



MANAGEMENT, MONITORING AND EVALUATION OF THE CRADLE OF HUMANKIND FOSSIL SITES



**UPDATED FOSSIL SITE MANAGEMENT PLAN
FOR**

SWARTKRANS

2009 - 2013



DRAFT FOSSIL SITE MANAGEMENT PLAN FOR SWARTKRANS

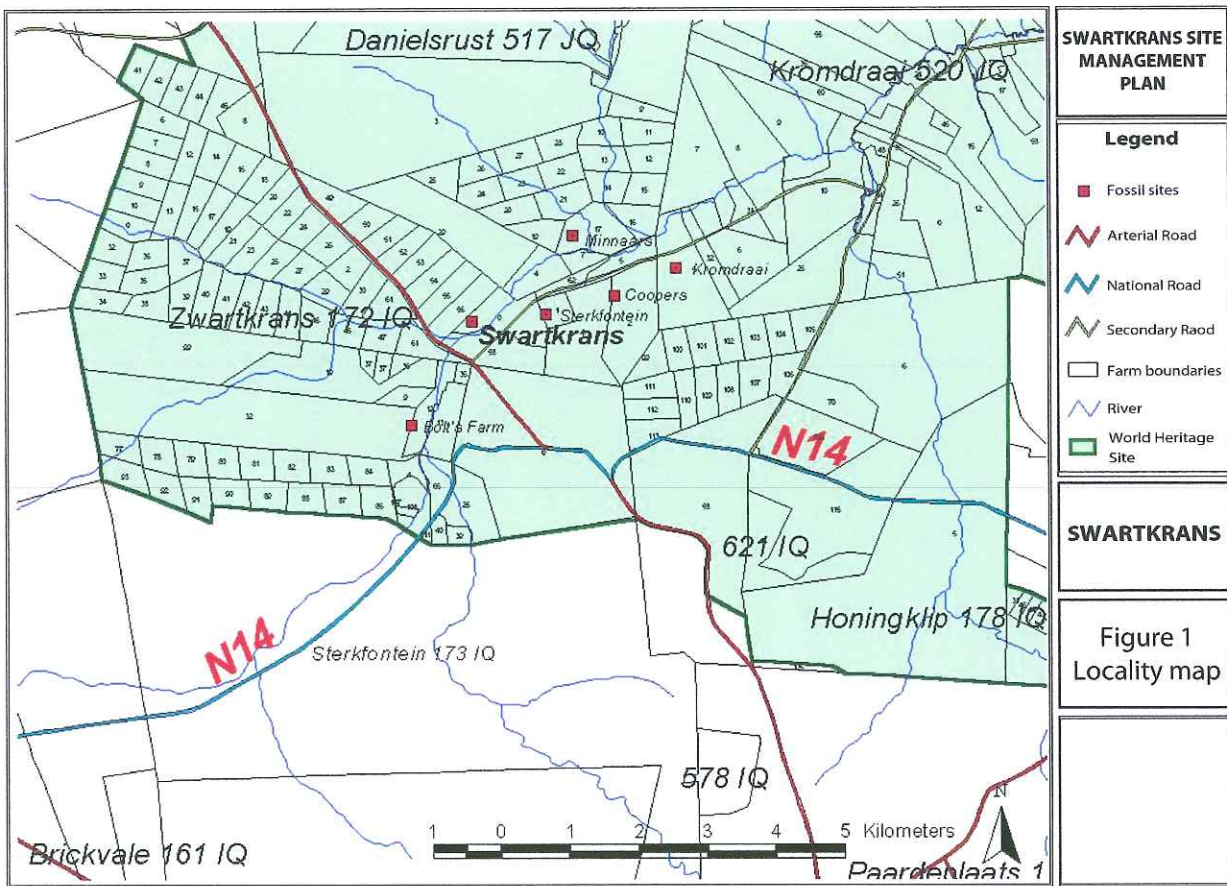
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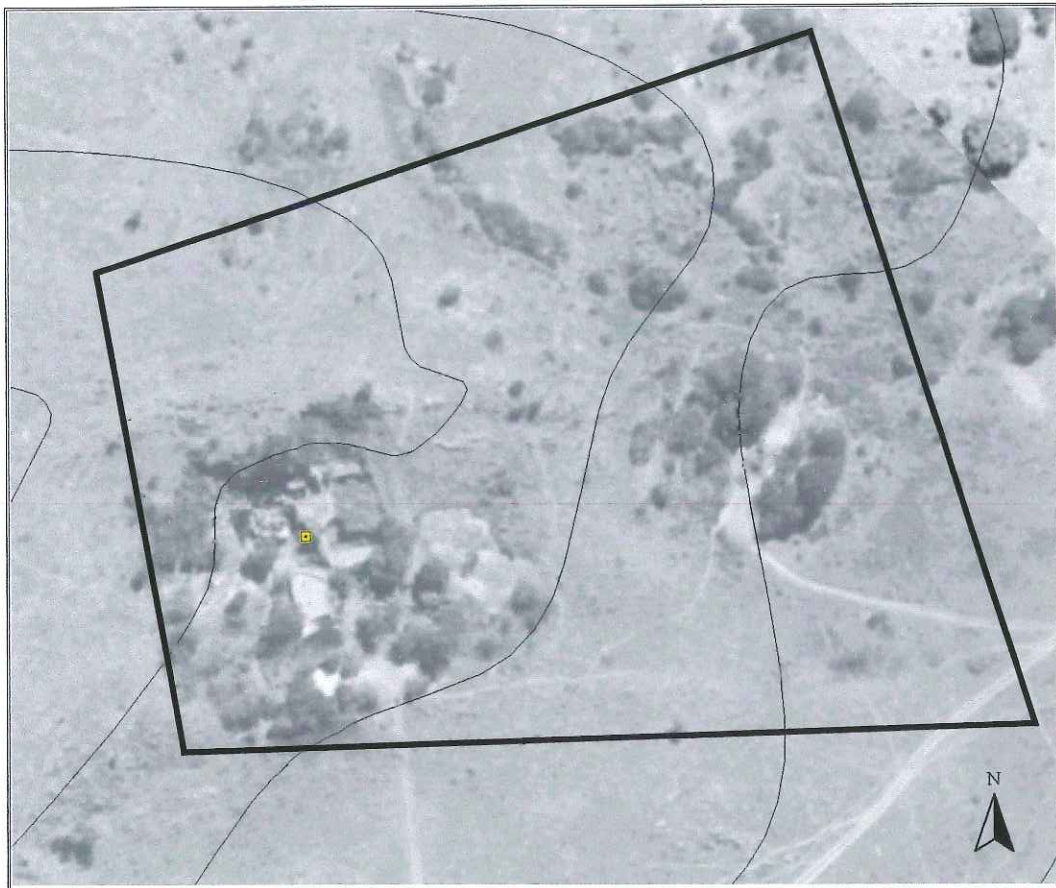
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SUMMARY OF KEY ISSUES

- Revisit and review the possibility of integrating Swartkrans into a broader tourist experience by linking the site by means of pathways or cycle tracks with Sterkfontein, as proposed in original management plan.
- Review the possibility of providing site interpretation on site, by means of information boards and small site museum. This is now necessary because of increased tourist activity on site.
- The site is urgently in need of a site safety inspection. Provision should be made for such inspections to take place on an annual basis. Site safety measures should include a means of evacuating injured persons from the underground area
- The site has for many years been in need of an environmentally acceptable toilet as well as ablution facilities
- The outer cave excavation area is unroofed and breccia is exposed to the elements. It is decalcifying and high excavation walls are friable and prone to collapse – an important witness section has already been lost in this way. Long term stabilization of abandoned working faces is a challenge at Swartkrans



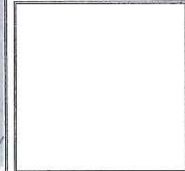


**SWARTKRANS SITE
MANAGEMENT
PLAN**

- Legend**
-  approximate position of site boundary
 -  contours
 -  palaeontological site

SWARTKRANS

Figure 2
Aerial view
of site



PROCLAMATION DIAGRAM

REGISTRATION COPY

SIDES metres		ANGLES OF DIRECTION	CO-ORDINATES		
			Y	System: WG 27°	X
		Constants	+0, 00	+2 800 000, 00	
A B	215, 17	246.04.30	A	-72 381, 07	+78 895, 60
B C	187, 09	344.05.00	B	-72 577, 75	+78 808, 34
C D	220, 19	88.17.50	C	-72 629, 06	+78 988, 26
D A	103, 05	164.17.30	D	-72 408, 97	+78 994, 81

TRIGONOMETRICAL BEACONS		
STERK FONTEIN B	84 Δ	-75 558, 23 +74 089, 49
KRUG 117	412 Δ	-69 559, 89 +81 488, 68

BEACON DESCRIPTIONS
A, B, C, D .. 20mm iron peg

SWARTKRANS PALAEOANTHROPOLOGICAL SITE

TIN
SCALE 1: 2000

Figure 3
Proclamation diagram

The figure A B C D A represents 3,0940 hectares of land being a declared area over Portion 65 of the farm ZWARTKRANS No. 172-IQ Province of Gauteng Framed for National Heritage Site declaration purposes in terms of the National Heritage Resources Act No 25 of 1999

by me P.H. Kohrs
Professional Land Surveyor PLS0314

Surveyed in January 2004

This diagram is annexed to No. d.d. i.f.o. Registrar of Deeds	The original diagram is No. 3461/2002 Transfer Grant C.C.T.	File -/21 S.R. No. 922/2004 T.P. Comp. IQND - 2
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SG No.
2291/2004

Approved

J.S. WEYERS
for

SURVEYOR-
GENERAL

2004-04-16

1 INTRODUCTION

The proclaimed National and World Heritage Site area is small – just over 3 hectares – and is tightly focused around the excavation area. However, the ‘transit experience’ to reach Swartkrans involves crossing the veld and the wetland of the Blaauwbank River, and climbing up towards the site over rocky grassland. This experience influences perceptions of the site, and the management plan has thus included all the area between the Sterkfontein tar road (the D1701) and the fossil site, within the realm of management consideration.

1.1 Objectives

- To preserve the full range of natural and cultural heritage values, the site significance and authenticity of the Swartkrans fossil site
- To balance opportunities for research, education and tourism without compromising the integrity of the site
- To recommend appropriate infrastructure and management strategies to achieve the above goals
- To preserve as much as possible of site context and sense of place in an area which is subject to unprecedented development
- To foster and maintain communication links between management bodies, landowners and researchers as partners in management and conservation of the fossil site.

1.2 Method

- Consult with landowners, researchers, repository institutions and support institutions to reveal concerns, contentious issues, requirements and future plans
- Research and understand the full range of natural, cultural, scientific, educational and ecological values of the site. Provide an updated list of values
- Refresh statement of site significance, in consultation with scientists
- Provide an illustrated status quo report against which change can be assessed
- Update the list of risks and threats
- Define desired states and management objectives
- Provide a new management table with management strategies backed, where possible, by operational guidelines for use in the field
- Monitor and evaluate progress at each fossil site inspection, review management strategies where necessary

1.3 Administrative information and legal status

Site:	Swartkrans (previously Zwartkrans)
Farm Name No.:	Portion R (=Portion 65) of Zwartkrans 172 IQ
Owner:	University of the Witwatersrand: purchased 1967
Contacts	Registrar 011 717 1201 Legal Office: Dawn Taylor 011 717 1242 E-mail: 160dawn@atlas.wits.ac.za Postal: University of the Witwatersrand, P/Bag 3 P.O. Wits 2050
Legal status	Declared National Monument (Zwartkrans), 1992 (modified 1994)

	National Heritage Site, November 2004; World Heritage Site 1999
Servitudes & Restrictions	To be investigated
Boundaries	See Figure 2: ABCD, A trapezium, marked with 20 mm iron pegs
Co-ordinates	See proclamation diagram, Fig. 3, taken from meridian and equator
Area:	3.0940 hectares
Permit holders	Dr. C. K. Brain with T Pickering
Designated repository	Wits BPI. Earlier collections are in the Transvaal Museum
Access to public	Limited access under the control of a specialist tour operator

1.4 Existing site management

The landowner, the University of the Witwatersrand, provides some management. Recently, this has included the repair of the road reserve fence along the Sterkfontein tar road (D1701), provision of a locked gate, and burning of firebreaks. Unauthorized access to vehicles is nominally controlled in this way, but as the fence is old and broken in places, pedestrian access is uncontrollable.

Deleted: ¶

The following controls and management interventions exist:

- The site is fenced off from the Sterkfontein-Kromdraai road.
- Access is controlled by a locked gate, and to a certain extent, by non-disclosure of the site. Publication and wide distribution of Cradle of Humankind maps has changed the efficacy of this tactic, and management steps will have to be taken to control unauthorized access.
- Tourists are confined to a pathway through the site, and are under constant supervision of a professional tourist guide
- The site is not open to the general public. A local tour-guide apparently has permission to take special interest tours to the site. The Management Authority, SAHRA and Landowners all have to sanction activities such as this on fossil sites, and the MA needs to report to SAHRA annually about this.
- A SAHRA Permit Committee member inspects the excavation site and ongoing excavations on a twice-annual basis
- The site inspection team, including MA, SAHRA and GDACE officials, plus a contracted specialist service provider, inspects the entire site on a twice-annual basis, monitoring the management criteria noted in the generic site management plan (see Table 1, generic plan)
- The MA monitors development within the surrounding COH WHS properties with a view to protecting heritage values.
- A site safety inspection has been provided for. This is meant to take place on an annual basis.
- GDACE is available for advice to landowners regarding erosion control, fire management, alien vegetation and weed clearance, and preservation of biodiversity
- The landowner burns firebreaks from time to time
- The Heritage Agreement and appended MOU between landowners and permitted scientists addresses issues of mutual management concern

2 SITE DESCRIPTION: PHYSICAL FEATURES, VALUES AND SIGNIFICANCE JULY 2008

This section starts with a short description of the fossil site and its contextual setting (2.1).

The fossil site management plan adopts a values-based approach and seeks to ensure that the many and various values of the site are conserved. Site values extend beyond those formally recognized as being of 'universal value' and this section seeks to provide an updated list of old, new and previously unrecorded or unrecognized values (2.2). Section 2.3 provides an updated statement of site significance which was prepared in consultation with permitted scientists working on site.

2.1 General site description

The Swartkrans fossil site is situated on the southern flank of a low hillock overlooking the wetlands of the adjacent Blaauwbank River which flows along the base of the valley separating this site from Sterkfontein on the opposite flank, approximately 1.13 km distant. The site is marked by a dense cluster of well-grown white stinkwood (*Celtis africana*) trees which grow from the shaft-like entrances to underground caverns and from abandoned miners' excavations. Some conspicuous old waste dumps attest to former exploitation of the site as a source of limestone. Remains of an old kiln are preserved at the foot of the hillock. A rough farm track from the Sterkfontein tar road (D1701) provides direct access to the site, crossing the wetland and stream by means of a causeway and leads diagonally across the hillside to the site (Figs 1, 2).

Swartkrans is the second most westerly of a line of five highly significant fossil sites, which from west to east are the Bolt's Farm cluster, Swartkrans, Sterkfontein, Cooper's and Kromdraai. The former management plan recommended that these sites and particularly Sterkfontein and Swartkrans, be linked by means of pedestrian pathways and cycle tracks to add value to the tourist experience presently on offer.

It is recommended that the linkage ideas proposed in the original management plan be revisited now that the tourist-related infrastructure at Sterkfontein is complete and functional.

2.2 Site values

Certain values, particularly the World Heritage Values are well documented but others have not been sufficiently recognized until now. Six sets of values have been identified: landscape values, palaeontological and archaeological values, mining and historical values, research values, biodiversity and ecological values and finally, educational and tourism values. The relative importance of these values differ – there are several that have allowed for World Heritage Status and National Heritage Site status while others are of a more regional or local value.

2.2.1 Landscape: Geological and geomorphological values

- Part of an important open space in an increasingly over-developed urban landscape
- Excellent example of karst topography showing avens, sinkholes and subsidence

- Outcrops of dolomite and the occurrence of stromatolites, pisolites, oolites and other interesting geological phenomena provide educational and tourism interest
- Wetland and stream course geomorphological features

2.2.2 Palaeontological and archaeological values

- Site of discovery of the robust australopithecine *Australopithecus* or *Paranthropus robustus* in 1948
- Largest sample of *Paranthropus robustus* of all fossil sites: Swartkrans the richest known source
- Preserves the remains of the probable tool-maker *Homo ergaster/ erectus* in deposits ranging from 1.8 and 1 million years
- Site showed for the first time that early humans co-existed with robust australopithecines
- Contains evidence of burnt bones – nearly 270 burnt bones recovered
- This is possibly some of the earliest evidence in the world for the possible use of fire by humans – 20 ancient hearths discovered dating to about 1 million years
- The site shows unequivocal evidence of bone tool use
- Wear patterns are consistent with their use as digging tools, possibly for geophytes and termites
- Site preserves sediments which range in age from 1.8 million years to about 11 000, which evidence is preserved in 5 different sedimentary members, each separated from the next by long periods of erosion
- Nine hundred stone artefacts found in Members 1, 2 and 3 are similar to the Oldowan, developed Oldowan and early Acheulean from East Africa and to artefacts of similar type found at Sterkfontein across the valley. Ongoing excavation is recovering new stone artefacts, as yet unpublished
- The site preserves evidence of interactions between extinct sabre-toothed cats, other carnivores such as leopards, and hominids and the early taphonomic interpretations by C.K.Brain for Swartkrans provided a breakthrough in our understanding of fossil hominid sites in general
- Evidence shows that the cave environment was dominated by carnivores during Members 1 and 2, but in Member 3, at about 1 million years ago, people first mastered fire and took the first steps to dominate the animal world.
- Gravels of the adjacent Blaauwbank River are the source of raw material for many of the stone artefacts recovered from Swartkrans and Sterkfontein
- Middle Stone Age artefacts have recently been recovered from the site

2.2.3 Mining and historical values

As with many of the other fossil sites in the Cradle of Humankind, Swartkrans was mined for its deposits of limestone in the form of travertine, which once covered the floors and walls of the ancient dolomitic caverns. Relics of this activity include:

- Upper loading ramp above remains of late 19th century or early 20th century kiln
- Poorly preserved old lime-burning kiln
- Extraction area and beginning of wagon track
- Ancient prickly pear trees (often planted by miners as a source of fruit) within and close to old workings
- Several abandoned miners' dumps, almost all of which have been reworked and sorted for their fossil content by Dr CK Brain. The sorted sterile residue of this disturbed material has been built into the walls and pathways that are characteristic of Swartkrans.

2.2.4 Research values

- There is still considerable research potential at Swartkrans although over 20 years of excavation has removed much of the residual cave fill. The extractive process has revealed much of the site significance which now resides, in the form of published reports, excavated fossil material, and artefacts in repositories off-site. Ongoing research currently underway has revealed previously unknown sedimentary layers, the exploration of which is extending our knowledge of the sequence of filling of the Swartkrans cave
- Research since 1948 has revealed all of the scientific values detailed above, values which provide the universal values of the site. Without research, the site would have little or no value except 'potential'.

2.2.5 Biodiversity and ecological values

- The wetland and adjacent floodplain, the rocky and stony grassland and the open grassland was once the source of a number of edible plant species. Some of these, especially the geophytes, might have been available to foraging hominids.
- The wetland provides a localized special habitat for plants and animals, or would do so if not so degraded and polluted
- The contrasting rocky and stony grassland habitat supports a different range of plants including the well concealed edible tuber *Brachystelma barberae*.
- The south-facing cooler slopes of the Swartkrans hill preserve a number of poisonous species, including *Boweia volubilis*, is a well-known San and Khoe arrow poison.
- The footslopes of the Swartkrans hillock host plants of *Tritonia nelsonii* (often called 'watsonia') which have an edible corm.
- The area preserves a considerable number of much-utilised traditional medicinal species including *Eucomis autumnalis* the 'malgij', and *Boophane disticha*, the 'giffbol' (also an arrow poison)
- The area has a flora of about 500 species (Mogg 1975), but at the time of writing, no species list for the site could be located. Neither edible, medicinal nor poisonous plants have been listed.
- The grassland biome is threatened elsewhere by overgrazing, too frequent fires and inappropriate land use, and Swartkrans, being a protected area, has the potential to preserve grassland habitat
- Local plant communities include fine examples of potential hominin food plants, and toxic and traditional medicinal plants abound.

2.2.6 Educational, tourism and economic values

Swartkrans offers considerable value for tourism and education:

- Easy access via a public road
- Visitors to Swartkrans can closely approach the excavated area and interact with it by moving through it, and it therefore has a more "friendly" atmosphere than Sterkfontein, where the security fencing creates a "hands off" message, isolating the site from visitors.
- The extensive excavation exposes various stratigraphic sections, and shows breccias at different degrees of decalcification. This allows the history of cave filling, calcification and subsequent decalcification and erosion to be explained
- The permanent grid provides a means to explain the necessity and technique of recording artefacts and fossils in three dimensions.

- The site also contains the only breccia that so far preserves demonstrable evidence of controlled fire use.
- Swartkrans is well situated in a larger potential tourism product that includes the Sterkfontein, Kromdraai and Cooper's sites.
- Excellent views down the Blaaubank Valley from the Lookout Dump, which is easily reached. The upper viewsite provides an even better contextual overview.
- The excellent all round views of the highveld grassland affords an opportunity to explain the factors controlling this biome, while the north-east shaft with its associated *Celtis* tree offers an opportunity to explain the role of various carnivores as taphonomic (bone-accumulating) agents.
- The active owl roost in this area, with the associated owl pellet accumulation below, provides an opportunity to explain the role of owls as the accumulators of micromammalian material in caverns.
- Swartkrans, more than any other site in the Cradle, is the home of Cave Taphonomy (the study of the manner of accumulation and preservation of bones in caves), and this aspect should be incorporated into any educational programmes that are initiated at this site.
- An existing pathway through the site which allows the visitor a close view of all the significant features
- Relative safety for researchers and tourists although site stability itself is currently at risk
- Extremely well-documented site significance, and an existing (though somewhat in need of an update) guide document covering all the features seen on the laid-out route
- Landowners are enthusiastic to promote both research and educational tourism
- Being owned by the University of the Witwatersrand, the site is in the "Public Domain" rather than in private ownership
- The close proximity of Swartkrans to the sites of Sterkfontein, Coopers and Kromdraai allow for their physical linkage by trails and hiking routes.
- Several features enable educational opportunities, for example the aven at the "Ladder Cave", the adjacent big tree and the associated rodent breccia for explaining the role of leopards and owls as bone accumulators

2.3 Revised statement of site significance

I am awaiting the revision of this section from the permitted scientists I am not going to delay submission because the section is very 'tight' and there is probably little modification from the former approved statement of site significance. As and when it comes in, I will submit it. In the mwan time, the original statement (2002):

"Swartkrans is significant because the fossil remains include the largest sample of *Paranthropus robustus* in Southern Africa, as well as remains of the probable tool-maker, *Homo ergaster/erectus* in parts of the cave fill that accumulated between 1.8 and 1 million years ago. About 270 bones from Member 3 at Swartkrans have been burnt. This is some of the earliest evidence in the world for the possible use of fire by humans. At least 68 bones from Members 1-3 at Swartkrans show use-wear consistent with them having been used as digging tools. About 900 stone artefacts found in Members 1, 2 and 3 are similar to the Oldowan, Developed Oldowan and Early Acheulian from East Africa and to the artefacts in the same time range found across the valley at Sterkfontein.

Dr C.K. Brain (1993:264) has summarised the significance of Swartkrans as follows:

Taphonomic reconstructions at Swartkrans have emphasised the importance of feline predation on early hominids, at a stage when human influence on the natural environment

was very slight, and when the balance of power lay with the cats. But the Swartkrans record also documents a technological innovation of immense importance: the management of fire, providing a measure of protection from nocturnal predators. In Member 3 at Swartkrans, a hint is discernible of a shift in the power balance towards the hominids – the first in a series of technologically-based triumphs that have established people as the dominant animals on earth.”

It was recommended by ICOMOS in 1999 that the fossil sites in the Cradle of Humankind be declared a World Heritage Site because they “contain an exceptionally large and scientifically significant group of sites which throw light on the earliest ancestors of humankind. They constitute a vast reserve of scientific information, the potential of which is enormous.”

In terms of the criteria set out in Section 3(3) of the National Heritage Resources Act (Act No. 25 of 1999), and specified for Grade I national heritage resources in the draft SAHRA Regulations on Grading System and Heritage Resources Assessment Criteria, Swartkrans qualifies for national heritage status because of its:

- (a) **Importance in the pattern of South Africa’s history.** The fossils demonstrate a significant stage in human evolutionary history because *Australopithecus africanus* was no longer the target of carnivores in the vicinity of Swartkrans between 1.8 and 1 million years ago. It had probably been replaced by the robust australopithecine, *Paranthropus robustus*, and tool-making humans such as *Homo ergaster/erectus*.
- (b) **Possession of uncommon, rare or endangered aspects of South Africa’s natural or cultural heritage.** *Paranthropus robustus* and *Homo erectus* fossils are rarely found in fossil deposits outside the Cradle of Humankind. The well documented finds at Swartkrans are therefore of national and international significance.
- (c) **Potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage.** Meticulous analysis of the Swartkrans breccias and their contents pioneered the study of taphonomy in Southern Africa. Taphonomy means “the laws of burial” and is concerned with what happens to animal remains between death and fossilisation. The information derived from taphonomy at Swartkrans and other sites in the Cradle of Humankind has led to an understanding of the natural environment and behaviour of hominins and the other animals that interacted with them. Analysis of the species represented indicates that most of the bones were accumulated as the result of carnivore kills and there were no major changes in the environment over the time period between 1.8 and 1 million years ago.
- (d) **Importance in demonstrating the principal characteristics of a particular class of South Africa’s natural or cultural places or objects.** Swartkrans is an excellent example of a fossil deposit that accumulated at an important stage in human evolution. There is evidence to suggest that by this stage *Homo ergaster/erectus* and/or *Paranthropus robustus* had developed the brain power to make use of fire, to use bones as tools and to stone artefacts.
- (e) **Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.** There are no aesthetic qualities at Swartkrans that are particularly valued by a community or cultural group.
- (f) **Importance in demonstrating a high degree of creative or technical achievement at a particular period.** Sterkfontein, Swartkrans and Kromdraai are the only cave sites in the world that have yielded stone tools classified as Oldowan. The Oldowan is one of the earliest stages of stone tool-making and demonstrates a relatively high degree of creative and technical achievement in the time period between 1.5 and 1.8 million years ago. Oldowan tools are known elsewhere only from open sites in Eastern and Southern Africa. In addition, Swartkrans has evidence for the use of bone tools that are rarely found elsewhere in this time range.

- (g) **Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.** Swartkrans has been associated since the 1940s with the community of geologists, palaeontologists, palaeo-anthropologists and archaeologists who have studied the history and contents of the breccias. It is also important to all South Africans who are interested in the history of our species.
- (h) **Strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.** Swartkrans was investigated in detail by Dr C.K. Brain and colleagues at the Transvaal Museum from 1965-1992. Their work made a substantial contribution to the field of taphonomy in South Africa and internationally.
- (i) **Significance relating to the history of slavery in South Africa.** The age of the deposits at Swartkrans places it well before the time period of slavery in South Africa.'

(Janette deacon 2002)

3 SITE ANALYSIS: STATUS QUO, RISKS AND THREATS, JULY 2008

In order to provide a basis against which change can be assessed, a status quo report is necessary. Ideally, change is assessed by means of comparison of 'fixed point photography' and such fixed points are in the process of being selected and installed. For scientific excavations, the datum point has been used where possible.

In order to assess the management strategies that may be necessary in order to preserve site values, threats and risks to site values have been analysed as part of the status quo, and the next section (Section 4) describes desired states and management outcomes.

3.1 Physical Environment: Surface

This section addresses the status quo, threats and risks of the seven elements of the physical environment.

3.1.1 Access: physical and legal

Status quo:

- Access to the site is direct by means of a rough farm track which gives off the Sterkfontein tar road through a normally locked gate. Limited access is by permission from the landowner or via the permitted scientists and under supervision. Recently, permission has been given to a tour operator to take tour groups to the site. Details of visitor numbers are unknown and impacts will need to be assessed.

Risks and Threats:

See infrastructure, 3.3.1 below.

3.1.2 Rangeland, wetland and river gravels

Status quo:

- The wetland is degraded and the stream is cutting a deep channel because of the large volumes and rapid flow of water released from the sewage works upstream (Fig 2). Regular discharge from the sewage works in the upper catchment often causes an

unpleasant smell, particularly after the rush of water released subsides when sluices are closed. Flies have become an additional problem.

- A further cause of wetland degradation is the causeway that bridges the Blaaubank River, which channels the water through narrow openings under the bridge. This focused flow has resulted in the cutting of a deep channel through the wetland that is causing it to dry out because it functions as a drainage ditch. Summer rains further scour the channel. A similar situation exists upstream where the R563 crosses the Blaauwbank River. The channel cutting is clearly visible on the orthophotos (see Fig. 2).
- It is recommended that fixed point photography be set up from the causeway where the main channel passes under it, so as to monitor upstream and downstream wetland conditions.
- The concrete causeway acts as a barrier to fish and other aquatic and benthic fauna. Water discharged from the pig farm and the Percy Stewart sewage works upstream is increasing pollution levels in the stream.
- It is recommended that regular water samples be taken from the causeway to monitor and locate sources of pollution in order that these be addressed.
- Constant burning is causing further degradation of the wetland and is reducing its reed and sedge soak and filtration function. Due to the fact that the filtering effect of the wetland and the associated habitat has been rendered ineffective, polluted water may enter the subterranean system and result in the possible reduction of species diversity.
- It is recommended that the landowner approach GDACE and request that an appropriate fire management program be applied to the site.
- The gravels of the ancient river terrace on the left and right banks are sensitive to disturbance because they act as a buffer area in the event of a flood. Their main significance, however, is that they constitute the source of much of the lithic raw material utilised in the manufacture of the Swartkrans and Sterkfontein stone tools. They should not be used to provide bulk material for road-building and repair

Risks and threats

- Further wetland degradation if the causeway is not re-engineered.
- Continued high water pollution levels if outside sources of pollution are not addressed
- Possible groundwater contamination
- Flies and odours
- Loss of wetland vegetation due to overly frequent fires
- Opportunistic use of gravel terraces for road fill

3.1.3 Erosion

Status quo:

- Erosion at Swartkrans is not problematic except where the access road has been allowed to channel water, eroding the surface and tracks. The road on both sides of the causeway is affected by erosion.
- It is recommended that erosion of the road surface (mainly on the southern side of the causeway) and tracks (mainly on the north of the causeway) be monitored.

Risks and Threats:

- Lack of interventions to deal with road runoff such as humps and mitre drains are causing the road surface and edges to deteriorate

3.1.4 Fire management

Status quo:

- Site inspections over the years seems to demonstrate that fire is an ongoing hazard, with potential threat to property and natural heritage values (Fig 4, 5). The too frequent burning of the reed bed along the stream has caused it to almost disappear, and its important function as a habitat and as filter of dirty water impaired.
- It is recommended that the landowner approach GDACE and request that an appropriate fire management program be applied to the site. Without detailed studies, the impact of fire on rangeland is difficult to assess. It is recommended that fire incidence be recorded, and that the impacts of fire be monitored with the help of GDACE.

Risks and Threats:

- Many residents close to Swartkrans and on surrounding properties increase the risk of uncontrolled getaway domestic fires
- No formal (written) fire management policy for property and no framework for assessing the impact of fire as yet exists. This is a generic issue relevant to the whole of the COH WHS.
- Uncontrolled fires continue to pose a threat to property and rangeland
- Frequent burning of wetland vegetation can destroy the reed beds and efficacy of the filtering function of wetland vegetation



Fig 4: Swartkrans hill showing the effect of uncontrolled fire



Fig 5: Burning firebreaks along the D1701 opposite Swartkrans (October 2006)

3.1.5 Red Data Species, rare plants and animals

Status quo:

- There are no botanical or faunal lists for Swartkrans, and no record of medicinal, edible or poisonous plants, although such economically important plants are known to occur (see Biodiversity and ecological values above). Such lists, and a record of the whereabouts of particular species, are essential to baseline studies of, for example, the impact of fire or wetland degradation.
- Rare species have not yet been mapped. Rare plants and animals are difficult to protect if their whereabouts are unknown.

Risks and threats:

- There is no up- to -date list or mapping of vegetation – over 500 species are known to occur in the Sterkfontein area (Mogg 1975) in this type of Highveld grassland. Rare and endangered species cannot be protected if not located and mapped.
- Edible, medicinal and toxic plant species not recorded – full values of site not clearly understood

3.1.6 Alien vegetation

Status quo:

- The Swartkrans site and particularly the wetland are extensively invaded by alien vegetation, including weeds.
- Invasion of the wetland by various species of alien plants has taken place - notably *Acacia mearnsii*, *Acacia decurrens*, *Ricinus communis*, *Campuloclinium macrocephalum* and 'four o' clocks' – *Mirabilis jalapa*
- The excavation area and many sinkholes are infested with *Pyracantha spp.* and *Opuntia spp.*

- There is as yet no species list of alien species at Swartkrans and such a list needs to be compiled. Infestations have not yet been mapped or prioritised and this needs to be done, species by species, in order that systematic clearing and follow-up clearance can be done. It is further recommended that fixed point photography be set up to monitor infested patches
- GDACE has field operational guidelines; these are noted in the generic site management plan. A guideline on the use of herbicides is also being prepared.

Risks and threats:

- Continued presence and spread of invasive species throughout individual sites and COH WHS, making eradication and control ever more difficult and expensive.

3.1.7 Visual aesthetics, site context

Status quo:

The key sensitivities, management precautions and some solutions to issues concerned with visual aesthetics are provided in the Generic Management Plan. At Swartkrans, the following observations regarding visual aesthetics may be made:

- There is a large viewshed, that is, the area of visual sensitivity surrounding the site - see Fig.2. This is the area within which development should be carefully controlled and monitored.
- There is an undisturbed natural skyline to the south, with wide extended views over a rural landscape which includes vistas of the Sterkfontein, Coopers and Kromdraai sites and provides a natural setting for the fossil site.
- The adjacent chicken-farm-cum-piggery, some buildings of which have been converted to storage sheds, creates an aesthetically displeasing vista adjacent to the property on the west, with several abandoned dilapidated buildings and a pump-house, some of which encroach on the wetland.
- The COH WHS MA makes strenuous attempts to monitor all new development proposal with a view to preserving sense of place and visual aesthetics
- The Sterkfontein caves signifier and new developments to the north of the site are unfortunately visually disturbing (Figs 6,7)

Risks and Threats

- Open rolling grassland country increases sensitivity of contextual area to visual impact of new developments
- Inappropriate structures and land use have the potential to spoil the sense of place.
- Developer-driven projects have the potential to spoil the rural ambience of the surrounding landscape



Fig 6: The strong visual impact of the Sterkfontein signifier, Compound and Visitor centre on the visual landscape as viewed from Swartkrans



Fig 7: New developments to the north of Sterkfontein and Swartkrans also have a strong visual impact, particularly the chicken batteries

3.2 Physical Environment: Subterranean

Status quo:

- There is today no natural subterranean environment at Swartkrans that is accessible to people. The subterranean environment is entirely man-made, first by limeworkers who removed travertine floor, wall and ceiling deposits of the ancient cave. The resulting void was subsequently extended by scientific excavation.

- The subterranean environment is the site of a new and exciting excavation but working conditions are dangerous and a site inspection is strongly recommended.
- That natural subterranean environments exist both beneath the present site and close by is attested by water draining away downwards into small underground passages and choked remnants of avens close to the cave.
- Monitoring of the subterranean environment is done by the SAHRA permit committee official and the professional Site Safety officer, who will have his or her own safety criteria.

Risks and threats:

- The subterranean excavations may pose safety risks for site users. The report of the professional site safety inspector is awaited

3.3 Infrastructure

3.3.1 Access roads, culverts, bridges, etc.

Status quo:

- Access to the site is direct by means of a short (about 500 m) rough farm track leading off the Sterkfontein tar road (D1701) by means of a gate. The first part of the track leads quite steeply down to the stream and its surface and margin is deeply rutted in places. There are no mitre drains or humps to control erosion of its surface. The stream is crossed by means of a concrete causeway which does not extend across the full width of the wetland, leaving the far end prone to waterlogging. The road causeway is therefore inadequate in the rainy season and its mode of construction may be an obstruction to faunal migration such as fish and benthic fauna.
- The causeway allows throughflow of water by means of some pipes passing through under the roadway. However, it impedes natural flow resulting in upstream damming and flooding and downstream erosion and channel formation. This is true also of the road bridge over the adjacent R563 and channel formation is clearly visible on aerial photographs. Channel formation causes desiccation of the wetland which is exacerbated by overly frequent burning of the once lush reed beds and other wetland vegetation. Channel deepening is exacerbated by the excessive flow occasioned by effluent from the Percy Stewart sewage works upstream of the site. Improving the causeway structure might help towards alleviating these problems.
- On the far side of the river, the track leads steeply up to the site, terminating in an informal 'public' carpark. There are insufficient mitre drains to prevent track erosion and the creation of a high 'middleman'. The carpark is not graveled or surfaced in any way and long grass in the summer and late autumn can cause a fire hazard for cars parked there. Researchers may continue and park in a leveled area within a specially created living and working space built by Dr C K Brain from sterile waste breccia.

Threats and risks:

- Further wetland degradation unless the causeway is re-engineered, and excessive throughput of effluent water reduced

3.3.2 Fencing and gates

Status quo:

- There is a five-strand barbed-wire fence along the road reserve against the Sterkfontein tar road (D1701) with a padlocked gate. Access is by appointment only and no free-range tourism is allowed. However, although the gate might control unauthorised vehicular access, pedestrians can enter at will. There is no caretaker at the site.
- An inner perimeter fence conforming to the proclaimed Heritage Site boundary was mooted but it was felt by stakeholders that such a fence would compromise the site

context and create a negative visual impact. The excavation area is thus open to anyone who chooses to walk there.

Risks and threats:

- Without a security fence and the permanent on-site presence of a caretaker, theft of equipment and materials will remain an ongoing problem

3.3.3 Parking

Status quo:

- The access track ends in the leveled living area adjacent to the excavations but visitors are expected to park on the sloping adjacent hillside outside. The area is not graveled and is prone to uncontrolled fires (Fig 4) as well as to erosion with frequent use.
- Researchers park in the shade within the leveled area which once accommodated the caravan of Dr Brain.

Risks and threats:

- None at present. If greater visitation is envisaged, there may be a risk of erosion in the car park. Graveling is recommended because of fires.

3.3.4 Built environment

Status quo:

- *Sheds and storage*
There is a storage shed with an enclosed portion and a larger wire-meshed portion. This has, however, been broken into several times and it is not safe to leave valuables here
- *Accommodation*
The house once used by caretaker George Makoena has been removed and there is now no permanent accommodation on site. A recent attack on a field assistant has rendered temporary accommodation in the caravan ill-advised. This impacts on scientists' budgets by obliging them to travel backwards and forwards to the site every day at considerable transport cost.
- *Pathways, walkways and viewing platforms*
Pathways, walkways, viewing platforms and substantial retaining walls have been built under the supervision of Dr C K Brain. These have been constructed from sterile dump material and the surface of some pathways is very rough and uneven. There are several deep and unprotected drops, uneven stairs and a precipitous metal stepladder which provides access to the underground excavations.
- *Tourist-related, including signage*
There were at one time numbered viewsites which matched a little booklet explaining aspects of the excavation which could be seen from these stopping points but these useful additions to site interpretation seem to have fallen into disuse. There is no interpretative signage erected on site. Dr Brain used to keep some charts and interpretation material in the shed and make this available to site visitors, but as the site is not generally open to the public, these are not always available.
- *Ablutions and storage*
The landowner has been promising for many years an acceptable enviroloo to replace the pit toilet previously on site and which is now derelict. Workers have to go across valley 1.3 km to Sterkfontein to get to running water and a functional toilet.

Risks and threats:

- Without a permanent resident caretaker, thefts and break-ins at the storage shed will remain a risk

- The cobbles from which the pathways have been built have become loosened over time and the uneven pathways are a safety risk
- There are several unprotected dangerous drops
- The lack of a toilet poses a threat of site pollution

3.3.5 Waste Management

Status quo:

- Sewage
There is as yet no provision for toilets and no functional toilet on site. This management issue has been outstanding for some time. Without adequate toilet facilities, responsible tourism cannot take place
- Litter
Permitted scientists are careful to remove all litter each time they visit the site

Risks and Threats:

- The lack of a toilet poses a threat of site pollution

3.3.6 Energy

Status quo:

- Swartkrans has no energy supply and cooking and heating has to be done using gas or firewood
- A generator provides power for drilling of deposit when required

Risks and threats:

- None at present

3.3.7 Water

Status quo:

- There is apparently no piped water at Swartkrans and water has to be brought in each time workers are there. A severed water pipeline was observed at the causeway after the recent rains.

Risks and threats:

- Lack of running water hampers excavation work and is necessary if responsible tourism is to take place

3.3.8 Telecommunications

- Telecommunications by means of cellular phones is possible

3.4 Research Environment

3.4.1 Previous and ongoing research and excavations

The site has been extensively excavated since 1948, when Robert Broom and John Robinson first initiated palaeontological exploration. The first phase of field work lasted until November 1949, after which palaeontological work was interrupted by lime-mining operations for about a

year. After Broom's death in 1951, Robinson continued working at Swartkrans until 1953. This early phase of field work yielded remains of the robust ape-man *Paranthropus robustus crassidens* (now *Australopithecus robustus*) as well as those of "*Telanthropus capensis*" - now known as *Homo ergaster*.

The site has been carefully and systematically excavated over many years by Bob Brain (from 1965 to 1991), and remains the best and most comprehensively examined and documented of the Cradle sites. After an hiatus of some years, Dr Brain resumed work at the site in 2004, and this research is still ongoing. Between 2000 and 2003, Prof Lee Berger held an excavation permit for Swartkrans but did not excavate there.

Dr Brain is the current permit holder, permit number 80/04/11/012/51 which is now due for renewal and a permit is in process of being issued.

Risks and Threats:

- Lack of funding inhibits research and site potential remains locked
- Lack of dedicated heritage officer in Management Authority prevents follow-through after site inspections and management issues remain unattended – a problem generic to all the fossil sites in the COH WHS.

3.4.2 Excavation edges

Status quo;

- The breccias and sediments of the outer cave are unroofed and exposed to the elements. They are generally decalcified, rather friable and prone to collapse. Excavation edges of old abandoned excavations in the outer cave area are therefore also friable, and this is recognized by scientists and managers alike, but these are difficult to stabilize effectively.
- Pathways need to be kept well away from excavation edges (this is not always the case) in order to prevent further destabilization, but also to reduce the risk of collapse of the excavation wall, and injury to life and limb of users of pathways.
- Excavation edges in the inner and lower cave are also prone to collapse due to the instability and cascading of the overlying sediment - excavation is into the base of a debris cone.
- Careful monitoring of the condition of excavation edges is recommended and stabilization measures taken where necessary. Protecting the edges and walls with plastic during the rainy season appears to be effective.

Risks and Threats:

- Excavation edges are friable at Swartkrans and prone to collapse in places, particularly where they surmount long vertical drops.

3.4.3 Excavation walls

Status quo:

- There are several very deep old excavations with high walls. One of these, an important witness section in Member 3, the burnt bone hearth area, has collapsed.
- The new excavation presently being undertaken in terms of permit No. 80/04/11/012/51 has created some extremely deep, vertical and friable walls (Fig 8). Some of these have the additional hazard of exposing loose rocks surrounded by decalcified and decalcifying breccia - a very dangerous threat to site stability and safety. Monitoring of the situation is ongoing.

Risks and threats:

- High excavation walls are prone to collapse particularly if decalcified.
- Boulders projecting from excavation walls may become dislodged causing cascading of site material
- Long-term stability of excavation walls is problematic and stabilization becomes an expensive factor
- High excavation walls are a safety risk



Fig 8: The current excavation at Swartkrans: a vertical excavation wall with a friable edge

3.4.4 Access to excavations: steps, ladders, lifts etc.

Status quo:

- Access to parts of the excavations in the outer cave is by means of 'benches' (terracing) left in the original cave deposit. In places steps have been cut to facilitate access, in others, steps have been built up using sterile breccia blocks and waste rock.
- Access to the lower cave excavation area is by means of a long painted metal ladder of sturdy construction. Access within and between various parts of the lower cave is by means of pathways and steps cut into natural deposit.
- The roof is extremely low in places and cascading sediment and scree is a hazard to personal safety. The latter hazard is exacerbated by the fact that excavation into the debris cone base is taking place, destabilizing the overlying loosely compacted material. The area is urgently in need of a site safety inspection.

Risks and threats:

- Safe access to excavation bases must at all times be borne in mind. The report of a professional site safety officer is expected shortly.

3.4.5 Erosion

Status quo:

- Erosion of the breccias is an ongoing problem. Tropical thunderstorms cause sediment to become wet and heavy and to collapse. Covering temporarily abandoned faces with industrial plastic seems to help in protecting sensitive faces.
- Chemical weathering and decalcification by tree roots and humic acid also destabilizes the breccia and this should be monitored where the roots of large stinkwood trees penetrate the breccia. The large *Celtis* tree above the current excavation is a case in point and its stability has been further undermined by having the surrounding earth excavated away, exposing its roots (Fig 9).

Risks and Threats:

- Collapse of site fabric is a risk. The area below the *Celtis* tree is particularly vulnerable.
 - Allowing excavations to deteriorate during and after completion by not stabilising excavation walls and edges
 - Failing to prevent surface water flow from eroding excavation edges, walls and footwalls, and from introducing surface-derived sediments into lower repositories



Fig 9: Large Celtis tree growing adjacent to the excavation has had much of its root system excavated away, creating the risk of uprooting during storms when the soil is saturated or during high winds.

3.4.6 Compliance with conditions of excavation permit

Status quo:

Inspection by a SAHRA permitting committee member takes place twice a year to check compliance with the terms of the permit

Risks and threats:

- Excavation is inevitably a destructive process. Inappropriate excavation techniques, recording techniques, recovery techniques, preparation techniques, inadequate subsequent publication and indifferent conservation of artefacts recovered is perhaps the greatest threat to the fossil sites. This is an issue generic to all the sites in the COH WHS, hence the SAHRA twice-yearly inspections. Non-compliance is not an issue at this site.

3.4.7 Witness sections

Status quo:

- Independent verification is a necessity of excellence in science. This is particularly true of the sedimentary divisions of cave fills into 'members' and other stratigraphic subdivisions, each of which are host to discrete fossil faunas and which are the basis of dating samples. If there are no witness samples left of such stratigraphic subdivisions, neither these nor dates nor faunal interpretations can be independently verified.
- Before it was removed, the hanging remnant provided a good visual witness section of stratigraphic interpretations made by Dr Brain. Its sediments were amenable to sampling and testing as and when suitable techniques became available.
- Its removal exposed a more detailed stratigraphy against the fractured face; it is recommended that this be left as a witness section.
- Elsewhere in the excavation, Member 3, the burnt bone member, collapsed after heavy rain, destroying the witness section.
- It is recommended that witness sections demonstrating the various members (there are 5 members) be selected and preserved for future sampling, as and when new investigative techniques become available.

Risks and Threats:

- Stratigraphic conclusions reached should be independently verifiable. If no witness sections are preserved, this would not be possible
- Dating results need to be independently verifiable. If witness sample sections are not preserved, this will not be possible
- New techniques and analytical procedures are perpetually coming to light. These need to be applied to sites from which earlier conclusions were obtained, in order to verify and expand understanding. If there are no witness sections, this cannot be accomplished.

3.4.8 Dumps

Status quo:

Until the "Hanging remnant" was taken off, all the dumps on site were old dumps created by and abandoned by limeworkers. During the course of excavations on site over a lifetime, Dr Brain has sorted through these dumps and recovered their fossil contents. The sterile residue has been

built into an amazing edifice of built-up and levelled viewing platforms, pathways, stairways, walkways, retaining walls, stone seats and the like.

The hanging remnant breccias are the first for which the provenance is known, and this presents a problem as to where to dump unwanted residues, and to store still-fossiliferous breccias in transit to laboratories for working (Figs. 10,11).

It is recommended that in future, a 'breccia and dump management policy' be applicable at sites in the Cradle.

It is recommended that monitoring of the various new dumps being created on site continues. Any new dumps must be recorded on the site plan.

Risks and Threats:

- Loss of information concerning the source, author and content of dumps
- Loss of or languishing information, because dumps are not processed for fossil content



Fig 10: Hanging remnant area after removal of unstable breccia (replace picture)



Fig 11: New dumps in the making at Swartkrans

3.4.9 Repository

The fossils and artefacts recovered from the early excavations are housed in the Transvaal Museum (Northern Flagship Institution) and those recovered more recently are scheduled to be placed in the University of the Witwatersrand Institute for Human Evolution (IHE) repository.

Risks and threats:

- Loss of, or deterioration of artefacts
 - Loss of information concerning artefacts
 - Lack of publicized information about artefacts
- These threats are not an issue at present.

3.5 Site safety and security

Status quo:

Site Safety should be considered from two perspectives: Firstly, the physical stability of the site itself, and secondly from the perspective that site stability impacts on the safety of researchers and those visiting the site.

Site Stability is affected by two different threat sources: Firstly, by natural causes which include the ongoing weathering and decalcifying processes, and secondly from man-made influences such as the alteration of surface drainage and poor excavation techniques. At Swartkrans, site stability has been drastically affected by mining activities in particular, and to a lesser degree by the entirely necessary process of excavation. However, it is only by the inherently destructive process of excavation that site significance is realised.

3.5.1 Physical safety

The increase in local crime, the attack on a field assistant on site, and several thefts of property from the storage shed has highlighted the fact that the Swartkrans site can no longer be considered safe.

3.5.2 Safety of surface and built environment

- The constructed pathways have a rough surface for walking on and in places, partially embedded stones have worked loose and are breaking free of their mortar.
- Several pathways pass close to steep unprotected drops
- There are no handrails at steep staircases, either those cut into the deposit or those built up out of rubble
- Edges of excavations are friable and can easily collapse, especially after heavy rains
- A narrow but sturdy ladder gives access to the underground excavations: a fall would almost certainly result in a broken limb if not worse

3.5.3 Safety of excavation area

- The edges of excavations are often friable and collapse is known to occur
- The excavated walls that have been artificially created are often extremely deep (without stepping out or benching) and are hazardous, especially where there are embedded large rocks which can dislodge after heavy rain. Recently excavated walls have now been benched
- The underground excavation is cutting into the base of a debris cone which continuously is prone to collapse downwards placing the excavator at risk
- The headroom is extremely low and bumping heads and foreheads is a risk
- The hanging wall is unstable in places
- The footwall is also unstable in places.
- Evacuating an injured person from the depths of the excavation would in itself be a hazardous task
- Recovery equipment (e.g. stretcher) and first aid box should be kept on site.

3.5.4 Subterranean safety

There is no natural subterranean environment at Swartkrans. See comments for excavation area above. The artificially created subterranean environment, by miners and excavators, is dangerous.

Threats and risks: surface, subterranean and infrastructure

- Personal safety might become a risk
- Equipment and vehicles may become at risk
- Lack of site safety inspections increases the risk of unintentional safety risks being incurred (in the excavation area)
- Unprotected drops create safety hazard, especially for elderly visitors
- Lack of emergency recovery equipment and first aid poses a threat to responsible tourism and to on-site excavators
- The report on site safety of surface features, infrastructure and the subterranean environment is awaited – all three areas carry safety risks at present

3.6 Presentation of site values

The World Heritage Convention and Act requires that the National Heritage and World Heritage Values of inscribed sites be presented to a wider audience. The many scientific values listed above are not yet presented on site and only a few of them are presented, marginally, in the Sterkfontein Museum. As the site is now open to supervised visits by tourists, it is important that some form of site interpretation be made available. It has been the intention of Dr Brain for many years to provide precisely this kind of material. It was also recommended in the previous

management plan that the site be incorporated in some kind of integrated tourist product which would link Swartkrans with Sterkfontein and ultimately also with the Cooper's and Kromdraai.

3.6.1 Site interpretation

Status quo:

No site interpretation on site at present. Visitors are shown two and three dimensional materials by permitted scientists at arranged visits, but the site is not yet open to the general public. Supervised tours by arrangement make do with their own support materials.

Threats and risks:

- Lack of site interpretation diminishes tourist experience – tourism is limited to special groups at present
- Lack of site interpretation restricts dissemination of knowledge concerning the site and inhibits its presentation to a wider audience as required in terms of the WHC
- Lack of presentation of site values to a wider audience prevents information concerning site significance from reaching public psyche
- Potential funders might not know about site significance
- Public not educated about full range of COH WHS values
- Work and efforts of researchers not fully valued

3.6.2 Visitor numbers

There is not yet a mechanism for recording visitor numbers.

Risks and threats:

- Visitor numbers are required for management purposes

4 MANAGEMENT OBJECTIVES: DESIRED OUTCOMES

This section notes desired states and management outcomes, and the section and Table that follow (Section 5) describe the management strategies required to achieve such outcomes. The management objectives have the preservation all site values as a goal. Fig 12 shows a plan of the site with key areas noted.

4.1 Physical environment, surface

Access:

- To ensure that permitted access to the site (legal right to access) is compliant with the landowner-scientist agreement and that cordial relations between researchers and landowner are maintained

Rangeland:

- To ensure that contextual veld conditions and rangeland in immediate vicinity of fossil site is maintained in as good a condition as possible, with regard to appropriate land use and management.
- To eventually rehabilitate the Blaaubank wetland and its wetland vegetation and fauna – a project for the greater COH WHS.
- To conserve the river terraces which were the source of lithic material for stone tools in the remote past. The terraces concerned fall outside the proclaimed area.

Erosion:

- To ensure that the fossil site and environs is free of active erosional problems and that existing areas of erosion are remedied, rehabilitated and monitored for follow-up action if necessary

Fire management:

- To ensure that a proper fire regime appropriate to Bankenveld is maintained on the fossil site.
- To ensure that fossil site users are aware of fire hazards and can control on-site fires.
- To ensure that the fossil site does not harbor or create fire hazards
- To ensure that the necessary fire-fighting equipment is on hand in the event of a domestic fire (extinguishers and beaters)
- To ensure that the basic data necessary to assess the long-term impact of frequent fires is available, which information is necessary to feed back into appropriate fire management
- To protect the vulnerable wetland from fires which destroy wetland vegetation

Biodiversity, rare plants and animals:

- To ensure that a database of plant and animal species present on site becomes available, because biological values are as yet poorly understood
- To assess which of these are target species for use as food, medicines, economic reasons, etc., and to what extent they are being collected
- To identify, record and map special species in order to ensure their protection

Alien vegetation:

- Desired outcome is a fossil site which is free from alien invasive species, and, as far as possible, from weeds. This will necessitate a 'generic' programme which includes the whole of the COH WHS plus upstream areas from which new infestations are introduced, particularly into the wetland.

Visual aesthetics:

- Desired outcome is protection of viewshed and contextual environment in order that the site does not become an island in a sea of inappropriate development or land use.

4.2 Physical environment, subterranean

- Desired outcome is a subterranean environment which, if it is being visited or excavated, is safe for all site users.

4.3 Infrastructure, built environment

Desired outcomes include the following:

- Re-engineering of the causeway in order to rectify problems connected with the focusing of stream flow, the upstream damming and downstream channel cutting which is causing wetland deterioration
- The installation of humps and mitre drains to correct erosional problems on the access road
- The re-surfacing of pathways on site to conform with safety regulations (Public Health and Safety), particularly if increased tourism is planned for the future
- The erection of the site plaque

- The erection of interpretative signage if regular tourism is to take place
- The installation of an environmentally acceptable toilet

4.4 Research environment

Desired outcomes include:

- To ensure that the activities of scientists on site are perceived as 'adding value' rather than as 'site users' and that authorities take cognizance of this, particularly with regard to funding items which are not directly research or science-orientated, such as the purchase of materials for storage containers, which items have little hope of being funded by the NRF or other funding bodies
- To ensure that lack of funding does not inhibit research opportunities and prevent site potential from being realised
- To ensure that the Management Authority has in-house heritage expertise which allows for the follow-up of fossil site inspection observations and recommendations
- To ensure that all structures, excavations and site features are committed to a site plan which includes the gazetted proclamation boundary
- To ensure that all dumps, old and new, are committed to plan, with appropriate annotations
- To ensure that new dumps are appropriately sited and properly constructed
- To ensure that excavations are safely executed and compliant with permit terms and conditions
- To ensure that appropriate witness sections are left and stabilized
- To ensure that sample sites are properly recorded and that results are independently verifiable
- To ensure safe excavation edges, walls and bases, and that these are stabilized when work ceases
- To ensure that fossils are carefully and properly prepared, catalogued, curated and housed in a safe repository
- To ensure that regular site safety inspections take place

4.5 Site safety and security

- Desired outcomes include the provision of safety interventions recommended by the professional site safety officer after inspection of the surface and subterranean environments as well as all infrastructure has taken place

The excavations at Swartkrans are, on the whole, fairly stable and provide much of what there is to look at. They encapsulate much of the residual site significance, and insights into the extremely complicated site stratigraphy. Their continued exposure is of significance in itself. Stabilisation of selected areas should be undertaken in terms of the recommendations contained in the operational guidelines.

4.6 Presentation of site values

- To ensure that the many heritage and natural values of the site are interpreted and made available to as wide a public as possible.

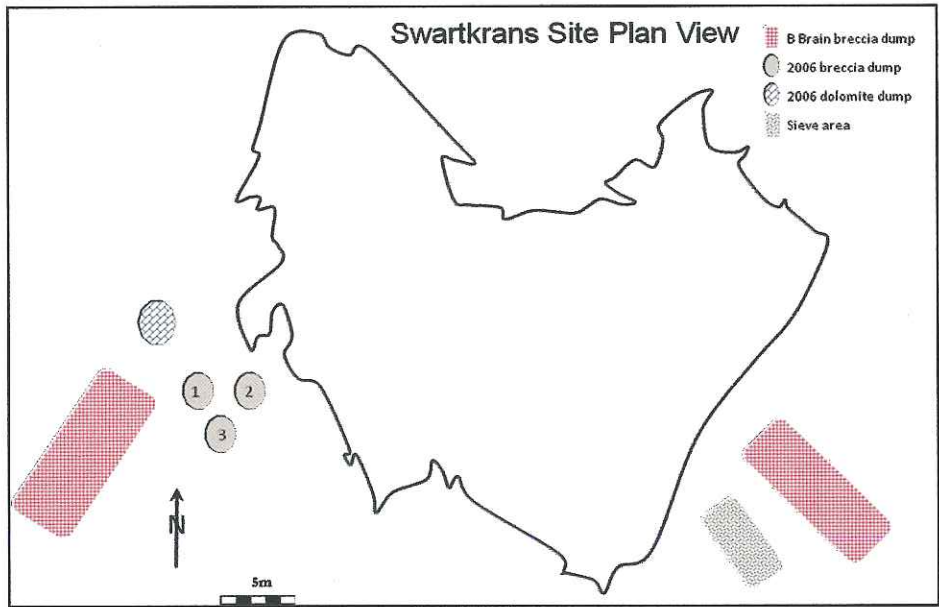


Fig 12 a: Plan view with breccia dumps from C. K. (Bob) Brain excavations and 2006 excavations and the location of waste dolomite and limestone material from 2006 sorting. Also noted is the sieve area. Plan view with excavation grid overlay. Renewed excavations began in 2005 on Members 1 and 4.

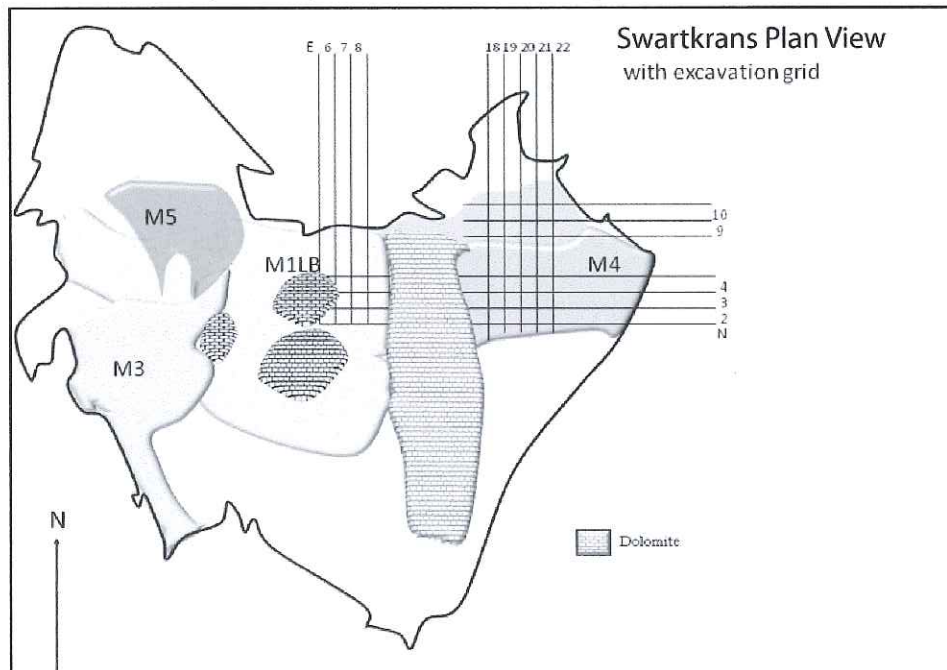


Fig 12b: Member 1 squares excavated include 2N 6E, 2N 7E, 2N 8E; 3N 6E, 3N 7E, 3N 8E and 4N 6E, 4N 7E, 4N 8E. Member 4 squares excavated includes: Surface— 2N 21E, 2N 22E; 3N 21E, 3N22E, and 4N 21E, 4N 22E. Underground—9N 18E, 9N 19E and 10N 18E, 10N 19E.

5 MANAGEMENT AND MONITORING TASKS

The following are operational management tasks and issues that need to be addressed now or in the future as part of on-going management actions in order to achieve the above-mentioned management outcomes. Their funding is still problematic.

The development of research at the fossil sites has been limited by the unfortunate perceptions that the State may not fund development on privately owned property and that the scientists are 'site-users'. This needs to change as it must be seen as the responsibility of the authorities to foster research and necessary associated development on these sites. It is recommended that in future, scientists be viewed rather as 'value adders' and thus eligible for some easement for the funding of heritage site management interventions which they are currently expected to fund, for example, fencing. In effect, the state has been expecting others to finance the protection of the COH WHS fossil sites.

Sites which have no active scientist are generally neglected – this is an indication of the positive influence which scientists have on fossil sites.

5.1 Community Involvement

The following opportunities for community involvement have been identified at Swartkrans:

- Building pathways
- Using dry stone walling (local stone) to create the protective walling around the proposed new view site and viewing platform
- Burning firebreaks
- Weed and alien vegetation control
- Recruitment of suitable candidates as tourist guides
- Conservation Rangers to patrol the area and report on issues that relate to the state of the environment.

The following tables have been drawn up with the specific aim of clarifying who should do what, and when, on the heritage site. The Tables also provide some indication of priority ratings. They have been constructed in such a way as to incorporate all the key management issues, strategies and monitoring criteria so that they may be used independently of the text.

The relative priority of the management measures has been identified based on ICCROM definitions as follows:

- Immediate - dangers to the public or a resource;
- Urgent - need to be attended to urgently to protect the resource;
- Necessary - need to be attended to, to protect the resource;
- Desirable - from a development perspective;
- Keep watch - monitor to see if the problem is serious.

(TABLE 1 FOLLOWS)

6 TABLE 1 : MANAGEMENT AND MONITORING TASKS FOR SWARTKRANS

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Alien vegetation, weeds	Heavy infestations within wetland, cave entrances, avens and other areas Visually displeasing Diminishes value of tourist experience Threat to biodiversity	Fossil site free of alien invasives (*) . Draw up identification, eradication and control programme. Map infestations and prioritise Assess equipment, manpower and costs, time needed Establish mode of dispersal and factors favouring establishment of alien species to prevent further infestations and spreading Destroy eradicated plants in a manner that further seed dispersal or spreading cannot occur Re-vegetate cleared areas. Soil contaminated with alien seed not to be utilized anywhere. Initiate a cyclical control programme (see field operational guideline in generic management plan)	Regular field scans and inspections, with action as necessary. Check for infestations and infestation density. A photographic baseline will be useful to monitor progress Surrounding area to be monitored also	Necessary	every spring and autumn	GDACE (with Working for Water Programme) in consultation with landowner Local community could be involved as part of poverty relief

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Weeds in excavation site	Uncontrolled weed growth reduces visibility of noteworthy sections Weeds create an impression of neglect and decay Weeds reduce the quality of the tourist experience	Desired outcome is weed-free fossil site (*). Regular eradication by hand, taking care not to unduly disturb breccias Burn or otherwise dispose of weeds so as not to spread seed Consult GDACE for their guidelines on the use of herbicides	Regular inspections – check for weed infestations and density	Necessary	at least quarterly	Landowner, permitted scientists might assist Local community could be involved as part of poverty relief
Red Data & ethno-botanically significant species	Unintentional destruction by development activities, over-collection, theft	Preservation of rare and ethno-botanically significant species (*). Create a plant species list for the Swartkrans fossil site, which indicates Red Data, economically significant, medicinal, poisonous and edible species. Identify, locate and map target species. Set up photographic monitoring, Assess impact of collection and/or utilization. Implement a protection strategy.	(Some species may have only a 'vulnerable' status). Monitor located target species and sample sites	Necessary	annually	GDACE, landowner. This requirement creates a number of research projects which could be tackled by Wits students

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Wetland	Risk of further degradation processes, desiccation, destruction of reedbed and wetland ecology. Loss of wetland species Reduction of quality of visitor experience	Desired outcome is a rehabilitated wetland (*). Instigate rehabilitation programme including restructuring of causeway to improve flow regime and reduce damming and channelling. Control fire frequency, discourage overgrazing, control alien plant infestations and weed growth	Monitor burning programme. Monitor for further channel incision, using fixed point photography if necessary	Urgent	Ongoing	GDACE, landowner
River Health	Imported water pollution from upstream sewage works and agricultural effluent	Improved quality of Blaauwbank River water (*). Implement a regular water monitoring programme to supplement monitoring data collected by DWAF. Monitoring to be undertaken upstream, downstream and on subterranean samples	Monitoring parameters to include pH, conductivity, suspended solids, major cations and anions, heavy metals, organics, complex organics.	Necessary	Frequency depends on pollution values and cost	GDACE – try to set up showcase programme with DWAF. MA to encourage landowner to ensure that this is done

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Fire	Further degradation of wetland, risk to property, built environment	Desired outcome: Fossil site and wetland protected from uncontrolled fire (*). Implement a fire management programme, Create a firebreak and inspection route around entire perimeter Controlled burning as per ecological requirements Establish a research programme to assess the impact of overly frequent burns	Check efficacy of fire breaks at the end of the rainy season, again at onset of windy season. Monitor road verges and areas around compounds, settlements Remind those responsible of the need for firebreak burning (Heritage Inspectors)	Urgent	End of rainy season, onset of windy season	GDACE, landowner. MA to encourage landowner to see that this is done
Erosion	Storm water is concentrated and channelled, especially in road trackways	Fossil site free from erosion problems (*). Install road humps and mitre drains in roads Rehabilitate erosion dongas	Check drainage interventions and water flow in access road Photographic monitoring of dongas	Necessary	Annually at beginning of rain season	Landowner.

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Causeway	Traffic safety, impedes water flow through wetland, fish and benthic faunal movement restricted. Flow is focused through pipes	Causeway re-engineered to facilitate wetland rehabilitation (*) . Restructure, extend and raise Ensure that full extent of wetland width subject to flooding is covered so that vehicles do not bog down	Monitor upstream side for trapped flotsam, check throughflow, after each flood event Check flow through pipes and gaps are sufficient	Necessary		GDACE, Landowner
Owl Roost	Disturbance and displacement by visitors Loss of significant modern analogue for past events in Swartkrans cave Loss of educational opportunity	Retention of owl roost (*) . Avoid "Ladder Cave" area and post informative signage	Monitor and control tour groups Post signage regarding appropriate behaviour	Urgent	Ongoing	Tour guide, researchers, all
Rehabilitati on work	Loss and dispersal of topsoil	Desired outcome is the conservation of topsoil for subsequent use, rather than dumping (*) Stockpile all topsoil removed for whatever purposes	Re-use on selected sites Do re-use soil contaminated with the seed of invasive aliens, i.e. do not spread soil taken from the wetland	Necessary	At all times	ALL

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
Protection of geological assets	Removal of stromatolites, inadequate presentation and interpretation of geological assets Diminished tourist experience	Desired outcome is the preservation and protection of Stromatolites and 'Pelindaba Stone' (*). Monitor for removal of stromatolitic rocks. Map points of geological interest and incorporate in heritage trail	Look for 'bald patches' in the rocky grassland where large pieces of rock have been removed Ensure that the geological values of the site are interpreted in tourist routes	necessary	At all times	GDACE, heritage inspectors, landowner, Scientists
"Fire pit" (Member 3 gully) (now collapsed)	<ul style="list-style-type: none"> • Unstable excavation walls • Rainstorms eroding already decalcified walls • Rocks tumble into pit 	<ul style="list-style-type: none"> • Preservation of 'fire pit' witness section (*). • Don't allow tourists to the bottom, but the tourist guide should point out the relevant horizon • Walls could be stabilized by chamfering loose edges and netting 	Monitor floor of fire pit for fallen debris, locate source (COLLAPSED)	Entire section unfortunately collapsed	No longer necessary	As above
Surface Drainage	Erosion and loss of stability	Desired outcome is the proper distribution of run-off over surface (*). Ensure surface drainage impacts on site stability are minimized	Monitor water flow around and into excavations, redirect and redistribute where this is exacerbating erosion. Monitor drainage interventions for blockage	Immediate	Ongoing	GDACE, research scientists

Issues	Threats or Risks	Desired outcome (*) and Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility Opportunities
MANAGEMENT AND MONITORING – SURFACE ENVIRONMENT						
National Monument Plaque area	Falling loose rock is a threat to tourist safety	<ul style="list-style-type: none"> • A safe tourist route is a desired outcome (*). • Stabilise adjacent wall • Possibly a knee-high parapet wall • Site safety inspection urgently required 	Monitor tourist pathway for fallen debris	Immediate		MA (site safety inspection) landowner and tourist concessionaire to finance infrastructure
"Ladder Cave" area: the northeast shaft and 'lower cave'	Hazardous situation caused by falls of loose rock precludes access to tourists. Cascading debris cone a threat to safety of excavator who is excavating in its base, underground	<p><i>Desired state is a site safe for research workers (*).</i></p> <p>Loose rock should be barred down using pinch bars. Process of removing loose material should be done by a professional, e.g. Miningtek.</p> <p>Post warning notice, provide barricade for cascading rock</p> <p>Site safety inspection urgently required</p> <p>Advice of site safety office necessary</p>	Monitor footwall below opening and lower cave for fallen and washed-in material, examine brow for loose rock. Regular examinations, plus compulsory examination after each heavy rainfall event and at end of rainy season. Annual site safety inspections must be regularly organized	Urgent, Immediate	COH WHS MA, Landowner	As above

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT AND MONITORING – INFRASTRUCTURE AND BUILT ENVIRONMENT, WASTE MANAGEMENT						
Fence and gate	Unauthorized access For threats, see text	<p><i>Desired state is controlled access (*).</i></p>	Check condition of fence, gate and padlock regularly	Ongoing, necessary	At all times	GDACE. Heritage

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
Access road	Erosion and rutting of surface and verges. Tracks are channeling water and eroding	Ensure that fence is not breached to discourage unauthorized vehicular access Ensure that gate is kept locked at all times Initiate a key protocol for site users to prevent misunderstandings and inadvertent exclusions Desired state is road surface and verges free of erosion problems (*).	Check that mitre drains are open, road surface twice a year and after heavy rainstorms Create and check efficacy of humps to direct water flow off road	Necessary	Ongoing	Landowner Inspectors, landowners, permitted scientists, tour operator
Causeway	See surface environment table above	See above	See above	See above	See above	See above
Parking area	Long grass under parked cars is a fire hazard Sloping unpaved surface will erode with frequent use	Desired state is erosion-free car park(*). Keep grass cut short Spread thick crushed gravel in parking area. Grass will establish	Check car park for long grass and signs of erosion Check that gravel capping is adequate	necessary	At all times, especially the fire season	Landowner, scientists

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When?	Responsibility, Opportunities
					How often?	
MANAGEMENT AND MONITORING – INFRASTRUCTURE AND BUILT ENVIRONMENT, WASTE MANAGEMENT						
		itself through this, but it will remain short and easy to control. The gravel will prevent erosion				
Pathways and viewing platforms	Deterioration through wear and tear constitutes a safety and erosion threat Loose stones may cause stumbling and falling	Desired state is safe walking surface on pathways (*) Monitor regularly, checking both surfaces and verges Repair loose rock and pathway surface, or redesign and replace with a safer surface	Regular monitoring - at least quarterly Check for projecting rocks Check for loose stones and partially embedded rocks Check for crumbling edges Check for safety interventions such as handrails and parapets Check for unexpected changes in footpath level Check stairs for handrail Check if warning signs regarding safety are in place	Necessary	At all times, especially prior to site visits by tourist groups	Landowner, tour operator
Causeway	See surface environment	See surface environment table	See surface environment table		Not built yet Old causeway - end and beginning rainy season, after floods	Ditto
Powerlines	Visual impact on 'sense of place'	Desired state is the protection of visual integrity and sense of place (*). Ensure that when and if power is supplied that lines are buried and that no unsightly poles and cables	Check development proposals Ensure that provision for buried cable has been made	necessary	When plans are submitted	SAHRA, GDACE, COH WHS MA

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT AND MONITORING – INFRASTRUCTURE AND BUILT ENVIRONMENT, WASTE MANAGEMENT						
Tele-communications	Visual impact on sense of place	<i>Protection of visual integrity and sense of place</i> (*). Ensure that when and if telephone lines are installed that lines are buried and that no unsightly poles and cables are visible	Check development proposals Ensure that provision for buried cable has been made	necessary	When plans are submitted	SAHRA, GDACE COH WHS MA
Shed, storeroom	Visual impact of untidy infrastructure Security	<i>Visual aesthetics</i> (*). Check in case repair and maintenance is needed Check on security of building	Look for signs of decay and dereliction Check locks and windows	necessary	At all times	All site users
Toilets, ablation facility	Necessary for responsible site use Landowner promised toilets long ago	<i>Desired state is an environmentally acceptable toilet installed</i> (*). It is recommended that toilets are installed immediately because the site is under excavation and frequently visited by tour groups	Check that toilet type chosen is environmentally suitable Check that installation site is suitable Check visual impact Check impact on present or future excavations	Urgent	immediately	Landowner, SAHRA to approve toilet design and siting.
Ablution facility	Necessary for responsible site use	<i>Ablution facility available on site</i> (*). It is recommended that some form of water storage facility and ablation facility is installed on site. Excavation is a dirty process and at present all water has to be brought to site	Check that design and siting of ablation block is appropriate Check for visual impact Check for impact on present or future excavations	Urgent	As soon as possible	Landowner

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT AND MONITORING – INFRASTRUCTURE AND BUILT ENVIRONMENT, WASTE MANAGEMENT						
Redundant infrastructure (such as disused old toilet)	Redundant derelict infrastructure is unsightly Visual detraction Creates a bad impression for tourists	Removal of redundant infrastructure and rehabilitation of foundation area (*). Check that redundant infrastructure is removed <i>in toto</i> from site and footprint rehabilitated as re-seeded with indigenous seed	Check old building site for proper rehabilitation Check that old building rubble has indeed been removed	necessary	When new toilets are installed	Landowner,
Signage	Lack of interpretative signage diminishes value of tourist experience Lack of site interpretation is a neglect of the requirements the WHC	Appropriate site signage and interpretation material installed when necessary (*). Encourage the installation of site interpretation boards and directional signage	Check for installation. Check legibility and clarity Check for accuracy of contents Check for deterioration due to high UV, rain, warping, etc	necessary	As soon as possible because tourist visits to sites are already taking place	Landowner, Scientists, tour operator
Signage, site safety and warnings	Lack of signage can expose visitors to unexpected hazards	Desired state: Appropriate safety signs and behavior modifiers in place (*). Encourage the installation of appropriate behavior modifiers and site safety signage	Check for installation Check for appropriate place of installation Check for suitable design and durability of signs Check for appropriate wording and legibility	necessary	As soon as possible because tourist visits to sites are already taking place	Landowner, Scientists, tour operator
Site plaque, World Heritage Site, National	Installation of such a plaque is necessary in terms of legislation governing both WHS and NHS	Desired state: site plaque installed (*). An appropriate place to mount such a plaque has been chosen in conjunction with landowners and	Ensure that the wording on the plaque is correct and appropriate Ensure that the SAHRA logo, and World Heritage Site logos both appear (What about the	necessary	As soon as possible	SAHRA

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT AND MONITORING – INFRASTRUCTURE AND BUILT ENVIRONMENT, WASTE MANAGEMENT						
Heritage Site		scientists	Wits logo?			
litter	Litter impairs visual aesthetics Litter creates a bad impression of neglect and bad management Litter encourages further litter Quality of tourist experience is diminished	Desired state: Litter free fossil site (*). Provide adequate number of litter bins Place litter bins appropriately	Ensure that litter bins are in place Ensure that there is a management process for removing and emptying litter bins Attempt to recycle different categories of litter	necessary	As soon as possible because tourist groups already visit the site	
Sewage	Pit toilets are not appropriate for dolomite areas	Desired state: environmentally acceptable toilet in place (*). Provide an alternative closed system toilet such as an enviroloo	See toilets, ablution facilities in table above above			

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
Permit conditions	All sorts of deviations possible Poor excavation techniques are a threat to site stability	Desired state: compliance with conditions in SAHRA permit (*). Monitoring. Checking by SAHRA official against the terms and conditions	Check all terms and conditions written into the permit such as:	Urgent	6-monthly Every fossil site Fossil site inspection and	SAHRA Research scientist See also The manage

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
	Poor excavation can cause loss of site significance Poor recording techniques can cause loss of information	written into the permit			ongoing during excavation	nt of Research document:
Grid control methods, datum	Poor recording results in loss of information or creating misinformation Not a problem at this site.	Desired state: adequate recording methods in place (*). Ensure that three-dimensional control is adequate, regardless of method used	Check for datum point, permanently fixed Check adequacy of control methods, whether 'Total Station' or other method	Urgent	Every fossil site inspection; and ongoing during excavation	SAHRA, research scientist
Pathways around excavation edge	Pathways which are too close endanger excavation edges and can cause friable edges to collapse. Pathways that are too close to excavation edges are a danger to site users	Desired state: Safe pathways that are not too close to excavation edges (*). Ensure that pathways providing access to excavations are at least 1 metre away from the excavation edge and even further if possible	Check position of pathway and alter if it threatened excavation edge	Necessary	Every fossil site inspection and ongoing during excavation	SAHRA, research scientist
Stability of excavation edges	Decalcified or unconsolidated breccia often produces friable crumbling excavation	Desired state: Excavation edges that are safe and stable (*). If edges are friable, provide stability by applying a thin covering	Check friability of excavation edges and apply remediation where necessary	Necessary	Every fossil site inspection	SAHRA

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
Unstable excavation walls	Some breccia is unconsolidated or decalcified and high vertical walls soon become unstable Unstable walls are liable to collapse, e.g. the member 3 'Fire section'	of cement which can be removed at a later stage Do not use this for pushing wheelbarrows of heavy material or for walking on but create an alternative access path on the outside of the protective layer Desired state: Excavation walls of safe height and degree of stability (*).	Check for excessively high vertical excavation walls Request the excavator to bench the excavation before proceeding downwards Request the excavator to explain how the wall will be stabilized when he or she abandons the excavation – whether this is permanent or temporary	necessary	At each site inspection	SAHRA
Access into excavation base: stairs, ladders and lifts	The means of access could pose safety risks Interventions should be removable and not	Desired state: safe and convenient access to excavation base (*). Ensure that the means of access	Check struts and rungs of ladders for rust (if metal) and wood rot or dry rot (if wooden) Check that ladders can bear the weight that they will be subjected	Necessary	At each fossil site inspection	GDACE, Landowner, Research scientist

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
	obscure or damage site fabric	are safe for site users	to			
Witness sections	Inadequate witness sections for the future when new techniques may become available. These act as a resource by which dating results and stratigraphic subdivisions can be independently verified	Desired state: appropriately selected and well-stabilised witness sections and sample sites (*). Monitor witness sections as per excavation plan	Ensure that witness sections have been identified Ensure that witness sections have been marked on plan Keep and monitor photographic record Ensure that witness section is protected against collapse or damage by ongoing excavations Stabilize when abandoning excavation	Urgent	6-monthly	SAHRA,
Stabilisation and rehabilitation of old excavations	Exposed old excavations may become unstable and erode	Desired state: old and abandoned excavation areas appropriately stabilised (*). Comply with the site safety report	Report on adequacy of stabilization measures, visible erosion	Urgent	At each fossil site inspection, ongoing when excavations in progress	SAHRA, Research scientists
Sampling procedures and sample site	Inadequate recording of sample sites can lead to loss of information of generation of misinformation All results of tests, whether or not these	Desired state: sampling protocols adhered to (*). All samples sent out of the country for assessment require an export permit. Samples should be collected in	If sampling is intended, ensure that a sampling permit has been applied for. Request a copy of the test results Check recording of sample sites Check if additional material remains for verification	necessary	At each fossil site inspection	SAHRA

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibilities, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
	are considered 'valid' or 'negative' must be lodged with SAHRA	such a way that a portion remains for independent verification. Sample sites need to be adequately marked or recorded for future generations of workers				
Old and existing dumps	Loss of information if source of dumps remains unrecorded	Desired state: all dumps recorded, committed to site plan and annotated (*). Record all dumps and photograph prior to undertaking collection or contemplating removal Commit old dumps to plan Make a note of their content and possible source	Check if old dumps are committed to plan	necessity	When research proposals come in. Check periodic site reports	SAHRA
New dumps and sieve heaps	New dumps can obstruct drainage lines They can also obscure important features when they become large They prevent excavation from taking place close to or underneath them and choice of dump	Desired state: new dumps appropriately constructed on appropriately chosen dump sites (*). See operational guidelines for dump construction, generic management plan.	Check if operational guidelines have been followed Check if new dumps have been committed to plan Check destination of material and lifespan of dump	necessity	At each fossil site inspection	SAHRA

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibilities, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
	<p>site is important Their construction and stability is important – dumps can cascade They can obliterate vegetation and site clearance is necessary before construction takes place</p>					
<p>On and off-site storage of fossil material</p>	<p>Long-term storage of 'not so interesting' fossiliferous breccia is a problem. Workers proceed to new projects leaving dumped material behind Removal and abandoning of breccia represents destruction of site significance and bottlenecks are created because much material is collected in the field whereas little material can be prepared</p>	<p>Prevention of bottlenecks and build-up of extensive breccia piles on site (*). Attempt to keep a balance between material collected and material prepared</p>	<p>Check bottlenecks in fossil preparation and volumes of unattended breccia</p>	<p>necessity</p>	<p>SAHRA</p>	
<p>Transport of</p>	<p>The NEMPAA has</p>	<p>Ensure that permits are in place</p>	<p>Check whether or not permit</p>	<p>necessity</p>	<p>At each</p>	<p>SAHRA</p>

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibility, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
breccia	rules which place restrictions on the movement of breccia	(*)	regulations are complied with		fossil site inspection	
Old kilns, wagon road, loading ramps	Old kilns are part of mining history of the site and need to be recorded before it is too late Neglecting kilns from site interpretation represents a loss of information and diminished value of tourist experience	Mining history included in site interpretation (*) . Ensure that the kilns are integrated into site interpretation	Check if kilns and mining history are part of the site interpretation	necessity	As and when opportunity arises	COHWHS MA and landowner? SAHRA
Miner's artefacts	Loss of artefacts means loss of information regarding historical archaeology and site history	Desired state is the preservation of any miners' relics and artefacts found on site (*) Ensure that any mining relics and miners' artefacts are recorded (find site) and preserved for future display in site museum	Inform site users of this request	necessity	As and when opportunity arises	Research scientist, landowner
Historical plantings, e.g. George M's Christmas tree and the	The well-established Christmas tree is strangely out of place and surrealistic, but it is part of site history.	Desired state: consensus on fate of Christmas tree and prickly pear tree (*) . Discuss fate of Christmas tree and prickly pear (a scheduled invasive	none	Low	N/A	All

Issues	Threats or Risks	Desired outcomes (*), Management Measures	Monitoring Criteria	Priority	When? How often?	Responsibilities, Opportunities
MANAGEMENT OF EXCAVATION AREAS AND HERITAGE ASSETS						
large prickly pear tree	The large prickly pear tree near the old miners' dump is probably an historic planting as miners were poor and planted prickly pears to eat	species) with site users and authorities				

7 BIBLIOGRAPHY

- Backwell, L.R. & d'Errico, F. 2001. First evidence of termite gathering by Swartkrans early hominids. *Proceedings of the National Academy of Science, USA* **98**:1358-1363.
- Brain, C.K. 1958. The Transvaal Ape-Man-Bearing Cave Deposits. *Transvaal Museum Memoir No. 11*, Transvaal Museum, Pretoria.
- Brain, C.K. 1974. Swartkrans. In: *Standard Encyclopaedia of Southern Africa*. Cape Town: Nassau.
- Brain, C.K. 1976. A reinterpretation of the Swartkrans site and its remains. *South African Journal of Science*, **72**: 141-146. Pretoria.
- Brain, C.K. 1981. *The Hunters or the Hunted? An Introduction to African Cave Taphonomy*, pp.1-365. Chicago, London: University of Chicago Press.
- Brain, C.K. 1985. Cultural and taphonomic comparisons of hominids from Swartkrans and Sterkfontein. In: E. Delson (ed.) *Ancestors: the Hard Evidence*, pp 72-75. New York: Alan R. Liss.
- Brain, C.K. (ed) 1993. *Swartkrans: a cave's chronicle of early man*. Pretoria: Transvaal Museum Monograph No. 8.
- Brain, C.K., Churcher, C.S., Clark, J.D., Grine, F., Shipman, P., Susman, R.L., Turner, A. & Watson V. 1988. New evidence of early hominids, their culture and environment from the Swartkrans Cave, South Africa. *South African Journal of Science* **84**:828-835.
- Brain, C.K. & Sillen, A. 1988. Evidence from the Swartkrans cave for the earliest use of fire. *Nature* **336**:464-466.
- Brain, C.K. & Watson, V. 1992. A guide to the Swartkrans early hominid cave site. *Annals of the Transvaal Museum* **35**(25):343-365.
- Broom, R. and Schepers, G.W.H. 1946. The South African fossil ape-men, the *Australopithecinae*. Pretoria: *Transvaal Museum Monograph No 2*.
- Butzer, K.W. 1976. Lithostratigraphy of the Swartkrans Formation. *South African Journal of Science* **72**:136-141.
- Clarke, R.J., Howell, F.C. & Brain C.K. 1970. More evidence for an advanced hominid at Swartkrans. *Nature*, **225**: 1219-122.
- Cooke, H.B.S. 1963. Pleistocene mammal faunas of Africa, with particular reference to southern Africa. In: F.C. Howell and F. Boulière (eds) *African Ecology and Human Evolution*, pp 65-116. Chicago: Aldine Publishing Company.
- D'Errico, F., Backwell, L. & Berger, L. 2001. Bone tool use in termite foraging by early hominids and its impact on understanding early hominid behaviour. *South African Journal of Science* **97**:71-75.
- De Ruiter, D.J. 2001. On the taxonomic status of the Swartkrans humerus, SK860. *Annals of the Transvaal Museum* **38**:71-72.
- Ewer, E.R. 1957. Faunal evidence on the dating of the Australopithecinae. In: J.D. Clark and S. Cole (eds.) *Prehistory: 3rd Pan-African Congress*, Livingstone 1955, pp. 135-142. London.
- Grine, F.E. 1989. New hominid fossils from the Swartkrans formation (1979-1998 excavations) craniodental specimens. *American Journal of Physical Anthropology*, **79**: 409-449.
- Grine, F.E. 1993. Description and preliminary analysis of new hominid craniodental fossils from the Swartkrans Formation. In: C.K. Brain (ed.) *Swartkrans: A Cave's Chronicle of Early Man*, pp. 75-116. Pretoria: Transvaal Museum Monograph No.8.

- Grine, F.E. & Sussman, R.L. 1991. New *Paranthropus robustus* radius from Member 1, Swartkrans Formation: comparative and functional morphology. *American Journal of Physical Anthropology* **84**:229-248.
- Leakey, M.D. 1970. Stone artefacts from Swartkrans. *Nature*, **225**: 1222-1225.
- McKee, J.K., Thackeray, J.F. & Berger, L.R. 1995. Faunal assemblage seriation of Southern African Pliocene and Pleistocene fossil deposits. *American Journal of Physical Anthropology* **96**:235-250.
- Mogg, A. O. D. (1975) Important Plants of Sterkfontein Wits University Press. 177 pp.
- Napier, J.R. 1959. Fossil metacarpals from Swartkrans. *Fossil Mammals of Africa No. 17*, pp. 1-18. British Museum (Natural History).
- Robinson J.T. 1963. Adaptive radiation in the australopithecines and the origin of man. In: F.C. Howell and F. Bourlière (eds.) *African Ecology and Human Evolution*, pp 385-416. Chicago: Aldine Publishing Company.
- Smith, I.W., Laing, M., Thackeray, J.F. & Watson, V. 1995. X-ray powder diffraction of fossils and associated breccias from the Sterkfontein Valley. *South African Journal of Science* **91** 589-596.
- Sussman, R.L. 1988. Hand of *Paranthropus robustus* from Member 1, Swartkrans: fossil evidence for tool behavior. *Science* **240**: 781-784.
- Sussman, R.L. 1989. New Hominid fossils from the Swartkrans formation (1979-1986 excavations): postcranial specimens. *American Journal of Physical Anthropology*, **79**: 451-474.
- Sussman, R.L., de Ruiter, D.J. & Brain, C.K. 2001. Recently identified post-cranial remains of *Paranthropus* and early *Homo* from Swartkrans Cave, South Africa. *Journal of Human Evolution* **39**:
- Sussman, R.L. & Grine, F.E. 1989. New *Paranthropus robustus* radius from Member 1, Swartkrans Formation. *American Journal of Physical Anthropology* **78**:311-312.
- Turner, A. 1985. Preliminary evidence for seasonal deposition patterns from Member 2 of the Swartkrans hominid site. *Journal of Archaeological Science* **12**:163-175.
- Vrba E.S. 1975. Some evidence of chronology and palaeoecology of Sterkfontein, Swartkrans and Kromdraai from the fossil Bovidae. *Nature*, **254**: 301-304.
- Vrba E.S. 1976. The fossil Bovidae of Sterkfontein, Swartkrans and Kromdraai. *Transvaal Museum Memoir No. 21*. Pretoria: Transvaal Museum.
- Vrba E.S. 1985. Early hominids in southern Africa: updated observations on chronological and ecological background. In: P.V. Tobias (ed.) *Hominid Evolution, Past, Present and Future*, pp. 195-200. New York: Alan R. Liss.
- Watson, V. 1991. Form, function and fibres: a preliminary study of the Swartkrans fossil birds. *Koedoe* **34/1**:23-29.

Awaiting an updated version from permit holder. The following to be added:

8 FIGURES, PLANS AND IMAGES

Fig 1: Locality Plan

Fig 2: Heritage Site plan

Fig 3: Site Analysis: possible linkage with Sterkfontein

Fig 4: proclamation diagram

Fig 5: Swartkrans hill with uncontrolled fire

Fig 6: Burning firebreaks at Swartkrans

Fig 7: Visual impact of new developments behind (north of) Swartkrans

Fig 8: Visual impact; Sterkfontein signifier

Fig 9: The new excavation at Swartkrans: vertical excavation wall with friable edge

Fig 10: partially excavated tree roots of large celtis adjacent to new excavation at Swartkrans

Fig 11: Hanging remnant area after removal

Fig 12 New dumps in the making, Swartkrans