Phase 1 Heritage Impact Assessment Report

Proposed Upgrade of Three Road Sections in the Mswaneni Area Close to Ladysmith, KwaZulu-Natal Province

Prepared By:

Prepared For:

CREDIT SHEET

Project Director

STEPHAN GAIGHER (BA Hons, Archaeology, UP)

Principal Investigator for G&A Heritage

Member of ASAPA (Site Director Status)

Tel: (015) 516 1561

Cell: 073 752 6583

E-mail: stephan@gaheritage.co.za

Website: www.gaheritage.co.za

Report Author

STEPHAN GAIGHER

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.*

SIGNED OFF BY: STEPHAN GAIGHER

MANAGEMENT SUMMARY

Site name and location: Mswaneni Road Upgrade Project, Kwa Zulu Natal.

Municipal Area: Msinga Local Municipality.

Developer: Msinga Local Municipality.

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

Date of Report: 19 September 2015

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 upgrade of three sections of road near Mswaneni in KZN.

A preliminary alignment following the existing road has been drawn to lead the study following the existing road.

The purpose of this heritage impact assessment is to outline the cultural heritage sensitivity of the proposed development area and to advise on mitigation should any heritage sites or landscapes be affected.

Findings
Several burial sites were identified close to the proposed road upgrade as well as some stone walled sites.

Recommendations
The construction of the existing road has resulted in damage to any possible previous sites of heritage significance. It is not anticipated that any further sites will be affected provided the recommendations regarding the burial sites are followed.

Fatal Flaws
No fatal flaws were identified.

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List of Abbreviations

Bp ..... Before Present

EIA..... Early Iron Age

ESA ..... Early Stone Age

Fm ..... Femtometre (10^{-15}m)

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

Um..... Micrometre (10^{-6} m)

WGS 84 ..... World Geodetic System for 1984

Chapter 1

PROJECT RESOURCES

HERITAGE IMPACT REPORT

HERITAGE IMPACT ASSESSMENT REPORT FOR THE PROPOSED MSWANENI ROAD UPGRADE, KWA ZULU NATAL.

INTRODUCTION

Legislation and methodology

G&A Heritage was appointed by GBS Environmental Consultants to undertake a heritage impact assessment for the proposed upgrade of the Mswaneni roads, in Kwa Zulu Natal with a total length of 7.9 km. Section 38(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 m^2 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.

While the above desribes the parameters of developments that fall under this Act., Section 38 (8) of the NHRA is applicable to this development. This section states that;

(8) *The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act 50 of 1991), or any other legislation: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.*

In regards to a development such as this that falls under Section 38 (8) of the NHRA, the requirements of Section 38 (3) applies to the subsequent reporting, stating that;

(3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2) (a): Provided that the following must be included:
(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;
(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.

(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 heritage impact assessment are as follows;

- Field investigations were performed on foot and by vehicle where access was readily available.
- Sites were evaluated by means of description of the cultural landscape, direct observations and analysis of written sources and available databases.
- It was assumed that the site layout as provided by GBS Environmental Consultants is accurate.
- We assumed that the public participation process performed as part of the Scoping and Environmental Impact Reporting (S&EIR) process was sufficiently encompassing not to be repeated in the Heritage Assessment 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	See PIA report	None
	36	Graves and burial sites	Possible Impact	Management Recommendations
	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	7.9 km road upgrade
Construction of a bridge or similar structure exceeding 50m in length.	No	N/A
Development exceeding 5000 m^2	No	N/A
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 Mswaneni Road Upgrade Project

Project Description

The Mswaneni village is serviced by several roads. Three sections of these roads are being upgraded to improved gravel roads. The tota distance is 7,9km.

Site Location

Mswaneni is within the Msinga Municipality close to Weenen and Muden.

Figure 1: Location Map (2830 CD 2005)

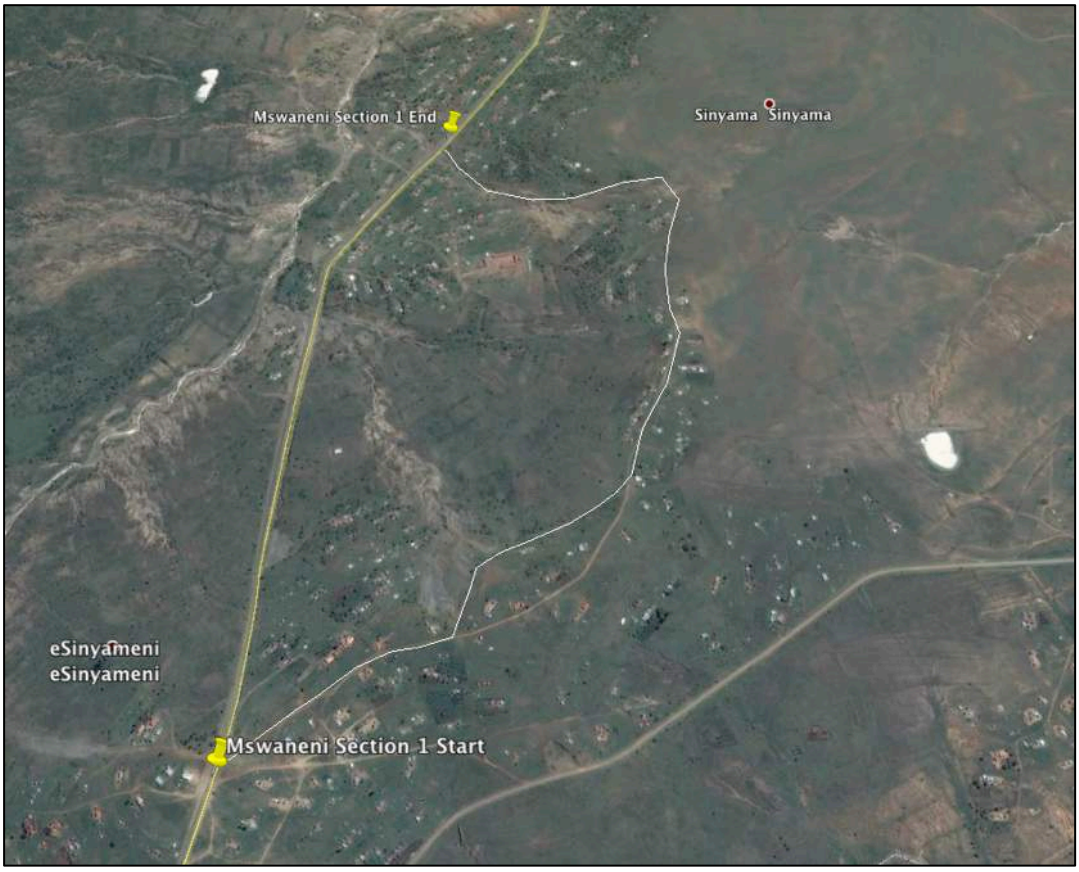

Figure 2: Road section 1

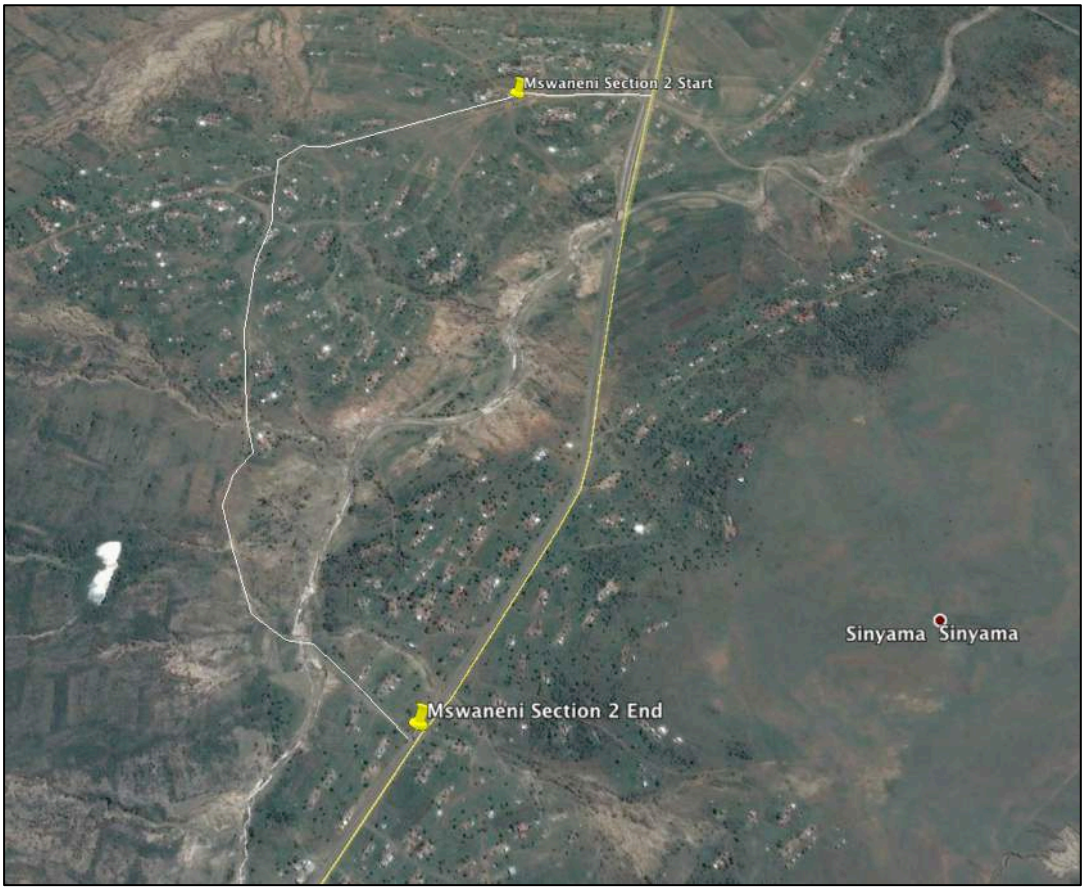

Figure 3. Road Section 2

Figure 4. Road section 3

Alternatives Considered

The no-go alternative where no construction is performed.

Chapter 2 PROJECT RESOURCES

"FOR THE EARLIER PERIODS OF HUMAN PREHISTORY NATAL, OWING TO ITS SPECIAL GEOGRAPHICAL AND GEOLOGICAL CONDITIONS, CAN PROVIDE A PATTERN FOR STUDIES IN ALL PARTS OF AFRICA SOUTH OF THE EQUATOR. TO STUDENTS IN THE NORTHERN HEMISPHERE ITS IMPORTANCE IS NATURALLY LESS; BUT THE CORRELATIONS WITH ALGERIA AND MOROCCO, LANDS OF SOMEWHAT SIMILAR FORMATION, PROVIDE A LINE, WHICH ARCHAEOLOGISTS THROUGHOUT AFRICA MAY GRASP. ONE SMALL PROVINCE CANNOT YIELD ALL THE EVIDENCE; BUT THIS SMALL PROVINCE IS ABLE TO GIVE AN UNUSUALLY COMPLETE AND CLEAR RECORD FROM DAYS WHEN MAN, AS A TOOL-MAKING ANIMAL, FIRST BECAME RECOGNISABLY HUMAN, TO THE TIME WHEN, WITH THE INVENTION OF THE BOW, HE ROSE ABOVE HIS BRUTE-SURROUNDINGS AND DONNED COMPLETE HUMANITY." O. DAVIES (1953).

HERITAGE INDICATORS WITHIN THE RECEIVING ENVIRONMENT

REGIONAL CULTURAL CONTEXT

PALEONTOLOGY

Since the bedrock is not going to be disturbed, a detailed paleontological assessment was not deemed necessary.

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 – 20 000 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 Khoekhoen cultural groups. Early to Middle Stone Age sites are uncommon 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 Middle Stone Age (MSA), as defined by Goodwin and Van Riet Lowe (1929), was viewed as a switch in technology from core tools to flake tools, and was thought to represent an intermediate technology between the Earlier and Later Stone Age (LSA). Triangular flakes with convergent dorsal scars and faceted butts distinguished the MSA, and radial and discoidal types, along with single and double platform examples, dominated cores. The 'type fossil' was considered to be the worked flake point. Due to both the relatively long time span encompassed by the MSA (c. 250 000-20 000BP) and the high degree of regional variation, it has proved difficult to include all MSA assemblages within Goodwin and Van Riet Lowe's criteria. More recent attempts have been made to revise the definition of the MSA (Klein 1970; Beaumont & Vogel 1972; Volman1984) and to establish a cultural sequence but with limited success. As a result identifying and understanding the end of the MSA is still difficult. Disagreement concerning the MSA/LSA transition in southern Africa centres on four issues: 1) the definition of what constitutes final MSA technology; 2) the existence of a transitional MSA/LSAindustry; 3) the dating of the MSA/LSA transition; and 4) the existence of an Early LSA (ELSA) which represents a distinct industry that is not part of the earliest recognized LSA, the Robberg (Clark, 1997).

1985 excavation at Umhlatuzana rock shelter in Natal by Kaplan yielded a long and detailed sequence of stone artefacts, which covered the time range from the Middle Stone Age (MSA) to the Later Stone Age (LSA), including the MSA/LSA transition, and early LSA microlithic bladelet assemblages. The change from the MSA to the beginning of the LSA took place between 35 000 and 25 000 BP. Robberg-like assemblages recovered from Umhlatuzana are the first to be positively identified in Natal. Pre-dating 18

000 BP and post-dating 12 000 BP, they show that assemblages of this nature were produced earlier and later in Natal than elsewhere in the country. Changes in the Umhlatuzana stone artefact assemblages were not the result of the introduction from elsewhere of new types of tools, but took place locally, as the result of a single evolving cultural tradition in a trajectory of cultural and social change (Kaplan, 1986).

Recent research by Wadley on the Middle Stone Age of Sibudu Cave north of Durban indicated that distinctions between the Middle Stone Age and the Late Stone Age based on backed blades could be misleading (Wadley, 2005). Although research on MSA sites is limited, this research illustrates the potential value of investigating Stone Age sites in KZN closer.

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.

A large representation of Rock-Art sites is located in this area. During 1981 Mazel completed a survey of the Drakensberg and Southern Natal and documented over 400 rock art sites with more than 20 000 paintings (Mazel, 1981). The occurrence of these sites is however subject to very specific environmental parameters, none of which are present in the study area.

Iron Age

During the third century AD, several groups of farming peoples from eastern and south central Africa began to settle along the east coast and river valleys that drain into the Indian Ocean (Maggs 1984a, 1989; Mitchell 2002). In eastern South Africa, these early farmers display a strong preference for settling a savannah environment along major water bodies where annual precipitation from 400 to over 1000mm provided adequate moisture for grain production. Over thirty EIA identified settlements in the Thukela Basin are clustered on discontinuous patches of rich colluvial soils within a short distance of the edge of the Thukela River or its tributaries. EIA settlements were initially established in the coastal forest in the fifth century AD and later in the savannah woodland belt alongside rivers in the (seventh century AD). The opening of riverine forest and woodlands by EIA farmers is apparent from the palaeobotanical record, current vegetation distribution (Hall 1981) and settlement distribution in the Thukela Basin. All documented sites are found within 100m of the relic canopy fringe (van Schalkwyk 1992).

EIA sites averaging 7 hectares in size are consistently located on the most productive nodes of soils confined to confluences and colluvial slip-off slopes along the major drainage courses, which comprise only about 9 per cent of the landscape (Maggs 1980: 7).

"*Interpretations of the internal spatial organization of EIA sites in southern Africa are complicated by the relatively long use and frequent reoccupation of sites, often over several hundred years (Maggs 1984b, 1989). These reoccupations of the same places have created a palimpsest of flat, expansive settlements, with both superimposed and laterally displaced stratigraphy (Greenfield et al. 2000). Despite this situation, several large-scale horizontal excavations of settlements in the region have demonstrated a spatial layout of features that are similar to homestead spatial organization derived from nineteenth- and twentieth-century Nguni and Sotho-Tswana ethnography (Kuper 1982), called the Central Cattle Pattern (CCP). This pattern is characterized by domestic residences of the senior man's wives placed in ranked order in an arc or circle around a central area containing livestock pens, the burials of high-status individuals and a court or assembly area where men gather to discuss political matters (Huffman 2001). Archaeologically, a similar pattern is represented by a series of domestic complexes (hut floors, grain bins or pits, ash and other refuse middens) surrounding a series of non-domestic activity areas, including livestock enclosures and specialist activity areas separated by an open space devoid of cultural materials. There is some variation in the size of the open space. At Broederstroom in north-eastern South Africa, the distance between hut floors and a livestock enclosure was as little as 10m (Huffman 1993). At KwaGandaganda in the Mngeni valley in KwaZulu-Natal, the open space was 90m across (Whitelaw 1994), and at Ndondondwane this open space was 60-100m*" (Greenfield and van Schalkwyk 2003) (Huskel J, Greenfield, Kent, D, Fowler, & Leonard O, van Schalkwyk, 2005).

As well, faunal evidence suggests that certain species, such as nyala antelope, were forced to shift the range of their habitat after the woodland was opened (Maggs 1995:175). A considerable number of Late Iron Age, stone walled sites, dating from the 18th and the 19th centuries (some of which may have been

occupied as early as the 16th century), occur along and on top of the rocky ridges here These settlements and features in these sites, such as huts, were built with dry stone, reed and clay.

Stone walled settlements are concentrated in clusters of sites and sometimes are dispersed over large areas making them vulnerable to developments of various kinds. A site consists of a circular or elliptical outer wall that is composed of a number of scalloped walls facing inwards towards one or more enclosures. Whilst the outer scalloped walls served as dwelling quarters for various family groups, cattle, sheep and goat were stock in the centrally located enclosures. Huts with clay walls and floors were built inside the dwelling units. Pottery and metal items are common on the sites. However, iron and copper were not produced locally on these sites.

Many of the Iron Age sites are also associated with Zulu encampments. Due to the often semi-nomadic nature of these and the use of removable huts, these sites are often difficult to identify and short term occupational sites might only manifest in some stone circles, use to anchor these structures to the ground.

The Historic Era

DATE	DESCRIPTION
18th Century	Northern KwaZulu-Natal's only inhabitants in the early 18th Century were the bushmen.
19th Century	By 1818, several Zulu clans had established themselves in the area. A series of savage wars ensued between the tribes led by Dingiswayo and Shaka respectively ending only when Shaka established himself as the ruler of all the Zulus. They then fought united against the neighbouring tribes bringing about a period known as the Mafakeng, creating chaos and devastation across the Midlands and Northern KwaZulu-Natal, as well as Lesotho and the Free State.
1837 - 1838	Piet Retief, a leading figure during the Great Trek, established a camp of 54 wagons near the Drakensberg ridge. He started negotiations with the Zulu King, Dingane in November 1837. It was agreed that the Voortrekkers may settle in the region, provided that the Boer delegation recover the cattle stolen by the rival Tlokwa nation. J.G. Bantjies drew up the Piet Retief / Digane Treaty outlining the areas of Natal to be secured for the Boers to settle and start their farms. Piet Retief and his entire party was slain by Dingane on 28 January 1838 when he returned to further negotiate land boundaries. Following the decisive victory at Blood River on 16 December 1838, Andries Pretorius and his commando recovered the remains of Retief and his men and reburied them on 21 December 1838.
1838 - 1843	Peace was restored to the region only for a short time, until the British annexed Natal in 1843 bringing about clashes between the Boers and the British.
1849 - 1854	Some 5000 odd British settlers arrived in the colony settling in the Buffalo Border region and up into the Natal. With the influx of people, the area was transformed. Permanent structures were built, roads laid out and the settlement became known as Post Halt Two, a stop over between Durban (then Port Natal) and Johannesburg. In 1854, Dr Sutherland (who became the Surveyor General for the Colony) and his wife found themselves stranded by the Ncandu River due to flooding. He spent two weeks settling out a new township.
1864 - 1873	In 1864, the town of Newcastle was officially registered, becoming the fourth settlement to be established in Natal. The town was named after the British Colonial Secretary, the Duke of Newcastle. In 1873 Newcastle became a separate electoral division.
1869 - 1878	The first church in Newcastle, the Dutch Reformed Church was built in 1869. The first school in Newcastle was opened in the Dutch Reformed Church building in 1874, but lasted only until 1878.
1870's	The Armoury (Old Magazine) Building was built by the Natal Mounted Rifles in the 1870's. The armoury is now used as a Moth Shellhole.
1875	The original Homestead, the Hilldrop House, of Sir Rider Haggard (the Author of "King Solomon's Mines") was built in 1875. Haggard lived in the house in 1881 and the house and farm is described in his book, "Jess". The Hilldrop House is where the peace treaty signed at O'Neil's Cottage was later ratified to bring the Transvaal's first war of independence against Britain to an end.

1876 - 1877	In 1876 the British authorities decided to establish a fort at Newcastle due to the threats from the new Zulu Kingdom of Cetshwayo and the pending annexation of the Transvaal. Major C.F. Amiel and 200 men from the Staffordshire Regiment arrived to build the fort, known as Fort Amiel. It was from Fort Amiel that the Natal Mounted police set out for Pretoria and the annexation of the Transvaal in 1877.
12 January 1878 – 22 January 1878	The Battle of Isandlwana Three British columns crossed into Zululand to get Cetshwayo to disband his army. The Central Column, lead by General Lord Chelmsford, accompanied by the Newcastle Mounted Rifles, crossed at Rorke's Drift. The Zulu army nearly wiped out the British camp at Isandlwana on the 22nd of January 1878. Chelmsford was forced to retreat. The British were able to regroup and with reinforcements from the UK were able to overcome the Zulu army.
1880	The Boers were dissatisfied with the British occupation and more battles ensued.
16 December 1880 – 23 March 1881	The First Boer War / War of Independence A British column moving from Lydenburg to Pretoria was halted at Bronkhorstspruit and the British garrisons in the Transvaal were invested. General Sit George Pomeroy Colley (Governor of Natal and Commander of the British Forces in South Africa) scrambled to gather a force of 2500 men and marched to Newcastle. On 28 January 1881, at Laing's Nek, he was confronted by a Boer force under the command of General Piet Joubert. Colley's force was ht with heavy losses. Another rebuff at Schuinshoogte on the 8th of February 1881 and finally at Majuba on the 27th of February 1881, his forces were driven from their positions.
1880 - 1881	During the First War of Independence, the home of Eugene O' Neil, which lay in no mans land between the British and the Boers became a makeshift hospital for British soldiers after their defeat at Majuba. The peace treat ending the war was negotiated here in March 1881 with Paul Kruger, President Brand, Marthinus Pretorius, Commandant General Piet Joubert, General Sir Evelyn Wood, Colonel Redvers Buller, Major Clark and Captain Roberts (amongst several others) present.
1881 - 1891	British preparations for the Pretoria Convention (the peace treat that ended the First Boer War) of 1881 were done at Newcastle. The discovery of coal in the late 1880's brought about a new era of prosperity. The first train arrived in Newcastle in 1890 and by the 7th of April 1891, the railway had been extended through Laing's Nek to Charlestown. The construction of the 640m long tunnel was considered to be an engineering feat of its time.
1891	In 1891, the Victorian house was built that became General Buller's headquarters.
1891	In 1891 the town was proclaimed a Borough.
1898	The ZAR and the Colony of Natal built the Buffalo River Bridge, to the northeast of Newcastle in 1898 jointly. The bridge was declared a national monument in 1982.
1899	Second Anglo Boer War On 14 October 1899 the first Boer forces, lead by General Ben Viljoen, entered to the town, renaming it Viljoensdorp. It remained in Boer's hands for the next 8 months before the British, under the command of General Buller were able to re-occupy it. Because of the town's strategic position and the possibility of attacks to the Boer commandos, the British were forced to place the town under martial law for the duration of the war.
1910 - 1969	Industrial Era By 1910 a dam had been constructed on the Ncandu River and waterworks established and electricity was available. Mr J.K. Eaton built a steel works plant in 1918. Within a few years the Newcastle Iron and Steel Works Ltd was established. Between 1920 and 1926 the first blast furnace to be erected in South Africa was completed. The project was acquired by Union Steel Corporation SA. By 1937 African Metals had purchased the Newcastle Works and by 1945, a second blast furnace was operating. Some 150 000 tons per annum of various grades of pig iron were being produced. As a result of the increased steel production a period of expansion came to the town. This expansion was of great financial benefit. Durban Falkirk Iron Co. Ltd. was in

	production by 1948 and was employing some 200 people. Throughout the '50s and '60s the growth was steady but slow. In May 1969 the government announced that the third Iscor Works would be established in Newcastle and as a direct result of Iscor, Newcastle developed rapidly as an industrial town and prominent growth point in Northern Natal. Later Karbochem established a plant in Newcastle and a vigorous marketing campaign by the municipality attracted a wealth of investment from the far East.
2000's - Present Day	An indication of the industrial future of Newcastle is reflected in the chrome chemical plant, which was completed in Newcastle, during 2002. This joint venture project between Karbochem and German manufacturing giant Bayer, has made Newcastle the largest producer of chrome chemicals in Africa. Mittal Steel also recently completed a R400 million project, to rebuild one of its coke batteries. Other large operations include a diamond cutting works, various heavy engineering concerns, steel reinforcement and a slagment cement factory. Today, Newcastle has the largest concentration of industry in the north western KwaZulu-Natal region.
Sources:	
http://newcastle.gov.za/history-of-newcastle/	
http://www.siyabona.com/kwazulu-natal-newcastle.html	
http://global.britannica.com/place/Newcastle-South-Africa	
http://www.kzn.co.za/16.northern_natal.htm	
http://www.zulu.org.za/discover/destinations/battlefields/regions/newcastle/historical-religious-cultural-assets/hilldrop-house-P55037	
http://www.battlefieldsroute.co.za/place/oneils-cottage/	

Previous Studies

G&A Heritage performed several similar studies on road upgrades in this general area in 2012, 2013 and 2014 for the same client. These were referenced as follows;

- Busani Road Upgrade HIA
- Chibide Road Upgrade HIA
- Graig Millar Road Upgrade HIA
- Emahashini Road upgrade HIA
- Fahlaza Road Upgrade HIA
- Gazaneni Road Upgrade HIA
- Gidamasoka Road Upgrade HIA
- Haladu Road Upgrade HIA
- Jikijiki Road Upgrade HIA
- Khuthalani Road Upgrade HIA
- Kwa Shishi Road Upgrade HIA
- Kwavumbu Road Upgrade HIA
- Lethithema Road Upgrade HIA
- Machibini Road Upgrade HIA
- Mevane Road Upgrade HIA
- Mgazini Road Upgrade HIA
- Mngwenya Road Upgrade HIA
- Ncence Road Upgrade HIA
- Nembeni Road Upgrade HIA
- Ngqungqula Road Upgrade HIA
- Nomafu Road Upgrade HIA
- Nsimbini Road Upgrade HIA
- Ntabampisi Road Upgrade HIA
- Nyoka Road Upgrade HIA
- Okhalweni Road Upgrade HIA
- Sigidisabeth Road Upgrade HIA
- Sinayi Road Upgrade HIA
- Songela Road Upgrade HIA
- Sthozini Road Upgrade HIA
- Zitende Road Upgrade HIA

- Bethulo Road Upgrade HIA
- Kosibiya Road Upgrade HIA
- Sobho Road Upgrade HIA
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Findings

No sites of any heritage value were identified in the study area.

Site 001

GPS 28° 53’ 52”S
30° 17’ 15”E

5 graves +/- 8m from the side of the proposed road.

Figure 5. Graves by the side of the road

Figure 6. Location of Site 001

Site 002

GPS 28° 53’ 50,9”S
30° 17’ 16,0”E

5 Graves approximately 1m from the side of the proposed road upgrade.

Figure 7. Graves at Site 002

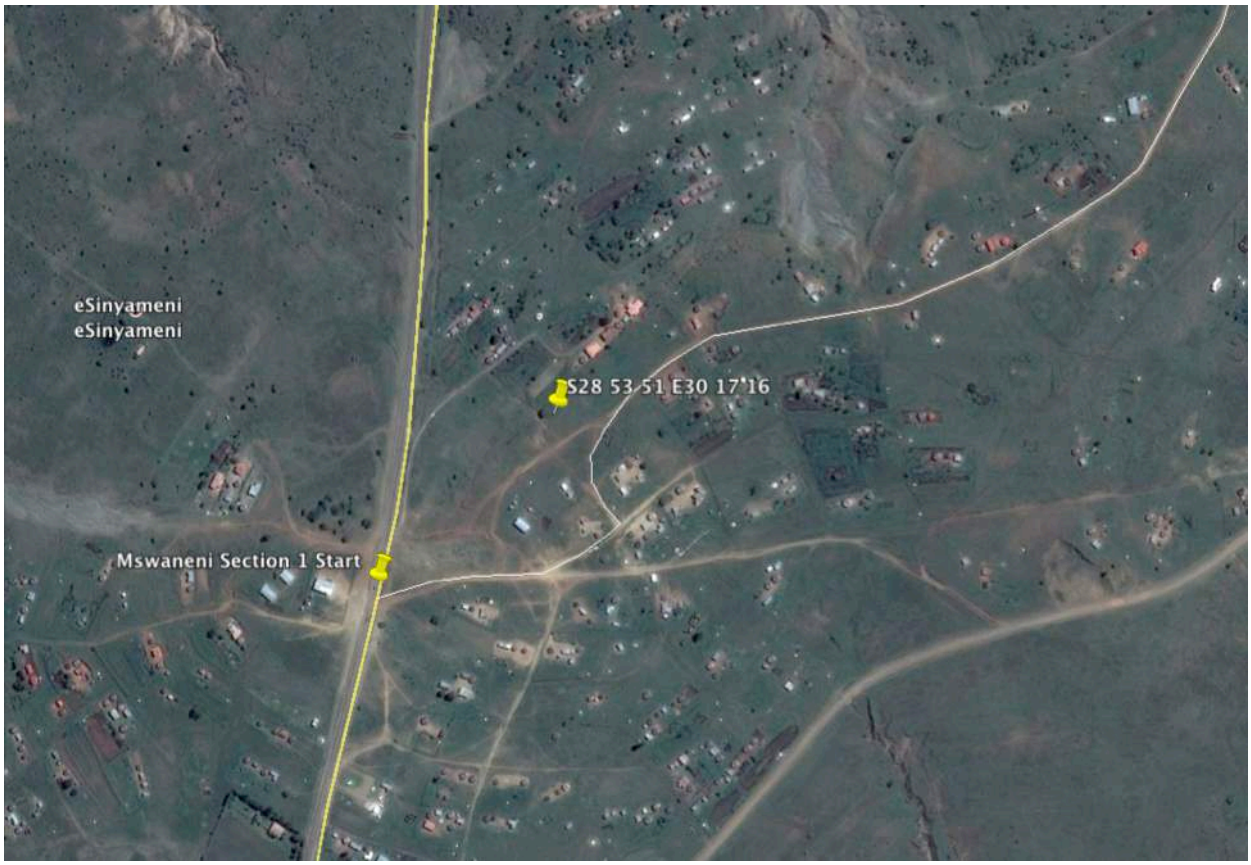

Figure 8. Location of Site 002

Site 003

GPS 28° 53’ 49,5”S
30° 17’ 18,5”E

Semi formal graveyard located around 6m from the side of the proposed road upgrade.

Figure 9. Site 003

Figure 10. Site 003

Site 004

GPS 28° 53’ 49,5”S
30° 17’ 18,5”E

4 Graves approximately 10m from the side of the proposed road upgrade.

Figure 11. Site 004

Figure 12. Location of Site 004

Site 005

GPS 28° 53' 47"S
30° 17' 25"E

5 Graves located approximately 15m north of the proposed road upgrade.

Figure 13. 5 Graves 15m from road

Figure 14. Site 005

Site 006

GPS 28° 53' 47"S
30° 17' 27"E

3 Graves 8-10m from the edge of the proposed road upgrade.

Figure 15. Site 006

Figure 16. Location of Site 006

Site 007

GPS 28° 53’ 47”S
30° 17’ 27”E

+/- 10 Graves on right approx 10 - 15m from road.

Figure 17. Graves at Site 007

Figure 18. Location of Site 007

Site 008

GPS 28° 53' 47"S
30° 17' 27"E

This is the remains of an Iron age livestock enclosure. It consists of four different stone walled enclosures. Most of the stone walls are dilapidated.

Figure 19. Stone walled kraal at Site 008

Figure 20. Location of Site 008

Site 009

GPS 28° 53' 01"S
30° 17' 47"E

Two graves approximatley 4m from the side of the road.

Figure 21. Graves at Site 009

Figure 22. Location of Site 009

Site 010

GPS 28° 53' 01"S
30° 17' 47"E

This is the remains of an Iron Age stone walled enclosure site. It consists of several stone walled structures and covers an area of around 100m^2

Figure 23. Stone walled kraal at Site 010

Figure 24. Location of Site 010

Site 011

GPS 28° 53' 01"S
30° 17' 38"E

+/- 10 Graves 10-11m from the side of the rpoposed road upgrade.

Figure 25. Graves at Site 011

Figure 26. Location of Site 011

Site 012

GPS 28° 52’ 58”S
30° 17’ 34”E

Remains of a stone walled kraal approximately 4 metres from the proposed road upgrade.

Figure 27. Stone walled site at Site 012

Figure 28. Location of Site 012

Site 013

GPS 28° 52’ 56”S
30° 17’ 29”E

5 Graves approximately 6 metres from the side of the road upgrade.

Figure 29. Site 013

Figure 30. Location of Site 013

Chapter 3

Impact Assessment

Methodology

This study defines the heritage component of the S&EIR process being undertaken for the P483 road upgrade. It is described as a first phase (HIA). This report attempts to evaluate both the accumulated heritage knowledge of the area as well as information derived from direct physical observations.

Evaluating Heritage Impacts

A combination of document research as well as the determination of the geographic suitability of areas and the evaluation of aerial photographs determined which areas could and should be accessed.

After plotting of the site on a GPS the areas were accessed using suitable combinations of vehicle access and access by foot.

Sites were documented by digital photography and geo-located with GPS readings using the WGS 84 datum.

Further techniques (where possible) included interviews with local inhabitants, visiting local museums and information centers and discussions with local experts. All this information was combined with information from an extensive literature study as well as the result of archival studies based on the SAHRA provincial databases.

This Heritage Impact Assessment 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
- SAHRIS Database of Heritage Studies
- Talana Museum Information
- Internet Search
- Historic Maps
- 1960, 1981, 1996, 2003 and 2004 Surveyor General Topographic Map series
- 1952 1:10 000 aerial photo survey
- Google Earth 2015 imagery
- Published articles and books
- JSTOR Article Archive

Fieldwork

Fieldwork for this study was performed on the 10th of September 2015. Most of the areas were found to be accessible by vehicle. Areas of possible significance were investigated on foot. The survey was tracked using GPS and a track file in GPX format is available on request.

Measuring Impacts

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

HISTORIC VALUE

It is important in the community, or pattern of history

- Important in the evolution of cultural landscapes and settlement patterns
- Important in exhibiting density, richness or diversity of cultural features illustrating the human occupation and evolution of the nation, province, region or locality.
- 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.
- 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

- 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

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

AESTHETIC VALUE

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

- Important to a community for aesthetic characteristics held in high esteem or otherwise valued by the community.
- Importance for its creative, design or artistic excellence, innovation or achievement.
- 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.
- 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.

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.

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

RARITY

It possesses uncommon, rare or endangered aspects of natural or cultural heritage.
- Importance for rare, endangered or uncommon structures, landscapes or phenomena.

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

Assessing site value by attribute

Table 5 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest

HISTORIC SIGNIFICANCE

No	Criteria	Significance Rating
1	***Are any of the identified sites or buildings associated with a historical person or group?*** No	N/A
2	***Are any of the buildings or identified sites associated with a historical event?*** No	N/A
3	***Are any of the identified sites or buildings associated with a religious, economic social or political or educational activity?*** No	N/A

4	***Are any of the identified sites or buildings of archaeological significance?*** No	N/A
5	***Are any of the identified buildings or structures older than 60 years?*** No	N/A

Architectural Significance

No	Criteria	Rating
1	***Are any of the buildings or structures an important example of a building type?*** No	N/A
2	***Are any of the buildings outstanding examples of a particular style or period?*** No	N/A
3	***Do any of the buildings contain fine architectural details and reflect exceptional craftsmanship?*** No	N/A
4	***Are any of the buildings an example of an industrial, engineering or technological development?*** No	N/A
5	***What is the state of the architectural and structural integrity of the building?*** No	N/A
6	***Is the building's current and future use in sympathy with its original use (for which the building was designed)?*** N/A	-
7	***Were the alterations done in sympathy with the original design?*** N/A	-
8	***Were the additions and extensions done in sympathy with the original design?*** N/A	-
9	***Are any of the buildings or structures the work of a major architect, engineer or builder?*** No.	N/A

Spatial Significance

Even though each building needs to be evaluated as a single artefact the site still needs to be evaluated in terms of its significance in its geographic area, city, town, village, neighbourhood or precinct. This set of criteria determines the spatial significance.

No	Criteria	Rating
1	***Can any of the identified buildings or structures be considered a landmark in the town or city?*** No	-
2	***Do any of the buildings contribute to the character of the neighborhood?*** No	-
3	***Do any of the buildings contribute to the character of the square or streetscape?*** No	-
4	***Do any of the buildings form part of an important group of buildings?*** No	-

Impact Evaluation

This HIA Methodology assists in evaluating the overall effect of a proposed activity on the heritage environment. The determination of the effect of a heritage impact on a heritage parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the heritage practitioner through the process of the heritage impact

assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

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 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.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the heritage 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 will be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

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		
Including a brief description of the impact of the heritage parameter being assessed in the context of the project. This criterion includes a brief written statement of the heritage 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 a heritage 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 heritage 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 heritage 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 heritage 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 heritage 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.

Anticipated Impact of the Development

Grave Sites

IMPACT TABLE FORMAT		
Heritage component	*Sites 001,002,003,004,005,006,007,009,011,013*	
Issue/Impact/Heritage Impact/Nature	*Upgrading of Mswaneni Road KZN*	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Irreversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Medium cumulative effect*	
Intensity/magnitude	*High*	
Significance Rating of Potential Impact	*51 points. The impact will have a high negative impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	1
Reversibility	4	2
Irreplaceable loss	3	1
Duration	2	2
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	51 (high negative)	8 (low negative)
Mitigation measure	*The indicated graves should be demarcated with barrier tape before construction commences. Graves within 3m of the*	

	proposed upgrade should be relocated to an official cemetery.

Stone Walled Sites

IMPACT TABLE FORMAT		
Heritage component	*Sites 008,010,012*	
Issue/Impact/Heritage Impact/Nature	*Upgrading of Mswaneni Road KZN*	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Irreversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Medium cumulative effect*	
Intensity/magnitude	*High*	
Significance Rating of Potential Impact	*51 points. The impact will have a high negative impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	1
Reversibility	4	2
Irreplaceable loss	3	1
Duration	2	2
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	51 (high negative)	8 (low negative)
Mitigation measure	*The perimeter of these sites should be indicated by barrier tape before construction commences. If development is to come within 3m of the site, a second phase of investigation will be required.*	

Paleontological sites

Paleontological sites will not be affected as bedrock is not to be disturbed by the proposed activities.

Mitigation

No mitigation needed.

Built Environment

Some structures associated with rural living were identified;

- Brick outbuildings (modern)
- Barb-wire fences (modern)
- Mud-brick huts (modern)
- Dirt roads (modern)
- Footpaths

Mitigation

None of the structures will be affected by the road upgrade activities.

Cultural Landscape

The following landscape types were identified during the study.

Landscape Type	**Description**	**Occurrence**	**Identified**

		still possible?	on site?
1 Paleontological	Mostly fossil remains. Remains include microbial fossils such as found in Barberton Greenstones	Yes, sub-surface	No
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	No	No
3 Historic Built Environment	- 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: - 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.	Yes	Yes
5 Historic rural town	- Historic mission settlements - Historic townscapes	No	No
6 Pristine natural landscape	- 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.	No	No
7 Relic Landscape	- Past farming settlements - Past industrial sites - Places of isolation related to attitudes to medical treatment - Battle sites - Sites of displacement,	Yes	No
8 Burial grounds and grave sites	- 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	No
9 Associated Landscapes	- 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	- Setting of the yard and its context	No	No

Farmyard	- 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		
11 Historic institutions	- Historical prisons - Hospital sites - Historical school/reformatory sites - Military bases	No	No
12 Scenic visual	- Scenic routes	No	No
13 Amenity landscape	- View sheds - View points - Views to and from - Gateway conditions - Distinctive representative landscape conditions - Scenic corridors	No	No

Mitigation

It is recommended that the development designs take into account the positive and negative characteristics of the existing cultural landscape type and that they endeavor to promote the positive aspects while at the same time mitigating the negative aspects.

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 Architects and The Department of Environmental Affairs and Development Planning (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 formalised. In these guidelines they recommend a buffer zone of 1km around significant heritage sites to minimise the visual impact.

Assumptions and Restrictions

- It is assumed that the SAHRIS database locations are correct
- It is assumed that the paleontological information collected for the project is comprehensive.
- It is assumed that the social impact assessment and public participation process of the S&EIR will result in the identification of any intangible sites of heritage potential.

Resource Management Recommendations

Although unlikely, sub-surface remains of heritage sites could still be encountered during the construction activities associated with the project. Such sites would offer no surface indication of their presence due to the high state of alterations in some areas as well as heavy plant cover in other areas. The following indicators of unmarked sub-surface sites could be encountered:

- Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate);
- Bone concentrations, either animal or human;
- Ceramic fragments such as pottery shards either historic or pre-contact;
- Stone concentrations of any formal nature.

The following recommendations are given should any sub-surface remains of heritage sites be identified as indicated above:

- All operators of excavation equipment should be made aware of the possibility of the occurrence of sub-surface heritage features and the following procedures should they be encountered.
- All construction in the immediate vicinity (50m radius of the site) should cease.
- The heritage practitioner should be informed as soon as possible.
- In the event of obvious human remains the South African Police Services (SAPS) should be notified.
- Mitigation measures (such as refilling etc.) should not be attempted.
- The area in a 50m radius of the find should be cordoned off with hazard tape.
- Public access should be limited.
- The area should be placed under guard.
- No media statements should be released until such time as the heritage practitioner has had sufficient time to analyze the finds.

Conclusion

The construction of the existing roads has resulted in damage to any possible previous sites of heritage significance. Provided the recommendations regarding the burial sites as well as the stone walled sites are followed, it is not anticipated that any further sites will be affected.

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DESKTOP PALAEONTOLOGICAL HERITAGE IMPACT ASSESSEMENT RE
THE SITE OF A PROPOSED SOLAR POWER PRODUCTION FACILITY KN
THE NEWCASTLE SOLAR ENERGY FACILITY TO BE LOCATED ON THE R
OF ERF 13661 WITHIN PORTION 17 OF THE FARM TWEEFONTEIN 344, KV
NATAL PROVINCE

Prepared for:

Heritage Contract and Archaeological Consulting CC

On Behalf of:

Building Energy SPA

Prepared By:

Prof B.D. Millsteed

EXECUTIVE SUMMARY

Building Energy SPA, an Independent Power Producer (IPP), is proposing the establishment of a small-scale commercial solar energy facility (using photovoltaic technology) of approximately 5 MW in capacity. The facility is proposed to be located approximately 8 km southeast of the town of Newcastle, on the Remainder of Erf 13661 within Portion 17 of the farm Tweefontein 344, Newcastle Local Municipality and Amajuba District Municipality in the Kwa-Zulu Natal Province. The aerial extent of the area reported upon, herein, as approximately 4.4 ha, but the area of the eventual photovoltaic array footprint will probably be somewhat smaller in extent. An electrical transmission line of approximately 1.4 km length is also proposed to connect the photovoltaic facility to the Karbochem Plant Substation located to the west of the photovoltaic facility. The proposed project will be referred to as the Newcastle Solar Energy Facility.

Building Energy SPA has appointed Savannah Environmental (Pty) Ltd to undertake a Basic Environmental Impact Assessment of the proposed project. Savannah Environmental (Pty) Ltd has appointed Heritage Contract and Archaeological Consulting CC, as independent consultants, to undertake a desktop Heritage Impact Assessment of the project area. Heritage Contract and Archaeological Consulting CC has contracted BM Geological Services to provide a desktop Palaeontological Heritage Impact Assessment Report in respect of the proposed project that will form part of the final Heritage Impact Assessment Report.

The project area is completely underlain by potentially fossiliferous sedimentary rocks of the Early Permian Vryheid Formation. The potential for the proposed project to result in a negative impact upon the palaeontological heritage of the site has been assessed as moderate. The fossils known to be present within the formation elsewhere in South Africa are known to contain highly scientifically and culturally significant fossils, particularly the plant macrofossils of the *Glossopteris* flora. Any damage caused to the fossil materials that may be present within the strata underlying the project area would be both permanent and irreversible. It is recommended that the site (including the route of the power line) be inspected by a palaeontologist, as part of a full Palaeontological Impact Assessment Study prior to commencement of the project to enable meaningful and informed further recommendations regarding damage mitigation protocols to be made, should any be required.

The project has been assessed as being socially beneficial, herein, as it would provide renewable electricity to an increasingly stressed national power grid. Should the damage mitigation and prevention protocols outlined, herein, be implemented this would minimise the possibility of any negative impact upon the fossil heritage of the area.

In summary, this desktop study has not identified any palaeontological reason to prejudice the progression of the Newcastle Solar Energy Facility subject to the necessary damage mitigation and avoidance protocols being implemented.

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1 INTRODUCTION

Building Energy SPA, an Independent Power Producer (IPP), is proposing the establishment of a small-scale commercial solar energy facility (using photovoltaic technology) of approximately 5 MW in capacity. The facility is proposed to be located approximately 8 km southeast of the town of Newcastle, on the Remainder of Erf 13661 within Portion 17 of the farm Tweefontein 344, Newcastle Local Municipality and Amajuba District Municipality in the Kwa-Zulu Natal Province. The aerial extent of the area reported upon, herein, as approximately 4.4 ha, but the area of the eventual photovoltaic array footprint will probably be somewhat smaller in extent. An electrical transmission line of approximately 1.4 km length is also proposed to connect the photovoltaic facility to the Karbochem Plant Substation located to the west of the photovoltaic facility. The proposed project will be referred to as the Newcastle Solar Energy Facility.

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2 TERMS OF REFERENCE AND SCOPE OF THE STUDY

The terms of reference for this study were as follows:-

- Conduct a desktop assessment of the potential impact of the proposed project on the palaeontological heritage of the project area.
- Describe the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Quantify the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Provide an overview of the applicable legislative framework.
- Make recommendations concerning future work programs as, and if, necessary.

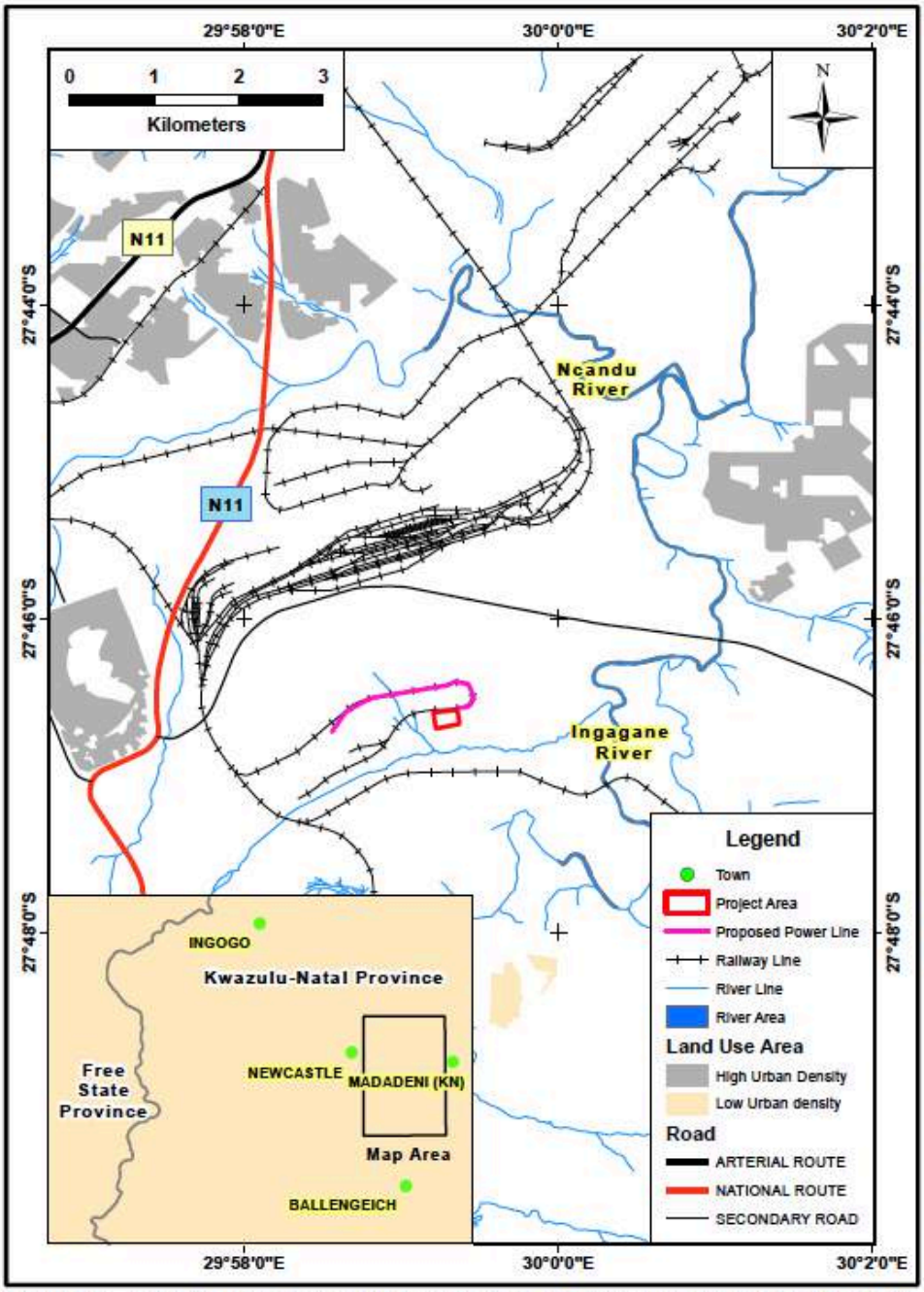

Figure 1: Location map showing the position of the Newcastle Solar Energy Facility and its associated proposed power line.

3 LEGISLATIVE REQUIREMENTS

South Africa's cultural resources are primarily dealt with in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

3.1 The National Heritage Resources Act

The following are protected as cultural heritage resources by the National Heritage Resources Act:

- Archaeological artefacts, structures and sites older than 100 years,
- Ethnographic art objects (e.g. prehistoric rock art) and ethnography,
- Objects of decorative and visual arts,
- Military objects, structures and sites older than 75 years,
- Historical objects, structures and sites older than 60 years,
- Proclaimed heritage sites,
- Grave yards and graves older than 60 years,
- Meteorites and fossils,
- Objects, structures and sites or scientific or technological value.

The Act also states that those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities. The national estate includes the following:

- Places, buildings, structures and equipment of cultural significance,
- Places to which oral traditions are attached or which are associated with living heritage,
- Historical settlements and townscapes,
- Landscapes and features of cultural significance,
- Geological sites of scientific or cultural importance,
- Sites of Archaeological and palaeontological importance,
- Graves and burial grounds,
- Sites of significance relating to the history of slavery,
- Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

3.2 Need for Impact Assessment Reports

Section 38 of the Act stipulates that any person who intends to undertake an activity that falls within the following:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length,
- The construction of a bridge or similar structure exceeding 50 m in length,

- Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof,
- Re-zoning of a site exceeding 10 000 m^2,
- Any other category provided for in the regulations of SAHRA or a provincial heritage 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. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

3.3 Legislation Specifically Pertinent to Palaeontology*

*Note: Section 2 of the Act defines "palaeontological" material as "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".

Section 35(4) of this Act specifically deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

- Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite,
- Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite,
- Trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites,
- Alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned palaeontological objects may only be disturbed or moved by a palaeontologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Further to the above point, Section 35(3) of this Act indicates that "any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority". Thus, regardless of the granting of any official clearance to proceed with any development based on an earlier assessment of its impact on the Palaeontological Heritage of an area, the development should be halted and the relevant authorities informed should fossil objects be uncovered during the progress of the development.

3.4 The National Environmental Management Act [as amended]

This Act does not provide the detailed protections and administrative procedures for the protection and management of the nation's Palaeontological Heritage as are detailed in the National Heritage Resources Act, but is more general in is application. In particular Section 2(2) of the Act states that environmental management must place people and their needs at the forefront of its concerns and, amongst other issues, serve their cultural interests equitably. Further to this point section 2(4)(a)(iii) states that disturbances of sites that constitute the nation's cultural heritage should be avoided, and where it cannot be avoided should be minimised and remedied.

Section 23(1) indicates that a general objective of integrated environmental management is to identify, predict and evaluate the actual and potential impact of activities upon the cultural heritage. This section also highlights the need to identify options for mitigating of negative effects of activities with a view to minimising negative impacts.

In order to give effect to the general objectives of integrated environmental management outlined in the Act the potential impact on cultural heritage of activities that require authorisation or permission by law must be investigated and assessed prior to their implementation and reported to the relevant organ of state. Thus, a survey and evaluation of cultural resources must be done in areas where development projects that will potentially negatively affect the cultural heritage will be performed. During this process the impact on the cultural heritage will be determined and proposals for the mitigation of the negative effects made.

4 RELEVENT EXPERIENCE

Prof Millsteed holds a PhD in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is currently the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Impact Assessment Report. Dr Millsteed is registered with the South African Council for Natural Scientific Professions (SACNASP), and is a member of the Palaeontological Society of South African and the Geological Society of South Africa.

5 INDEPENDENCE

Prof Millsteed was contracted as an independent consultant to conduct this Palaeontological Heritage Impact Assessment study and shall receive fair remuneration for these professional services. Neither Prof Millsteed nor BM Geological Services has any financial interest either in Building Energy SPA or the proposed Newcastle Solar Energy Facility.

6 GEOLOGY AND FOSSIL POTENTIAL

Figure 2 shows that the project area is completely underlain by rocks of the Early Permian Vryheid Formation. A summary of the characteristics of the Vryheid Formation and its fossiliferous potential follows.

6.1 Vryheid Formation

6.1.1 Geology

The Main Karoo Basin consists of a retro-arc foreland basin filled with a lithological succession ranging in age from the Late Carboniferous to the Middle Jurassic (Johnson *et al*., 2006). The basin-fill sequence wedges out northwards over the adjacent Kaapvaal Craton.

In the Main Karoo Basin of South Africa the Vryheid Formation is a sandstone and coal-rich stratigraphic unit that interfingers with (i.e., is transitional with and partially time equivalent to) the overlying Volkrust and underlying Pietermaritzburg Formations; both of which are both are predominantly argillaceous (Figure 3). Genetically the formation can be divided into lower fluvial-dominated deltaic interval, a middle fluvial interval (the coal-bearing zone) and an upper fluvial-dominated deltaic interval (Johnson *et al*., 2006). The thickness and frequency of the sandstone units increases from the base of the formation, reaching their maximum in the middle fluvial interval and then decrease again towards the overlying Volksrust Formation. To the south and south-east the

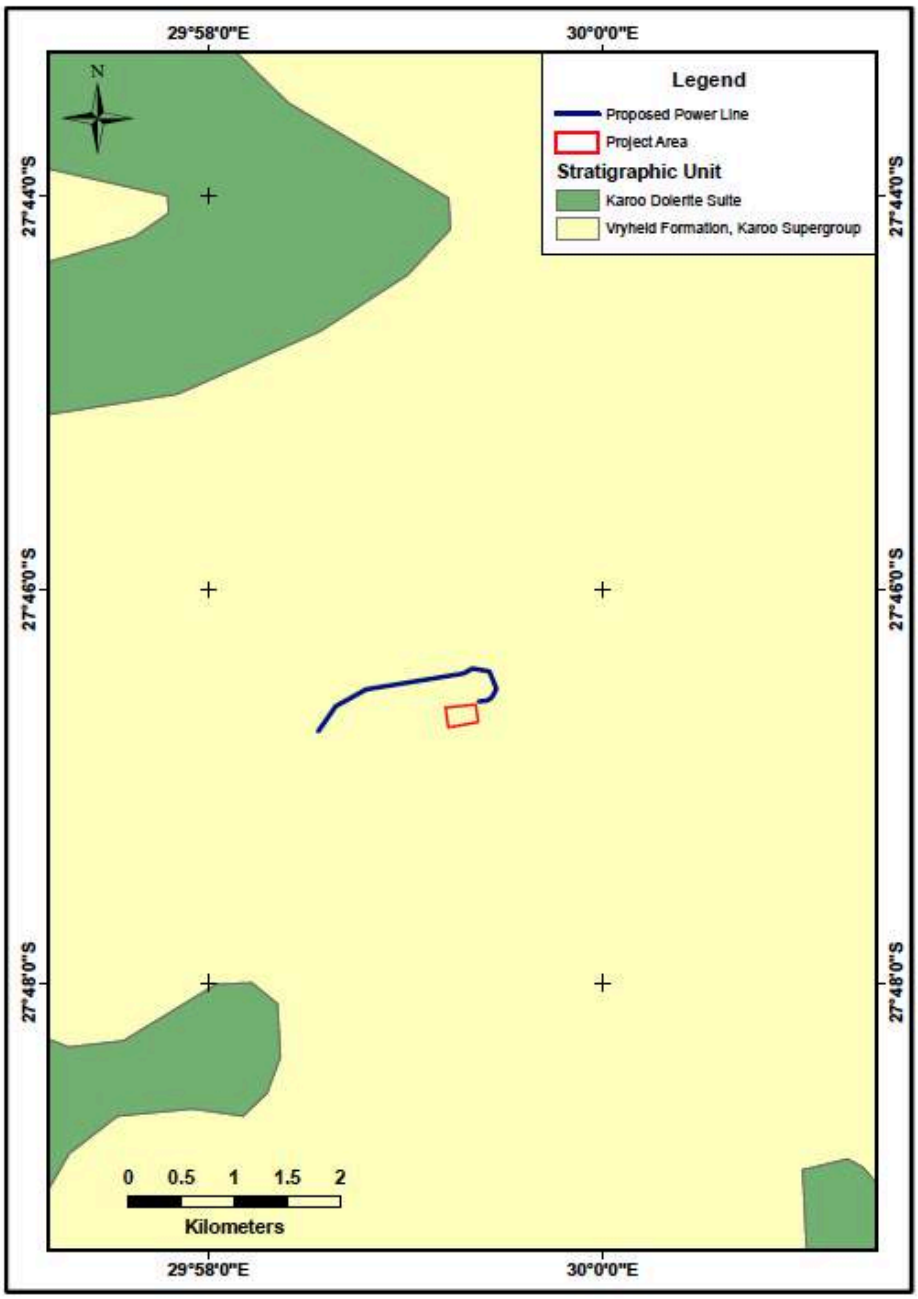

Figure 2: Geological map of the area underlying the Newcastle Solar Energy Facility and its associated power line.

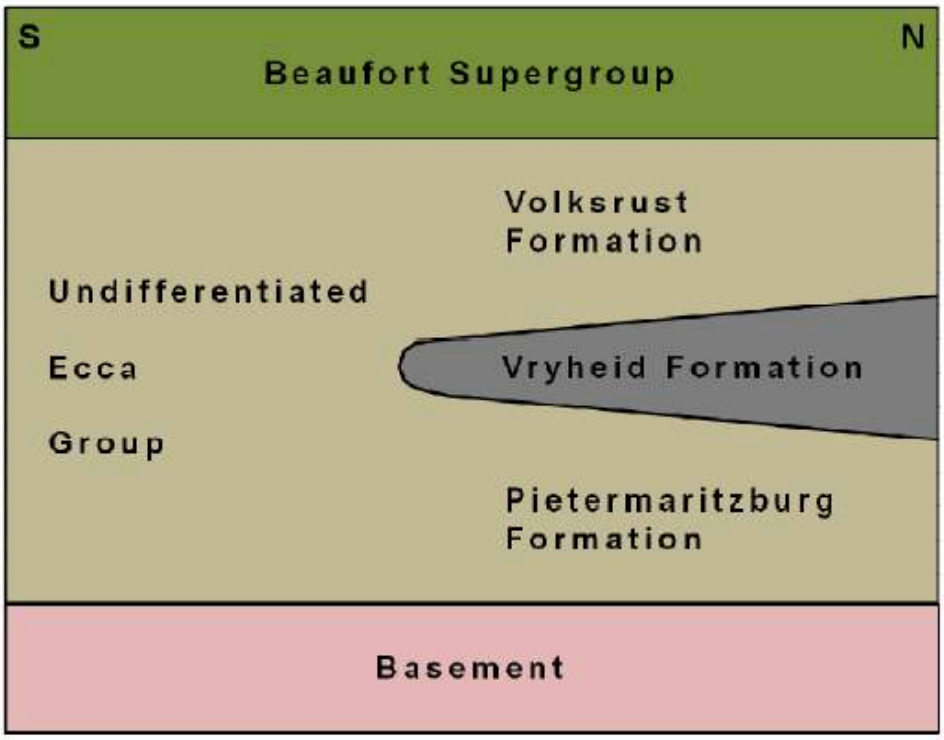

Figure 3: Schematic north-south oriented stratigraphic section of the Ecca Group in the north-east corner of the Karoo Basin. The Volksrust and Pietermaritzburg Formations can only be recognised when the Vryheid Formation forms part of the vertical sequence. In the north and north-western portions of the basin the Pietermaritzburg Formation was not deposited and the coal-bearing strata of the Vryheid Formation rest directly upon the basement.

Vryheid Formation grades laterally into undifferentiated, deep-water argillites of the Ecca Group (Figure 3).

The Vryheid Formation is one of sixteen (16) recognised stratigraphic units that constitute the Permian Ecca Group. During the deposition of the Ecca Group the basin was dominated by a large sea (the salinity levels of this water body remain unresolved). The exception to this model was the deposition of the coal-bearing strata of the Vryheid Formation along the northern margin during an episode of deltaic progradation into the basin.

Deposition of the Vryheid Formation was terminated by a basin-wide transgression that drowned the Vryheid deltas and their coal swamps resulting in the deposition of the deep water sediments of the Volksrust Formation.

6.1.2 Palaeontological potential

The most conspicuous and common components of the palaeontological record of the Ecca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large and conspicuous leaf form taxa dominate the *Glossopteris* flora; these being *Glossopteris* and *Gangamopteris*. Within the upper Ecca (containing the Vryheid Formation) *Gangamopteris* has ceased to occur with only *Glossopteris* present (Anderson and McLauchlan, 1976). The palaeobotanical record of the Ecca Group is diverse and the literature describing it is voluminous (numerous papers having been published by E. Plumstead, H. Anderson, J. Anderson, E. Kovaks-Endrődy and M. Bamford amongst others). A comprehensive review of the flora in the Karoo Basin literature is, accordingly, beyond the scope of this study, but a thorough review of the palaeobotanical content of the Ecca Group in general and the Vryheid Formation in particular is presented in Bamford (2004). In that summary it is indicated that the Vryheid Formation can be expected to contain the plant macrofossils *Buthelezia*, *Sphenophyllum*, *Rangia*, *Phyllotheca*, *Schizoneura*, *Sphenopteris*, *Noeggerathiopsis*, *Taeniopteris*, *Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon* and *Prototaxoxylon*. In addition to the above records can be added the observations of Tavener-Smith *et al*., (1988) where it was noted that both *Glossopteris* and *Vertebraria* occur within the palaeontological record of the formation.

In portions of the formation that are typified by low thermal alteration abundant assemblages of palynomorph plant microfossils (including acritarchs) can be expected (Anderson, 1977).

Jubb and Gardiner (1975) report the presence of fragmentary fish fossils within the Ecca sequence of southern Africa; these being *Coelacanthus dendrites* from the Somkele coal-field of northern Natal and *Namaicthys digitata* from correlative strata in the Senge Coal-fields of Zimbabwe. While fish faunas are obviously rare and none have been reported from the Vryheid Formation the possibility remains that they may be present.

Animal body fossils are rare within the Ecca Group in general (excepting the time equivalent faunas of the Whitehill Formation). However, no reptile fossils have been identified within the Vryheid Formation.

Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage they identified two forms (*Helminthiopsis* and *Taphrelminthopsis* within horizontally laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

7 ENVIRONMENT OF THE PROPOSED PROJECT SITE

The area reported upon herein for the photovoltaic facility is approximately 4.4 ha in extent, but the final footprint of the project within this area will probably be somewhat smaller in aerial extent. An electrical transmission line of approximately 1.4 km length is also proposed to connect the photovoltaic facility to the Karbochem Plant Substation located to the west of the photovoltaic facility. Examination of Google earth imagery (Figure 4) indicates that the proposed location of the photovoltaic generation facility is located immediately adjacent to the Karbochem rubber plant and Lanxess chrome chemicals; the photovoltaic facility being located upon undeveloped grassland. The proposed power line exits the photovoltaic facility on its north-eastern corner and extends towards the north, before curving markedly to the west (skirting an industrial development) and then heads westwards (Figure 4). The initial portion of the power line is also located upon undeveloped grassland, but its east-west oriented northern section appears to parallel an existing road.

The vegetation cover of the project area (including the power line) consists of the KwaZulu-Natal Highland Thornveld (Figure 5). The conservation status of the KwaZulu-Natal Highland Thornveld is described by Mucina and Rutherford (2006) as least threatened. Figure 6 indicates that the entire project site is located on the southern flanks of a low, rounded hill. No significant fluvial drainage lines traverse the project area, although drainage lines immediately to the west and south of the site drain eastwards into the Ingagane River (located approximately 1.5 km to the east of the project area).

Figure 4: Google earth image of the site of the proposed Newcatle Solar Energy Facility (red polygon) and its associated power line (purple line).

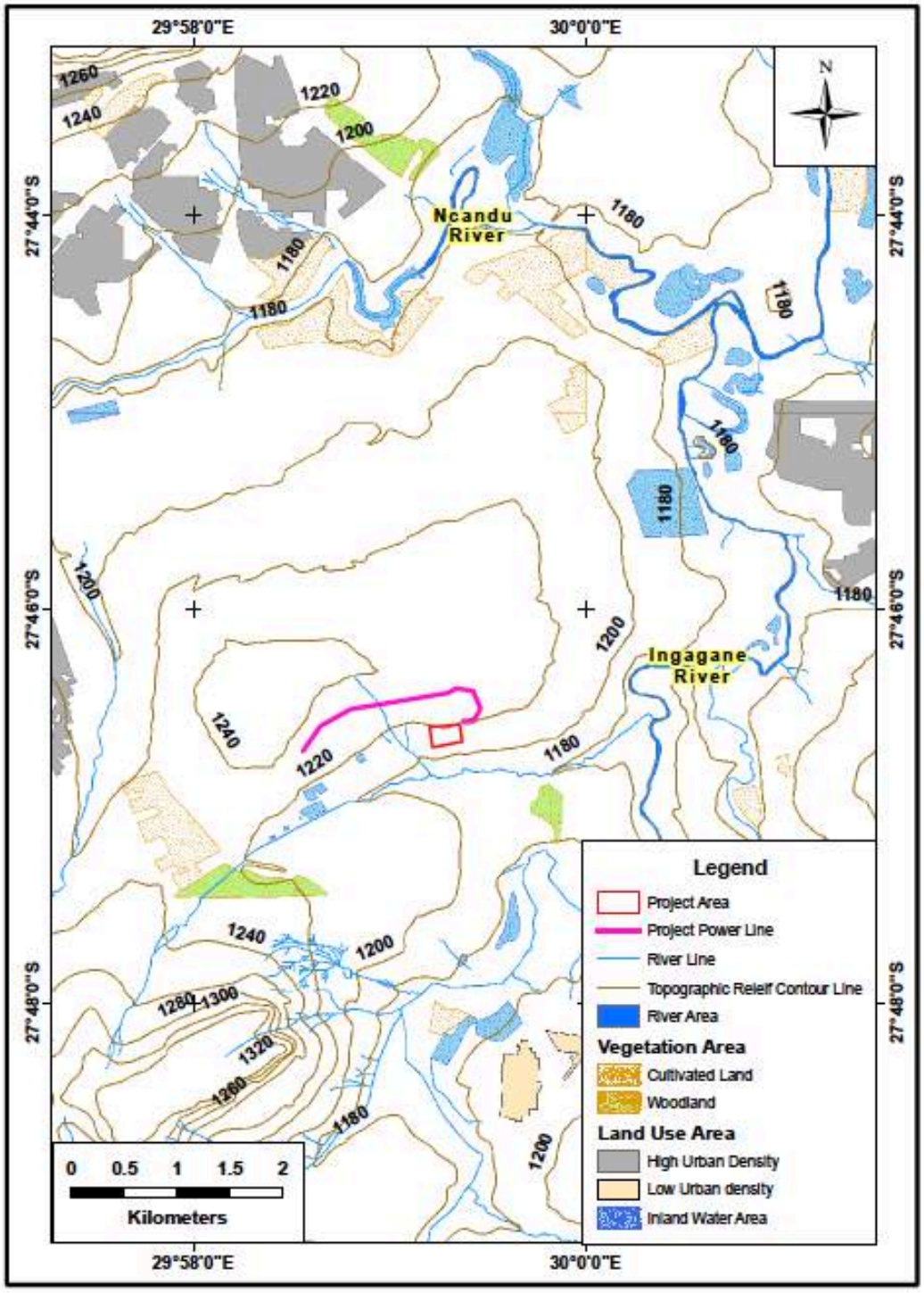

Figure 5: Map of the two project area and its immediate environs. The project area lies on the southern margin of a low rounded hill. No significant fluvial systems traverse the proposed power production infrastructure, but two located to the immediate west and south of the site flow in to the Ingagane River. The western drainage line cross-cuts the proposed power line. The topographic contour interval is 20 m.

Palaeontological Impact Assessment Report –On the site of a proposed solar power production facility known as the Newcastle Solar Energy Facility, on the Remainder of Erf 13661 on Portion 17 of the farm Tweefontein 344, Kwa-Zulu Natal Province.

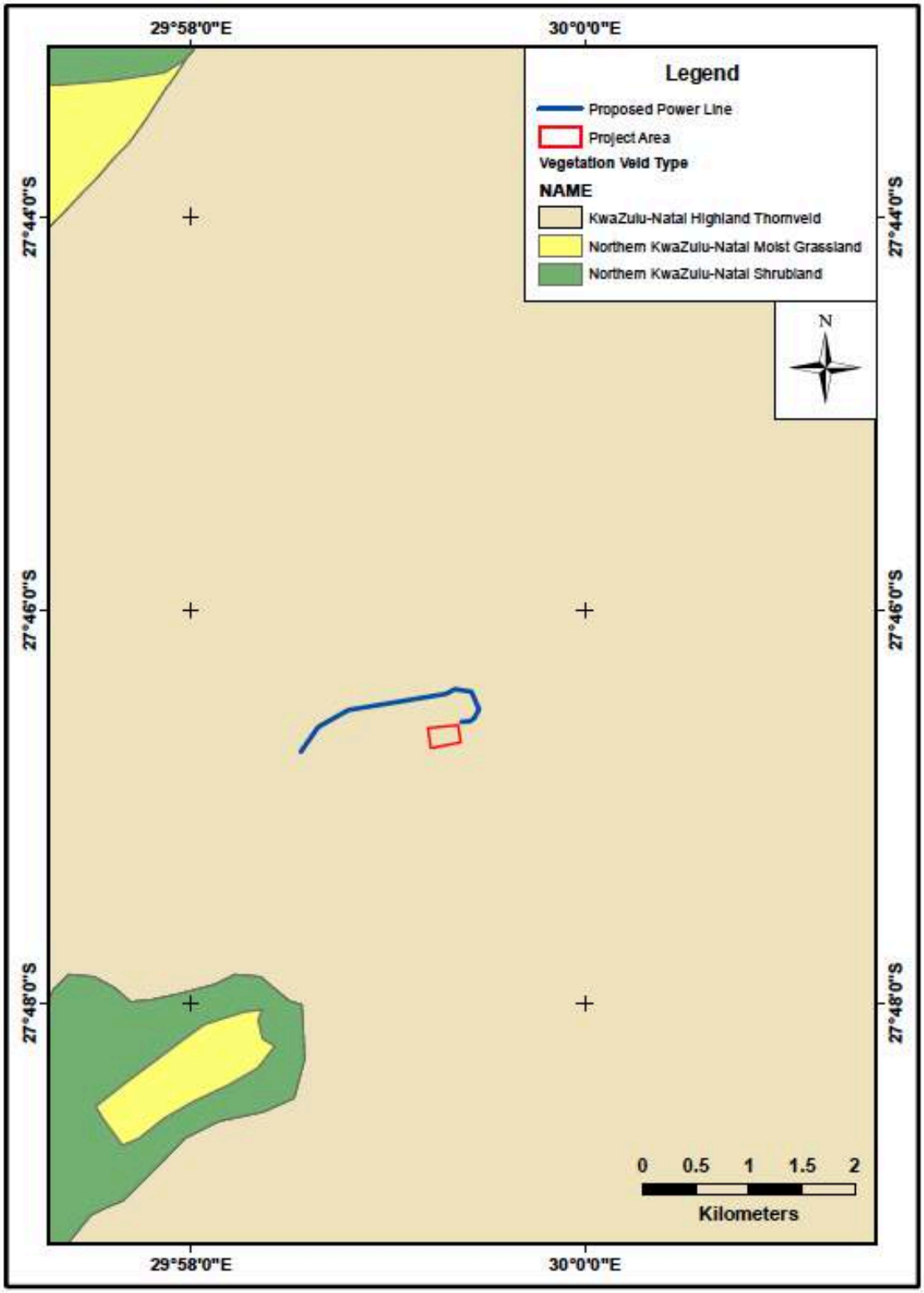

Figure 6: Map of the distribution of the vegetation veld types located beneath the project area and within its immediate environs (after Mucina and Rutherford, 2006).

8 OVERVIEW OF SCOPE OF THE PROJECT

The development footprint of the proposed Newcastle Solar Energy Facility will be less than 4.4 ha in extent for the area to underlie the photovoltaic array. An electrical transmission line of approximately 1.4 Km length is also proposed to link the electricity production facility to the national power grid. Within this general framework the following infrastructure will be established:

- Arrays of photovoltaic (PV) panels with a capacity of up to 5 MW.
- Mounting structures to be either rammed steel piles or piles with pre-manufactured concrete footing to support the PV panels.
- Cabling between the projects components, to be lain underground.
- Inverters/transformer enclosures.
- An on-site switching station.
- An overhead power line of approx. 1400 m to facilitate the connection between the solar energy facility and the existing Karbochem Plant Substation located to the west of the facility.
- Internal access roads.
- Fencing and workshop area for maintenance, storage and an on-site office.

8.1 Effect of project on the geology

It may be interpreted from Section 8 above that the development anticipated within the project area could be expected to be restricted to the upper 1-2 m of the land surface, with the deepest anticipated impacts upon the underlying geology resulting from the excavations required to lay the underground cables and for the foundations required for the various buildings, photovoltaic panels or the power line pylons.

9 IMPACT ASSESSMENT

The potential impact of the proposed mining area is categorised below according to the following criteria:-

9.1 Nature of Impact

The potential negative impacts of the proposed project on the palaeontological heritage of the area are:

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations. Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage

of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the project's infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

9.2 Extent of impact

The possible extent of the permanent impact of the proposed project on the palaeontological heritage of South Africa is restricted to the damage, destruction or accidental relocation of fossil material caused by the excavations and construction of the necessary infrastructure elements forming part of the project. The possible source of a less permanent negative impact on the palaeontological heritage is the loss of access for scientific research to any fossil materials that become covered by the various infrastructural elements that comprise the project. The **extent of the area of potential impact is, accordingly, categorised as local** (i.e., restricted to the project site).

9.3 Duration of impact

The anticipated duration of the identified potential impact is assessed as potentially **permanent to long term**. This is assessment is based on the fact that, in the absence of mitigation procedures (should fossil material be present within the area to be affected) the damage or destruction of any palaeontological materials will be permanent. Similarly, any fossil materials that exist below the structures and infrastructural elements that will constitute the solar power facility and the associated power line pylons will be unavailable for scientific study for the life of the existence of those features. The life of the facility is expected to be permanent herein.

9.4 Probability of impact

The sediments of the Vryheid Formation are noted for containing an important palaeontological heritage particularly in respect of plant macrofossils of the *Glossopteris* flora. However, the occurrence of fossils within the geological record is erratic in general and the chance of impacting upon most macrofossil types at any particular point within the Vryheid Formation is low. It must be noted however, that where plant macrofossils or trace fossils are present within a sequence (as they are in the Vryheid Formation)

they are often in dense accumulations and the probability of a negative impact is accordingly assessed as being **moderate**.

9.5 Significance of the impact

Should the project progress without due care to the possibility of fossils being present within the Vryheid Formation the resultant damage, destruction or inadvertent relocation any affected fossils will be permanent and irreversible. This potential for negative impact is accentuated by the fact that often the plant macrofossils and trace fossils that are known to be present in this formation often occur in dense accumulations, and as such, if any negative impact occurs it may well affect many fossils simultaneously. The delta top/fluvial/coal swamp environments that existed during the deposition of the Vryheid Formation provide an important window into the evolution of plant life of the famous *Glossopteris* flora during the Early Permian within the Main Karoo Basin. Their significance is due to the uniqueness of their terrestrial environments within the basin fill of the Main Karoo Basin at that time. Thus, any fossil materials occurring within the project area are potentially extremely scientifically and culturally significant and any negative impact on them would be of **high significance**.

The scientific and cultural significance of fossil materials is underscored by the fact that many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the construction of project infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

The certainty of the exact *in situ* location of fossils and their precise location within the stratigraphic sequence is essential to the scientific value of fossils. The movement of any fossil material during the construction of the facility that results in the exact original location of the fossil becoming unknown will either greatly diminish or destroy the scientific value of the fossil.

9.6 Severity / Benefit scale

The proposed project is categorised, herein, as being potentially **beneficial**. This classification is based on the intention that the project will provide renewable energy to an increasingly strained national power grid.

The probability of a negative impact on the palaeontological heritage of the project areas has been categorised as moderate. However, the implementation of suitable damage mitigation and avoidance protocols, as outlined below, will minimise the probability of any negative impact occurring.

9.7 Status

The proposed project would provide electricity to the national power grid, which is currently regularly failing to meet the demands placed upon it. As such, the project is determined as having a **positive status** herein.

10 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSABLE LOSS

The degree to which the possible negative effects of the proposed project can be mitigated, reversed or will result in irreversible loss of the palaeontological heritage can be determined as discussed below.

10.1 Mitigation

It is recommended that thorough examination of the project area (including the proposed route of the power line) be made by a palaeontologist prior to the commencement of the project as part of a full Palaeontological Impact Assessment Study. This would allow a meaningful evaluation of the presence of potentially fossiliferous strata within the project area. If fossil materials prove to be present the process would allow the identification of any such fossils that should either be protected completely or could have damage mitigation procedures emplaced to minimise negative impacts.

It is also recommended that, should the project proceed to commencement, a close examination of all excavations be made while they are occurring. Should any fossil materials be identified, the excavations should be halted and SAHRA informed of the discovery (as required in Section 3.3 above). A significant potential benefit of the examination of the excavations associated with the construction of the project is that currently unobservable fossils may be uncovered. As long as the construction process is closely monitored it is possible that potentially significant fossil material may be made available for scientific study.

Should scientifically or culturally significant fossil material exist within the project area any negative impact upon it could be mitigated by its excavation (under permit from SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved.

10.2 Reversal of damage

Any damage to, or the destruction of, palaeontological materials or reduction of scientific value due to a loss of the original location is **irreversible**.

10.3 Degree of irreversible loss

Once a fossil is damaged, destroyed or moved from its original position without its geographical position and stratigraphic location being recorded the **damage is irreversible**.

Fossils are usually scarce and sporadic in their occurrence and the chances of negatively impacting on a fossil in any particular area are low. However, any fossil material is potentially of the greatest scientific and cultural importance. Thus, the potential always exists during construction and excavation within potentially fossiliferous rocks for the permanent and irreversible loss of extremely significant or irreplaceable fossil material. This said, many fossils are incomplete in their state of preservation or are examples of relatively common taxa. As such, just because a fossil is present it is not necessarily of great scientific value. Accordingly, not all fossils are necessary significant culturally of scientifically significant and the potential degree of irreversible loss will vary from case to case. The judgement on the significance of the fossil must be made by an experienced palaeontologist.

11 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The information provided within this report was derived from a desktop study of available maps and scientific literature; no direct observation was made of the area as result of a site visit.

12 ENVIRONMENTAL IMPACT STATEMENT

A desktop Palaeontological Impact Assessment Study has been conducted on the site of the proposed photovoltaic array and associated power transmission line; collectively named the Newcastle Solar Power Facility. The proposed project area is moderately large, consisting of an approximately 4.4 ha extent for the photovoltaic array as well as a length of approximately 1.4 km for the associated power line. However, any negative impacts to the palaeontological heritage of the region will be limited to the footprint area of the required infrastructure and the extent of any impacts is accordingly characterised as local.

The effects of the required construction operations to the geological strata underlying the project area will be restricted to the Early Permian Vryheid Formation; this geological unit is known to be fossiliferous. The probability of the project resulting in a negative

impact on the palaeontological heritage of the Vryheid Formation has been assessed as moderate. Any negative impact on the fossil materials will potentially be highly significant due to the scientific and cultural importance of many of the fossils that may be expected to be present. However, the social benefits of the project have been classified as beneficial, herein, as the project aims to provide renewable electricity to the increasingly stressed national power grid. It is accordingly recommended that the project area should be inspected by a palaeontologist prior to the commencement of the project to assess the palaeontological potential of the site and to enable informed recommendations to be made should damage mitigation or avoidance protocols need to be outlined. The implementation of this protocol will minimise the potential negative impact of the project.

This desktop study has not identified any palaeontological reason to prejudice the progression of the Newcastle Solar Energy Facility, subject to the recommended damage mitigation procedures being enacted.

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Prof B.D. Millsteed

14th July 2014