

**Palaeontological Impact Assessment for the proposed
Dispatch Rider project, Middelburg Mine Services
North
Mpumalanga Province**

H236

Desktop Study (Phase 1)

For

**Jones & Wagener
Engineering and Environmental Consultants**

April 2022

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Expertise of Specialist

The Palaeontologist Consultant: 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 Jones & Wagener Engineering and Environmental Consultants, 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:

A handwritten signature in blue ink, appearing to read 'M. Bamford', with a horizontal line underneath.

Executive Summary

A Palaeontological Impact Assessment (PIA) was requested for the planned expansion of underground mining, the Dispatch Rider project, for Middelburg Mine Services North (MMS North) for Sertiti Power (Pty) Ltd (Seriti) in order to meet their quota commitment to Duvha Power Station. 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), requires that a PIA be completed for the proposed development,

The existing coal mine lies on the potentially fossiliferous Vryheid Formation (Ecca Group, Karoo Supergroup) and the surface has already been highly disturbed by existing mining activities. The proposed mine expansion will be underground and the proposed new infrastructure will be located on disturbed land. Fossils associated with coal seams include impressions of *Glossopteris* leaves, lycopods, sphenophytes, ferns and early gymnosperms can occur in the shales between the coal seams. The coal itself does not have any recognisable fossils because they have been completely altered and compressed by natural compression and heating over time.

Although the Vryheid Formation is considered to be very highly sensitive for palaeontology, the site is already disturbed and fossils are unlikely to be found on the surface. Nonetheless, a Fossil Chance Find Protocol should be added to the Environmental Management Programme (EMPr). Based on this information it is recommended that no palaeontological site visit is required unless fossils are found once the mining operations have commenced.

The palaeontological impact is low so the project should go ahead.

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1. Background

Seriti Power Proprietary Limited (Seriti)'s Middelburg Mine Services North (MMS North), plan to extend the coal mining operations to include seams below the current mining operation (Figure 1).

Project Background

MMS North is an operational mine of Seriti, situated between the towns of eMalahleni, Middelburg and Kriel, in the Mpumalanga Province of South Africa. Seriti is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) and notarially executed on the 21st of May 2015 under DMR reference MP30/5/1/2/2/379MR, in respect of its Middelburg Mine Services North and South Sections. This mining right comprises of the following areas:

- Middelburg Mines North Section (MMS North) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North, Vandyksdrift and South Eskom Processing Plants; and
- Middelburg Mines South Section (MMS South) consisting of the Wolvekrans, Vlaklaagte (mining ceased); Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Export Plant.

MMS North is an opencast mine, which supplies coal to Eskom's Duvha Power Station. Seriti is contracted to supply thermal coal to this power station until 2034 in terms of their current Coal Supply Agreement. The Life of Operation Plan (LoOP) for MMS North has confirmed a future shortfall of coal production. This necessitates the development of additional reserves in order to minimise buy-in coal and supplement the current volume of coal to supply the Duvha Power Station (SEAC, 2019).

Seriti therefore proposes to mine the No. 1, No. 2 and No. 4 seam coal using underground mining at the Dispatch Rider section, which is located in the south of the Hartbeestfontein section. This is expected to extend the current life of mine (LOM). The proposed project is located within the existing MMS mining right boundary, with the exception of a portion of the area to be mined to the east, which forms part of the Dispatch Rider prospecting right area.

Dispatch Rider Project

Mining of the opencast area (DW pit) in the southern portion of the Hartbeestfontein section was approved in an amendment of the Environmental Management Programme Report (EMPR) in 2007.

The Dispatch Rider project entails the following:

- Changing the mining method of the existing EMPR approved opencast area (pit DW) to underground mining;
- Extending the underground mine to the adjacent property to the east within the Dispatch Rider prospecting right area; and

- Development of infrastructure in support of the Dispatch Rider underground mine.

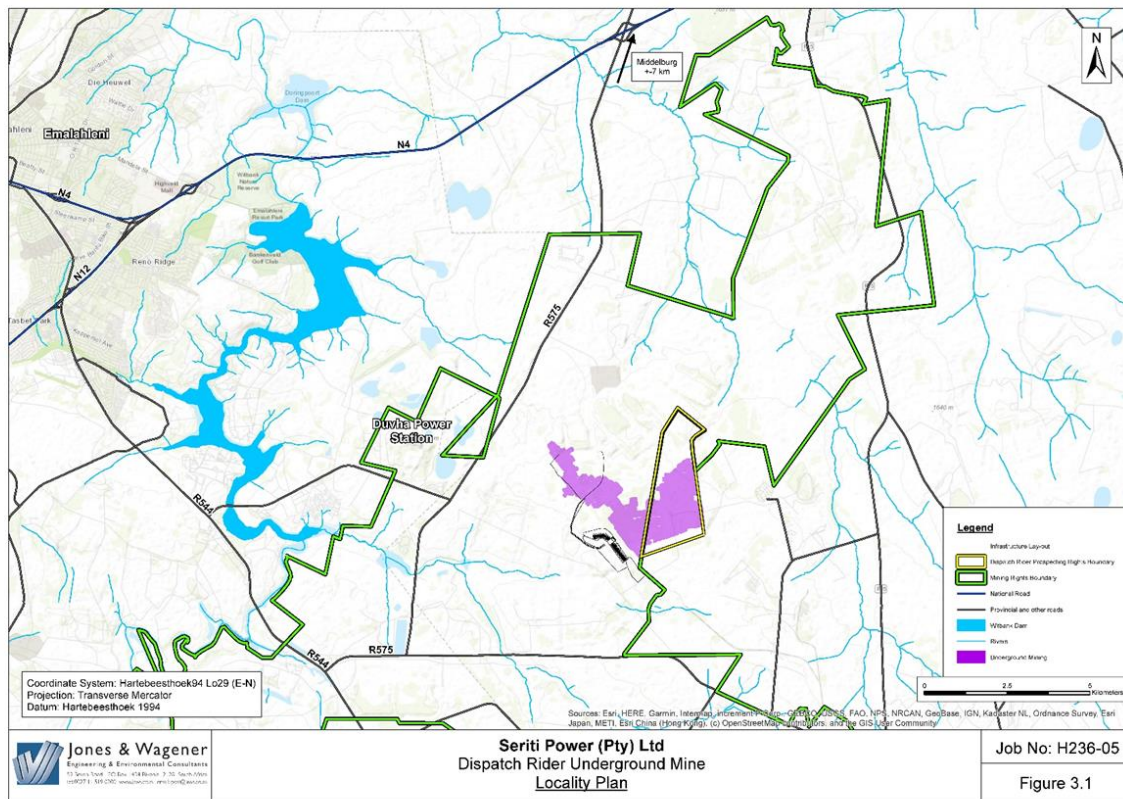


Figure 1: Locality Plan.

Figure 2 below shows the extent of the underground mining. Mining will be done using continuous miners. No shafts will be sunk for the project. The adjacent high wall of an old opencast pit will be used to gain access to the underground.

Infrastructure associated with the Dispatch Rider project is indicated in Figure 3. The infrastructure required in support of the project will include the following:

- Adit/portal;
- Portal sump;
- Vent fans;
- Electrical substation and overhead line (33 kV unit diverted from existing power line);
- Mine service water reservoir receiving raw water from one of the existing mine voids (e.g. H3/H4 or Vlaklaagte void). Water from the mine service water reservoir will be pumped and distributed to the underground mine, as well as to the dust suppression system. This dam will also feed the Wash Bay Storage Tank and Fire Water Tanks;
- Control room, lamp and crush room, offices and parking, change house and security;
- Two Run of Mine (ROM) stockpiles;
- Above ground steel water tank for the storage of mine impacted water with an estimated capacity of 10 Mℓ (referred to as the mine impacted water steel tank);

- Two steel fire water tanks (expected capacity of 2 Mℓ each);
- Potable water tank supplied from the existing Usuthu pipeline;
- Brake test ramp;
- Fuel and lube bay;
- Wash bay;
- Workshop and stores;
- Water filtration plant.

No new haul roads will be developed since existing haul roads will be used. Road development will be limited to service roads.

A Palaeontological Impact Assessment (PIA) was requested for the Dispatch Rider 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 PIA was completed for the proposed development and is presented herein.

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

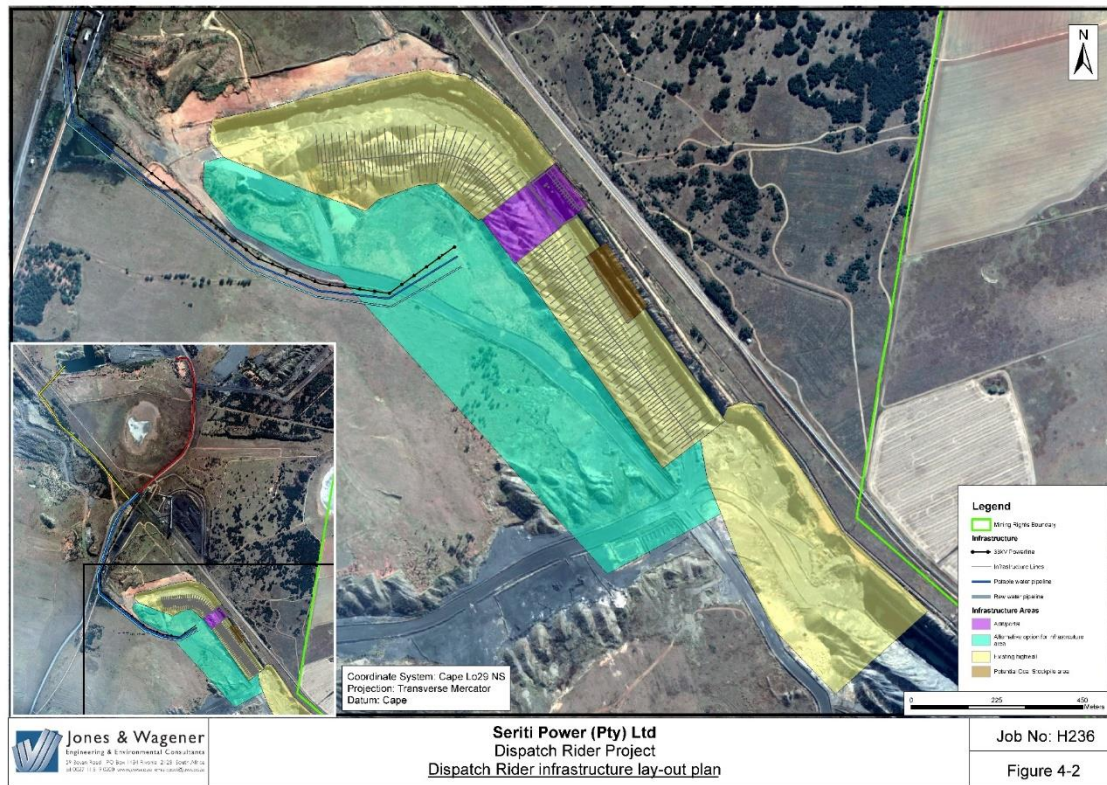


Figure 3: Details of the infrastructure for the Dispatch Rider project.

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 (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

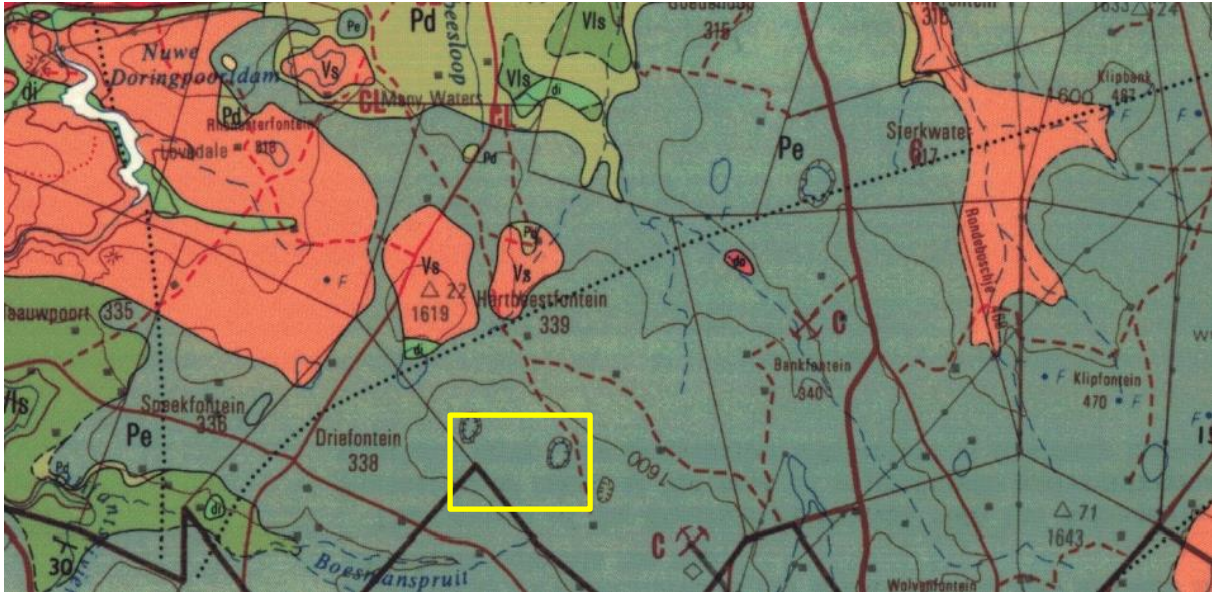


Figure 4: Geological maps of the area around MMS North and the Dispatch Rider project with the site indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand ERPM.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson 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
Pe	Vryheid Fm, Eccca Group, Karoo SG	Shales, sandstone, coal	Early Permian, Middle Eccca
Pd	Dwyka Group, Karoo Supergroup	Diamictites, tillites, shales, mudstones	Late Carboniferous to Early Permian

The colliery is in the northern part of the Karoo Basin in the Witbank coalfield with many other coal mines in the region. The coals were formed over time from peats that accumulated in and around the large Karoo inland “sea”, during the Early Permian.

As the continent gradually moved northwards away from its position over the South Pole, the ice sheets melted and drained into the inland Karoo Sea. The early sediments deposited were the Dwyka tillites and diamictites, i.e. debris and stones that had been entrapped in the icesheets. Then the region was densely vegetated as the climate warmed. This vegetation

formed peats that were buried under more and more sediments. Because of the uneven topography and local settings such as swamps, deltas, lakes, rivers, the peats and later the coals vary in thickness, type and quality (Cadle et al., 1993). Successive deposition of sediments and the gradual drying of the climate meant that no more peats were formed so overlying sediments do not have coal seams, this includes most of the Beaufort Group rocks.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 5 with the Vryheid Formation indicated as very highly sensitive (red on the SAHRIS map).

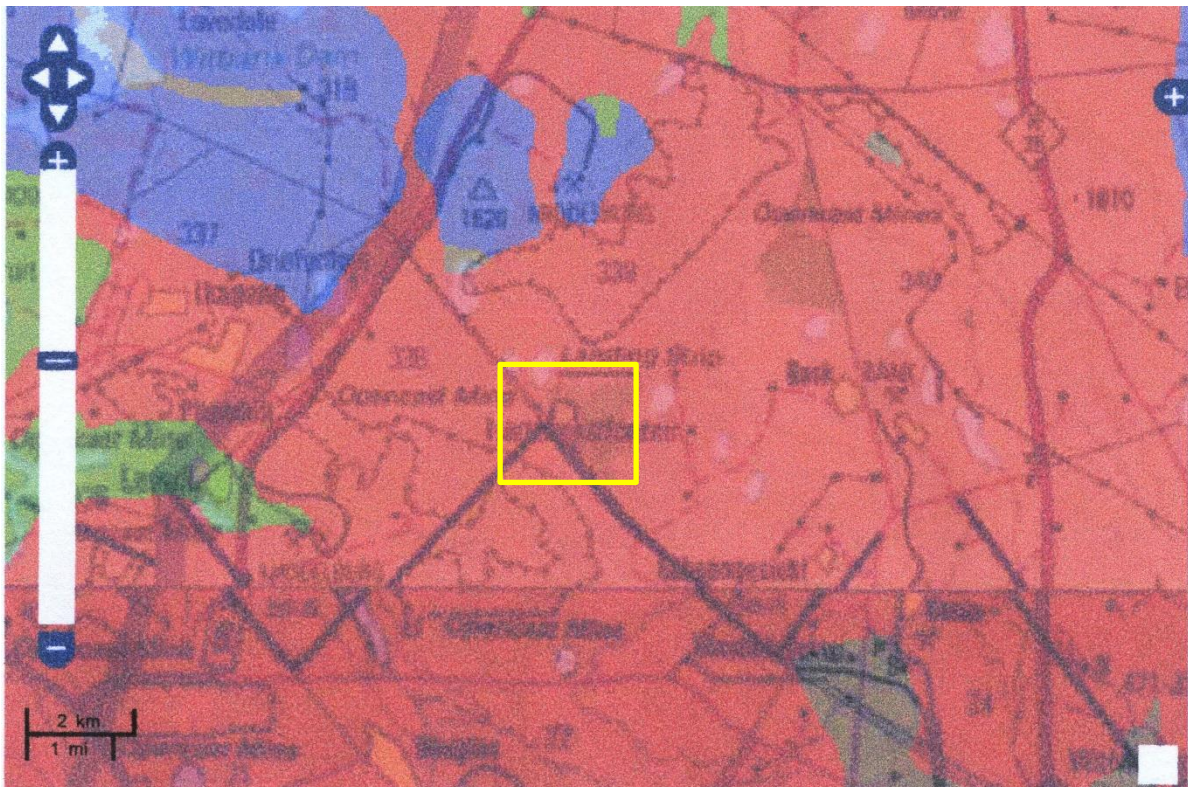


Figure 5: SAHRIS palaeosensitivity map for the site for the proposed Dispatch Rider project shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The fossils occurring in the Vryheid Formation are plants of the *Glossopteris* flora and include leaves, roots and reproductive structures of the seed fern *Glossopteris*, as well lycopods, sphenophytes, ferns and early gymnosperms (see Appendix A). Although these plants are abundant in exposures where they occur, the distribution of sites is scattered and unpredictable (Plumstead, 1969; Anderson and Anderson, 1985; own observations). There were very few land vertebrates at this time as they evolved later. Also, one seldom finds fossils plants and animals together because the conditions for preservation are different: plants require a reducing environment and bones require an oxidizing environment.

From the SAHRIS map above the area is indicated as very highly sensitive (red), however the area is already highly disturbed from previous mining activities (Figures 2 and 3).

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considered the criteria encapsulated in Table 3:

TABLE 3A: 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 3B: IMPACT ASSESSMENT – PLANNING PHASE

PART B: ASSESSMENT		
SEVERITY/NATURE	H	-
	M	-
	L	Dolerites, coarse sandstones and coals do not preserve plant fossils; only the shales between the coal seams are likely to preserve fossils. So far there are no records from the Vryheid formation of plant or animal fossils in this mined site so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	L	-
	M	-
	H	Where manifested, the impact will be permanent.
SPATIAL SCALE	L	Since only the possible fossils within the area would be fossil plants from the <i>Glossopteris</i> flora in the shales, the spatial scale will be localised within the site boundary.
	M	-

PART B: ASSESSMENT		
	H	-
	H	-
PROBABILITY	M	It is unlikely that any fossils would be found in the loose coal and carbonaceous shales that have been mined and exposed to weathering. There might be fossils in the partings between the coal seams far below ground. Therefore, a Fossil Chance Find Protocol should be added to the eventual EMPr.
	L	-

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The surface is already very disturbed from previous and current mining activities and the coals and carbonaceous shales exposed will have weathered rapidly. Since there is a small chance that fossil plant impressions of the *Glossopteris* flora in the Vryheid Formation may be found below ground in un-weathered shales, once mining operations commence, 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**. Once any fossils have been removed there will be NO impact on any further stages (operational, closure).

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 do contain fossil plant, insect, and invertebrate material. The exposed and weathered shales and carbonaceous shales would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the exposed and weathered shales and carbonaceous shales of the Vryheid Formation. There is a very small chance that fossil plant impressions of the *Glossopteris* flora may occur in the shales below ground so a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once mining has commenced then these should be rescued and a palaeontologist called to assess and collect a representative sample.

As far as the palaeontology is concerned, the project may go ahead.

7. References

- Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodrum 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.
- Cadle, A.B., Cairncross, B., Christie, A.D.M., Roberts, D.L., 1993. The Karoo basin of South Africa: the type basin for the coal bearing deposits of southern Africa. *International Journal of Coal Geology* 23, 117-157.
- 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.
- 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 / mining activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations/mining commence.
2. When excavations begin the rocks 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 project 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 1.5). 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/miners 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 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 from the Vryheid Formation

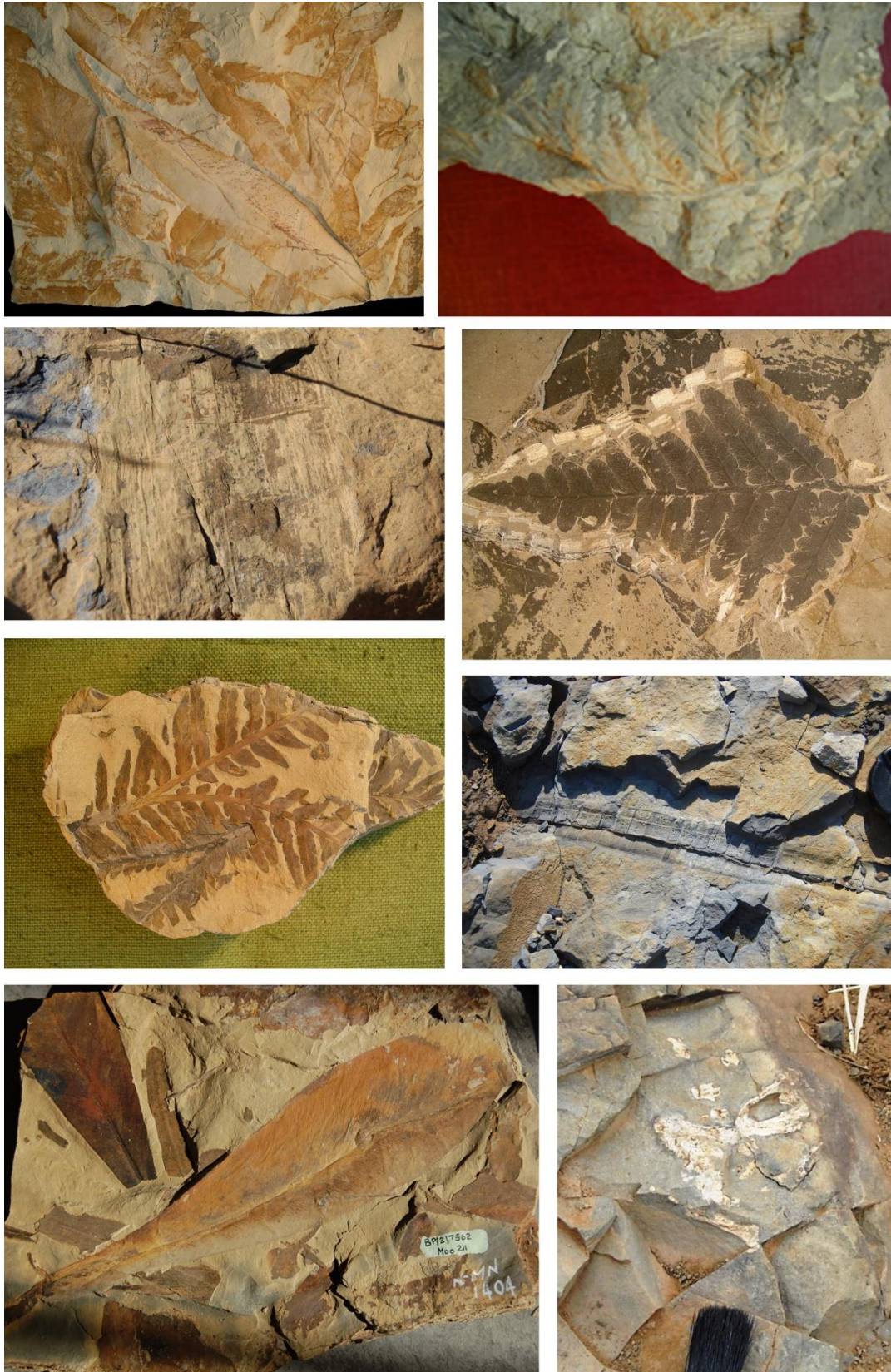


Figure 6: A selection of fossils plants from the Vryheid Formation. Note: impressions of plants are the most common. Compressions (with cuticle preserved) are rare. Bottom right shows bone fragments exposed on the surface (rocks of the Beaufort Group).

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD November 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-
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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 –
Journal of African Earth Sciences: 2020 -

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; i10-index = 80

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)