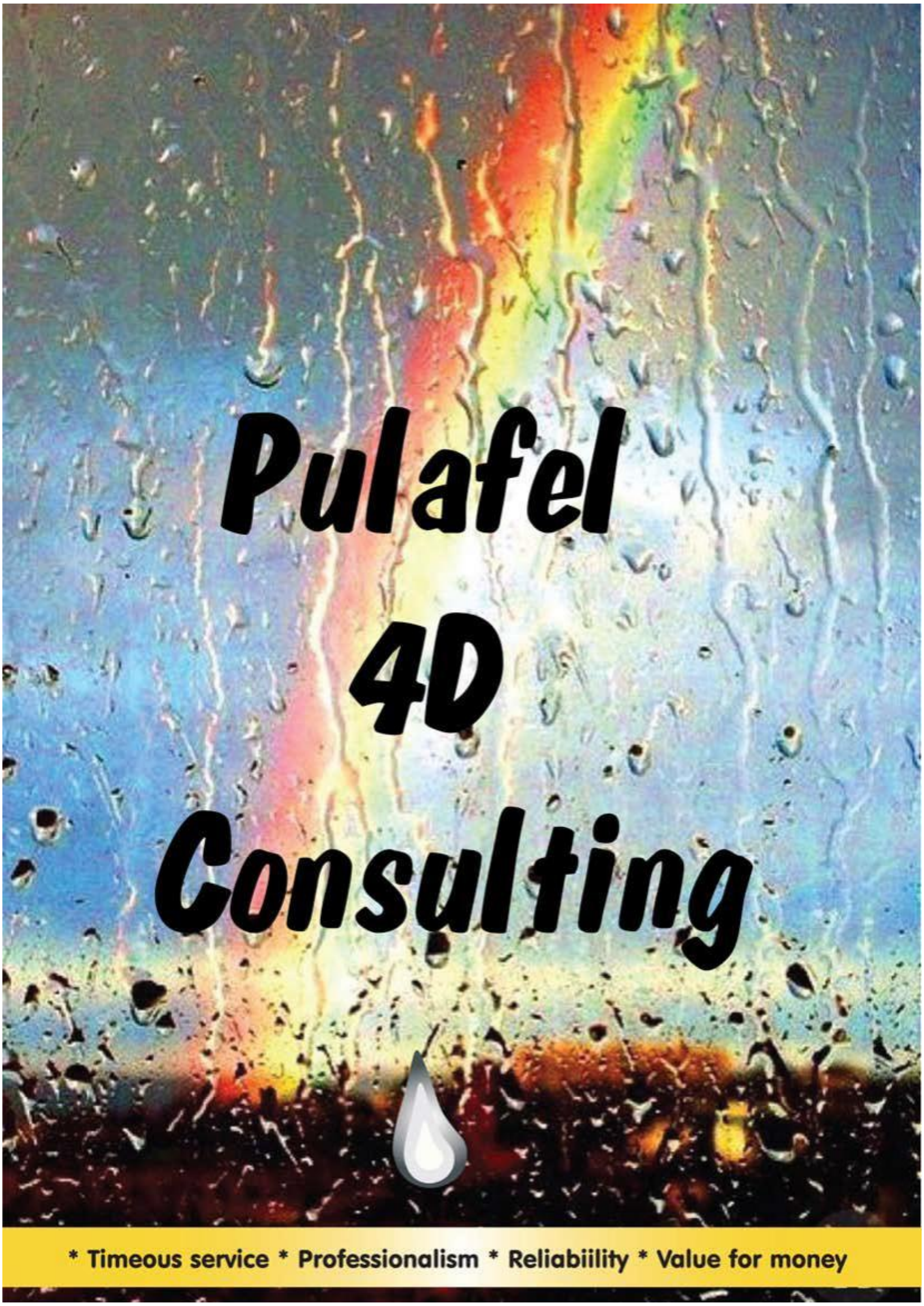

COMPANY REGISTRATION # 2018/593198/07

Desktop & Field Palaeontological Impact Assessment for a Diamond Prospecting Right on the Farm Stofbakkies 30 in the administrative district of Prieska, Northern Cape Province, South Africa.

21 August 2023

Report prepared for: M & S Consulting
By

Pulafel 4D Consulting (Pty) Ltd

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DECLARATION OF INDEPENDENCE

We, Joseph Chikumbirike & Sifelani Jirah, declare that we act as independent specialist consultants. We do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. We have no interest in secondary or downstream developments as a result of the authorization of this project.

21 August 2023

Executive Summary

At the request of Pulafel 4D Consulting (Pty) Ltd, a Desktop and Field Palaeontological Impact Assessment (PIA) was carried out on the Farm Stofbakkies 30 in Prieska District. Stofbakkies is located about 3km northwest of Prieska in the Northern Cape Province, where Xhariep (Pty) Ltd has applied for a prospecting right to prospect for **diamonds**. It is expected that the proposed prospecting activities could impact on early Proterozoic sedimentary strata which are not considered to be paleontologically sensitive. Given the scope of the proposed activities, the likelihood of palaeontological impact on early Proterozoic carbonate rocks is considered **LOW**, especially if prospecting by way of core drilling is considered. However, because of the thick sandy overburden (which are not considered to be palaeontologically significant in this case) and the lack of details regarding the actual position in terms of the geographic coordinates (GPS coordinates) of the proposed prospecting, it is recommended that in the event of impact on fresh carbonate rocks that may result from trenching and pitting, new exposures should require brief monitoring by a palaeontologist. In this case, potential prospecting areas that are capped by well-developed wind-blown sand deposits are assigned a site rating of Generally Protected B (GP.B) and will require monitoring if trenching and pitting activities are to be conducted.

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Introduction

At the request of M&S Consulting, Desktop and a Field Heritage Impact Assessment was carried out on the Farm Stofbakkies 30, Prieska district, located about 3 km northwest of Prieska in the Northern Cape Province (**Fig. 1**).

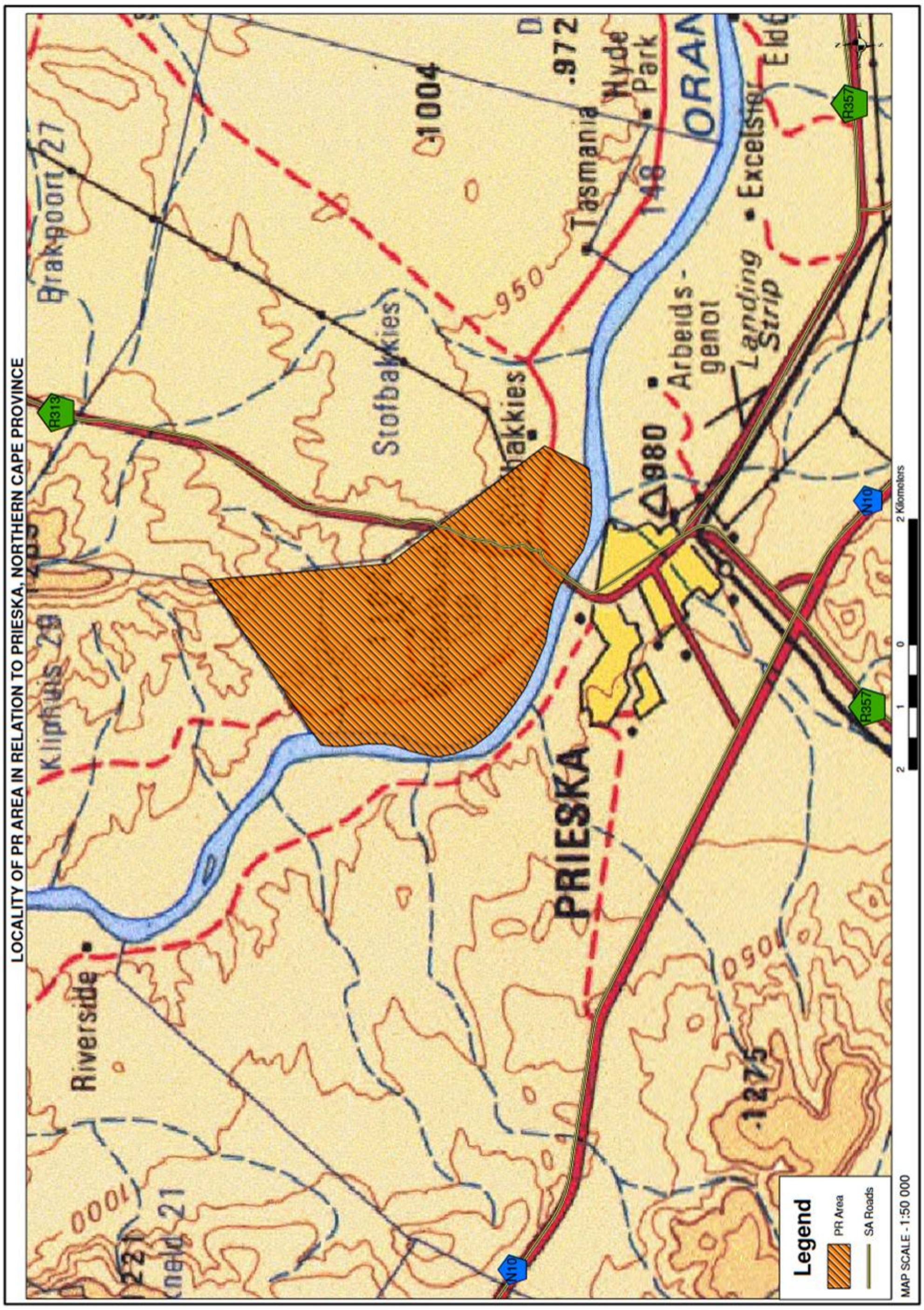

Fig. 1. Extract from 1:250 000 topographical sheet 2922 Prieska showing the approximate location of the proposed diamond prospecting activities on Stofbakkies 30 Farm just northeast of Prieska, Siyathemba Municipality, Northern Cape (orange shaded area).

Fig 1: Topographic map showing the location of the project area.

Xhariep (Pty) Ltd applied for a prospecting right to prospect for diamonds. The region's unique and non-renewable (archaeological and palaeontological) heritage sites are ‘Generally’ protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority.

Legislative framework

The primary legal trigger for identifying when heritage specialist involvement is required in the Environmental Impact Assessment process is the National Heritage Resources (NHR) Act (Act No 25 of 1999). The NHR Act requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological values or significances are protected. Thus, any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures over 60 years of age, living heritage and the collection of oral histories, historical settlements, landscapes, geological sites, palaeontological sites and objects.

The Act identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development relevant to this study are listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the NHR Act as follows:

34. (1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

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

- destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- *b)* destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

36 36 (3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- (c) bring onto or use at a burial ground or grave referred to in paragraph *(a)* or *(b)* any excavation equipment, or any equipment which assists in the detection or recovery of metals.

38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as—

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length; • Any development or other activity which will change the character of the site

a) exceeding 5000 m^2 in extent; or

b) involving three or more existing erven or subdivisions thereof; or

c) involving three or more subdivisions thereof which have been consolidated within the past five years;

- The rezoning of a site exceeding 10 000 m^2; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

Table 1: Relationship between different heritage contexts, heritage resources likely to occur within these contexts, and likely sources of heritage impacts in the central interior of South Africa.

Heritage Context	Heritage Resources	Impact
Palaeontology	Precambrian shallow marine and lacustrine stromatolites, organic-walled microfossils, Ghaap Plateau (Transvaal Supergroup) Palaeozoic and Mesozoic fossil remains, e.g. Karoo Supergroup Neogene regolith	Road cuttings Quarry excavation Bridge and pipeline construction (Quaternary alluvial deposits)
Archaeology Early Stone Age Middle Stone Age LSA - Herder Historical	Types of sites that could occur in the Free State include: Localized Stone Age sites containing lithic artifacts, animal and human remains found near *inter alia* the following: River courses/springs Stone tool making sites Cave sites and rock shelters Freshwater shell middens Ancient, kraals and stonewalled complexes Abandoned areas of past human settlement Burials over 100 years old Historical middens Structural remains Objects including industrial machinery and aircraft	Subsurface excavations including ground levelling, landscaping, foundation preparation, road building, bridge building, pipeline construction, construction of electrical infrastructure and alternative energy facilities, township development.
History	Historical townscapes, e.g., Kimberley Historical structures, i.e., older than 60 years Historical burial sites Places associated with social identity/displacement, e.g., Witsieshoek Cave, Oppermansgronde Historical mission settlements, e.g., Bethulie, Beersheba, Moffat Mission	Demolition or alteration work. New development.
Natural Landscapes	Formally proclaimed nature reserves Evidence of pre-colonial occupation Scenic resources, e.g., view corridors, viewing sites, Historical structures/settlements older than 60 years Geological sites of cultural significance.	Demolition or alteration work. New development.
Relic Landscape Context	Battle and military sites, e.g., Magersfontein Precolonial settlement and burial sites Historical graves (marked or unmarked, known or unknown) Human remains (older than 100 years) Associated burial goods (older than 100 years) Burial architecture (older than 60 years)	Demolition or alteration work. New development.

Table 2. Examples of heritage resources located in the central interior of South Africa.

Historically, archaeologically and palaeontologically significant heritage sites & landscapes	**Examples**
Landscapes with unique geological or palaeontological history	Karoo Basin Beaufort Group sedimentary strata Glacial striations on Ventersdorp andesites Vredefort Dome World Heritage Site. Taung World Heritage Site
Landscapes characterised by certain geomorphological attributes where a range of archaeological and palaeontological sites could be located.	Vaal, Modder and Riet River valleys Pans, pandunes and natural springs of the Free State panveld. Ghaap Plateau
Relic landscapes with evidence of past, now discontinued human activities	Wonderwerk Cave Stone Age deposits Cave sites and rock shelters in the Maluti Drakensberg region (rock art) Southern Highveld pre-colonial settlement complexes. Dithakong settlement complexes Rock engravings on Ventersdorp andesites
Landscapes containing concentrations of historical structures.	Concentration camps & cemeteries from the South African War.
Historical towns, historically significant farmsteads, settlements & routes	Batho historical township area in Mangaung (Bloemfontein). Kimberley
Battlefield Sites, burial grounds and grave sites older than 60 years.	Sannaspos Magersfontein

Table 3. Field rating categories as prescribed by SAHRA.

Field Rating	Grade	Significance	Mitigation
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation: mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

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Assumptions and Limitations

The proposed prospecting localities have not been finalized prior to the archaeological field assessment and it is likely that an apparently well-developed aeolian sand overburden may hamper Stone Age archaeological visibility within the study area.

Planned activities.

The application is for a prospecting right for diamonds. It is planned to determine the mineral resource and distribution for this project by means of non-invasive as well as invasive prospecting methods. The information obtained during the initial non-invasive field survey and evaluation process of the geological maps and data, will then be used to determine the target area and planned positions of the intended invasive prospecting. Invasive prospecting will take place via:

Description of planned non-invasive activities:

(These activities do not disturb the land where prospecting will take place)

Phase 1:

A site investigation (reconnaissance visit) of the PR Area will be undertaken to identify infrastructure and determine any potential problems that may need to be addressed.

Phase 2:

To direct the exploration programme in an efficient manner, the following shall be done:

· Desktop study – A comprehensive study will be done researching all available information. A desktop study will be undertaken of the diamond potential of the area.

· Geological mapping - The geology of the PR Area will be interpreted by using aerial photographs and satellite images to ascertain target areas for possible gravel deposits and kimberlites. The area will then be mapped in detail by a qualified and registered geologist, which map shall include the various rock types and their contacts.

· Report – A report making recommendations regarding further investigations of the mineralized areas will be compiled.

Phases 4, 6 and 8:

Samples will be obtained at 1m intervals from all the boreholes and will be analyzed for several elements. In addition, samples might also be used for the following:

· Petrographic Examination. Small samples (<5kg) collected from outcrops or boreholes may be submitted for petrographic examination.

· Small amounts of material (<10kg) from outcrops and drilling will be used to carry out physical property tests such as density.

· Geotechnical tests. Geotechnical investigations such as rock quality designation (RQD) and rock strength will be conducted on some of the drill material.

Phase 9:

All the drill sampling data will then be modeled to obtain a final interpretation of the potential of the deposit. A detailed feasibility report will be compiled after drilling operations have been completed to evaluate the economic viability of the project.

Description of planned invasive activities:

(These activities result in land disturbances)

Phase 3: Percussion drilling

Percussion drilling will be used to identify the position of a suspected gravel deposit. The position of the boreholes is dependent on the results of the review of historical activities, geological mapping, desktop study and reconnaissance visit.

Twenty boreholes, approximately 50m deep each (can be more or less depending on results), are planned. The collar position of all boreholes will be surveyed. All drilling will be short term and undertaken by a contractor using truck-mounted equipment.

Angled percussion holes are planned to locate and intersect the mineralization. A traverse line or grid drilling is used to identify and define the extent of any mineralization. The sizes of the boreholes drilled will be determined by such factors as cost, proposed sampling, availability of drilling machines and the volume of sample required, among others.

Each drill site will be rehabilitated. The boreholes will be filled with drill chips and covered with topsoil.

Phases 5 and 7: Reverse Circulation drilling

Diamond and/or Reverse Circulation will be drilled to delineate the potential economic zones of the gravel deposit. The position of the in-fill boreholes is dependent on the results of the percussion drilling phase.

Twenty boreholes, approximately 50m deep each (can be more or less depending on results), are planned (ten boreholes during phase 5 and ten boreholes during phase 7). The eventual extent of the gravel deposit, if one exists, will determine the number of boreholes to be drilled. The collar position of all boreholes will be surveyed. All drilling will be short term and undertaken by a contractor using truck-mounted equipment.

Angled RC holes are planned to locate and intersect the mineralization. A traverse line or grid drilling is used to identify and define the extent of any mineralization. The sizes of the boreholes drilled will be determined by such factors as cost, proposed sampling, availability of drilling machines and the volume of sample required, among others.

Each drill site will be rehabilitated. All shallow boreholes (i.e. <10m) will be backfilled and levelled. All boreholes deeper than 10m will be covered with a metal plate and 1000mm of previously stored topsoil.

Description of site layout:

No offices and storerooms will be established at the site as Xhariep Plant and Mining (Pty) Ltd (hereinafter referred to as 'Xhariep') shall make use of facilities in the town of Kimberley.

Description of the Affected Area

The study area is characterized by undulated rocky terrain that is primarily covered by well-developed aeolian sand and sand dunes along the low-lying areas. The 1: 250 000 scale geological map 2922 Prieska shows the geology of the study area.

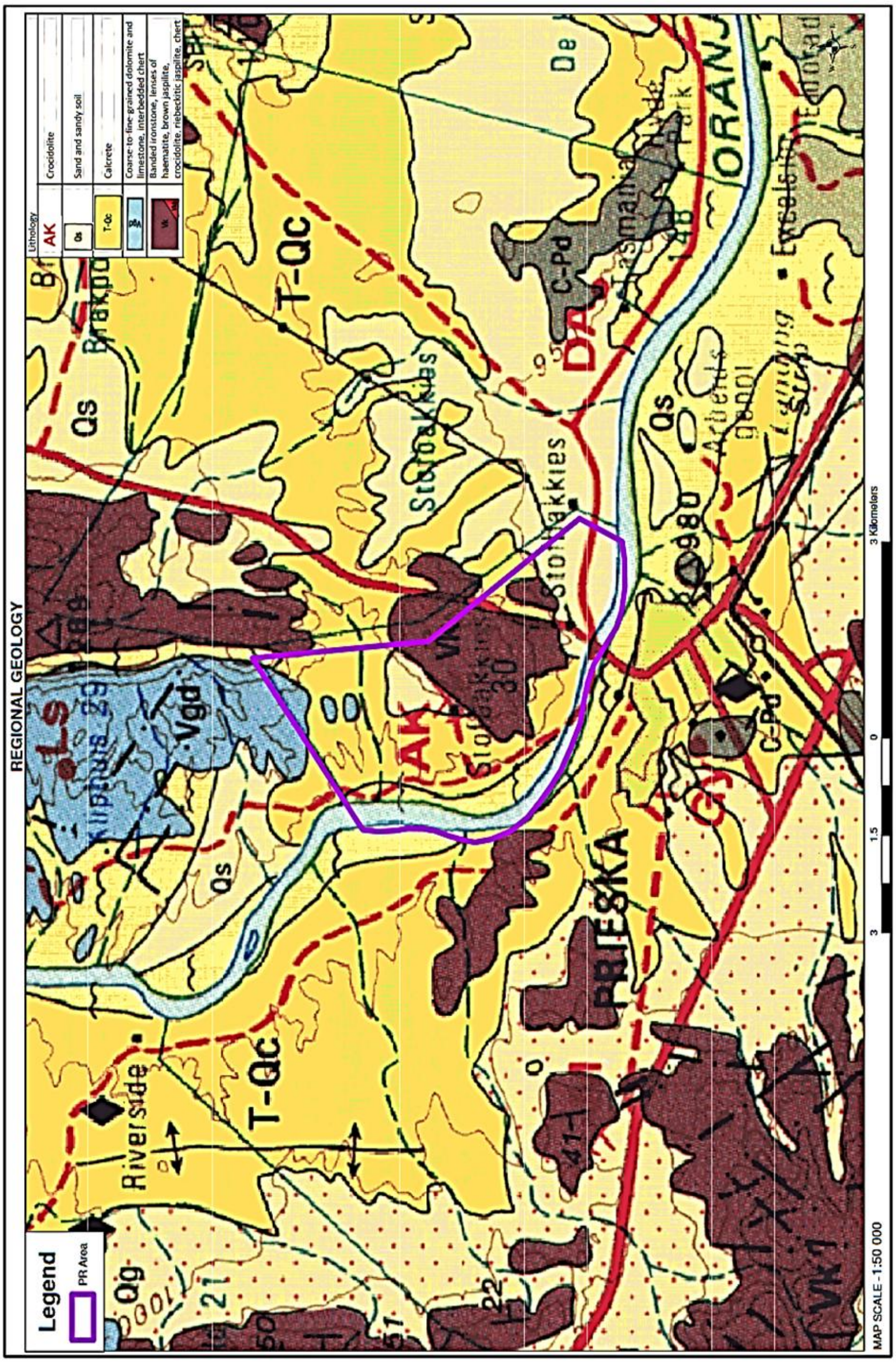

Fig. 2. Extract from 1:250 000 geology sheet 2922 Prieska (Council for Geoscince, Pretoria) showing approximate location of the proposed diamond prospecting activities on the Farm Stofbakkies 30, just northwest of Prieska, Northern Cape (outlined in purple). The study area is underlain by banded ironstone, lenses of haematite, brown jaspilite, crocidolite, riebeckitic jaspilite, chert (Vk, brown); Coarse to fine grained dolomite and limestone, interbedded chert (Vgd, pale blue); calcrete (T-Qc, dark yellow); Sand and sandy soil (Qs, light yellow) and crocidolite (AK).

Fig 2: Extract from 1:250 000 geology sheet 2922 Prieska indicating the geology of the project area.

THE GEOLOGICAL CONTEXT

The geology of the study area is presented in Fig 2 above**.** The study area is characterized by**:**

- Gordonia Formation (KALAHARI GROUP) and surface calcrete. Mainly aeolian sands with minor fluvial gravels, freshwater fan deposits, and calcretes (T-Qc and Qs) (5.3 MYA – 11,700 years)
- Asbestos Hills Subgroup (Kuruman & Danielskuil formations (GHAAP GROUP) Banded Iron Formations (BIF) with cherty bands (Vk) (c. 2.5 – 2.4 Ga)
- Campell Rand Subgroup (Kogelbeen, Gamohaan & Tsineng formations (GHAAP GROUP) Limestones, dolomites, subordinate cherts and tuffs (Vgd) (c. 2.6 – 2.5 Ga)
- Most of the Precambrian bedrock outcrop in the study area is mantled by a range of – mostly unconsolidated – superficial deposits of ill-defined Late Caenozoic age.
- The calcretised breccias contain angular or occasionally water-worn, poorly sorted clasts of carbonate, chert, BIF as well as sparse embedded MSA tools.

The Campbell Rand Subgroup (Vgd in **Fig. 2**) of the Ghaap Group previously included within the “Ghaap plateau Formation” in older literature – represented here is a very thick (1.6 - 2.5 km) carbonate platform succession of dolostones, dolomitic limestones and cherts with minor tuffs and siliciclastic rocks. It was deposited on the shallow submerged shelf of the Kaapvaal Craton roughly 2.6 to 2.5 Ga (billion years ago) (See McCarthy & Rubidge, pp. 112-118). A range of shallow water facies, often forming depositional cycles reflecting sea level changes, are represented here, including stromatolitic limestones and dolostones and cherts (Beukes 1980, Beukes 1986, Sumner 2002, Eriksson et al. 2006, Sumner & Beukes 2006).

Precambrian bedrocks are mostly covered by various, mostly unconsolidated superficial deposits of Late Caenozoic age (Almond 2018d, 2019). These younger deposits include thick mantles of colluvial to alluvial gravels, downwasted cherty surface rubble, orange-hued aeolian (wind-blown) Kalahari sands, as well as sandy to gravelly alluvial sediments (often calcretised) along stream and river valley floors.

It is noted that stromatolites, even where abundantly present, are generally not readily visible within freshly excavated carbonate bedrock, especially where this is scratched and soil-covered, as readily seen in parts of the study area.

ERA	YEARS IN MILLION	PERIOD	EPOCH	FAUNA	FLORA
Cenozoic	1	Quaternary	Recent (Holocene)	Age of Mammals	Angiosperms Monocotyledons
	6		Pleistocene	Age of Human beings	Age of Angiosperms - Dicotyledons
	15	Tertiary	Pliocene	Human evolution	
	10		Miocene	Mammals and birds	
	20		Oligocene		
	100		Eocene		
			Paleocene		
Mesozoic	125	Cretaceous		(Golden age of Reptiles) Rise of Dinosaurs	Sphenopsides, Ginkgos, Gnetales, (Dicotyledons)
	150	Jurassic			Herbaceous lycopods, Ferns, Conifers, Cycads
	180	Triassic			
Paleozoic	205	Permian		Mammal like reptiles	Arborescent lycopods
	230	Carboniferous	Pennsylvanian	Earliest Amphibians and abundant Echinoderms	Seed ferns and Bryophytes
	255		Mississippian	Earliest reptiles	
	315	Devonian		Age of fishes	Progymnosperms
	350	Silurian		Earliest fishes and land invertebrates	Zosterophyllum
	430	Ordovician		Dominance of invertebrates	Appearance of first land plants
	510	Cambrian		Fossil invertebrates	Origin of algae
Precambrian	3000	Upper		Multicellular organisms	
		Middle		Appearance of eukaryotes	
		Lower			Planktons prokaryotes

Fig 3: Geological Time Scale (https://www.google.com/search?q=geological+time).

Fossils within Late Caenozoic superficial sediments

Most of the Late Caenozoic superficial sediments within the prospecting area are of low palaeontological sensitivity, preserving few, if any, scientifically valuable fossil remains. Calcretes associated with the Campbell Rand carbonates might contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial sands and gravels. Unconsolidated surface gravels and colluvium are for the most entirely unfossiliferous. However, occasional reworked cherty carbonate blocks within ferruginous colluvial gravels may contain small silicified stromatolitic dome; stromatolitic horizons may have been preferentially silicified during diagenesis and are therefore preferentially represented within surface gravels that concentrate resistant-weathering rock rubble. Occurrences of calc-tufa, flowstone, and fissure-infill breccias in the karstified Campbell Rand outcrop area might possibly be associated with micromammal remains as well as the bones and teeth of larger mammals, reptiles and birds, plant fossils etc., as well - seen, for example, in karstified Precambrian carbonate successions in Namibia. No bones, teeth or other fossil remains were observed in this context during the present field study, while occasional embedded cherty stone artefacts including probable MSA imply a Pleistocene or younger age.

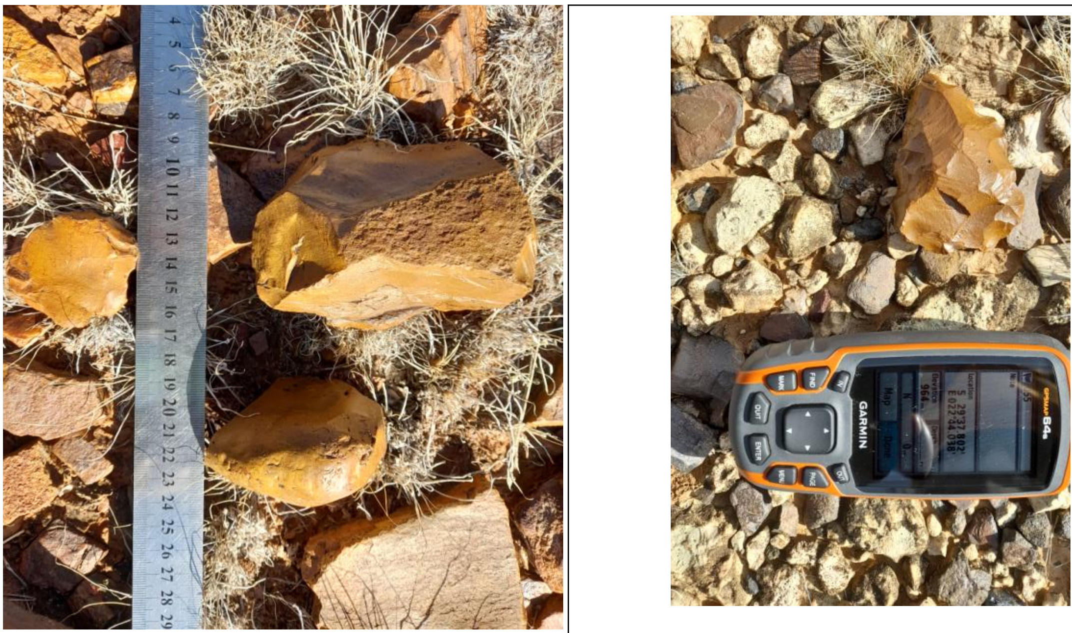

Fig 4: Lithic material remains made using the chert raw material (Source: authors).

Fossils within the Kalahari Group

The fossil record of the Kalahari Group is generally sparse and low in diversity. This applies to the calcretes and dune sands that overlie the Precambrian bedrocks within the present study area.

The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life (**Fig 3**), apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from underlying lime-rich bedrocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g., Hodotermes*, the harvester termite), ostrich eggshells (*Struthio*), tortoise remains and shells of land snails (*e.g., Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g., Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al*., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be **LOW**. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments, including calcretes, notably those associated with ancient alluvial sands and gravels. Younger (Quaternary to Recent) surface gravels and colluvium are probably unfossiliferous.

Important, taxonomically diverse Middle to Late Pleistocene mammalian macrofaunas as well as Stone Age artefacts have been recorded from multiple doline (solution hollow) infill sediments at Kathu Pan, *c*. 5.5. km NW of Kathu town (Beaumont 1990, Beaumont 2004, Beaumont *et al.* 1984), about 280km from Prieska. The fauna mainly consists of delicate, fragmentary tooth material (caps or shells or dental enamel). Most teeth and associated artefacts are covered with a distinctive shiny silicate patina. The fossils are assigned to the Cornelian Mammal Age (*c*. 1.6 Ma to 500 ka) and Florisian Mammal Age (*c*. 200 to 12 ka) that are associated with Acheulean and MSA stone artefact assemblages respectively (Klein 1984, 1988, Beaumont *et al.* 1984, Beaumont 1990, Beaumont 2004, Porat *et al.* 2010). Interesting Cornelian mammal taxa found at Kathu pan include the extinct *Elephas recki* and *Hippopotamus gorgops* as well as various equids, white rhino and hartebeest / wildebeest-sized alcephalines. The dominance of grazers over browsers or mixed feeders among the Middle Pleistocene mammalian fauna suggests that the vegetation was grassy savannah at the time. Higher up in the succession the remains of typical Florisian forms such as *Pelorovis antiquus* the Giant Buffalo, *Megalotragus priscus* the Giant Hartebeest and *Equus capensis* the giant Cape Horse also occur. Many of the tooth fragments as well as the associated MSA stone artefacts in this younger horizon are abraded, suggesting fluvial reworking of material into the doline together with the gravelly sand matrix. Additional fossil material of biostratigraphic and palaeoecological interest from the Kathu Pan doline infills include fossil pollens from well-developed peat horizons (Scott 2000), bird fossils, ostrich eggshell fragments and terrestrial gastropods. The mammalian remains may belong to animals attracted to permanent waterholes (*e.g.*, spring eyes), especially during drier phases of the Pleistocene Epoch. The close association of large mammal fossils with abundant stone tools well as occasional evidence for butchering suggests that human hunters or scavengers may also have played a role as concentration agents. It is possible that solution cavities within calcretised alluvial sediments might also contain important fossil vertebrate and Stone Age archaeological remains. However, these Kathu pan deposits lie outside the footprint of the present prospecting project.

Palaeontology

Background, Impact Statement and Recommendation

The shallow shelf and intertidal sediments of the carbonate-dominated lower part of the Ghaap Group (Campbell Rand Subgroup) are well known for their rich fossil biota of stromatolites or microbially generated, finely-laminated sheets, mounds, domes, columns and branching structures. Some stromatolite occurrences on the Ghaap

Plateau of the Northern Cape are spectacularly well-preserved (e.g., Boetsap locality northeast of Daniëlskuil figured by McCarthy & Rubidge 2005, Eriksson et al. 2006). Detailed studies of these 2.6-2.5 Ga carbonate sediments and their stromatolitic biotas have been presented by Young (1932 and several subsequent papers), Beukes (1980, 1983), Eriksson & Truswell (1974), Eriksson & Altermann (1998), Eriksson et al (2006), Altermann and Herbig (1991), Altermann and Wotherspoon (1995), and Sumner (2002). The oldest, Archaean stromatolite occurrences from the Ghaap Group have been reviewed by Schopf (2006, with full references therein).

Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial sands and gravels.

Unconsolidated surface gravels and colluvium are for the most entirely unfossiliferous. However, sporadic reworked cherty carbonate blocks within ferruginous colluvial gravels do contain small silicified stromatolitic domes; stromatolitic horizons were preferentially silicified during diagenesis and are therefore preferentially represented within surface gravels that concentrate resistant-weathering rock rubble.

It is expected that the proposed prospecting activities could impact on early Proterozoic sedimentary strata (c. 2.2 Ga) that are represented by siliciclastic rocks, volcanic lavas and ironstones which are not considered to be paleontologically sensitive. Given the scope of the proposed activities, the likelihood of palaeontological impact on early Proterozoic carbonate rocks is considered **LOW**, especially if prospecting by way of core drilling is taken into consideration. However, because of the thick sandy overburden (which is not considered to be palaeontologically significant in this case) and the lack of details regarding the position of the proposed prospecting localities, it is recommended that in the event of impact on fresh carbonate rocks that may result from trenching and pitting, new exposures should require brief monitoring by a palaeontologist. The superficial aeolian (Kalahari Group) overburden within the vicinity of the study area is not considered to be palaeontologically significant.

Methodology

Heritage significance was evaluated through a desktop study and carried out based on existing field data, database information and published literature.

Terms of reference:

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

The study area is rated according to field rating categories as prescribed by SAHRA (**Table 3**).

FINDINGS

Table 4. GPS Locality data for various field points encountered during the Field survey. GPS readings taken using a handheld Garmin GPS map 60Sx instrument and the datum used is WGS 84.

LABEL	LONGITUDE	LATITUDE	DESCRIPTION
S1	S29º 39.230'	E022º 44.766'	Sandy soils with loose blocks of banded ironstone weathered from the nearby kopje. Vegetation is Acacia bushes
S2	S29º 39.157'	E022º 44.609'	Crossing road towards the BIF kopje
S3	S29º 39.140'	E022º 44.625'	Banded ironstone, stromatolites on banded ironstone and aerial view from the BIF kopje
S4	S	E	Old settlement with abandoned houses, kraal and 2 graves
S5	S	E	Old, abandoned quarry on calcrete lithology
S6	S29º 38.308'	E022º 44.136'	Huge gravesite with minimum counted grave plus/minus 20
S7	S29º 38.024'	E022º 44.416'	Old mine infrastructure and old mine quarries on calcrete and banded ironstone
S8	S29º 38.000'	E022º 44.990'	Abandoned explosives room possibly for mining activities on label S7. Next to the explosives room is abandoned animal watering infrastructure (tank,

			drinking trough) and abandoned stone structure.
S9	S29º 37.985'	E022º 44.213'	Old, abandoned building and around the abandoned structure is some crocidolite mineral pieces hosted in a banded ironstone matrix. Middle Stone Age stone tools on T-Qc lithology made of chert
S10	S29º 36.952'	E022º 43.818'	Dolomite/limestone rocks weathering brown
S11	S	E	Boundary fence with adjacent Farm (Kliphuis 29)
S12	S	E	Land under agricultural use

Table 5. Potential fossil heritage in the Stofbakkies 30 diamond prospecting study area

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONTOLOGICAL SENSITIVITY	RECOMMENED SPECIALIST MITIGATION
Gordonia Formation **KALAHARI GROUP** **and** **SURFACE CALCRETE**	Mainly aeolian sands with minor fluvial gravels, freshwater fan deposits, and calcretes PLIO-PLEISTOCENE to RECENT	Calcretised rhizoliths, rare mammalian and reptile bones, teeth, plant remains Fresh water units associated with stromatolites	GENERALLY **LOW** with exception of rare pockets of fossiliferous fissure infill, karst breccia	NONE RECOMMENDED Any chance fossil finds to be reported by ECO to SAHRA
Asbestos Hills Subgroup (Kuruman & Danielskuil formations **GHAAP GROUP**	Banded Iron Formations (BIF) with cherty bands EARLY PROTEROZOIC (c. 2.5 – 2.4 Ga)	Important early microfossil biotas No macrofossils reported to date	**LOW**	NONE RECOMMENDED

Campell Rand Subgroup **GHAAP GROUP**	Limestones, dolomites, subordinate cherts and tuffs LATE ARCHAEAN – EARLY PROTEROZ OIC (c. 2.6 – 2.5 Ga)	Range of microbiotas including various forms of stromatolite, organic-walled microfossils within cherts	**HIGH**	Stromatolite-rich exposures to be protected. Specialist recording and mitigation of chance fossil finds

Fig.3. Google Earth image of the field area showing the points where field information was recorded (s1-s12)

Fig 5: Google Earth image of the area showing the points where field information was recorded.

Fig 6: Sandy soils with loose blocks of banded ironstone weathered from the nearby kopje. Vegetation is Acacia bushes.

Fig 7: Banded ironstone, stromatolites on banded ironstone and aerial view from the BIF kopje

Fig 8: Old mine infrastructure and old mine quarries on calcrete and banded ironstone

Fig 9: Abandoned explosives room possibly for mining activities on label S7. Next to the explosives room is abandoned animal watering infrastructure (tank, drinking trough) and abandoned stone structure.

Fig 10: Old abandoned building and around the abandoned structure is some crocidolite mineral pieces hosted in a banded ironstone matrix.

Fig 11: Dolomite/limestone rocks weathering brown

Fig 12: Boundary fence with adjacent Farm (Kliphuis 29)

Fig 13: Land under agricultural use

POTENTIAL IMPACT

Pre-Construction phase

It is assumed that the pre-construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources.

Construction Phase

During this phase, the impacts and effects are similar in nature but more extensive than the pre-construction phase. Potential impacts include destruction or partial destruction of non-renewable heritage resources.

Operation Phase

No impacts are expected during the operation phase.

Conclusion and recommendations

According to the SAHRA Paleontological sensitivity map the study area is of **Moderate** paleontological significance. The study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary). There is a very small chance that fossils may have been trapped in features such as palaeo-pans or palaeo-springs, and buried by the aeolian sands, but no such feature is visible in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr (Bamford 2022).

No adverse impact on heritage resources is expected by the project and it is recommended that the project commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA.

RECOMMENDATIONS FOR CONDITION OF AUTHORISATION

The following recommendations for Environmental Authorisation apply and the project may only proceed based on approval from SAHRA:

Recommendations:

- Implementation of a Chance Find Procedure for the project

CHANCE FIND PROCEDURES

MONITORING PROGRAMME FOR PALAEONTOLOGY

The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.

1. When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.

2. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures.

3. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.

4. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.

5. Fossil plants or vertebrates that are of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.

6. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.

7. If no fossils are found and the excavations have finished then no further monitoring is required.

Reasoned Opinion

The overall impact of the project is considered to be **LOW** and residual impacts can be managed to an acceptable level through implementation of the recommendations made in this report. The socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the project.x

POTENTIAL RISK

Potential risks to the proposed project are the occurrence of intangible features and unrecorded cultural resources (of which graves are the highest risk). This can cause delays during prospecting, as well as additional costs involved in mitigation and possible layout changes.

MONITORING REQUIREMENTS

Day-to-day monitoring can be conducted by the Environmental Control Officers (ECO). The ECO or other responsible persons should be trained along the following lines:

• Induction training: Responsible staff identified by the developer should attend a short course on heritage management and identification of heritage resources.

• Site monitoring and watching brief: As most heritage resources occur below surface, all earth-moving activities need to be routinely monitored in case of accidental discoveries. The greatest potential impacts are from pre-construction and construction activities. The ECO should monitor all such activities daily. If any heritage resources are found, the chance finds procedure must be followed as outlined above.

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