evidence of hunter-gatherers and herders is dotted all over Namaqualand along the Gariep River, along the coast, in caves and on the rocky outcrops. The descendants of the herder people are still living in Namaqualand today, although having lost a great deal of their original culture and traditions. During colonial times, in the 1700's, the Europeans moved in and settled as stock farmers. Technology became part of the Namaqualand cultural landscape in the form of copper and diamond mining.

The main formally defined cultural landscape type to be identified in the surrounding areas is the Richtersveld Cultural and Botanical Landscape World Heritage Site. Although this site falls outside of the buffer zone for this area, it is still prudent to list it here.

The extensive communal grazed lands of the Richtersveld Cultural and Botanical Landscape are a testimony to land management processes which have ensured the protection of the succulent Karoo vegetation and thus demonstrates a harmonious interaction between people and nature. Furthermore, the seasonal migrations of grazers between stock posts with traditional demountable mat-roofed houses, reflect a practice that was once much more widespread over Southern Africa, and which has persisted for at least two millennia; the Nama are now its last practitioners.

The cultural landscape comprises all the elements linked to the transhumance lifestyle of the Nama pastoralists. The authenticity of the grazing areas and stock posts is incontrovertible. The authenticity of the traditional domed houses is mainly intact, despite the incorporation of some new materials along with the finely braided traditional mats. There are increasing numbers of young people interested in continuing the traditions. The following landscape types could possibly be present in the study areas.

The Richtersveld Cultural and Botanical Landscape have full legal protection. The process of declaring the property as a Heritage Area was completed in early 2007. The traditional land-use system of the Nama should be seen as part of the protection system. A buffer zone has been established. The two key areas for conservation measures are sustaining the grazing areas and sustaining the tradition of building portable mat-roofed houses. The Richtersveld Community Conservancy (RCC) is managed by a Communal Property Association (CPA) with a Management Committee (company without profit) and a participative Management Plan is in place to manage the identified Heritage Area. The Management Plan, addresses management structures, infrastructure development, awareness raising, tourism development and monitoring and evaluation. It should provide support to the traditional management system rather than replacing it.

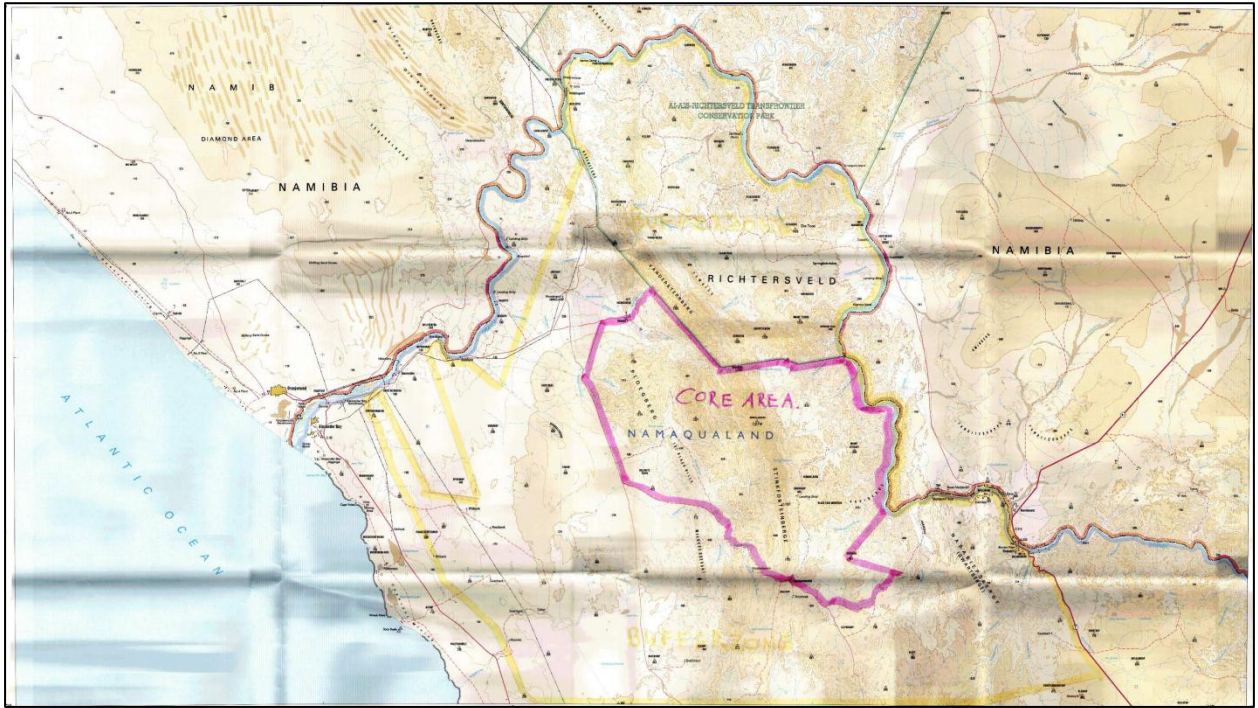


Figure 6. Showing the Richtersveld WHS and Buffer Zone

Cultural Landscape

The following landscape types could possibly be present in the study areas.

| Landscape Type | Description | Occurrence still possible? | Likely occurrence? |
|------------------------------|--|----------------------------|--------------------|
| 1 Paleontological | Mostly fossil remains. Remains include microbial fossils such as found in Baberton Greenstones | Yes, sub-surface | Unlikely |
| 2 Archaeological | Evidence of human occupation associated with the following phases – Early-, Middle-, Late Stone Age, Early-, Late Iron Age, Pre-Contact Sites, Post-Contact Sites | Yes | Unlikely |
| 3 Historic Built Environment | <ul style="list-style-type: none"> - Historical townscapes/streetscapes - Historical structures; i.e. older than 60 years - Formal public spaces - Formally declared urban conservation areas - Places associated with social identity/displacement | No | No |
| 4 Historic Farmland | These possess distinctive patterns of settlement and historical features such as: <ul style="list-style-type: none"> - Historical farm yards - Historical farm workers villages/settlements - Irrigation furrows - Tree alignments and groupings - Historical routes and pathways - Distinctive types of planting - Distinctive architecture of cultivation e.g. planting blocks, trellising, terracing, ornamental planting. | No | No |
| 5 Historic rural | <ul style="list-style-type: none"> - Historic mission settlements | No | No |

| | | | |
|----------------------------------|--|------|----------|
| town | <ul style="list-style-type: none"> - Historic townscapes | | |
| 6 Pristine natural landscape | <ul style="list-style-type: none"> - Historical patterns of access to a natural amenity - Formally proclaimed nature reserves - Evidence of pre-colonial occupation - Scenic resources, e.g. view corridors, viewing sites, visual edges, visual linkages - Historical structures/settlements older than 60 years - Pre-colonial or historical burial sites - Geological sites of cultural significance. | Yes | Unlikely |
| 7 Relic Landscape | <ul style="list-style-type: none"> - Past farming settlements - Past industrial sites - Places of isolation related to attitudes to medical treatment - Battle sites - Sites of displacement, | No | No |
| 8 Burial grounds and grave sites | <ul style="list-style-type: none"> - Pre-colonial burials (marked or unmarked, known or unknown) - Historical graves (marked or unmarked, known or unknown) - Graves of victims of conflict - Human remains (older than 100 years) - Associated burial goods (older than 100 years) - Burial architecture (older than 60 years) | Yes, | Unlikely |
| 9 Associated Landscapes | <ul style="list-style-type: none"> - Sites associated with living heritage e.g. initiation sites, harvesting of natural resources for traditional medicinal purposes - Sites associated with displacement & contestation - Sites of political conflict/struggle - Sites associated with an historic event/person - Sites associated with public memory | No | No |
| 10 Historical Farmyard | <ul style="list-style-type: none"> - Setting of the yard and its context - Composition of structures - Historical/architectural value of individual structures - Tree alignments - Views to and from - Axial relationships - System of enclosure, e.g. defining walls - Systems of water reticulation and irrigation, e.g. furrows - Sites associated with slavery and farm labour - Colonial period archaeology | No | No |
| 11 Historic institutions | <ul style="list-style-type: none"> - Historical prisons - Hospital sites - Historical school/reformatory sites - Military bases | No | No |
| 12 Scenic visual | <ul style="list-style-type: none"> - Scenic routes | No | No |
| 13 Amenity | <ul style="list-style-type: none"> - View sheds | No | No |

| | | | |
|-----------|---|--|--|
| landscape | <ul style="list-style-type: none"> - View points - Views to and from - Gateway conditions - Distinctive representative landscape conditions - Scenic corridors | | |
|-----------|---|--|--|

Impacts Anticipated

In 2003 the SAHRA compiled the following guidelines to evaluate the cultural significance of individual heritage resources:

TYPE OF RESOURCE

- Place
- Archaeological Site
- Structure
- Grave
- Paleontological Feature
- Geological Feature

TYPE OF SIGNIFICANCE

1. HISTORIC VALUE

It is important in the community, or pattern of history

- o Important in the evolution of cultural landscapes and settlement patterns
- o Important in exhibiting density, richness or diversity of cultural features illustrating the human occupation and evolution of the nation, province, region or locality.
- o Important for association with events, developments or cultural phases that have had a significant role in the human occupation and evolution of the nation, province, region or community.
- o Important as an example for technical, creative, design or artistic excellence, innovation or achievement in a particular period.

It has strong or special association with the life or work of a person, group or organisation of importance in history

- o Importance for close associations with individuals, groups or organisations whose life, works or activities have been significant within the history of the nation, province, region or community.

It has significance relating to the history of slavery

- o Importance for a direct link to the history of slavery in South Africa.

2. AESTHETIC VALUE

It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group.

- o Important to a community for aesthetic characteristics held in high esteem or otherwise valued by the community.
- o Importance for its creative, design or artistic excellence, innovation or achievement.
- o Importance for its contribution to the aesthetic values of the setting demonstrated by a landmark quality or having impact on important vistas or otherwise contributing to the identified aesthetic qualities of the cultural environs or the natural landscape within which it is located.
- o In the case of an historic precinct, importance for the aesthetic character created by the individual components which collectively form a significant streetscape, townscape or cultural environment.

3. SCIENTIFIC VALUE

It has potential to yield information that will contribute to an understanding of natural or cultural heritage

- Importance for information contributing to a wider understanding of natural or cultural history by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.
- Importance for information contributing to a wider understanding of the origin of the universe or of the development of the earth.
- Importance for information contributing to a wider understanding of the origin of life; the development of plant or animal species, or the biological or cultural development of hominid or human species.
- Importance for its potential to yield information contributing to a wider understanding of the history of human occupation of the nation, Province, region or locality.
- It is important in demonstrating a high degree of creative or technical achievement at a particular period
- Importance for its technical innovation or achievement.

4. SOCIAL VALUE

- It has strong or special association with a particular community or cultural group for social, cultural or spiritual reasons
- Importance as a place highly valued by a community or cultural group for reasons of social, cultural, religious, spiritual, symbolic, aesthetic or educational associations.
- Importance in contributing to a community's sense of place.

DEGREES OF SIGNIFICANCE

1. RARITY

It possesses uncommon, rare or endangered aspects of natural or cultural heritage.

- Importance for rare, endangered or uncommon structures, landscapes or phenomena.

2. REPRESENTIVITY

- It is important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects.
- Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class.
- Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.

The table below illustrates how a site's heritage significance is determined

| Spheres of Significance | High | Medium | Low |
|-------------------------|------|--------|-----|
| International | | | |
| National | | | |
| Provincial | | | |
| Regional | | | |
| Local | | | |
| Specific Community | | | |

What other similar sites may be compared to this site?

Impact Statement

Assessment of Impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase are assessed in terms of the following criteria:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The duration, wherein it will be indicated whether:
 - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - medium-term (5–15 years) – assigned a score of 3;
 - long term (> 15 years) - assigned a score of 4; or
 - permanent - assigned a score of 5;
- The magnitude, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The significance is calculated by combining the criteria in the following formula:

$$S=(E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Archaeological Sites - Pre-Contact Heritage (Stone Age Sites)

Nature of Impacts: Placement of the solar generation plant could negatively affect sites associated with the Late Stone Age.

Extent of Impacts: Localised damage to the sites (see *Impact Statement* section for application).

| | | |
|---|---|-----------------------|
| Nature of Impact: Possible pre-contact Stone Age site could be damaged locally by excavation activities and associated activities | | |
| | Without Mitigation | With Mitigation |
| Extent | Local (2) | Local (2) |
| Duration | Long term (5) | Long term (5) |
| Magnitude | Medium (3) | Low (1) |
| Probability | Probable (3) | Improbable (1) |
| Significance | Medium (30) | Low (8) |
| Status | Negative | Positive |
| Reversibility | Irreversible | Irreversible |
| Irreplaceable loss of resource | Yes | No |
| Can impacts be mitigated | No | Yes |
| Mitigation | Walk-down phase before construction | |
| Cumulative impacts | None | |
| Residual impacts | Loss of heritage related information | |

Paleontological sites

Nature of Impacts: No paleontological sites of high value could be identified. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction of the generation facility and associated infrastructure.

Extent of Impact: Localised damage to possible paleontological sites within the pylon foundations where bedrock is close to the surface or exposed.

| | | |
|--|-----------------------|-----------------------|
| Nature of Impact: Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction of the pylon foundations. | | |
| | Without Mitigation | With Mitigation |
| Extent | Local (2) | Local (2) |
| Duration | Short term (2) | Long term (5) |
| Magnitude | Low (2) | Low (1) |
| Probability | Improbable (2) | Improbable (1) |
| Significance | Low (12) | Low (8) |
| Status | Negative | Positive |
| Reversibility | Irreversible | Reversible |
| Irreplaceable loss of resource | Yes | No |
| Can impacts be mitigated | No | Yes |

| | |
|--------------------|---|
| Mitigation | No further mitigation is recommended provided bedrock is not to be disturbed |
| Cumulative impacts | None |
| Residual impacts | None |

Mitigation

Paleontological monitoring during excavation activities if bedrock is to be disturbed.

Cultural Landscape

Several possible cultural landscape components were identified within the study corridors.

Nature of Impacts: The construction of the solar generation sites could result in alteration in the cultural characteristics of the landscape.

Extent of Impact: Limited impacts on the cultural landscape are anticipated.

| | | |
|--|---|-----------------------|
| Nature of Impact: Limited impacts on the cultural landscape are anticipated. | | |
| | Without Mitigation | With Mitigation |
| Extent | Local (2) | Local (2) |
| Duration | Short term (2) | Long term (2) |
| Magnitude | Low (1) | Low (1) |
| Probability | Improbable (3) | Improbable (3) |
| Significance | Low (15) | Low (15) |
| Status | Positive | Positive |
| Reversibility | Reversible | Reversible |
| Irreplaceable loss of resource | No | No |
| Can impacts be mitigated | Yes | Yes |
| Mitigation | No further mitigation is recommended | |
| Cumulative impacts | None | |
| Residual impacts | None | |

Mitigation

No further mitigation is recommended.

Heritage Management Planning

Minimising the Impact on Archaeological Sites (as per the NHRA)

| |
|--|
| Objective 1: Minimising the impact on archaeological sites |
| The development of solar generation sites and associated infrastructure could impact on unidentified sites of archaeological importance. |

| | |
|----------------------|--|
| Project Component | Solar Array, roads, power lines and construction camps |
| Potential Impact | Destruction of archaeological sites |
| Activity/Risk source | Solar array foundations, power lines and roads |
| Mitigation Target | Conserve archaeological sites |

| Mitigation: Action | Responsibility | Time Frame |
|--|----------------------------------|--------------------------------|
| Investigation of the final alignment of the connecting power line should be done during a walk-down phase before construction begins | Contracted heritage practitioner | Before construction commences. |

| | |
|-----------------------|--|
| Performance Indicator | No destruction of archaeological sites |
|-----------------------|--|

| | |
|------------|------|
| Monitoring | None |
|------------|------|

Minimising the Impact on Paleontological Sites (as per the NHRA)

| |
|--|
| Objective 1: Minimising the impact on Paleontological sites |
| The development of solar generation sites and associated infrastructure could impact on unidentified sites of paleontological importance if bedrock was to be disturbed. |

| | |
|----------------------|--|
| Project Component | Solar Array, roads, power lines and construction camps |
| Potential Impact | Destruction of paleontological sites |
| Activity/Risk source | Solar array foundations, power lines and roads |
| Mitigation Target | Conserve paleontological sites |

| Mitigation: Action | Responsibility | Time Frame |
|---|--|---------------------------|
| Should the development impact on bedrock, such activities could affect paleontological resources. | Paleontological monitoring in areas where bedrock is expected to be disturbed. | During construction phase |

| | |
|-----------------------|---|
| Performance Indicator | No destruction of paleontological sites |
| Monitoring | Paleontological monitoring during the construction phase where bedrock is to be affected. |

Minimising the impact on the cultural landscape (as per the NHRA)

| |
|---|
| Objective 1: Minimising the impact on the cultural landscape |
| Although areas with components of important cultural landscapes were identified, no areas with significance high enough for alteration of the proposed project layout could be defined. |

| | |
|----------------------|--|
| Project Component | Solar array, power lines, roads and construction camps |
| Potential Impact | Negative impacts on the cultural landscape |
| Activity/Risk source | Placement of infrastructure |
| Mitigation Target | Preservation of cultural landscape components |

| Mitigation: Action | Responsibility | Time Frame |
|-------------------------------|----------------|------------|
| No further action is required | None | None |

| | |
|-----------------------|---|
| Performance Indicator | No alteration to the cultural landscape |
| Monitoring | No monitoring is required |

Minimising the impact on Burial and Grave Sites (as per the NHRA)

| |
|---|
| Objective 1: Minimising the impact on burial and grave sites |
| The placement of solar sites could impact on unidentified burial or grave sites |

| | |
|----------------------|--|
| Project Component | Solar array, power lines, roads and construction camps |
| Potential Impact | Destruction of grave and burial sites |
| Activity/Risk source | Solar array and associated infrastructure |
| Mitigation Target | Mitigate impacts on burial or grave sites |

| Mitigation: Action | Responsibility | Time Frame |
|--------------------------|-------------------------------|-------------|
| On uncovering a possible | Environmental control officer | Immediately |

| | | |
|--|--|--|
| grave or burial site it is imperative that construction be ceased immediately. The area should be marked and a heritage practitioner should be informed immediately. | | |
|--|--|--|

| | |
|-----------------------|--------------------------------------|
| Performance Indicator | Mitigation of burial and grave sites |
| Monitoring | No monitoring is required |

Conclusion

The study area was investigated for sites of heritage significance that might be affected by the construction of the proposed distribution infrastructure. The only sign of sites of heritage potential were the limited scattering of quartzite, Late Stone Age tools found in one area. These finds in themselves do not constitute a site but do indicate the possible occurrence of such sites. The large sections of quartzite ridges could have been a source of low quality tool manufacturing material. Even though quartzite is relative hard it is also brittle and not suitable for controlled knapping. For this reason only short term use tools were usually manufactured.

One site for the placement of Solar Array generation plant was investigated. Due to the topographic requirements of Solar Arrays the areas are by nature flat and featureless with limited possibilities of water intrusion. Traditionally people have congregated in areas where shelter is found in some geographic feature or in areas that are elevated above the surrounding landscape. Accesses to water sources are also a deciding factor in the location of occupational sites. None of these factors were present in the areas investigated. Some dry dongas were located in some of the sites; however these are not reliable sources of water.

The power line alignment had not been confirmed during the site inspection and for this reason it was recommended that this component be subjected to a walk-down phase after the alignment has been set.

The area could still contain the remains of nomadic hunter/gatherer camps and some areas with suitable substrates could have been used as quarries for material to produce Stone Age tools. No such sites were however identified. We should however in this case apply the rule of *Absence of Evidence is not Evidence of Absence*. It is therefore recommended that the finalized power line alignment route be subjected to a walk-down by a qualified archaeologist before construction commences to identify any archaeological or burial sites. This action is not necessary for the placement sites of the solar arrays.

In one area scatterings of surface stone tools were noticed, however these were not concentrated enough to be classified as a Stone Age Site. Their presence does indicate that such sites could still be found sub-surface. It is also important to remember that sites such as these do not offer silhouette, profiles such as Irons Age and Historic sites and they are therefore difficult to identify unless the observer is on top of the site or very close to it. Some such sites might therefore have been missed.

Collection Area 1

This area produced four possible Late Stone Age tools or flakes. These were found in one area where the greatest distance between two artifacts was 22 meters. No sub-surface deposit was evident. The area showed natural ridges of quartzite in some areas while other parts of the study area has obviously been ploughed in the recent past. The area where the tools were noted was not altered. The vegetation is low density Karoo shrub forming part of the Nama-Karoo Biome.

The largest of the tools measure 8cm x 4cm while the smallest measure around 2cm x 3cm. The artifacts were all produced from crystalline quartz.



In Situ location of artifacts

The area under investigation is mostly flat with natural and eroded ditches and undulations found throughout. The area where the tools were recovered was the only area that contained large boulders. It is possible that these rock formations functioned as a receptacle for erosion displaced stones and pebbles as the concentration of small pebbles in this area far outweighed that of other areas. It is postulated that the stone tools recovered was displaced from another area and deposited with the rest of the coarse sediment along this rocky outcrop.

This outcrop is a geographic feature that could also have attracted occupation by humans, however no sub-surface deposits were noticed.

Due to the fact that these tools are obviously out of context they have a heritage significance of **very low**.



General Landscape



Tools recovered from this site



Collection area location GPS 28° 36.165' S 19° 51.150' E

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APPENDIX A
General Methodology

Methodology Inventory

Inventory studies involve the in-field survey and recording of archaeological resources within a proposed development area. The nature and scope of this type of study is defined primarily by the results of the overview study. In the case of site-specific developments, direct implementation of an inventory study may preclude the need for an overview.

There are a number of different methodological approaches to conducting inventory studies. Therefore, the proponent, in collaboration with the archaeological consultant, must develop an inventory plan for review and approval by the SAHRA prior to implementation (*Dincause, Dena F., H. Martin Wobst, Robert J. Hasenstab and David M. Lacy 1984*).

Significance Criteria

There are several kinds of significance, including scientific, public, ethnic, historic and economic, that need to be taken into account when evaluating heritage resources. For any site, explicit criteria are used to measure these values. Checklists of criteria for evaluating pre-contact and post-contact archaeological sites are provided in Appendix B and Appendix C. These checklists are not intended to be exhaustive or inflexible. Innovative approaches to site evaluation which emphasize quantitative analysis and objectivity are encouraged. The process used to derive a measure of relative site significance must be rigorously documented, particularly the system for ranking or weighting various evaluated criteria.

Site integrity, or the degree to which a heritage site has been impaired or disturbed as a result of past land alteration, is an important consideration in evaluating site significance. In this regard, it is important to recognize that although an archaeological site has been disturbed, it may still contain important scientific information.

Heritage resources may be of scientific value in two respects. The potential to yield information which, if properly recovered, will enhance understanding of Southern African human history is one appropriate measure of scientific significance. In this respect, archaeological sites should be evaluated in terms of their potential to resolve current archaeological research problems. Scientific significance also refers to the potential for relevant contributions to other academic disciplines or to industry.

Public significance refers to the potential a site has for enhancing the public's understanding and appreciation of the past. The interpretive, educational and recreational potential of a site are valid indications of public value. Public significance criteria such as ease of access, land ownership, or scenic setting are often external to the site itself. The relevance of heritage resource data to private industry may also be interpreted as a particular kind of public significance.

Ethnic significance applies to heritage sites which have value to an ethnically distinct community or group of people. Determining the ethnic significance of an archaeological site may require consultation with persons having special knowledge of a particular site. It is essential that ethnic significance be assessed by someone properly trained in obtaining and evaluating such data.

Historic archaeological sites may relate to individuals or events that made an important, lasting contribution to the development of a particular locality or the province. Historically important sites also reflect or commemorate the historic socioeconomic character of an area. Sites having high historical value will also usually have high public value.

The economic or monetary value of a heritage site, where calculable, is also an important indication of significance. In some cases, it may be possible to project monetary benefits derived from the public's use of a heritage site as an educational or recreational facility. This may be accomplished by employing established economic evaluation methods; most of which have been developed for valuating outdoor recreation. The objective is to determine the willingness of users, including local residents and tourists, to pay for the experiences or services the site provides even though no payment is presently being made. Calculation of user benefits will normally require some study of the visitor population (*Smith, L.D. 1977*).

Assessing Impacts

A heritage resource impact may be broadly defined as the net change between the integrity of a heritage site with and without the proposed development. This change may be either beneficial or adverse.

Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource. For example, development may have a beneficial effect by preventing or lessening natural site erosion. Similarly, an action may serve to preserve a site for future investigation by covering it with a protective layer of fill. In other cases, the public or economic significance of an archaeological site may be enhanced by actions which facilitate non-destructive public use. Although beneficial impacts are unlikely to occur frequently, they should be included in the assessment.

More commonly, the effects of a project on heritage sites are of an adverse nature. Adverse impacts occur under conditions that include:

- (a) destruction or alteration of all or part of a heritage site;
- (b) isolation of a site from its natural setting; and
- (c) introduction of physical, chemical or visual elements that are out-of-character with the heritage resource and its setting.

Adverse effects can be more specifically defined as direct or indirect impacts. Direct impacts are the immediately demonstrable effects of a project which can be attributed to particular land modifying actions. They are directly caused by a project or its ancillary facilities and occur at the same time and place. The immediate consequences of a project action, such as slope failure following reservoir inundation, are also considered direct impacts.

Indirect impacts result from activities other than actual project actions. Nevertheless, they are clearly induced by a project and would not occur without it. For example, project development may induce changes in land use or population density, such as increased urban and recreational development, which may indirectly impact upon heritage sites. Increased vandalism of heritage sites, resulting from improved or newly introduced access, is also considered an indirect impact. Indirect impacts are much more difficult to assess and quantify than impacts of a direct nature.

Once all project related impacts are identified, it is necessary to determine their individual level-of-effect on heritage resources. This assessment is aimed at determining the extent or degree to which future opportunities for scientific research, preservation, or public appreciation are foreclosed or otherwise adversely affected by a proposed action. Therefore, the assessment provides a reasonable indication of the relative significance or importance of a particular impact. Normally, the assessment should follow site evaluation since it is important to know what heritage values may be adversely affected.

The assessment should include careful consideration of the following level-of-effect indicators, which are defined in Appendix D:

- magnitude
- severity
- duration
- range
- frequency
- diversity
- cumulative effect
- rate of change

The level-of-effect assessment should be conducted and reported in a quantitative and objective fashion. The methodological approach, particularly the system of ranking level-of-effect indicators, must be rigorously documented and recommendations should be made with respect to managing uncertainties in the assessment. (*Zubrow, Ezra B.A., 1984*).

The study area was surveyed using standard archaeological surveying methods. The area was surveyed using directional parameters supplied by the GPS and surveyed by foot. This technique has proven to result in the maximum coverage of an area. This action is defined as;

'an archaeologist being present in the course of the carrying-out of the development works (which may include conservation works), so as to identify and protect archaeological deposits, features or objects which may be uncovered or otherwise affected by the works' (DAHGI 1999a, 28).

Standard archaeological documentation formats were employed in the description of sites. Using standard site documentation forms as comparable medium, it enabled the surveyors to evaluate the relative importance of sites found. Furthermore GPS (Global Positioning System) readings of all finds and sites were taken. This information was then plotted using a **Garmin Colorado** GPS (WGS 84- datum).

Indicators such as surface finds, plant growth anomalies, local information and topography were used in identifying sites of possible archaeological importance. Test probes were done at intervals to determine sub-surface occurrence of archaeological material. The importance of sites was assessed by comparisons with published information as well as comparative collections.

Test excavation is that form of archaeological excavation where the purpose is to establish the nature and extent of archaeological deposits and features present in a location which it is proposed to develop (though not normally to fully investigate those deposits or features) and allow an assessment to be made of the archaeological impact of the proposed development. It may also be referred to as archaeological testing' (DAHGI 1999a, 27).

'Test excavation should not be confused with, or referred to as, archaeological assessment which is the overall process of assessing the archaeological impact of development. Test excavation is one of the techniques in carrying out archaeological assessment which may also include, as appropriate, documentary research, field walking, examination of upstanding or visible features or structures, examination of aerial photographs, satellite or other remote sensing imagery, geophysical survey, and topographical assessment' (DAHGI 1999b, 18).

Scientific Significance

(a) Does the site contain evidence which may substantively enhance understanding of culture history, culture process, and other aspects of local and regional prehistory?

internal stratification and depth

chronologically sensitive cultural items

materials for absolute dating

association with ancient landforms

quantity and variety of tool type

distinct intra-site activity areas

tool types indicative of specific socio-economic or religious activity

cultural features such as burials, dwellings, hearths, etc.

diagnostic faunal and floral remains

exotic cultural items and materials

uniqueness or representativeness of the site
integrity of the site

(b) Does the site contain evidence which may be used for experimentation aimed at improving archaeological methods and techniques?

monitoring impacts from artificial or natural agents
site preservation or conservation experiments
data recovery experiments
sampling experiments
intra-site spatial analysis

(c) Does the site contain evidence which can make important contributions to paleoenvironmental studies?

topographical, geomorphological context
depositional character
diagnostic faunal, floral data

(d) Does the site contain evidence which can contribute to other scientific disciplines such as hydrology, geomorphology, pedology, meteorology, zoology, botany, forensic medicine, and environmental hazards research, or to industry including forestry and commercial fisheries?

Public Significance

(a) Does the site have potential for public use in an interpretive, educational or recreational capacity?

integrity of the site
technical and economic feasibility of restoration and development for public use
visibility of cultural features and their ability to be easily interpreted
accessibility to the public

opportunities for protection against vandalism
representativeness and uniqueness of the site
aesthetics of the local setting
proximity to established recreation areas
present and potential land use
land ownership and administration
legal and jurisdictional status
local community attitude toward development

(b) Does the site receive visitation or use by tourists, local residents or school groups?

Ethnic Significance

(a) Does the site presently have traditional, social or religious importance to a particular group or community?

ethnographic or ethno-historic reference

documented local community recognition or, and concern for, the site

Economic Significance

(a) What value of user-benefits may be placed on the site?

visitors' willingness-to-pay

visitors' travel costs

Scientific Significance

(a) Does the site contain evidence which may substantively enhance understanding of historic patterns of settlement and land use in a particular locality, regional or larger area?

(b) Does the site contain evidence which can make important contributions to other scientific disciplines or industry?

Historic Significance

(a) Is the site associated with the early exploration, settlement, land use, or other aspect of southern Africa's cultural development?

(b) Is the site associated with the life or activities of a particular historic figure, group, organization, or institution that has made a significant contribution to, or impact on, the community, province or nation?

(c) Is the site associated with a particular historic event whether cultural, economic, military, religious, social or political that has made a significant contribution to, or impact on, the community, province or nation?

(d) Is the site associated with a traditional recurring event in the history of the community, province, or nation, such as an annual celebration?

Public Significance

(a) Does the site have potential for public use in an interpretive, educational or recreational capacity?

visibility and accessibility to the public

ability of the site to be easily interpreted

opportunities for protection against vandalism

economic and engineering feasibility of reconstruction, restoration and maintenance

representativeness and uniqueness of the site

proximity to established recreation areas

compatibility with surrounding zoning regulations or land use

land ownership and administration

local community attitude toward site preservation, development or destruction

present use of site

(b) Does the site receive visitation or use by tourists, local residents or school groups?

Ethnic Significance

(a) Does the site presently have traditional, social or religious importance to a particular group or community?

Economic Significance

(a) What value of user-benefits may be placed on the site?

visitors' willingness-to-pay

visitors' travel costs

Integrity and Condition

(a) Does the site occupy its original location?

(b) Has the site undergone structural alterations? If so, to what degree has the site maintained its original structure?

(c) Does the original site retain most of its original materials?

(d) Has the site been disturbed by either natural or artificial means?

Other

(a) Is the site a commonly acknowledged landmark?

(b) Does, or could, the site contribute to a sense of continuity or identity either alone or in conjunction with similar sites in the vicinity?

(c) Is the site a good typical example of an early structure or device commonly used for a specific purpose throughout an area or period of time?

(d) Is the site representative of a particular architectural style or pattern?

Indicators of Impact Severity

Magnitude

The amount of physical alteration or destruction which can be expected. The resultant loss of heritage value is measured either in amount or degree of disturbance.

Severity

The irreversibility of an impact. Adverse impacts which result in a totally irreversible and irretrievable loss of heritage value are of the highest severity.

Duration

The length of time an adverse impact persists. Impacts may have short-term or temporary effects, or conversely, more persistent, long-term effects on heritage sites.

Range

The spatial distribution, whether widespread or site-specific, of an adverse impact.

Frequency

The number of times an impact can be expected. For example, an adverse impact of variable magnitude and severity may occur only once. An impact such as that resulting from cultivation may be of recurring or on-going nature.

Diversity

The number of different kinds of project-related actions expected to affect a heritage site.

Cumulative Effect

A progressive alteration or destruction of a site owing to the repetitive nature of one or more impacts.

Rate of Change

The rate at which an impact will effectively alter the integrity or physical condition of a heritage site. Although an important level-of-effect indicator, it is often difficult to estimate. Rate of change is normally assessed during or following project construction.

