APPENDIX A

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED PROSPECTING RIGHT APPLICATION ON VARIOUS PORTIONS OF THE FARMS GNOOLOOMA 416, MELTON 420, DIEPWATER 361, LA ROCHELLE 359 AND PLUMSTEAD 418, NORTHERN CAPE PROVINCE

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CaseID: 16605

(NC 30/5/1/1/2/12769 PR)

Compiled for:

UBIQUE Heritage Consultants

963 Bontebok Avenue

Allen's Nek 1709

info@ubiquecrm.com

Prepared by

Banzai Environmental

July 2021

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation.
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not.
- All the particulars furnished by me in this form are true and correct.
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

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SIGNATURE: 

The heritage impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1 and 10	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 10	
(g) An identification of any areas to be avoided, including buffers	Section 1 and 10	
(h) A map superimposing the activity including the associated structures and infrastructure on the	Section 5 – Geological and	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
environmental sensitivities of the site including areas to be avoided, including buffers;	Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 10	
(k) Any mitigation measures for inclusion in the EMPr	None	
(l) Any conditions for inclusion in the environmental authorisation	None	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	None	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 10	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 1 and 10	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent		Not

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
authority.		applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by UBIQUE Heritage Consultants to conduct the Palaeontological Desktop Assessment to assess the proposed Prospecting Right Application on various Portions of the Farms Gnoolooma 416, Melton 420, Diepwater 361, La Rochelle 359 and Plumstead 418, Northern Cape Province. To comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the planned development area and to evaluate the impact of the proposed development on the Palaeontological Heritage.

The proposed development near Kathu in the Northern Cape is underlain by Quaternary aged sediments of the Kalahari Group as well as According to this map the proposed development is largely underlain surface windblown sand as well as surface limestone with the western portion of the study area underlain by rocks of the Griqualand West Basin. The general low palaeontological sensitivity of the bedrocks and superficial sediments in the proposed development footprint, indicates that the proposed development will have an overall LOW impact significance in terms of palaeontological heritage. It is therefore considered that the development is will not lead to detrimental impacts on the palaeontological resources of the area. If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation can be carry out by a paleontologist.

It is consequently recommended that no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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1. INTRODUCTION

Menar Capital (Pty) Ltd appointed uKhozi Environmentalists (Pty) Ltd to conduct an Environmental Authorisation (EA) Application to prospect for iron ore and manganese on various portions of the farms Gnoolooma 416, Melton 420, Diepwater 361, La Rochelle 359 and Plumstead 418, Kathu Magisterial District, Northern Cape Province (**Figure1-4**).

Information provided by uKhozi Environmentalists (Pty) Ltd:
The proposed prospecting activities will establish the extent and the quality of the iron and manganese ore body through non-invasive (desktop study) and invasive (core drilling) methods.
Non-invasive prospecting activities will consist of:

- Desktop studies
- Spatial Database Compilation
- Land Survey
- Remote sensing
- Geophysical survey

Data will be extracted and plotted into geological maps identifying areas for invasive prospecting resource determination.
Invasive prospecting activities will consist of:

- Establishment of the drill site and temporary contractors' yard
- Core drilling.
- Rehabilitation of boreholes
- Drill rig, machinery, and vehicle movement.
- Water Management.
- Ablution Facilities.
- Domestic Waste Management
- Storage and Handling of Dangerous goods

Following the invasive prospecting activities and laboratory analysis, data will be assessed in a pre-feasibility study to determine mining potential.
The invasive prospecting activities is not expected to exceed 1 ha in size and existing roads will be used as far as possible.

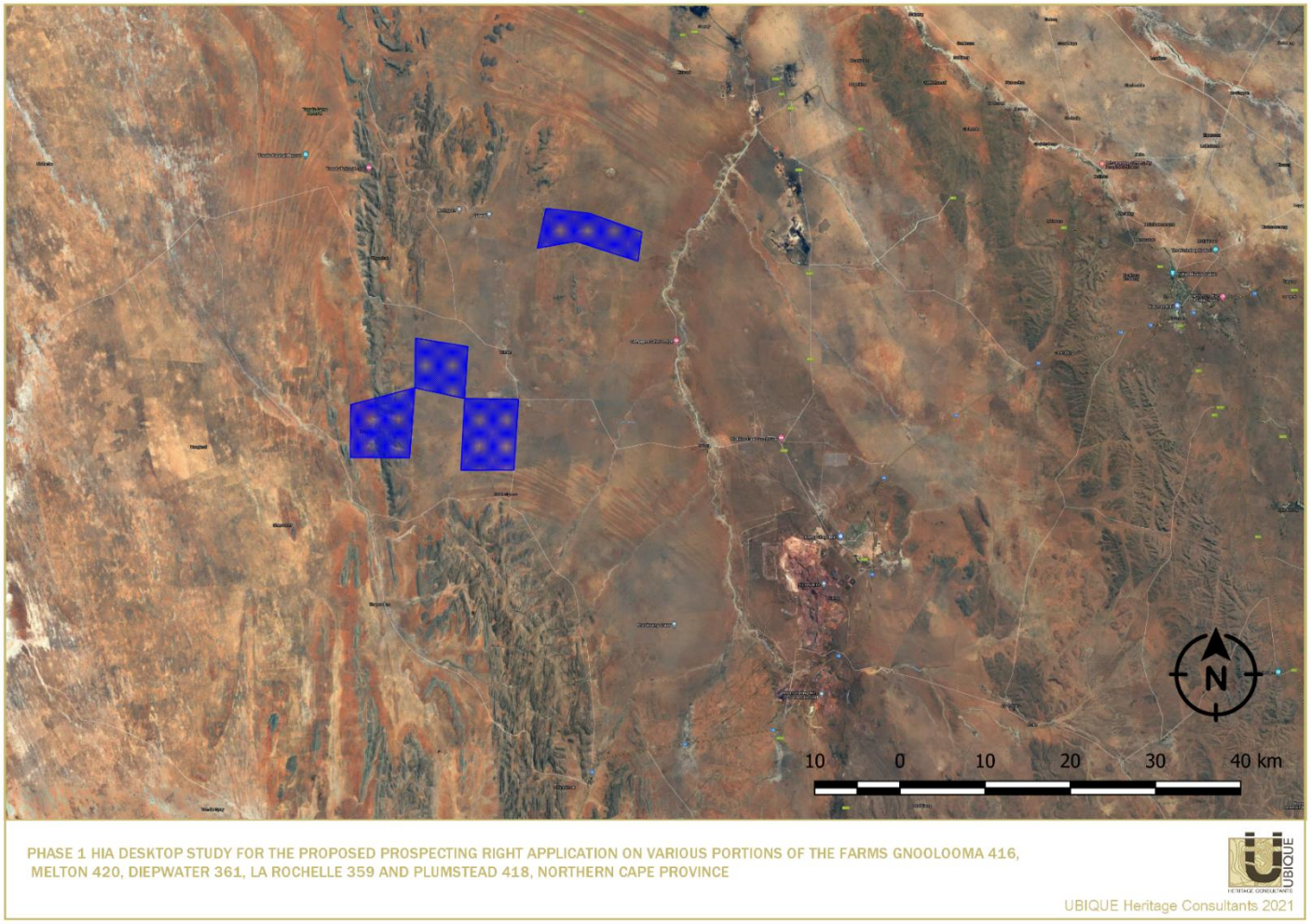


***Figure 13**:Google Earth (2021) image of the proposed prospecting locality on various portions of the farms Gnoolooma 416, Melton 420, Diepwater 361, La Rochelle 359 and Plumstead 418, Kathu Magisterial District, Northern Cape Province. Locality Map.*

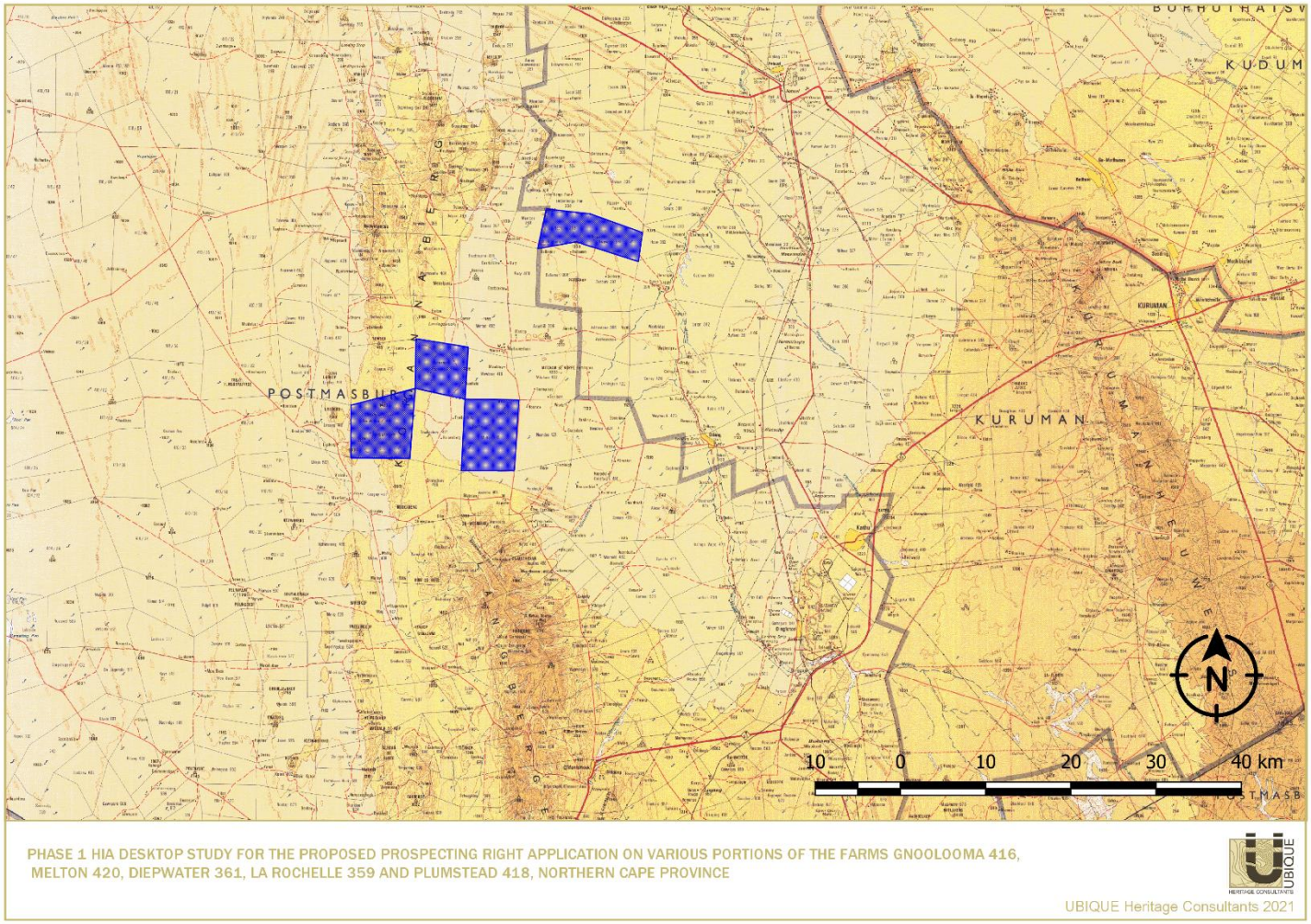


***Figure 14**:Regional setting of the proposed iron ore and manganese prospecting.*

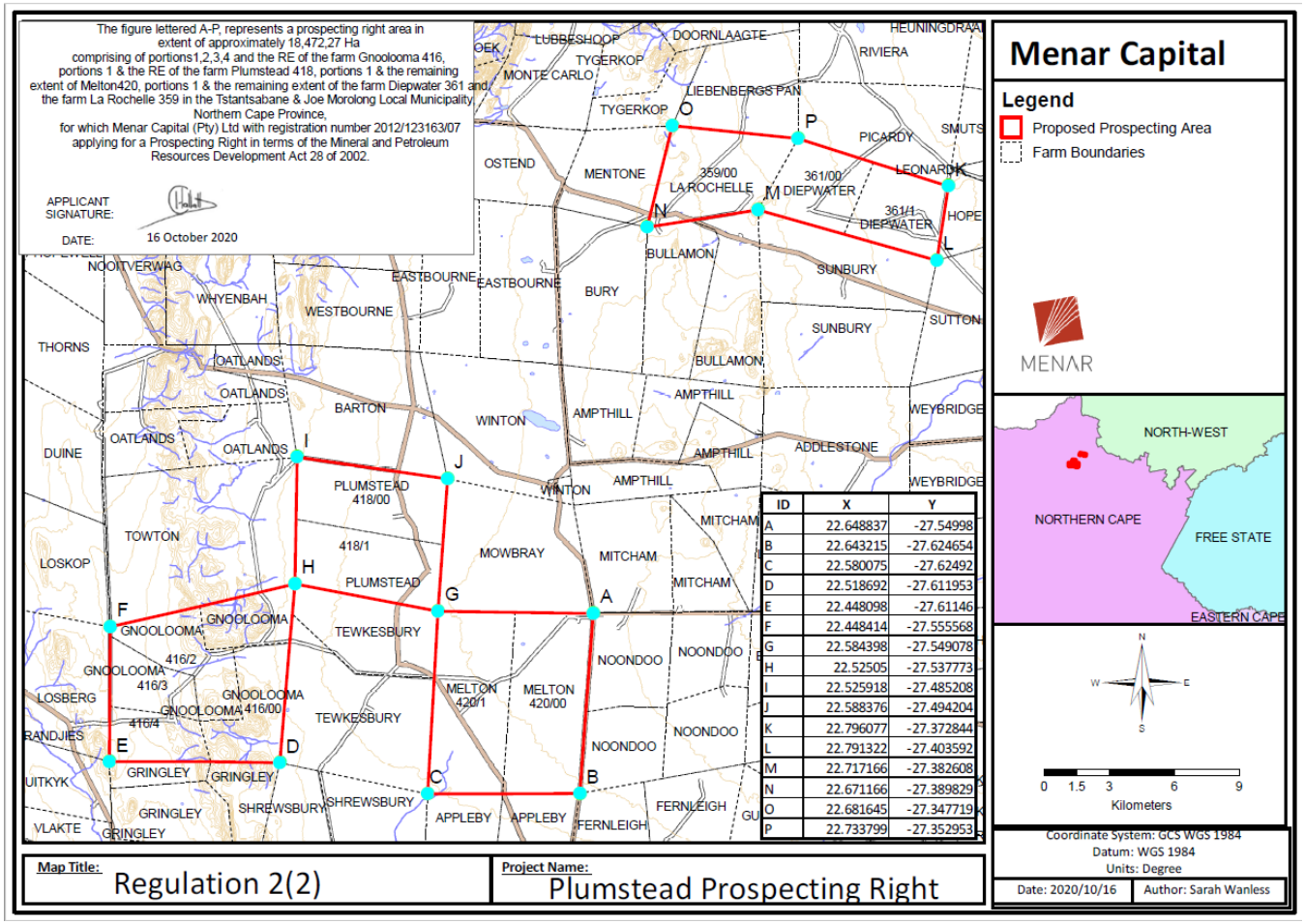


***Figure 15**: Regulation 2.2.*

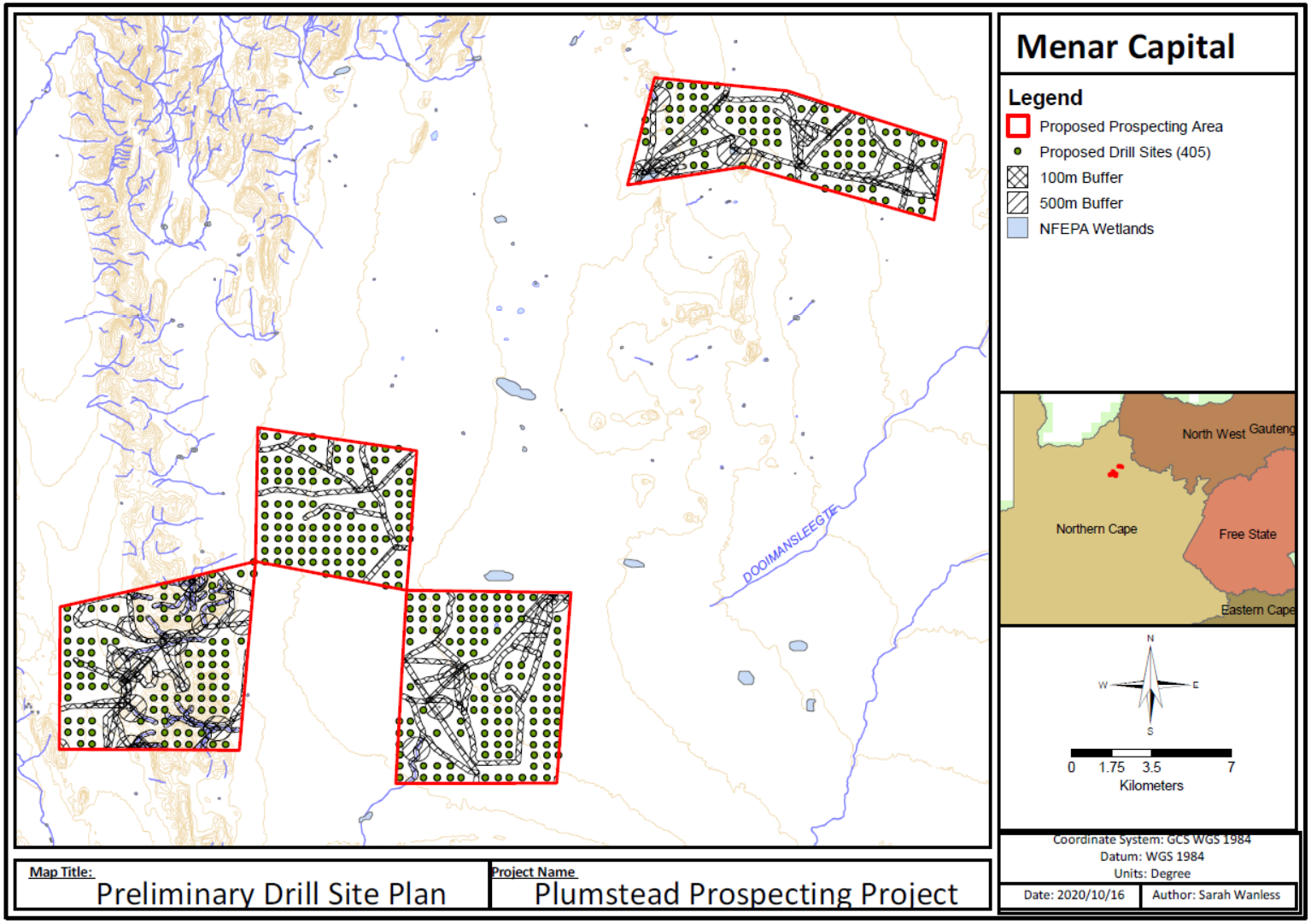


***Figure 16**:Preliminary Drill Site Plan.*

Palaeontological Desktop Assessment to assess the proposed Prospecting Right Application on various Portions of the Farms Gnoolooma 416, Melton 420, Diepwater 361, La Rochelle 359 And Plumstead 418, Northern Cape Province

2. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This present study has been conducted by Mrs Elize Butler. She has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-five years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3. LEGISLATION

3.1. National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact Assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

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 a site—

a. (exceeding 5 000 m^2 in extent; or
b. involving three or more existing erven or subdivisions thereof; or
c. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
d. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority

e. the re-zoning of a site exceeding 10 000m² in extent;

or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4. OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.

Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements.

Submit a comprehensive overview of all appropriate legislation, guidelines.

Description of the proposed project and provide information regarding the developer and consultant who commissioned the study.

Description and location of the proposed development and provide geological and topographical maps.

Provide Palaeontological and geological history of the affected area;

Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development.

Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

f. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.

g. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.

h. **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.

A fair assessment of alternatives (infrastructure alternatives have been provided).

Recommend mitigation measures to minimise the impact of the proposed development; and

Implications of specialist findings for the proposed development (such as permits, licenses etc).

5. GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed development is depicted on the 1: 250 000 2722 Kuruman (1979) Geological Map (Council for Geosciences, Pretoria) (**Error! Reference source not found.**5). According to this map, the proposed development is largely underlain surface windblown sand (Qs) as well as surface limestone (Tl) with the western portion of the study area underlain by rocks of the Griqualand West Basin (**Figure 5-10**). Although a short explanation is printed on the Geological Map itself, a thorough sheet explanation is not supplied. This map is outdated and out of print. Recent modifications to the stratigraphic subdivision and alignments of the Precambruim rocks present in the Kathu area has been finalized. Eriksson *et al.* (2006) conducted stratigraphic studies on the Transvaal Supergroup, while Moen (2006) conducted the study for the Olifantshoek Supergroup.

Simplified regional geological maps based on Cairncross and Beukes (2013) and Smith and Beukes (2016) were published. These geological maps (**Figure 6-8**) indicates that the proposed development is located on the western side of the Maremane Dome (a major N-S trending anticline in the Early Proterozoic bedrocks of the Ghaap Group, Transvaal Supergroup). The Maremane Dome contain carbonate rocks of the Campbell Rand Subgroup (Ghaap Group, Transvaal Supergroup) overlain by the Kalahari Group.

In the past, the shallow marine carbonates of the Campbell Rand Subgroup (Ghaap Group) were included in the Ghaapplato Formation. It is about 2.6 to 2.5 Ga (billion years old) and was deposited on the shallow submerged shelf of the Kaapvaal Craton. This carbonate platform is very thick (about 1.6 -2.5 km) and comprise of cherts with minor tuffs and siliciclastic rocks as well as dolostones and dolomitic limestones.

Recurring changes in sea level were triggered by changing depositional cycles in shallow water facies. Stromatolitic limestones and dolostones, laminated calcilutites, oolites, cherts, with subordinate siliclastics (siltstones and shales) and minor tuffs (Beukes 1980, Beukes 1986, Sumner 2002, Eriksson *et al.* 2006, Sumner & Beukes 2006) are present. The Campbellrand carbonate bedrocks in the area are karstified and probably not exposed at the surface.

At the western side of the Maremane Dome (Campbell Rand carbonates, Asbesheuwels Banded Iron Formation and Koegas quartzites and iron formation), a major unconformity exists at the base of the Palaeoproterozoic Elim Group (basal Keis Supergroup). This unconformity is (about 2.2-2.0 Ga) cuts the folded Ghaap Group succession and is associated with the development of manganese and iron ores. These ores are mined in the Sishen – Postmasburg region of Griqualand West. These ores are associated with the palaeokarst-related Manganore Formation overlying the Campbell Rand Subgroup carbonates of the Maremane Dome as well as the Gamagara Formation at the base of the Elim Group. In the past the Elim Group was included in the Olifantshoek Group (Schalkwyk 2005, Van Niekerk 2006, Da Silva 2011, Cairncross & Beukes 2013, Smith & Beukes 2016). In the greater Kathu region, the Postasburg group comprise of basaltic to andesitic lavas of the Ongeluk Formation (dated to 2.2 Ga) that crops out south of the Gamagara River.

In the Sishen/Kathu region, the older Precambrian rocks are mantled by the late Cretaceous to Late Caenozoic aeolian sands, clays, calcretes and gravels of the Kalahari Group Group [approximately Ca 65 – 2.5 million years old (Ma)]. Studies have shown that the Kalahari Group sediments that overlie the Precambrian rocks are about 80 m thick (Haddon, 2005). The earliest Kalahari beds are assigned to the Wessels Formation (basal gravels) and Budin Formation (calcareous clays) and are probably Late Cretaceous in age (Partridge *et al.* 2006).

The top 15 m of the Kalahari sediments consist of clays, calcretised siltstones, and pebbly horizons with the occurrence of solution hollows along joint surfaces (10 m from the surface). Calcretised silcretes with *in situ* brecciations are present close to the surface. Thick pedogenic calcretes (Plio-Pleistocene Mokalanen Formation**)** are mapped along the Ga-Mogara drainage line and underlies the Kalahari sands in this area, thus indicating the seasonally arid climates over the last five million years (Truter *et al.* 1938; Boardman and Visser 1958). Surface limestones may be up to 20 m thick and are locally conglomeratic with clasts of reworked calcrete and foreign pebbles. These limestones might be secondarily silicified.

Pleistocene Kalahari sands (Gordonia Formation) has been described to mantle thick calcretes and down wasted surface gravels (Almond 2013). He described a range of calcrete types, namely brecciated, gravelly, honeycomb, silicified, and karstified facies, the latter with an associated sand- or gravel-infilled solution hollows. Unconsolidated, reddish-brown aeolian sands of the Quaternary Gordonia Formation are present in the Sishen area. These sands are Late Pliocene / Early Pleistocene to Recent in age due to the Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291) found in them. Recent studies have dated the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma and placed the Gordonia Formation almost completely within the Pleistocene Epoch.

The fossil assemblages of the Kalahari are generally high in diversity that occur over a wide range. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter. Fossils are mostly associated with ancient lakes, pans and river systems.

Table 2: Fossil Heritage probably present in the development footprint. Table modified from Palaeotechnical Report (Almond and Pether 2009).

Subgroup/ sequence	**Group**	**Formation**	**Fossil Heritage**
Tertiary-Quaternary	Kalahari	-	Terrestrial organisms include trace fossils, ostracods, bivalves, gastropod shells, diatoms and trace fossils. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways.
Griqualand West Super Group	Campbell Rand Subgroup	Ghaapplato	Stromatolites eg Cyanobacterial microfossils

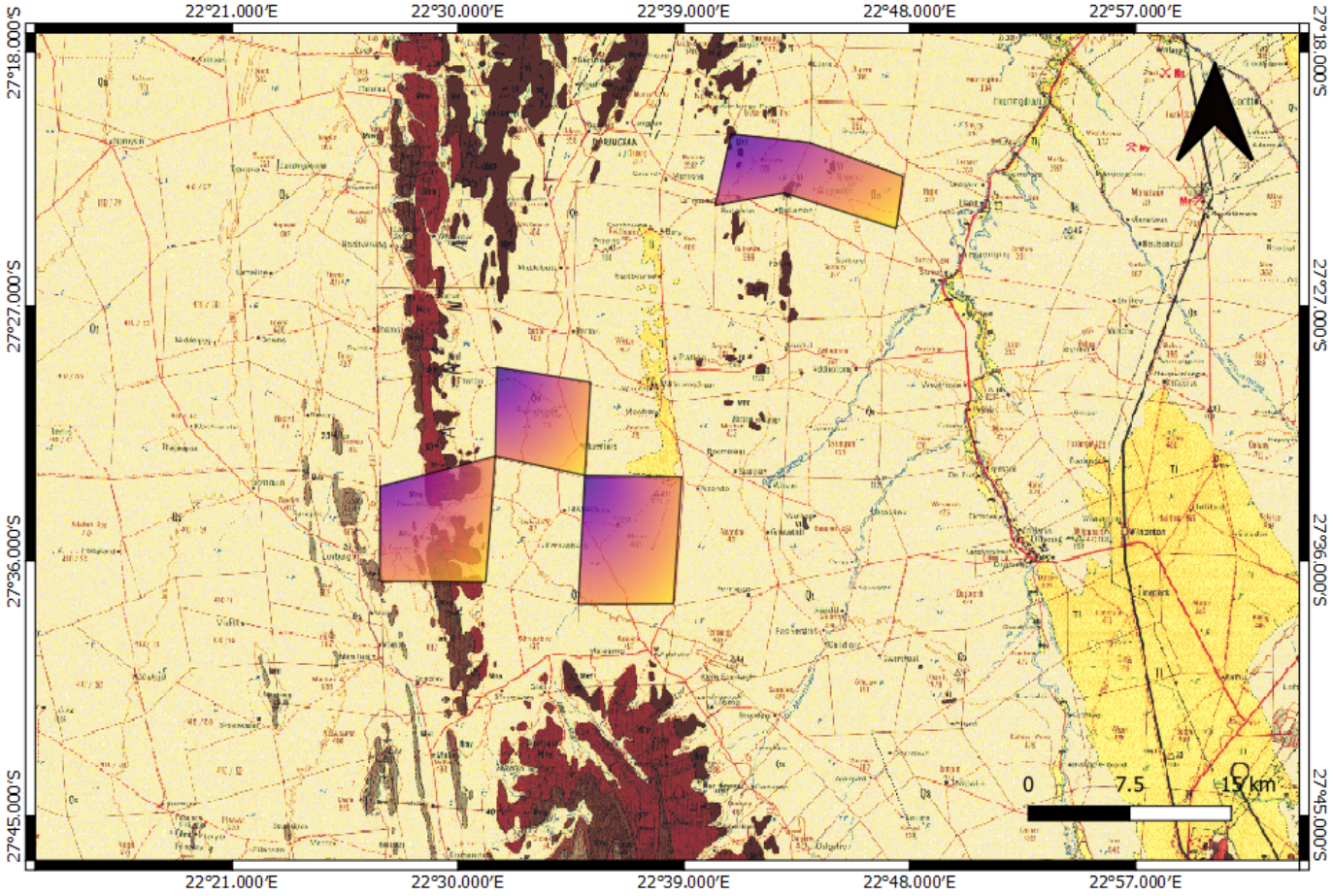


Figure 17: Extract of the 1:250 000 2722 Kuruman Geological Map (1976) (Council of Geoscience, Pretoria) indicating the locality of the proposed vineyard and game farm on Plot 337 and 396 near Kakamas in the Northern Cape.

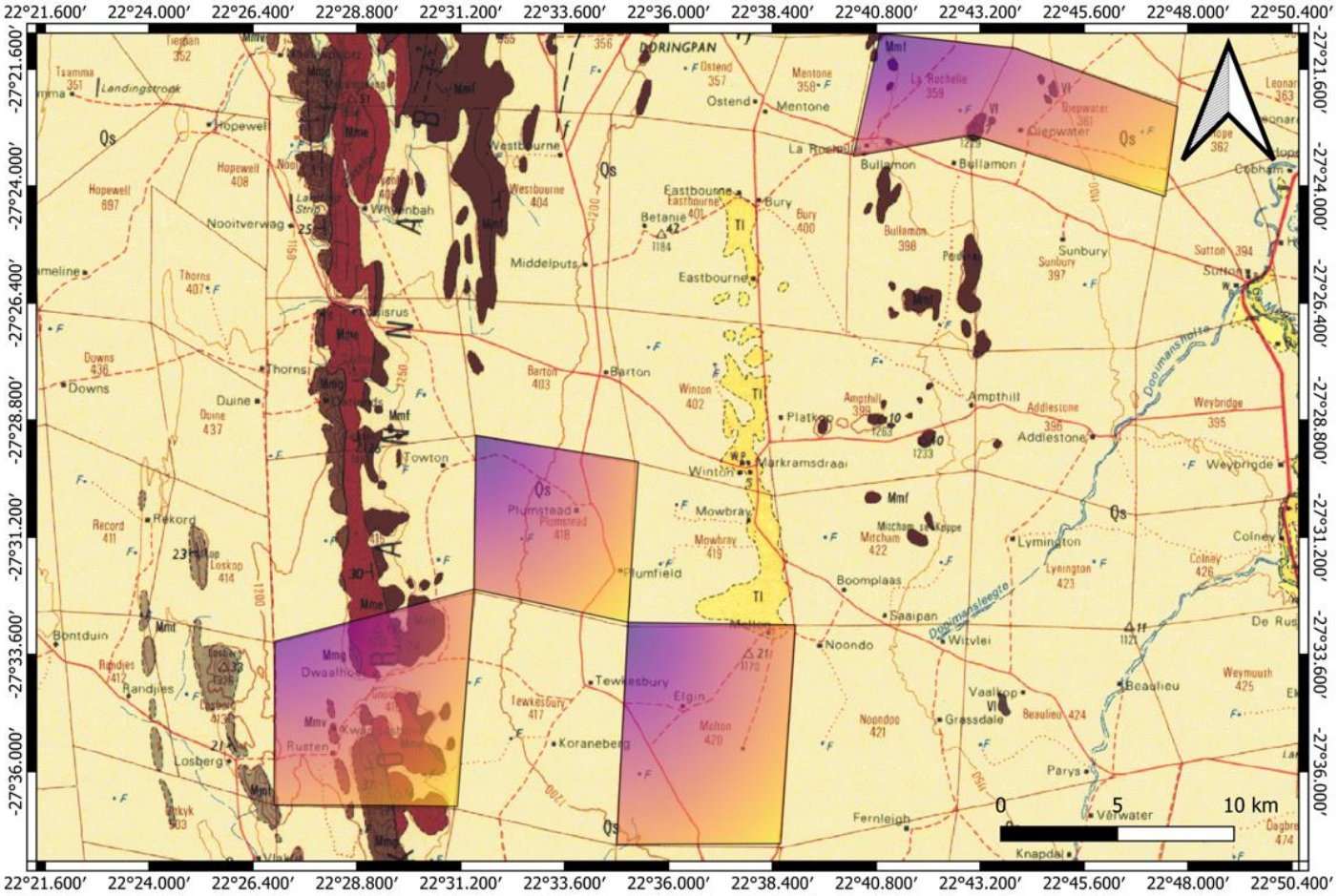


Figure 18:Close up view of the geology of the proposed development. A portion of Diepwater 361 (northeast) is underlain by the Matsap Subgroup of the of the Volop Group, the eastern tip of Melton 420 is underlain by surface limestone (Tl), while Gnoolooma in the west is underlain by sediments of the Matsap Subgroup (Glen Lyon (Mmg) and Mme Ellies Rus) while the rest of the development is underlain by surface windblown sand (Qs)

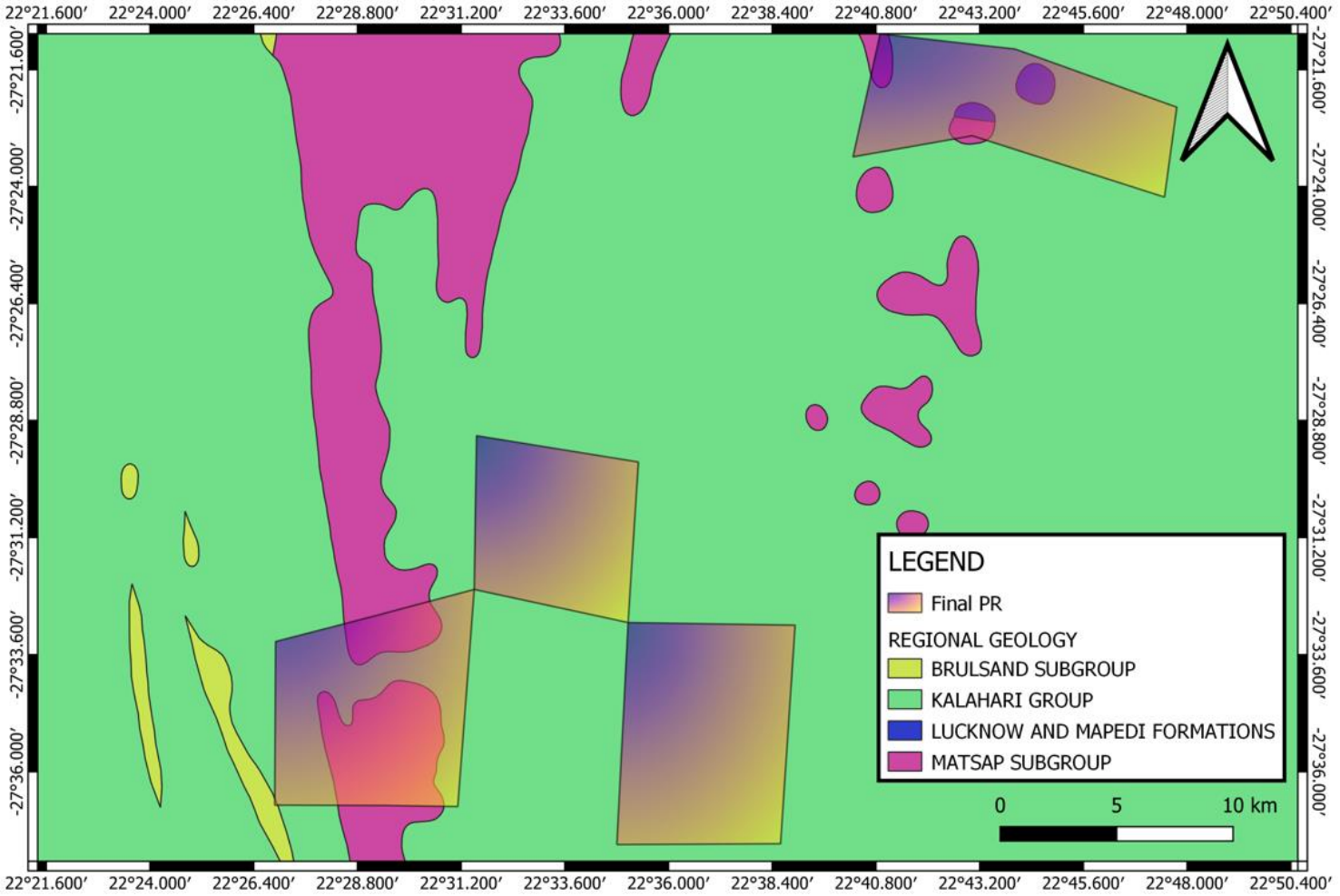
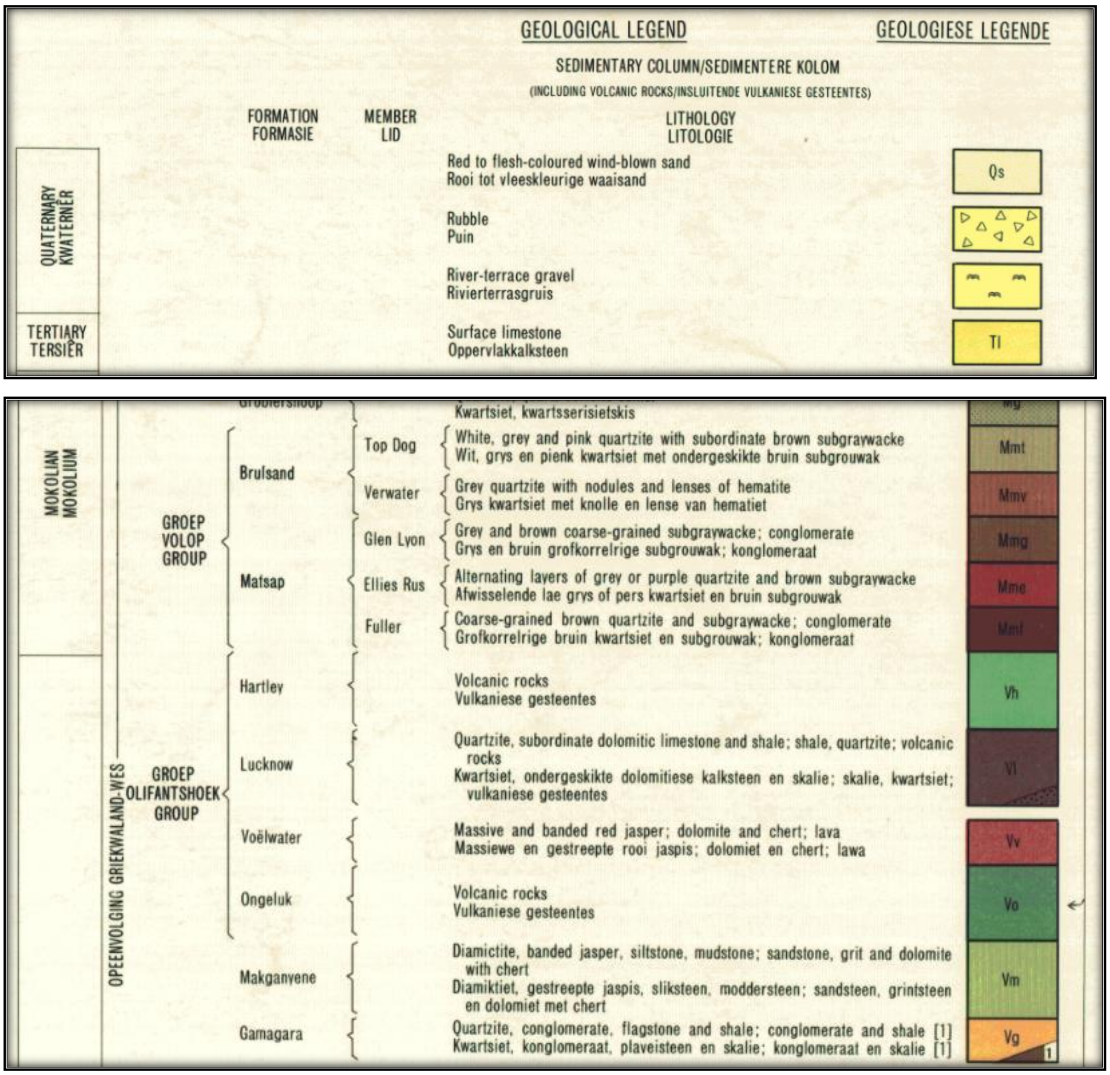
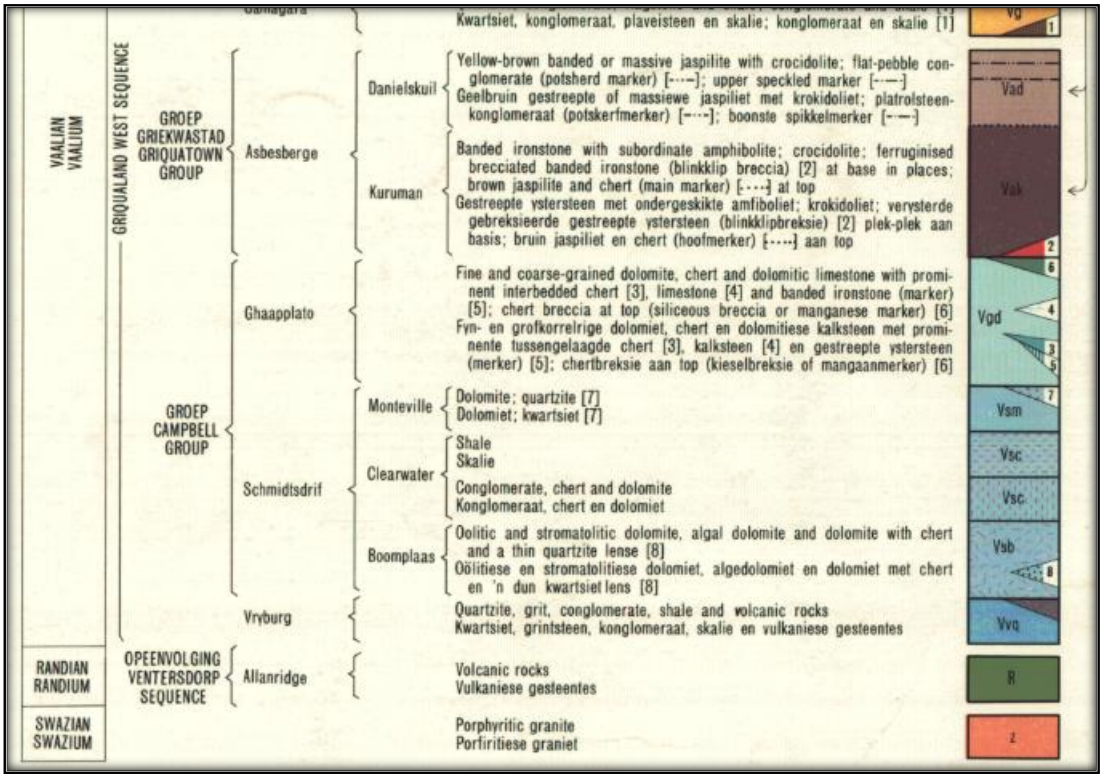


Figure 19: Surface geology of the proposed development (shape files obtained from the Council of Geosciences, Pretoria, Map drawn by QGIS 3.16).

Legend of the 1:250 000 2722 Kuruman Geological Map (1976) (Council of Geoscience, Pretoria)





Qs – Red to flesh-coloured wind-blown sand (beige). Kalahari Group. Quaternary.

Vo – Amygdaloidal andesitic lava with interbeds of tuff, agglomerate, chert and red jasper (green). Ongeluk Formation, Olifantshoek Group, Transvaal Supergroup.

Tl – Surface limestone (yellow). Kalahari Group.

Mmt- Top Dog Member; Brulsand Fm, Volop Group; white, grey and pink quartzite with subordinate brown subgraywacke

Mmv- Verwater Member, Brulsand Fm, Volop Group; Grey Quartzite with nodules and lenses of hamatite

Mmg- Glen Lyon Member, Matsap Fm, Volop Group; Grey and brown coarse-grained subgraywacke; conglomerate

Mme- Ellies Rus, Member, Matsap Fm, Volop Group; alternating layers of grey or purple quartzite and brown subgraywacke

Vad – Danielskuil Formation, Asbesberge Subgroup, Griqualand West Group, Transvaal Supergroup. yellow-brown banded or massive jaspilite and crocodolite.

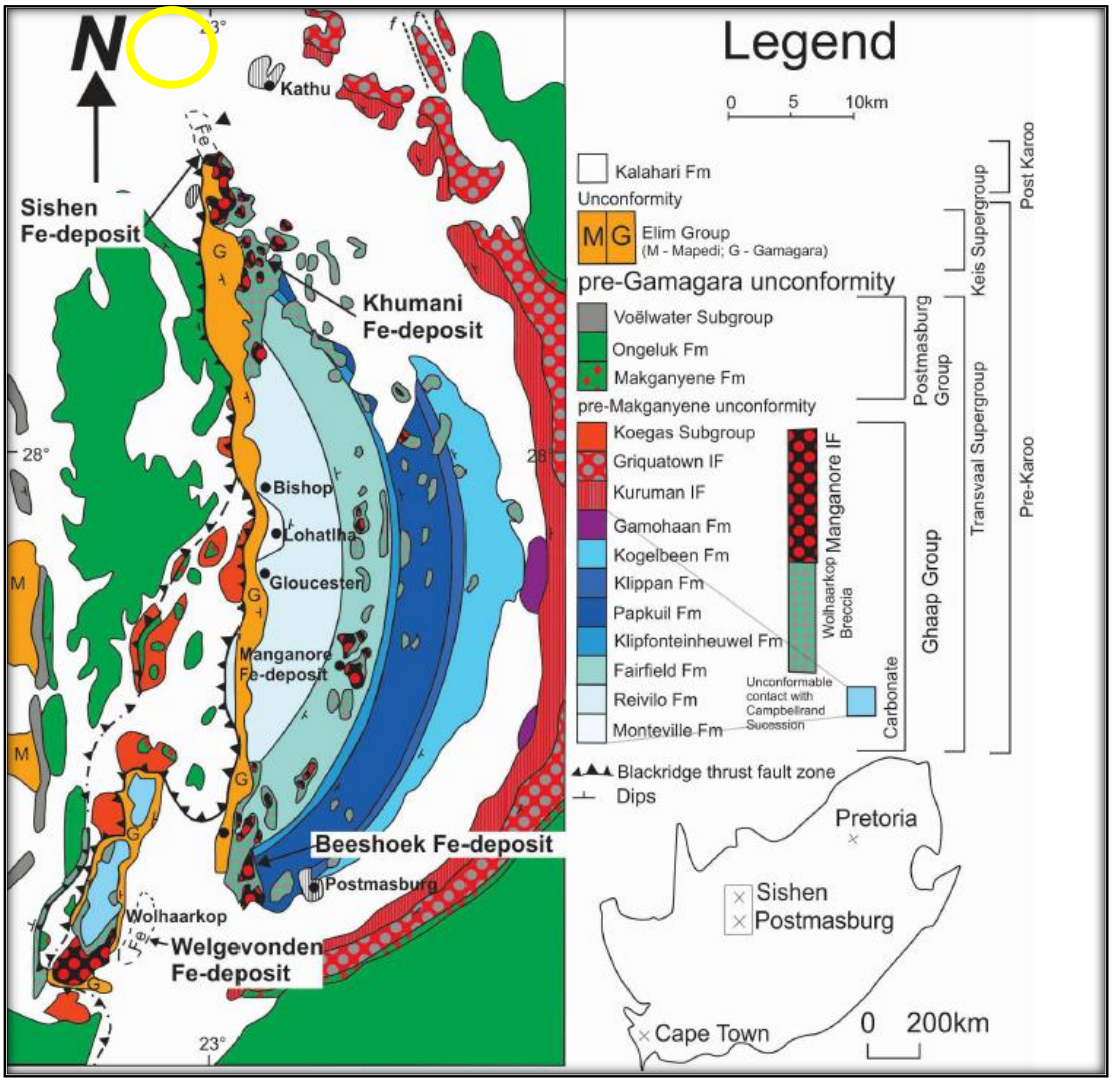


***Figure 20**: Updated Regional Geology of the Maremane Dome in the Northern* Cape (taken from Smith & Beukes 2016). *The approximate location of the proposed development is indicated by the yellow circle.*

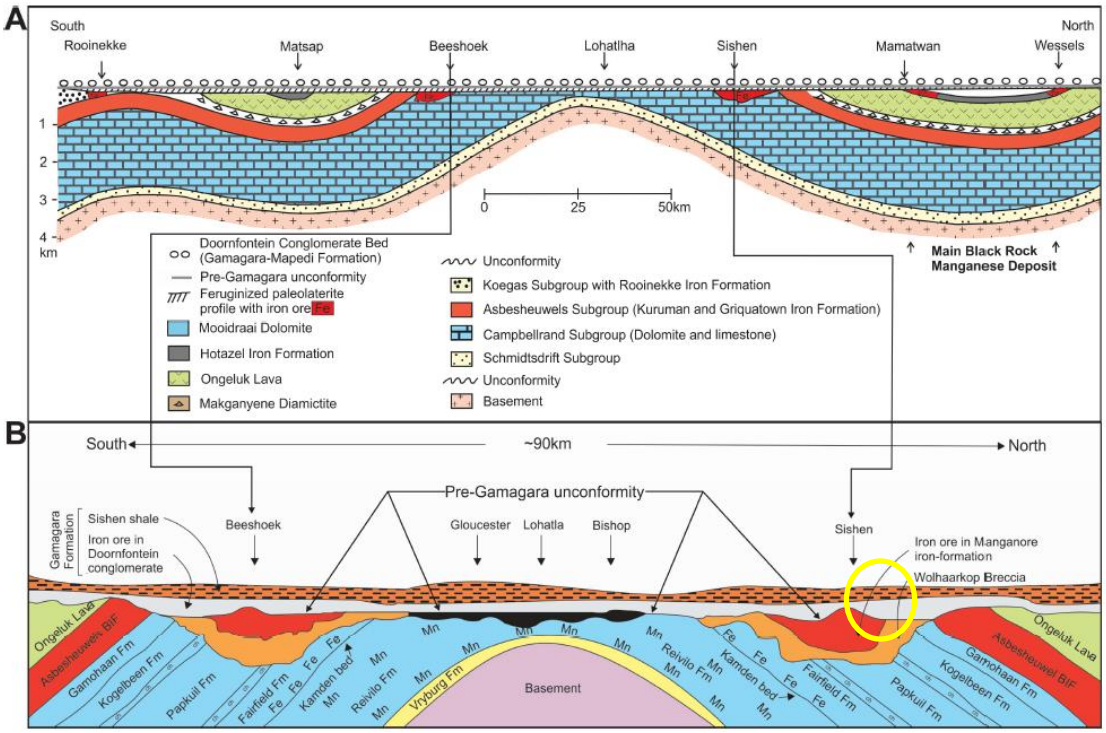


***Figure 21**: Schematic north-south cross section through (A) the western margin of the Griqualand West and (B) the Maremane Dome (modified after Cairncross et al, 1997; Van Deventer, 2009). Sub-surface dips of lithology are exaggerated for illustration purposes (taken from Smith & Beukes 2016). The approximate location of the proposed development is indicated by the yellow circle.*

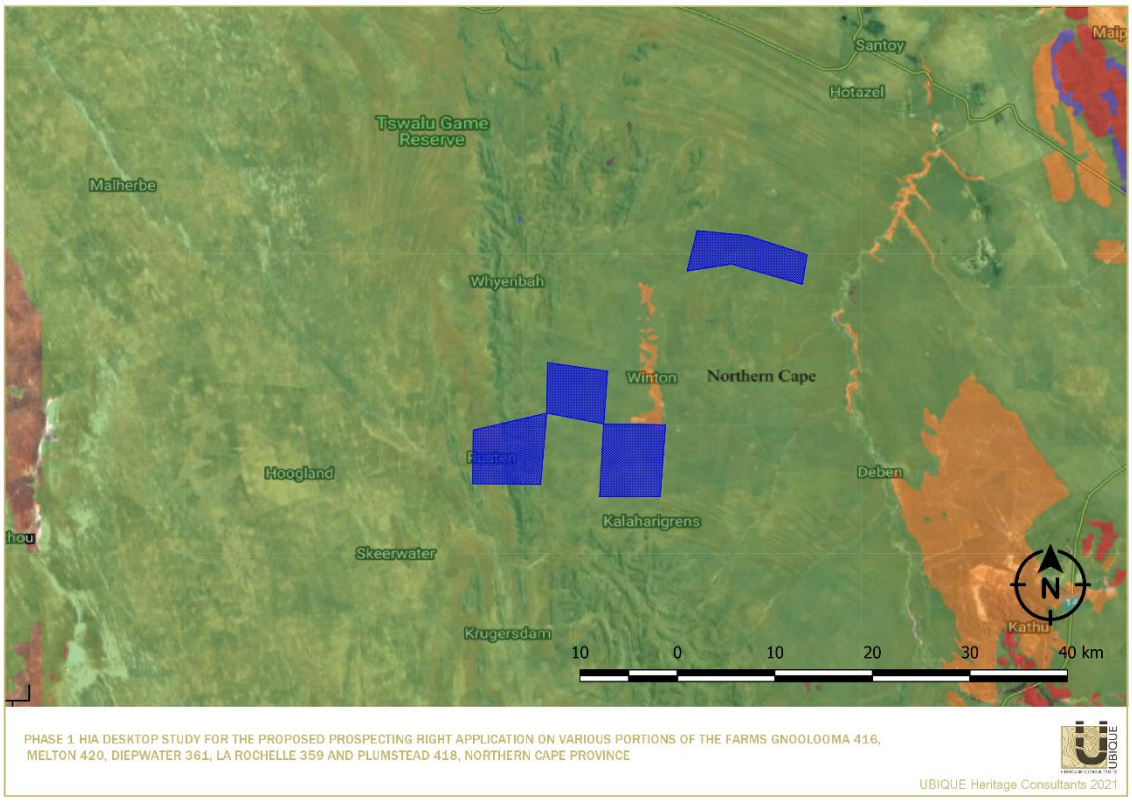


Figure 22: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the location of the proposed development.

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	**HIGH**	**desktop study is required and based on the outcome of the desktop study, a field assessment is likely**
GREEN	**MODERATE**	**desktop study is required**
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS palaeo sensitivity map (**Figure 10**) there is a moderate chance of finding fossils in the green area (Kalahari Group) and a relative high possibility of finding fossils in the surface

limestone. Literature does not indicate fossil finds in this area and as this area is extremely small, the possibility of finding fossils in this area is small.

6. GEOGRAPHICAL LOCATION OF THE SITE

The proposed study area for the prospecting for iron ore and manganese is located on Portions 1, 2, 3, 4 and the Remaining Extent (RE) of the Farm Gnoolooma 416, Portions 1 & the RE of the Farm Plumstead 418, Portions 1 & the RE of the Farm Melton 420, Portions 1 & the RE of the Farm Diepwater 361 and the RE of the Farm La Rochelle 359, situated in the Tsantsabane and Joe Morolong Local Municipalities, Northern Cape Province (Figure 1-3).

7. METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes all trace fossils and fossils. All available information is consulted to compile a desktop study and includes Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1. Assumptions and Limitations

The focal point of geological maps is the geology of the area, and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists, and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date, or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is sourced to provide information on the existence of fossils in an area that was not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies, it is generally **assumed** that exposed fossil heritage is present within the footprint. **A field assessment will thus improve the accuracy of the desktop assessment.**

8. ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984),

1: 250 000 2722 Kuruman Geological Map (1976) (Council of Geoscience, Pretoria)

A Google Earth map with polygons of the proposed development was obtained from Unique Heritage Consultants.

9. IMPACT ASSESSMENT METHODOLOGY

Impact assessment must take account of the nature, scale and duration of impacts on the environment, whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria are used:

Table 3: The Rating System-

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory.

		Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.

2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.** The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately.

		These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

(**Extent (1) + probability (2) + reversibility (4) + irreplaceability (4) + duration (4) + cumulative effect) (2) x magnitude/intensity (1) = 17**

9.1. Summary of Impact Tables

Loss of fossil heritage will be a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a low probability. The magnitude of the impact on the fossil heritage will be low. The significance of the impact occurring will be LOW.

10. FINDINGS AND RECOMMENDATIONS

The proposed development near Kathu in the Northern Cape is underlain by Quaternary aged sediments of the Kalahari Group as well as According to this map the proposed development is largely underlain surface windblown sand as well as surface limestone with the western portion of the study area underlain by rocks of the Griqualand West Basin. The general low palaeontological sensitivity of the bedrocks and superficial sediments in the proposed development footprint, indicates that the proposed development will have an overall LOW impact significance in terms of palaeontological heritage. It is therefore considered that the development is will not lead to detrimental impacts on the palaeontological resources of the area. If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation can be carry out by a paleontologist.

It is consequently recommended that no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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