PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED DEVELOPMENT OF OPEN PIT MINING AT PIT 36W (New Pit) AND 62E (Dishaba) AMANDELBULT MINE COMPLEX, THABAZIMBI, LIMPOPO PROVINCE.

Prepared for:

PGS HERITAGE (PTY) LTD

DATE: 25 April 2017

By

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EXECUTIVE SUMMARY

Banzai Environmental Pty (Ltd) was appointed by PGS Heritage to undertake a Palaeontological desktop assessment assessing the potential palaeontological impact of the planned mining activities on the farm Haakdoorndrift 374 KQ, portion 4 (Pit 62E and 60E, Dishaba) and Elandsfontein 386 KQ, portion 0 (Pit 36W, New Pit), Thabazimbi, Limpopo Province. This report forms part of the Basic Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. According to the latter Act, a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to assess the impact of the construction and operation of the project on the palaeontological resources.

The proposed Study Area is entirely underlain by sedimentary rocks of the **Bushveld Igneous Complex and Quaternary sediments overlying the igneous bedrock**. These intrusive igneous rocks of the Rustenburg Layered Suite are completely unfossiliferous. Igneous rocks thus have **no significance** in terms of local palaeontological heritage. The Quaternary superficial deposits have been relatively neglected in palaeontological terms but they may sometimes contain important fossil biotas. These fossil assemblages in the Quaternary are mostly sparse, low in diversity, and occur over a wide geographic area, and thus the **palaeontological sensitivity** of the Quaternary deposits within the study region is rated as **low**. Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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1 INTRODUCTION

Aurecon South Africa (Pty) Ltd has been appointed by Anglo American Platinum Amandelbult Mine to assist with a Basic Assessment process for two open cast pits namely Pit 62E and an EMP-amendment for Pit 36W, Thabazimbi, Limpopo Province, South Africa.

Banzai Environmental Pty Ltd has been appointed by PGS Heritage in assessing the palaeontological impact in the proposed mining activities on Haakdoorndrift 374 KQ, portion 4 (Pit 62E and 60E, Dishaba) and Elandsfontein 386 KQ, portion 0 (Pit 36W, New Pit) Thabazimbi, Limpopo Province (Fig.1-2).

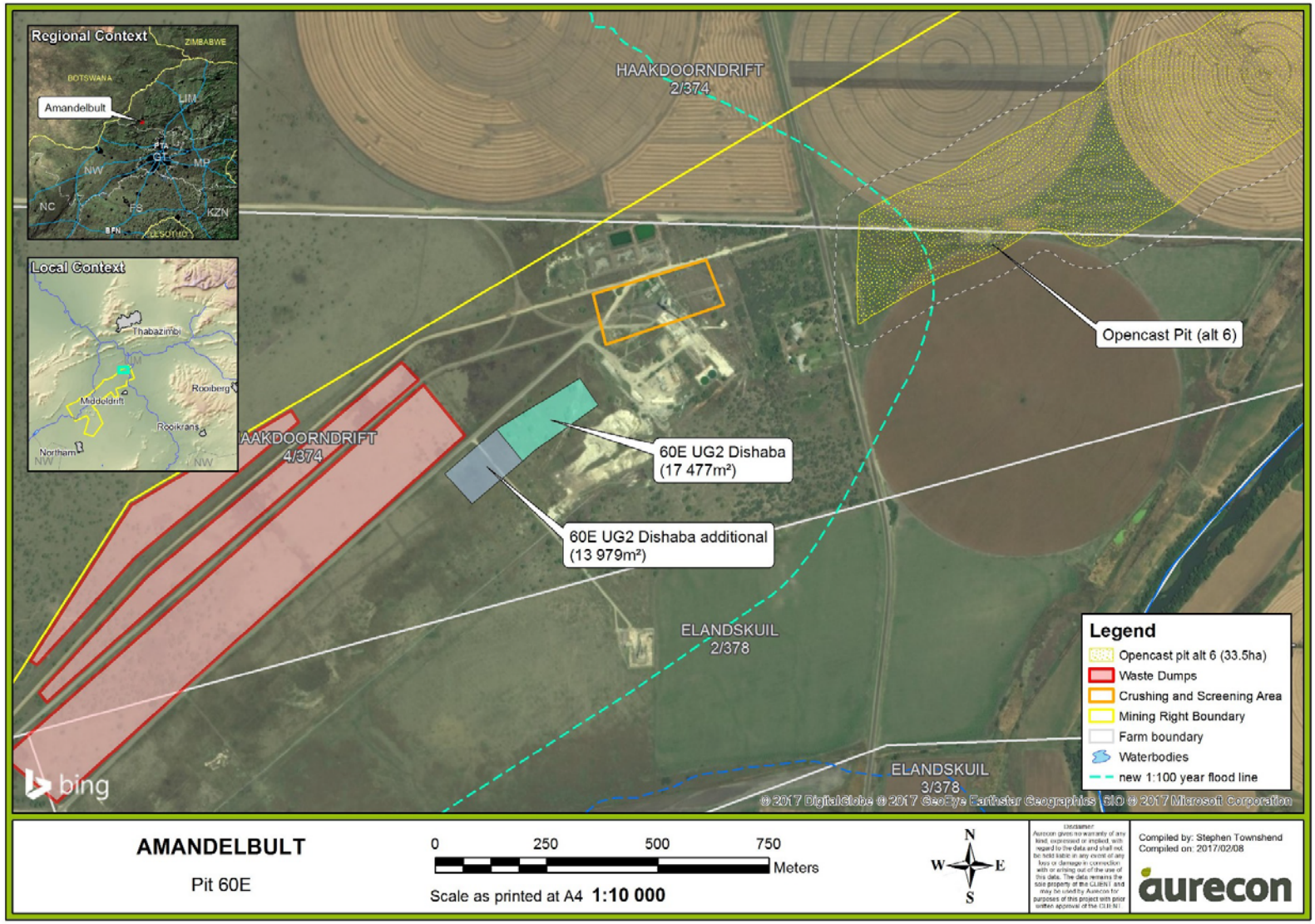

Figure 1 Locality map of Pit 62E, made up of the two 60E portions shown as blue and green polygons.

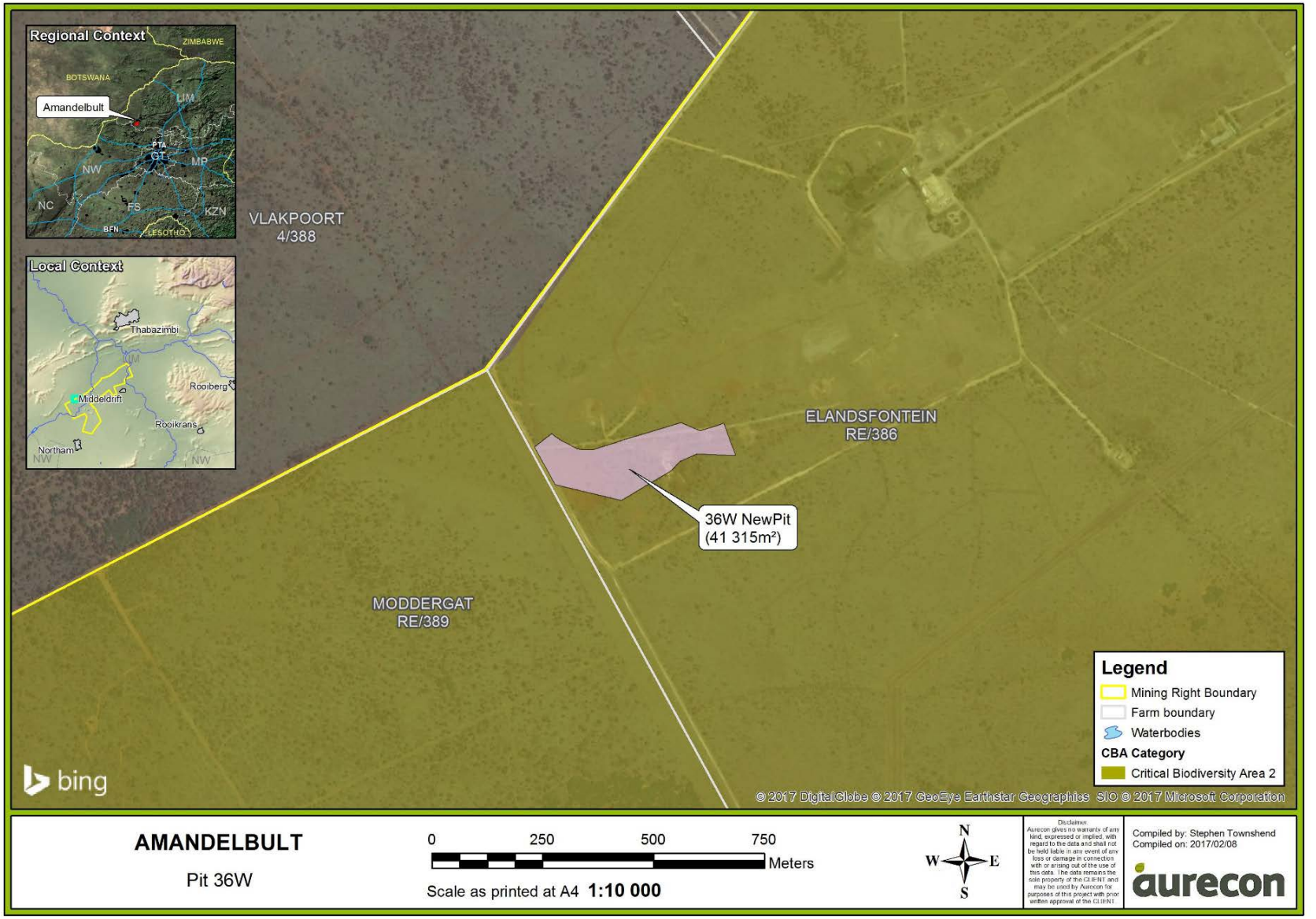

Figure 2. Locality map of Pit 36W, showing its location within a Critical Biodiversity Area as per the Limpopo Conservation Plan.

2 SCOPE

According to the South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites (APM) Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports, the aims of the palaeontological impact assessment are:

- To identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- To assess the level of palaeontological significance of these formations;
- To comment on the impact of the development on these exposed and/or potential fossil resources; and
- To make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is therefore to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA) and the EIA Report, to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; fossil sensitivity maps; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area on a desktop level. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of the palaeontological sensitivity of the rocks and the nature and scale of the development itself (extent of new bedrock excavated).

If rocks of moderate to high palaeontological sensitivity are present within the study area, a Phase 1 field-based assessment by a professional palaeontologist is necessary. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.

When specialist palaeontological mitigation is suggested, it may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is

still exposed and available for study. Mitigation usually involves the careful sampling, collection and recording of fossils, as well as relevant data concerning the surrounding sedimentary matrix. Excavation of the fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. With appropriate mitigation, many developments involving bedrock excavation will have a *positive* impact on our understanding of local palaeontological heritage.

2.1 ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist.
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g*. of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

2.2 LEGISLATION

Cultural Heritage in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Environmental Impact Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the site.

SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999

In Section 3 of The National Heritage Resources Act, various categories of heritage resources are recognized as part of the National Estate. This include among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- 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;
    - Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
    - Trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
    - Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
    - Serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order; and/or

- Carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary.

3 GEOGRAPHICAL LOCATION OF THE SITE

The proposed open cast pits of Pit 62E and 60E (Dishaba), and Pit 36W (New Pit) is located approximately 15km north of Northam and 20km south of Thabazimbi in the Limpopo Province, South Africa (Fig.1-2).

4 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed study site is completely underlain by the **Rustenburg Layered Suite of the Bushveld Igneous Complex** and **Quaternary sediments** overlying the igneous bedrock.

4.1 GEOLOGY

4.1.1 Bushveld Igneous Complex

The Rustenburg Layered Suite is Vaalian in age (2,100 – 1,920 Million years old) and consists of an igneous intrusion with anorthosite, hybrid gabbro, gabbro, diabase, epidiorite, pyroxenite, and norite rocks.

4.1.2 Quaternary sediments

Quaternary superficial deposits of Late Caenozoic (Miocene to Pliocene to Recent) age occur throughout the Karoo Basin (Partridge et al. 2006). They include pedocretes (for example calcretes), colluvial slope deposits, down wasted surface gravels, river alluvium, wind-blown sands and spring and pan sediments. Hill slopes are frequently mantled with a layer of colluvium or slope deposits (e.g. sandstone and dolerite scree).

4.2 PALAEONTOLOGICAL HERITAGE

4.2.1 Bushveld Igneous Complex

These intrusive igneous rocks of the Rustenburg Layered Suite are completely unfossiliferous. This layer in the proposed development site is thus of NO significance in terms of local palaeontological heritage.

4.2.2 Quaternary sediments

In palaeontological terms the Quaternary superficial deposits have been relatively neglected. They may sometimes contain important fossil biotas, e.g. bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises. Non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites), and plant remains such as peats or palynomorphs (pollens, spores) in organic-rich alluvial horizons. Siliceous diatoms in pan sediments have also been found. These fossil assemblages are rare, low in diversity, and occur over a wide geographic area, and thus the palaeontological sensitivity of the Quaternary deposits in the study region is rated as low.

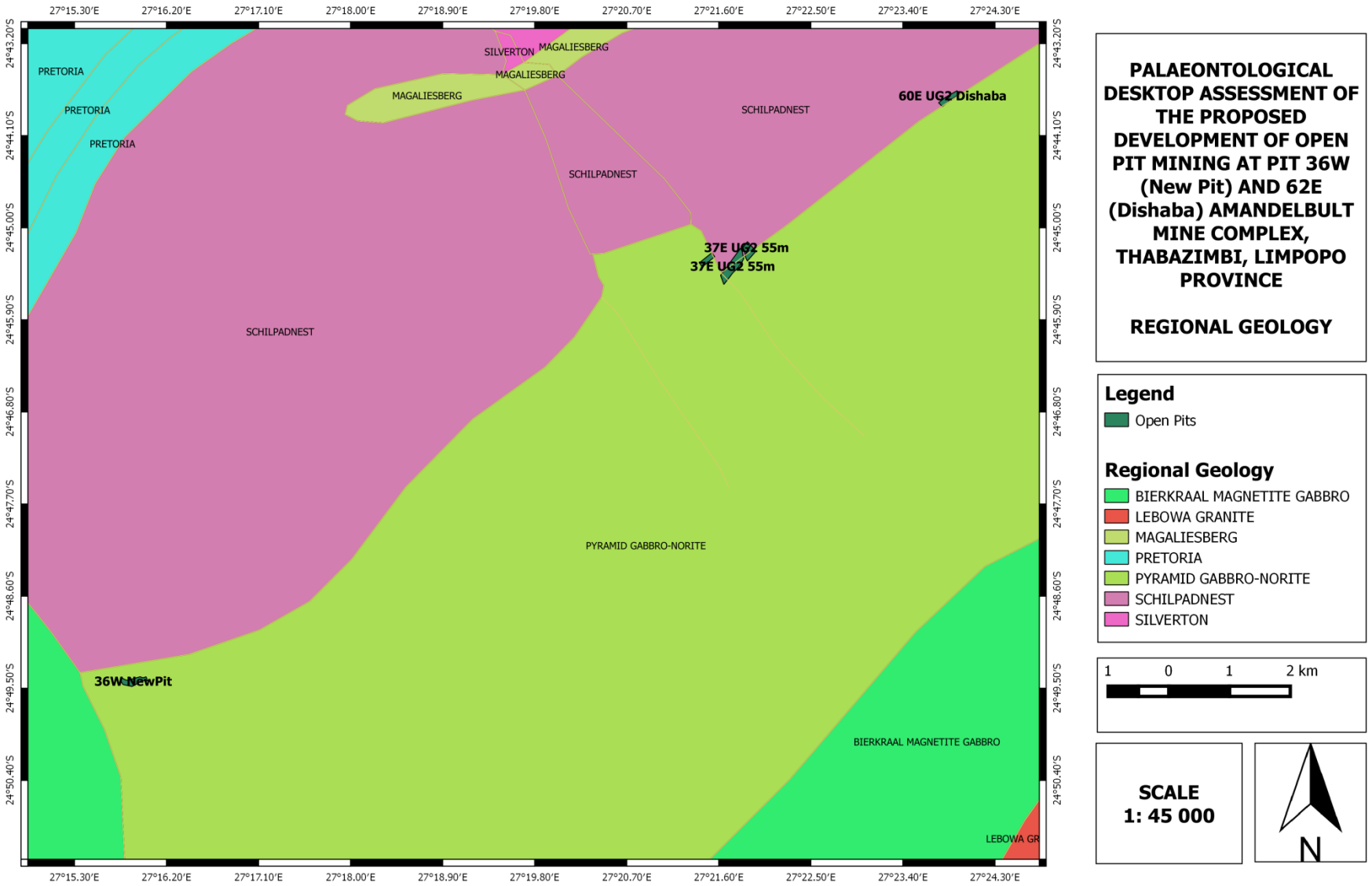

Figure 3: The surface geology of the proposed new mining operations (indicated in dark green) on the farm Haakdoorndrift 374 KQ, portion 4 (Pit 62E and 60E, Dishaba) and Elandsfontein 386 KQ, portion 0 (Pit 36W, New Pit), Thabazimbi, Limpopo Province. The open pit mining site is completely underlain by the Rustenburg Layered Suite of the Bushveld Igneous Complex and Quaternary sediments overlying the igneous bedrock.

5 IMPACT ASSESSMENT

These intrusive igneous rocks of the **Rustenburg Layered Suite** are completely **unfossiliferous**. **This layer** thus has NO significance in terms of local palaeontological heritage.

The **Quaternary superficial deposits** have been relatively neglected in palaeontological terms. They may sometimes contain important fossil biotas, e.g. bones, teeth and horn cores of mammals and reptile remains. Non-marine molluscs, ostrich egg shells, trace fossils and plant remains in organic-rich alluvial horizons are also preserved. Siliceous diatoms in pan sediments have been found. These fossil assemblages in the Quaternary are rare, low in diversity, and occur over a wide geographic area, and thus the **palaeontological sensitivity** of the Quaternary deposits within the study region is rated as **low.** Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

The Impact ratings relevant to the proposed open cast pits of Pit 62E and 60E (Dishaba), and Pit 36W (New Pit), Thabazimbi are indicated in yellow.

Table 1: Definition of Intensity ratings

Rating	Criteria	
	Negative impacts (-)	**Positive impacts (+)**
Very high (-/+ 4)	Very high degree of damage to natural or social systems or resources. These processes or resources may restore to their pre-project condition over very	Great improvement to ecosystem or social processes and services or resources.
High (-/+ 3)	High degree damage to natural or social system components, species or	Intense positive benefits for natural or social systems or resources.
Moderate (-/+ 2)	Moderate damage to natural or social system components, species or	Average, on-going positive benefits for natural or social systems or resources.
Low (-/+ 1)	Minor damage to natural or social system components, species or resources. Likely to recover over time. Ecosystems and valuable social	Low positive impacts on natural or social systems or resources.
Negligible (0)	Negligible damage to individual components of natural or social systems or resources, such that it is	Limited low-level benefits to natural or social systems or resources.

Table 2: Definition of Duration ratings

Rating	Criteria
2	**Long-term**: The impact will continue for 6-15 years.
1	**Medium-term:** The impact will continue for 2-5 years.
0	**Short-term:** The impact will continue for between 1 month and 2 years.

Table 3: Definition of Extent ratings

Rating	Criteria
2	**Regional:** The impact will affect the entire region
1	**Local:** The impact will extend across the site and to nearby properties.
0	**Site specific:** The impact will be limited to the site or immediate area.

Table 4: Definition of Probability ratings

Rating	Criteria
4	**Certain/ Definite:** There are sound scientific reasons to expect that the impact will
3	**Very likely:** It is most likely that the impact will occur.
2	**Fairly likely:** This impact has occurred numerous times here or elsewhere in a similar environment and with a similar type of development and could very conceivably
1	**Unlikely:** This impact has not happened yet but could happen.
0	**Very unlikely:** The impact is expected never to happen or has a very low chance of

Table 5: Application of Consequence ratings

Rating	Consequence rating
-8	Extremely detrimental
-7 to -6	Highly detrimental
-5 to -4	Moderately detrimental
-3 to -2	Slightly detrimental
-1 to 1	Negligible
2 to 3	Slightly beneficial
4 to 5	Moderately beneficial
6 to 7	Highly beneficial
8	Extremely beneficial

Table 6: Application of significance ratings

Rating	Significance rating
-4	Very high - negative
-3	High - negative
-2	Moderate - negative
-1	Low - negative
0	Very low
1	Low - positive
2	Moderate - positive

3	High - positive
4	Very high - positive

Table 7: Definition of Confidence ratings

Rating	Criteria
Low	Judgement is based on intuition and there some major assumptions used in
Medium	Determination is based on common sense and general knowledge. The assumptions made, whilst having a degree of uncertainty, are fairly robust.
High	Substantive supportive data or evidence exists to verify the assessment.

Table Summary

- The Intensity of the development on the Palaeontological Heritage is Low negative.
- The Duration of the Impact will be long term (6-15 years).
- The duration of the extent will be site specific.
- The probability is unlikely that the impact will occur.
- The development will only be slightly detrimental to the environment.
- The significance of the impact is low negative and the latter can all be said with a medium confidence.

Mitigation Measures

It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development, **pending** the discovery or exposure of any fossil remains during the construction phase.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

6 FINDINGS AND RECOMMENDATIONS

The proposed development site of the new open cast mining operations on planned mining activities on the farm Haakdoorndrift 374 KQ, portion 4 (Pit 62E and 60E, Dishaba) and Elandsfontein 386 KQ, portion 0 (Pit 36W, New Pit), Thabazimbi, Limpopo Province is completely underlain by the Rustenburg Layered Suite of the Bushveld Igneous Complex and Quaternary sediments overlying the igneous bedrock.

These intrusive igneous rocks of the **Rustenburg Layered Suite** are completely **unfossiliferous**. **This layer** thus has **NO significance** in terms of local palaeontological heritage.

The **Quaternary superficial deposits** have been relatively neglected in palaeontological terms. They may sometimes contain important fossil biotas, e.g. bones, teeth and horn cores of mammals and reptile remains. Non-marine molluscs, ostrich egg shells, trace fossils and plant remains in organic-rich alluvial horizons are also preserved. Siliceous diatoms in pan sediments have been found. These fossil assemblages **in the Quaternary** are rare, low in diversity, and occur over a wide geographic area, and thus the **palaeontological sensitivity** of the **Quaternary** deposits within the study region is rated as **low.** Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

7 PROTOCOL FOR FINDS

Determine the geology of the development area

- The Environment Control Officer (ECO) (Environmental Manager) in collaboration with the project geologist must determine the geological background of areas where development will expose bedrock.
- The SAHRIS Fossil Heritage Layer (available from the SAHRA web page) needs to be consulted to determine whether the geology is considered sensitive. If the geology is found to be insignificant development may proceed without hindrance. When the SAHRIS Fossil Heritage indicates a low significance or higher a palaeontologist with the necessary expertise must be identified.

Palaeontological field assessment

- The ECO must obtain the services of a qualified palaeontologist.
- The palaeontologist will conduct a field assessment to identify and assess any possible fossils that may occur in the rocks. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.
- If fossils are found on the development site the palaeontologist involved would require a collection permit from SAHRA.
- Mitigation may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is still exposed and available for study. Mitigation entails careful sampling, collection and recording of fossils, as well as relevant data concerning the surrounding sedimentary matrix.
- Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

Ongoing fossil collection in the Mining Industry

- The ECO must confirm that the mine geologist regularly inspect the potential fossil bearing rock before being discarded.
- The ECO must collect any identified fossiliferous material.
- The relevant qualified palaeontologist must carry out inspections of the discard dumps on a regular basis (timeframe agreed with Mine).

- The palaeontologist will remove fossils from the mine that is considered to be of good quality or scientific value and catalogue them for curation.

Chance find Procedure

- If a chance find is made the person responsible for the find must immediately stop all work near the find.
- The site must be secured to protect it from any further damage
- The person who made the find must immediately report the find to his/her direct supervisor, according to reporting protocols instituted by the Mine. The supervisor must report the find to his/her manager and the ECO. The ECO must report the find to the relevant Authorities and a relevant palaeontologist.
- The ECO must make sure that a relevant palaeontologist is engaged to investigate the chance find and site and assess its context, age and possibility of the find representing a more extensive site.
- Both ECO and palaeontological specialist must ensure that accurate records and documentation are kept. (Documentation must start with the initial find report, and include records of all actions taken, persons involved and contacted, comments received and findings).
- Documentation and records will be essential to request authorizations and permits from the relevant Authorities to continue work on site
- The palaeontologist will submit a report, which will include all records kept by the ECO to SAHRA.
- The report will include recommendations for additional specialist work that may be necessary, or request approval to continue with the development.
- Once the necessary approvals have been issued, the Mine may carry on with the development.
- The ECO will be in charge to close off the chance find procedure and could require implementing or integrating any requirements issued by any Authority into operational management plans

8 REFERENCES

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9 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty three years. She has been conducting Palaeontological Impact Assessments since 2014.

10 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 favourable 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 favourable 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 realise that a false declaration is an offence 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:  _____