DESKTOP PALAEONTOLOGICAL ASSESSMENT

PROPOSED EXPANSION OF CHICKEN HOUSES FROM APPROXIMATELY 30 000 TO 60 000 CHICKENS, BULHOEK FARM, NEAR SWARTRUGGENS, KGETLENGRIVIER LOCAL MUNICIPALITY, BOJANA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE.

FOR

CTS Heritage Consultants

DATE: 26 January 2022

By

Dr Gideon Groenewald
Cell: 078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by CTS Heritage to undertake a desktop palaeontological assessment survey for the proposed expansion of chicken houses from approximately 30 000 to 60 000 chickens, Bulhoek farm, near Swartruggens, Kgetlengrivier Local Municipality, Bojana District Municipality, Northwest Province. The agricultural development falls in a rural setting where the natural ecosystem has been modified by agricultural activities over the years (CTS Heritage, 2021).

Quantum Foods proposes the expansion of a poultry farm that will be expanded from approximately 30 000 to 60 000 chickens (rounded up) on Bulhoek Farm, near Swartruggens, North West Province.

It is expected that there will be eight (8) new chicken “laying” houses constructed each with a footprint of either 60 m x 13.5 m or 100 m x 12 m depending on the site.

The development site is underlain by quartzite and shale of the Pretoria Group, Transvaal Supergroup, with low to high sensitivity for palaeontological heritage.

No significant fossils are expected in areas underlain by shale and slate of the Strubenkop Formation but areas underlain by quartzite and shale of the Daspoort Formation have a high palaeontological sensitivity.

If excavation expose fossils, it will be very important that a suitably qualified palaeontological specialist be appointed to do a Phase 1 PIA and to upgrade the “Chance Find Protocol” document. The CFP document must then be included as part of the EMPr of this project, to record all unexpected fossils associated with the geological formations on site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a high Palaeontological Sensitivity is allocated to the larger part of the study area underlain by quartzite and shale of the Daspoort Formation.
- Further mitigation for Palaeontological Heritage is recommended for this project if excavation of deeper than 0.5m into bedrock of the Daspoort Formation is envisaged (geotechnical reports in EIA procedure).
- A suitably qualified palaeontologist must implement and upgrade the “Chance Find Protocol” (CFP) for areas with a high palaeontological significance (CFP attached to this report).

- Recommendations must be approved by SAHRA for inclusion in the EMPr of the project.
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INTRODUCTION

Gideon Groenewald was appointed by CTS Heritage to undertake a desktop palaeontological assessment survey for the proposed expansion of chicken houses from approximately 30 000 to 60 000 chickens, Bulhoek farm, near Swartruggens, Kgetlengrivier Local Municipality, Bojana District Municipality, Northwest Province. The agricultural development falls in a rural setting where the natural ecosystem has been modified by agricultural activities over the years (CTS Heritage, 2021).

Quantum Foods proposes the expansion of a poultry farm that will be expanded from approximately 30 000 to 60 000 chickens (rounded up) on Bulhoek Farm, near Swartruggens, North West Province.

It is expected that there will be eight (8) new chicken “laying” houses constructed each with a footprint of either 60 m x 13.5 m or 100 m x 12 m depending on the site.

Waste removal: After the quarantine period on the farm, the chicken carcasses will be taken to the local zoo and the remaining general waste will be disposed of at a registered landfill site. The chicken manure is collected by an external farmer to use as fertilizer.

This Desktop Survey is done as preparation for a possible field visit and to complete a Phase 1 PIA if so required by SAHRA. Most of the development falls in a geological unit that is known for its highly significant palaeontological heritage, and the scale of excavation might require a Phase 1 PIA study.

Legal Requirements

This palaeontological assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017). In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A desktop investigation is often the only opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the "*SAHRA APM Guidelines: Minimum Standards for the Archaeological & 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.

Prior to a field investigation, a preliminary assessment (desktop study) of the topography and geology of the study area is made, using appropriate 1:250 000 geological information (2526 Rustenburg) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc.) are identified within the study area and the known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas are identified within the development footprint to focus the field investigator's time and resources. The aim of the desktop survey is to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the minimal extent of fresh bedrock excavation

envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute

	significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMPr for the project.
GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments

	are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMPr of the project.

When rock units of Moderate to Very High Palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. A suitably qualified Palaeontologist must clear all projects falling on Low to Very Low Palaeontological sensitive geology.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out

fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).

Locality and Proposed Development

The project comprises the proposed expansion of an existing chicken egg-laying facility to accommodate 60 000 chickens in comparison to the present 30 000.

The development falls west of Rustenburg, northeast of Swartruggens (north of the N4 highway) in the Northwest Province (CTS Heritage, 2021). The larger part of the development falls on sandy soils resulting from weathering of the quartzites a small portion underlain by clay-rich sediments (Figure 1).

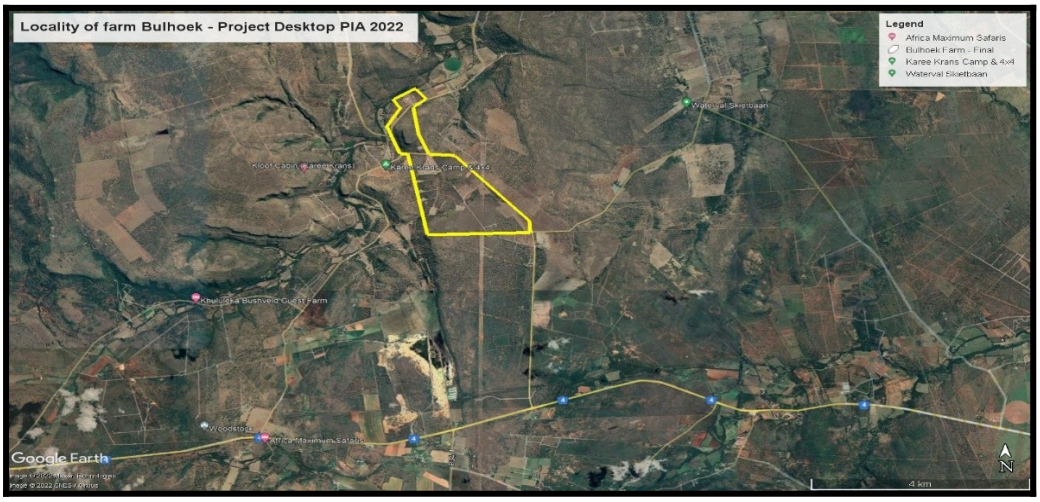
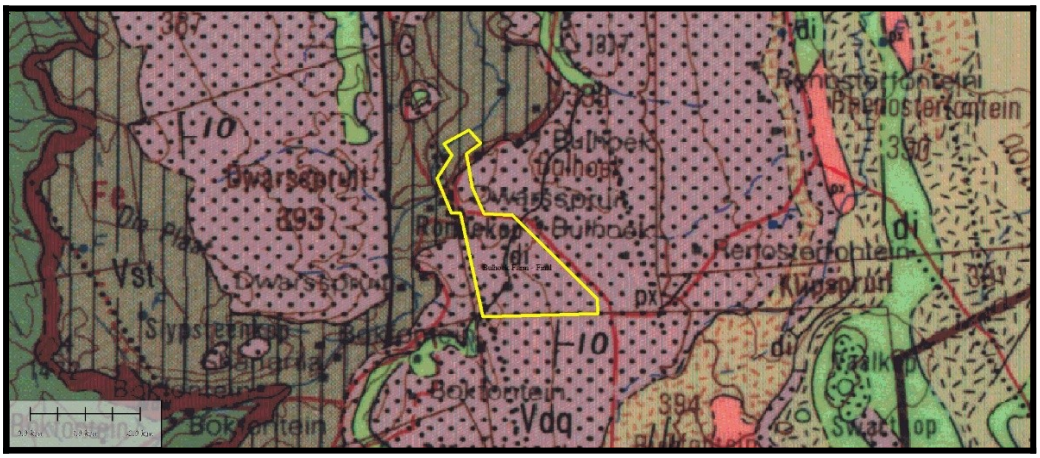


Figure 1 Locality of the Bulhoek farm development upgrade

GEOLOGY

The development site is underlain by Vaalian aged quartzites, shale and slate of the Transvaal Supergroup (Figure 2)

Figure 2 Geology of the study area. The development site falls on clayey soils on the Strubenkop Formation (Vst) and sandy soils associated with the Daspoort Formation (Vdq)



Transvaal Supergoup

Pretoria Group

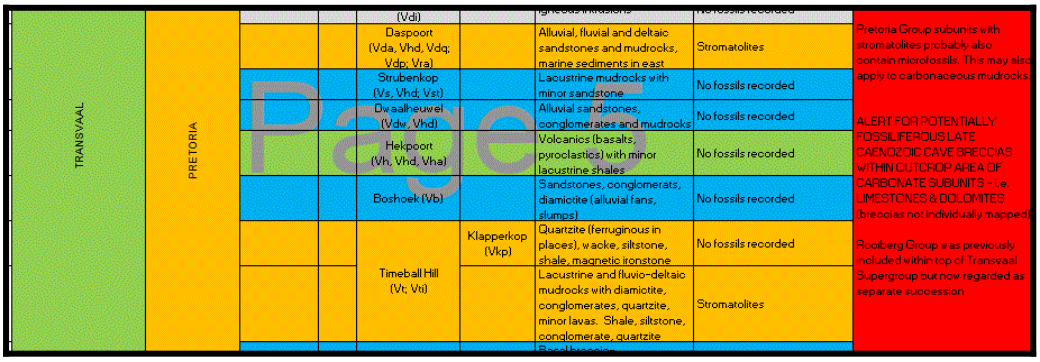
The Vallian aged Pretoria Group consists of a sequence of marine, lacustrine and deltaic sediments with a few interbedded volcanic layers (Figure 3).

Strubenkop Formation (Vst)

The Vaalian aged Strubenkop Formation (Vst) is interpreted as a lacustrine mudrock unit with minor sandstone. The majority of the outcrops consists of well-defined slate and/or shale beds and several iron-rich layers, associated with subordinate quartzite, are present (Groenewald et al 2014; Johnson et al 2009; McCarthy and Rubidge, 2005; MacRae, 1999).

Daspoort Formation (Vdq)

The Vaalian aged Daspoort Formation (Vdq) represents an alluvial, fluvial and deltaic sandstone sequence with interbedded mudstone and evidence of marine deposition in places (Groenewald et al 2014; Johnson et al 2009; McCarthy and Rubidge, 2005; MacRae, 1999).



TRANSVAAL	PRETORIA			(Vdi)		igneous intrusions	No fossils recorded	
				Daspoort (Vda, Vhd, Vdq; Vdp; Vra)		Alluvial, fluvial and deltaic sandstones and mudrocks, marine sediments in east	Stromatolites	Pretoria Group subunits with stromatolites probably also contain microfossils. This may also apply to carbonaceous mudrocks.
				Strubenkop (Vs, Vhd; Vst)		Lacustrine mudrocks with minor sandstone	No fossils recorded	
				Dwaalheuwel (Vdw, Vhd)		Alluvial sandstones, conglomerates and mudrocks	No fossils recorded	ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN OUTCROP AREA OF CARBONATE SUBUNITS - i.e. LIMESTONES & DOLOMITES (breccias not individually mapped)
				Hekpoort (Vh, Vhd, Vha)		Volcanics (basalts, pyroclastics) with minor lacustrine shales	No fossils recorded	
				Boshoek (Vb)		Sandstones, conglomerats, diamictite (alluvial fans, slumps)	No fossils recorded	
			Timeball Hill (Vt; Vti)		Klapperkop (Vkp)	Quartzite (ferruginous in places), wacke, siltstone, shale, magnetic ironstone	No fossils recorded	Rooiberg Group was previously included within top of Transvaal Supergroup but now regarded as separate succession
						Lacustrine and fluvio-deltaic mudrocks with diamictite, conglomerates, quartzite, minor lavas. Shale, siltstone, conglomerate, quartzite	Stromatolites	
						Basal breccias		

PALAEONTOLOGY

Following previous studies, summarized by Groenewald *et al* (2014), no significant fossils have been recorded in the Strubenkop Formation whereas significant cyanobacteria were recorded from the Daspoort Formation. Due to the very high chance find of cave breccias, associated with karst topography in the dolomitic units of the Pretoria Group, it is important to note the very high possibility of finding significant remains of Hominids in the study area (Groenewald et al 2014).

Transvaal Supergoup

Pretoria Group

Strubenkop Formation (Vst)

The Vaalian aged Strubenkop Formation (Vst) is a lacustrine mudstone unit and no significant fossils have, up to date, been recorded from this unit.

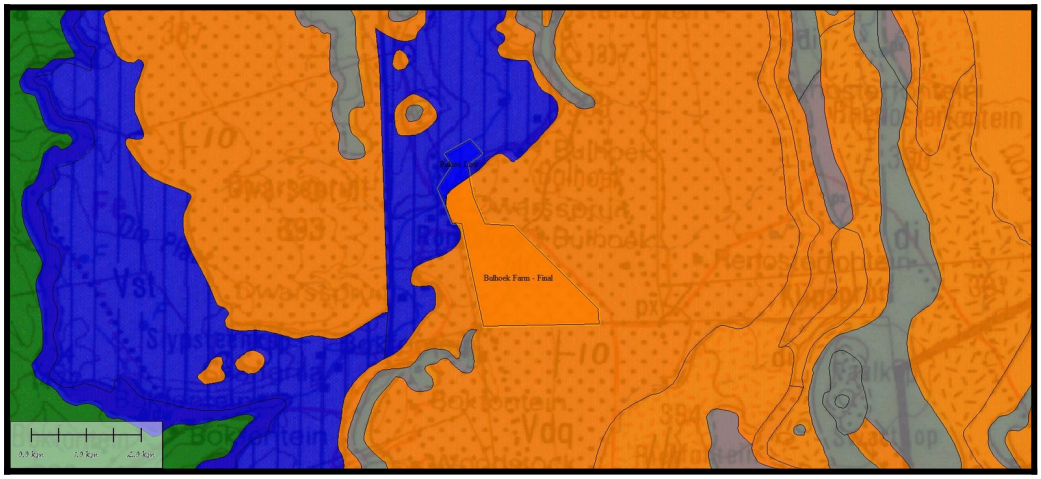
Daspoort Formation (Vdq)

The Vaalian aged Daspoort Fornmation is interpreted as a complex unit of alluvial, fluvial and deltaic sediments with records of cyanobacteria remains (stromatolites) from the unit (Eriksson *et al*, 2012; Durand, 2018; Groenewald *et al* 2014; Almond and Pether, 2008; Johnson et al, 2009; McCarthy and Rubidge, 2005, MacRae, 1999).

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop

investigation confirms that the study area is underlain by relatively shallow (>0.5m) sandy soil associated with the weathering of sedimentary rocks of the Transvaal Supergroup (Figure 4).

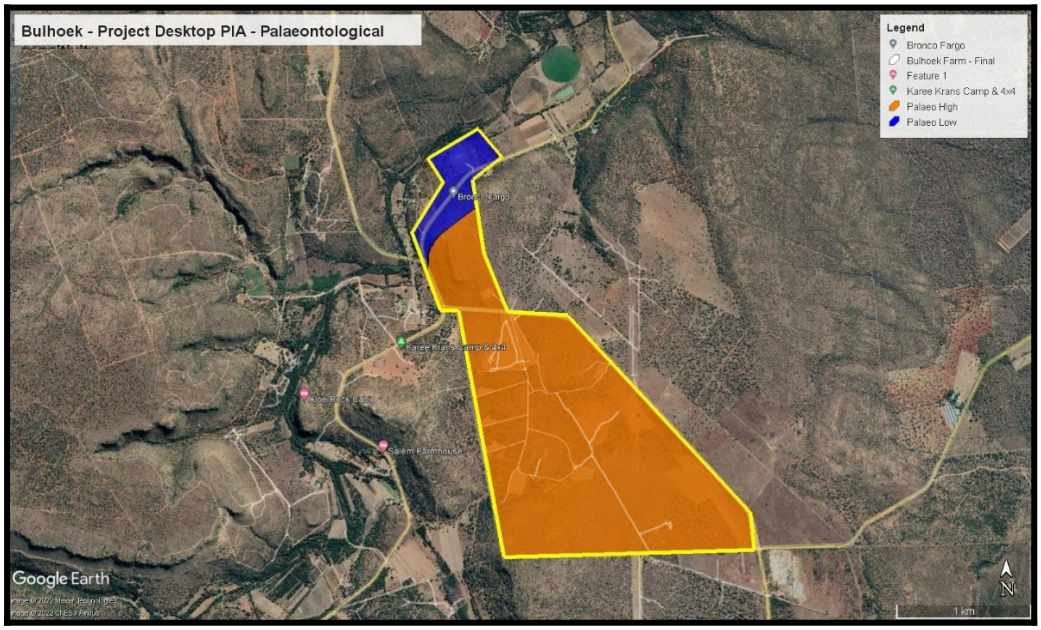


A very small part of the proposed linear development falls on a relatively low sensitive shale and minor sandstone (Figure 4).

From information supplied, it is envisaged that very few deep excavations (>0.5m into bedrock) are planned during this development. The regional impact assessment (Figure 4) provides evidence of the scale of the possible impact on the geological environment and our professional opinion is that the scale of activity will not lead to highly significant destruction of fossils, unless, by chance, deep excavation (>0.5m into bedrock of the Daspoort Formation) is planned following the geotechnical impact assessment at the specific points where new chicken houses are planned for this project (EIA Procedures). Specific sites where the 8 new houses are planned was not provided for this investigation and it is advised that the positions are therefore planned at places of least impact on geological formations, for example in areas with deep sandy soils.

If deep excavation is planned that will expose more than 0,5m of undisturbed bedrock, a suitably qualified palaeontologist must visit the site to do a Phase 1 field assessment during the planned excavation period, but limited to the actual sites indicated on the Geotechnical impact reports (EMPr documentation).

Palaeontological sensitivity is indicated with orange (high) and blue (low) colours on the sensitivity map (Figure 5).



If any fossils are unexpectedly recorded during excavations of more than 0.5m depth, a suitably qualified palaeontologist must be appointed to complete a Phase 1 PIA and to upgrade the “Chance Find Protocol” (CFP) document. The CFP report must be included into the EMPr of the project and upgraded continuously during the construction phase if excavations of deeper than 0.5m into bedrock are planned for this project.

CONCLUSION

The development site applicable to the application for proposed expansion of chicken houses from approximately 30 000 to 60 000 chickens, Bulhoek farm, near Swartruggens, Kgetlengrivier Local Municipality, Bojana District Municipality, Northwest Province., is underlain by quartzite and shale of the Pretoria Group, Transvaal Supergroup, with low to high sensitivity for palaeontological heritage.

No significant fossils are expected in areas underlain by shale and slate of the Strubenkop Formation but areas underlain by quartzite and shale of the Daspoort Formation (orange colour in Figure 5) have a high palaeontological sensitivity.

If excavation expose fossils, it will be very important that a suitably qualified palaeontological specialist be appointed to do a Phase 1 PIA and to upgrade the “Chance Find Protocol” document. The CFP document must then be included as part of the EMPr of this project, to record all unexpected fossils associated with the geological formations on site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a high Palaeontological Sensitivity is allocated to the larger part of the study area underlain by quartzite and shale of the Daspoort Formation.
- Further mitigation for Palaeontological Heritage is recommended for this project if excavation of deeper than 0.5m into bedrock of the Daspoort Formation is envisaged (geotechnical reports in EIA procedure).
- A suitably qualified palaeontologist must implement and upgrade the “Chance Find Protocol” (CFP) for areas with a high palaeontological significance (CFP attached to this report).
- Recommendations must be approved by SAHRA for inclusion in the EMPr of the project.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist