Palaeontological Impact Assessment for the proposed Welgedacht Balloon Siding between Springs and Delmas, Gauteng Province

Site Visit (Phase 2) Report

For

Elemental Sustainability

31 January 2021 revised Feb 2022

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Elemental Sustainability, Johannesburg, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A Palaeontological Impact Assessment site visit was requested for the proposed railway balloon loop and conveyor system for Welgedacht Colliery on Farms Palmietkullen 241 and Geigerle 238.

To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit (or Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed project on 27th January 2021 by palaeontologists Mr Rick Tolchard and Mr Mathew Robinson.

The proposed route lies on the shales, mudstones, sandstones and coals of the Vryheid Formation (Ecca Group, Karoo Supergroup) and on Quaternary alluvium along the stream. Fossil plant impressions of the *Glossopteris* flora could occur in the Vryheid Formation but no vertebrate fossils. Transported and fragmentary fossils might occur in the alluvium. The site visit and survey showed that there were NO FOSSILS visible along any of the routes. There is a small chance that fossils could occur below the surface, therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological assessment is required unless fossils are found once excavations for rail line, conveyor and amenities have commenced.

ACRONYMS

EMPr – Environmental Management Protocol
NHRA – National Heritage Resources Act
PIA – Paaleontological Impact Assessment
ToR – Terms of reference
SAHRA – South African Heritage Resources Agency

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LIST of Tables and Figures

1. Background

Project background

Canyon resources (Pty) Ltd. proposes to develop the Welgedacht Balloon Siding, which will consist of extending the railway line from the main Transnet Railway Line, the establishment of a conveyor belt, pollution control dams and product stockpile as part of the project on Farms Palmietkullen 241 and Geigerle 238. The Welgedacht Balloon Siding is located between Springs and Delmas and just north of Aston Lake (Figures 1, 2). The project area is farmland, and partly in the northern wetland that is the inlet to the dam (Aston Lake). There are two options each for the conveyor route and dams so the whole area should be surveyed.

A Palaeontological Impact Assessment was requested for the Welgedacht Balloon Siding project. The Welgedacht Balloon Siding and infrastructure is on previously disturbed land. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit (or phase 2) Palaeontological Impact Assessment (PIA) was completed on 10 November 2020 by palaeontologists Mr Rick Tolchard and Mr Mathew Robinson, and the observations and results are reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
g	An identification of any areas to be avoided, including buffers	N/A
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;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
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 4
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed development on Welgedacht and Palmietkullen Farms with the various sections shown in the coloured polygons. Map supplied by Elemental Sustainability.

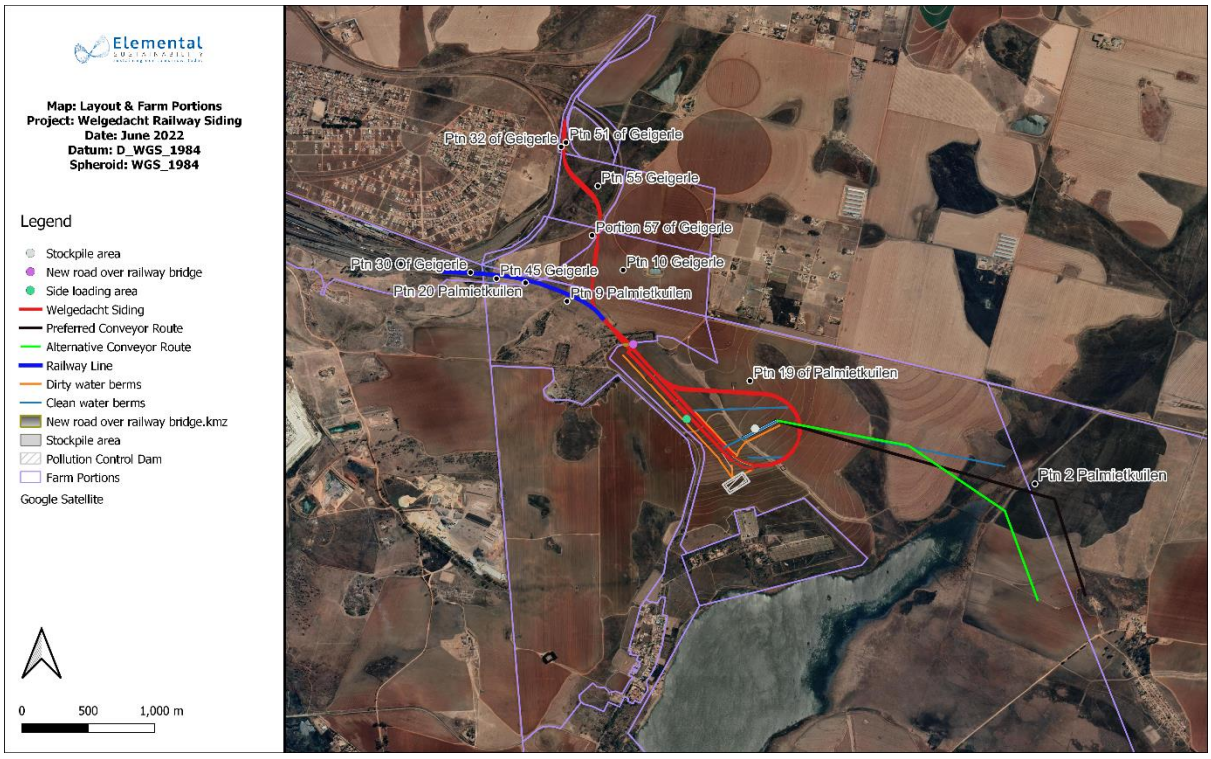

Figure 2: Topographic map of Welgedacht Balloon Siding project (see Figure 1) with the proposed structures shown by the red, blue and green lines. Yellow lines show the outline of the farm portions and boundaries.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (as reported herein, and collect or rescue fossils if required);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*as indicated in section 4 below)*; and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a just a representative sample collected and housed in a recognised repository.

3. Geology and Palaeontology

i. Project location and geological context

The Welgedacht Balloon Siding lies in the north-eastern margin of the Karoo Basin and in the western portion of the Witbank coalfield. In this area all five coal seams of the Vryheid Formation are present but at varying depths and thicknesses because of the uneven basal topography (Snyman, 1998).

The Main Karoo Basin is a huge area stretching from Middelburg in the northeast to around Touws Rivier in the southwest. It unconformably overlies much older rocks, such as the Transvaal Supergroup in the north-eastern part and Cape Supergroup rocks in the southwest. At the base of the Karoo Supergroup are the Dwyka Group tillites, diamictites, mudstones and shales that were deposited when the various ice sheets covering the continent melted and filled the lowland. At this time, the continent was positioned over the South Pole, but it moved slowly northward and warmed up. The next stratum is the Ecca Group and the Vryheid Formation overlies the basal Pietermaritzburg Formation.

Composed of shales, mudstones, sandstones and coal seams the Vryheid Formation was deposited in warmer and wetter conditions where there was abundant plant biomass as well as a depositional setting with water to bury vegetation and exclude oxygen. The peats were buried under more sediments and over time altered by increased pressure and temperature to form coal seams. Overlying the Vryheid Formation is the Volksrust Formation that was deposited in deep or shallow water but did not include coal. Overlying the Ecca Group are the rocks of the Beaufort and Stormberg Groups, but not exposed in this region.

Much more recently in the Quaternary, soils have formed from the weathering of the underlying rocks, and in river or stream valleys the soils are washed away and transported downstream, forming alluvium or colluvium.

Much older rocks occur to the northwest, the dolomites and cherts of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup; blue in Figure 3), and the Karoo rocks lie unconformably on these.

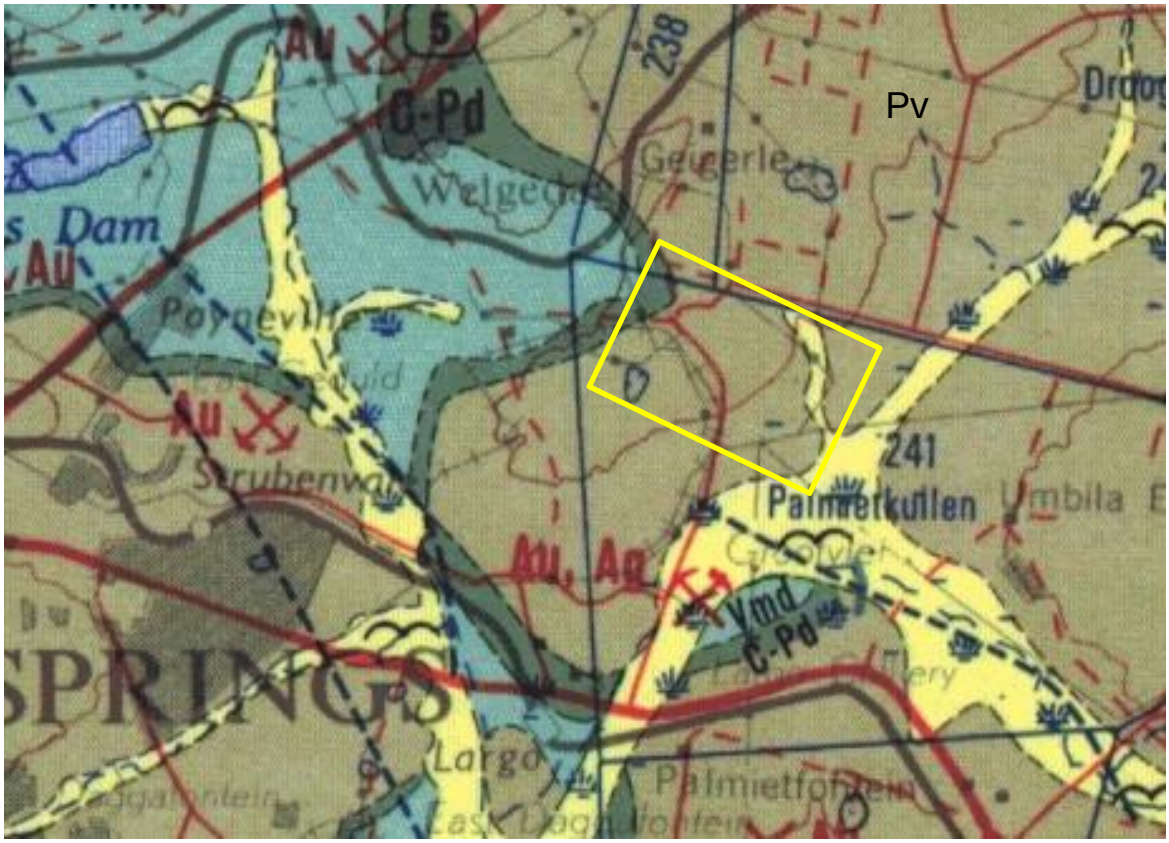

Figure 3: Geological map of the area around the northeast of Springs and the Welgedacht Balloon Siding. The location of the proposed project is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand ERPM.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Johnson et al., 2006; McCarthy et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, sandstone, coal	Lower Permian, Middle Ecca
C-Pd	Dwyka Group, Karoo SG	Tillites, diamictites, mudstone	Late Carboniferous to early Permian

Symbol	Group/Formation	Lithology	Approximate Age
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert	Ca 2222Ma or younger

ii. Palaeontological context

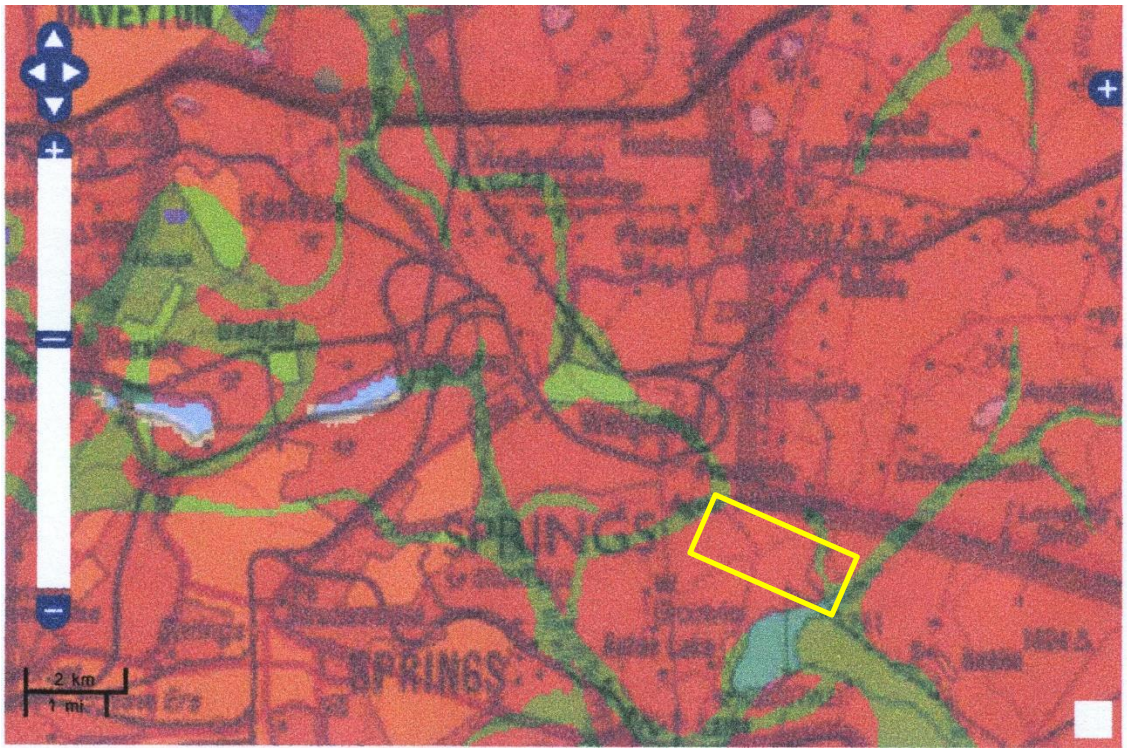

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed diverted road route shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The palaeontological sensitivity of the area under consideration is presented in Figure 4, with the very highly sensitive areas (red) corresponding to the Vryheid Formation and the moderately sensitive areas (green) referring to the Dwyka Group tillites in the northwest corner, and Quaternary soils and alluvium in the southeast corner.

Dwyka Group sediments only rarely preserve fossils and they would be fragments from the *Glossopteris* flora, and only in the mudstone facies of the seven facies that occur in this group (Johnson et al., 2006).

Coals are formed from the burial and alteration of peats to such an extent that the original plants forming the peats can no longer be recognised. The higher the quality of the coal the more transformation has taken place. Coals per se, are not of interest to palaeontologists. In

the shale lenses between coal seams, however, impressions of the plant material are often preserved and, in some settings, can be very well preserved. Plants making up the Vryheid Formation coals belong to the *Glossopteris* flora. The glossopterids are an extinct group of seed ferns that dominated the Gondwanan landscape during the Permian period. Other plants that occurred in this flora are a variety of lycopods, sphenophytes, ferns and some early gymnosperms (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

Vertebrate fossils have not been recorded from any Vryheid Formation sites because the conditions for preservation of plants and animals are different. Plants require an anoxic reducing environment whereas the animals need an oxidising environment (Briggs and McMahon, 2016). Furthermore, very few land vertebrates were present at this time, just rare fish and amphibians (Rubidge, 2005).

Modern soils and alluvium do not preserve fossils as they are the product of weathering of rocks and then transportation of the sediments and modern organic matter. Very rarely some robust fossils, such as bones or silicified wood fragments, can be incorporated in the alluvium, but they would be out of primary context and so are of very limited scientific interest.

From the SAHRIS map above the area is indicated as very highly sensitive (red) so a site visit was undertaken on 27th January 2021 with the objective of looking for fossils of the *Glossopteris* flora in the Vryheid Formation.

Iii Site visit observations

The proposed route for the diverted road was traversed on foot and any break in the vegetation was studied. The existing farm road has been widened and graded so the soils were exposed but the route across the river was undisturbed.

Table 3: Site visit observations. Figures refer to the photographs presented after the table.

GPS coordinates	Observations	Figure
Stop 1 S26° 13’ 50.3226” E28° 33’ 9.41108” 1627m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	5, 6
Stop 2 S26° 13’ 51.03503” E28° 33’ 10.59122” 1615m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	7, 8
Stop 3 S26° 13’ 56.92455” E28° 33’ 13.54655” 1609m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	9, 10

GPS coordinates	Observations	Figure
Stop 4 S26° 14’ 4.14343” E28° 33’ 8.13499” 1612m	General view of the wetland area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	11, 12
Stop 5 S26° 14’ 8.52678” E28° 33’ 13.69591” 1609m	Dense vegetation and no fossils	n/a
Stop 6 S26° 13’ 51.23493” E28° 33’ 14.58969” 1615m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	n/a
Stop 7 S26° 13’ 52.55554” E28° 33’ 20.15333” 1606m	Dense vegetation and deep soils	n/a
Stop 8 S26° 14’ 2.96013” E28° 34’ 4.99829” 1612m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	13, 14
Stop 9 S26° 14’ 11.59089” E28° 34’ 2.11478” 1622m	Dense vegetation and no fossils	n/a
Stop 10 S26° 14’ 27.26944” E28° 33’ 56.01222” 1613m	General view of the area; general view with the exposed soils in the foreground. Deep soils and densely vegetated so there are no rocky or shale outcrops and no fossils	15, 16

Fig 5: Stop 1 – general view of the field with thick vegetation indicating deep soil cover

Fig 6: Stop 1 – only small stones, probably imported road metal, present.

Fig 7: Stop 2 -

Fig 8: Stop 2 -

Fig 9: Stop 3 -

Fig 10: Stop 3 -

Fig 11: Stop 4 -

Fig 12: Stop 4 -

Fig 12: Stop 8 -

Fig 13: Stop 8 -

Fig 14: Stop 10 -

Fig 15: Stop 10 -

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 4:

TABLE 4A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 4B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Quaternary soils and alluvium do not preserve plant or animal fossils; so far there are no records from the Vryheid formation of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely. No fossils were seen
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since only the possible fossils within the area would be fossil plants from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the loose soils that will be removed for the various constructions, but there might be fossil leaf impressions in the shales below the soils, therefore, a Fossil Chance Find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The site visit confirmed that there are no fossils along the proposed route exposed on the surface or where the topsoils have been removed. The geological structures suggest that the rocks are the right age and type to preserve *Glossopteris* fossils BUT none was seen. Since there is a small chance that fossils from the Vryheid Formation may be preserved below the land surface in shales, a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low (Table 5).

Table 5: Final Impact – result highlighted in right column

Environmental Significance	Description / criteria
Very high (VH)	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
High (H)	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
Medium-high (MH)	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked at.
Medium (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
Low (L)	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
Positive impact (+)	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and could contain fossil plant, insect, and invertebrate material. The sands of the Quaternary period would not preserve fossils. From the site visit survey and observations, there are no fossils in the surface soils and alluvium, and there are no exposures of shales where fossil leaf impressions could be preserved. It is unknown if there are fossils below the land surface.

6. Recommendation

Based on the site visit survey and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary or of the Permian Vryheid Formation as seen to a depth of around 1m. There is a very small chance that fossils may occur in the shales below ground level of the Vryheid Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found once drilling and excavations for the rail and conveyor foundations have commenced, then they should be

rescued and a palaeontologist called to assess and collect a representative sample. As far as the palaeontology is concerned, there is no preference for where the road should cross the stream, and the Welgedacht Balloon Siding project can proceed.

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Bamford, M.K. 2004. Diversity of woody vegetation of Gondwanan southern Africa. Gondwana Research 7, 153-164.

Briggs, D.E.G., McMahon, S., 2016. The role of experiments in the taphonomy of exceptional preservation. Palaeontology 59, 1-11.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

McCarthy, T.S., 2006. The Witwatersrand Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 155-186.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Rubidge, B.S., 2005. 27th Du Toit Memorial Lecture: re-uniting lost continents — fossil reptiles from the ancient Karoo and their wanderlust. South African Journal of Geology 108: 135-172.

Snyman, C.P., 1998. Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds), The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations/drilling commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects,

bone, coal) should be put aside in a suitably protected place. This way the construction activities will not be interrupted.

3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 16). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossils that could be found

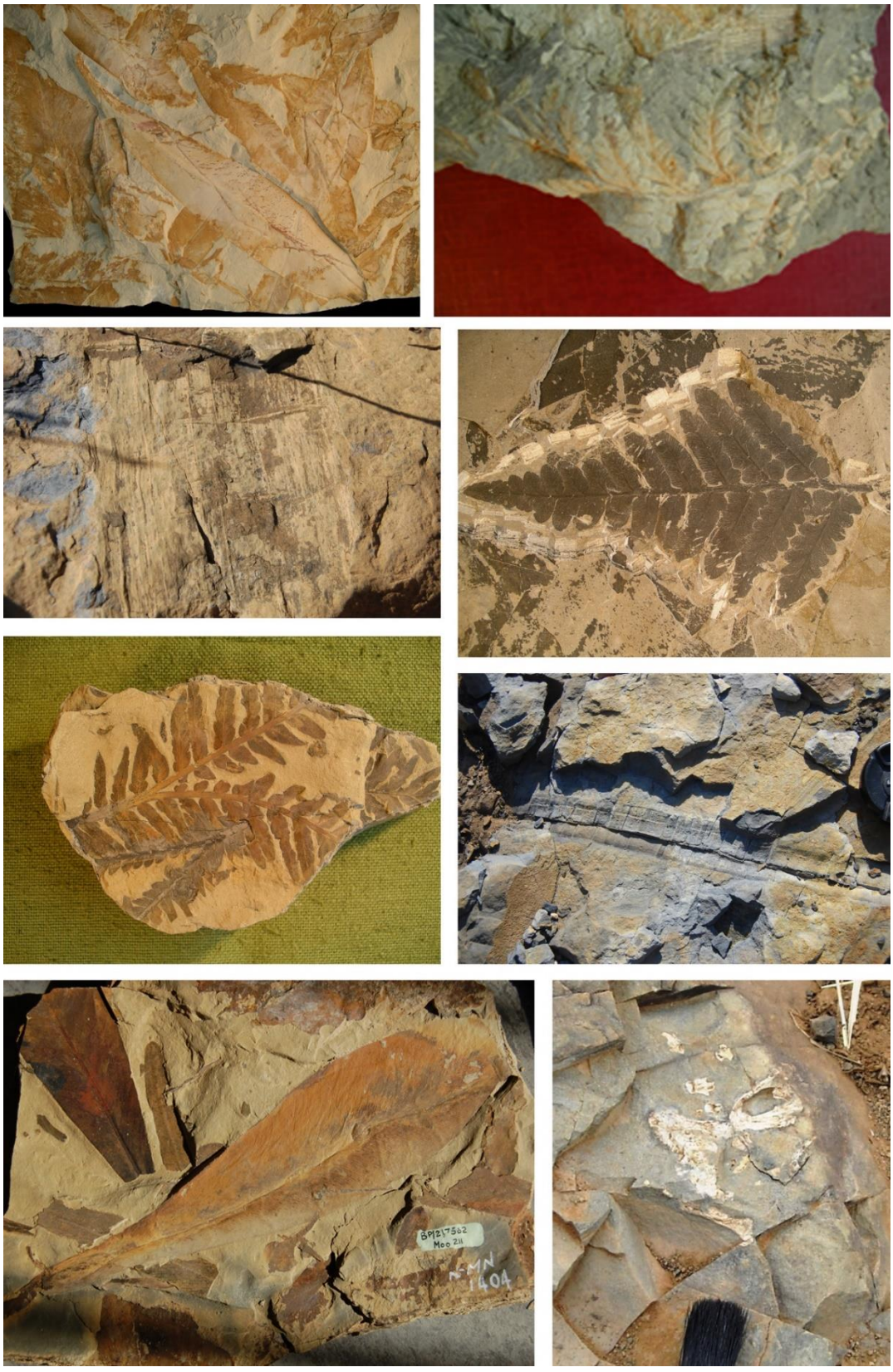

Figure 16: Examples of fossil plants from the Vryheid Formation collected from other sites.

Appendix B – Details of specialists

Curriculum vitae (short) - Marion Bamford PhD
January 2021

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991

International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	9	2
Masters	9	5
PhD	11	5
Postdoctoral fellows	10	4

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 –

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources

- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
  Skeerpoort Farm Mast 2020 for HCAC
  Vulindlela Eco village 2020 for 1World
  KwaZamakhule Township 2020 for Kudzala
  Sunset Copper 2020 for Digby Wells

xi) Research Output

Publications by M K Bamford up to November 2020 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 29; Google scholar h index = 36;
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)

NRF Rating: C-2 (1999-2004)

Mr Frederick Tolchard
Brief Curriculum Vitae – January 2021

Academic training

BA Archaeology – University of the Witwatersrand, graduated 2015
BSc (Honours) Palaeontology – University of the Witwatersrand, 2017 with distinction
MSc Palaeontology – University of the Witwatersrand, 2018 – 2019. Graduated 2020 with Distinction
PhD Palaeontology – Wits – 2020 - current

Field Experience

Honours Fieldtrip – Karoo biostratigraphy – April 2017
Research fieldwork – Elliot Formation with Prof Choiniere – April 2018, November 2018; April 2019

Publications

Tolchard, F., Nesbitt, S.J., Desojo, J.B., Viglietti, P.A., Butler, R.J. and Choiniere, J.N., 2019. 'Rauisuchian' material from the lower Elliot Formation of South Africa: Implications for late Triassic biogeography and biostratigraphy. Journal of African Earth Sciences, 160, 103610.

Viglietti, P.A., McPhee, B.W., Bordy, E.M., Sciscio, L., Barrett, P.M., Benson, R.B.J., Wills, F., Tolchard, F., Choiniere, J.N., 2020. Biostratigraphy of the Scalenodontoides Assemblage Zone (Stormberg Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 239-248.

PIA fieldwork projects

2018 May – Williston area – SARAO project, Digby Wells
2018 September – Lichtenburg PVs – CTS Heritage
2018 November – Nomalanga farming – Digby Wells
2019 January – Thubelisha coal – Digby Wells
2019 March – Matla coal – Digby Wells
2019 March – Musina-Machado SEZ – Digby Wells
2019 June – Temo coal – Digby Wells
2019 September – Makapanstad Agripark – Plantago
2020 January – Hendrina, Kwazamakuhle – Kudzala
2020 February – Hartebeestpoort Dam - Prescali
2020 March – Twyfelaar Coal mine – Digby Wells
2020 March – Ceres Borrow Pits – ACO Associates
2020 March – Copper Sunset Sand – Digby Wells
2020 October – Belfast loop and Expansion – Nsovo
2020 October – VLNR lodge Mapungubwe – HCAC
2020 November – Delmore Park BWSS - HCAC
2020 December – Kromdraai commercial - HCAC