Palaeontological Impact Assessment for the proposed VLNR Lodge near Mapungubwe, Limpopo Province

Site Visit (Phase 2) Report

For

Heritage Consultants and Archaeological Contracts

27 October 2020

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 23 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Heritage Contracts and Archaeological Consulting, Modimolle, 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 was requested for the proposed construction of a Lodge on the north side of Lizzulea Dam, Venetia-Limpopo Nature Reserve, south of Mapungubwe. 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 (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development on 20th October 2020.

The proposed site lies on the potentially fossil-rich sediments of the Karoo Supergroup, Tuli Basin formations, namely the Bosbokpoort and Clarens Formations, so a site visit was conducted. Only trace fossils of invertebrate burrows and rhizoliths were found on rock fragments, i.e. not in situ, but this indicates their presence nearby. Clarens Formation red beds were found and they should be avoided for any development if possible. Although no body fossils or plant impressions were found, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological site visits are required unless bones or plants are found once excavations and drilling commence. Then a palaeontologist should be called to collect a representative sample.

Table of Contents

1. Background

The proposal to construct a lodge on the northern bank of the Lizzulea Dam in the Venetia-Limpopo Nature Reserve, south of Mapungubwe, Limpopo Province, on an area of about 500ha, has been put forward. The area is indicated as very highly sensitive on the SAHRIS palaeosensitivity map so a site visit is required. This was completed by PhD candidate Mr Rick Tolchard and is reported herein.

A Palaeontological Impact Assessment was required for the project. 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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

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
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix
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
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 construction of a lodge with the affected area shown by the yellow shading. Map supplied by HCAC.

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

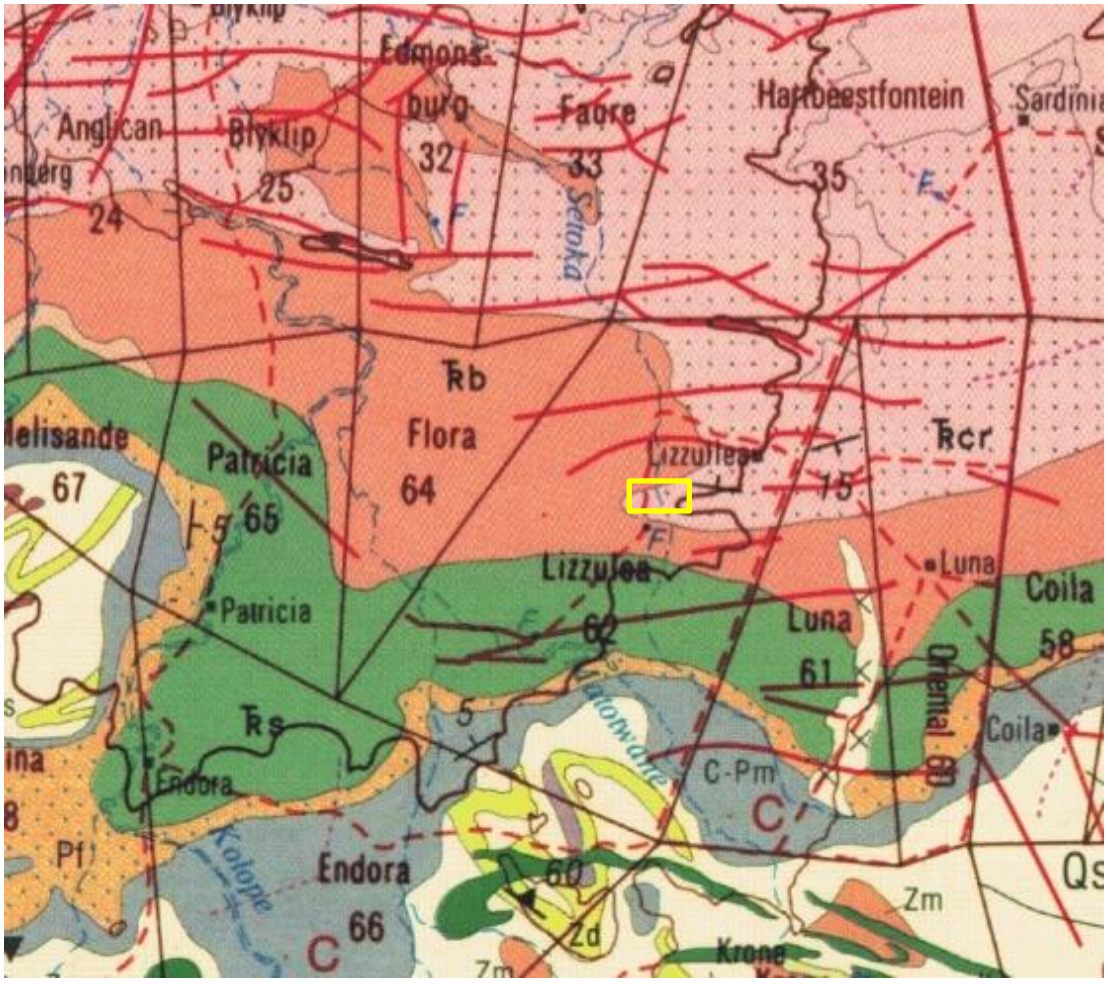

Figure 2: Geological map of the area around the Farm Lizzulea with the proposed site for the lodge indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2228 Alldays.

Table 2: Explanation of symbols for the geological map and approximate ages (Bordy, 2018; Bordy and Catuneanu, 2001; Johnson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary	Sandy soils	Neogene, ca 2.5 Ma to present
Tr-cr	Clarens Fm, Stormberg Group, Karoo SG	Red rocks – fine-grained red and white mottled argillaceous sandstone	Jurassic
Tr-b	Bosbokpoort Fm, Karoo SG	Brick-red to purplish mudstones and siltstones	Middle - late Triassic
Tr-s	Solitude Fm, Karoo SG	Multi-coloured siltstones, sandstones, mudstones	Early Triassic, Beaufort Group
Pf	Fripp Fm, (Molteno Fm), Karoo SG	White feldspathic sandstones, grit and conglomerate	Late Permian – Triassic?
C-Pm	Mikambeni, Madzaringwe, Tshidzi Fms, Dwyka and Ecca Groups, Karoo SG	Mudstone, shale, carbonaceous shale, sandstone, conglomerate, coal seams, locally diamictites or conglomerate at the base	Late Carboniferous to Middle Permian

The site is in the Tuli Basin with a sequence of Karoo Supergroup rocks but the formations have different names. The Tuli and Tshipise Basins are controlled by faults that follow the trend of the Limpopo Belt, namely ENE – WSW faults so the sediments are preserved in fault blocks (Johnson et al., 2006).

Although not differentiated in the 1:250 000 geological map, the basal rocks comprise three formations, the Tshidzi, Madzaringwe and Mikambeni Formations are equivalent of the Dwyka and Ecca Group sediments of the main Karoo Basin (Johnson et al., 2006; Bordy, 2018).

The overlying Fripp Formation, probably equivalent of the Molteno Formation Group is composed of sandstones and grits and was probably deposited by braided streams flowing towards the northwest and west.

Above the Fripp Formation is the Solitude Formation of fine-grained sediments and may represent the floodplain and overbank deposits of meandering rivers (Johnson et al., 2006).

Bosbokpoort Formation's predominantly red fine-grained sediments overlie the Solitude Formation and suggest deposition on the floodplains of meandering rivers, under dry oxidising conditions because of the abundance of calcareous concretions (ibid).

The youngest formation in this sequence is the Clarens Formation and it has been divided into a lower Red Rocks Member and upper Tshipise Member. Both are composed of aeolian sands and indicate dry conditions except for possible water-lain deposits at the base (ibid).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3 with most of the area indicated as very highly sensitive (red) because of the rocks of the Karoo Supergroup. During the site visit these rocks were investigated and surveyed for fossils.

In particular, the Bosbokpoort and Clarens Formations potentially could have plant fossils of the *Dicriodium* flora (seed ferns, ferns, gymnosperms, lycopods and sphenophytes) or vertebrates such as therapsids (*Thrinaxodon*), dinosaurs (*Massospondylus, Euskeleosaurus*), plus many other vertebrates (Rubidge et al., 1995; Bordy, 2018; Bordy et al., 2020). Fossils are rare in the Clarens Formation relative to the older Elliot formation (Bordy et a;., 2020).

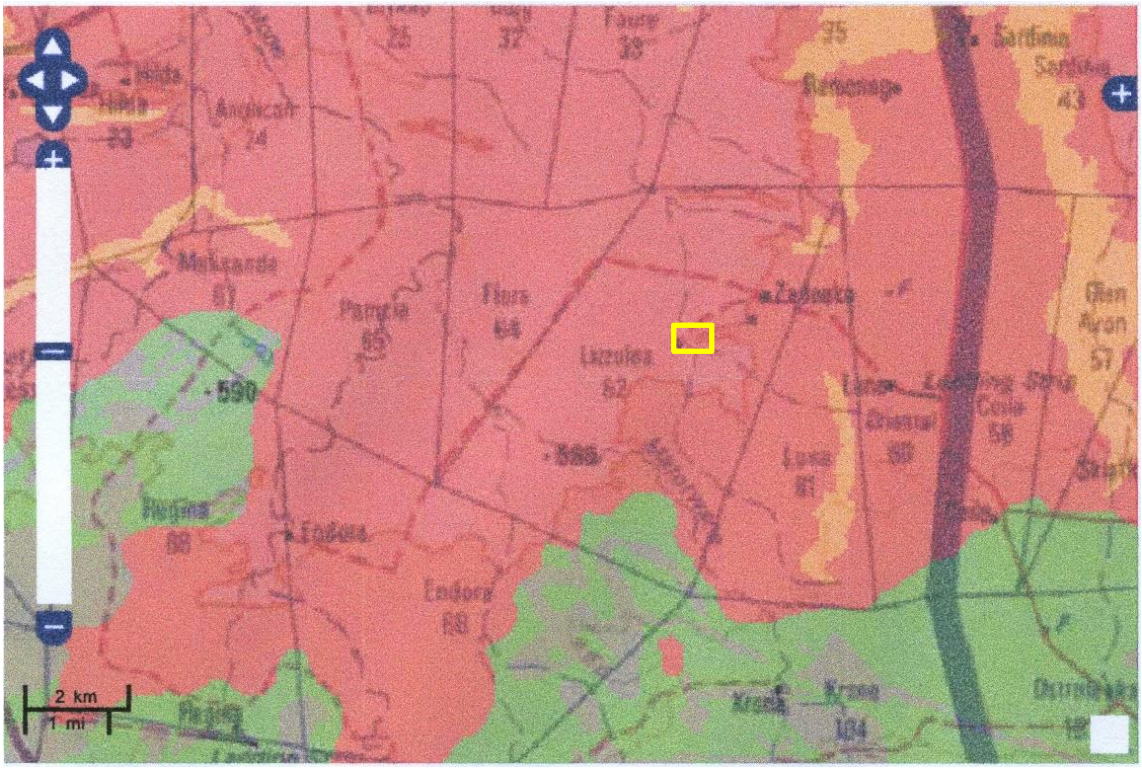

Figure 3: SAHRIS palaeosensitivity map for the site for the proposed lodge on Farm Lizzulea in the Venetia-Limpopo Nature Reserve shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

Iii Site visit observations

Mr Rick Tolchard visited the site on 20th October with Dr Jaco van der Walt (archaeologist). All photographs in Figures 4-7 were taken by Tolchard.

GPS coordinates	Observations	Figure
Trace fossils 22° 20’ 38.46” S 29°19’ 47.17” E 625m	Close to the dam on the northern bank and northwards from the bank where there are a variety of scattered rocks. Some fragments have trace fossils on them but the source was not found.	4a-d; 5a-d
Clarens outcrop, trace fossils 22° 20’ 37.70” S 29°:19’ 42.00” E 613m	Some outcrops with *in situ* strata were seen, but they are generally very weathered. No vertebrate fossils were found but with mire time and excavation equipment it might be possible to find fossils bones.	6a-d
22° 20’ 37.52” S 29° 19’ 41.91” E 609m	To the north of the dam there is less outcrop of potentially fossiliferous rocks, however no fossils were found	7

Figure 4: Site visit photographs. A – view southwards over the dam from the north bank. B – Typical view of mixed rock scatter that is common in the site. C – invertebrate burrow in a small fragment of calcrete (arrowed). D – variety of unidentifiable trace fossils (white circles and lines) in a fragment of ochre-coloured rock, probably not local.

Figure 5: Photographs – A – black staining of manganese oxide. B – sharp contact between fine-grained sandstone (left) and coarser-grained sands with trough cross-bedding (right) and possibly lower when in situ. C - trace fossils on rock fragments, probably *Skolithos* vertical burrows seen as holes with black infil. D – worm burrows in fine sand.

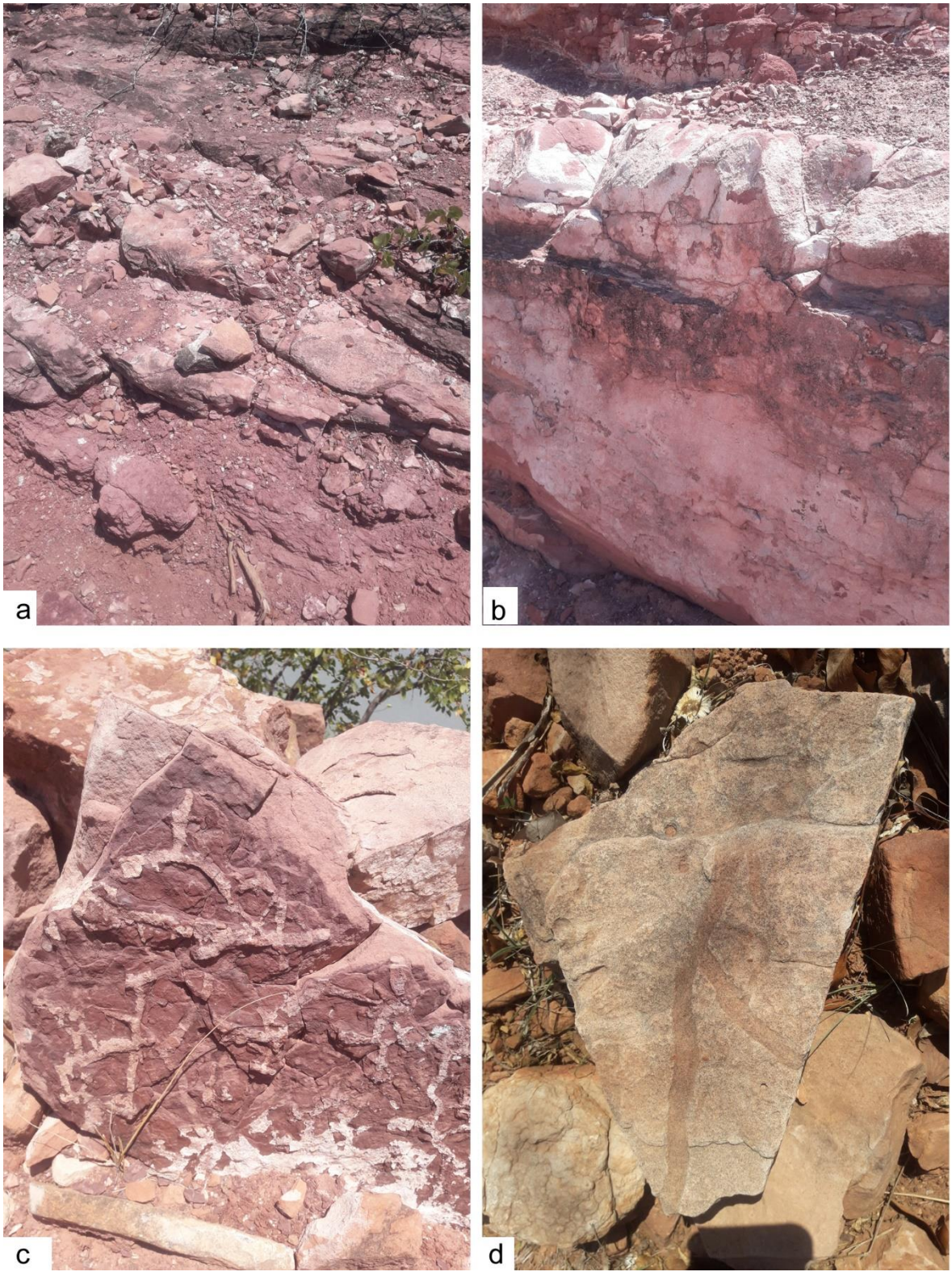

Figure 6: Clarens Formation site and trace fossils. A – typical red beds of the Clarens Formation. B – layer of calcareous nodules (white/pink) in the Clarens formation indicating drying out of floodplain deposits. C – trace fossils: worm burrows and rhizoliths (root casts) on a rock fragment. D – invertebrate burrow, about 15mm wide.

Figure 7: Open area looking northwards showing the rocky surface and sparse vegetation of bare mopane trees (*Colophospermum mopane*).

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in **Error! Reference source not found.**A:

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 *severely* altered.
	8	**High**	Bio-physical and/or social functions and/or processes might be *considerably* altered.
	6	**Medium**	Bio-physical and/or social functions and/or processes might be *notably* altered.
	4	**Low**	Bio-physical and/or social functions and/or processes might be *slightly* altered.
	2	**Very low**	Bio-physical and/or social functions and/or processes might be *negligibly* altered.
	0	**Zero**	Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10**	**Very high**	Positive: Bio-physical and/or social functions and/or processes might be *substantially* enhanced.
	8	**High**	**Positive**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced.
	6	**Medium**	**Positive**: Bio-physical and/or social functions and/or processes might be *notably* enhanced.
	4	**Low**	**Positive**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced.
	2	**Very low**	**Positive**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced.
	0	**Zero**	**Positive**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
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 Mothae Diamond Mine and within the provincial boundaries.
	2	**Local**	Within a 5 km radius of the Mothae Diamond Mine.
	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	**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. ***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. ***Low:*** The activity is localised and might have a negligible cumulative impact. ***None:*** No cumulative impact on the environment.

Pre-mitigation (construction phase only, operation and closure not relevant)
SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.

SS = (6 + 5 +1+ 3 + 5) x 3
= 20 x 3
= 60
= Medium impact pre-mitigation (see table 3B)

With Mitigation – after removal of the top soil and if fossils are found once the foundations are being dug, the then photographs must be sent to a palaeontologist to assess their scientific importance (for example, unidentifiable bone or plant fragments are not important). From the photographs the palaeontologist must a) go to site as soon as possible and excavate the fossils, with a SAHRA permit, or b) request that the developer or environmental officer remove the fossils and put them aside for collection later, or c) recommend that the fragments be disposed of, (see Section 8).
SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.

SS = (0 + 2 + 1 + 1 + 0) x 0
= 4 x 0
= 0
= Positive impact post-mitigation

Table 3B: Significance Scores and Environmental Significance calculated from Table 3A.

Significance Score	Environmental Significance	Description / criteria
125 – 150	**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.
100 – 124	**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.
75 – 99	**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.
40 – 74	**Medium (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**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.

Based on the nature of the project, and the observations from the site visit survey, surface activities will not impact on the fossil heritage. A variety of trace fossils was found but they were not in situ and the primary source is not known. Clarens sediments are present and there might be fossils preserved below ground, however, as noted by Bordy et al. (2020), fossil plants are very rare and vertebrate fossils are rare. Since there is a small chance that fossils from the Bosbokpoort and the Clarens Formations may be disturbed 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 medium if no mitigation is done.

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 sandstones, shales and sands are typical for the country and could contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils. The trace fossils are ex situ and the source is unknown. Fossils might be preserved below ground.

6. Recommendation

Based on the site visit observations and survey, there are no body fossils on the surface, only isolated rock fragments with trace fossils. No fossils have been recorded from here but based on the geology there is the chance that fossils are preserved below the ground. It is not yet known where the lodge and amenities will be placed. There is a small chance that fossils may occur in the sandstones and shales of the Bosbokpoort or the Clarens Formations, so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found once excavations or drilling for building foundations and amenities has commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

The collection of such fossils would be a positive impact because they would not otherwise have been found and made available for scientific study.

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.

Bordy, E.M., 2018. Lithostratigraphy of the Tshidzi Formation (Dwyka Group, Karoo Supergroup), South Africa. South African Journal of Geology 121, 109 – 118.

Bordy, E.M., Abrahams M., Sharman, G.R., Viglietti, P.A., Benson, R.B.J., McPhee, B.W., Barrett, P.M., Sciscio, L., Condon, D., Mundil, R., Rademan, R., Jinnah, Z., Clark, J.M., Suarez, C.A., Chapelle, K.E.J., Choiniere, J.N., 2020. A chronostratigraphic framework for the upper Stormberg Group: Implications for the Triassic-Jurassic boundary in southern Africa. Earth Science Reviews 203, 103120. https://doi.org/10.1016/j.earscirev.2020.103120

Bordy, E.M., Head, H.V., 2018. Lithostratigraphy of the Clarens Formation (Stormberg Group, Karoo Supergroup), South Africa. South African Journal of Geology 121, 119 – 130.

Bordy, E,M., Catuneanu, O., 2001. Sedimentology of the upper Karoo fluvial strata in the Tuli Basin, South Africa. Journal of African Earth Sciences 33, 605 – 629.

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.

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.

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 photographed and the photographs sent to a palaeontologist to assess the importance.
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 Figures 8-10). This information will be built into the EMP's training and awareness plan and procedures.
4. The palaeontologist must decide on the scientific importance of the fossils and recommend one of three options:
5. A. The palaeontologist must excavate the fossils before excavations can resume. 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.

   B. The developer can remove the fossils and put them aside until the palaeontologist can come to site to collect them.

   C. The fossils are of no scientific value and can be removed and discarded.
6. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.

7. If no good fossil material is recovered then no site inspections by the palaeontologist will 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 fossil plants and vertebrates from the Molteno and Clarens Formations that could occur on site.

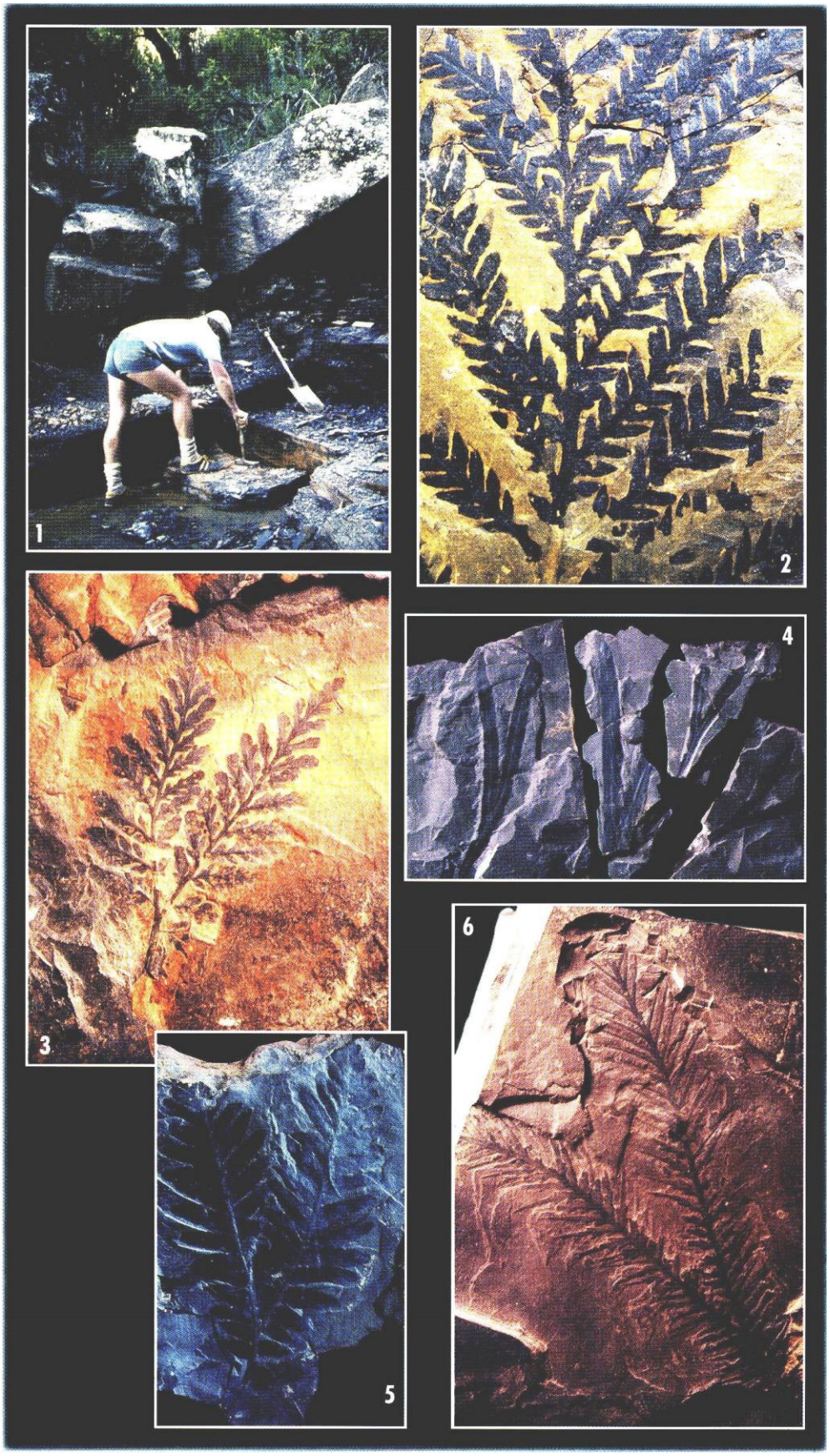

Figure 8: Examples of fossil plant impressions from the Molteno flora (equivalent of the Bosbokpoort Formation. From McRae, 1999, Life Etched in Stone. GSSA.

Figure 9: Some vertebrate bones from the Elliott Fm, already prepared.

Figure 10: Unidentified fossil bones sticking out of a rock – the typical appearance of fossils seen in the field.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
July 2020

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 October 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 = 35;
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 – September 2020

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