Phase 1 Cultural Heritage Impact Assessment:

THE PROPOSED CONSTRUCTION OF RIVER CROSSINGS ALONG UNDERGROUND HV FEEDER CABLES IN SANDTON AND GRAIGHALL, CITY OF JOHANNESBURG DISTRICT MUNICIPALITY, GAUTENG PROVINCE

Prepared for:
Envirolution (Ms S Bolingo)

- Postal Address: P O Box 1898, Sunninghill, 2157; Tel: 0861 444 499, E-mail: sheila@envirolution.co.za

Prepared by:
J A van Schalkwyk (D Litt et Phil),

- Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.
- Postal Address: 62 Coetzer Avenue, Monument Park, 0181; Tel: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

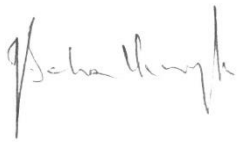
Report No: 2017/JvS/071

- Status: Final
- Date: December 2017
- Revision No: -
- Date: -

Declaration:

I, J.A. van Schalkwyk, declare that:

- I am suitably qualified and accredited to act as independent specialist in this application.
- I do not have any financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services, for which a fair numeration is charged.
- The work was conducted in an objective manner and any circumstances that might have compromised this have been reported.



J A van Schalkwyk
Heritage Consultant
December 2017

EXECUTIVE SUMMARY

Phase 1 Cultural Heritage Impact Assessment:
THE PROPOSED CONSTRUCTION OF RIVER CROSSINGS ALONG UNDERGROUND HV FEEDER CABLES IN SANDTON AND GRAIGHALL, CITY OF JOHANNESBURG DISTRICT MUNICIPALITY, GAUTENG PROVINCE

Envirolution Consulting (Pty) Ltd has been requested by Eskom SOC (Pty) Ltd to conduct a Basic Assessment and Water Use Licence Application (WULA) for the proposed construction of river crossings along underground HV feeder cables in Sandton and Craighall in Gauteng Province. Eskom is proposing a replacement and network strengthening strategy for the HV cable systems in the above-mentioned area in order to sustain load growth as well as provide high-level of network reliability for the future.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Envirolution* to conduct a cultural heritage assessment to determine if the proposed replacement and network strengthening strategy for the HV cable systems in the above-mentioned area would have an impact on any sites, features or objects of cultural heritage significance.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age and Iron Age) occupation and a much later colonial (farmer) component. The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less.

Impact assessment

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- Due to the density of the urban development in the region, it is very unlikely that any sites or features dating to the pre-colonial history of the region would still exist in the study area. However, isolated objects such as Stone Age artefacts might be exposed in areas close to stream beds.

- A large number of features, mostly houses, but also infrastructure related features, occur in the region. All of these are very formal and clearly visible. Due to the fact that the development will take place inside the river reserve, it is highly unlikely that any such features would be impacted on by the construction of construction of the HV feeder underground cables.

Alternatives considered

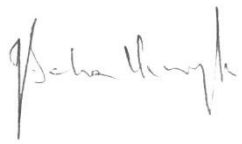
- Based on current understanding of the project, both the alternative technologies proposed for installing the HV cables would be suitable for constructing the underground HV feeder cables.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view it is recommended that the proposed development be allowed to continue.

Conditions for inclusion in the environmental authorisation:

- Should heritage features, archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.



J A van Schalkwyk
Heritage Consultant
December 2017

TECHNICAL SUMMARY

Project description	
Description	Installation of HV feeder underground cables
Project name	Eskom River Crossings

Applicant
Eskom

Environmental assessors
Envirolution
Ms S Bolingo

Property details	
Province	Gauteng
Magisterial district	Johannesburg
District municipality	City of Johannesburg
Topo-cadastral map	2628AA
Farm name	Various
Closest town	Johannesburg

Development criteria in terms of Section 38(1) of the NHR Act	Yes/No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length	Yes
Construction of bridge or similar structure exceeding 50m in length	No
Development exceeding 5000 sq m	No
Development involving three or more existing erven or subdivisions	No
Development involving three or more erven or divisions that have been consolidated within past five years	No
Rezoning of site exceeding 10 000 sq m	No
Any other development category, public open space, squares, parks, recreation grounds	No

Land use	
Previous land use	Urban
Current land use	Urban

TABLE OF CONTENTS

LIST OF FIGURES

GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 000 000 - 150 000 Before Present
Middle Stone Age	150 000 - 30 000 BP
Later Stone Age	30 000 - until c. AD 200

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Later Iron Age	AD 1300 - AD 1830

Historical Period: Since the arrival of the white settlers - c. AD 1840 - in this part of the country.

Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Mitigation, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

ABBREVIATIONS

ADRC	Archaeological Data Recording Centre
ASAPA	Association of Southern African Professional Archaeologists
CS-G	Chief Surveyor-General
EIA	Early Iron Age
ESA	Early Stone Age
LIA	Late Iron Age
LSA	Later Stone Age
HIA	Heritage Impact Assessment
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency

Phase 1 Cultural Heritage Impact Assessment:
THE PROPOSED CONSTRUCTION OF RIVER CROSSINGS ALONG UNDERGROUND HV FEEDER CABLES IN SANDTON AND GRAIGHALL, CITY OF JOHANNESBURG DISTRICT MUNICIPALITY, GAUTENG PROVINCE

1. INTRODUCTION

Envirolution Consulting (Pty) Ltd has been requested by Eskom SOC (Pty) Ltd) to conduct a Basic Assessment and Water Use Licence Application (WULA) for the proposed construction of river crossings along underground HV feeder cables in Sandton and Craighall in Gauteng Province. Eskom is proposing a replacement and network strengthening strategy for the HV cable systems in the above-mentioned area in order to sustain load growth as well as provide high-level of network reliability for the future.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. However, according to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Envirolution* to conduct a cultural heritage assessment to determine if the proposed replacement and network strengthening strategy for the HV cable systems in the above-mentioned area would have an impact on any sites, features or objects of cultural heritage significance.

This report forms part of the Environmental Impact Assessment (EIA) as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and is intended for submission to the South African Heritage Resources Agency (SAHRA).

2. TERMS OF REFERENCE

The aim of a full HIA investigation is to provide an informed heritage-related opinion about the proposed development by an appropriate heritage specialist. The objectives are to identify heritage resources (involving site inspections, existing heritage data and additional heritage specialists if necessary); assess their significances; assess alternatives in order to promote heritage conservation issues; and to assess the acceptability of the proposed development from a heritage perspective.

The result of this investigation is a heritage impact assessment report indicating the presence/ absence of heritage resources and how to manage them in the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, on condition of successful implementation of proposed mitigation measures.

2.1 **Scope of work**

The aim of this study is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where the replacement and network strengthening strategy for the HV cable systems is to be developed. This includes:

- Conducting a desk-top investigation of the area;
- A visit to the proposed development site,

The objectives were to:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.

2.2 **Limitations**

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate.
- No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities.
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is sufficient and that is does not have to be repeated as part of the heritage impact assessment.
- The unpredictability of buried archaeological remains.
- This report does not consider the palaeontological potential of the site.

3. LEGISLATIVE FRAMEWORK

The HIA is governed by national legislation and standards and International Best Practise. These include:

- South African Legislation
    - National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) – see Appendix 4 for more detail on this Act
    - Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA);
    - National Environmental Management Act 1998 (Act No. 107 of 1998) (NEMA); and
    - National Water Act, 1998 (Act No. 36 of 1998) (NWA).
- Standards and Regulations
    - South African Heritage Resources Agency (SAHRA) Minimum Standards;
    - Association of Southern African Professional Archaeologists (ASAPA) Constitution and Code of Ethics;
    - Anthropological Association of Southern Africa Constitution and Code of Ethics.
- International Best Practise and Guidelines
    - ICOMOS Standards (Guidance on Heritage Impact Assessments for Cultural World Heritage Properties); and
    - The UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (1972).

4. HERITAGE RESOURCES

4.1 **The National Estate**

The NHRA (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- 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 natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

4.2 **Cultural significance**

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix was developed whereby the above criteria were applied for the determination of the significance of each identified site (see Appendix 3). This allowed some form of control over the application of similar values for similar identified sites.

5. STUDY APPROACH AND METHODOLOGY

5.1 **Extent of the Study**

This survey and impact assessment covers the area as presented in Section 7 below and illustrated in Figures 2 & 3.

5.2 **Methodology**

5.2.1.1 Survey of the literature
A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted – see list of references in Section 11.

- Information on events, sites and features in the larger region were obtained from these sources.

5.2.1.2 Data bases
The *Heritage Atlas Database,* various SAHRA databases, the *Environmental Potential Atlas*, the *Chief Surveyor General* and the *National Archives of South Africa* were consulted.

- Database surveys produced a number of sites located in the larger region of the proposed development.

5.2.1.3 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources

The results of the above investigation are summarised in Table 1 below – see list of references in Section 11.

Table 1: Pre-Feasibility Assessment

Category	Period	Probability	Reference
Early hominin	Pliocene – Lower Pleistocene		
	Early hominin	None	
Stone Age	Lower Pleistocene – Holocene		
	Early Stone Age	Low	Heritage Database
	Middle Stone Age	Low	Heritage Database; Mason (1986)
	Later Stone Age	Low	Heritage Database

	Rock Art	None	
Iron Age	Holocene		
	Early Iron Age	None	
	Middle Iron Age	None	
	Later Iron Age	Low	Mason (1986)
Colonial period	Holocene		
	Contact period	Low	Brodie (2008); Mason (1986)
	Recent history	Medium	Brodie (2008); Van der Waal (1979)
	Industrial heritage	Low	Mendelsohn & Potgieter (1986)

5.2.2 *Field survey*

The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible sites, objects and structures. The area that had to be investigated was identified by the Envirolution by means of maps and .k*ml* files indicating the development area. This was loaded onto a Asus device and used in Google Earth during the field survey to access the areas.

The site was visited on 12 December 2017. The site was investigated by accessing each of the river crossing points – see Fig. 1 below.

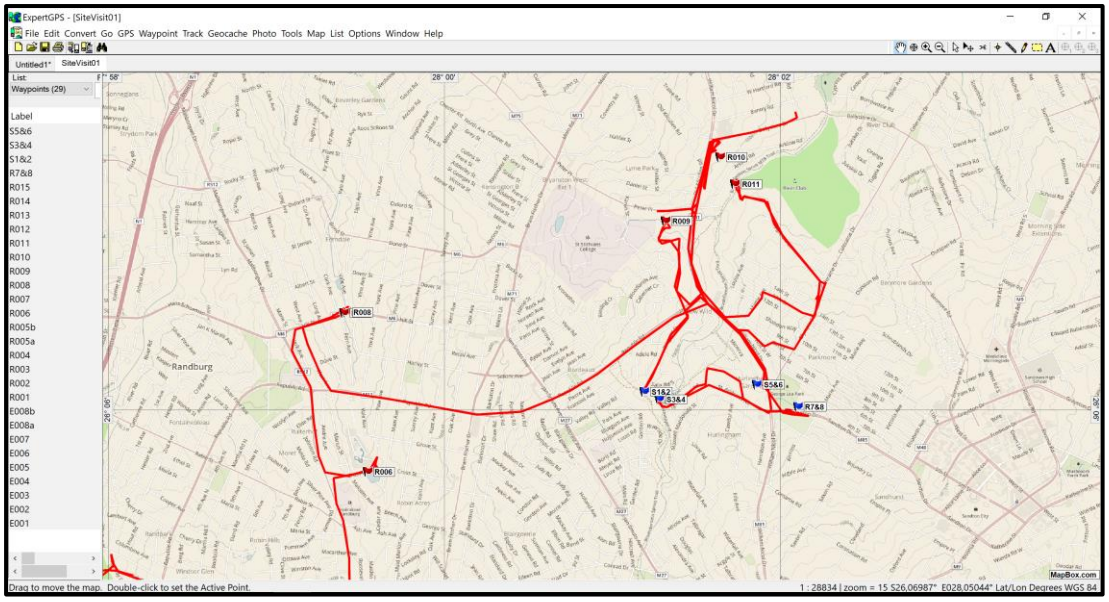


Fig. 1. Map indicating the track log of the field survey.

During the site visit, the archaeological visibility was much limited by the dense vegetation encountered at the different crossing points. Therefore, I completed a **controlled-exclusive surface survey**, where 'sufficient information exists on an area to make solid and defensible assumptions and judgements about where [heritage resource and] sites may and may not be' and 'an inspection of the surface of the ground, wherever this surface is visible, is made, with no substantial attempt to clear brush, turf, deadfall, leaves or other material that may cover the surface and with no attempt to look beneath the surface beyond the inspection of rodent burrows, cut banks and other exposures that are observed by accident' (King 1978).

5.2.3 *Documentation*

All sites, objects and structures that are identified are documented according to the general minimum standards accepted by the archaeological profession. Coordinates of individual localities are determined by means of the *Global Positioning System* (GPS) and plotted on a map. This information is added to the description in order to facilitate the identification of each locality.

The track log and identified sites were recorded by means of a Garmin Oregon 550 handheld GPS device. Photographic recording was done by means of a Canon EOS 550D digital camera.

Map datum used: Hartebeeshoek 94 (WGS84).

6. SITE SIGNIFICANCE AND ASSESSMENT

6.1 **Heritage assessment criteria and grading**

The National Heritage Resources Act, Act no. 25 of 1999, stipulates the assessment criteria and grading of heritage sites. The following grading categories are distinguished in Section 7 of the Act:

Table 2: Site Grading System.

SAHRA Cultural Heritage Site Significance			
Field Rating	Grade	Significance	Recommended Mitigation
National Significance	Grade I	High significance	Conservation by SAHRA, national site nomination, mention any relevant international ranking. No alteration whatsoever without permit from SAHRA
Provincial Significance	Grade II	High significance	Conservation by provincial heritage authority, provincial site nomination. No alteration whatsoever without permit from provincial heritage authority.
Local Significance	Grade III-A	High significance	Conservation by local authority, no alteration whatsoever without permit from provincial heritage authority. Mitigation as part of development process not advised.
Local Significance	Grade III-B	High significance	Conservation by local authority, no external alteration without permit from provincial heritage authority. Could be mitigated and (part) retained as heritage register site.
Generally Protected A	Grade IV-A	High/medium significance	Conservation by local authority. Site should be mitigated before destruction. Destruction permit required from provincial heritage authority.
Generally Protected B	Grade IV-B	Medium significance	Conservation by local authority. Site should be recorded before destruction. Destruction permit required from provincial heritage authority.
Generally Protected C	Grade IV-C	Low significance	Conservation by local authority. Site has been sufficiently recorded in the Phase 1 HIA. It requires no further recording before destruction. Destruction permit required from provincial heritage authority.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II, III and IV sites, the applicable of mitigation measures would allow the development activities to continue.

6.2 **Methodology for the assessment of potential impacts**

All impacts identified during the EIA stage of the study will be classified in terms of their significance. Issues were assessed in terms of the following criteria:

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

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M) x P; where
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are calculated as follows:

Table 3: Significance Ranking

Significance of impact					
Extent +	Duration +	Magnitude +	x Probability	= Significance	Weight
-	-	-	-	-	-
Points	Significant Weighting	Discussion			
< 30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.			

Extent +	Duration +	Magnitude +	x Probability	= Significance	Weight
31-60 points	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.			
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.			

7. PROJECT DESCRIPTION

7.1 **Site location**

The study area is located in Craighall and Sandton, on the eastern side of the N1 western by-pass in the City of Johannesburg Metropolitan Municipality. It includes suburbs such as Benmore Gardens, Duxbury, Hurlingham, Morningside and Parkmore (Fig. 2). For more information, see the Technical Summary on p. iii above.

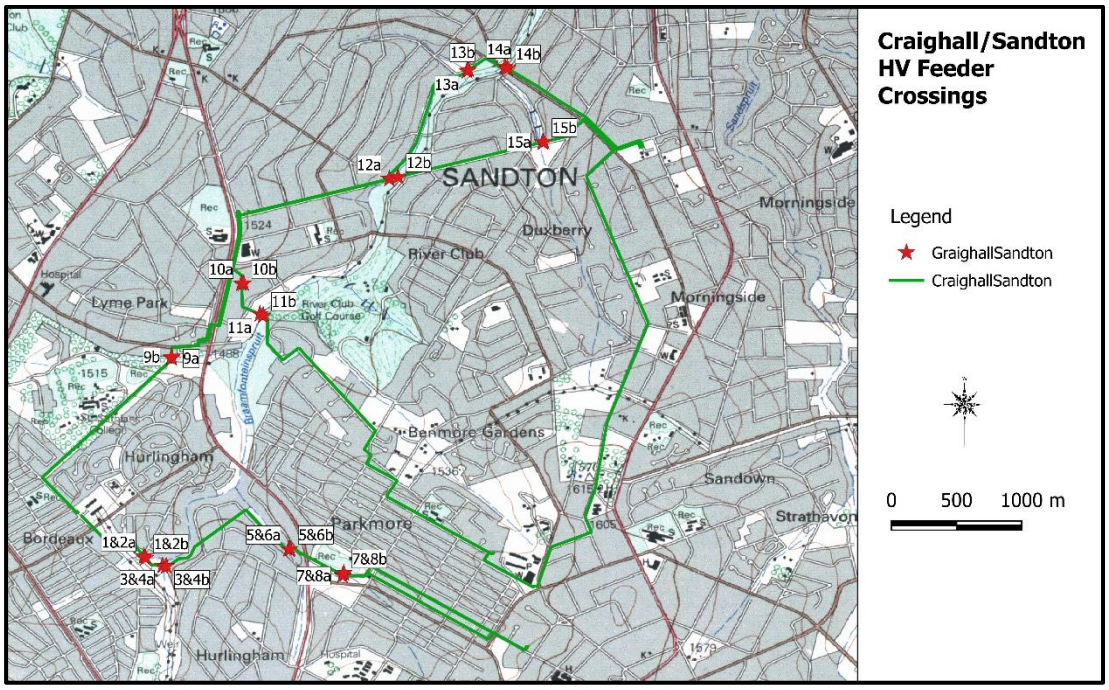


Fig. 2. Location of the proposed crossing points.

7.2 **Development proposal**

Eskom SOC (Pty) Ltd) propose the construction of river crossings along underground HV feeder cables in Craighall and Sandton in Gauteng Province. Eskom is proposing a replacement and network strengthening strategy for the HV cable systems in the above-mentioned area in order to sustain load growth as well as provide high-level of network reliability for the future.

Two types of technologies are considered for use in crossing the rivers:

<u>Directional Drilling:</u>

Summary:

Directional drilling is a controlled horizontal trenchless drilling method by which ducting pipes are installed for underground applications (cables and auxiliary services/equipment) as part of the procedure, after drilling. Underground directional drilling equipment is used to drill holes that correspond to the pipe diameter being installed and is the Eskom preferred method for trenchless road, river, rail and service crossings or where it may not be possible to construct a standard cable trench. This method is limited by a combination of the maximum length of the drilling (+- 80m), depth of drilling and is not suitable to go through large rock formations.

Method:

A Directional drilling rig and supporting equipment are set-up at the drill entry location determined during the design phase. (This is typically close to, next to or inside the end of an already excavated cable trench, stabilised by wooden shoring.) The directional drilling rig is anchored to the ground surface using anchor stakes. The Directional drilling rig is used to drill (through the use of a drill string, and drill bit for mechanical cutting) a pilot hole through a predetermined drill path comprising of soil and rock. (Drill bits are capable of drilling through minor rock formations.) The drilling is also assisted by a natural fluid mixture of pure clay, oil and water, if required. This fluid is pumped out at low pressure at the tip of the drill head to: Transport drill cuttings to the surface, Clean build-up on the drill bit, Cool the drill bit, Reduce the friction between the drill and bore wall, and stabilize the bore hole.

Periodic readings from electronic tracking components situated inside the head of the drill bit are used to determine the horizontal and vertical coordinates along the pilot hole in relation to the initial entry point. The pilot drill path may also be tracked using surface monitoring system. This information can then be used by the drill operator to control the drill bit head from the directional drilling rig. The drill path can be straight, at an arc or semi-circle, depending on the depth to be achieved and application.

Once the directional drilling rig and drill bit was successful in breaking the ground surface at the exit location (where another standard cable trench would be), the drill bit is replaced with a back reamer (similar to a drill bit but has a larger cutter head). The drill string is then pulled back through the pilot hole and the back reamer enlarges the diameter of the pilot drill hole. The back reamer may be used over a few passes in order to achieve the desired bore hole diameter. Once the desired bore hole diameter is achieved, the reamer is replaced with a pipe puller and a PVC pipe (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) which is then pulled from the exit side of the bore hole to where the directional drilling rig is located. The same fluid as mentioned previously is used during back reaming as well installation of the PVC pipe.

The PVC pipe is protected with rollers inside the cable trench during the installation / back pulling. An inspection of the PVC pipe is performed to identify any damage done to the pipeline during the pull back. Upon successful pull back of the PVC pipe, the drilling equipment is dismantled and demobilized.

The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment.

Once the above is completed, the cable trench(es) leading to the PVC pipe(s) are backfilled and the surfaces are re-instated.

<u>Pipe jacking:</u>

Summary:

Pipe jacking is horizontal trenchless hydraulic push method by which concrete pipes are jacked into position, and ducting pipes are installed inside the concrete pipes for underground

applications (cables and auxiliary services/equipment). It is the Eskom preferred method for trenchless road, river, rail and service crossings where directional drilling cannot be applied. - This method is not as limited as directional drilling, and can be used over long distances, at greater depths and can go through larger rock formations.

Method:

A pipe jacking rig and supporting equipment are set-up above ground level at the pipe jacking entry location determined during the design phase. (This is typically close to an already excavated cable trench.) The Pipe jacking rig comprises of a crane which is anchored to the ground surface using anchor stakes, and a hydraulic jack installed at the bottom of a shaft. Before pipe jacking can take place, a shaft have to be excavated. The shaft's dimensions must be adequate to allow a concrete pipe (+- Up to 1,5m diameter, +- 2,5m long) to be lowered comfortably in the shaft, to the required depth it must be installed. (The side walls of the shaft is also stabilised using wooden shoring and concrete and is dependent on the soil conditions on-site.) A similar shaft is constructed at the remote end, which is aligned to the designed pipe jacking path.

Once excavations are done, a concrete pipe is lowered into the shaft. A hydraulic jack at the bottom of the shaft is used to push the concrete pipe horizontally forward, between the beginning and end shafts. Once the concrete pipe has been pushed / jacked into place, hand excavation is used to remove the soil and rock inside the concrete pipe. This process is then repeated by lowering the next concrete pipe, hydraulically jacking the pipe, removing the soil and rock inside it, until a continues concrete pipe tunnel is constructed between start and end shafts. Concrete screed is used between the individual concrete pipes to seal the concrete pipe tunnel. (Should large rock formations be encountered, the rock can be jack hammered or blasted way.) The direction of the concrete pipe tunnel is carefully controlled through control over the hydraulic jack, to ensure a perfect connection between the start and end shafts.

Once the concrete pipe tunnel is complete, it is inspected for any defects. PVC pipes in varying diameters (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) are then installed inside the concrete pipe tunnel and fixed into place with a bentonite filling. The PVC pipes are inspected for defects after installation. Upon successful completion of the installation, the pipe jacking rig is dismantled and demobilized.

The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment.

Once the above is completed, the cable trench(es) and pipe jacking shaft leading to the PVC pipes are backfilled and the surfaces are re-instated.

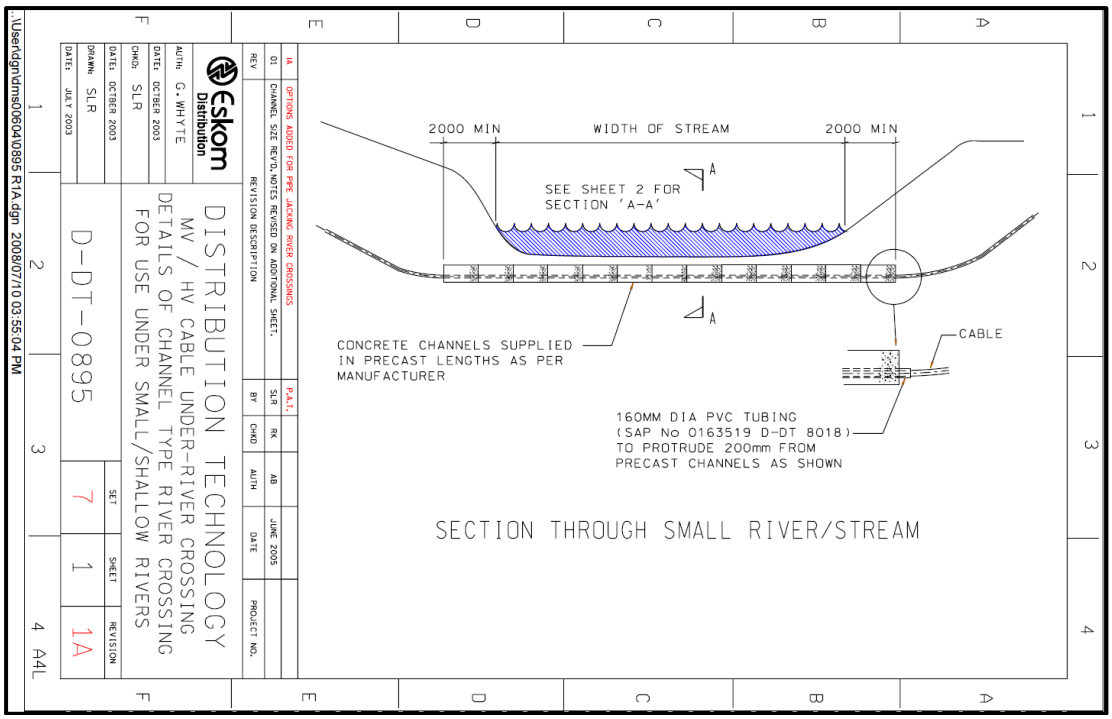


Fig. 3. Graphic presentation of the cable crossing techniques.

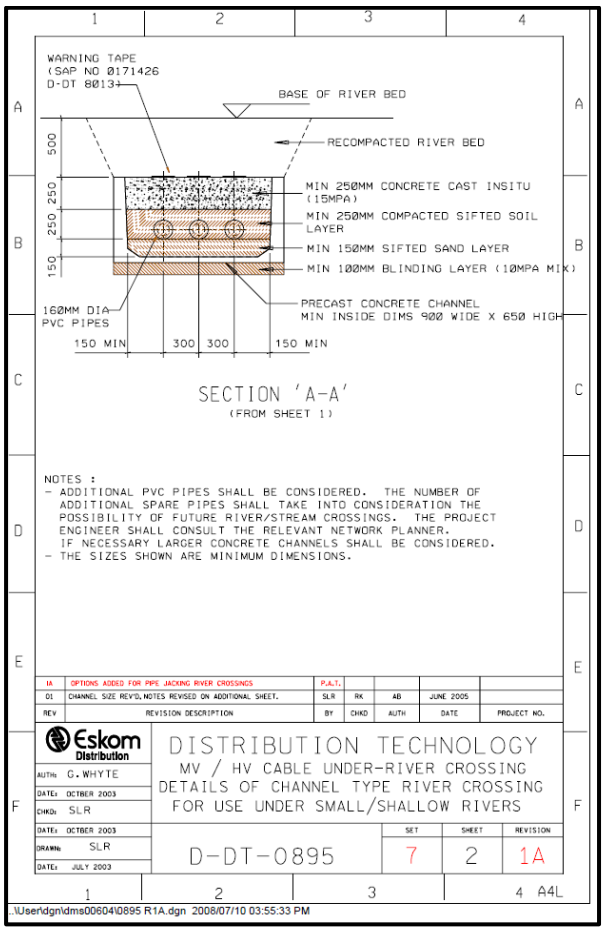


Fig. 4. Graphic presentation of the cable crossing techniques.

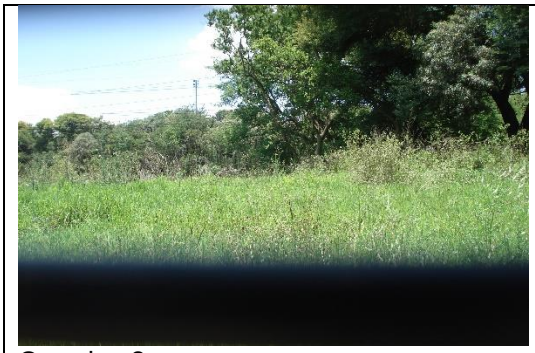
8. DESCRIPTION OF THE AFFECTED ENVIRONMENT

8.1 **Site description**

Except for a few natural water courses that are in most cases linked to public open spaces, the area has been subjected to high density urban development over the past fifty years. This would have effectively destroyed any heritage features that predated this development. Exceptions are rocky outcrops, which in most cases are protected and are known for their geological significance.

 Crossing 1	 Crossing 1
 Crossing 2	 Crossing 2
 Crossing 3	 Crossing 3

 Crossing 4	 Crossing 4
 Crossing 5	 Crossing 5
 Crossing 6	 Crossing 6
 Crossing 7	 Crossing 7

 Crossing 8	 Crossing 8
 Crossing 9	 Crossing 9
 Crossing 10	 Crossing 10
 Crossing 11	 Crossing 11

 Crossing 12	 Crossing 12
 Crossing 13	 Crossing 13
 Crossing 14	 Crossing 14
 Crossing 15	 Crossing 15

Fig. 5. Views over the different river crossing areas.

8.2 **Overview of the region**

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representivity – see Section 3.2 and Appendix 3 for more information.

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age and Iron Age) occupation and a much later colonial (farmer) component. The second component is an urban one, most of which developed during the last 150 years or less.

- The following discussion is largely based on the City of Johannesburg State of the Environment report (2008).

In geological terms, Johannesburg is located in the Witwatersrand Basin. Its sedimentary rocks, including the gold-bearing conglomerates in the upper part of the sequence of Witwatersrand rocks (the Witwatersrand Supergroup) were deposited between 3000 and 2700 million years ago in a fluvial and shallow marine environment by rivers. Most of the rocks are now buried beneath younger rock formations, but the upturned northern margin of the basin is well preserved in an arc stretching from Heidelberg in the east through Johannesburg and the West Rand to Carletonville. The central part of this arc, which represents the shoreline of the ancient sea, is commonly referred to as the *Rand* or *Reef*.

The older basement consists of ancient volcanic rocks termed *greenstones*, which have been intruded by a variety of granitic rocks. These rocks are exposed at places in the Johannesburg Granite Dome in the Midrand area. The age of the basement rocks ranges from 3000 million to 3400 million years. The lower division of the Witwatersrand sedimentary sequence is known as the West Rand Group. The lowermost sedimentary unit is the Orange Grove Quartzite, a hard erosion-resistant ridge stretching from Linksfield through Parktown and Northcliff to the Walter Sisulu Botanical Garden. This quartzite is ideal building stone and many of the mansions on Parktown Ridge are built of this rock. The sediments above the Orange Grove Quartzite are mainly shales (Parktown Shales) containing several magnetite-bearing beds. The overlying Brixton Quartzite contains evidence of shallow-water tidal conditions. The upper division of the Witwatersrand Supergroup, known as the Central Rand Group, consists mainly of quartzites and quartz-pebble conglomerates laid down by high-energy streams and rivers about 2750 million years ago. The most important conglomerates from an economic point of view are the gold-bearing Main Reef, Main Reef Leader and South Reef.

The Witwatersrand sediments are overlain by vast outpourings of lava belonging to the Ventersdorp Supergroup. These lavas are resistant to erosion in the southern Johannesburg area and give rise to the Klipriviersberg range.

Very little is known about the earliest human occupation of Johannesburg. However, there is little doubt that the first humans in the area may have been *Homo erectus* who roamed the area during the Acheulian period of the Early Stone Age, 500 000 years ago. The ancestor of *Homo erectus*, *Australopithecus*, considered to be the earliest ancestor of humans, lived in the Sterkfontein Valley around Krugersdorp (today the Cradle of Humankind – a World Heritage Site) several million years ago.

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

The Late Stone Age, considered to have started some 30 000 years ago, is associated with the predecessors of the San and Khoi Khoi. San hunter-gatherer bands with their small (microlithic) stone tools lived in Johannesburg.

Evidence of Stone Age habitation in the Johannesburg area can be found at sites such as the Waterfall Quarry, The Boulders, Glenferness Cave, Witkoppen, Lone Hill and the Klipriviersberg.

Because colonial farmers, settlers and miners have continuously and intensively used the development area for the past 150 years, very few signs of Stone Age occupation in the form of surface deposits and finds of artefacts have survived.

The excavations at The Boulders indicate that between 350 AD and 600 AD early Tswana communities lived in the Midrand area, building semi-permanent settlements of stone, wood and clay, growing crops, farming with livestock and manufacturing pots and iron implements. They moved out after 600 AD and returned about 1200 AD.

Between 1100 AD and 1200 AD San communities inhabited the area. Tswana communities returned in about 1500 AD and stayed in the area until their displacement by the Matabele kingdom during the 1820s and early 1830s and by colonial settlers since the 1840s.

Evidence of Iron Age habitation in Johannesburg can be found at various places, including the stone-walled sites on the Klipriviersberg Nature Reserve (more than 100 individual sites), Melville Koppies, Lonehill, Bruma Lake and Hearn Drive.

The Iron Age heritage of the Johannesburg area is the most visible in the Klipriviersberg Nature Reserve. Between 1400 and 1650, Iron Age Twana communities inhabited this area and archaeologists have uncovered nearly 20 settlements dating from about 1500 in the reserve, their position indicating a large, settled, pastoral community. The Tswana built large stonewall enclosures to accommodate huts and demarcate family enclosures. Villages were laid out in a circular, scalloped pattern, resembling a sunflower, with an animal enclosure in the middle where herds were kept for protection. Each 'petal' housed an individual household and between these enclosures were smaller enclosures for calves, goats and chickens. Some of these villages were large and would have housed as many as 100 people. The communities in the Klipriviersberg did not smelt their own iron, but acquired iron tools and objects from their Tswana neighbours, living in the areas now known as Melville Koppies and Lone Hill.

The first white colonists who settled in the Midrand area came for very much the same reasons as the Iron Age groups: water and grazing for cattle, water for crop-farming, trees, thatching grass, clay for making bricks and pots, mild climate, wildlife and the presence of the hills as shelter and protection.

In the 1820s the first white people appeared on the scene, hunters, traders, missionaries and other travellers. Permanent occupation by whites began in the early 1840s, when Voortrekker farmers established the farms that today form Johannesburg. These farms were subdivided many times over in more recent years and more farmsteads were established. Gradually the entire area was divided into farms. However, it was only since the 1880s that these farms were formally surveyed and mapped, and when not only their names but also the names of rivers and other features became permanent fixtures on maps. A number of farmsteads and cemeteries (white farmers and African farm workers) are preserved that were established during this era.

The dolomitic rocks of the Transvaal Supergroup attracted the attention of early prospectors due to their similarity to the rocks of the already active Pilgrim’s Rest goldfields. Gold deposits were discovered as early as 1874 in the Blaauwbank area near Magaliesburg. In January 1886, finally, two prospectors, George Harrison and George Walker, discovered the Main Reef Leader on the farm Langlaagte. Other deposits on other farms followed soon and on 20 September 1886 nine farms on the Central Rand were declared public diggings.

The Boer government soon realised the need for proclaiming a town to serve as a centre for the new goldfields. The fledgling town of Johannesburg was laid out on a triangular wedge of “uitvalgrond” (area excluded when farms were surveyed) named Randjeslaagte, situated between the farms Doornfontein, Braamfontein and Turffontein.

The town was much the same as any small prospecting settlement, but, as word spread, people flocked to the area from all other regions of the country, as well as from North America, Great Britain and the European continent, making Johannesburg the fastest-growing town in South Africa. The original mining village with its corrugated iron buildings was transformed into a town with solid buildings such as banks, hotels, stock exchange, stores, government buildings and public open spaces, around which mining magnates erected their mansions. The village site soon became too small and suburbs such as Doornfontein, Berea, Jeppestown, Yeoville, Fordsburg and others had been established by 1890.

Now part of Johannesburg, Roodepoort, meaning "red valley" in Afrikaans, was the second town to be established on the Witwatersrand after Johannesburg. It dates back to 1884, when Fred Struben discovered the first payable gold in the area at what he called the Confidence Reef, a large rocky outcrop in the centre of Roodepoort. At the time the area was settled by scattered Boer farmers on nine farms. Four of the farms - Roodepoort, Vogelstruisfontein, Paardekraal and Wilgespruit - were soon declared public diggings. The diggers needed a place to pitch their tents and so the farm Roodepoort opened up its land. A shantytown sprang up. Four mining towns, Roodepoort, Florida, Hamberg and Maraisburg, were proclaimed between 1886 and 1888. These towns were consolidated into a new municipality, Roodepoort-Maraisburg, after the Anglo-Boer War.

Early Johannesburg did not offer its Black citizens much in the way of housing. While the mines generally looked after their own, and most domestics could expect to have sleep-in quarters, the remainder had to fend for themselves. Almost from the onset, when the town was first laid out, separate suburbs, or "locations" as they were known, were allocated for Black, Malay and Asian occupation. This is an aspect of colonial town planning that was not unique to the Transvaal, but was common to most other parts of southern Africa. Not only did it conform to existing Zuid Afrikaansche Republiek (ZAR), or Transvaal, policies, but the idea of separate residential areas for Black and White also suited the mining companies, who had recently adopted the "compound" as a means of housing their Black labourers.

Many memorials and cemeteries commemorate the Anglo-Boer War (1899-1902) in Johannesburg. Its residents fought on both sides in the war. Occupied by the British in 1900, the city became a centre of military administration with new barracks and hospitals, but also was chosen a site for Boer and African concentration camps.

After the war proper municipal government was instituted for Johannesburg and the Roodepoort area. Both areas saw tremendous urban expansion with the development of many new (white) suburbs. The Inner City developed into a showpiece of Art Deco architecture. Art Deco hit South Africa a decade later than it took off in the rest of the world. America and Europe in the 1920s saw the birth of the Art Deco movement, with its eclectic style capturing industrial modernity and, in contrast, fantasy. The depression of 1929 slowed things, but South Africa was buoyed by gold at that time, and Johannesburg experienced a boom, as reflected in the rush of new buildings that went up in the city centre.

Johannesburg's (white) suburbs are the product of extensive urban sprawl and are regionalised into north, south, east and west, and they generally have different personalities. While the CBD and the immediate surrounding areas were formerly desirable living areas, the spatial accommodation of the suburbs has tended to see a flight from the city and immediate surrounds. The inner-city buildings have gradually been let out to the lower income groups and illegal immigrants and as a result abandoned buildings and crime have become a feature of inner city life. The suburbs to the south of the city are mainly blue collar neighbourhoods and situated closer to some townships. The suburbs to the west have in recent years floundered with the decline of the mining industry but have in some cases experienced some revival with properties being bought up by the black middle class.

The biggest sprawl lies to the east and north. The eastern suburbs are relatively prosperous and close to various industrial zones. The northern suburbs have been the recipient of most of the flight from the inner city and some residential areas have become commercialised particularly around the area of Sandton, stretching north towards Midrand, a half way point between Johannesburg and the capital Pretoria. Formerly peri-urban areas, the northern suburbs exploded in the 1950s and 1960s, with the result that new municipalities (including Sandton, Randburg and Midrand) were established.

The history of the African, Indian and Coloured populations of Johannesburg followed a different pattern. The successive white governments tried to manage the urbanisation of Africans for most of the 20th century through a complex series of laws that tried to control the movement of populations by racial group. This attempt to control human movement was legally codified from 1948 when the National Party took power and it became the cornerstone of the apartheid legislation.

In Johannesburg this took for the form of the system of forced removals, which resulted in the forced relocation of the population of non-European descent into specified areas. It is this system that created the sprawling towns of Soweto (**So**uth **We**stern **To**wnships), one of the areas where blacks were forced to live during the apartheid era, and Lenasia, established for Indians in the 1950s.

Randburg

During the early 1950s the predominant Afrikaans orientated National Party won the elections. However, their majority was not sufficient to make changes to the constitution. One area of concern was their poor representation in the Johannesburg region. They therefore set about to create a predominate Afrikaans-speaking community in north-western Johannesburg. One driving force was local resident Robert van Tonder, who viewed the Johannesburg Council as 'communistic', as well as harbouring a dissatisfaction with the Peri-Urban Board. Van Tonder launched a campaign for the independent status of the suburbs of the North-western LAC. On presenting his petition to the Administrator, Dr William Nicol, a commission was set up to investigate the possibilities of granting autonomy to the North-western Johannesburg LAC, consisting of nine suburbs. The new town was approved and was formalised after the general election in 1959 (Brodie 2008:232-233).

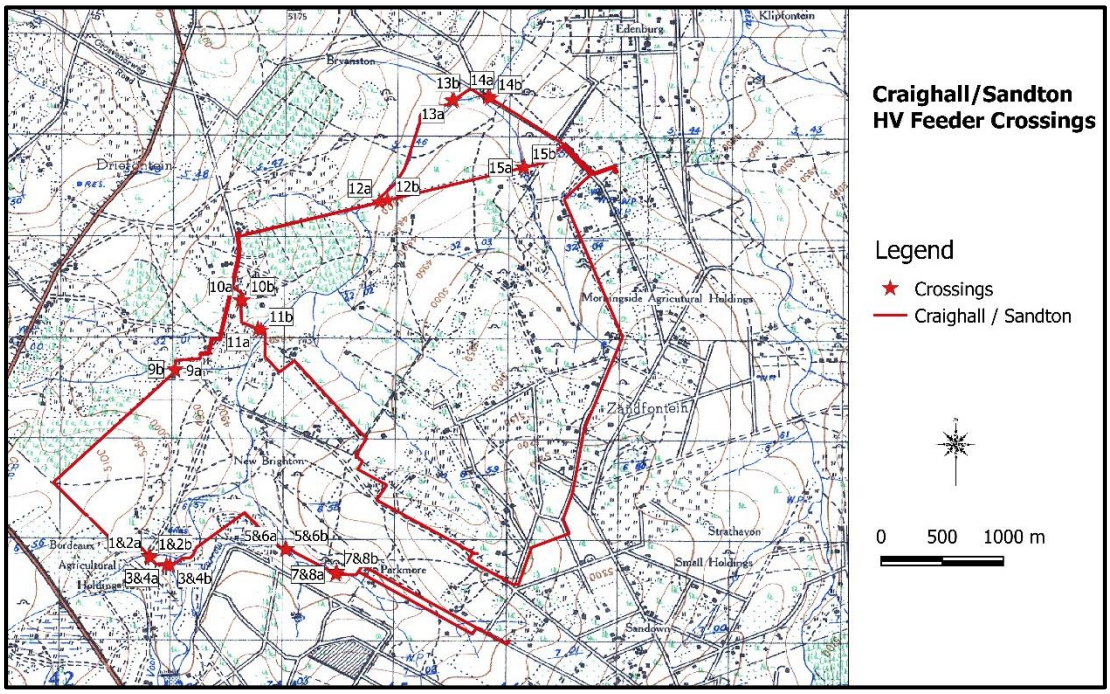


Fig. 6. The study area depicted on the 1943 version of the 1:50 000 topocadastral map.

From the 1943 version of the 1:50 000 topocadastral map (Fig. 6), it can be seen that very little development took place in the region of the study area about sixty years ago. Plotting known sites in the study area as well as in a buffer area of three kilometres surrounding the study area, Fig. 7 below, it can be seen that few sites or features of heritage significance exists.

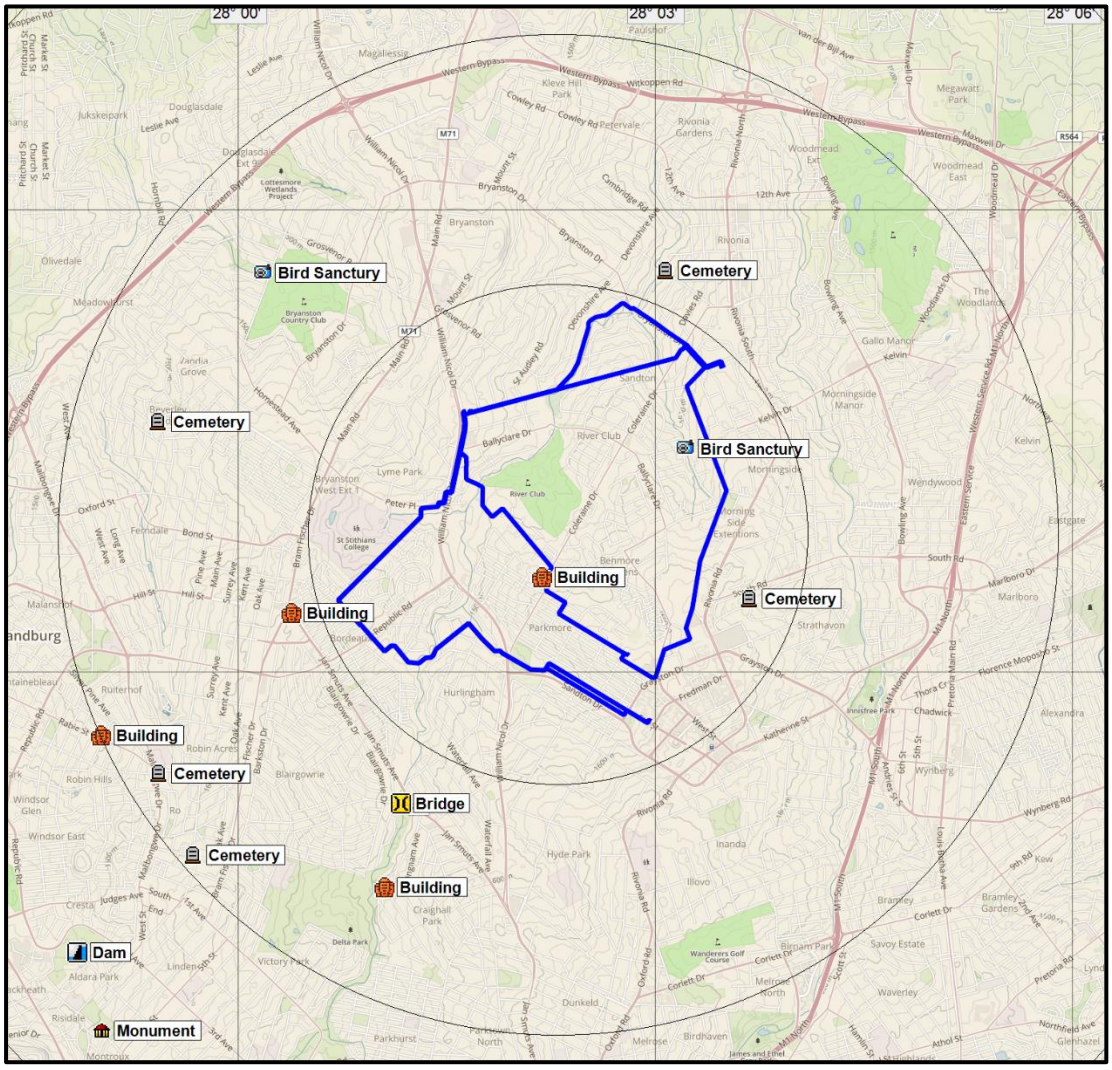


Fig. 7. Heritage scan of the surrounding area.

8.3 **Identified sites**

The following sites, features and objects of cultural significance were identified in the study area – see Appendix 6 for a discussion of each individual site.

In terms of Section 7 of the NHRA, all the sites currently known, or which are expected to occur in the study area are evaluated to have a grading as identified in the table below.

8.3.1 *Stone Age*

- No sites, features or objects dating to the Stone Age were identified in the study area.

8.3.2 *Iron Age*

- No sites, features or objects dating to the Iron Age were identified in the study area.

8.3.3 *Historic period*

- No sites, features or objects dating to the historic period were identified in the study area.

Table 4. Summary of Identified Heritage Resources in the Study Area.

IDENTIFIED HERITAGE RESOURCES			
NHRA category	**Number**	**Coordinates**	**Impact rating**
Formal protections (NHRA)			
National heritage site (Section 27)	None	-	-
Provincial heritage site (Section 27)	None	-	-
Provisional protection (Section 29)	None	-	-
Listed in heritage register (Section 30)	None	-	-
Structures older than 60 years (Section 34)	None	-	-
Archaeological site or material (Section 35)	None	-	-
Palaeontological site or material (Section 35)	None	-	-
Graves or burial grounds (Section 36)	None	-	-
Public monuments or memorials (Section 37)	None	-	-
Any other heritage resources (Geological)	None	-	-

8.4 **Impact assessment**

Heritage impacts are categorised as:

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries;
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment;
- Cumulative impacts that are combinations of the above.

Impacts can be managed through one or a combination of the following measures:

- Mitigation
- Avoidance
- Compensation
- Enhancement (positive impacts)
- Rehabilitation
- Interpretation
- Memorialisation

Sources of risk were considered with regards to development activities defined in Section 2(viii) of the NHRA that may be triggered and are summarised in Table 5 below. These issues formed the basis of the impact assessment described. The potential risks are discussed according to the various phases of the project below.

Table 5. Potential Risk Sources.

	Activity	Description	Risk
Issue 1	Removal of Vegetation	Vegetation removal for site preparation and the	The identified risk is damage or changes to resources that

		installation of required infrastructure, e.g. access roads and water pipelines.	are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.
Issue 2	Construction of required infrastructure, e.g. access roads, water pipelines	Construction machinery and vehicles will be utilised to construct the required infrastructure, e.g. access roads and water pipelines.	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development and is presented in Table 6 below:

- Due to the density of the urban development in the region, it is very unlikely that any sites or features dating to the pre-colonial history of the region would still exist in the study area. However, isolated objects such as Stone Age artefacts might be exposed in areas close to stream beds.

- A number of features, mostly houses, but also infrastructure related features, occur in the region. All of these are very formal and clearly visible. Due to the fact that the development will take place inside the river reserve, it is highly unlikely that any such features would be impacted on by the construction of the HV feeder underground cables.

Table 6: Impact rating

Nature: Impacts could involve displacement or destruction of heritage structures or features in the proposed development areas.		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Definite	Low
Duration	Permanent	Permanent
Extent	Local	Local
Magnitude	Minor	Minor
Significance	**Low**	**Low**
Status (positive or negative)	Negative	Neutral
OPERATIONAL PHASE		
Probability	Low	Low
Duration	Permanent	Permanent
Extent	Local	Local
Magnitude	Minor	Minor
Significance	**Low**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Non-reversible	Non-reversible
Irreplaceable loss of resources?	Low	No
Can impacts be mitigated?	N.A.	
Mitigation: No mitigation required.		

Cumulative impacts: No cumulative impact is anticipated.
Residual Risks: n/a

8.5 **Alternatives considered**

Based on current understanding of the project, the suitability of the two alternatives methods are evaluated as follows:

- Based on current understanding of the project, both the alternative technologies proposed for installing the HV cables would be suitable for constructing the underground HV feeder cables.

Table 7: Comparison of Alternatives

Not Preferred	The alternative will result in a high impact / increase the impact	
Favourable	The alternative will result in low impact / reduced impact	
Preferred	The impact will be relatively insignificant	
Alternative	Preference	Motivation
Technology		
Pipe Jacking	Acceptable	No impact on heritage sites, features or objects
Directional drilling	Acceptable	No impact on heritage sites, features or objects

9. MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

9.1 **Objectives**

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these

specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

9.2 **Control**

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

Table 8: Environmental Management Programme for the project

Construction			
Action required	Protection of heritage sites, features and objects		
Potential Impact	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		
Operation			
Action required	Protection of heritage sites, features and objects		
Potential Impact	It is unlike that the negative impacts identified for pre-mitigation will occur if the recommendations are followed.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

10. RECOMMENDATIONS

The aim of the survey was to locate, identify, evaluate and document sites, objects and structures of cultural significance found within the area in which the development is proposed.

Impact assessment

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- Due to the density of the urban development in the region, it is very unlikely that any sites or features dating to the pre-colonial history of the region would still exist in the study area. However, isolated objects such as Stone Age artefacts might be exposed in areas close to stream beds.

- A large number of features, mostly houses, but also infrastructure related features, occur in the region. All of these are very formal and clearly visible. Due to the fact that the development will take place inside the river reserve, it is highly unlikely that any such features would be impacted on by the construction of construction of the HV feeder underground cables.

Alternatives considered

- Based on current understanding of the project, both the alternative technologies proposed for installing the HV cables would be suitable for constructing the underground HV feeder cables.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view it is recommended that the proposed development be allowed to continue.

Conditions for inclusion in the environmental authorisation:

- Should heritage features, archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

11. REFERENCES

11.1 **Data bases**

Chief Surveyor General
Environmental Potential Atlas, Department of Environmental Affairs and Tourism.
Heritage Atlas Database, Pretoria
National Archives of South Africa
SAHRA Archaeology and Palaeontology Report Mapping Project (2009)
SAHRIS Database

11.2 **Literature**

Acocks, J.P.H. 1975. *Veld Types of South Africa*. Memoirs of the Botanical Survey of South Africa, No. 40. Pretoria: Botanical Research Institute.

Brodie, N. (ed.) 2008. *The Joburg Book. A guide to the city's history, people and places*. Northlands: Pan Macmillan South Africa.

King, T.F. 1978. *The Archaeological Survey: Its Methods and Uses*. Interagency Archaeological Services, Department of the Interior, Washington, D.C.

Mason, R.J. 1969. *The Prehistory of the Transvaal*. Johannesburg: Witwatersrand University Press.

Mason, R.J. 1986. *Origins of the Black People of Johannesburg and the southern western central Transvaal AD 350-1880*. Occasional Paper No. 16. Johannesburg: Archaeological Research Unit, University of the Witwatersrand.

Mendelsohn, F. & Potgieter, C.T. (reds.). 1986. *Guidebook to Sites of Geological and Mining Interest on the Central Witwatersrand*. Johannesburg: The Geological Society of South Africa.

Van der Waal, G-M. 1979. *Projek: Opname historiese geboue in Johannesburg: Buitewyke. Volume II*. Johannesburg: Ranse Afrikaanse Universiteit.

Van der Waal, G-M. 1986. *Van Mynkamp to Metropolis*. Pretoria: Chris van Resnburg Publikasies.

Wilson, M.G.C. & Anhaeusser, C.R. (eds.) 1998. *The Mineral Resources of South Africa*. Sixth Edition. Handbook 16. Pretoria: Council for Geosciences.

11.3 **Maps and aerial photographs**

1: 50 000 Topocadastral maps

Google Earth

11.4 **Websites**

www.heritageregister.org.za

APPENDIX 1. INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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. The author of this report will not be held liable for such oversights or for costs incurred as a result of such oversights.

Although the author exercises due care and diligence in rendering services and preparing documents, he accepts no liability and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX 2. SPECIALIST COMPETENCY

Johan (Johnny) van Schalkwyk

J A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 40 years. Originally based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape, Northern Cape, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 70 papers, most in scientifically accredited journals. During this period he has done more than 2000 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.

A complete *curriculum vitae* can be supplied on request.

APPENDIX 3. CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE RESOURCES

A system for site grading was established by the NHRA and further developed by the South African Heritage Resources Agency (SAHRA 2007) and has been approved by ASAPA for use in southern Africa and was utilised during this assessment.

Significance

According to the NHRA, Section 2(vi) the **significance** of a heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. SITE EVALUATION			
1.1 Historic value			
Is it important in the community, or pattern of history			
Does it have strong or special association with the life or work of a person, group or organisation of importance in history			
Does it have significance relating to the history of slavery			
1.2 Aesthetic value			
It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group			
1.3 Scientific value			
Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage			
Is it important in demonstrating a high degree of creative or technical achievement at a particular period			
1.4 Social value			
Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons			
1.5 Rarity			
Does it possess uncommon, rare or endangered aspects of natural or cultural heritage			
1.6 Representivity			
Is it 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.			
2. Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific community			
3. Field Register Rating			
1.	National/Grade 1: High significance - No alteration whatsoever without permit from SAHRA		
2.	Provincial/Grade 2: High significance - No alteration whatsoever without		

	permit from provincial heritage authority.	
3.	Local/Grade 3A: High significance - Mitigation as part of development process not advised.	
4.	Local/Grade 3B: High significance - Could be mitigated and (part) retained as heritage register site	
5.	Generally protected A: High/medium significance - Should be mitigated before destruction	
6.	Generally protected B: Medium significance - Should be recorded before destruction	
7.	Generally protected C: Low significance - Requires no further recording before destruction	

APPENDIX 4. RELEVANT LEGISLATION

All archaeological and palaeontological sites, and meteorites are protected by the National Heritage Resources Act (Act no 25 of 1999) as stated in Section 35:

(1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) 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.

(4) No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) 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

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

In terms of cemeteries and graves the following (Section 36):

(1) Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit.

(2) SAHRA must identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with the grave referred to in subsection (1), and must maintain such memorials.

(3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority-

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

The National Heritage Resources Act (Act no 25 of 1999) stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- **Grade I**: Heritage resources with qualities so exceptional that they are of special national significance;
- **Grade II**: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III**: Other heritage resources worthy of conservation, and which prescribes heritage resources assessment criteria, consistent with the criteria set out in section 3(3), which must be used by a heritage resources authority or a local authority to assess the intrinsic, comparative and contextual significance of a heritage resource and the relative benefits and costs of its protection, so that the appropriate level of grading of the resource and the consequent responsibility for its management may be allocated in terms of section 8.

Presenting archaeological sites as part of tourism attraction requires, in terms 44 of the Act, a Conservation Management Plan as well as a permit from SAHRA.

(1) Heritage resources authorities and local authorities must, wherever appropriate, co-ordinate and promote the presentation and use of places of cultural significance and heritage resources which form part of the national estate and for which they are responsible in terms of section 5 for public enjoyment, education. research and tourism, including-

(a) the erection of explanatory plaques and interpretive facilities, including interpretive centres and visitor facilities;
(b) the training and provision of guides;
(c) the mounting of exhibitions;
(d) the erection of memorials; and
(e) any other means necessary for the effective presentation of the national estate.

(2) Where a heritage resource which is formally protected in terms of Part l of this Chapter is to be presented, the person wishing to undertake such presentation must, at least 60 days prior to the institution of interpretive measures or manufacture of associated material, consult with the heritage resources authority which is responsible for the protection of such heritage resource regarding the contents of interpretive material or programmes.

(3) A person may only erect a plaque or other permanent display or structure associated with such presentation in the vicinity of a place protected in terms of this Act in consultation with the heritage resources authority responsible for the protection of the place.