



PALAEONTOLOGICAL DESKTOP ASSESSMENT

S24G PROCESS:

CONSTRUCTION AND
INFILLING OF
WATERCOURSE ON
TIEGERPOORT FARM,
GAUTENG

2022

COMPILED FOR: Alta van Dyk
Environmental



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.

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SIGNATURE:



The Palaeontological Desktop 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: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the 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 5 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 6 – 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 & 10	Desktop Assessment



Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(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 specifically 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 & 10	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 10	
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6 – Geological and 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	Section 1 and 10	
(l) Any conditions for inclusion in the environmental authorisation	Section 1 and 10	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 10	



Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(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 EMP, 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 was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.



Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not 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 to conduct the Palaeontological Desktop Assessment (PDA) for the S24G Process for the unlawful construction and infilling of a watercourse on the Remainder of Portion 274 of the Farm Tiegerpoort 371-JR, City of Tshwane, Gauteng Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The study area is underlain by intrusive diabase rocks as well as the Silverton and Daspoort Formations of the Pretoria Group (Transvaal Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the intrusive metamorphic diabase rocks is Zero while that of the Silverton and Daspoort Formations is High. The Updated Geology compiled by the Council for Geosciences (Pretoria) indicates that the S24G application is entirely underlain by the Daspoort Formation of the Pretoria Group (Transvaal Supergroup).

The Pretoria Group sedimentary rocks in and near the study area are extensively intruded, and locally metamorphosed by the intrusion of diabase. These rocks would have had a thermal metamorphic effect on the nearby sediments of the Pretoria Group that would in turn decrease the chance of fossil preservation. **It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area and that the S24G Application be granted from a Palaeontological view.**

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager 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 mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.



TABLE OF CONTENT

1	INTRODUCTION'	2
2	APPLICABLE ENVIRONMENTAL LEGISLATION	6
2.1	National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA): EIA Regulations	6
2.2	National Environmental Management Waste Act, 2008 (Act 59 of 2008) (NEMWA)	8
2.3	National Water Act, 1998 (Act 36 of 1998)	8
3	QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	8
4	LEGISLATION	9
5	OBJECTIVE	11
6	GEOLOGICAL AND PALAEOLOGICAL HISTORY	12
7	METHODS	17
7.1	Assumptions and Limitations	18
8	ADDITIONAL INFORMATION CONSULTED	18
9	IMPACT ASSESSMENT METHODOLOGY	19
9.1	Summary of Impact Tables	20
10	FINDINGS AND RECOMMENDATIONS	20
11	CHANCE FINDS PROTOCOL	21
11.1	Chance Find Procedure	22
12	BIBLIOGRAPHY	23



List of Figures

Figure 1:Regional Locality of the S24G Application on Tiegerpoort Farm, City of Tshwane, in Gauteng. ... 2

Figure 2: Locality of the S24G Application on Tiegerpoort Farm, City of Tshwane, in Gauteng. 3

Figure 3:Google Earth Image (2019) showing the access points in relation to the site 4

Figure 4:Google Earth Image (2021) showing the construction activities undertaken on site 5

Figure 5: Extract of the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) indicating the S24G Application in Gauteng. 14

Figure 6: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences, Pretoria) indicating the S24G Application. 16

Figure 7:Updated Geology (Council of Geosciences, Pretoria) of the S24G Application on Farm Tiegerpoort, in Gauteng. 17

List of Tables

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)..... iv

Table 2: Listed Activities Triggered 6

Table 3:NEWA Triggered Activities 8

Table 4: Legend of the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) 15

Table 5:Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website 16

Table 6: The rating system 19

Table 7: Summary of Impact Tables 20

Appendix A: CV

1 INTRODUCTION

Alta van Dyk Environmental has been appointed by Ms. Sethole to undertake the application process for an *Ex Post Facto* environmental authorisation according to NEMA S24G for the construction and infilling of a watercourse on the Remainder of Portion 274 of the Farm Tiegerpoort 371-JR, Gauteng Province. This application will also require a Water Use License Application in terms of the National Water Act, 1998 (Act 36 of 1998).

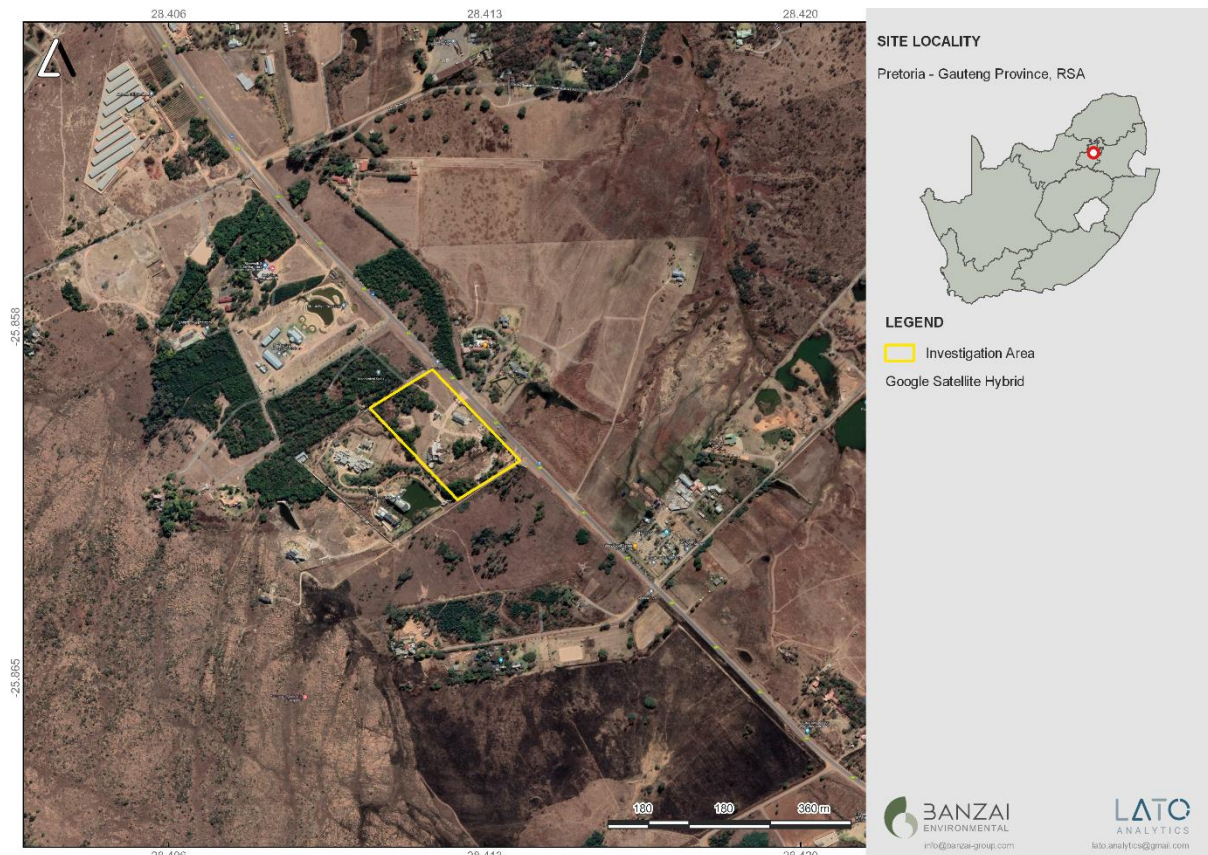


Figure 1:Regional Locality of the S24G Application on Tiegerpoort Farm, City of Tshwane, in Gauteng.

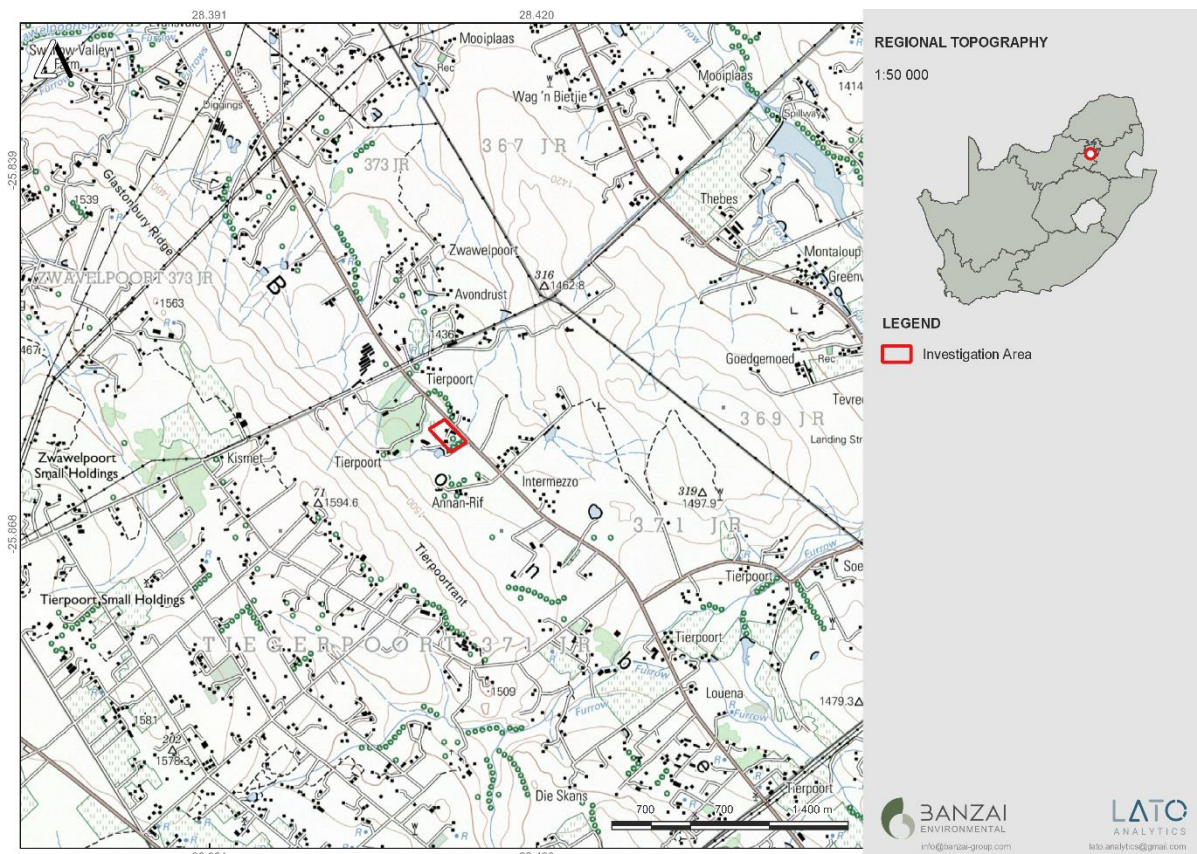


Figure 2: Locality of the S24G Application on Tiegertpoort Farm, City of Tshwane, in Gauteng.

In June 2021, Ms. Sethole commenced with activities listed in terms of NEMA Environmental Impact Assessment (EIA) Regulations 2014 (as amended) and National Environmental Management Waste Act, 2008, GNR 921 of 2013 without obtaining Environmental Authorisation (EA) from the relevant Competent Authority, the Gauteng Department of Agriculture and Rural Development (GDARD). Realizing the contravention, Ms. Sethole has voluntarily decided to undertake a Section 24G application process and construction activities on site have ceased.

The current consent of use for the property is for a “guesthouse” which was approved by the former Kungwini Local Municipality. It is however the intention of Ms. Sethole to include certain land uses on the site to make provision for a wider convenient service to be provided at the facility. These include a conference center, wedding chapel, staff quarters, and self-catering units. The aforementioned land uses do not fall under the definition of a guest house, hence Ms. Sethole applied to the City of Tshwane for consent of a lodge in 2019. The application was submitted in terms of Clause 16 of the Tshwane Town-Planning scheme, 2008 (revised 2014) read with Section 16(3) of the City of Tshwane Land-Use Management By-Law, 2016.

Approval in terms of the consent use application has not yet been obtained from the City of Tshwane (CoT). However, the Gauteng Department of Roads and Transport (Gautrans) as a Commentary Authority approved the application with certain conditions. Comments received from the CoT: Transportation Planning Division indicated that the access point to the facility shall be relocated as it is not in line with the CoT Roads Master Plan (RMP). Currently access to the site is gained from the north eastern boundary off Graham Road, and the CoT requested that access to the property should be gained from the right of way servitude that intersects with Graham Road. This is the gravel road to the south east of the property. The new access road will join an existing road (developed prior to 1998). The existing road is a narrow width gravel road, approximately 4m wide which traversed the watercourse. (Figure 3). In order to make use of the existing access road, access to the site will have to be via the south eastern boundary.



Figure 3: Google Earth Image (2019) showing the access points in relation to the site

Due to the constrictions associated with the south eastern access, Ms. Sethole appointed Design Engineers for the design of the road and a floodline assessment was undertaken to determine the geographical location of the relevant floodlines. A Water Use License Application process was also in progress for the watercourse crossing.

As the request for change in access was a formal response from the CoT, Ms. Sethole was under the impression that she could commence with the construction activities on site without any further approvals. Construction activities on site commenced in June 2021 which include the following (Figure 4).

- Relocating the entry/exit point from Graham Road (north of the site) to the south east of the site (approximately 100m from Graham Road);
- The construction of an access road;
- The widening of an existing access road;
- Construction of a culvert within the watercourse;
- Deposition and infilling with inert building rubble and excavations within a watercourse; and
- The disposal of inert waste on land (building rubble).

An attenuation dam previously existed along the watercourse, west of the existing water crossing. Ms. Sethole has infilled the attenuation pond and constructed a second culvert with the intention to channelize the watercourse. The construction of a new culvert was also in support of the widening of the existing access road and also serves as a new flow path (diversion) of the watercourse. In terms of the site topography, steeper slopes are located within the vicinity of the watercourse situated on site. Due to the steep slopes, extensive erosion is encountered on site, whereby the bank of the watercourse is extensively eroded. It was the intention of Ms. Sethole to stabilise the banks of the watercourse by the infilling and compaction of waste/rubble material to achieve a levelled grassed area, hence the building rubble that has been disposed off on site.



Figure 4: Google Earth Image (2021) showing the construction activities undertaken on site



2 APPLICABLE ENVIRONMENTAL LEGISLATION

National Environmental Management, 1998 (Act 107 of 1998) (as amended)

Section 24 (1) of the National Environmental Management Act 107 of 1998, as amended states the following: Consequences of unlawful commencement of activity-(1) on application by a person who-

- (a) has commenced with a listed or specified activity without an environmental authorisation in contravention of section 24F (1)
- (b) has commenced, undertaken or conducted a waste management activity without a waste management license in terms of Section 20 (b) of the National Environmental Management Waste Act, 2008 (Act No 59 of 2008)

Ms Sethole, unintentionally commenced with the construction activities on site which violates Section 24 (F) (1) of NEMA. This has resulted in the Section 24G application for the consequences of unlawful commencement of activities.

2.1 National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA): EIA Regulations

In accordance with the 2014 Environmental Impact Assessment (EIA) Regulation, as amended, a specific list of activities which could potentially have a detrimental impact on the receiving environment have been identified, for which an EA is required. The list of activities as provided in **Table 1** are triggered based on the activities undertaken on site and where applicable triggered in terms of the rehabilitation activities.

Table 2: Listed Activities Triggered

Notice No	Activity	Applicability
GN983	Activity 19 The infilling or depositing of any material of more than 10 cubic metres into, or dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	Construction of a culvert was undertaken within a watercourse. The attenuation dam within the watercourse was infilled.



GN985	Activity 4 The development of a road wider than 4 meters with a reserve of less than 13.5m.	The new section of access road constructed is wider than 4m and is approximately 95m in length.
GN985	Activity 12 The clearance of an area of more than 300m ² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan	Clearance of vegetation undertaken in support of the access road. Vegetation clearance will also be undertaken for rehabilitation activities such as slope stabilization (proposed in terms of rehabilitation)
GN985	Activity 14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more;	The construction of a road within 32m of the watercourse. The construction of a culvert within the watercourse.
	where such development occurs- (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	Energy dissipation structures at the boundary wall south west of the site (proposed in terms of rehabilitation)
GN985	Activity 18 The widening of a road by more than 4m, or the lengthening of a road by more than 1km	The existing access road was widened along the watercourse crossing to allow for traffic in both directions.
GN958	Activity 23 The expansion of- (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs- (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	The existing access road was widened along the watercourse crossing to allow for traffic in both directions



2.2 National Environmental Management Waste Act, 2008 (Act 59 of 2008) (NEMWA)

Government Notice No 921 of 29 November 2013 promulgated in terms of NEMWA for the waste management activities that have or are likely to have a detrimental effect on the environment. **Table 2** provides details of the activities that commenced on site that required a Waste management License in terms GNR 921.

Table 3: NEMWA Triggered Activities

Listed Activities in Terms of GN 921 of the NEMWA	Applicability
Category A: Activity 9 The disposal of inert waste to land in excess of 25 tons but not exceeding 25000 tons, excluding the disposal of such waste for the purposes of levelling and building which has been authorised by or other legislation.	Building rubble was disposed on site and used for the infill of the attenuation dam.

2.3 National Water Act, 1998 (Act 36 of 1998)

A Water Use License Application (WULA) will also be undertaken as per the National Water Act (Act 36 of 1998). The following water uses have been identified in terms of Section 21 of the Act and the project falls within the Department of Water and Sanitation's regulated area.

- Section 21(c) and (i) – Impeding or diverting the flow of water in a water course
- Section 21(i) -altering the bed, banks, course or characteristics of a watercourse

Information provided by Alta van Dyk Environmental

3 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This 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-eight 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.

4 LEGISLATION

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”**.

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49



- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) “...identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”.

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and 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 is triggered through section 38 of the NHRA that can form part of the Heritage Impact Assessment (HIA) if it is required by SAHRA and adhere to the conditions of the Act. According to **Section 38 (1)**, SAHRA must be contacted to determine if an HIA or sub-studies (historical, palaeontological or archaeological) 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 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m² in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.



5 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 of 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:
 - a. **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.
 - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
 - c. **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.
- 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).

6 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The geology of the proposed Tiegerpoort S24G application is indicated on the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) (**Figure 5, Table 4**). The northern portion of the study area is underlain by intrusive diabase rocks (di; green) as well as the Silverton (Vs, khaki) and Daspoort (Vdq; purple with black dots) Formations of the Pretoria Group (Transvaal Supergroup).

According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the intrusive metamorphic diabase rocks is Zero while that of the Silverton and Daspoort Formations is High (**Figure 6, Table 5**). The Updated Geology compiled by the Council for Geosciences (Pretoria) indicates that the S24G application is entirely underlain by the Daspoort Formation (**Figure 7**) of the Pretoria Group (Transvaal Supergroup).

The Pretoria Group sedimentary rocks in and near the study area are extensively intruded, and locally metamorphosed by the intrusion of the diabase. These rocks would have had a thermal metamorphic effect on the nearby sediments of the Pretoria Group that would in turn decrease the chance of fossil preservation.

The Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton of South Africa namely the Griqualand West Basin, Transvaal Basin, as well as the Kanye Basin in Botswana. The Griqualand West Basin can be subdivided into the Ghaap Plateau and Prieska sub basins. Rocks of the Transvaal Supergroup in the Transvaal Basin were intruded by the Bushveld Complex approximately 2060 million years ago. The Transvaal Supergroup overlays the Archaean basement as well as the Witwatersrand and Ventersdorp Supergroups.

The Precambrian Transvaal Supergroup is approximately 2550-2050 Ma years old (Bekker et al. 2008; Catuneanu et al 1999) (Late Archaean to Early Proterozoic) and is about 15 km thick. This Supergroup consists of sedimentary, volcanic and unmetamorphosed clastic rocks. The sandstone dominated Magaliesberg Formation overlies the mudrocks of the Silverton Formation, and in turn the Silverton Formation overlies the sandstone dominated Daspoort Formation. The Daspoort Formation overlies the Strubenkop (Eriksson et al., 1993b). The Daspoort Formation consists of sandstone and mudrocks. Erickson, et al, 1993 suggested that the Daspoort Formation probably indicates the beginning of a marine transgression that regulated the deposition of the shales of the Silverton Formation as well as the sandstones of the Magaliesberg Formation. Evidence for this suggestion is the existence of thin stromatolitic carbonates and cherts at the top of the Daspoort Formation passing into compressed transgressive chert or dolomite covered by shales of the Silverton Formation. The Daspoort Formation is characterised by subordinate mudrocks and ironstones in the east of the basin (Button, 1973a), and mature quartz arenites. Erikson et al (1993b) also describes pebbly arenites, immature sandstones,



conglomerates and mudrocks in this formation that reflects the beginning of a major marine transgression that deposited the Silverton and Magaliesberg Formations (Eriksson et al., 1995). Thin stromatolitic cherts and carbonates (top of formation) normally changes into a condensed, transgressive dolomite or chert and is finally covered by the Silverton Shales. The Hekpoort formation consists of Basaltic andesite and pyroclastic rocks and is volcanic in origin. In the south the basaltic andesitic lavas are more than 1100m thick thinning to 800m in the west and is less than 50m thinning in the north. Subaerial fissure eruptions are dominant, with local pyroclastic systems (Oberholzer, 1995). Small lacustrine shale deposits are present between recurrent hiatuses in volcanism. Button (1973a) suggested an uppermost, widespread palaeosol.

The Timeball Hill Formation comprises of conglomerates, diamictite, quartzite, minor lavas with lacustrine and fluvio-deltaic mudrocks, while the overlying Klapperkop Member of the Timeball Hill Formation consist of conglomerate, quartzite, shale and siltstone (Groenewald 2014). Catuneanu & Eriksson (2002) is of the opinion that the Timeball Hill Formation was deposited within a deep marine basin. The Timeball Hill Formation is known to contain stromatolites and are associated with thin carbonate interbeds within turbidite sequences in the lower part of the formation (Catuneanu & Eriksson 2002). Stromatolites have not been recorded from the overlying fluvio-deltaic Klapperkop Quartzite Member. Other subunits in the Pretoria Group comprising stromatolites possibly also contain organic-walled microfossils.

Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 1995; Altermann 2001; Buick, 2001; and Schopf, 2006).

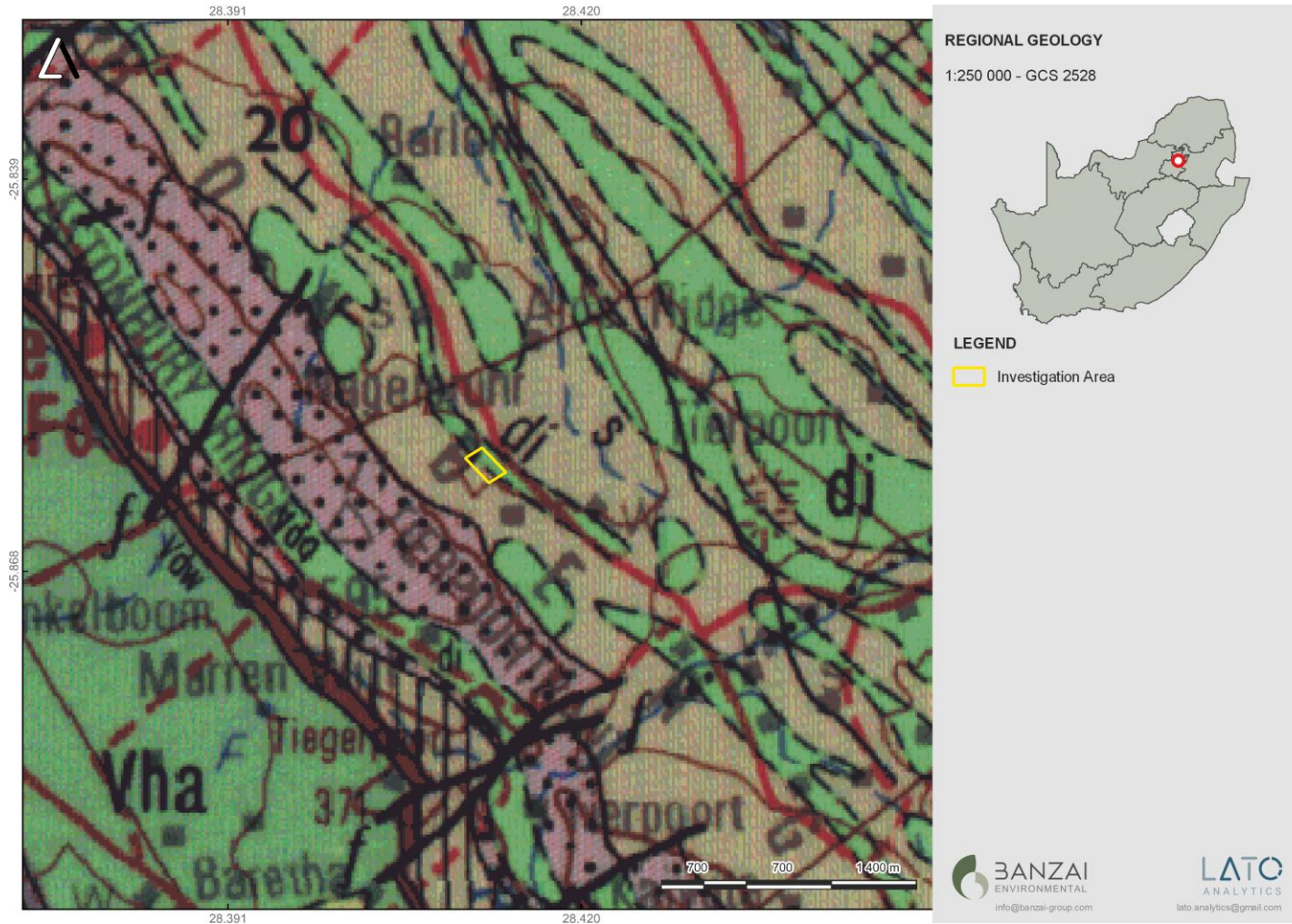
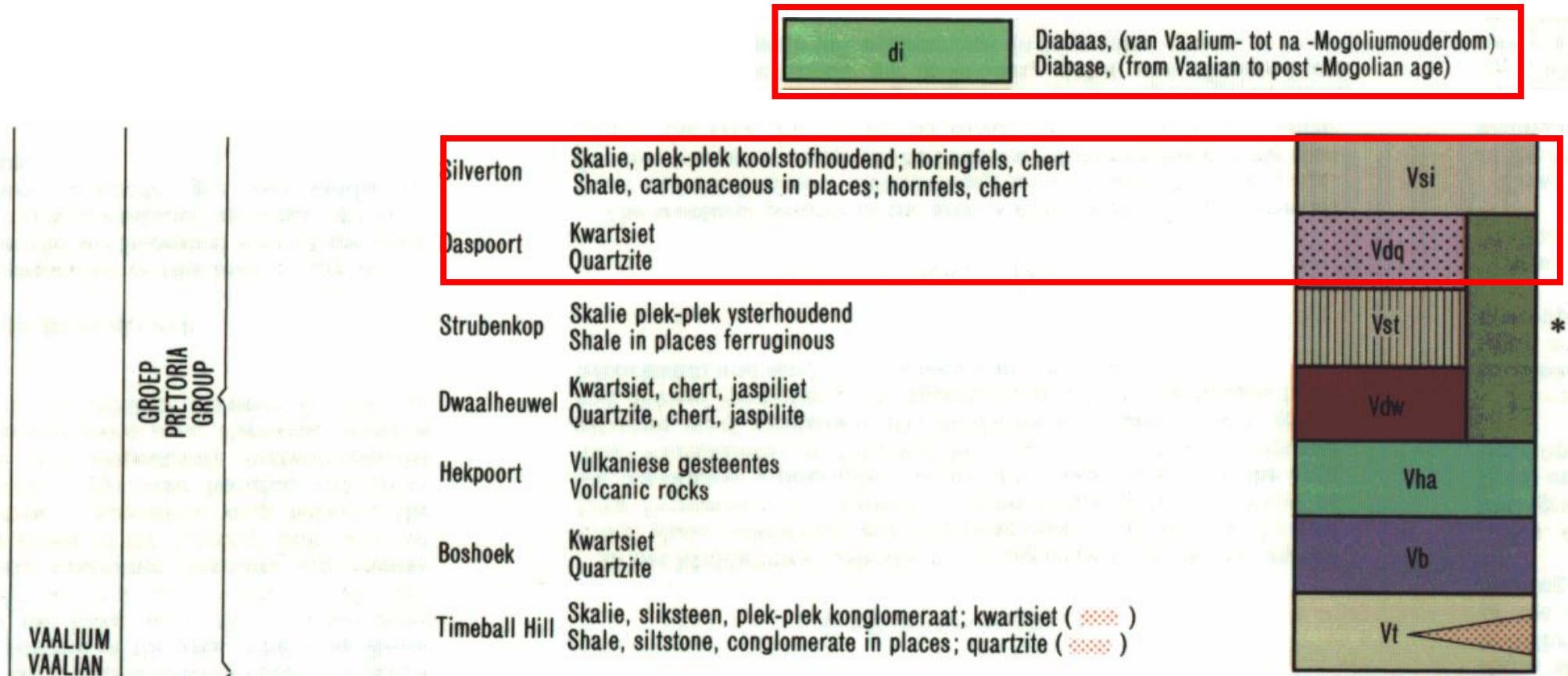


Figure 5: Extract of the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) indicating the S24G Application in Gauteng.

The northern portion is underlain by intrusive diabase rocks (di; green) while the southern portion is underlain by the Silverton (Vsi, khaki) and Daspoort (Vdq; purple with black dots) Formations of the Pretoria Group (Transvaal Supergroup)

Table 4: Legend of the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria)



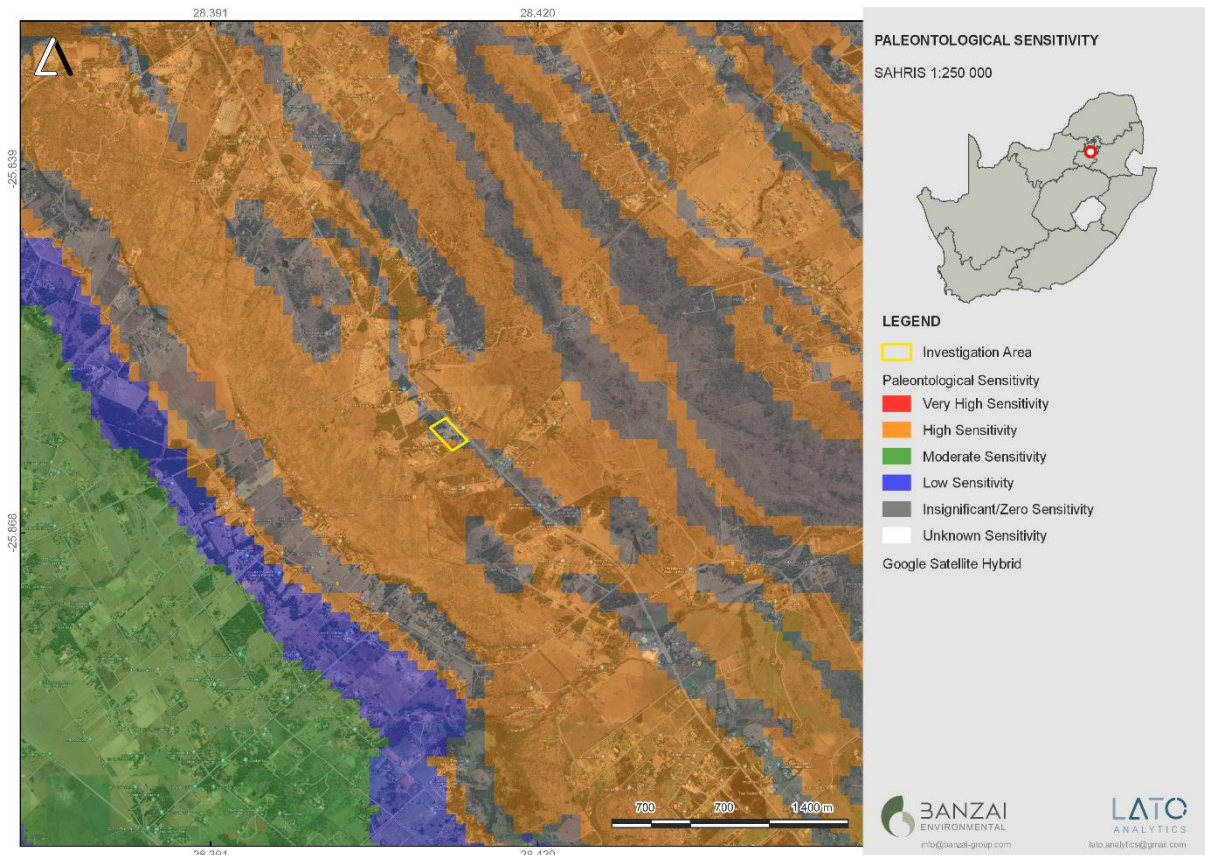


Figure 6: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences, Pretoria) indicating the S24G Application.

Table 5: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website)

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 Palaeosensitivity map (Figure 6; Table 5) the proposed development is underlain by sediments with a High (orange) and moderate (green) and Zero (grey) Palaeontological Sensitivity.

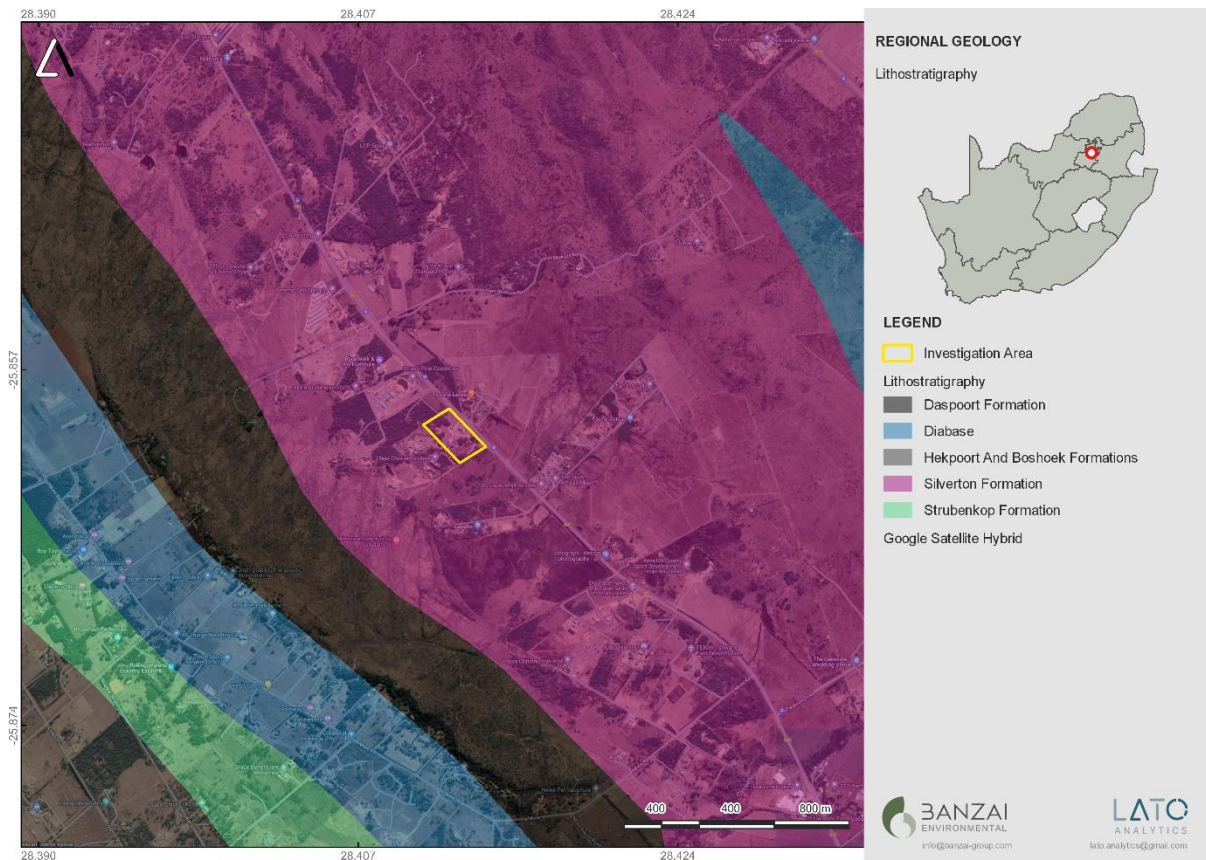


Figure 7: Updated Geology (Council of Geosciences, Pretoria) of the S24G Application on Farm Tiegerpoort, in Gauteng.

7 METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This includes all trace fossils as well as all fossils in the proposed footprint. All possible



information is consulted to compile a desktop study, and this includes the following: all 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 of the Geological Maps 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 also used to provide information on the existence of fossils in an area which has 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).
- A Google Earth map with polygons of the proposed development was obtained from Alta van Dyk Environmental.
- 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria)
- Updated Geology (2018) (obtained from the Council of Geosciences, Pretoria).



9 IMPACT ASSESSMENT METHODOLOGY

Table 6: The rating system

Evaluation Component	Rating	Scale	Description / criteria
MAGNITUDE of negative impact (at the indicated spatial scale)	10	Very high	Bio-physical and/or social functions and/or processes might be <i>severely</i> altered.
	8	High	Bio-physical and/or social functions and/or processes might be <i>considerably</i> altered.
	6	Medium	Bio-physical and/or social functions and/or processes might be <i>notably</i> altered.
	4	Low	Bio-physical and/or social functions and/or processes might be <i>slightly</i> altered.
	2	Very low	Bio-physical and/or social functions and/or processes might be <i>negligibly</i> altered.
	0	Zero	Bio-physical and/or social functions and/or processes will remain <i>unaltered</i> .
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	10	Very high	Positive: Bio-physical and/or social functions and/or processes might be <i>substantially</i> enhanced.
	8	High	Positive: Bio-physical and/or social functions and/or processes might be <i>considerably</i> enhanced.
	6	Medium	Positive: Bio-physical and/or social functions and/or processes might be <i>notably</i> enhanced.
	4	Low	Positive: Bio-physical and/or social functions and/or processes might be <i>slightly</i> enhanced.
	2	Very low	Positive: Bio-physical and/or social functions and/or processes might be <i>negligibly</i> enhanced.
	0	Zero	Positive: Bio-physical and/or social functions and/or processes will remain <i>unaltered</i> .
DURATION	5	Permanent	Impact in perpetuity. –
	4	Long term	Impact ceases after operational phase/life of the activity > 60 years.
	3	Medium term	Impact might occur during the operational phase/life of the activity – 60 years.
	2	Short term	Impact might occur during the construction phase - < 3 years.
	1	Immediate	Instant impact.
EXTENT (or spatial scale/influence of impact)	5	International	Beyond the National boundaries.
	4	National	Beyond provincial boundaries, but within National boundaries.
	3	Regional	Beyond 5 km of the mine area and within the provincial boundaries.
	2	Local	Within a 5 km radius of the mine area.
	1	Site-specific	On site or within 100 meters of the site boundaries.
	0	None	Zero extent.
IRREPLACEABLE loss of resources	5	Definite	Definite loss of irreplaceable resources.
	4	High potential	High potential for loss of irreplaceable resources.
	3	Moderate potential	Moderate potential for loss of irreplaceable resources.
	2	Low potential	Low potential for loss of irreplaceable resources.
	1	Very low potential	Very low potential for loss of irreplaceable resources.
	0	None	Zero potential.
REVERSIBILITY of impact	5	Irreversible	Impact cannot be reversed.
	4	Low irreversibility	Low potential that impact might be reversed.
	3	Moderate reversibility	Moderate potential that impact might be reversed.
	2	High reversibility	High potential that impact might be reversed.
	1	Reversible	Impact will be reversible.
	0	No impact	No impact.
PROBABILITY (of occurrence)	5	Definite	>95% chance of the potential impact occurring.
	4	High probability	75% - 95% chance of the potential impact occurring.
	3	Medium probability	25% - 75% chance of the potential impact occurring.
	2	Low probability	5% - 25% chance of the potential impact occurring.
	1	Improbable	<5% chance of the potential impact occurring.
	0	No probability	Zero probability.
Evaluation Component	Rating scale and description / criteria		



CUMULATIVE impacts	<p>High: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.</p> <p>Medium: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.</p> <p>Low: The activity is localised and might have a negligible cumulative impact.</p> <p>None: No cumulative impact on the environment.</p>
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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 but are regarded as having a Low probability. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be low.

Table 7: Summary of Impact Tables

	Site	Probability	Duration	Magnitude	Reversibility	Irreplicable Loss	Cumulative Effect	Significance
	1	2	5	2	2	2	Low	24

10 FINDINGS AND RECOMMENDATIONS

The study area is underlain by intrusive diabase rocks as well as the Silverton and Daspoort Formations of the Pretoria Group (Transvaal Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the intrusive metamorphic diabase rocks is Zero while that of the Silverton and Daspoort Formations is High. The Updated Geology compiled by the Council for Geosciences (Pretoria) indicates that the S24G application is entirely underlain by the Daspoort Formation of the Pretoria Group (Transvaal Supergroup).

The Pretoria Group sedimentary rocks in and near the study area are extensively intruded, and locally metamorphosed by the intrusion of diabase. These rocks would have had a thermal metamorphic effect on the nearby sediments of the Pretoria Group that would in turn decrease the chance of fossil preservation. **It is therefore considered that the proposed development will not lead to damaging impacts**



on the palaeontological resources of the area and that the S24G Application be granted from a Palaeontological view.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager 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 mitigation (recording and collection) can be carry out by a paleontologist. Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

11 CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act No 25 of 1999) (NHRA)**. According to Section 3 of the Act, all Heritage resources 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 and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, 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.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.



It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

11.1 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, 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). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.



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Appendix A

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 29 years in Palaeontology

EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

B. Sc (Hons) Zoology, 1991
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Management Course, 1991
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M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

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