

**CULTURAL HERITAGE DESKTOP ASSESSMENT  
OF THE PROPOSED BIOENERGY FACILITY,  
HARMONY GOLD MINE, WELKOM, FREE STATE  
PROVINCE**

**ACTIVE HERITAGE cc.**

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## LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1750 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2010).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2000)
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

## **EXECUTIVE SUMMARY**

A desktop cultural heritage study of the proposed Bioenergy Facility at Harmony Gold Mine near Welkom, Free State Province identified no heritage sites. The proposed development may proceed from a heritage point of view. Attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) which, requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

## 1 INTRODUCTION

Active Heritage cc was appointed by Green Door Environmental to conduct a desktop phase 1 heritage impact assessment (HIA) of the proposed Bioenergy Facility at Harmony Gold Mine near Welkom, Free State Province. The desktop study entailed an investigation of relevant literature and heritage data bases. Available aerial photographs of the project area were also consulted. No ground survey was conducted.

### Table 1. Background information

Consultant:	Frans Prins (Active Heritage) for Green Door Environmental
Type of development:	The proposed Bioenergy facility comprises of: i) a 520 ha energy crop on a disused tailings footprint and on surrounding, lesser impacted mine land; ii) the installation of an Anaerobic Treatment Plant for the production of biogas from the harvested energy crop; iii) the installation of a Biogas Treatment Plant for the production of Bio-CNG, including a 450 m <sup>3</sup> storage facility; iv) the installation of biogas combustion equipment for the generation of renewable electricity; v) the installation of algae raceways on a 17 ha footprint, including an Algae-ethanol Fermentation plant for ethanol production; vi) the installation of a Bio-CNG fuelling station for vehicles; and vii) the installation of a Biomass-fired combustion equipment for the generation of heat energy from combusting wood chips and alien vegetation.

#### Growing of the Energy Crop

The proposed Bioenergy project primarily consists of; the growing of energy crops on 260 ha of mine impacted land (tailings footprint) and an additional 260 ha on the surrounding, lesser impacted mine land. These energy crops will be grown on a two year rotational cycle, with a suitable secondary crop planted every season to restore soil fertility prior to the planting of the energy crop. The combined 520 ha energy crop will be grown under irrigation, using a towable centre pivot. Water for irrigation will be abstracted (approximately 5 to 8 Mega litres per day) from a Toronto Pan. Harmony is already licensed by the Department of Water Affairs to abstract water from this source. Planting of the energy crop will be done by contractors to minimise the capital expenditure required, and also to provide employment and entrepreneurial opportunities to the local communities. Irrigation equipment will be automated, and harvesting partially mechanised. It is therefore anticipated that 200 direct employment opportunities and a number of indirect jobs will be created.

#### Processing of the Energy Crop

The harvested energy crops will be transported to the Bioenergy Plant, where it will be hammer-milled and diluted before the mixture is fed into an Anaerobic Treatment Plant, in which it will be

anaerobically digested to produce methane rich biogas.

#### Anaerobic Treatment Plant

The proposed Anaerobic Treatment Plant is a NewGen Bioenergy System which will have an footprint of  $\pm 5,000\text{m}^2$ . The effluent slurry that comes out after the required minimum digestion period (Hydraulic Retention Time) will be deposited onto an existing tailings dam. The raw biogas trapped underneath the geomembrane cover will be extracted and distributed via to the various points of use.

#### Points of use

A third of the total biogas,  $\pm 6,250\text{m}^3$ , will be distributed to an onsite user as a replacement fuel for currently used liquid fuels. No processing of the raw biogas will be required prior to use at this point. Gas Treatment/Processing Plant The remainder of the biogas,  $\pm 12,500\text{m}^3/\text{day}$ , will be channelled into a  $\pm 50\text{m}^2$  Gas Treatment Plant to remove all the unwanted impurities and gases, such as  $\text{CO}_2$ . The clean, processed gas ( $\pm 8,750\text{m}^3/\text{day}$ ) will then be compressed to produce Bio-CNG ( $35\text{m}^3/\text{day}$ ). This Bio-CNG will then be stored in a  $450\text{m}^3$  storage facility, before it is transported by trucks to various points of use.

#### Renewable Electricity Generation

Excess methane rich biogas that cannot be effectively utilised in the above mentioned processes will be channelled into Micro turbines for the generation of renewable electricity on site. The electrical capacity ( $\pm 200\text{Kw}$ ) will solely be for the Mine's own usage.

#### Algae Raceways

The proposed Bioenergy facility also includes the establishment of Algae Raceways covering 17 ha of land. The algae will be cultured or grown on effluent wastewater recovered from the Anaerobic Treatment Plant ( $16\ 500$  litres/day), and on Carbon dioxide ( $3\ 750\text{m}^3/\text{day}$ ) recovered from the Gas Processing Plant.

#### Biochemical Fermentation Plant

The harvested algae will be mixed with water and allowed to undergo the process of fermentation, before being finally distilled in distillation columns to produce e-Ethanol ( $2\ 350$  to  $2\ 750$  litres/day). The entire distillation process will result in water off-take of between  $14\ 100$  to  $16\ 500$  litres/day. The e-Ethanol will be blended with an ignition improver to produce a hydrous ethanol fuel, E95, to be used in vehicles.

#### Biomass-fired Combustion Equipment

The proposed Bioenergy Facility includes combustion equipment to be fired by wood chips recovered during the extraction or ore from underground operations. Another potential fuel source considered during the feasibility study was the combustion of invasive plants removed during land preparation or site clearance. This will be investigated further in the EIA. A layout plan showing the locations of the proposed Bioenergy facility and associated infrastructure is shown in Figures 1 and 2

Rezoning or subdivision:	Rezoning
Terms of reference	To carry out a desktop based Heritage Impact Assessment of the proposed Bioenergy Facility as part of a Scoping and Environmental Impact Assessment (EIA) process.
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999).

## 2 OBJECTIVES

Active Heritage cc was subcontracted by Green Door Environmental to undertake a desktop cultural heritage assessment for the proposed Bioenergy Facility at Harmony Gold Mine near Welkom (Figs 1, 2, & 3). This first phase of an HIA is required as a preliminary desktop exercise to identify potential heritage resources which may be impacted during the construction, operation, and decommissioning phases of the proposed project. The conclusions reached are based on the available literature, an investigation of aerial photographs of the study-area and the consultation of accessible heritage databases and registers. The project seeks to assess the value and significance of the known heritage resources found within the study area as well as ensure their protection and conservation. The view is promoted that development should take place in harmony with the sustainable use of heritage resources.

The heritage practitioner is required to provide:

- Review of project information
- Site reconnaissance and preparation of field notes – where relevant
- Review of existing information/data relevant to the study area and section of the route
- Liaise with specialists on other routes to share information sources, research methodologies, observations and initial findings – where relevant
- Drafting of report, including description of the affected environment and assessment
- Recommendations regarding a methodology to be adopted in assessing potentially significant impacts in the EIA Phase.

### 3 STUDY AREA

The proposed development is located on The Farm Friedesheim, No. 51 Welkom, Rem of The Farm Friedeshaim, No. 51 Welkom, Rem of The Farm Wesselia, No. 101 Welkom, Rem of The Farm Geduld, No. 97 Welkom, Rem of The Farm Welkom, No. 80 Welkom, Rem of The Farm Marmageli, No. 20 Welkom, Rem of The Farm Meriba, No. 16 Welkom, The Farm Meriba, No. 118 Welkom, Rem of The Farm Toronto, No. 115 Welkom, Rem, Portions 2, 8, 7 of The Farm Therons Rust, No. 69 Welkom, Rem of Portion 1 of The Farm Theronia, No. 71 Welkom.

The area is located to the North West of Welkom, along the R30 to Odendaalsrus, near Jabulani Village. The properties are unzoned and predominantly covered by mine residue sand with dotted patches of alien vegetation. Access to the tailings footprint for the proposed energy crop plantation can be gained from the R30 to Odendaalsrus, off the Jabulani Village turn (Figs 1 & 2).

### 4 LEGAL FRAMEWORK

According to Section 3 (2) of the NHRA, the heritage resources of South Africa include:

- “a. places, buildings, structures and equipment of cultural significance;
- b. places to which oral traditions are attached or which are associated with living heritage;
- c. historical settlements and townscapes;
- d. landscapes and natural features of cultural significance;
- e. geological sites of scientific or cultural importance;
- f. archaeological and palaeontological sites;
- g. graves and burial grounds, including.
  - ancestral graves;
  - ii. royal graves and graves of traditional leaders;
  - iii. graves of victims of conflict;
  - iv. graves of individuals designated by the Minister by notice in the Gazette;
  - v. historical graves and cemeteries; and
  - vi. other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);



- h. sites of significance relating to the history of slavery in South Africa;
- i. 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;
- ii. objects to which oral traditions are attached or which are associated with living heritage;
- iii. ethnographic art and objects;
- iv. military objects;
- v. objects of decorative or fine art;
- vi. objects of scientific or technological interest; and
- vii. 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).”

In terms of 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:

- “a. its importance in the community, or pattern of South Africa's history;
- b. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- c. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- d. its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- e. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- f. its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- g. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- h. 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
- i. sites of significance relating to the history of slavery in South Africa.”

The National Heritage Resources Act also protects intangible heritage such as traditional activities, oral histories and places where significant events happened.

## **5 STUDY APPROACH/METHODS**

### **5.1 Methodology**

A desktop study was conducted of the SAHRA inventory of heritage sites in the greater Welkom area. In addition, archaeological and historical literature covering the northern Free State Province was consulted. Available Heritage Impact Assessment reports that covers the close environs of the study area were also consulted. Aerial photographs covering the study area was investigated for potential heritage sites. . The following documents were consulted in this study:

- South African National Archive Documents
- SAHRA Database of Heritage Studies
- Internet Search
- Historic Maps
- Google Earth 2011, 2009 & 2003 imagery
- Published articles and books
- JSTOR Article Archive
- South African Rock Art Digital Archive (SARADA)
- Rock Art Research Institute (RARI)

### **5.2.2 Visibility**

The aerial photograph survey indicated good visibility of the project area. Potential heritage sites and human made structures were clearly visible.

### **5.2.3 Disturbance**

No evidence for the potential disturbance of heritage sites is evident. However, extensive mining activities over a long period of time have scarred the land surface

and it is possible that heritage sites were destroyed, buried, or altered during this period.

## **6 DESCRIPTION OF THE CURRENT ENVIRONMENT THAT MAY BE AFFECTED BY THE PROPOSED ACTIVITY**

### **6.1 Locational data**

*Province:* Free State

*Town:* Welkom

### **6.2 Background to heritage resources of the study area**

The following brief overview of archaeological (pre-historical) and historical information will help to contextualise the footprint in the context of the greater Welkom area.

#### **6.2.1 Stone Age**

The greater project area is home to all three of the known phases of the Stone Age, namely: the Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). Early to Middle Stone Age sites are less common in this area.

Early Stone Age sites have been ascribed to *Homo erectus* and *Homo ergaster*. These early hominins were hunters and scavengers. They typically lived near permanent sources of water and that is also where most of these sites occur. Although they could control fire it is debateable to what extent they had symbolic cognitive expressions. It was only much later during the Middle Stone Age, some 200 000 years ago, that anatomically modern people or *Homo sapiens* emerged in Eastern and Southern Africa respectively. Unlike their hominin predecessors they manufactured a wider range of tools, with more advanced technologies that included the spear thrower and even the bow and arrow in some areas. This enabled skilled hunter-gatherer bands to adapt more successfully to different environments. From this time onwards, rock shelters were reoccupied over very long periods of time (Mitchell 2002).

The Late Stone Age, considered to have started some 20 000 to 40 000 years ago, is associated with the predecessors of the Khoisan hunter-gatherers that were encountered by the first Europeans in southern Africa some 300 years ago. Later Stone Age hunter-gatherers lived well into the 19th century in some places in SA including the greater project area. Stone Age sites may occur in some locales in the area

The following Stone Age components could occur in this area:

- Early Stone Age sites dating to more than 300 000 years old.
- Middle Stone Age sites dating from approximately 200 000 to 30 000 years ago.
- Later Stone Age (San hunter-gatherer) artefacts dating to within the last 30 000 years.

### **6.2.2 Iron Age**

Early Iron Age sites do not occur in the Free State. However, Later Iron Age sites belonging to Bantu-speaking agro pastoralists are abundant in northern and eastern Free State (Dreyer 1996; Maggs 1976). These sites that date from between 1600 AD and 1850 AD were inhabited by the ancestors of the Fokeng and Kwena peoples (Huffman 2007).

### **6.2.3 The Historic Era**

The area was transgressed by Voortrekkers in the 1830's. Some farmsteads and associated cemeteries belonging to these early Dutch settlers occur in the area. Sites belonging to the Anglo-Boer war period of 1899-1901 are also scattered throughout the Free State. None, however, are known from the footprint. The town of Welkom was founded in 1946 after gold was discovered on the farm St Helena (Coetzee 2008). Some of the old mineshafts at Harmony Gold Mines are older than 60 years (ibid) and are therefore protected by heritage legislation. However these do not occur on the footprint. Only one heritage site is listed for Welkom on the SAHRA national register and this include a historical building called the "moth house" that dates to the early decades of the 20<sup>th</sup> century. This heritage site does not occur near the footprint.

### 6.2.4 Palaeontology

No sites of palaeontological significance are documented in the literature covering the greater Welkom area. However, palaeontologically significant areas occur to the east and north of Welkom.

### 6.3. Distribution of heritage sites on the project area and their significance (heritage value)

The desktop study, including a survey of available aerial photographs of the study area, has not shown evidence for the occurrence of any heritage sites on the footprint. Most of the areas identified for the establishment of bio energy facilities are situated on disturbed mine land. A previous heritage impact assessment study at Harmony Goldmines near Welkom identified some old mineshafts older than 60 years (Coetzee 2008). Being older than 60 years these shafts are strictly protected by heritage legislation and they were rated as Generally Protected a (Table 2). However, none of these shafts occur on the footprint and they are therefore not threatened by the proposed development.

**Table 2. Field rating and recommended grading of sites (SAHRA 2005)**

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
Provincial (Grade II)	This site is considered to be of Provincial significance	Nominated to be declared by Provincial Heritage Authority
Local Grade IIIA	This site is considered to be of HIGH significance locally	The site should be retained as a heritage site
Local Grade IIIB	This site is considered to be of HIGH significance locally	The site should be mitigated, and part retained as a heritage site
Generally Protected A	High to medium significance	Mitigation necessary before destruction
Generally Protected B	Medium significance	The site needs to be recorded before destruction
Generally Protected C	Low significance	No further recording is required before destruction

## **7 RECOMMENDATIONS**

Cultural heritage includes both tangible and intangible aspects. The tangible aspects of heritage such as archaeological sites, palaeontological features or fossils, historical buildings, graves, and to some extent cultural landscapes are for the most part non-renewable. Unlike natural resources tangible cultural heritage cannot be renewed once damaged or destroyed. Land rehabilitation measures will have no effect on tangible cultural heritage once altered or destroyed. Any construction activity that could damage heritage sites or structures such as digging of trenches, construction of access roads, erection of on-site infrastructure, or stone robbing should be avoided in the immediate vicinity of heritage sites. In some instances mitigation may be possible and an archaeological or palaeontological rescue excavation may be suggested for particular sites that will be damaged during development. Such excavation can only proceed once a permit has been issued by the relevant heritage agency.

In terms of the proposed Bioenergy Facility at Harmony Gold Mine there are no immediate threats to the heritage resources of this area. However, should the proposed development expand to include areas outside of the designated footprint then another heritage survey will be required. It should also be pointed out that the National Heritage Act requires that operations exposing archaeological, historical, and palaeontological residues and features should cease immediately pending an evaluation by the heritage authorities.

## **8 CONCLUSION**

The proposed extension and upgrading of the proposed Bioenergy Facility at Harmony Goldmine near Welkom may proceed from an archaeological point of view as no heritage sites or features are in danger of being destroyed or altered.

9 MAPS AND FIGURES

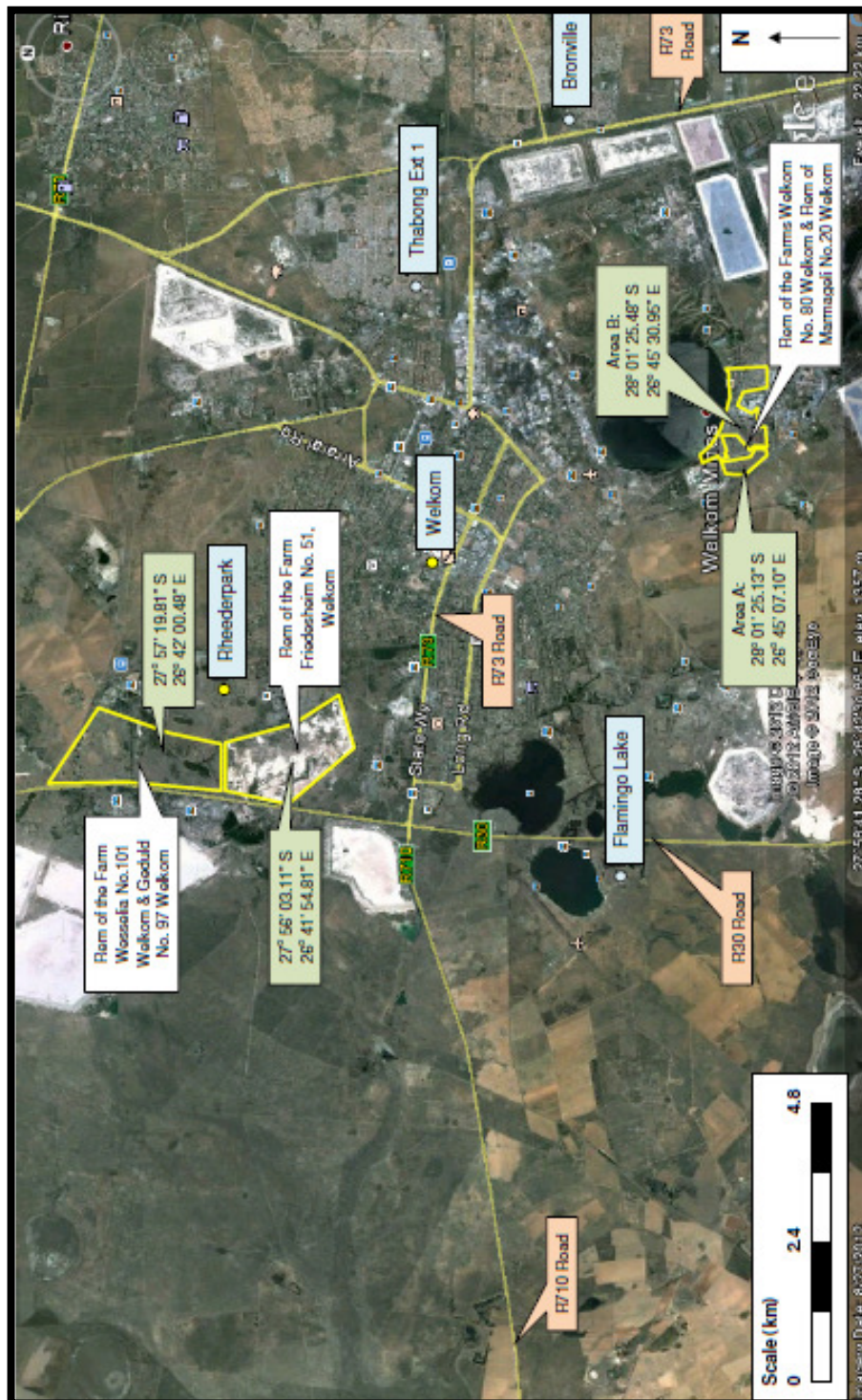
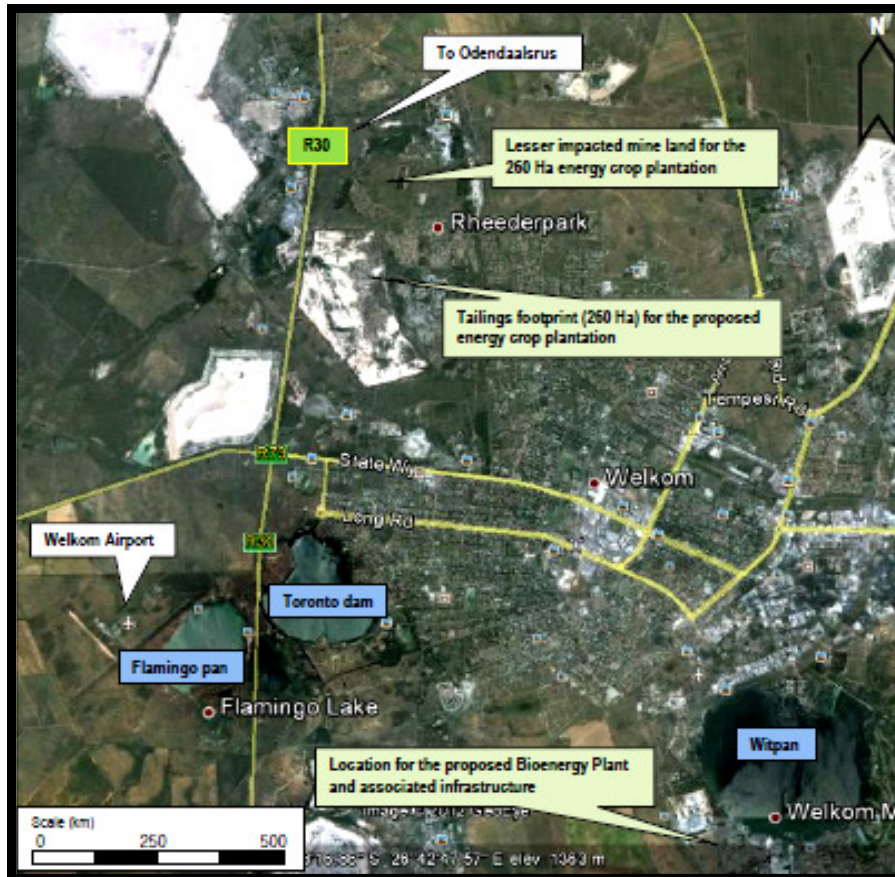


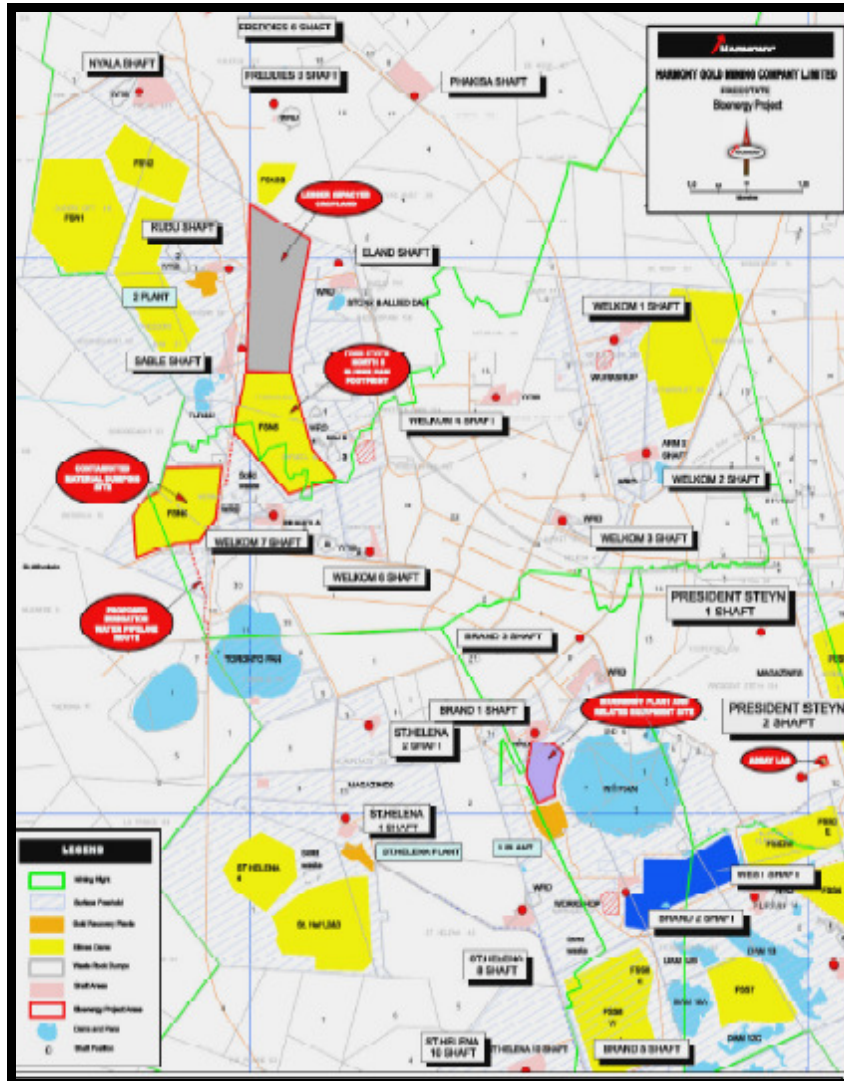
Figure 1. Google aerial photograph showing the locality of the Harmony Gold Mine near Welkom.





**Figure 2. Google aerial photograph showing the localities of the proposed Harmony Bioenergy Facility and its surrounding land uses in Welkom.**





**Figure 3. Map showing the locations of the proposed Bioenergy Facilities at Harmony Goldmine, Welkom.**

## 10 REFERENCES

Coetzee, F. Cultural heritage survey of the proposed Phakisa Housing Development, Welkom, Free State. *Unpublished CRM report for Exigent Environmental*. Pretoria.

Flemiger, D. 2006b. World Heritage Sites of South Africa: Cradle of Humankind. 30<sup>o</sup> South Publishers. Pinetown

Huffman, T. 2007. *Handbook to the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa*. University of KwaZulu-Natal Press, Pietermaritzburg.

Maggs, T. 1976. *Iron Age Communities on the Southern Highveld*. David Philip: Cape Town

Mitchell, P. 2002. *The Archaeology of Southern Africa*. University Press: Cambridge

SAHRA, 2005. *Minimum Standards for the Archaeological and the Palaeontological Components of Impact Assessment Reports*, Draft version 1.4.