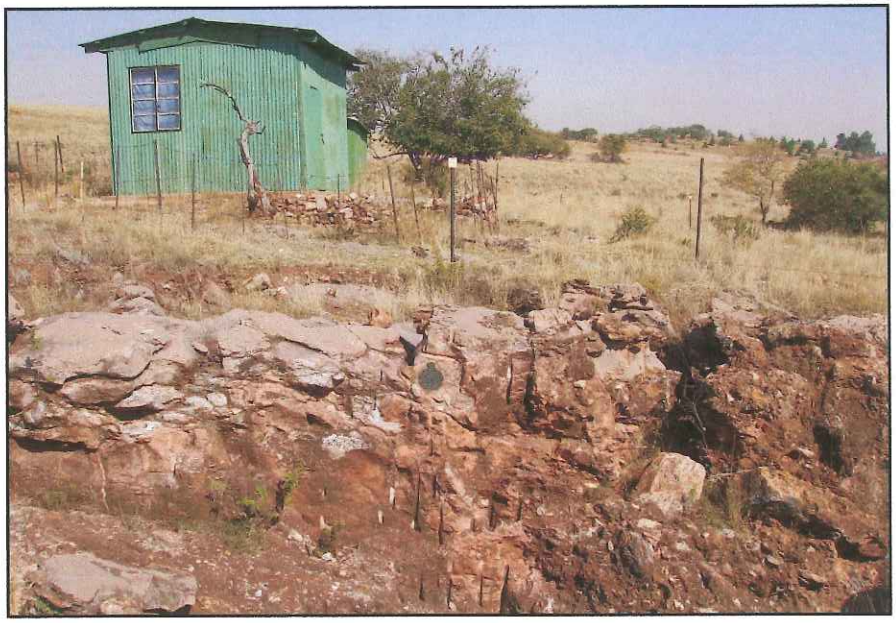
Cradle of Humankind©
World Heritage Site

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



UPDATED FOSSIL SITE MANAGEMENT PLAN
FOR

KROMDRAAI

2009 - 2013

GAUTENG
PROVINCIAL GOVERNMENT

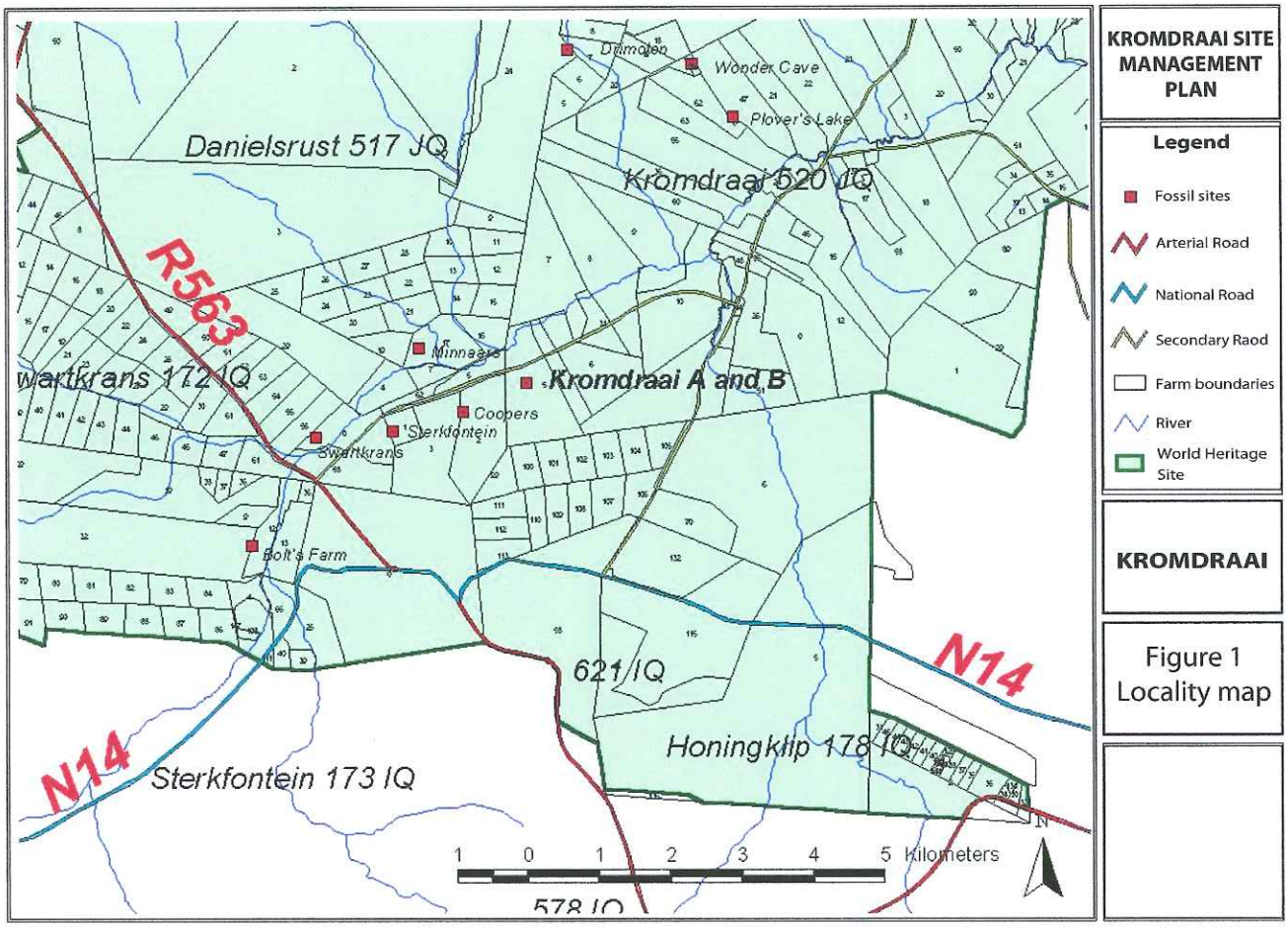
REVISED

UPDATED SITE MANAGEMENT PLAN FOR KROMDRAAI

Contents

SUMMARY OF KEY ISSUES

- Landowner's core interest is commercial farming (livestock) and he is not in favour of tourism.
- There is no longer a caretaker on site. Lack of surveillance leads to site vulnerability
- Theft has become a major problem: structural material and equipment plus an entire shed and store-cum-shelter have been dismantled and removed (Figs. 8 and 9)
- The grid system, plus the datum, has been vandalized and/or stolen
- Site is a preferred pathway or short cut, and many unauthorized pedestrians cross through the site, as attested by vandalized property
- Many local residents and an informal settlement close by
- A perimeter fence is recommended, this might need to be electrified
- No water on site
- Re-opening of scientific excavation is imminent


KROMDRAAI SITE MANAGEMENT PLAN
Legend
Fossil sites
Arterial Road
National Road
Secondary Raod
Farm boundaries
River
World Heritage Site
KROMDRAAI
Figure 1
Locality map
Danielsrust 517 JQ
Kromdraai 520 JQ
Drimolen
Wonder Cave
Plover's Lake
R563
Minnaars
Kromdraai A and B
Coopers
Sterkfontein
Swartkrans
Bolt's Farm
N14
621 IQ
Honingklip 178 IQ
Sterkfontein 173 IQ
1 0 1 2 3 4 5 Kilometers
578 IQ

KROMDRAAI SITE MANAGEMENT PLAN

Legend

approximate position of site boundary

palaeontological site

KROMDRAAI

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	9.48	235.24.40	A	-74 993.91	+78 017.39
B C	147.05	325.36.30	B	-75 001.72	+78 012.01
C D	197.31	324.50.10	C	-75 084.78	+78 133.35
D E	156.30	64.32.20	D	-75 198.41	+78 294.65
E F	168.67	152.30.20	E	-75 057.29	+78 361.84
F G	122.17	233.00.10	F	-74 979.43	+78 212.22
G A	147.04	145.35.30	G	-75 077.00	+78 138.71
TRIGONOMETRICAL BEACONS					
STERKFONTEIN B		84 Δ		-75 558.23	+74 089.49
KRUG 117		412 Δ		-69 559.89	+81 488.68

SG No.
2299/2004

Approved

J.S. WEYERS
for
SURVEYOR-GENERAL
2004 -04- 16

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

KROMDRAAI PALAEOANTHROPOLOGICAL SITE

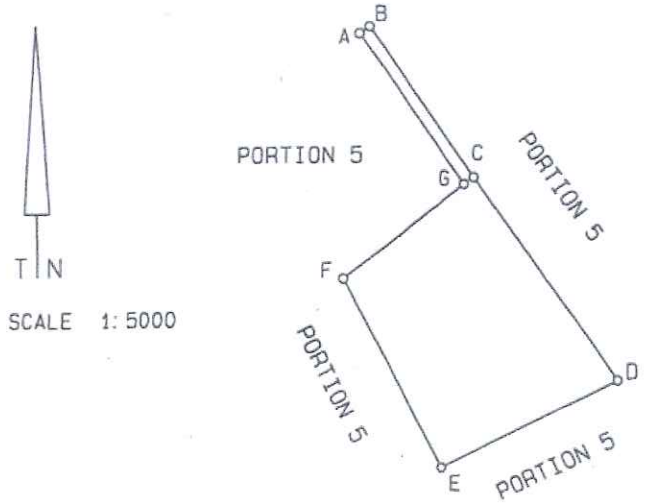


Figure 3
Proclamation diagram

The figure A B C D E F G A
represents 2.7567 hectares of land being
a declared area over Portion 5
of the farm KROMDRAAI No. 520-JQ
Province of Gauteng
Framed for National Heritage Site declaration in terms
of the National Heritage Resources Act No 25 of 1999.

Surveyed in January 2004

by me P.H. KOHRS
Professional Land Surveyor PLS0314

This diagram is annexed to No. d.d. i.f.o. PTA Registrar of deeds	The original diagram is No. A 2309/1931 Transfer Grant No.G72/1962 C.C.T.	File -/5 S.R. No. 922/2004 T.P. - - Comp.

1 INTRODUCTION

The primary consideration in the compilation of this fossil site management plan, along with conservation of site values and significance, has been the landowner's stance that his livelihood depends on the commercial success and viability of his farming enterprise, a high density feed-lot and Brahman breeding enterprise. The animals are valuable, and stock theft is an ongoing problem. Strangers and strange vehicles are, not surprisingly, viewed with suspicion.

The landowner is not interested tourism, and the activities of researchers have the potential to conflict with the landowner's aspirations and routines at various points. The landowner would not welcome full-scale tourism at the site, and of necessity, adherence to protocols and careful site use by researchers and their teams needs to be strictly controlled. The site is one that would lend itself to having a small interpretive centre.

In constructing the updated site management plan for the Kromdraai Fossil Site, the requirements of the landowner have been borne in mind, and special care has been taken to ensure that the management of research-related activities on his property is done in such a way as to minimize potential points of conflict.

This consideration also applies to and affects the nearby Cooper's Fossil Site, situated on the same property (see site management plan for Cooper's).

A comprehensive Landowner-Scientist Agreement which defines the terms of site access and use, and roles and responsibilities for different management areas, needs to be drawn up and signed, as the site excavations are shortly to reopen. The landowner-scientist agreement forms part of the SAHRA permitting process. Management issues usually included in such agreements are noted in the generic management plan.

1.1 Objectives

- To preserve the full range of natural and cultural heritage values, the site significance and authenticity of the Kromdraai fossil site
- To identify and understand the issues that threaten site significance and to provide management measures and monitoring to address them
- To balance opportunities for research, education, site presentation, and tourism without compromising the integrity of the site or the aspirations and requirements of the landowner
- 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 that is subject to unprecedented development. Kromdraai is excellently situated to demonstrate the Highveld rocky grassland habitat and several biological interactions characteristic of this biome
- 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. Collation of information gained from a series of eight fossil site inspections has been incorporated

- Provide an updated list of site 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:	Kromdraai
Farm Name & No.:	Portion 5 Kromdraai 520 JQ (Fig 1)
Owner:	Mr Riaan Lotz
Contacts:	P O Box 862, Krugersdorp, 1740 011 957 0326 or 083 233 2097
Legal Status:	Declared National Monument, 1946, 1993; National Heritage Site, November 2004; World Heritage Site, 1999
Servitudes & Restrictions:	To be investigated
NHS Boundary:	A panhandle, A,B,C,D,E,F,G See Figures 2 , 3, 4
Co-ordinates:	See proclamation diagram Fig 3, taken off Meridian and Equator
Area:	2.7567 ha
Permit Holder:	Dr Francis Thackeray, NFI
Designated Repository:	Northern Flagship Institution
Access to Public:	Can only be visited on guided tours arranged by local tour operators with the landowner

Deleted:

1.4 Existing site management

There is a boundary fence around the main property and vehicular access from the Sterkfontein tar road is controlled. There is a locked gate allocated for use by permitted scientists and their field assistants. Owners of strange vehicles found on the property are challenged. The presence of livestock on the property makes it vulnerable to stock theft and keeping the gates closed and locked is important. The permitted scientist will need to have a new MOU signed with the landowner, which sets out terms and conditions of site use and entry.

However, more difficult to control is the pedestrian traffic across the site, some of it unauthorized. The Kromdraai fossil site is part of a preferred pathway as attested by footpath crossing the site and leading off over the hill to the south. Unauthorized pedestrian access to the site is problematic, in particular because since the last management plan was written, the site caretaker has passed away. Testimony to the consequence of a lack of surveillance is the theft of an entire shed-cum-store, its entire contents, and the caretaker's metal hut.

Many of the environmental site management functions are provided by the landowner such as rangeland management, control of erosion, upkeep of access roads (except those portions used

only by the researchers), control of alien vegetation and weeds, livestock management and fire management. The Kromdraai site is heavily infested with, in particular, *Pyracantha.*

Visual impact is managed, as far as possible, by the COH WHS MA which assesses the visual impact of any proposed developments. ESKOM and telephone lines are very conspicuous in this part of the COH WHS and it is recommended that in time, this issue is addressed.

Additional existing site management includes:

- Visitors are confined to a non-sensitive route around the site, and are under constant supervision of a professional tourist guide and/or the permitted scientist (Dr. Francis Thackeray)
- The site is not open to the general public. Visits are by appointment only and most people are unaware of the whereabouts of the Kromdraai fossil site. Its entrance is not conspicuously signposted.
- A SAHRA Permit Committee member inspects the excavation site and any ongoing excavations on a twice-annual basis, particularly with a view to assessing compliance with terms and conditions of the permit. At the moment, there is no active excavation, but a permit has been applied for and the excavation will re-open shortly.
- The permit holders need to manage and supervise the activities of the excavators and support staff of preparators on site – none on site at present.
- The site inspection team, including COH WHS 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 management plan) and particularly the monitoring criteria in Table 1 of this document. Inspections are carried out regardless of whether or not there is an active excavation in progress.
- The COH WHS MA monitors development within the surrounding COH WHS properties with a view to protecting heritage values such as sense of place and visual aesthetics.
- A site safety inspection has been provided for. This is meant to take place on an annual basis. However, there is no easily accessible subterranean environment at Kromdraai and the remains of the subterranean cave are not normally part of the site interpretation. The subterranean part of the cave is not at present being excavated. It is only the safety of surface features that need be considered in this report.
- GDACE is available for advice to landowners regarding erosion control, fire management, alien vegetation and weed clearance, and preservation of biodiversity. Infestations with alien species, like many fossil sites in the COH WHS, is rife.
- The landowner burns firebreaks from time to time, but uncontrolled fires sometimes occur and these have the potential to cause extensive and expensive damage. Wooden and thatched structures are not advisable
- The Heritage Agreement is an important management tool.
- Another is the Landowner-Scientist Agreement. The terms of SAHRA permit require that such an agreement be implemented. Management issues covered in the scientist-landowner agreement are discussed in the Guidelines appended to the Generic Issues document.

2 SITE DESCRIPTION, PHYSICAL FEATURES, SITE VALUES AND SIGNIFICANCE

2.1.1 General site description

The Kromdraai A and Kromdraai B fossil sites are situated near the crest of a low dolomitic hill some 1.5 - 2 kms east of Sterkfontein on the farm Kromdraai in the Krugersdorp district (Fig. 1) The Kromdraai A and B deposits are about 40 m apart. An excellent view westwards down the Blaauwbank Valley is available from the Kromdraai hillock, and Sterkfontein, the Coopers Site and Swartkrans can all be pointed out in this direction, while to the north, the Minnaar's site can be seen.

The site is reached by a short but steep and eroding farm track which gives directly off the Sterkfontein tar road, and which passes the old kilns and lime loading area before cresting the rise of the hillock. The car park is uncomfortably close to the excavation edge and not more than 4 or 5 vehicles at the most can be accommodated.

The site lends itself to possible future linkage in an extended tourism product incorporating trails between Swartkrans, Sterkfontein, the Cooper's Site and Kromdraai

The fossil site consists of two erosion channels that were used in the past as carnivore lairs. They filled with breccia and are now exposed on a relatively flat surface. The two channels are known as Kromdraai A, from which stone tools and mammalian fossils (including the type specimen of the extinct sabre-toothed cat *Dinofelis*), but no hominins, have been recovered; and Kromdraai B in which mammalian fossils, two stone tools and the remains of at least three *Paranthropus robustus* individuals were found. The breccia deposits have been divided into 5 stratigraphic members. At least some of the hominin fossils were recovered from Member 3. The stone artefacts indicate an Earlier Stone Age Acheulian or Developed Oldowan technology.

On faunal grounds, Kromdraai A is thought to be slightly younger than Kromdraai B but both are estimated to date within the period 1.5 - 2.0 my. The type specimen of P. *robustus* (TM 1517) is thought to be at least 1.95 million years, based on identification of the Olduvai Event, using palaeomagnetic dating combined with faunal analysis. Analysis of the fauna for palaeo-environmental information indicates that the site was surrounded by savanna grassland within the period 1.5 – 2.0 million years ago.

The Kromdraai A deposit is also referred to as the Kromdraai Faunal Site, probably because as yet, it has not yielded any ape-man remains, although a number of fossil mammalian species have been recovered. The Kromdraai A fossil fauna has invariably been associated with the Kromdraai B australopithecine remains. Kromdraai B, on the other hand, has yielded remains of the robust hominin *Paranthropus robustus* but relatively few fossil faunal remains. No direct link between the two exposures of breccia has as yet been demonstrated: There are several other areas of exposed breccia on the hilltop (Fig. 4).

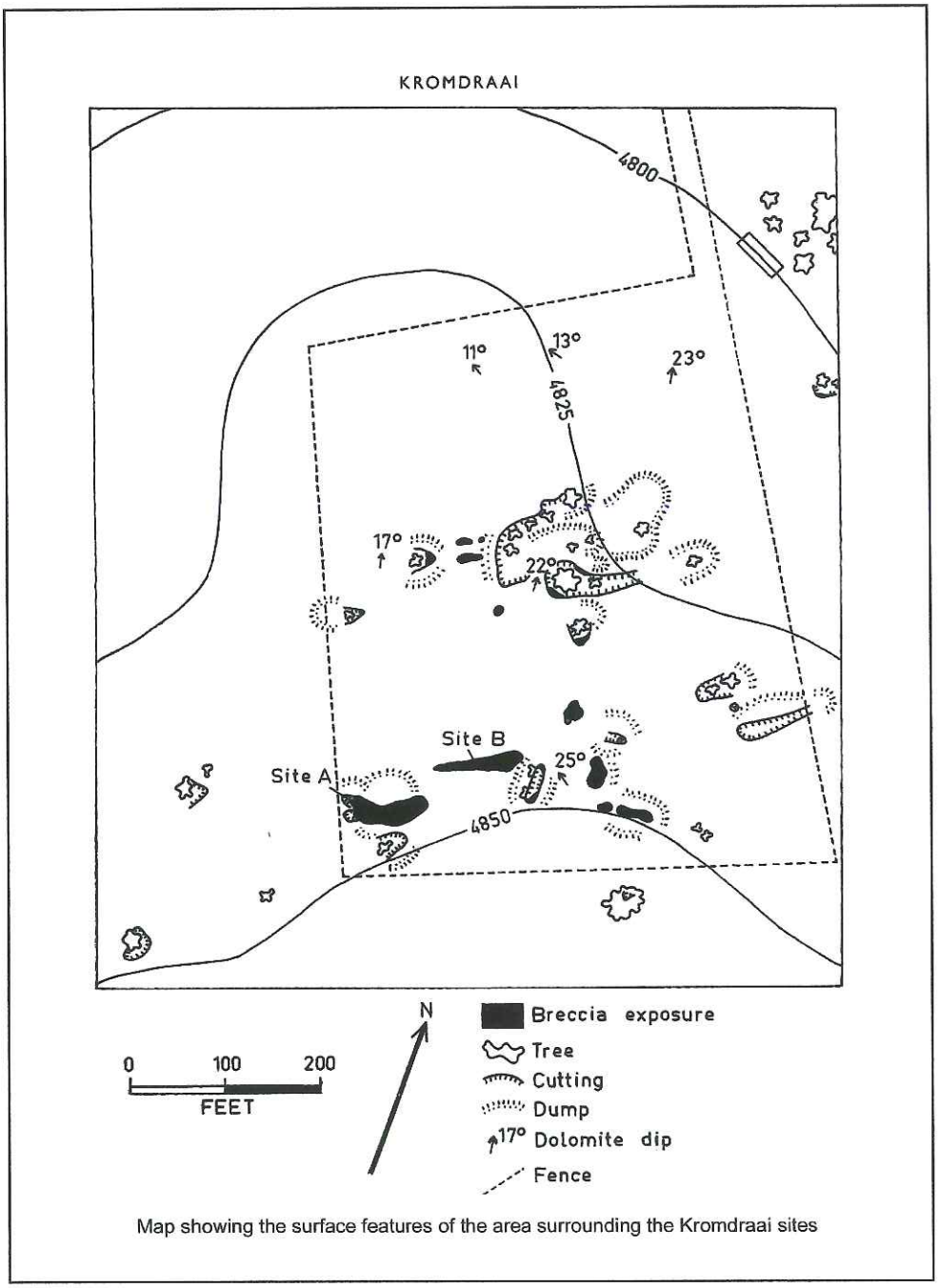
Both Kromdraai A and Kromdraai B are long, narrow and fissure-like and contain a mixture of both heavily calcified and decalcified deposits. Both have been fairly extensively excavated in the past, Kromdraai B to a depth of almost 2.5 metres.

Dolomite near the caves is reasonably undisturbed and chert bands are common. Many stromatolites also occur, but most of the loose pieces have been removed by collectors and the commercial exploitation of "Pelindaba Stone" over the years. This is especially true of the zone of stromatolites between Kromdraai and Sterkfontein. Excellent examples used to be available for demonstration in the 1960s but these are nowhere to be found today. The site provides fine examples of mat and biscuit stromatolites and oolites.

There is a small subterranean system associated with but not demonstrably connected to the Kromdraai Fossil Site. This cavern is small, about 3,5m x 12m in size and pinches out towards the rear of the cave. (Source: M. Buchanan, Subterranean Report, 2002). The entire cave was stripped of speleothem by limeworkers during the 1920s and 1930s. The cave is used as a habitat by bats and an owl. There is a strong possibility that more extensive subterranean caverns lie concealed within the Kromdraai hillock, their entrances choked with rubble.

It is not recommend that the subterranean environment be incorporated in any presentation of the Kromdraai site and its condition and safety is therefore not an issue at present.

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 (3.1). Section 3.2 provides an updated statement of site significance which was prepared in consultation with permitted scientists working on site.



Map showing the surface features of the area surrounding the Kromdraai sites

Fig 4: Site plan showing position of fossiliferous breccias of Kromdraai A and B (From Brain, 1958)

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

- The view from the Kromdraai site includes several other important fossil sites to the north and west of Kromdraai
- The wide views allow the main features of karst landscape to be pointed out, such as the clumping of trees around sinkholes, the hollows indicating the position of collapsed caves, etc.
- The taphonomic implications of the clumped distribution of large trees can be explained very well from Kromdraai
- The Highveld rocky grassland preserves many examples of economically significant plants, some of them edible, some used in traditional medicine, and some toxic.
- The open space in itself is an asset given the unprecedented development of the surrounding landscape and paucity of green belts in the urban centres around the COH WHS
- The main geological features of karst geology can be demonstrated on site. There are good examples of weathered dolomite, chert bands, stromatolites, some pisolites and oolites. (Fig 5)

Fig 5: Chert bands with intervening dolomitic layers, some of them oolitic.

2.2.2 Palaeontological and archaeological values

- Kromdraai is the site of the first discovery of the robust ape-man *Paranthropus robustus*, discovered by schoolboy Gert Terblanche in June 1938, recognized by Robert Broom
- The discovery marked a turning point in world opinion – hominin fossils recovered from South African sites could no longer be ignored
- Several other hominin fossils recovered since then
- Many thousands of fossil mammal specimens, some of them extinct, have been found at Kromdraai
- Amongst these are the fossil giant wildebeest, and extinct forms of springbok, eland and kudu
- Kromdraai A is the Type locality of the extinct sabre-toothed cat *Dinofelis*
- Early Stone Age tools recovered in situ in Kromdraai A, believed to be about 1.0 million years old, belonging to the Developed Oldowan or early Acheulean stone tool industry
- Fossil pollens recovered from members 2,3 and 4 but results still debated

2.2.3 Mining and historical values

- The Kromdraai subterranean cavern system has been stripped of its speleothem. Miners also removed surface outcrops of travertine. However, little remains of their mining activities on site except for discarded dumped material, and an area of spread lime which once formed a loading area close to the remains of some kilns.
- The relics can be incorporated into site interpretation and demonstrated to visitors to the site

2.2.4 Research values

- The deposit has proved rather disappointing compared with richer sites such as Sterkfontein, Swartkrans, Drimolen, Gladysvale and the surprisingly rich Cooper's Site nearby. However, a considerable volume of breccia remains and the research potential is good.
- It is impossible to predict how many fossils will come out of a dig, but the discovery of stone tools in Kromdraai A Faunal Site is tantalizing and worth further exploration

2.2.5 Biodiversity and ecological values

- The grassland and rocky hillside habitat around Kromdraai is likely to contain up to 500 plant species
- Many of these are interesting edible, medicinal, toxic, economically significant or 'magical' plants
- It is recommended that a plant and indigenous animal species list be drawn up for Kromdraai as at the time of writing, no such lists exist.
- Subterranean environments present
- Resident porcupines- significant as a bone-collecting agent
- Resident owl – significant bone-collector
- Interesting Highveld flora
- Many species of edible, medicinal, toxic, and economically significant plants
- Open grassland with Highveld trees

2.2.6 Educational, tourism and economic values

Kromdraai, situated at no great distance from Sterkfontein (1.5-2 km) and Cooper's Site (400m), is ideally situated for tourism. Kromdraai could be incorporated with these sites into a satisfying and enriching tourist experience. There are geological, palaeontological and biological site values which could become part of an interactive tour and the short distance between sites means that more of the COH WHS could be exposed and presented to a wider public. Many of the processes which gave rise to the fossiliferous deposits and which preserved bones in the first place can be demonstrated first hand on site. It provides visitors with the opportunity to interact with a real and fascinating environment.

The previous management plan recommended that Kromdraai A and B and the Cooper's Site be linked with Swartkrans and Sterkfontein to provide a more meaningful "Cradle" tourist experience. This, however, could only be achieved with the full and willing co-operation of the landowner.

It is recommended that appropriate steps be taken to ensure that the property can be purchased at some time in the future by an organ of state (or possibly Wits University), in order to ensure that the assets of Cooper's and Kromdraai become publicly available at some future date.

Summary:

- Landowner not in favour of tourism because of commercial activities already on site, however, a
- Unique combination of tourism and educational attributes exist, and there are many site values which would support tourism
- The nearby Sterkfontein Cave provide visitors with a modern analogue for ancient cavern systems which makes the Kromdraai cave remnant and fissure deposits more readily understandable
- Nearby Sterkfontein provides backup services
- The site is ideally placed for a linked tourist experience with Sterkfontein, Swartkrans and Cooper's
- Site is authentic and many geological, palaeontological and natural heritage assets are preserved on site
- Site is situated in grassland biome which has the added attraction of cave environments
- Many biological interactions are still present onsite, e.g. active owl roost, porcupines, etc.
- The full range of fossil site attributes can be demonstrated in an authentic way.
- The active excavation on site which will include digging and sieving will be a major drawcard and visitors can have a close look at a real excavation site because there is no intervening fence
- Professional scientists are usually on site when tourists visit and can give first hand high quality and accurate information regarding site
- The site offers special and unique educational and student and excavator training opportunities
- The site preserves a substantial volume of fossiliferous breccia which will provide research opportunities for decades to come

Risks and Threats:

- Lack of presentation of site values to a wider audience prevents information concerning site significance from reaching public psyche
- Lack of site interpretation diminishes tourist experience
- 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
- Mining relics not yet mapped and recorded – important for historical reasons. They might need to be removed or altered at some future date (for example trenches and pits) and they therefore require recording. Elements such as test pits and drives, dumps and excavations need to be included
- Failure to recognize mining history could diminish the value of tourist experience – mining values well acknowledged on this site.

2.3 Revised statement of site significance

The fossil site at Kromdraai is of national heritage significance because it is the type site of the robust australopithecine, *Paranthropus robustus,* and is one of only three hominin fossil sites in the Cradle of Humankind World Heritage Site where Earlier Stone Age stone tools have been found.

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, Kromdraai qualifies for national heritage status because of its:

(a) **Importance in the pattern of South Africa's history**. The hominin fossils at Kromdraai demonstrate that this part of South Africa was home to some of our earliest human ancestors between 1.3 and 1.8 million years ago, and that it was within the range of distribution of the earliest species of tool-making humans.

(b) **Possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage**. Hominin fossils are rare worldwide because of their limited geographical distribution and the rarity of natural conditions for fossilisation and preservation. Although relatively few hominin fossils have been found at Kromdraai, the place is of historical significance at national and international level because it is the type site of *Paranthropus robustus* that was first discovered and described in 1938.

(c) **Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage**. Analysis of the fossils found in two trenches cut through bone-bearing breccia at Kromdraai has given valuable information about environmental conditions in the period between 1.3 and 1.8 million years ago. The stone tools and fossil hominin finds have contributed to an understanding of the habits and capabilities of our human and pre-human ancestors.

(d) **Importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects**. When it was found at Kromdraai B in 1938, the type specimen of *Paranthropus robustus* was of considerable significance in demonstrating the principal characteristics of this robust hominin that was distinctly different from *Australopithecus africanus*.

(e) **Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group**. Kromdraai does not exhibit any particular aesthetic characteristics beyond its setting in a rural dolomitic landscape.

(f) **Importance in demonstrating a high degree of creative or technical achievement at a particular period**. Two Earlier Stone Age stone tools have been recovered from Kromdraai B but the sample is too small for their full significance to be assessed.

(g) **Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons**. Kromdraai has been associated since the 1930s with the community of geologists, palaeontologists, palaeo-anthropologists and archaeologists who have studied the history and contents of the breccias in the Sterkfontein valley. 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**. Well known palaeontologists and palaeo-anthropologists associated with Kromdraai include Dr Robert Broom who first described *Paranthropus robustus* in 1938, Dr C.K. Brain and Dr Elisabeth Vrba who studied the faunal remains, and Dr Francis Thackeray who described the stone tools.

(i) **Significance relating to the history of slavery in South Africa**. The age of the deposits at Kromdraai places it well before the time period of slavery in South Africa.

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 of seven elements of the physical environment, namely physical and legal access to the property, rangeland or veld condition, erosion, fire management, rare plants and animals, alien invasive species and visual aesthetics.

3.1.1 Access: physical and legal

Status quo:

- An excavation permit has been applied for. Access to the Kromdraai site, for research scientists, as on the Coopers Site, will be in terms of an agreed and signed agreement with the landowner. The management areas addressed should include those listed under the Guidelines, in the Generic Issues document.

Risks and Threats:

- None at present

3.1.2 Rangeland

Status quo:

- Kromdraai, at only 2.75 ha, is one of the smaller COH WHS fossil sites. It does preserve some interesting vegetation, and within the wider context of the site, up to 500 species may be present (Mogg 1975). Many unexpected plants seek shelter in the shade and relative coolness of the sinkholes. Such habitats are also frost, wind and fire-protected. There are several species of dry grassland ferns on the rocky hillsides. There is at

present no species list for the site, and edible, medicinal and toxic species have not yet been identified. For a World Heritage Site, the vegetation is rather poorly documented except in general terms by means of books on the highveld flowers, or vegetation or trees of the Magaliesberg. From a management point of view, a great deal of baseline data is required before the impacts of grazing and fire frequency can be understood, and creating basic species lists is the first step. Ultimately, there should be a herbarium of plant specimens collected.

- As far as management goes, this is largely the domain of the landowner who manages grazing pressure, fire management and erosion.

Summary:

- Rangeland in moderate condition, managed as part of main property
- No plant species list available
- No faunal lists available
- Edible, medicinal and economically significant species need to be recorded and monitored

Risks and Threats:

- Biological values of the site poorly or at best incompletely understood
- No means of assessing impacts of fire and plant utilisation

3.1.3 Erosion

Within the 2.75 ha declared as a World Heritage Site, erosion is confined to the access road (see below) and the car park area.

Erosion of the access road is discussed under point 4.3.1 below. The car park is subject to erosion only when there is regular work on site – as at Cooper's site. A watch should be kept to see that appropriate steps are taken if erosion becomes significant here.

Status quo:

- Road tracks are channeling run-off which is causing erosion of surface and margins.
- Repairs have been carried out by researcher-landowner team but erosion is an ongoing problem
- Monitor rehabilitation and efficacy of repairs on an ongoing basis
- There are no other problems with erosion on site (excavation area treated separately)

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:

- There is no-one permanently resident on site. However, there are many families resident nearby and fire is a constant threat in the dry season after the first frosts when the long grass dries off.
- There is no firebreak around the site and fire-prone structures would be at risk because of the small size of the property. The permitted scientist would need to discuss with the

landowner, in terms of the agreement, what contribution they can make to the management of fire. Ultimately The landowner manages fire on the property, and to a certain extent, without firebreaks, the Kromdraai Site is vulnerable.

- It is recommended that all who work on site regularly should keep fire beaters handy in the dry season. Open fires and smoking are not permitted at Coopers, and it is probable that the same will apply to Kromdraai.
- It is recommended that a fire incidence (how many fires, which months, how intense possible mode of starting, from which direction did they come, etc.) recording for the property be put in place (landowner)
- It is recommended that a fire management plan for property is in place (landowner)
- Create baseline rangeland data (generic, for COH WHS) against which the impact of fire can be assessed
- Fire management strategy within and around the accommodation area needs to be set up (see site safety), e.g. beaters provided, researcher to take steps to contain fires accidentally started.

Risks and Threats:

- 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
- Many residents on the property and surrounding properties increase the risk of uncontrolled getaway domestic fires

3.1.5 Red Data Species, rare plants and animals

There are no botanical or faunal lists for Kromdraai 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.

Rare species have not yet been mapped. Rare plants and animals are difficult to protect if their whereabouts are unknown.

It is recommended that species lists of plants and animals be drawn up and the occurrence of economically significant species as well as medicinal and poisonous plants recorded on a map. Impact of collection and use should be noted. This is not the responsibility of the permitted scientists but it should become part of a research project to document all the site values of the COH WHS and the impacts which are operating on them.

Status quo:

- See summary for rangelands.

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

Kromdraai is infested with alien vegetation and to a small extent with weeds. Partially choked avens and the shaft-like entrances to subterranean systems are the most heavily impacted. The presence of the prickly fire-thorn, *Pyracantha,* makes inspection and exploration of these areas difficult if not impossible. There is as yet no list of alien species at Kromdraai and it is recommended that such a list should be compiled.

Infestations on the site have not yet been mapped and prioritized 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. This will need to be done on a patch by patch basis. Because much of both narrow fissure deposits is visible from the total station at the datum point, it is recommended that fixed point photography be done from here.

GDACE has field operational guidelines for alien plants; these are noted in the generic site management plan Appendix. A guideline on the use of herbicides is also being prepared.

Weed management at Kromdraai (formerly part of the job description of the resident caretaker) needs constant attention, particularly where there are areas of disturbance, but the excavation areas themselves are completely weed-free. The growth of young saplings of indigenous tree species is a greater problem

Status quo:

- There is no list of alien invasive species and weeds occurring on Kromdraai
- Occurrence and density of invasive alien species has not been mapped or prioritized, making management and control difficult
- Field operational guidelines for appropriate eradication treatments for each species are not yet available
- There is no agreed plan of management or budget for control for a maintenance level of clearance or rehabilitation of cleared spaces
- There is no broader plan for alien vegetation control covering the COH WHS as a whole so that re-infestation is likely (by birds or baboons and other widely-ranging mammalian seed dispersal agents)
- Photographic monitoring for clearance programme needs to be set up.
- Weeds and sapling growth in and around the excavation site and work area are being effectively controlled by the researchers and their field staff. There are some weeds growing on the dump.

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

The key sensitivities, management precautions and some solutions to issues concerned with visual aesthetics are provided in the Generic Management Plan.

Kromdraai has a huge viewshed, looking westwards along the Sterkfontein valley. Current land use of the surrounding area is for farmland and for accommodation and tourism-related enterprise. Although there are many structures in the viewshed, the landscape still has a

pleasing rural ambience (Fig 6). The locations of four other fossil sites can be seen from Kromdraai.

Status quo:

- Contextual landscape of the site is still visually pleasing (Fig 6)
- The COH WHS MA screens all proposed new developments and protects visual integrity wherever possible
- The erosion and development of piospheres (dusty trampled areas devoid of vegetation) around the feeding and watering troughs and the erosion of the soccer field are potentially negative impacts on the view, besides being potential environmental problems (also visible from the Cooper's Site)
- Remains of previous structures will have to be demolished and the footprint rehabilitated (e.g. demolished pit toilet, Fig 7))
- All redundant infrastructure needs to be removed (e.g. the vandalized shed-cum-store ad caretakers hut, Fig 8) unless it is to be rebuilt.

Threats and risks:

- Open rolling grassland country with 360-degree views increases sensitivity of contextual area to visual impact of new developments. Inappropriate structures and land use have the potential to spoil the relatively unspoilt sense of place.

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Fig 6: Although in a relatively developed part of the cradle of Humankind, Kromdraai still has a pleasing rural ambience

Fig 7: Redundant building materials resulting from the demolition of the pit toilet at the Kromdraai site ought to be removed

Fig 8: The two huts, one for accommodation of the on-site caretaker, the other for storage, that used to stand on the Kromdraai site

Fig 9: All that is left of the two huts after the theft of 2008

3.2 Physical Environment: Subterranean

Status quo:

- The subterranean environment is not significant at Kromdraai and better examples of subterranean environments can be demonstrated at a number of other sites
- Site safety is not a factor because the subterranean environment is neither visited by tourists or students nor is it being excavated or explored

Threats and risks:

- None at present

3.3 Infrastructure

3.3.1 Access roads, culverts, bridges, etc.

Please see section on erosion above (3.1.3) because of overlap.

3.3.2 Fencing and gates

Status quo:

- The outer perimeter of the host property is fenced.
- There is a locked gate which the researcher may use
- At the time of first proclamation of Kromdraai as a National Monument, a fence was erected around the fossil site but this has fallen into total disrepair and its elements have been stolen.
- The lack of a fence around the site coupled with the loss of the resident caretaker has resulted in uncontrolled theft of materials
- Without some form of security, the personal safety of a caretaker cannot be guaranteed, given the attack on a field worker at Swartkrans
- The lack of fencing around the excavation site will allow cattle to enter the excavation site area causing trampling damage to excavation edges and walls. There is a slight

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danger of animals falling in although there is little to attract them to venture so close to the excavations
- For this site, it is recommended that a secure fence be erected. In view of prevalent theft of any building material that can be used for informal housing, the type and construction of the fence will need careful consideration, A wire and fence-dropper fence will simply be removed
- It is recommended that SAHRA be approached to assist with funding this fence. The fence and its design will need to be approved by the permit committee of SAHRA and should be erected as soon as funds become available.

Threats and risks:
- The lack of a caretaker and secure fence has led to destruction and theft of all infrastructure on site. The consequence of this is that every piece of excavation equipment has to be carried back and forth because it cannot be left on site. This greatly increases the inconvenience and expense of carrying out an excavation at this vulnerable site

3.3.3 Parking

Status quo:
- The cars of the permitted scientists and visitors park in a flat space adjacent to the excavation
- There are seldom more than one or two cars and space at this level of use is not a problem.
- The parking area is close to the excavation and there is little room for expansion
- Should greater site use become an issue, it is recommended that parking for extra site users be located elsewhere, away from the excavation (turning and manoeuvering is problematic when there are many cars at the traditional car park)
- The thin vegetation cover is vulnerable, keep a watch on erosion and take action when necessary

Threats and risks:
- Researchers' car park is not graveled and may erode with frequent use

3.3.4 Built environment

Status quo:

Sheds and storage
- For many years, there was a roofed shed with wire-mesh walls which provided a lock-up space for excavation equipment. The additional surveillance of a resident caretaker was sufficient, or nearly so, to deter thieves. Since the loss of the caretaker, the structure and its entire contents have been stolen. There is no secure storage on site, and equipment has to be hauled backwards and forwards every day.
- The water storage tank was also removed from its mounting and rolled away.

Threats and risks:
- See comments for fencing and gates above

Accommodation
- There used to be a caretaker's hut and adjacent toilet bit this too has been demolished and stolen

- The theft of all materials which can be used for building purposes, even to the steel droppers used to mark out the excavation grid which had heavy concrete bases, places constraints on the type of material which can be used with confidence. Given the social setting of Kromdraai, it would appear likely that theft will be a persistent and ongoing problem
- Securing the site and/or acquiring another caretaker appear to be the only possible solutions. Carting equipment is costly and time-consuming and rapidly diminishes tight excavation budgets
- It has been suggested that a new caretaker's hut be situated in the hollow below the site adjacent to the road.

Threats and risks:

- See comments for fencing and gates above

Pathways, walkways and viewing platforms

- There are no formal pathways, boardwalks and viewing platforms at Kromdraai and it is unlikely that anything more than a leveled pathway will be necessary because there is excellent visibility into the excavation trenches from several places around the periphery.
- Care should be taken not to locate pathways too close to excavation edges, although these seem to be stable at both Kromdraai A and Kromdraai B.

Threats and risks:

- None at present

Tourist-related, including signage

- There is no tourist-related infrastructure or signage on the Kromdraai site, neither is the site open to the general public.
- Small-scale specialist tours do take place from time to time but these are always accompanied by a specialist or scientist.
- There used to be limited site interpretation material locked up in the storage shed but this has disappeared along with everything else.
- It is suggested that a wooden box containing site pamphlets is provided.

Threats and risks:

- None at present

Ablutions and storage

- There is no piped water to the site. Water used to be brought in and left in a bowser, and a plastic tank collected run-off from the shed roof. Both roof and tank have been stolen.
- Water now has to be hauled to site. Apart from domestic use, it is required for washing, wet sieving and preparation of fossils
- The lack of running water would be a problem for a resident caretaker as well as the scientist responsible for bringing it in.
- Water on site is a prerequisite for responsible tourism
- There are no ablution facilities and the only toilet used to be a pit toilet. This has now been demolished and there is no toilet on site any more.

Threats and risks:

- Lack of infrastructure and support facilities makes excavation slower, more expensive and difficult
- Otherwise, no threats and risks at present

- See comments for fences and gates above

3.3.5 Waste Management

Status quo:
Sewage
See above

Litter

- Litter removal has become the responsibility of the researcher and it needs to be removed from the site and disposed of elsewhere.
- Waste management is written into the researcher-landowner agreement

Risks and Threats:

- There is no threat at present. Potential risks include groundwater and site pollution

3.3.6 Energy

Status quo:

- There is no electricity supply on Kromdraai
- Open fires and smoking are forbidden on Cooper's and it would probably be the same for Kromdraai, making gas the only alternative

Threats and risks:

- None at present

3.3.7 Water

Status quo:
See 3.3.4 above

3.3.8 Telecommunications

- Cellular telecommunications only

Risks and Threats:

- Emergencies may require rapid communication and response

3.4 Research Environment

3.4.1 Previous and ongoing research and excavations

Specimens of bone-bearing breccia were collected from Kromdraai as early as 1895 by David Draper who forwarded them to the British Museum in London.

In 1938, a schoolboy, Gert Terblanche, found part of the skull of *Paranthropus robustus* and gave it to Dr Robert Broom who recovered the rest of the fossil from a breccia in Kromdraai B. It

comprises part of the brain-case and face, palate, upper and lower jaws with teeth, and a few limb bones. He published a description of this, the first specimen of a robust australopithecine, later in the same year.

Further investigations have been led by members of staff of the Transvaal Museum since the 1950s. Excavations were undertaken in the 1950s by Dr C.K. Brain, in the 1970s by Dr Elisabeth Vrba and since 1993 by Dr Francis Thackeray. Other collaborative work on the fossils and dating has taken place with H.B.S. Cooke, D Panagos, T.C. Partridge and J. McKee and, in collaboration with Dr Thackeray, by Dominique Gommery, Jose Braga, Frank Senegas, Stephany Potze, Joe Kirschvink, Leslie Aiello, N.J. van der Merwe, Lee Berger, Ceri McCrae, Darryl de Ruiter and Colin Menter.

An excavation permit for Kromdraai is currently held by Dr Francis Thackeray. It is in the process of renewal (application for renewal already submitted). Dr Francis Thackeray of the Northern Flagship Institution (NFI) or Transvaal Museum (TM) has been working the site with collaborators from Wits (Dr Kathy Kuman and Lee Berger), from Harvard University, and from University College, London..

3.4.2 Excavation edges

Status quo

- The breccias of Kromdraai B in particular, are fairly heavily calcified and friable excavation edges are not a problem
- At Kromdraai B, breccia is less heavily calcified and friable edges have been packed with sand bags where they are prone to erode
- On the whole, excavation edges are stable
- Care should be taken not to develop pathways that are too close to excavation edges
- Fixed point photographic monitoring from the datum point is recommended, (for Kromdraai B) and the eastern and western extremities of Kromdraai A

Risks and threats:

- None at present

3.4.3 Excavation walls

Status quo

- Excavation walls are generally stable. Decalcified breccia has been removed to points where the breccia is calcified and there are no unstable overhangs or loose and eroding decalcified breccia
- Excavation walls are not overly deep – perhaps 3 metres at their deepest
- Where loose rock occurs embedded on excavation walls, it should be removed before it collapses, bringing down breccia with it.
- Unstable excavation edges should be beveled off

Threats and risks:

- None at present

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

- There are no active excavations at present, and no ladders, stairs, or steps.
- The excavations of the past have not produced excessively deep excavations (see also section 3.1.3) and these can still be accessed by climbing down on stepped out breccia

- Should excavations deepen, plans should be submitted as to how the excavation base is to be accessed

Threats and Risks:
None at present:

3.4.5 Erosion

Status quo:

- Erosion within the Kromdraai A and B deposits has been arrested by packing with sandbags
- There are no problem areas at the site

3.4.6 Compliance with conditions of excavation permit

Status quo:

- The new permit has not yet been issued.

Threats and Risks:

- 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:

- At Kromdraai B, a representative witness section has been selected and will be left in perpetuity.
- The witness section is stable and clearly demonstrable from the excavation edge (Fig. 10)

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.

Fig 10: Witness section defined by early excavations at the site. The flowstone horizon clearly seals the underlying sediments and has younger overlying breccias.

3.4.8 Dumps

Status quo:

- There is a dump at Kromdraai, to the west of Kromdraai B. The dump needs to be committed to plan and annotated as to source, fossil content and intended action regarding its future

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

3.4.9 Repository

Status quo:

- The designated repository for materials collected so far is the Northern Flagship Institute of the Transvaal Museum as it was originally called.
- The repository conforms to the minimum standards required in terms of the SAHRA guidelines and inspections take place from time to time to ensure compliance with the requirements set out therein.

Risks and Threats:

- Loss of, or deterioration of artefacts
- Loss of information concerning artefacts
- Lack of publicized information about artefacts

3.5 Site safety and security

3.5.1 Physical safety

Status quo:

- The site is situated within an area where access is tightly controlled. However, a considerable amount of unmonitored, unauthorised pedestrian traffic crosses the larger Kromdraai property, and particularly through the Kromdraai site. The site has experienced a number of thefts and cannot be said to be secure. The recent attack on a worker at Swartkrans has underlined the fact that personal safety can no longer be taken for granted, particularly if there are only one or two workers on site, especially if they are female. Even hijacking cannot be ruled out. Personal security can become problematic because of the isolation of the site, out of earshot and sight from the nearest residents.
- In this type of situation pro-active management action is problematic, one can only impress the need to be watchful at all times
- The security fence suggested above needs to be considered by management partners – SAHRA would normally be responsible for a perimeter fence.
- As the site is a panhandle, it seems sensible to exclude fencing the road, should a fence be recommended.

Risks and Threats:

- Personal safety might become a risk
- Equipment and vehicles may become at risk
- Built environment is at risk
- No possibility of leaving anything on site
- Conditions may render research unsafe to the point of not being worthwhile

3.5.2 Safety of surface and built environment

Status quo:

- There is no permanent built environment at the Kromdraai site any longer. The two huts, an accommodation hut for the former on-site caretaker and a storeroom
- The surface of the site is safe except for hazards mentioned under 'excavation area'
- Warnings need to be posted regarding the presence of bees' and wasps' nests

Risks and Threats:

- Personal injury to research staff or site visitors or loss of property
- The risk that insurance measures may not be adequate against litigation

3.5.3 Safety of excavation area

Status quo:

- Excavation edges are stable and protected
- Excavation walls are high but not unstable
- Excavation base can be safely reached
- No-go areas (cave) are not visited and attention is not drawn to their presence.
- There is good cellular telephonic connectivity and a first aid and evacuation procedure will need to be incorporated into the permitted scientists planning
- The excavators, sieving team and preparators will need to be equipped with the obligatory protective clothing such as boots, gloves, eye goggles and filtering masks. This is a requirement of the Public Health and Safety regulations

- Scavenging of fossils is not a big problem

Risks and Threats:
- The report of a site safety inspection is pending

3.5.4 Subterranean safety

Status quo:
See 3.2 above
- The outcome of a site safety report by a professional site safety officer is awaited before making comment

3.6 Presentation of site values

3.6.1 Site interpretation

Status quo:
- The landowner is indifferent to tourism on site and wishes to focus his efforts on livestock farming
- As much as the present permitted scientist (Dr F Thackeray) would like to have a small site museum, security, accommodation and funding is a problem.
- There is no site interpretation in the form of signage or interpretation boards
- There is limited site visitation and tourism and thus limited site interpretation is taking place
- Site interpretation is entirely oral by the tour operator, tourist guide or permitted scientist
- Very few people know of the interesting newer discoveries that have been made at this site. New information has come to light and this needs to be made public if palaeoanthropology is to be kept in the public psyche
- All tours operated on site need to have the written approval of the landowner
- Tourist activities on World Heritage Sites and National Heritage Sites need the approval of the Management Authority and SAHRA for National Heritage Sites (because of possible damage to, as well as presentation of, a formally protected heritage resource). In terms of the NEMPAA, the permission of GDACE may also be required.
- There are restrictions on the filming and capturing of images on World Heritage Sites and a procedure needs to be put in place to regulate this requirement. This would need to incorporate the requirements of the NHR Act section 27(23)(b)) which concerns "reproduction for profit without a permit issued by SAHRA")

Risks and Threats:
- 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

3.6.2 Visitor numbers

Status quo:
- There is no regular mechanism for recording and reporting visitor numbers as yet

Risks and Threats

- The tourist numbers are required by SAHRA and the Managing Authority and are not currently available on record

4 MANAGEMENT OBJECTIVES, DESIRED OUTCOMES

This section (Section 4) notes management objectives and desired 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 of all site values as a goal.

4.1 Physical environment, surface

Management objectives and desired outcomes with regard to the physical environment of the Kromdraai fossil site include:

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 landowner, scientists and management partners are maintained

Rangeland:

- To ensure that contextual veld conditions and rangeland in the immediate vicinity of the fossil site is maintained in as good a condition as possible, with regard to appropriate land use and management. To ensure that activities taking place within the fossil site take cognizance of the need to conserve optimum rangeland condition

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 site.
- To ensure that the fossil site does not harbor or create fire hazards
- To ensure that fossil site researchers are aware of fire hazards and can control on-site fires.
- 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, to feed back into appropriate fire management

Biodiversity, rare plants and animals:

- To ensure that a database of plant and animal species present on site is 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. There are many sub-outcomes to this goal such as the listing of invasive species, their identification, mapping and prioritizing for control, acquiring a budget for control and for follow-up, as well as implementation.

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

The subterranean environment is not significant at Kromdraai at present. There are no immediate management objectives in this regard at present

4.3 Infrastructure, built environment

There is no significant built environment at Kromdraai at present.

Future desired outcomes include the following:

- Minimise the visual impact of infrastructure by screening or camouflage
- Redundant infrastructure removed and the foundations rehabilitated
- Adequate and environmentally acceptable toilet and ablution facilities installed
- Suitable accommodation for caretaker may be required, and possibly re-located to a less exposed more secure location

4.4 Research environment

Desired outcomes include:

- To ensure that the activities of scientists on site are perceived as 'adding value' 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 accommodation and 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
- 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 the mapping, recording, conservation and broader presentation of the well-preserved historical mining relics on site
- 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:

- A surface environment, subterranean environment and work environment which is safe for all site users
- It is desirable that an evacuation policy in the event of accident or medical crisis be drawn up and that basic first aid is available on site

4.6 Presentation of site values

A desired outcome is:

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

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 desired outcomes detailed above. 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.

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 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 - to be attended to urgently as it constitutes a danger to the public or a resource;
- Urgent - to be attended to urgently to protect the resource;
- Necessary - to be attended to, to protect the resource;
- Desirable - to be attended to from a development perspective;
- Keep watch – to be monitored to see if the problem is serious.

TABLE 1 FOLLOWS:
MANAGEMENT MEASURES AND MONITORING CRITERIA

6 TABLE 1: MANAGEMENT TABLE AND MONITORING CRITERIA FOR KROMDRAAI SITE

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Surface environment						
Access - legal access to property	• Access is a sensitive issue, valuable stud animals are target of stock theft • Landowner is particular about access, and sensitive to strange vehicles	• ***Maintenance of cordial relations with landowner regarding access (*)*** • Ensure that properly negotiated preferably written letters of permission are obtained by all site users or those in charge	Necessary-	Permitted researchers, landowner	• Check if access issue has been addressed in MOU's between landowner and research scientists • Check if tour operator and tourist guides have same permissions	Annual, ongoing. An agreement is currently in place.
Unauthorised access to property	• Removal of rock, fossils, breccia and artefacts • Removal of edible and medicinal plants • Theft of moveable property and livestock	• ***No unauthorized visitation to site (*)*** • Research and field staff to maintain surveillance • Security fence has been suggested, the idea needs to be pursued with scientists and SAHRA	Necessary	SAHRA responsible for perimeter fencing Permitted scientists, field staff, landowner	• Check stockpiled breccia • Check for signs of digging out of plants • Maintain surveillance over movable property, building materials etc	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Rangeland condition	• Deterioration of rangeland due to overstocking, overgrazing, trampling or too frequent fires	• ***Rangeland in optimum condition (*)*** • Rangeland management in the contextual area is a landowner function; little can be done at the small scale of the heritage site • GDACE can advise • Permitted scientist can report problems to landowner • Plan for acquiring baseline data against which impacts can be assessed • Plant species list required, noting edibles, medicinal, toxic species, etc	Desirable	Landowner	• Check for trampled bare area • Check for loss of palatable grasses and forbs	

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Retention of topsoil, surface drainage, surface erosion	• Loss and dispersal of topsoil makes re-vegetation difficult	• ***Fossil site free of erosion (*)*** • Check all tracks and car park • Check for surface drainage and distribution of runoff over surface • Check for signs of surface erosion • Lightly gravel parking area if necessary and distribute runoff appropriately	Necessary	Research scientists, landowner	• Check for worn patches of vegetation where cars habitually park • Check for erosion gulleys in tracks • Check for patches of exposed soil	Ongoing
Erosion of tracks	• Loss of topsoil • Unsightly bare patches of soil	• ***Fossil site free of erosion (*)*** • Rehabilitate eroded tracks by creating mitre drains • Restore by packing surface ruts with rock and brushwood to break flow of water (see Coetzee 2005) • Implement fixed point photography monitoring (see text)		Landowner, GDACE to advise	• Check for deepening of ruts or curbing of further erosion • Check that mitre drains on track are kept open • Check that humps are strategically placed to divert water from road surface • Monitor and change strategy is necessary	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Fire Management	• Too frequent fires have a negative effect on vegetation • Fire is a threat to moveable property	• ***Proper fire regime for Bankenveld maintained (*)*** • Implement a fire management policy • Record fire frequency and intensity • Establish possible contribution and necessary compliance by scientists • Enforce ban on open cooking and heating fires • Provide suitable beaters for research staff to use in the event of an uncontrolled fire • Be aware of how quickly fire spreads and move vehicles and personnel to safety timeously		Landowner, GDACE	• Set up rangeland study for base data against which fire impact can be assessed • Set up a fire frequency recording programme • Ensure that beaters are always on hand • Regular update of fire management policy	

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Red data species, rare and economically significant plants	• Loss of edible and medicinal plants. Many important plant species are not on RED DATA list.	• ***Preservation of biodiversity (*)*** • Surveillance of indigenous plant use • Draw up a species list of medicinal, poisonous, edible and economically significant species • Map occurrence and preferred microhabitats • Monitor collection and utilization	Necessary	Landowner, researchers and their staff, GDACE	• Check for signs of digging geophytes out by the roots • Check local roadside vendors for plants on sale • Report incidents to GDACE	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Invasive alien plant species.	• Invasion of avens and other habitats by alien species • Loss of biodiversity • Unattractive landscape • Spiny and prickly species inhibit exploration	• ***Fossil site free of invasive aliens(*)*** • Make a list of all invasive plant species • Map and prioritise infestations • Determine best eradication or control programme. GDACE available for assistance • Assess costs and find budget • Begin control according to guideline provided in generic management plan • Enlist expertise of GDACE • Implement control and clearance programme • Monitor and follow up as required		Landowner, research scientists (in work environment)	• Visual checks for infestations and incidence density • Monitor with fixed point photography where clearance has been initiated.	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Weeds & shrub growth in excavation site	• Roots of trees and saplings destabilize breccias in time • Plants reduce visibility of noteworthy sections • Weeds give a negative visual experience and project an air of dereliction	• ***Weed-free fossil site (*)*** • Pull weeds by hand, or 'skoffel' • Destroy in a manner that does not spread seed further	Necessary	Landowner, research scientists (in excavation environment)	• Visual checks for weed infestations • Fixed point photography for controls of large stands of weeds	Ongoing
Development in 'viewshed'	• Negative visual impact	• ***Viewshed and 'sense of place' maintained (*)*** • COH WHS to monitor all new development plans	Necessary	COH WHS MA	• Check plans for visual impact on viewshed of site	Ongoing
Habitat protection: Removal of stromatolites.	• Loss of Heritage material and site significance. • Loss of micro-habitats (mosaic of sunny and shady areas).	• ***Preservation of Pelindaba Stone and stromatolites (*) (Generic to COH WHS)*** • Landowner, Research scientists and field staff to maintain surveillance • Heritage Inspectors to be alerted	Necessary	Landowner, permitted scientists, field staff, Heritage Inspectors	• Check for signs of disturbed soil, exposed patches of soil, overturned and disturbed rock	Ongoing
SUBTERRANEAN ENVIRONMENT						

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Interpretation of subterranean environment	• Lack of information regarding the significance of caves to the science of palaeontology • Lack of appreciation of the significance and sensitivities of the subterranean environment (e.g. specialist habitat, bats, owls, porcupines, etc)	• ***Well-interpreted subterranean environment (*)*** • Incorporate caves and ecology of subterranean environment into site interpretation. This should be done without entering the Kromdraai cave which is off-limits to school groups and visitors	Desirable	Researchers, tourist guide, those that interpret the sites	• Check that subterranean environments are suitably interpreted	Ongoing
Porcupine lairs and owl roosts	• Disturbance and displacement of animals • Porcupine lairs and owl roosts are important as modern analogues for taphonomic processes of the past	• ***Preservation of porcupine lairs and owl roosts (*)*** • Protect any porcupine lairs on site • Encourage that their behaviour and lair contents are studied without disturbing animals	desirable	All site users	• Check that porcupine lairs remain active – note presence of quills, droppings, gnawed bones	Ongoing
INFRASTRUCTURE						
Access road	• See erosion above	• See erosion above			•	

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Perimeter fence, except for panhandle covering road access	• Resident livestock trampling excavation area, can cause damage • Cattle can fall in • Main problem is lack of security and theft	• **Site which is secure against theft, safe from trampling, and not a hazard to livestock (*)** • Danger to excavations identified by scientists • Danger to animals identified by landowner • Negotiate the possibility of a fence with landowner • Approach SAHRA for funding	Urgent	Landowner, research scientists, SAHRA	• If and when installed, check state of repair • Check efficacy of fence – does it solve the problem? • Does it cause other problems?	Ongoing
Car park – erosion of surface	• Frequent parking can cause erosion of surface	• ***Erosion-free fossil site and environs (*)*** • Monitor and spread crushed stone gravel when necessary	Keep watch	Researchers	• Check surface and surrounds of car park for signs of erosion	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Toilets, ablution	• No toilet ar Kromdraai • Inadequate or improper sewage disposal could pollute groundwater • Poor toilet facilities create a poor tourist impression • Single chemical toilet for all site users and visitors is inadequate – separate male and female toilets required • Unscreened , lack of privacy	• ***Environmentally suitable male and female toilets available on site (*)*** • VIP or Enviroloos to be installed in time	Necessary	Researcher, (for excavators and visitors)	• Check type of toilet is environmentally suitable • Check efficacy, odours, flies	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Waste management and disposal	• Litter, windblown • Cattle and wild animals die from ingesting plastic bags	• ***Litter-free fossil site when excavations in operation (*)*** • When excavations begin, provide litter bins, more when extra people are expected • Ensure that litter cannot be wind distributed • Collect and remove all litter regularly • Best practice would require sorting and recycling litter		All site users	• Check for left litter lying or blowing about • Check that litter bins have been installed • Check removal schedule • Check that litter stored on site cannot be wind distributed • Encourage recycling	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Pathways for site users and visitors	• Pathways too close to excavations can cause excavation edges to collapse • Visitors/children can fall into excavations, avens or miners' excavations (stepping backwards) • Pathways can cause erosion	• ***Safe pathways not too close to excavation edges (*)*** • Provide psychological barriers for edges of steep drops • Use safe retaining area for site visitors • Provide anti-erosion measures at sensitive areas • Do not create more pathways than necessary. Define preferred pathways and stick to these rather than make many paths	Keep watch	Researchers	• Check visitor pathways for safety - for visitors and for that of site fabric • Check pathways for wear and tear and channelling/erosion • Check anti-erosion measures if these have been applied	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Site plaque recognizing World Heritage Site status and National Heritage Site Status	• Required in terms of the WHC Act and NHRA • Enhances site status	• ***Site Plaque finally installed (*)*** • Select appropriate position, agreed by researchers and landowner (Done) • Ensure wording appropriate and agreed, checked by SAHRA • Ensure that both SAHRA and WHS logos appear • Acquire budget • SAHRA to install	Necessary	SAHRA	• Check plaque condition and safety (brass plaques liable to theft)	Ongoing
Signage: adequacy	• Poor tourist experience if site not adequately interpreted	• ***Adequate interpretative signage of site (*) (possible future requirement)*** • Site not open to general public, specialist tour operator and permitted scientist provide site interpretation	Attended	Researchers	• As and when it becomes necessary, check quality of signage • Check quality of site interpretation	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Visitor impacts	• Littering • Pollution • Erosion of pathways • Disturbance of excavations • Theft of fossils • Graffitti	• ***Elimination or minimization of visitor impacts(*)*** • These potential impacts all adequately attended at Kromdraai • Toilet facilities inadequate/non-existent	Attended	Researchers, tour operator	• Check for littering • Check for pollution of site • Check all walkways for wear and tear • Check for visitor disturbance of excavations or equipment • Check for tampering with and removal of stored fossils • Check for graffiti	Ongoing
Infrastructure: water	• Inadequate water supply inhibits and slows excavation • Hauling water is expensive and diminishes excavation budgets • Inadequate water supply creates extremely uncomfortable working conditions for site workers • Lack of water slows down breccia preparation • Water needed for ablutions • Water needed to control dust	• ***Future planning*** • Water needs to be brought onto site. • Water storage container can be removed at end of season • Site water container stolen and needs replacement • No easy solution to this problem. Similar conditions exist elsewhere	Necessary	Researchers, some easement is indicated	• Concealed/screened storage tank	Nothing to monitor at this stage

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Infrastructure: Energy	• Lack of energy reduces excavation speed and efficiency	• ***Future planning*** • If brought to site, bury cable underground	Desirable	Landowner, researchers	• None	None
Telecommunications	• Telephone necessary for responsible tourism • No landline	• Researchers to ensure cellphone is on site			• None	
RESEARCH ENVIRONMENT						
Safety of heritage material, pathways	• Trampling by visitors	• ***Fossils safe from trampling (*)*** • Check a suitable route around Kromdraai A and Kromdraai B and provide a pathway that is not too close to excavation edge, which can be re-routed as excavation develops		Researcher	• Monitor site for trampling, particularly in pathway areas	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Excavation edges	• Decalcifying breccia results in the excavation walls having friable edges • Unstable edges collapse • This poses a risk of physical danger as well as of information loss	• ***Safe and stable excavation edges (*)*** • Manage sharp edges appropriately • Provide physical barrier or psychological barrier to prevent visitors getting too close • Do not site pathways too close to excavation edges • Cap unstable edges with lime cement • Cover with plastic to prevent rain erosion	Necessary Situation in hand	Researcher	• Researchers to monitor every time they are digging • Monitor for fallen and slumped wall deposit. Check footwall for fallen debris. • Check for beveled edge • Check location of footpaths • Check plastic protection coverings • Annual professional assessment	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Excavation walls	• Unstable walls, particularly if decalcified tend to slump and collapse • Collapse poses a threat to site users below unstable areas • Collapse poses a threat to site significance because of mixing of deposit • Very high walls are difficult to stabilize when excavation is terminated or completed • Very high walls are susceptible to problems noted above	• ***Safe and stable excavation walls (*)*** • Excavation walls at Kromdraai are all acceptable at present • Deep excavations should be "benched", quarry-style. • Unstable walls should be stabilised - geotextile or sandbagging with 10% cement •	Situation in hand Necessary In future	SAHRA, researchers	• Check degree of calcification of breccia – hard breccia can take higher walls than decalcified material • Check unsupported wall height and recommend benching out if it appears unstable • Check wall for loose rocks and boulders and bar down (*) if necessary • Manage friable excavation edges as appropriate • * To bar down means to use an appropriate rod as a lever (such as a crowbar) and to carefully remove projecting or unstable rocks in a controlled way, rather than letting them collapse, bringing slumped wall material with them.	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Access to bottom of excavation	• Steps, ladders, etc. must be safe and stable if used	• ***Safe access to all parts of the excavation (*)*** • Researchers access excavation bottoms by climbing in – base is at about 2.5 m • Make benching shallow enough to use as steps • Create and cap steps with protective layer • Ensure ladders are safe	Situation in hand	Researchers	• Check access routes to excavation base for safety and stability • Check that access route does not put fragile fossils at risk	Ongoing
Compliance with terms and conditions of permits	• Loss of information and site significance	• ***Compliance with terms and conditions of SAHRA permit and any other permits in force (*)*** • Check all terms and conditions written into the permit	Necessary	SAHRA, researchers	Check all terms and conditions written into the permit:	At each site inspection

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Witness sections	• Loss of information ad site significance	• ***Mapped and recorded dumps, on site plan. Properly constructed dumps (*)*** • Ensure that selection of appropriate witness sections are a requirement in terms of the permit • Ensure that the researcher provides adequate criteria for the election of witness sections • Ensure that all significant features are covered by on included in witness sections proposed • Ensure that witness sections are not prone to collapse and that they are stabilized on closure of excavation • Ensure that witness section is committed to plan	Necessary Situation in hand	Researcher	• Check that witness sections have been defined and are left standing in a stabilized condition	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Breccia Dumps	• Loss of information concerning source and contents of dumped material (NB) • Footprint site of dumps not checked for significant plants • Position unacceptable to landowner • Position obscures significant part of deposit • Dump built over cave infill • No proper toe to dump or careless containment • Dump is cascading due to incorrect angle of repose • Dump origin not recorded • Dump contents not recorded • Duration of dump on site not recorded • Dump built over or too close to drainage line • Needs on dump	• This SAHRA to request that the scientist explain how dumped material – whether sterile or fossiliferous and 'in transit '– is to be managed. This dump management plan needs to become part of permitting requirement	Necessary	SAHRA, researchers	• Check placement of dump on landscape, particularly new dumps. • Check new and existing dumps against Dump Guideline in generic management plan.	

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Sieved residue dumps, sterile	• Could be placed where they will inconvenience landowner • Placed where they will constitute a visual impediment • Built in such a way that they will erode or become unstable • See points recorded for dumps above	• ***Appropriate disposal of sieved waste*** (*) • Could be used for road and erosion repair if really sterile and also in other places • Sieved material EIA to become part of permit application – see recommendation regarding dumps above	Necessary	SAHRA, researchers	• Check location of sieved waste material • Check for stability and erosion • Apply same monitoring criteria as noted for dumped breccia above	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Security of breccia piles	• Exposed fossiliferous breccia is at risk to scavenging by souvenir hunters, many small pieces lying about • Limited tourism is taking place on site	• ***Fossils safe from theft and tampering (*)*** • Portable blocks should be taken to the laboratory each day • Visitor groups should not free-range: provide site guide • Keep groups to a size than can be properly supervised • Importance of every fossil should be taught – signage that outlines appropriate behavior to be erected in time • Control access to excavation area strictly	Necessary	Researchers	• Monitor for security of fossiliferous breccia. Only non-portable blocks should be left in accessible places • Monitor site for vulnerable pieces and remove for safe keeping	Ongoing
Repository – not part of the field inspections but should be part of management planning	• Poor repository policies can result in information loss • Poor repository policy can result in problems of locating fossils	• Monitor repositories. See 'Minimum Standards for Repositories' guideline as prepared by SAHRA		SAHRA	• Monitor repositories	Ongoing
Site safety, security and stability						

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Signage, site safety and warnings	• Lack of appropriate signage can expose visitors to unexpected hazards, e.g. that there is a bees' nest	• Install appropriate behavior modifiers and site safety signage as and when this becomes necessary • Appropriate safety signage is a requirement of Public (Occupational) Health and Safety Act • Maropeng even warns against possible presence of snakes	Necessary	Researchers, landowner, tour operators	• Check for installation of warning signs and appropriate wording • Check for appropriate location of signs, design and durability	Ongoing
Subterranean environments at Kromdraai: nearby caves	• Instability due to previous mining activities and blasting • Natural instability	• No-go areas for tourists; specialist caving groups only •	Necessary	Researchers, tour operators	• Check that no-go instruction is being obeyed	Ongoing
Bees, "Kransbye", Wasps	• The numerous cavities and hollows are home to several bee hives and wasps' nests. Many people are allergic to bee stings in particular.	• Ensure that the necessary antihistamines are on hand. • Destroy or have hives removed if these are where people frequently work. • Post warning signage • Provide first aid post	Necessary	Researcher, Tour Operator	• Monitoring should include checking the route for insect problems. • Monitor speed at which an emergency case could reach appropriate medical help	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Accidental falls	• Visitors, tourists,or students suing the operator	• Ensure that pathways are as even as possible. Provide psychological barriers at vertical drops and changes of level. • Keep group sizes small enough to control at all times	Necessary if tourism is taking place on site	Tourist operator, researcher	• Monitor route by walking it regularly to check for flaws in routing, infrastructure	Ongoing
Theft, crime	• The isolated situation makes the site particularly prone to petty theft of excavation and other equipment. • Personal safety is becoming a factor	• Control on all persons entering the area. • Keep regular surveillance and report strange or suspicious persons • Security fence might help	Necessary	Researchers, landowner, site users	• Security checks in place	Ongoing
GENERIC ISSUES RELATING TO FOSSIL SITE EXCAVATIONS – PLEASE SEE GENERIC TABLE IN GENERIC ISSUES DOCUMENT						

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