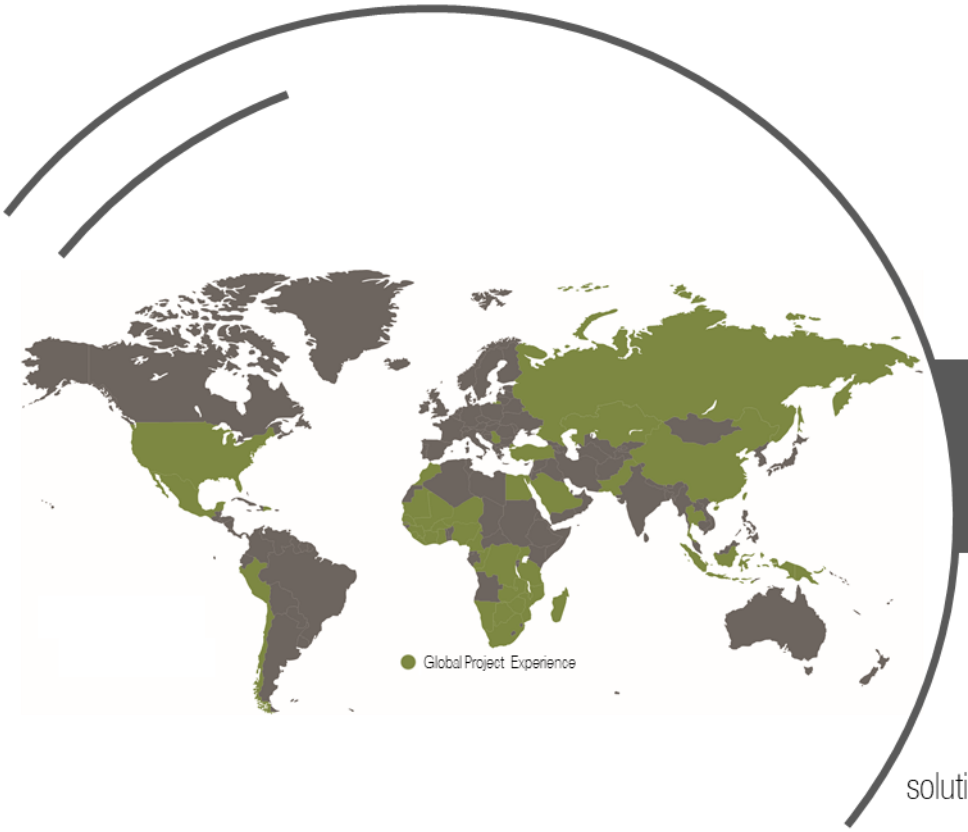

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Mining Permit Applications to undertake Sand Mining at the New Vaal Colliery, Free State Province

Heritage Impact Assessment

Prepared for:
Copper Sunset (Pty) Ltd

Project Number:
COP6147

March 2020

Digby Wells and Associates
(South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

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Report Type:	Heritage Impact Assessment
Project Name:	Mining Permit Applications to undertake Sand Mining at the New Vaal Colliery, Free State Province
Project Code:	COP6147

Name	Responsibility	Signature	Date
Shannon Hardwick HRM Consultant ASAPA Member: 451	Report Compilation Pre-disturbance Survey		March 2020
Justin du Piesanie Divisional Manager: Social and Heritage Services ASAPA Member 270	Technical Review		March 2020

ACRONYMS

Acronym	Description
APM	Archaeology, Palaeontology and Meteorites
ASAPA	The Association of Southern African Professional Archaeologists
BA	Basic Assessment
CE	Common Era
CFP	Chance Find Protocol
CMP	Conservation Management Plan
Copper Sunset	Copper Sunset (Pty) Ltd
CRM	Cultural Resources Management
CS	Cultural Significance
EA	Environmental Authorisation
EFC	Early Farming Community
EIA	Environmental Impact Assessment
ESA	Early Stone Age
FDDM	Fezile Dabi District Municipality
GIS	Geographic Information Systems
GN R	Government Notice Regulations
GSSA	Genealogical Society of South Africa
ha	Hectares
HFS	Heritage Free State
HIA	Heritage Impact Assessment
HRM	Heritage Resources Management
I&APs	Interested and Affected Parties
ICOMOS	The International Council on Monuments and Sites
IDP	Integrated Development Plan
kya	Thousand Years Ago

Acronym	Description
LFC	Late Farming Community
LSA	Later Stone Age
MLM	Metsimahalo Local Municipality
MPRDA	The Minerals and Petroleum Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Area
MSA	Middle Stone Age
MSc	Master of Science
mya	Million Years Ago
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA	The National Heritage Resources Management Act, 1999 (Act No. 25 of 1999)
NID	Notification of Intent to Develop
NWA	The National Water Act, 1998 (Act No. 36 of 1998)
PIA	Palaeontological Impact Assessment
PPP	Public Participation Process
PSM	Palaeo-Sensitivity Map
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SEP	Stakeholder Engagement Process
Seriti	Seriti Resources
SoW	Scope of Work
Wits	University of the Witwatersrand

DECLARATION OF INDEPENDENCE

Digby Wells and Associates (South Africa) (Pty) Ltd

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I, Shannon Hardwick as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Copper Sunset (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the Heritage Resources Management (HRM) Process for the New Vaal Sand Mining Right and Mining Permit Applications.

_____

Full Name:	Shannon Hardwick
Title/ Position:	Heritage Resources Management Consultant
Qualification(s):	MSc
Experience (Years):	2 years
Registration(s):	Association of Southern African Professional Archaeologists (ASAPA) International Council on Monuments and Sites (ICOMOS) South Africa

DECLARATION OF INDEPENDENCE

Digby Wells and Associates (South Africa) (Pty) Ltd

Contact Person: Justin du Piesanie

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2191		

I, Justin du Piesanie as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Copper Sunset (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the Heritage Resources Management (HRM) Process for the New Vaal Sand Mining Right and Mining Permit Applications.

_____

Full Name:	Justin du Piesanie
Title/ Position:	Divisional Manager: Social and Heritage Services
Qualification(s):	MSc
Experience (Years):	12 years
Registration(s):	Association of Southern African Professional Archaeologists (ASAPA) International Council on Monuments and Sites (ICOMOS) South Africa International Association for Impact Assessment South Africa (IAIAsa)

EXECUTIVE SUMMARY

Copper Sunset (Pty) Ltd (hereinafter Copper Sunset) intend to apply for a Mining Permit for the mining of sand in the New Vaal Colliery Mining Right Area (MRA) near Vereeniging in the Free State Province (the Project). The New Vaal Colliery is located immediately south of Vereeniging and approximately 18 km northeast of Sasolburg.

Seriti Resources (hereinafter Seriti) holds a Mining Right for the New Vaal Colliery and are presently extending the coal-mining operation ("the New Vaal Life Extension Project"). Copper Sunset and Seriti have come to an agreement which will allow Copper Sunset to mine the sand prior to Seriti mining the coal. The areas proposed for sand mining (approximately 14.2 hectares [ha]) fall within the intended extension area.

Copper Sunset have divided the potential sand mining area into two parts, one requiring a Mining Permit Application, the other a Mining Right Application[1]. This application is applicable to the Mining Permit Application, and is subject to a Basic Assessment (BA) process.

Copper Sunset appointed Digby Wells Environmental (hereinafter Digby Wells) to undertake the BA process in compliance with:

- The Minerals and Petroleum Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The NEMA EIA Regulations, 2014 (as amended) (Government Notice Regulations [GN R] 982 as amended by GN R 326); and
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA).

Digby Wells undertook a Heritage Resources Management (HRM) process in support of the BA processes in compliance with the aforementioned legislation and the National Heritage Resources Management Act, 1999 (Act No. 25 of 1999) (NHRA). This report constitutes a Heritage Impact Assessment (HIA) report to inform the Mining Permit Application.

Digby Wells identified no heritage resources within the proposed Project area. The area is presently characterised by many oak trees, which have remained on the property from the previous landowner. These oak trees were part of an oak plantation which was established in 1948. The Project area has a long history of disturbance and it is therefore unlikely that any archaeological material would remain *in situ*, or within any discernible context.

The proposed sand mining operation, construction of an access road and establishment of temporary infrastructure does not pose a risk of direct negative impacts to known heritage resources. This notwithstanding, there is a chance of exposing archaeological materials and palaeontological fossils during the construction and operational phases. This could result in

[1] This report is to inform the EA for the Mining Permit Application. A Mining Right Application for the planned larger operational footprint will be made at a later date.

damage to or the destruction of cultural and fossil heritage resources. The table below summarises this risk.

Summary of the potential risk to heritage resources

Unplanned event	Potential impact
Accidental exposure of *in situ* palaeontological or archaeological material during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 35 of the NHRA.
Accidental exposure of *in situ* historical built environment sites during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 34 of the NHRA
Accidental exposure of *in situ* burial grounds or graves during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 36 of the NHRA.
Accidental exposure of human remains during the construction phase of the Project.	

To mitigate against these impacts, Digby Wells recommends that Copper Sunset develop and implement a Chance Finds Procedure (CFP) prior to the commencement of the construction phase of the Project. Digby Wells does not object to the implementation of the Project from a heritage perspective, provided this recommendation is implemented.

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1 Introduction

Copper Sunset (Pty) Ltd (hereinafter Copper Sunset) intend to apply for a Mining Permit for the mining of sand in the New Vaal Colliery Mining Right Area (MRA) near Vereeniging in the Free State Province (the Project). Copper Sunset have divided the potential sand mining area into two parts, one requiring a Mining Permit Application, the other a Mining Right Application[2]. This application is applicable to the Mining Permit Application, and is subject to a Basic Assessment (BA) process.

Copper Sunset appointed Digby Wells Environmental (hereinafter Digby Wells) to undertake the BA process in compliance with:

- The Minerals and Petroleum Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R326 of 7 April 2017) (EIA Regulations, 2014, as amended), promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); and
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA).

Digby Wells undertook a Heritage Resources Management (HRM) process in support of the BA processes in compliance with the aforementioned legislation and the National Heritage Resources Management Act, 1999 (Act No. 25 of 1999) (NHRA). This report constitutes a Heritage Impact Assessment (HIA) report to inform the Mining Permit Application.

1.1 Project background and description

The New Vaal Colliery is located immediately south of Vereeniging and approximately 18 km northeast of Sasolburg. The Project falls within the Sasolburg Magisterial District and is located within the Metsimahalo Local Municipality (MLM). The MLM is part of the Fezile Dabi District Municipality (FDDM) of the Free State Province. Plan 1 presents the regional setting within which the Project is located.

Seriti Resources (hereinafter Seriti) holds a Mining Right for the New Vaal Colliery and are presently extending the operation (“the New Vaal Life Extension Project”). Copper Sunset and Seriti have come to an agreement which will allow Copper Sunset to mine the sand prior to Seriti mining the coal. The areas proposed for sand mining (approximately 14.2 hectares [ha]) fall within the intended extension area. The area is presently characterised by many oak trees, which have remained on the property from the previous landowner. These oak trees were part of an oak plantation which was established in 1948 (refer to Figure 5-3).

To minimise potential delays to the New Vaal mining plan, Copper Sunset has divided the sand mining area into two parts: an area of 5 ha which will be mined first and a second area

[2] This report is to inform the EA for the Mining Permit Application. A Mining Right Application for the planned larger operational footprint will be made at a later date.

of 9.2 ha which will be mined later. Copper Sunset therefore must apply for a Mining Permit to exploit the resource in these areas. Plan 2 presents the proposed Project design.

The Project will not require any permanent infrastructure and there will not be any changes to New Vaal's existing or future planned infrastructure. All machinery brought in by Copper Sunset will be mobile. The Project will, however, require the construction of an access road to gain access to the sand resource without disturbing the coal-mining process.

The Project will include:

- Clearing the existing vegetation, which will include the remnants of the oak plantation (remaining trees and surrounding shrubbery);
- Stripping the topsoil, which will be stockpiled separately for use in rehabilitation activities;
- Strip-mining the sand. Sand will be stockpiled before it is loaded into customers' vehicles and removed; and
- Concurrent rehabilitation as the sand is extracted. The area will be sloped and allowed to revegetate naturally.

1.2 Project alternatives

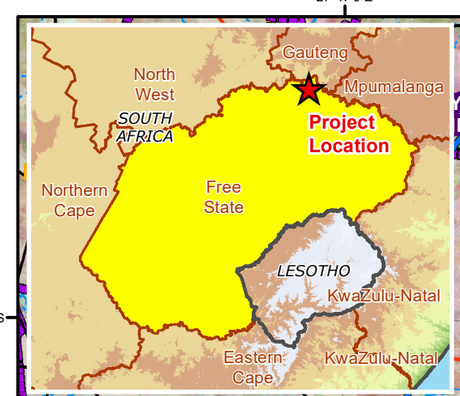
No alternatives have been considered in terms of the location of the Project as the Project is located where the resource exists. Alternative methods for mining the sand and alternative technologies are discussed in the BA report. These alternatives are not expected to affect the assessment of the impact to the heritage resources and will not be discussed in detail here.

One alternative which will affect the impact to heritage resources is the 'no-go' alternative. Should the Project not obtain approval, or not go ahead for any reason, the potential negative environmental impacts associated with the development of the Project would not occur. However, the potential benefits associated with the Project would also not occur.

Plan 1

Copper Sunset

Regional Setting



27°47'0"E 27°54'0"E 28°1'0"E 28°8'0"E

26°32'0"S 26°39'0"S 26°46'0"S 26°53'0"S

EKURHULENI
Daleside
Highbury
De Deur
Evaton
Sebokeng
Randvaal
Meyerton
SEDIBENG
Gauteng
Lesedi Local Municipality
Emfuleni Local Municipality
Vlakplaas
N1
Midvaal Local Municipality
Mining Permit Area
Vereeniging
Sharpeville
Vanderbijlpark
Lochvaal Barrage
Viljoensdrif
R716
Vaalpark
R59
Sasolburg
Metsimaholo Local Municipality
FEZILE DABI
R57
R82
716
Coalbrook
Zamdela
R549
549
Deneysville
VAALRIVIER
WILGERIVIER

Legend

- Mining Permit Area (5ha)
- Seriti Mining Right Area
- Major Town
- Secondary Town
- Other Town
- Settlement
- National Route
- Main Road
- Secondary Road
- Railway Line
- Non-Perennial River/Stream
- Perennial River/Stream
- Provincial Boundary
- District Municipalities (2016)
- Local Municipalities Boundary (2016)

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Central Meridian: 27°E	Date: 06/02/2020

N

0 2 4 8

Kilometres

1:200 000

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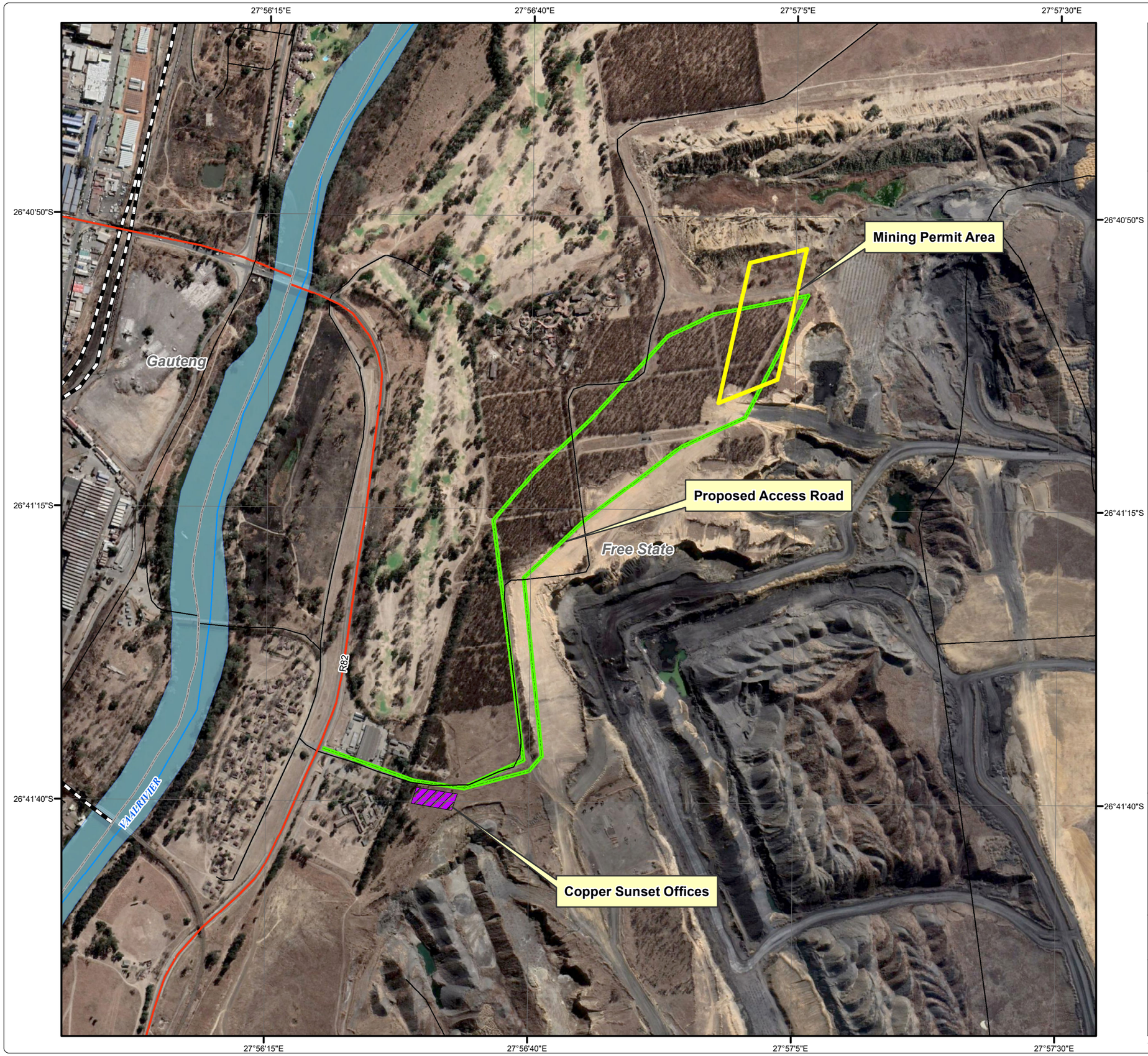
Plan 2

Copper Sunset

Infrastructure Layout



Legend

- Mining Permit Area (5ha)
- Main Road
- Street
- Railway Line
- Perennial River/Stream
- Proposed Access Road
- Copper Sunset Offices
- Provincial Boundary

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Central Meridian: 27°E	Date: 06/02/2020

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0 100 200 400

Metres

1:10 000

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1.3 Terms of Reference

Copper Sunset appointed Digby Wells to complete a Mining Permit Application to mine sand at the New Vaal colliery and undertake the necessary environmental studies in support of the application. The environmental studies included an HRM process in compliance with Section 38(8) of the NHRA.

1.4 Scope of Work

The Scope of Work (SoW) for the specialist HRM process included the compilation of an HIA report to comply with the requirements encapsulated in Section 38(3) of the NHRA. Digby Wells completed the following activities as part of the SoW:

- Description of the predominant cultural landscape supported through primary and secondary data collection;
- Assessment of the Cultural Significance (CS) of the identified heritage resources;
- Identification of potential impacts to heritage resources based on the Project description and Project activities;
- An evaluation of the potential impacts to heritage resources relative to the sustainable socio-economic benefits that may result from the Project;
- Recommending feasible management measures and/or mitigation strategies to avoid and/or minimise negative impacts and enhance potential benefits resulting from the Project; and
- Submission of the HIA report to the SAHRA and the Heritage Free State (HFS) for Statutory Comment as required under Section 38(8) of the NHRA.

1.5 Expertise of the specialist

Table 1-1 presents a summary of the expertise of the specialists involved in the compilation of this report. Appendix A includes the full CVs of the specialists.

Table 1-1: Expertise of the specialists

Team Member	Bio Sketch
Shannon Hardwick ASAPA Member: 451 Years' Experience: 2	Shannon joined the Digby Wells team in May 2017 as a Heritage Management Intern and has most recently been appointed as a Heritage Resources Management Consultant. Shannon is an archaeologist who obtained a Master of Science (MSc) degree from the University of the Witwatersrand in 2013, specialising in historical archaeobotany in the Limpopo Province. She is a published co-author of one paper in *Journal of Ethnobiology*. Since joining Digby Wells, Shannon has gained generalist experience through the compilation of various heritage assessments, including Heritage Scoping Reports (HSRs), HIAs, Heritage Basic Assessment Reports (HBARs) and Section 34 permit applications. Her other experience includes compiling a Community Health, Safety and

Team Member	Bio Sketch
	Security Management Plan (CHSSMP) and various social baselines, including researching Artisanal and Small-Scale Mining as part of a Livelihood Restoration Framework (LRF). Shannon's experience in the field includes pre-disturbance surveys in South Africa, Malawi and the Democratic Republic of the Congo and social fieldwork in Malawi.
Justin du Piesanie ASAPA Member 270 ASAPA CRM Unit ICOMOS Member 14274 IAIAsa Member Years' Experience: 12	Justin is the Divisional Manager for Social and Heritage Services at Digby Wells. Justin joined the company in August 2011 as an archaeologist and was subsequently made HRM Manager in 2016 and Divisional Manager in 2018. He obtained his Master of Science (MSc) degree in Archaeology from the University of the Witwatersrand in 2008, specialising in the Southern African Iron Age. Justin also attended courses in architectural and urban conservation through the University of Cape Town's Faculty of Engineering and the Built Environment Continuing Professional Development Programme in 2013. Justin is a professional member of the Association of Southern African Professional Archaeologists (ASAPA), and accredited by the association's Cultural Resources Management (CRM) section. He is also a member of the International Council on Monuments and Sites (ICOMOS), an advisory body to the UNESCO World Heritage Convention. He has over 12 years combined experience in HRM in South Africa, including heritage assessments, archaeological mitigation, grave relocation, NHRA Section 34 application processes, and Conservation Management Plans (CMPs). Justin has gained further generalist experience since his appointment at Digby Wells in Botswana, Burkina Faso, Cameroon, the Democratic Republic of Congo, Liberia, Malawi, Mali and Senegal on projects that have required compliance with IFC requirements such as Performance Standard 8: Cultural Heritage. Furthermore, Justin has acted as a technical expert reviewer of HRM projects undertaken in Cameroon, Malawi and Senegal. Justin's current focus at Digby Wells is to develop the HRM process as an integrated discipline following international HRM principles and standards. This approach aims to provide clients with comprehensive, project-specific solutions that promote ethical heritage management and assist in achieving strategic objectives.

1.6 Structure of the report

Table 1-2 presents the structure for the remainder of the report and indicates where each section meets the information requirements encapsulated in the NHRA and Appendix 6 of the EIA Regulations, 2014 [as amended by Government Notice Regulation (GN R) 326 of 07 April 2017].

Table 1-2: Structure of the report

Description	App. 6	NHRA	Section
Declaration that the report author(s) is (are) independent.	(b)	-	Page ii and iii
An indication of the scope of, and the purpose for which, the report was prepared.	(c)	-	1.3 1.4
Details of the person who prepared the report and their expertise to carry out the specialist study.	(a)	-	1.5 Appendix A
Outlines the legislative framework relevant to the specialist heritage study.	-	-	2
Identifies the specific constraints and limitations of the HIA, including any assumptions made and any uncertainties or gaps in knowledge.	(i)	-	3
Describes the methodology employed in the compilation of this HIA.	(e)	-	4 Appendix B
An indication of the quality and age of base data used for the specialist report.	(cA)	-	4.4 11
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	(d)	-	0
Provides the baseline cultural landscape.	-	38(3)(a)	5
Motivates for the defined CS of the identified heritage resources and landscape.	-	38(3)(b)	6
A description of the potential impacts to heritage resources by project related activities, including: - Existing impacts on the site; - Possible risks to heritage resources; - Cumulative impacts of the proposed development; - Acceptable levels of change; and - Heritage-related risks to the project.	(cB)	38(3)(c)-	6
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	(j)	38(3)(c)	

Description	App. 6	NHRA	Section
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	(f)	-	
Considers the development context to assess the socio-economic benefits of the project in relation to the presented impacts and risks.	-	38(3)(d)	7
A description of any consultation process that was undertaken during the course of preparing the specialist report and the results of such consultation.	(o)	38(3)(e)	8
A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	(p)	38(3)(e)	
Details the specific recommendations based on the contents of the HIA.	-	38(3)(g)	9
An identification of any areas to be avoided, including buffers.	(g)		
Any mitigation measures for inclusion in the Environmental Management Programme (EMPr)	(k)		
Any conditions for inclusion in the environmental authorisation.	(l)		
Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	(m)		
A reasoned opinion— (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	(n)	38(3)(g)	10
Collates the most salient points of the HIA and concludes with the specific outcomes and recommendations of the study.	-	38(3)(f) 38(3)(g)	10
Lists the source material used in the development of the report.	(cA)	-	11

Description	App. 6	NHRA	Section
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	(h)	-	Plan 4
Any other information requested by the competent authority.	(q)	-	-

2 Legislative and policy framework

Table 2-1 provides a summary of the applicable national South African legislation. Table 2-2 presents a summary of the policies considered in this HIA.

Table 2-1: Applicable legislation considered in the HRM process

Applicable legislation used to compile the report	Reference where applied
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) Section 24 of the Constitution states that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that – i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development	The HRM process was undertaken to identify heritage resources and determine heritage impacts associated with the Project. As part of the HRM process, applicable mitigation measures, monitoring plans and/or remediation were recommended to ensure that any potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) The MPRDA overarching legislation that regulates all mining activities in the Republic of South Africa. Section 27 of the MPRDA prescribes the requirements for Mining Permit Applications. In support of this application, the proponent must in terms of Section 27(2) simultaneously apply for an Environmental Authorisation as contemplated by the NEMA.	The application was completed in accordance with Section 27 and the requirements for Environmental Authorisation (EA) in terms of Section 24 of the NEMA.

Applicable legislation used to compile the report	Reference where applied
National Environmental Management Act, 1998 (Act No. 107 of 1998) The NEMA, as amended, was set in place in accordance with section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making on issues affecting the environment. Section 24 (1)(a), (b) and (c) of NEMA state that: *The potential impact on the environment, socio-economic conditions and cultural heritage of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The Environmental Impact Assessment (EIA) Regulations, Government Notice Regulation (GN) R.982 were published on 04 December 2014 and promulgated on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R.983 (Listing Notice No. 1), GN R.984 (Listing Notice No. 2) and GN R.985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended.	The application process was undertaken in accordance with the principles of Section 2 of NEMA as well as with the EIA 2017 Regulations, promulgated in terms of NEMA.
GN R. 982: Environmental Impact Assessment Regulations, 2014 (as amended by GN R 326 of 7 April 2017) These three listing notices set out a list of identified activities which may not commence without an Environmental Authorisation from the relevant Competent Authority through one of the following processes: • Regulation GN R. 983 (as amended by GN R 327) - Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and which must follow a basic assessment process. • Regulation GN R. 984 (as amended by GN R 325) – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation	Refer to the Notification of Intent to Develop (NID) for a full description of the Listed Activities triggered by the proposed Project. To comply with the regulations, a BA process must be completed in support of EA in terms of Listing Notice 1. This HIA was completed to inform the EIA process to comply with Section 24 of the NEMA.

Applicable legislation used to compile the report	Reference where applied
and which must follow an environmental impact assessment process. • Regulation GN R. 985 (as amended by GN R 324) – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies which if undertaken within the stipulated provincial boundaries will require environmental authorisation. The basic assessment process will need to be followed.	
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The NHRA is the overarching legislation that protects and regulates the management of heritage resources in South Africa, with specific reference to the following Sections: • 5. General principles for HRM; • 6. Principles for management of heritage resources; • 7. Heritage assessment criteria and grading; and • 38. Heritage resources management. The Act requires that Heritage Resources Authorities (HRAs), be notified as early as possible of any developments that may exceed certain minimum thresholds in terms of Section 38(1), or when assessments of impacts on heritage resources are required by other legislation in terms of Section 38(8) of the Act.	This HIA was compiled to comply with Section 5, 38(3), (4) and (8) of the NHRA. This HIA was submitted to the responsible HRAs, which in this instance is SAHRA and HFS.
NHRA Regulations, 2000 (GN R 548) The NHRA Regulations regulate the general provisions and permit application process in respect of heritage resources included in the national estate. Applications must be made in accordance with these regulations. The following Chapters are applicable to this assessment: • II. Permit Applications and General Provisions for Permits; • III: Application for Permit: National Heritage Site, Provincial Heritage Site, Provisionally-	The HRM process was undertaken with cognisance of the applicable regulations. The proposed mitigation strategies and management measures must comply with these requirements.

Applicable legislation used to compile the report	Reference where applied
Protected Place or Structure older than 60 years; • IV: Application for Permit: Archaeological or Palaeontological or Meteorite; • IX: Application for Permit: Burial Grounds and Graves; • X: Procedure for Consultation regarding Protected Area; • XI: Procedure for Consultation regarding Burial Grounds and Graves; and • XII: Discovery of Previously Unknown Graves.	

Table 2-2: Applicable policies considered in the HRM process

Applicable policies used to compile the report	Reference where applied
SAHRA Archaeology, Palaeontology and Meteorites (APM) Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports (2007) The guidelines provide the minimum standards that must be adhered to for the compilation of an HIA report. Chapter II Section 7 outlines the minimum requirements for inclusion in the heritage assessment as follows: • Background information on the Project; • Background information on the cultural baseline; • Description of the properties or affected environs; • Description of identified sites or resources; • Recommended field rating of the identified sites to comply with Section 38 of the NHRA; • A statement of Cultural Significance in terms of Section 3(3) of the NHRA; and • Recommendations for mitigation or management of identified heritage resources.	The HIA was compiled to adhere to the minimum standards as defined by Chapter II of the SAHRA APM Guidelines (2007)

3 Constraints and limitations

Digby Wells encountered constraints and limitations during the compilation of this report. Table 3-1 presents an overview of these limitations and the consequences.

Table 3-1: Constraints and Limitations

Description	Consequence
Whilst every attempt was made to obtain the latest available information, the reviewed literature does not represent an exhaustive list of information sources for the various study areas.	The cultural heritage baseline presented in Section 5 below is considered accurate, but may not include new data or information which may not have been made available to the public.
Results from previously-completed heritage assessments as sourced from SAHRIS, that may have formed part of the Project area were not verified in-field.	It is assumed the previously recorded heritage resources are accurate and true.
Archaeological resources commonly occur at subsurface levels. These resources cannot be adequately recorded or documented by assessors without destructive and intrusive methodologies and without the correct permits issued in terms of Section 35 of the NHRA.	The reviewed literature, previously-completed heritage assessments and the results of the field survey are in themselves limited to surface observations. Subsurface tangible heritage may be exposed during Project activities. Should this occur, Copper Sunset must alert the HRAs of the find and may need to enlist the services of a suitably qualified archaeologist to advise them on the way forward.

4 Methodology

4.1 Defining the study area

Heritage resources do not exist in isolation to the greater natural and social environment, including the socio-cultural, socio-economic and socio-political environments. In addition, the NHRA requires the grading of heritage resources in terms of national, provincial and local concern based on their importance and consequent official (i.e. State) management effort required. The type and level of baseline information required to adequately predict heritage impacts varies between these categories. Three 'concentric' study areas were defined for the purposes of this study, and include:

- The *site-specific study area*: the farm portions extent associated with the proposed Project, including a 500 m buffer area. The site-specific study area may extend linearly, in which case the site-specific study area will include the linear development and a 200 m buffer on either side of the footprint;
- The *local study area*: the area most likely to be influenced by any changes to heritage resources in the Project area or where Project development could cause heritage impacts. Defined as the area bounded by the local municipality, in this instance the MLM, with particular reference to the immediate surrounding properties and/or farms. The local study area was specifically examined to offer a backdrop to the socio-

economic conditions within which the proposed development will occur. The local study area furthermore provided the local development and planning context that may contribute to cumulative impacts; and

- The *regional study area*: the area bounded by the district municipality, which here is FDDM. Where necessary, the regional study area may be extended outside the boundaries of the district municipality to include much wider regional expressions of specific types of heritage resources and historical events. The regional study area also provided the regional development and planning context that may contribute to cumulative impacts.

4.2 Statement of Cultural Significance

Digby Wells designed the significance rating process to provide a numerical rating of the CS of identified heritage resources. This process considers heritage resources assessment criteria set out in subsection 3(3) of the NHRA, which determines the intrinsic, comparative and contextual significance of identified heritage resources. A resource's importance rating is based on information obtained through review of available credible sources and representativity or uniqueness (i.e. known examples of similar resources to exist).

The rationale behind the heritage value matrix takes into account that a heritage resource's value is a direct indication of its sensitivity to change (i.e. impacts). Value, therefore, was determined prior to completing any assessment of impacts.

The matrix rated the potential, or importance, of an identified resource relative to its contribution to certain values – aesthetic, historical, scientific and social. Resource significance is directly related to the impact on it that could result from Project activities, as it provided minimum accepted levels of change to the resource.

4.3 Definition of heritage impacts

Potential impacts to heritage resources may manifest differently across geographical areas or diverse communities when one considers the simultaneous effect to the tangible resource and social repercussions associated with the intangible aspects. Furthermore, potential impacts may concurrently influence the CS of heritage resources. This assessment therefore considers three broad categories adapted from Winter & Baumann (2005, p. 36). These are described in Table 4-1.

Table 4-1: Impact definition

Category	Description
Direct Impact	Affect the fabric or physical integrity of the heritage resource, for example destruction of an archaeological site or historical building. Direct impacts may be the most immediate and noticeable. Such impacts are usually ranked as the most intense but can often be erroneously assessed as high-ranking.

Category	Description
Indirect Impact	Occur later in time or at a different place from the causal activity, or as a result of a complex pathway. For example, restricted access to a heritage resource resulting in the gradual erosion of its CS that may be dependent on ritual patterns of access. Although the physical fabric of the resource is not affected through any direct impact, its significance is affected to the extent that it can ultimately result in the loss of the resource itself.
Cumulative Impact	Result from in-combination effects on heritage resources acting within a host of processes that are insignificant when seen in isolation, but which collectively have a significant effect. Examples of the different cumulative effects include: • Additive: the simple sum of all the effects, e.g. the reclamation of a historical TSF will minimise the sense of the historic mining landscape. • Synergistic: effects interact to produce a total effect greater than the sum of the individual effects, e.g. the removal of all historical TSFs will sterilise the historic mining landscape. • Time crowding: frequent, repetitive impacts on a particular resource at the same time, e.g. the effect of regular blasting activities on a nearby rock art site or protected historical building could be high. • Neutralizing: where the effects may counteract each other to reduce the overall effect, e.g. the effect of changes from a historic to modern mining landscape could reduce the overall impact on the sense-of-place of the study area. • Space crowding: high spatial density of impacts on a heritage resource, e.g. density of new buildings resulting in suburbanisation of a historical rural landscape.

4.4 Secondary data collection

Data collection assists in the development of a cultural heritage baseline profile of the study area under consideration. Qualitative data was collected to inform this HIA and was primarily obtained through secondary information sources, i.e. desktop literature review and historical layering.

A survey of diverse information repositories was made to identify appropriate relevant information sources. These sources were analysed for credibility and relevance. These credible, relevant sources were then critically reviewed. The objectives of the literature review include:

- Gaining an understanding of the cultural landscape within which the proposed Project is located; and

- Identify any potential fatal flaws, sensitive areas, current social complexities and issues and known or possible tangible heritage.

Repositories that were surveyed included the South African Heritage Resources Information System (SAHRIS), online/electronic journals and platforms and select internet sources. This HIA includes a summary and discussion of the most relevant findings. Table 4-2 lists the sources consulted in the literature review (refer to Section 11 for more detailed references).

Table 4-2: Qualitative data sources

Reviewed Qualitative Data		
Databases		
Genealogical Society of South Africa (GSSA) database (2011)	University of the Witwatersrand (WITS) Archaeological Database (2010)	
SAHRIS	SAHRIS Palaeo-sensitivity Map (PSM)	
Statistics South Africa (2011)	Wazimap (2017)	
SAHRIS Cases		
Map ID: 01217	Map ID: 02335`	Case ID: 11167
Map ID:01606	Case ID: 5035	Case ID: 12401
Map ID: 01681	Case ID: 6525	
Cited Text		
Bamford, 2012, 2014, 2016	Behrens & Swanepoel, 2008	Brodie, 2008
Clark, 1982	Deacon & Deacon, 1999	Delius & Cope, 2007
Esterhuysen & Smith, 2007	FDDM, 2018	Groenewald & Groenewald, 2014
Landau, 2010	Maggs, 1976	Mitchell, 2002
Mucina & Rutherford, 2010	Pistorious, 2008a, 2008b	Winter & Baumann, 2005

Table 4-3 below lists the sources of historical imagery. Historical layering is a process whereby diverse cartographic sources from various time periods are layered chronologically using Geographic Information Systems (GIS). The rationale behind historical layering is threefold, as it:

- Enables a virtual representation of changes in the land use of a particular area over time;
- Provides relative dates based on the presence or absence of visible features; and
- Identified potential locations where heritage resources may exist within an area.

Table 4-3: Aerial imagery considered

Aerial photographs						
Job no.	**Flight plan**	**Photo no.**	**Map ref.**	**Area**	**Date**	**Ref.**
221	5	95110	2627 / 2628	Vereeniging	1948	National Geographical Institute

4.5 Primary data collection

Shannon Hardwick undertook a pre-disturbance survey of the Project area on 8 January 2020. The survey was pedestrian and non-intrusive (i.e. no sampling was undertaken). The aim of the survey was to:

- Visually record the current state of the cultural landscape; and
- Record a representative sample of the visible, tangible heritage resources present within the development footprint area, site-specific study area and greater study area.

Identified heritage resources were recorded as waypoints using a handheld GPS device. The heritage resources were also recorded through written and photographic records. Plan 4 presents the results of the pre-disturbance survey, including the waypoints and GPS tracks.

4.6 Site naming convention

Heritage resources identified by Digby Wells during the field survey are prefixed by the SAHRIS case identification generated for this Project. Information on the relevant period or feature code and site number follows (e.g. 5520/BGG-001). The site name may be shortened on plans or figures to the period/feature code and site number (e.g. BGG-001). Table 4-4 presents a list of the period and feature codes relevant to this area (refer to Section 5 for an explanation of what these terms mean).

Table 4-4: Feature and period codes relevant to this HIA

Feature or Period Code	Reference
BGG	Burial Grounds and Graves
HST	Historical Structure

Heritage resources identified through secondary data collection were prefixed by the relevant SAHRIS case or map identification number (*where applicable*) and the original site name as used by the author of that assessment (e.g. 1681/Site 1).

5 Cultural heritage baseline description

The site-specific Project area is underlain by geological features within the Karoo Supergroup, specifically the *Vryheid Formation*. The *Vryheid Formation* is the basal layer of the Ecca Group and dates to approximately 280 million years ago (mya). These layers were deposited in a deltaic[3] environment (Bamford, 2016). The *Vryheid Formation* includes shales, mudstones, sandstones and coal. This unit is considered of very-high palaeontological sensitivity (SAHRA, 2013; Groenewald & Groenewald, 2014).

Fossil plants are usually preserved in the shales between the coal horizons and, to a lesser extent, within the sandstone surface outcrops (Bamford, 2012; 2014; 2016). Common fossil plants within the *Vryheid Formation* include *Glossopteris* leaves, roots and inflorescences; and *Calamites* stems. Coal deposits can potentially also include fossils of mammal-like reptiles and amphibians. These are however, rarely, if ever, preserved with plant fossils.

Table 5-1 provides a general breakdown of the timeframes within the archaeological and cultural past in South Africa. Figure 5-1 below provides a breakdown of the previously identified heritage resources representing each of these periods. Plan 3 presents the spatial relationship between the identified heritage resources within the regional setting.

Table 5-1: Archaeological periods in South Africa

The Stone Age	Early Stone Age (ESA)	2 mya to 250 thousand years ago (kya)
	Middle Stone Age (MSA)	250 kya to 20 kya
	Later Stone Age (LSA)	20 kya to 500 CE (Common Era[4])
Farming Communities	Early Farming communities (EFC)	500 to 1400 CE
	Late Farming Communities (LFC)	1100 to 1800 CE
Historical Period	-	1500 CE to 1994 (Behrens & Swanepoel, 2008)

Adapted from Esterhuysen & Smith (2007)

[3] When lithologies are deposited onto an alluvial plain through river action.

[4] Common Era (CE) refers to the same period as *Anno Domini* (“In the year of our Lord”, referred to as AD): i.e. the time after the accepted year of the birth of Jesus Christ and which forms the basis of the Julian and Gregorian calendars. Years before this time are referred to as ‘Before Christ’ (BC) or, here, BCE (Before Common Era).

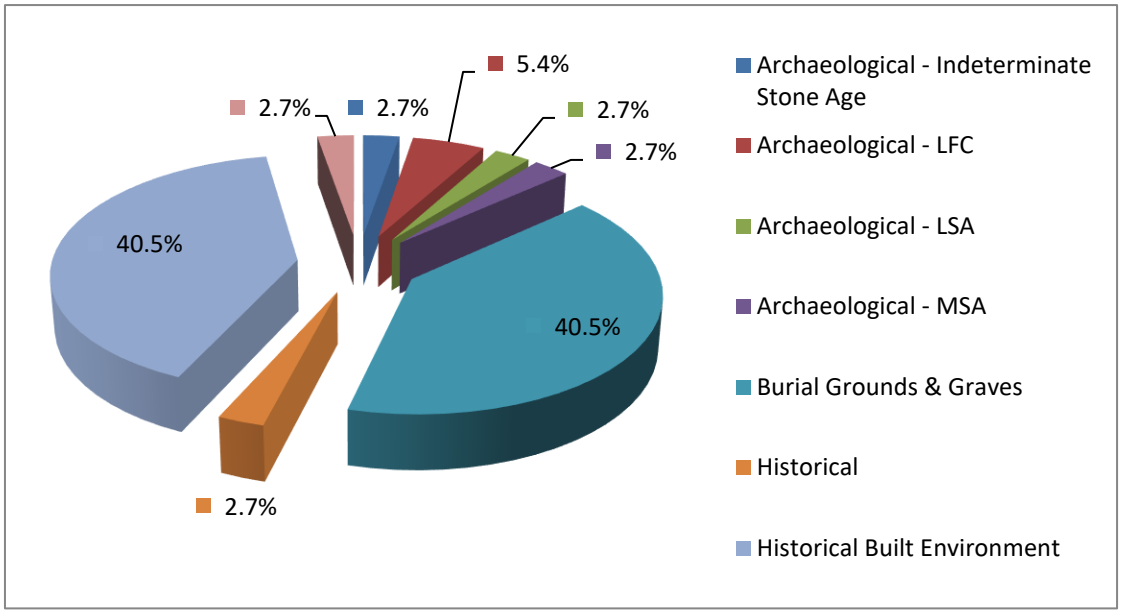

Figure 5-1: Heritage resources identified within the regional study area

The cultural heritage landscape is dominated by the historical built environment and burial grounds and graves, although there are expressions of the MSA, LSA and LFC periods. The section that follows will present a brief overview of the archaeological periods present within the regional study area. The reviewed literature included no reports of archaeological material representing the ESA or EFC periods and, as such, these will not be described further in this report.

The Stone Age is divided into three phases defined by the production of stone tools by various hominid species: the ESA, the MSA and the LSA. The MSA dates from approximately 250 to 20 kya. High proportions of blades that are created through the Levallois technique and which are minimally modified characterise the early MSA (Clark, 1982). The MSA is further defined by blades and points which were produced from good-quality raw materials and the use of bone tools, ochre, beads and pendants (Deacon & Deacon, 1999). A low-density scatter of MSA tools exposed by transmission lines represents the period in this area (Du Piesanie & Nel, 2014). An additional stone tool scatter was recorded but the period was not established (Du Piesanie & Nel, 2014).

The LSA started approximately 40 kya and continued up to the historical period, overlapping in some areas with the Farming Community period. LSA stone tools are specialised and specific tools are created for specific functions (Mitchell, 2002). The inclusion of bone tools into the archaeological record further characterises this period. LSA sites commonly include diagnostic artefacts, such as microlithic scrapers and segments.

In southern Africa, the LSA is closely associated with hunter-gatherer groups, including the San (Mitchell, 2002). Due to the nomadic nature of the LSA peoples, open-air sites are generally poorly preserved and difficult to identify. The LSA is further characterised by evidence of ritual practises and complex societies (Deacon & Deacon, 1999). This can be

expressed through rock art. No rock art was identified within the study area. The LSA was represented by a low-density scatter of lithics (Van Schalkwyk, et al., 1996).

The Farming Community period correlates to the movements of Bantu-speaking agro-pastoralists into southern Africa. The results of the literature review demonstrate heritage resources associated only with the LFC. The LFC is represented by stonewalling or through secondary tangible indicators such as ceramics and evidence for domestic animals, including dung deposits and faunal remains.

Stonewalling is the most visible indicator of LFC settlements. Several types of stonewalling have been described through decades of research and, within the larger study area, the most common is Type V. Maggs (1976) first described these settlements, which consist of many primary enclosures grouped around a ring. The enclosures may be contiguous or linked by secondary walling to form a secondary enclosure. There is no surrounding perimeter wall, although there may be additional free-standing structures around the periphery of the settlement.

Heritage resources associated with the LFC account for 5.4% of the identified heritage resources. Two instances of stonewalling have been identified in the area (Van Schalkwyk, et al., 1996). Van Schalkwyk *et al* (1996) did not describe the type of walling, but it is most likely Type V.

The historical period[5] is commonly regarded as the period characterised by contact between Europeans and Bantu-speaking African groups and the written records associated with this interaction. However, the division between the LFC and historical period is artificial, as there is a large amount of overlap between the two.

The period of approximately 1817 to 1826 AD is generally referred to as the Mfecane or, north of the Orange River, the Difaqane. Many aspects of the Mfecane/Difaqane have been debated and challenged (Landau, 2010). The traditional understanding of the period is that Mzilikazi and his Ndebele group were pushed out of their territory by the Zulu group led by Shaka. This displacement had a knock-on effect, as multiple groups were subsequently displaced to the north and the west. A drought during this time exacerbated the instability and increased the pressure on food supplies, which were already running low. European settlers, traders, missionaries and travellers moving into the interior further added to instability and resulting power struggles. The Mfecane/Difaqane was characterised by unprecedented (at least within the records of the Europeans travelling within southern Africa) social and political mobilisation and violence across the Highveld as individuals sought personal and food security

As a result of social and political upheaval, the Highveld was vulnerable to intrusive groups including the Swazi and the *Voortrekkers*. Groups of Afrikaaners initiated a move from the Cape to the interior to establish an independent state in approximately 1835. The migration of

[5] In southern Africa, the last 500 years represents a formative period that is marked by enormous internal economic invention and political experimentation that shaped the cultural contours and categories of modern identities outside of European contact. This period is currently not well documented, but is being explored through the 500 year initiative (Swanepoel, et al., 2008).

these *Voortrekkers* is commonly referred to as the Great Trek (or *Groot Trek*) (Delius & Cope, 2007; Voortrekkers, 2014).

Soon after settling in the Highveld area, the Trekboers (now farmers) discovered and exploited the Highveld Coalfields. The coal was initially used by the Boers as a domestic resource; however the discovery of gold in the Witwatersrand in 1886 created an enormous demand for coal (Brodie, 2008; Pistorious, 2008a; 2008b). This increase in the demand for coal drove the commercial exploitation of the coal, until the industry was put on hold by the outbreak of the South African War of 1899-1902 (previously referred to as the Second Anglo-Boer War), which officially started on October 9th, 1899.

Heritage resources representing the historical period include the historical built environment (15 records or 40.5% of the total records), a historical place of significance (one record or 2.7% of all records), a memorial (one record or 2.7% of all records) and burial grounds and graves (15 records or 40.5% of all records). These have been recorded as:

- Burial grounds and graves, which range in size from single graves to more than fifty but less than one hundred graves (Van Schalkwyk, et al., 1996; Dreyer, 2005; Birkholtz & James, 2008; Beater, 2017; Hardwick & Du Piesanie, 2019);
- The historical place of significance is the site of the Coalbrook Mine Disaster of 21 January 1960 (Birkholtz & James, 2008);
- The memorial was constructed in the memory of Frits Pistorius, a young boy who had been murdered in 1952 (Dreyer, 2005); and
- Historical buildings which include buildings, structural remains, remains of functional structures and the remains of *werwe* (farmsteads) (Dreyer, 2005; Van Ryneveld, 2007; Du Piesanie & Nel, 2014; Higgitt & Du Piesanie, 2015; Beater, 2017; Hardwick & Du Piesanie, 2019).

Plan 3

Copper Sunset

Site Matrix

Legend

- Mining Permit Area (5ha)
- Site Matrix
- Main Road
- Secondary Road
- Street
- Major Town
- Secondary Town
- Other Town
- Settlement
- Railway Line
- Non-Perennial River/Stream
- Perennial River/Stream
- Proposed Access Road
- Copper Sunset Offices
- Provincial Boundary

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5.1 Existing environment

The Project is located within an active coal mine, although the proposed Project footprint has not been affected by mining activities as yet. The area has, however, been extensively disturbed since at least 1948 though the establishment and operation of an oak plantation. Many of the oak trees from the plantation are still living in the proposed development footprint.

Table 5-2 presents an overview of the natural environmental within which the Project is situated. Figure 5-2 below presents the condition of the Project area at the time of the pre-disturbance survey.

Table 5-2: Summary of the vegetation setting of the Project

Biome	Bio-region	Vegetation Type
Grassland	Dry Highveld Grassland	Central Free State Grassland (Gh6) Short grassland which occur on undulating plains. Dwarf karoo bushes may establish themselves in severely degraded areas. Areas that are overgrazed and trampled are vulnerable to *Vachellia karoo* encroachment. This vegetation unit is associated with sedimentary mudstones and sandstones of the Adelaide Subgroup (of the Beaufort Group) and layers of the Ecca Group (both in the Karoo Supergroup). This unit may also occur on intrusive dolerites of the Jurassic Karoo Dolerite Suite. This vegetation unit is considered vulnerable as almost a quarter has been transformed though cultivation and the construction of dams. No significant alien flora infestation has been noted for this unit but the unit is vulnerable to encroachment of dwarf karoo shrubs in degraded areas.

Adapted from Mucina & Rutherford (2010)

5.2 Results from the pre-disturbance survey

Plan 4 presents the spatial distribution of these sites and includes the tracks, indicating the areas that were surveyed. No heritage resources were identified during the pre-disturbance surveys.

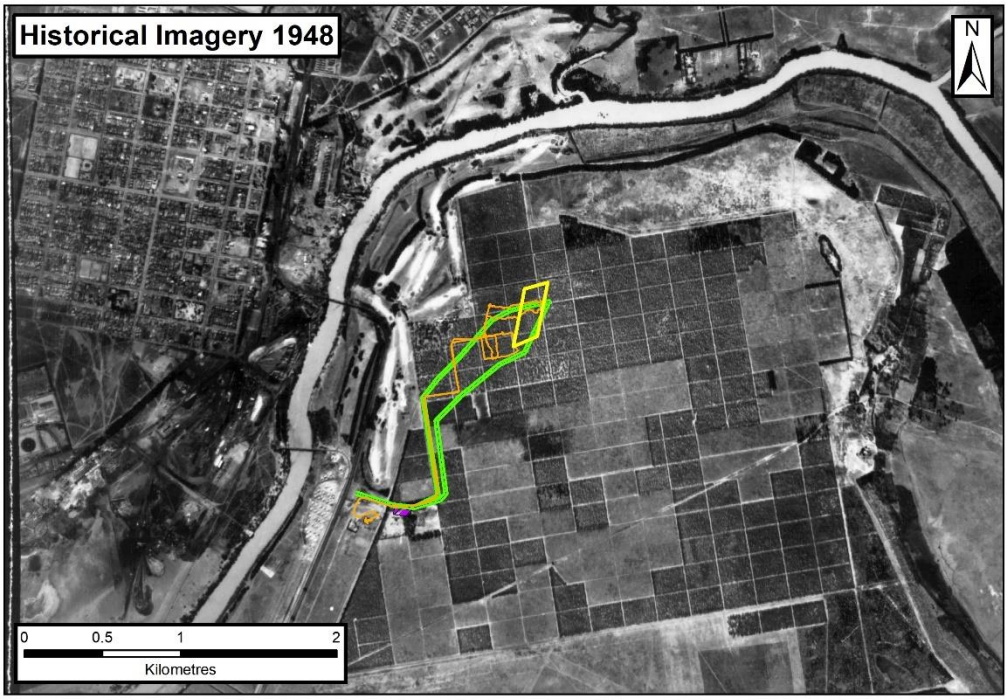


Figure 5-3 presents the results of the historical layering. The old plantation established in 1948 covered the entire Project area. The Project area therefore has a long history of disturbance and this could explain why no heritage resources were identified in the Project area. No structures that may be associated with the plantation were identified within the proposed development footprint.

Figure 5-2: Photographs illustrating the current environment within the Project area

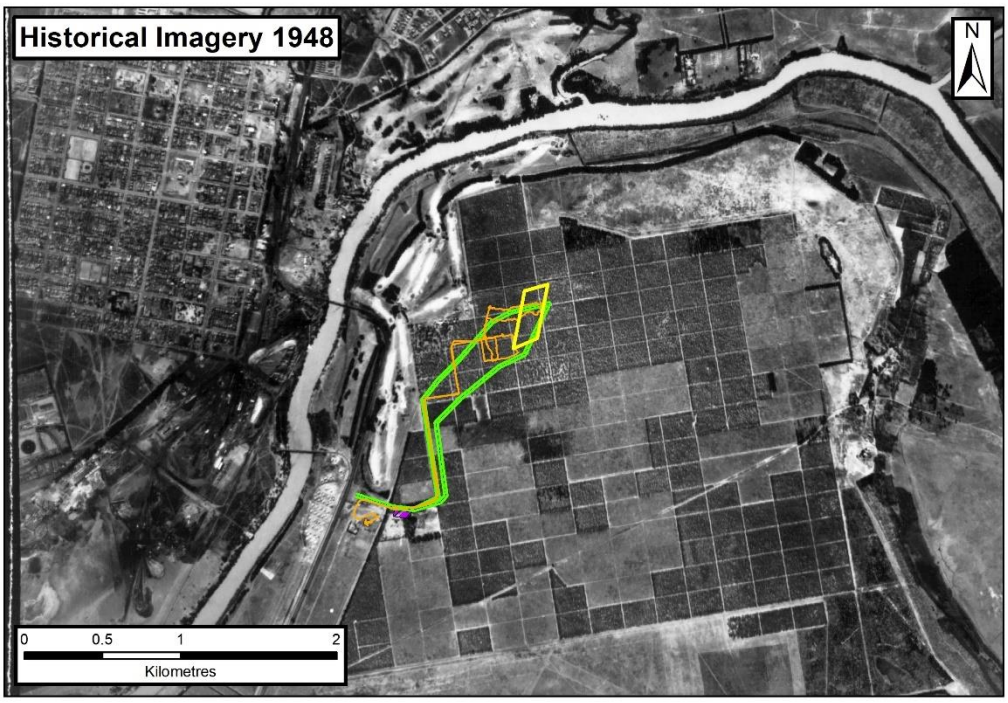
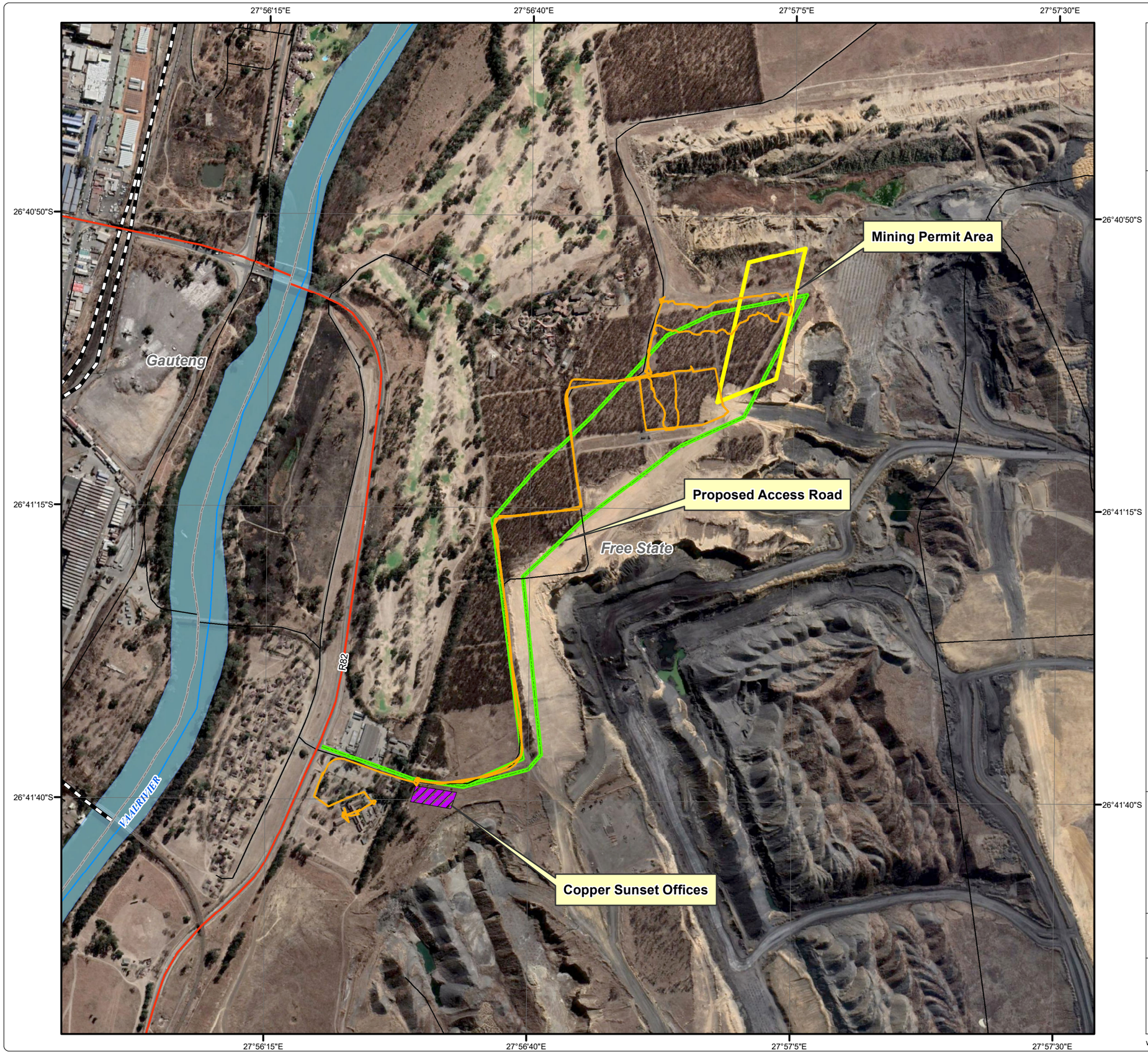


Figure 5-3: Historical Imagery showing the Project area in 1948

Plan 4

Copper Sunset

Pre-Disturbance Survey Plan



Legend

- Mining Permit Area (5ha)
- Main Road
- Street
- Railway Line
- Perennial River/Stream
- Heritage Site Visit Tracks
- Proposed Access Road
- Copper Sunset Offices
- Provincial Boundary

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6 Impact assessment

This report considered the potential impacts that may be caused through the establishment of the sand mining operation, construction of the road and the installation of the necessary temporary infrastructure as described in Section 1.1. No heritage resources were identified within the proposed development footprint area and therefore no direct impacts to heritage resources are envisaged. This notwithstanding, the Project does pose the risk of cumulative impacts on the landscape and there is potential for low-risk and unplanned events to occur. These are discussed below.

Palaeontological resources and the potential impact to fossil heritage are interpreted from specialist Palaeontological Impact Assessment (refer to Appendix C). The findings of the PIA process are similar to those of a PIA completed for an adjacent property[6] (Millsteed, 2014). Given the nature of the Project, anticipated disturbance to the surface will be limited to a few meters in depth. Furthermore, as previously noted, the Project area has been subject to anthropogenic disturbance by the existing plantation.

Taking cognisance of this, in conjunction with the erratic nature of fossil occurrence within the geological records, the potential of impacts to these resource types is low (Millsteed, 2014, p. 20, Bamford, this report).

6.1 Cumulative impacts on the cultural landscape

Cumulative impacts occur from in-combination effects of various impacts on heritage resources acting within a host of processes that result in an incremental effect. The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of their effects when acting in isolation.

The Project requires consideration, in conjunction with other planned developments in line with the strategic development plans with the Free State Province, to identify the possible in-combination effects of various impacts to known heritage resources. Table 6-1 presents the potential cumulative impacts of the Project.

[6] Available at: https://sahris.sahra.org.za/heritage-reports/palaeontological-impact-assessment-lethabo

Table 6-1: Summary of potential cumulative impacts

Type	Cumulative Impact	Direction of Impact	Extent of Impact
Additive, Synergistic	The development and operation of the proposed Project will add to the existing and proposed infrastructure in the area and will contribute to the degradation of the sense-of-place of the cultural landscape. Considering the greater development landscape, the effects from the various proposed developments will interact to produce a total greater effect on the cultural landscape and degradation thereof.	Negative	Local

6.2 Low risks and unplanned events

This section considers the potential risks *to* protected heritage resources, as well as the potential heritage risks that could arise *for* Copper Sunset in terms of implementation of the Project. These two aspects are discussed separately.

No heritage resources were identified in the Project area. Should any previously-unidentified heritage resources be identified during construction or operation activities, and where Copper Sunset knowingly does not take proactive management measures, potential risks to Copper Sunset may include litigation in terms of Section 51 of the NHRA and social or reputational repercussions. Table 6-2 presents a summary of the primary risks that may arise for Copper Sunset.

Table 6-2: Identified heritage risks that may arise for Copper Sunset

Description	Primary Risk
Heritage resources with a high CS rating are inherently sensitive to any development in so far that the continued survival of the resource could be threatened. In addition to this, certain heritage resources are formally protected thereby restricting various development activities.	Negative Record of Decision (RoD) and/or development restrictions issued by the Institute and/or SAHRA in terms of Section 38(8) of the NHRA.
Impacting on heritage resources formally and generally protected by the NHRA without following due process. Due process may include social consultations and/or permit application processes to SAHRA and/or HFS.	Fines Penalties Seizure of Equipment Compulsory Repair / Cease Work Orders Imprisonment

In the event that additional heritage resources are identified during construction of the proposed infrastructure, potential risks to those heritage resources will need to be assessed. Table 6-3 provides an overview of these potential unplanned events, the subsequent impact that may occur and mitigation measures and management strategies to remove or reduce these risks.

Table 6-3: Identified unplanned events and associated impacts

Unplanned event	Potential impact	Mitigation / Management / Monitoring
Accidental exposure of *in situ* historical built environment sites during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 34 of the NHRA	Establish a Project-specific Chance Find Procedure (CFP) Fossil Finds Procedure (FFP) as a condition of authorisation. Refer to Section 9 for more detailed recommendations.
Accidental exposure of *in situ* palaeontological or archaeological material during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 35 of the NHRA	
Accidental exposure of *in situ* burial grounds or graves during the implementation of the Project.	Damage or destruction of heritage resources generally protected under Section 36 of the NHRA.	
Accidental exposure of human remains during the construction phase of the Project.		

7 Identified heritage impacts versus socio-economic benefit

This section provides a brief overview[7] of the socio-economic context within which the Project will be situated. The Project area falls within Ward 19 of the MLM within FDDM. This section presents a summary of the information included in the Integrated Development Plan (IDP) for the FDDM. Information from Wazimap (2017) has been used to supplement the IDP data[8].

[7] For a more detailed analysis of the socio-economic context and the positive and negative impacts of the Project, refer to the BAR compiled in support of the Mining Permit application.

[8] These data were used because it realigns the 2011 Census data captured and presented by Statistics South Africa (2011) with new municipal boundaries used in the 2016 Municipal Elections (Open Up, 2017). This report uses the Census 2011 data as data from the 2016 Community Survey are not yet available at ward level.

Mpumalanga includes five district municipalities. Manguang is the largest of the district municipalities and FDDM is the second smallest in terms of the population. The 2011 census recorded 2 745 591 people living in Mpumalanga, of which 488 035 people lived in FDDM (approximately 18% of the population of the province) (Statistics South Africa, 2011; Wazimap, 2017). The FDDM includes four local municipalities of which Moqhaka is the largest and MLM is the second largest. The 2011 census recorded 149 107 people living in the MLM which accounts for approximately 31% of the population of FDDM and 5% of the province's population.

Unemployment has been highlighted as a challenge within the district (FDDM, 2018). The official unemployment rate within the district in 2010 was 22% (compared to 28.7% for the province). The unofficial unemployment rate for the same time, however, was approximately 40%. Table 7-1 presents the figures as of the 2011 census.

Table 7-1: Summary of the employment statistics within the regional study area

Employment Statistics	Ward 19		MLM		FDDM	
	No.	%	No.	%	No.	%
Total Population	7 553	-	149 107	-	4488 035	-
Working Age (15-64)	4,909	65	96,166	64.5	295,524	60.6
Employed	2 166	28.7	44 261	29.7	117 732	24.1

Adapted from Statistics South Africa (2011) and Wazimap (2017)

As of 2010, a total of 96 000 employment opportunities existed within the district (FDDM, 2018). As per the IDP, agriculture, manufacturing, community services and households were the main contributors of employment opportunities. This notwithstanding, employment opportunities in both agriculture and manufacturing have decreased over the last ten years. The 2018-2019 IDP highlights the importance of job creation in these sectors as well as in the informal sector.

Based on the review of the applicable planning documents and the motivation above, the potential socio-economic benefits that may result from the Project outweigh the identified impacts and risks to known heritage resources within the site-specific study area. This statement is supported by the following:

- No heritage resources were identified in the proposed Project area and no impacts to heritage resources are foreseen;
- Despite not being in the top contributors for job creation, the proposed Project has the potential to contribute to the regional and local economies; and
- The proposed Project is expected to contribute (directly or indirectly) to the employment of people in an area where unemployment is a challenge.

8 Consultation

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the BA process. The objectives of the Stakeholder Engagement Process (SEP) include the following:

- To ensure that I&APs are informed about the project;
- To provide I&APs with an opportunity to engage and provide comment on the project;
- To draw on local knowledge by identifying environmental and social concerns associated with the project;
- To involve I&APs in identifying methods in which concerns can be addressed;
- To verify that stakeholder comments have been accurately recorded; and
- To comply with the legal requirements.

The Public Participation Process (PPP) will be completed upon the distribution of the HIA as a process separate to the heritage specialist assessment. No formal consultation was undertaken as part of this assessment. Should any I&AP comments be submitted in relevance to heritage resources during the PPP process, these will be considered in the final BA Report.

Site surveys can often present an opportunity for informal consultation with specific stakeholders (usually farm owners, managers and employees). This consultation can result in the identification of burial grounds and graves – importantly, these could include formal burial grounds or graves, sometimes with no visible surface markers – or in the identification of sacred sites or other places of importance, which may not otherwise be identified. No such consultation was undertaken during the pre-disturbance survey.

9 Recommendations

The proposed sand mining operation, construction of an access road and establishment of temporary infrastructure does not pose a risk of direct negative impacts to known heritage resources. This notwithstanding, there is a chance of exposing archaeological materials and palaeontological fossils during the construction and operational phases, resulting damaged or destruction. To mitigate against these impacts, Digby Wells recommends that Copper Sunset develop and implement a CFP and FFP prior to the commencement of the construction phase of the Project. These procedures must be submitted to SAHRA and approved before they can be implemented.

10 Conclusion

The aim of the HRM process was to comply with regulatory requirements contained within Section 38 of the NHRA through the following:

- Defining the cultural landscape within which the Project is situated;
- Identifying, as far as is feasible, heritage resources that may be impacted upon by the project as well as define the CS;

- Assessing the possible impacts to the identified heritage resources;
- Considering the socio-economic benefits of the Project; and
- Providing feasible mitigation and management measures to avoid, remove or reduce perceived impacts and risks.

These objectives were met as presented in Sections 5 through 9 above. Based on the understanding of the Project while considering the results of this assessment, Digby Wells does not object to the Project provided the recommendations detailed above are adopted.

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DIGBY WELLS
ENVIRONMENTAL

Appendix A: Specialist CV

Miss Shannon Hardwick

Heritage Resources Management Consultant

Social and Heritage Services

Digby Wells Environmental

1 Education

Date	Degree(s) or Diploma(s) obtained	Institution
2013	MSc (Archaeology)	University of the Witwatersrand
2010	BSc (Honours) (Archaeology)	University of the Witwatersrand
2009	BSc	University of the Witwatersrand
2006	Matric	Rand Park High School

2 Language Skills

Language	Written	Spoken
English	Excellent	Excellent
Afrikaans	Fair	Basic

3 Employment

Period	Company	Title/position
2019 to Present	Digby Wells Environmental	Heritage Resources Management Consultant
2017 to 2019	Digby Wells Environmental	Assistant Heritage Resources Management Consultant
2017 to 2017	Digby Wells Environmental	Social and Heritage Services Intern
2016 to 2017	Tarsus Academy	Facilitator
2011 to 2016	University of the Witwatersrand	Teaching Assistant
2011	University of the Witwatersrand	Collections Assistant

4 Experience

I joined the Digby Wells team in May 2017 as a Heritage Management Intern and has most recently been appointed as a Heritage Resources Management Consultant. I am an archaeologist and obtained a Master of Science (MSc) degree from the University of the Witwatersrand in 2013, specialising in historical archaeobotany in the Limpopo Province. I am a published co-author of one paper in *Journal of Ethnobiology*.

Since joining Digby Wells, I have gained generalist experience through the compilation of various heritage assessments, including Notification of Intent to Develop (NIDs), Heritage Scoping Reports (HSRs), Heritage Impact Assessment (HIA) reports, Heritage Basic Assessment Reports (HBARs) and permit applications to undertake permitted activities in terms of Sections 34 and 35 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA). I have also obtained experience in compiling socio-economic documents, including a Community Health, Safety and Security Management Plan (CHSSMP) and social baselines and data analysis for Projects in South Africa, Malawi, Mali and Sierra Leone. My fieldwork experience includes heritage pre-disturbance surveys in South Africa, Malawi and the Democratic Republic of the Congo and social fieldwork in Malawi.

I am a registered member of the Association of Southern African Professional Archaeologists (ASAPA) and the International Council on Monuments and Sites (ICOMOS).

5 Project Experience

My project experience is listed in the table below.

Project Experience

Project Title	Name of Client	Project Location	Date of Completion	Project / Experience Description
Environmental Authorisation for the Dagsoom Coal Mining Project near Ermelo, Mpumalanga Province	Dagsoom Coal Mining (Pty) Ltd	Ermelo, Mpumalanga Province	Ongoing	Heritage Impact Assessment
Regional Tailings Storage Facility Heritage Mitigations	Ergo Mining (Pty) Ltd	Randfontein, Gauteng	Ongoing	Section 34 Permit Application Process
Weltervreden Mine Environmental Authorisation, Water Use Licence and Mining Right Application Project	Mbuyelo Group (Pty) Ltd	Belfast, Mpumalanga	Ongoing	Heritage Impact Assessment

Project Title	Name of Client	Project Location	Date of Completion	Project / Experience Description
Environmental Authorisation for the proposed Lephalale Pipeline Project, Limpopo Province	MDT Environmental (Pty) Ltd	Lephalale, Limpopo Province	2019	Notification of Intent to Develop
Heritage Resources Management Process Update for the Exxaro Matla Mine	Exxaro Coal Mpumalanga (Pty) Ltd	Kriel, Mpumalanga Province	2019	Heritage Site Management Plan Update
Environmental Authorisation for the proposed Musina-Makhado Special Economic Zone Development Project, Limpopo Province	Limpopo Economic Development Agency	Vhembe District Municipality, Limpopo Province	Ongoing	Heritage Impact Assessment Project Management
Songwe Hills Rare Earth Elements Project	Mkango Resources Limited	Phalombe District, Malawi	Ongoing	Heritage Impact Assessment
Elandsfontein Colliery Burial Grounds and Graves Chance Finds	Anker Coal and Mineral Holdings SA (Pty) Ltd Elandsfontein Colliery (Pty) Ltd	Clewer, Emalahleni, Mpumalanga Province	December 2018	Site Inspection Project Management
Environmental Authorisation Process to Decommission a Conveyor Belt Servitude, Road and Quarry at Twistdraai East Colliery	Sasol Mining (Pty) Ltd	Secunda, Mpumalanga Province	Ongoing	Notification of Intent to Develop
Environmental and Social Impact Assessment for the Bougouni Lithium Project, Mali	Future Minerals S.A.R.L.	Bougouni, Mali	Ongoing	Heritage Impact Assessment
Environmental Authorisation for the Nomalanga Estates Expansion Project, KwaZulu-Natal	Nomalanga Property Holdings (Pty) Ltd	Greytown. KwaZulu-Natal	Ongoing	Heritage Impact Assessment
Environmental Authorisation for the Temo Mine proposed Rail, Road and Pipeline Development, Limpopo Province	Temo Coal Mining (Pty) Ltd	Lephalale, Limpopo Province	Ongoing	Heritage Impact Assessment

Project Title	Name of Client	Project Location	Date of Completion	Project / Experience Description
Gorumbwa RAP Audit	Randgold Resources Limited	Kibali Sector, Democratic Republic of the Congo	December 2018	Resettlement Action Plan Audit
Sasol Sigma Defunct Colliery Surface Mitigation Project: Proposed Rover Diversion and Flood Protection Berms	Sasol Mining (Pty) Ltd	Sasolburg, Free State Province	November 2018	Notification of Intent to Develop
Basic Assessment and Regulation 31 Amendment / Consolidation for Sigma Colliery: Mooikraal and Sigma Colliery: 3 Shaft	Sasol Mining (Pty) Ltd	Sasolburg, Free State Province	Ongoing	Notification of Intent to Develop
Sasol Mining Sigma Colliery Ash Backfilling Project, Sasolburg, Free State Province	Sasol Mining (Pty) Ltd	Sasolburg, Free State Province	July 2018	Heritage Basic Assessment Report Update
Constructed Landfill Site for the Sierra Rutile Limited Mining Operation, Southern Province, Sierra Leone	Sierra Rutile Limited	Southern Province, Sierra Leone	May 2019	Social Impact Assessment
Environmental Impact Assessment for the Klipspruit Colliery Water Treatment Plant and associated pipeline, Mpumalanga	South32 SA Coal Holdings (Pty) Ltd	Ogies, Mpumalanga Province	Ongoing	Notification of Intent to Develop; Social baseline
Proposed construction of a Water Treatment Plant and associated infrastructure for the Treatment of Mine-Affected Water at the Kilbarchan Colliery	Eskom Holdings SOC Limited	Newcastle, KwaZulu-Natal Province	Ongoing	Heritage Impact Assessment
Belfast Implementation Project	Exxaro Coal Mpumalanga (Pty) Ltd	Belfast, Mpumalanga Province	Ongoing	Section 34 Permit Application

Project Title	Name of Client	Project Location	Date of Completion	Project / Experience Description
Newcastle Landfill Project	GCS Water and Environmental Consultants	Newcastle, KwaZulu-Natal	March 2019	Heritage Impact Assessment
NHRA Section 34 Permit Application process for the Davin and Queens Court Buildings on Erf 173 and 174, West Germiston, Gauteng Province	IDC Architects	Johannesburg, Gauteng Province	May 2018	Section 34 Permit Application Process
Basic Assessment and Environmental Management Plan for the Proposed pipeline from the Mbali Colliery to the Tweefontein Water Reclamation Plant, Mpumalanga Province	HCI Coal (Pty) Ltd Mbali Colliery	Ogies, Mpumalanga Province	February 2018	Heritage Basic Assessment Report
The South African Radio Astronomy Observatory Square Kilometre Array Heritage Impact Assessment and Conservation Management Plan Project	The South African Radio Astronomy Observatory (SARAO)	Carnarvon, Northern Cape Province	July 2018	Heritage Impact Assessment; Conservation Management Plan
Environmental Impact Assessment for the proposed Future Developments within the Sun City Resort Complex	Sun International (Pty) Ltd	Rustenburg, North West Province	Ongoing	Heritage Impact Assessment Conservation Management Plan Social Baseline
Environmental Fatal Flaw Analysis for the Mabula Filling Station	Mr van den Bergh	Waterberg, Limpopo Province	November 2017	Fatal Flaw Analysis
Environmental Impact Assessment for the Blyvoor Gold Mining Project near Carletonville, Gauteng Province	Blyvoor Gold Capital (Pty) Ltd	Carletonville, Gauteng	Ongoing	Notification of Intent to Develop; Social Baseline

Project Title	Name of Client	Project Location	Date of Completion	Project / Experience Description
Heritage Resources Management Process for the Exxaro Matla Mine	Exxaro Coal Mpumalanga (Pty) Ltd	Kriel, Mpumalanga Province	October 2018	Heritage Impact Assessment
Liwonde Additional Studies	Mota-Engil Africa	Liwonde, Malawi	June 2018	Community Health, Safety and Security Management Plan
Environmental Impact Assessment for the Millsite TSF Complex	Sibanye-Stillwater	Randfontein, Gauteng	December 2017	Heritage Impact Assessment
Heritage Resources Management Process for the Portion 296 of the farm Zuurfontein 33 IR Proposed Residential Establishment Project	Shuma Africa Projects (Pty) Ltd	Ekurhuleni (Johannesburg), Gauteng	June 2017	Notification of Intent to Develop
NHRA Section 35 Archaeological Investigations, Lanxess Chrome Mine, North-West Province	Lanxess Chrome Mine (Pty) Ltd	Rustenburg, North West Province	August 2017	Archaeological Phase 2 Mitigation
Environmental and Social Input for the Pre-Feasibility Study	Birimium Gold	Bougouni, Mali	October 2018	Pre-Feasibility Study; Heritage Impact Assessment

6 Professional Registration

Position	Professional Body	Member Number
Member	Association of Southern African Professional Archaeologists (ASAPA)	451
Member	International Council on Monuments and Sites (ICOMOS)	38048

7 Publications

Esterhuysen, A.B. & Hardwick, S.K. 2017. Plant remains recovered from the 1854 siege of the Kekana Ndebele, Historic Cave, Makapan Valley, South Africa. *Journal of Ethnobiology* 37(1): 97-119.

Mr. Justin du Piesanie

Divisional Manager

Social and Heritage Services

Digby Wells Environmental

1 Education

Date	Degree(s) or Diploma(s) obtained	Institution
2015	Continued Professional Development, Intermediate Project Management Course	PM.Ideas: A division of the Mindset Group
2013	Continued Professional Development Programme, Architectural and Urban Conservation: Researching and Assessing Local Environments	University of Cape Town
2008	MSc	University of the Witwatersrand
2005	BA (Honours) (Archaeology)	University of the Witwatersrand
2004	BA	University of the Witwatersrand
2001	Matric	Norkem Park High School

2 Language Skills

Language	Written	Spoken
English	Excellent	Excellent
Afrikaans	Proficient	Good

3 Employment

Period	Company	Title/position
2018 to present	Digby Wells Environmental	Divisional Manager: Social and Heritage Services
2016-2018	Digby Wells Environmental	Unit Manager: Heritage Resources Management
2011-2016	Digby Wells Environmental	Heritage Management Consultant: Archaeologist
2009-2011	University of the Witwatersrand	Archaeology Collections Manager
2009-2011	Independent	Archaeologist
2006-2007	Maropeng & Sterkfontein Caves UNESCO World Heritage Site	Tour guide

4 Experience

I joined the company in August 2011 as an archaeologist. Subsequently, Digby Wells appointed me as the Heritage Unit Manager and Divisional Manager for Social and Heritage Services in 2016 and 2018 respectively. I obtained my Master of Science (MSc) degree in Archaeology from the University of the Witwatersrand in 2008, specialising in the Southern African Iron Age. I further attended courses in architectural and urban conservation through the University of Cape Town's Faculty of Engineering and the Built Environment Continuing Professional Development Programme in 2013. I am a professional member of the Association of Southern African Professional Archaeologists (ASAPA), and accredited by the association's Cultural Resources Management (CRM) section. I am also a member of the International Council on Monuments and Sites (ICOMOS), an advisory body to the UNESCO World Heritage Convention. I have over 10 years combined experience in HRM in South Africa, including heritage assessments, archaeological mitigation, grave relocation, and NHRA Section 34 application processes. I gained further generalist experience since my appointment at Digby Wells in Botswana, Burkina Faso, Cameroon, the Democratic Republic of Congo, Liberia, Malawi, Mali, Senegal and Tanzania on projects that have required compliance with IFC requirements such as Performance Standard 8: Cultural Heritage. Furthermore, I have acted as a technical expert reviewer of HRM projects undertaken in Cameroon and Senegal. As Divisional Manager for Social and Heritage Services at Digby Wells Environmental, I manage several large capital Projects and multidisciplinary teams placing me in the best position to identify and exploit points of integration between the HRM process and greater social landscape. This approach to HRM, as an integrated discipline, is grounded in

international HRM principles and standards that has allowed me to provide comprehensive, project-specific solutions that promote ethical heritage management and assist in achieving the strategic objectives of our clients, as well as maintain or enhance Cultural Significance of the relevant cultural heritage resources.

5 Project Experience

Please see the following table for relevant Project experience:

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Matla Mine 1 GRP	Kriel, Mpumalanga, South Africa	2020	-	Grave Relocation	Exxaro Coal Mpumalanga (Pty) Ltd
Mafube RAP and GRP	Middelburg, Mpumalanga, South Africa	2019	-	Grave Relocation	Mafube Coal
SARAO SKA Project: Heritage Mitigations	Carnarvon, Northern Cape, South Africa	2019	-	Heritage Management and Mitigation	SARAO
Kibali Kalimva & Ikamva Pit ESIA	Orientale Province, Democratic Republic of Congo	2019	2019	Heritage Impact Assessment	Barrick Gold Corporation
Ergo City Deep HSMP	Johannesburg, Gauteng, South Africa	2019	2019	Heritage Site Management Plan	Ergo (Pty) Ltd
Ergo RTSF Section 34 Process	Westonaria, Gauteng, South Africa	2019	-	Section 34 Destruction Permit Applications	Ergo (Pty) Ltd
Twyfelaar EIA	Ermelo, Mpumalanga, South Africa	2019	2019	Heritage Impact Assessment	Dagsoom Coal Mining (Pty) Ltd
Sasol River Diversion	Sasolburg, Free State, South Africa	2019	2019	Heritage Impact Assessment	Sasol Mining
Sun City EIA and CMP	Pilanesberg, North-West Province, South Africa	2018	2019	Heritage Impact Assessment and Conservation Management Plan	Sun International
Exxaro Matla HRM	Kriel, Mpumalanga, South Africa	2017	2019	Heritage Impact Assessment and Conservation Management Plan	Exxaro Coal Mpumalanga (Pty) Ltd

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Exxaro Belfast GRP	Belfast, Mpumalanga, South Africa	2013	2019	Grave Relocation	Exxaro Coal Mpumalanga (Pty) Ltd
Eskom Northern KZN Strengthening	KwaZulu-Natal, South Africa	2016	2018	Heritage Impact Assessment	ILISO Consulting
Thabametsi GRP	Lephalale, Limpopo Province, South Africa	2017	2018	Grave Relocation	Exxaro Resources Ltd
SKA HIA and CMP	Carnarvon, Northern Cape, South Africa	2017	2018	Heritage Impact Assessment and Conservation Management Plan	SARAO
Grootegeluk Watching Brief	Lephalale, Limpopo Province, South Africa	2017	2017	Watching Brief	Exxaro Resources Ltd
Matla HSMP	Kriel, Mpumalanga Province, South Africa	2017	2017	Heritage Site Management Plan	Exxaro Coal Mpumalanga (Pty) Ltd
Ledjadja Coal Borrow Pits	Lephalale, Limpopo Province, South Africa	2017	2017	Heritage Basic Assessment	Ledjadja Coal (Pty) Ltd
Exxaro Belfast Implementation Project PIA	Belfast, Mpumalanga, South Africa	2017	2017	Palaeontological Impact Assessment	Exxaro Coal Mpumalanga (Pty) Ltd
Lanxess Chrome Mine Archaeological Mitigation	Rustenburg, North West Province, South Africa	2017	2017	Phase 2 Excavations	Lanxess Chrome Mine (Pty) Ltd
Tharisa Apollo EIA Project	KwaZulu-Natal, South Africa	2017	2017	Heritage Impact Assessment	GCS (Pty) Ltd
Queen Street Section 34 Process	Germiston, Johannesburg, Gauteng, South Africa	2017	2017	Section 34 Destruction Permit Applications	IDC Architects
Goulamina EIA Project	Goulamina, Sikasso Region, Mali	2017	2017	Heritage Impact Assessment	Birimian Limited

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Zuurfontein Residential Establishment Project	Ekurhuleni, Gauteng, South Africa	2017	2017	Notification of Intent to Develop	Shuma Africa Projects
Kibali Grave Relocation Training and Implementation	Orientale Province, Democratic Republic of Congo	2017	2017	Grave Relocation	Randgold Resources Limited
Massawa EIA	Senegal	2016	2017	Heritage Impact Assessment and Technical Reviewer	Randgold Resources Limited
Beatrix EIA and EMP	Welkom, Free State, South Africa	2016	2017	Heritage Impact Assessment	Sibanye Stillwater
Sun City Chair Lift	Pilanesberg, North-West Province, South Africa	2016	2017	Notification of Intent to Develop and Heritage Basic Assessment	Sun International
Hendrina Underground Coal Mine EIA	Hendrina, Mpumalanga, South Africa	2016	2017	Heritage Impact Assessment	Umcebo Mining (Pty) Ltd
Elandsfontein EMP Update	Clewer, Mpumalanga, South Africa	2016	2017	Heritage Impact Assessment	Anker Coal
Groningen and Inhambane PRA	Limpopo Province, South Africa	2016	2016	Heritage Basic Assessment	Rustenburg Platinum Mines Limited
Palmietkuilen MRA	Springs, Gauteng, South Africa	2016	2016	Heritage Impact Assessment	Canyon Resources (Pty) Ltd
Copper Sunset Sand Mining S.102	Free State, South Africa	2016	2016	Heritage Basic Assessment	Copper Sunset Sand (Pty) Ltd
Grootvlei MRA	Springs, Gauteng, South Africa	2016	2016	Notification of Intent to Develop	Ergo (Pty) Ltd
Lambda EMP	Mpumalanga, South Africa	2016	2016	Palaeontological Impact Assessment	Eskom Holdings SOC Limited
Kilbarchan Basic Assessment and EMP	Newcastle, KwaZulu-Natal, South Africa	2016	2016	Heritage Basic Assessment	Eskom Holdings SOC Limited
Grootegeluk Amendment	Lephalale, Limpopo	2016	2016	Notification of Intent to Develop	Exxaro Coal Resources (Pty) Ltd

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
	Province, South Africa				
Garsfontein Township Development	Pretoria, Gauteng, South Africa	2016	2016	Notification of Intent to Develop	Leungo Construction Enterprises
Louis Botha Phase 2	Johannesburg, Gauteng, South Africa	2016	2016	Phase 2 Excavations	Royal Haskoning DHV
Sun City Heritage Mapping	Pilanesberg, North-West Province, South Africa	2016	2016	Phase 2 Mapping	Sun International
Gino's Building Section 34 Destruction Permit Application	Johannesburg, Gauteng, South Africa	2015	2016	Heritage Impact Assessment and Section 34 Destruction Permit Application	Bigen Africa Services (Pty) Ltd
EDC Block Refurbishment Project	Johannesburg, Gauteng, South Africa	2015	2016	Heritage Impact Assessment and Section 34 Permit Application	Bigen Africa Services (Pty) Ltd
Namane IPP and Transmission Line EIA	Steenbokpan, Limpopo Province, South Africa	2015	2016	Heritage Impact Assessment	Namane Resources (Pty) Ltd
Temo Coal Road Diversion and Rail Loop EIA	Steenbokpan, Limpopo Province, South Africa	2015	2016	Heritage Impact Assessment	Namane Resources (Pty) Ltd
Sibanye WRTRP	Gauteng, South Africa	2014	2016	Heritage Impact Assessment	Sibanye Stillwater
NTEM Iron Ore Mine and Pipeline Project	Cameroon	2014	2016	Technical Review	IMIC plc
NLGM Constructed Wetlands Project	Liberia	2015	2015	Heritage Impact Assessment	Aureus Mining
ERPM Section 34 Destruction Permits Applications	Johannesburg, Gauteng, South Africa	2015	2015	Section 34 Destruction Permit Applications	Ergo (Pty) Ltd
JMEP II EIA	Botswana	2015	2015	Heritage Impact Assessment	Jindal
Oakleaf ESIA Project	Bronkhorstspruit, Gauteng, South Africa	2014	2015	Heritage Impact Assessment	Oakleaf Investment Holdings

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Imvula Project	Kriel, Mpumalanga, South Africa	2014	2015	Heritage Impact Assessment	Ixia Coal
VMIC Vanadium EIA Project	Mokopane, Limpopo, South Africa	2014	2015	Heritage Impact Assessment	VM Investment Company
Everest North Mining Project	Steelpoort, Mpumalanga, South Africa	2012	2015	Heritage Impact Assessment	Aquarius Resources
Nzoro 2 Hydro Power Project	Orientale Province, Democratic Republic of Congo	2014	2014	Social consultation	Randgold Resources Limited
Eastern Basin AMD Project	Springs, Gauteng, South Africa	2014	2014	Heritage Impact Assessment	AECOM
Soweto Cluster Reclamation Project	Soweto, Gauteng, South Africa	2014	2014	Heritage Impact Assessment	Ergo (Pty) Ltd
Klipspruit South Project	Ogies, Mpumalanga, South Africa	2014	2014	Heritage Impact Assessment	BHP Billiton
Klipspruit Extension: Weltevreden Project	Ogies, Mpumalanga, South Africa	2014	2014	Heritage Impact Assessment	BHP Billiton
Ergo Rondebult Pipeline Basic Assessment	Johannesburg, South Africa	2014	2014	Heritage Basic Assessment	Ergo (Pty) Ltd
Kibali ESIA Update Project	Orientale Province, Democratic Republic of Congo	2014	2014	Heritage Impact Assessment	Randgold Resources Limited
GoldOne EMP Consolidation	Westonaria, Gauteng, South Africa	2014	2014	Gap analysis	Gold One International
Yzermite PIA	Wakkerstroom, Mpumalanga, South Africa	2014	2014	Palaeontological Impact Assessment	EcoPartners
Sasol Mooikraal Basic Assessment	Sasolburg, Free State, South Africa	2014	2014	Heritage Basic Assessment	Sasol Mining

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Rea Vaya Phase II C Project	Johannesburg, Gauteng, South Africa	2014	2014	Heritage Impact Assessment	ILISO Consulting
New Liberty Gold Project	Liberia	2013	2014	Grave Relocation	Aureus Mining
Putu Iron Ore Mine Project	Petroken, Liberia	2013	2014	Heritage Impact Assessment	Atkins Limited
Sasol Twistdraai Project	Secunda, Mpumalanga, South Africa	2013	2014	Notification of Intent to Develop	ERM Southern Africa
Kibali Gold Hydro-Power Project	Orientale Province, Democratic Republic of Congo	2012	2014	Heritage Impact Assessment	Randgold Resources Limited
SEGA Gold Mining Project	Burkina Faso	2013	2013	Technical Reviewer	Cluff Gold PLC
Consbrey and Harwar Collieries Project	Breyton, Mpumalanga, South Africa	2013	2013	Heritage Impact Assessment	Msobo Coal
Falea Uranium Mine Environmental Assessment	Falea, Mali	2013	2013	Heritage Scoping	Rockgate Capital
Daleside Acetylene Gas Production Facility	Gauteng, South Africa	2013	2013	Heritage Impact Assessment	ERM Southern Africa
SEGA Gold Mining Project	Burkina Faso	2012	2013	Socio Economic and Asset Survey	Cluff Gold PLC
Kibali Gold Project Grave Relocation Plan	Orientale Province, Democratic Republic of Congo	2011	2013	Grave Relocation	Randgold Resources Limited
Everest North Mining Project	Steelpoort, Mpumalanga, South Africa	2012	2012	Heritage Impact Assessment	Aquarius Resources
Environmental Authorisation for the Gold One Geluksdal TSF and Pipeline	Gauteng, South Africa	2012	2012	Heritage Impact Assessment	Gold One International
Platreef Burial Grounds and Graves Survey	Mokopane, Limpopo Province, South Africa	2012	2012	Burial Grounds and Graves Survey	Platreef Resources

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Resgen Boikarabelo Coal Mine	Limpopo Province, South Africa	2012	2012	Phase 2 Excavations	Resources Generation
Bokoni Platinum Road Watching Brief	Burgersfort, Limpopo Province, South Africa	2012	2012	Watching Brief	Bokoni Platinum Mine
Transnet NMPP Line	Kwa-Zulu Natal, South Africa	2010	2010	Heritage survey	Umlando Consultants
Archaeological Impact Assessment – Witpoortjie Project	Johannesburg, Gauteng, South Africa	2010	2010	Archaeological Impact Assessment	ARM
Der Brochen Archaeological Excavations	Steelpoort, Mpumalanga, South Africa	2010	2010	Phase 2 Excavations	Heritage Contracts Unit
De Brochen and Booysendal Archaeology Project	Steelpoort, Mpumalanga, South Africa	2010	2010	Site Recording: Mapping	Heritage Contracts Unit
Eskom Thohoyandou Electricity Master Network	Limpopo Province, South Africa	2010	2010	Heritage Statement	Strategic Environmental Focus
Batlhako Mine Expansion	North-West Province, South Africa	2010	2010	Phase 2 Mapping	Heritage Contracts Unit
Wenzelrust Excavations	Shoshanguve, Gauteng, South Africa	2009	2009	Phase 2 Excavations	Heritage Contracts Unit
University of the Witwatersrand Parys LIA Shelter Project	Parys, Free State, South Africa	2009	2009	Phase 2 Mapping	University of the Witwatersrand
Archaeological Assessment of Modderfontein AH Holdings	Johannesburg, Gauteng, South Africa	2008	2008	Heritage Basic Assessment	ARM
Heritage Assessment of Rhino Mines	Thabazimbi, Limpopo Province, South Africa	2008	2008	Heritage Impact Assessment	Rhino Mines
Cronimet Project	Thabazimbi, Limpopo Province, South Africa	2008	2008	Archaeological surveys	Cronimet

PROJECT	LOCATION	DATES		PROJECT TYPE	CLIENT
Eskom Thohoyandou SEA Project	Limpopo Province, South Africa	2008	2008	Heritage Statement	Eskom
Witbank Dam Archaeological Impact Assessment	Witbank, Mpumalanga, South Africa	2007	2007	Archaeological survey	ARM
Sun City Archaeological Site Mapping	Sun City, Pilanesberg, North West Province, South Africa	2006	2006	Site Recording: Mapping	Sun International
Klipriviersberg Archaeological Survey	Meyersdal, Gauteng, South Africa	2005	2006	Archaeological surveys	ARM

6 Professional Registration

Position	Professional Body	Registration Number
Member	Association for Southern African Professional Archaeologists (ASAPA); ASAPA Cultural Resources Management (CRM) section	270
Member	International Council on Monuments and Sites (ICOMOS)	14274
Member	Society for Africanist Archaeologists (SAfA)	N/A
Member	International Association of Impact Assessors (IAIA) South Africa	5494

7 Publications

Huffman, T.N. & du Piesanie, J.J. 2011. Khami and the Venda in the Mapungubwe Landscape. Journal of African Archaeology 9(2): 189-206

du Piesanie, J.J., 2017. Book Review: African Cultural Heritage Conservation and Management. South African Archaeological Bulletin 72(205)

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Appendix B: HRM Methodology

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ENVIRONMENTAL

Cultural Significance, Field Rating and Impact Assessment

Methodology Statement

Project Number:

ZZZ9999

Prepared for:

Internal Document

June 2019

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This document has been prepared by Digby Wells Environmental.

Report Type:	**Methodology Statement**
Project Name:	**Cultural Significance, Field Rating and Impact Assessment**
Project Code:	**ZZZ9999**

Revision History

Name	Responsibility	Version	Date
Johan Nel ASAPA Member 095	HRM Unit Manager	Ver. 1	May 2014
		Ver. 2	October 2014
		Ver. 3	May 2015
Justin du Piesanie ASAPA Member 270	Divisional Manager: Social and Heritage Services	Ver. 4	January 2016
		Ver. 5	June 2016
		Ver. 6	June 2019

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1 Introduction

Cultural heritage resources are intrinsic to the history and beliefs of communities. They characterise community identity and cultures, are finite, non-renewable and irreplaceable. Considering the innate value of cultural heritage resources, Heritage Resources Management (HRM) acknowledges that these have lasting worth as evidence of the origins of life, humanity and society. It is incumbent of the assessor to determine the cultural significance[1] (CS) of cultural heritage resources to allow for the implementation of appropriate management. This is achieved through assessing cultural heritage resources' value relative to certain prescribed criteria encapsulated in policies and legal frameworks, such as the South African National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

Commensurate to the NHRA, with specific reference to Section 38, this methodology aims to ensure that clients protect cultural heritage during implementation of project activities by either avoiding, removing or reducing the intensity of adverse impacts to tangible[2] and intangible[3] cultural heritage resources within the defined area of influence.

The methodology to define CS and assess the potential effects of a project is discussed separately in the sections below.

2 Evaluation of Cultural Significance and Field Ratings

2.1 Cultural Significance Determination

Digby Wells developed a CS Determination Methodology to assign identified cultural heritage resources with a numerical CS rating in an objective as possible way and that can be independently reproduced provided that the same information sources are used, should this be required.

This methodology determines the intrinsic, comparative and contextual significance of identified cultural heritage resources by considering their:

1. Importance rated on a six-point scale against four criteria; and
2. Physical integrity rated on a five-point scale.

[1] Cultural significance is defined as the intrinsic "aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance" of a cultural heritage resource. These attributes are combined and reduced to four themes used in the Digby Wells significance matrix: aesthetic, historical, scientific and social.

[2] (i) Moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls.

[3] Cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

The assigned ratings consider information obtained through a review of available credible sources and representativity or uniqueness (i.e. known examples of similar resources to exist), as well as the current preservation *status-quo* as observed.

Figure 2-2 depicts the CS formula and importance criteria, and it describes ratings on the importance physical integrity scales

2.2 Field Rating Determination

Grading of heritage resources remains the responsibility of heritage resources authorities. However, the South African Heritage Resources Agency (SAHRA) Minimum Standards requires heritage reports include Field Ratings for identified resources to comply with section 38 of the NHRA. Section 7 of the NHRA provides for a system of grading of heritage resources that form part of the national estate and distinguishes between three categories.

The field rating process is designed to provide a numerical rating of the recommended grading of identified heritage resources. The evaluation is done as objectively as possible by integrating the field rating into the significance matrix.

Field ratings guide decision-making in terms of appropriate minimum required mitigation measures and consequent management responsibilities in accordance with Section 8 of the NHRA. Figure 2-1 presents the formula and the parameters used to determine the Field Ratings.

Field Rating = Average Sum of Aesthetic + Historic + Scientific + Social

rated against

Value	Field Rating	Designation	Authority
0	Resource not assessed	None	None
1	Resources afforded general protection in terms of Sections 34 to 37 of the NHRA and with negligible significance	Grade IV C	Local
2	Resources afforded general protection in terms of Sections 34 to 37 of the NHRA and with low significance	Grade IV B	
3	Resources afforded general protection in terms of Sections 34 to 37 of the NHRA and with medium-high significance	Grade IV A	
4	Resources afforded general protection in terms of Sections 34 to 37 of the NHRA and with high significance	Grade III B	
5	Resources afforded general protection in terms of Sections 34 to 37 of the NHRA and with very high significance	Grade II A	
6	Resources under formal protection that can be considered to have special qualities that make them significant within a province or region	Grade II	Provincial
7	Resources under formal protection that can be considered to have special qualities that make them significant within a national or international context	Grade I	National

Figure 2-1: Field Ratings Methodology

IMPORTANCE = AVERAGE SUM OF AESTHETIC + HISTORIC + SCIENTIFIC + SOCIAL

where

Aesthetic
Importance in aesthetic characteristics

Degree of technical / creative skill at a particular period

Historic
Importance to a community or pattern in the country's history

Site of significance relating to the history of slavery

Association with the life work of a person, group or organisation of importance in the history of the country

Scientific
Possession of uncommon, rare or endangered natural or cultural heritage aspects

Potential to yield information

Importance in demonstrating principle characteristics

Social
Association to a community or cultural group for social, cultural or spiritual reasons

rated against

IMPORTANCE: a site or heritage resource may be important in terms of one or more dimensions - aesthetic, historic, scientific and social. Each dimension consists of one or more attributes against which importance is determined. Importance of each dimension and subsequent attributes must be considered in relation to the resource's authenticity. Importance ratings must be informed and motivated by certain information sources. The credibility of information sources must therefore be evaluated and referred to when importance is discussed.	
0	The resource exhibits attributes that may be considered in a particular dimension, but it is so poorly represented that it cannot or does not contribute to the resource's overall value.
1	Common, well represented throughout diverse cultural landscapes
2	Generally well represented but exhibits superior qualities in comparison to other similar examples
3	The resource exhibits attributes that are rare and uncommon within a region. It is important to specific communities.
4	Rare and uncommon, value of national importance
5	The resource exhibits attributes that are considered singular, unique and/or irreplaceable to the degree that its significance can be universally accepted.
-	Not assessed - dimension and/or attribute not considered in determining value.

×

Integrity
Physical status quo of preservation from observation

rated against

INTEGRITY: the undivided or unbroken state, material wholeness, completeness or entirety of a resource or site	
0	No information potential, complete loss of meaning, Fabric completely degraded, original setting lost
1	Fabric poorly preserved, limited information, little meaning ascribed, extensive encroachment on setting
2	Fabric is preserved, some information potential (quality questionable) and meaning evident, some encroachment on setting
3	Fabric well preserved, good quality information and meaning evident, limited encroachment
4	Excellent preservation of fabric, high information potential of high quality, meaning is well established, no encroachment on setting

Figure 2-2: CS Determination Methodology

3 Impact Assessment Methodology

The rationale behind CS determination recognises that the value of a cultural heritage resource is a direct indication of its sensitivity to change (impacts) as well as the maximum acceptable levels of change to the resource. Therefore, the assessor must determine CS prior to the completion of any impact assessment.

These requirements in terms of international best practice standards are integrated into the impact assessment methodology to guide both assessments of impacts and recommendations for mitigation and management of resources.

The following are terms and definitions applicable to the Environmental Impact Assessment (EIA) concept (ISO 14001):

- **Project Activity:** Activities associated with the Project that result in an environmental interaction during various phases, i.e. construction, operation and decommissioning, e.g., new processing plant, new stockpiles, development of open pit, dewatering, water treatment plant;
- **Environmental Interaction:** An element or characteristic of an activity, product, or service that interacts or can interact with the environment. Environmental interactions can cause environmental impacts (but may not necessarily do so). They can have either beneficial impacts or adverse impacts and can have a direct and decisive impact on the environment or contribute only partially or indirectly to a larger environmental change;
- **Environmental Aspect:** Various natural and human environments that an activity may interact with. These environments extend from within the activity itself to the global system, and include air, water, land, flora, fauna (including people) and natural resources of all kinds; and
- **Environmental Impact:** A change to the environment that is caused either partly or entirely by one or more environmental interactions. An environmental interaction can have either a direct and decisive impact on the environment or contribute only partially or indirectly to a larger environmental change. In addition, it can have either a beneficial environmental impact or an adverse environmental impact.

The assessment process identified potential issues and impacts through examination of:

- Project phases and activities,
- Interactions between activities and the environmental aspect; and
- The interdependencies between environmental aspects.

Figure 3-1 presents a graphical summary of this concept and Figure 3-2 provides an example of the process.

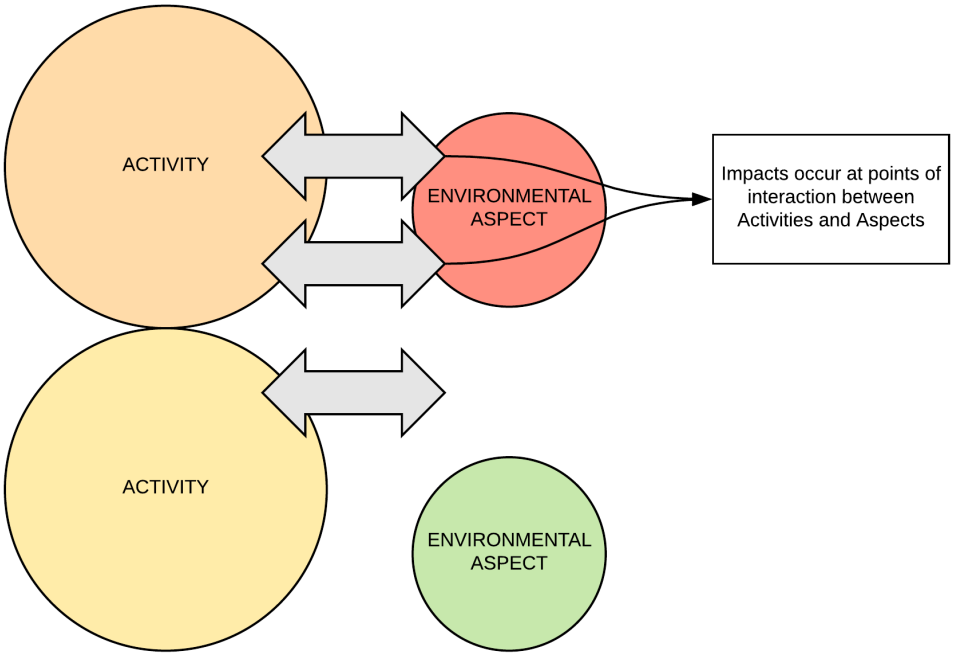

Figure 3-1: Graphical Representation of Impact Assessment Concept

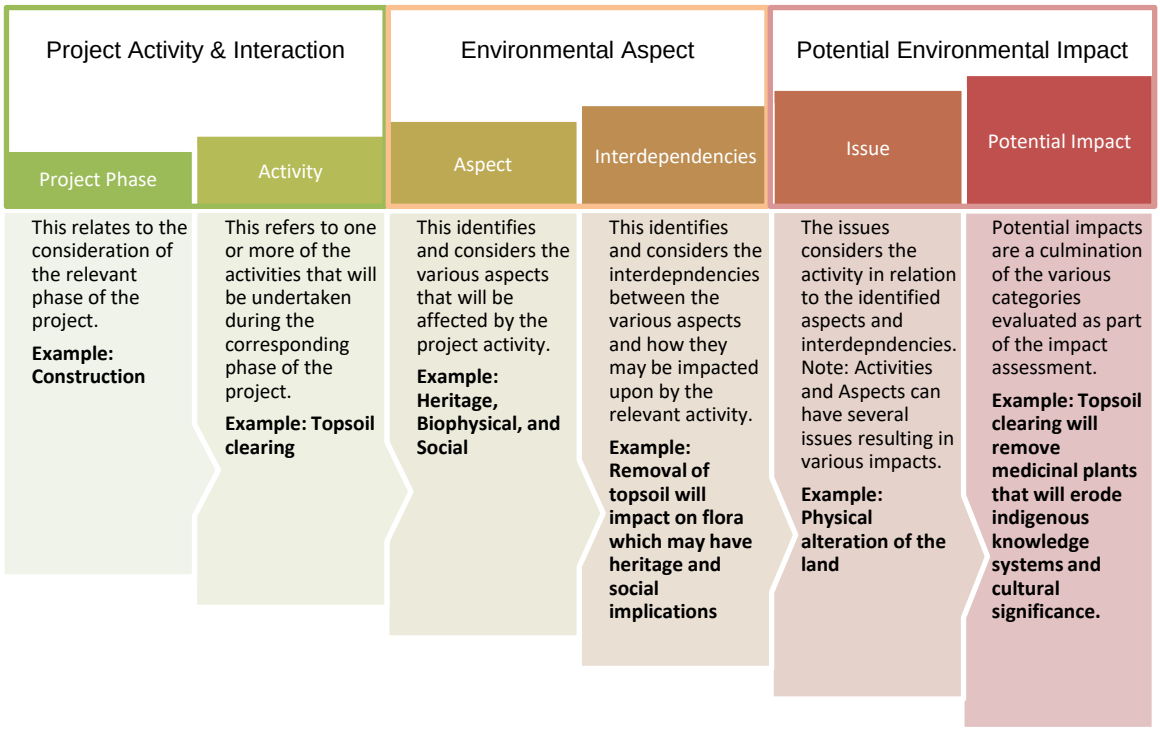

Figure 3-2: Example of how Potential Impacts are considered

3.1 Categorising Impacts to Cultural Heritage

Impacts may manifest differently among geographical areas and diverse communities. For instance, impacts to cultural heritage resources can simultaneously affect the tangible cultural heritage resource and have social repercussions. The severity of the impact is compounded when the intensity of physical impacts and social repercussions differ significantly, e.g. removal of a grave surface dressings results in a minor physical impact but has a significant social impact. In addition, impacts to cultural heritage resources can influence the determined CS without a physical impact taking place. Given this reasoning, impacts as considered here are generally placed into three broad categories (adapted from Winter & Bauman 2005: 36):

- **Direct or primary impacts** affect the fabric or physical integrity of the cultural heritage resource, for example destruction of an archaeological site or historical building. Direct or primary impacts may be the most immediate and noticeable. Such impacts are usually ranked as the most intense, but can often be erroneously assessed as high-ranking. For example, the destruction of a low-density scatter of archaeological material culture may be assessed as a negatively high impact if CS is not considered;
- **Indirect, induced or secondary impacts** can occur later in time or at a different place from the causal activity, or because of a complex pathway. For example, restricted access to a cultural heritage resource resulting in the gradual erosion of its CS that may be dependent on ritual patterns of access. Although the physical fabric of the cultural heritage resource is not affected through any primary impact, its CS is affected, which can ultimately result in the loss of the resource itself; and
- **Cumulative impacts** result from in-combination effects on cultural heritage resources acting within a host of processes that are insignificant when seen in isolation, but which collectively have a significant effect. Cumulative effects can be:
  - **Additive**: the simple sum of all the effects, e.g. the total number of development activities that will occur within the study area;
  - **Synergistic**: effects interact to produce a total effect greater than the sum of the individual effects, e.g. the effect of each different activity on the archaeological landscape in the study area;
  - **Time crowding**: frequent, repetitive impacts on a cultural heritage resource at the same time, e.g. the effect of regular blasting activities on a nearby rock art site or protected historical building;
  - **Neutralizing**: where the effects may counteract each other to reduce the overall effect, e.g. the effect of changes in land use could reduce the overall impact on sites within the archaeological landscape of the study area; and/or

- **Space crowding**: high spatial density of impacts on a cultural heritage resource, e.g. density of new buildings resulting in suburbanisation of a historical rural landscape.

The fact that cultural heritage resources do not exist in isolation from the wider natural, social, cultural and heritage landscape demonstrates the relevance of the above distinctions: CS is therefore also linked to rarity / uniqueness, physical integrity and importance to diverse communities.

3.2 Impact Assessment

The impact assessment process is designed to provide a numerical rating of the identified potential impacts. This methodology follows the established impact assessment formula:

Impact = consequence of an event x probability of the event occurring

where:

Consequence = type of impact x (Duration + Extent + Intensity)

and

Probability = Likelihood of an impact occurring

In the formula for calculating consequence:

Type of impact = +1 (positive) or -1 (negative)

Table 3-1 presents a description of the duration, extent, intensity and probability ratings. The intensity rating definitions consider the determined CS of the identified cultural heritage resources. These criteria are used to determine the impact ratings as defined in Table 3-2 below. Table 3-3 represents the relationship between consequence, probability and significance.

The impact assessment process considers pre- and post-mitigation scenarios with the intention of managing and/or mitigating impacts in line with the EIA Mitigation Hierarchy, i.e. avoiding all impacts on cultural heritage resources. Where Project-related mitigation does not avoid or sufficiently minimise negative impacts on cultural heritage resources, mitigation of these resources may be required.

Table 3-1: Description of Duration, Extent, Intensity and Probability Ratings Used in the Impact Assessment

Value	CONSEQUENCE						PROBABILITY RATING - A measure of the chance that consequences of that selected level of severity could occur during the exposure window.	
	DURATION RATING - A measure of the lifespan of the impact		EXTENT RATING A measure of how wide the impact would occur		INTENSITY RATING- A measure of the degree of harm, injury or loss.			
	Probability	Description	Exposure	Description	Intensity	Description	Probability	Description
7	**Permanent**	Impact will permanently alter or change the heritage resource and/or value (Complete loss of information)	**International**	Impacts on heritage resources will have international repercussions, issues or effects, i.e. in context of international cultural significance, legislation, associations, etc.	**Extremely high**	Major change to Heritage Resource with High-Very High Value	**Certain/Definite**	Happens frequently. The impact will occur regardless of the implementation of any preventative or corrective actions.
6	**Beyond Project Life**	Impact will reduce over time after project life (Mainly renewable resources and indirect impacts)	**National**	Impacts on heritage resources will have national repercussions, issues or effects, i.e. in context of national cultural significance, legislation, associations, etc.	**Very high**	Moderate change to Heritage Resource with High-Very High Value	**High probability**	Happens often. It is most likely that the impact will occur.
5	**Project Life**	The impact will cease after project life.	**Region**	Impacts on heritage resources will have provincial repercussions, issues or effects, i.e. in context of provincial cultural significance, legislation, associations, etc.	**High**	Minor change to Heritage Resource with High-Very High Value	**Likely**	Could easily happen. The impact may occur.
4	**Long Term**	Impact will remain for >50% - Project Life	**Municipal area**	Impacts on heritage resources will have regional repercussions, issues or effects, i.e. in context of the regional study area.	**Moderately high**	Major change to Heritage Resource with Medium-Medium High Value	**Probable**	Could happen. Has occurred here or elsewhere
3	**Medium Term**	Impact will remain for >10% - 50% of Project Life	**Local**	Impacts on heritage resources will have local repercussions, issues or effects, i.e. in context of the local study area.	**Moderate**	Moderate change to Heritage Resource with Medium - Medium High Value	**Unlikely / Low probability**	Has not happened yet, but could happen once in a lifetime of the project. There is a possibility that the impact will occur.

Value	CONSEQUENCE						PROBABILITY RATING - A measure of the chance that consequences of that selected level of severity could occur during the exposure window.	
	DURATION RATING - A measure of the lifespan of the impact		EXTENT RATING A measure of how wide the impact would occur		INTENSITY RATING- A measure of the degree of harm, injury or loss.			
	Probability	**Description**	**Exposure**	**Description**	**Intensity**	**Description**	**Probability**	**Description**
2	**Short Term**	Impact will remain for <10% of Project Life	**Limited**	Impacts on heritage resources will have site specific repercussions, issues or effects, i.e. in context of the site-specific study area.	**Low**	Minor change to Heritage Resource with Medium - Medium High Value	**Rare / Improbable**	Conceivable, but only in extreme circumstances. Have not happened during the lifetime of the project, but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	**Transient**	Impact may be sporadic/limited duration and can occur at any time. E.g. Only during specific times of operation, and not affecting heritage value.	**Very Limited**	Impacts on heritage resources will be limited to the identified resource and its immediate surroundings, i.e. in context of the specific heritage site.	**Very low**	No change to Heritage Resource with values medium or higher, or Any change to Heritage Resource with Low Value	**Highly Unlikely /None**	Expected never to happen. Impact will not occur.

Table 3-2: Impact Significance Scores, Descriptions and Ratings

Score	Description	Rating
109 to 147	A very beneficial impact which may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change.	Major (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the heritage resources.	Moderate (positive)
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the project. These impacts will usually result in positive medium to long-term effect on the heritage resources.	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the heritage resources.	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the heritage resources.	Negligible (negative)
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the heritage resources.	Minor (negative)
-73 to -108	A serious negative impact which may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term change to the heritage resources and result in severe effects.	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects.	Major (negative)

Table 3-3 Relationship between Consequence, Probability and Significance

Relationship between consequence, probability and significance ratings

Significance

Probability	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

4 Recommended Management and Mitigation Measures

The CS of an identified heritage resource informs the level of the identified potential impact to that resource which in turn informs the recommended management and mitigation requirements. Table 4-1 presents an overview of the minimum recommended mitigation requirements considering the CS of the heritage resource.

Table 4-1: Minimum Recommended Management or Mitigation Requirements Considering CS

Determined CS	Minimum Management / Mitigation Requirements[4]
Negligible	Sufficiently recorded through assessment, no mitigation required
Low	Resource must be recorded before destruction, may include detailed mapping or surface sampling
Medium	Mitigation of the resource to include detailed recording and limited test excavations
Medium-High	Project design must aim to minimise impacts; Mitigation of resources to include extensive sampling through test excavations and analysis
High	Project design must aim to avoid impacts; Cultural heritage resource to be partially conserved, must be managed by way of Conservation Management Plan
Very High	Project design must be amended to avoid all impacts; Cultural heritage resources to be conserved in entirety and conserved and managed by way of Conservation Management Plan

The desired outcome of an impact assessment is the avoidance of all negative impacts and enhancement of positive ones. While this is not always possible, the recommended management or mitigation measures must be reasonable and feasible taking into consideration the determined CS and nature of the Project.

Two categories of impact management options are considered: avoidance and mitigation.

Avoidance requires changes or amendments to Project design, planning and siting of infrastructure to avoid physical impacts on heritage resources. It is the preferred option, especially where cultural heritage resources with high – very-high CS will be impacted.

[4] Based on minimum requirements encapsulated in guidelines developed by SAHRA

Mitigation of cultural heritage resources may be necessary where avoidance is not possible, thus resulting in partial or complete changes (including destruction) to a resource. Such resources need to be protected until they are fully recorded, documented and researched before any negative impact occurs. Options for mitigating a negative impact can include minimization, offsets, and compensation. Examples of mitigation measures specific to cultural heritage include:

- Intensive detailed recording of sites through various non-intrusive techniques to create a documentary record of the site – "preservation by record"; and
- Intrusive recording and sampling such as shovel test pits (STPs) and excavations, relocation (usually burial grounds and graves, but certain types of sites may be relocated), restoration and alteration. Any form of intrusive mitigation is normally a regulated permitted activity for which permits[5] need to be issued by the Heritage Resource Authorities (HRAs). Such mitigation may result in a reassessment of the value of a cultural heritage resource that could require conservation measures to be implemented. Alternatively, an application for a destruction permit may be made if the resource has been sufficiently sampled.

Where resources have negligible CS, the specialist may recommend that no further mitigation is required, and the site may be destroyed where authorised.

Community consultation is an integral activity to all above-mentioned avoidance and mitigation measures.

[5] Permit application processes must comply with the relevant Section of the NHRA and applicable Chapter(s) of the NHRA Regulations, 2000 (Government Notice Regulation [GN R] 548) and must be issued by SAHRA or the Provincial Heritage Resources Authority (PHRA) as is applicable.

DIGBY WELLS
ENVIRONMENTAL

Appendix C: Palaeontology Impact Assessment

Palaeontological Impact Assessment for the proposed sand mining by Copper Sunset on New Vaal Colliery, Vereeniging, Free State Province

COP6147

Site Visit (Phase 2) Report

For

Digby Wells (Pty) Ltd

10 March 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 Digby Wells (Pty) Ltd, 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 was requested for the proposed mining of surficial sand by Copper Sunset on the property of Seriti New Vaal Colliery, Vereeniging, Free State Province. There are two sections for the sand mining and both are considered in this report.

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 and survey Palaeontological Impact Assessment (PIA) was completed for the proposed project by Rick Tolchard on the 5th of March 2020.

The proposed site lies on the overlying Quaternary alluvial and Aeolian sands with the Vryheid Formation coals well below the surface. Transported sands from ancient volcanic rocks do not preserve fossils but rarely entrap fossils from other deposits. The site is also very close to the coal deposits so a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological site visit is required unless the geologist or responsible person on site finds fossils.

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1. Background

Copper Sunset (Pty) Ltd (hereinafter Copper Sunset) want to mine sand at the New Vaal Colliery before the Colliery mine the coal (Figure 1) (the Project). Because of the time pressure for Copper Sunset to mine the sand before Seriti want to mine the coal, they have divided up the Project area into two sections so they can apply for a Mining Right and a Mining Permit. This report applies to both sections of land (Figure 2) and the entire area was surveyed by a palaeontologist.

i. Site Description

Seriti New Vaal Colliery is situated on the southern bank of the Vaal River, in the Free State Province. Vereeniging to the north, and Vanderbijlpark to the west, are on the other side of the Vaal River and in Gauteng Province. Figure 1 presents the location of the proposed Project. In this figure, the yellow polygon represents the area earmarked for the sand mining. Figure 2 presents both phases of the proposed Project in relation to the Colliery.

A Palaeontological Impact Assessment site visit was requested for the two sections of the sand mining project by Copper Sunset. 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 and survey Palaeontological Impact Assessment (PIA) was completed for the proposed project by Rick Tolchard on the 5th of March 2020 and is reported herein.

Figure 1: Google Map image of the proposed Sand Mining area within the Seriti New Vaal Colliery Mining Right Area, south of the Vaal River and Vereeniging and east of Vanderbijlpark in the Free State

Map supplied by Digby Wells.

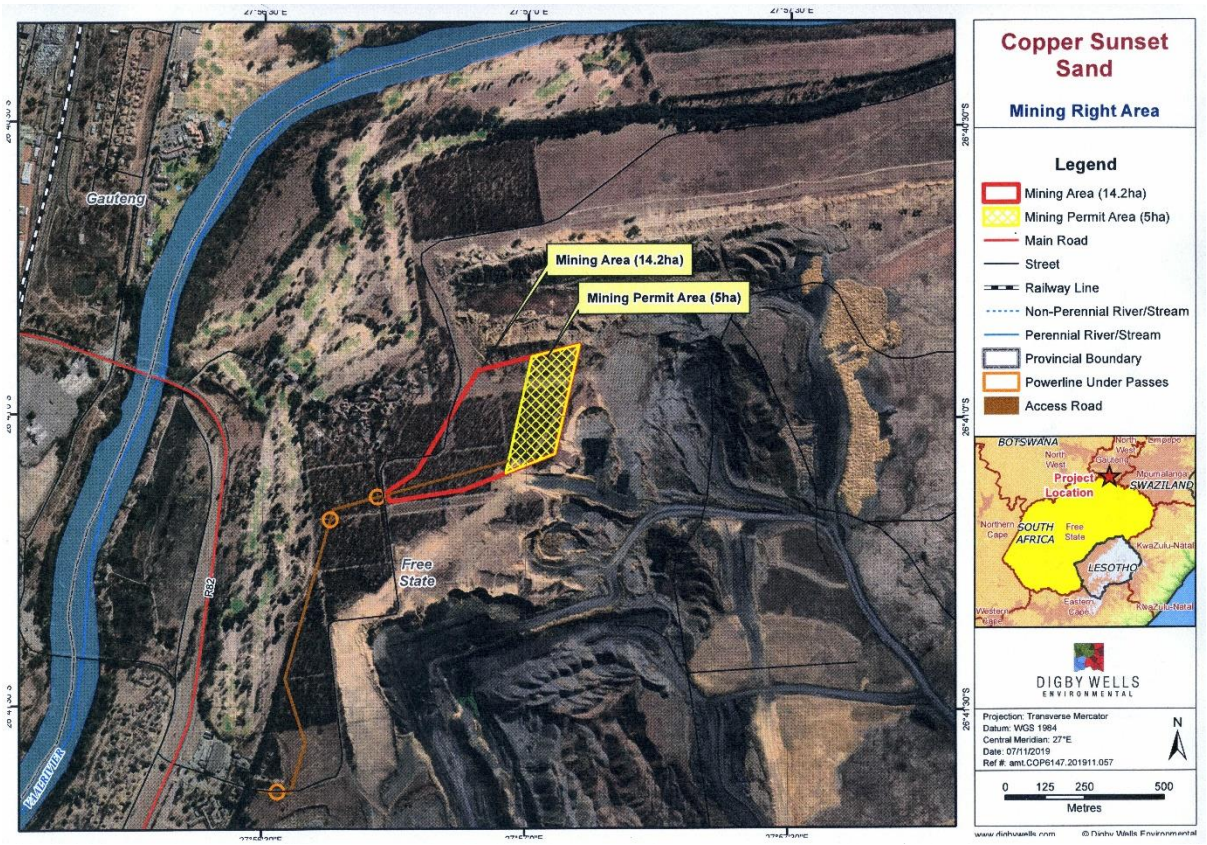

Figure 2: The proposed Sand Mining Area, including both Phases planned for Sand Mining

Map supplied by Digby Wells.

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**
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 i
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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section**
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

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 site for the proposed mining of sand lies in the northern part of the main Karoo Basin on the northern margin of the Vereeniging-Sasolburg Coalfield, just south of the Vaal River. It is on the property of the Seriti New Vaal Colliery where they are actively mining the no 1 to 3 coal seams. These are overlain by thick dolerite and diamictite (Snyman, 1998). The coal is in the lower Permian Vryheid Formation, Ecca Group.

On the surface, and particularly along the Vaal River, are alluvial and Aeolian sands that have been transported her by wind and flooding waters. The sands have a much older origin but have been deposited here during the Quaternary.

Ancient and non-fossiliferous rocks of the Hekpoort Formation (Pretoria Group, Karoo Supergroup) underlie the town of Vanderbijlpark but these are andesites and will not be considered any further.

Figure 3 presents the regional geology within which the Project is located. The Project area is shown in the yellow rectangle. Table 2 includes an explanation of the abbreviations of the rock types. In this table, SG refers to Supergroup, Fm refers to Formation and Ma refers to million years. Geological features impacted by the Project are highlighted through grey shading.

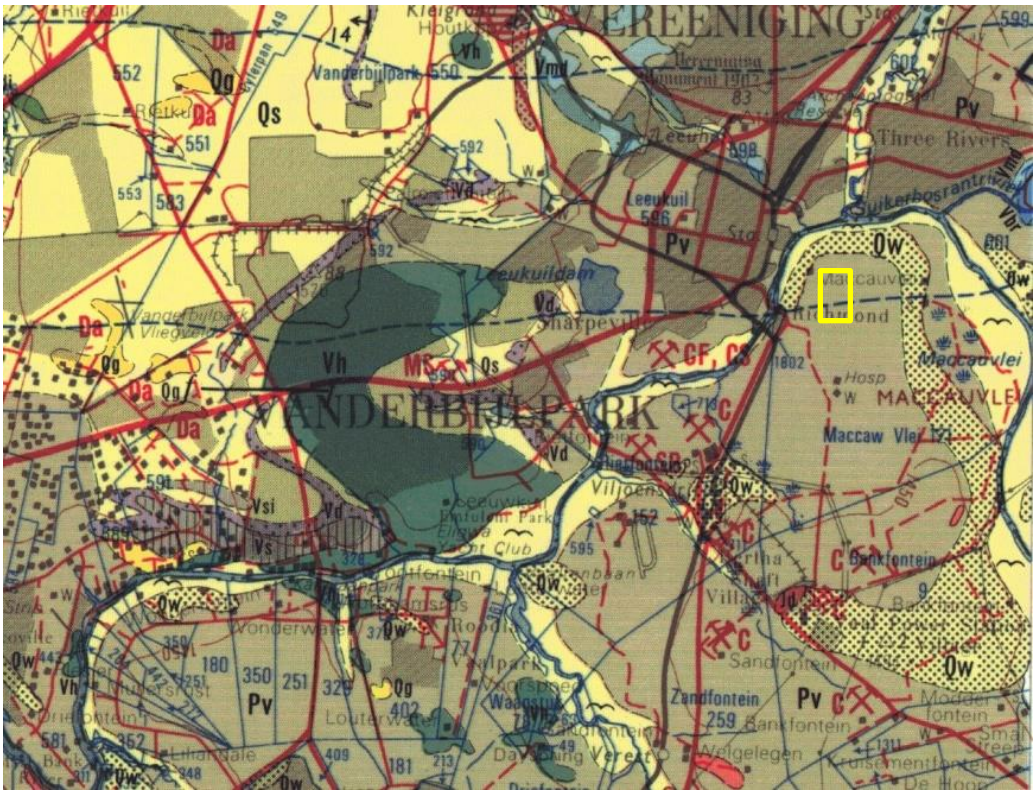

Figure 3: Geological map of the area around New Vaal Colliery with the proposed sand mining area indicated within the yellow rectangle.

Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006, 2012; Johnson et al., 2006).

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary	Alluvium, soil	Quaternary, ca 2.5 Ma to present
Qw	Quaternary	Aeolian sands	Quaternary, ca 2.5 Ma to present
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, sandstone, coal	Lower Permian, Middle Ecca
Vh	Hekpoort Fm, Pretoria Group, Transvaal SG	Andesite, agglomerate, tuff	Ca 2224 Ma

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Quaternary sands that overlie the sandstones, shales and coal seams of the Vryheid Formation. Between the coal seams of the Vryheid Formation, the shales may contain impressions of fossil leaves and reproductive structures of the Glossopteris Formation. The coal itself is highly altered by temperature and pressure so although it is composed of organic matter, no original plant structures are preserved.

The coal deposit is the domain of the Seriti New Vaal Colliery. This report is only considering the overlying Quaternary sands that the company Sunset Copper Sands will be mining.

Sands have been transported here naturally, from a distance by the river and wind action. There is a small chance that fossils could have been transported by the river but they would have been sorted by the flow of the river with large fossils deposited first and small fossils later as the energy of the river dissipated. Any fragile fossils would have been destroyed. Only more robust fossils, such as bones or silicified wood, could survive but they would be completely out of context and so of very little scientific value. The source area for the fluvial sands in the Vaal River is in ancient rocks of the Witwatersrand and Pretoria Supergroups and these only rarely have delicate microbial structures or massive dolomite, rarely with stromatolites (Eriksson et al., 2012). Aeolian sands could only transport very small particles and none would be recognisable.

From the SAHRIS map below (Figure 4) the area is indicated as moderately sensitive (green) for the sand mining area and very highly sensitive for the coal deposits, so a site visit was undertaken on 5th March by Rick Tolchard.

The area is highly disturbed by current coal mining activities but both sand mining sections were surveyed on foot. There is a covering of soil and sand with dense grasses and scattered trees.

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed sand mining operation on the property of New Vaal Colliery 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

The proposed Project area was surveyed on the 5th of March 2020. Table 3 presents a summary of in-field observations which are illustrated in Figure 5 to Figure 7 below. All photographs were taken by Rick Tolchard during the site inspection.

Table 3: GPS Points and Site Observations from the Paleontological Survey

Point No.	GPS coordinates	Observations	Figure
Stop 1:	S26°43'45.33459" E27°57'35.97093" 1461m	Entrance to the site showing sandy soil, grasses and scattered trees. The lack of tree diversity indicates a secondary grassland savanna.	5A
Stop 2:	S26°40'57.60843" E27°56'56.71104" 1478m	Same sandy soils and vegetation.	5B
Stop 3:	S26°40'58.70619" E27°56'55.96934" 1474m	Same sandy soils and vegetation.	5C

Point No.	GPS coordinates	Observations	Figure
Stop 4:	S26°41'0.84091" E27°56'54.22041" 1475m	Sandy soils with small stones and shattered rock (possibly imported road metal). Some parts have shorter grasses.	5D, 6A, B
Stop 5	S26°41'4.2297" E27°56'53.42379" 1502m	Same vegetation with thicker and taller grasses under the trees.	6C
Stop 6:	S26°41'6.63146" E27°56'52.09248"	Same thick vegetation on sandy soils. No rocky outcrops	6D
Stop 7:	S26°41'8.21353" E27°56'52.60243" 1458m	Another section within the trees and thick grasses.	7A
Stop 8:	S26°41'5.77374" E27°56'57.93735" 1471m	Thick grasses and scattered trees on deep sandy soils (foreground)	7B
Stop 9:	S26°40'58.10194" E27°56'56.72884" 1466m	Rare exposure of bare sandy soils with no vegetation and no fossils.	7C

Both sections for the two phase of mining (Figure 2) are relatively flat with medium height grassland and scattered trees. The lack of diversity amongst the trees indicates that this is a secondary grassland and has been disturbed by previous farming activities. There were no differences in the vegetation that would indicate a localised soil difference, such as a pan or vlei. Such a soil feature might have Quaternary fossil bones or organic material. There were no exposures of shales or mudstones that might contain fossil plant impressions from the Vryheid Formation.

From the site visit it can be concluded that there were no fossils of either Quaternary age or Permian coal flora plants.

Figure 5: A - Entrance to the site (Stop 1) showing sandy soil, grasses and scattered trees. B – Stop 2 – same soils and vegetation. C – Stop 3 – same soils and vegetation. D – Stop 4 sandy soils with small stones and shattered rock (possibly imported road metal).

Figure 6: A - Stop 4 another exposure of pebbles on sand, B – shorter grasses on sandy soil. C – Stop 5 with thick grasses under the trees. D – Stop 6 – same thick vegetation on sandy soils.

Figure 7: A – Stop 7, another section within the trees and thick grasses. B – Stop 8 – thick grasses and scatters trees on sandy soils (foreground). C – Stop 9 – rare exposure of bare sandy soils with no vegetation and no fossils.

4. Impact assessment

Table 4 presents the criteria used to assess the potential impacts to palaeontological resources. Table 5 presents the results of the impact assessment.

Table 4: 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 5: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	**H**	-
	M	-
	L	Aeolian and alluvial sands do not preserve plant or animal fossils but might entrap them along the journey. So far there are no records from this section of the Vaal River. No fossils were found during the survey. The impact would be very unlikely.
	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 transported, robust fossil plants from anywhere upriver or local pans, 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 sand that will be mined, nonetheless a Fossil Chance Find protocol should be added to the eventual EMPr.

Based on the nature of the project, and the observations from the site visit, surface activities will not impact upon the fossil heritage as none could be found in the project footprint. The geological structures suggest that the source rocks for the fluvial sands are much too old to contain fossils. Furthermore, the material to be mined is loose sand and this does not preserve fossils. There were no Quaternary pan or vlei features. Since there is an extremely small chance that fossils from the underlying Vryheid Formation 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 extremely low.

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 not contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils as they have been transported. The source area for the fluvial sands is in ancient volcanic rocks. Aeolian sands could only entrap sand sized particles.

6. Recommendation

Based on experience, the lack of any previously recorded fossils from the area, and primarily from the site visit, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. There is a very small chance that fossils may occur in the underlying shales of the early Permian Vryheid Formation so a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once mining has commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

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.

Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R., Lenhardt, N., 2012. A case study of microbial mats-related features in coastal epeiric sandstones from the Palaeoproterozoic Pretoria Group, Transvaal Supergroup, Kaapvaal craton, South Africa; the effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred palaeoenvironment. Sedimentary Geology 263, 67-75.

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 excavations/mining 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 mining 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 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 Permian and Quaternary fossils

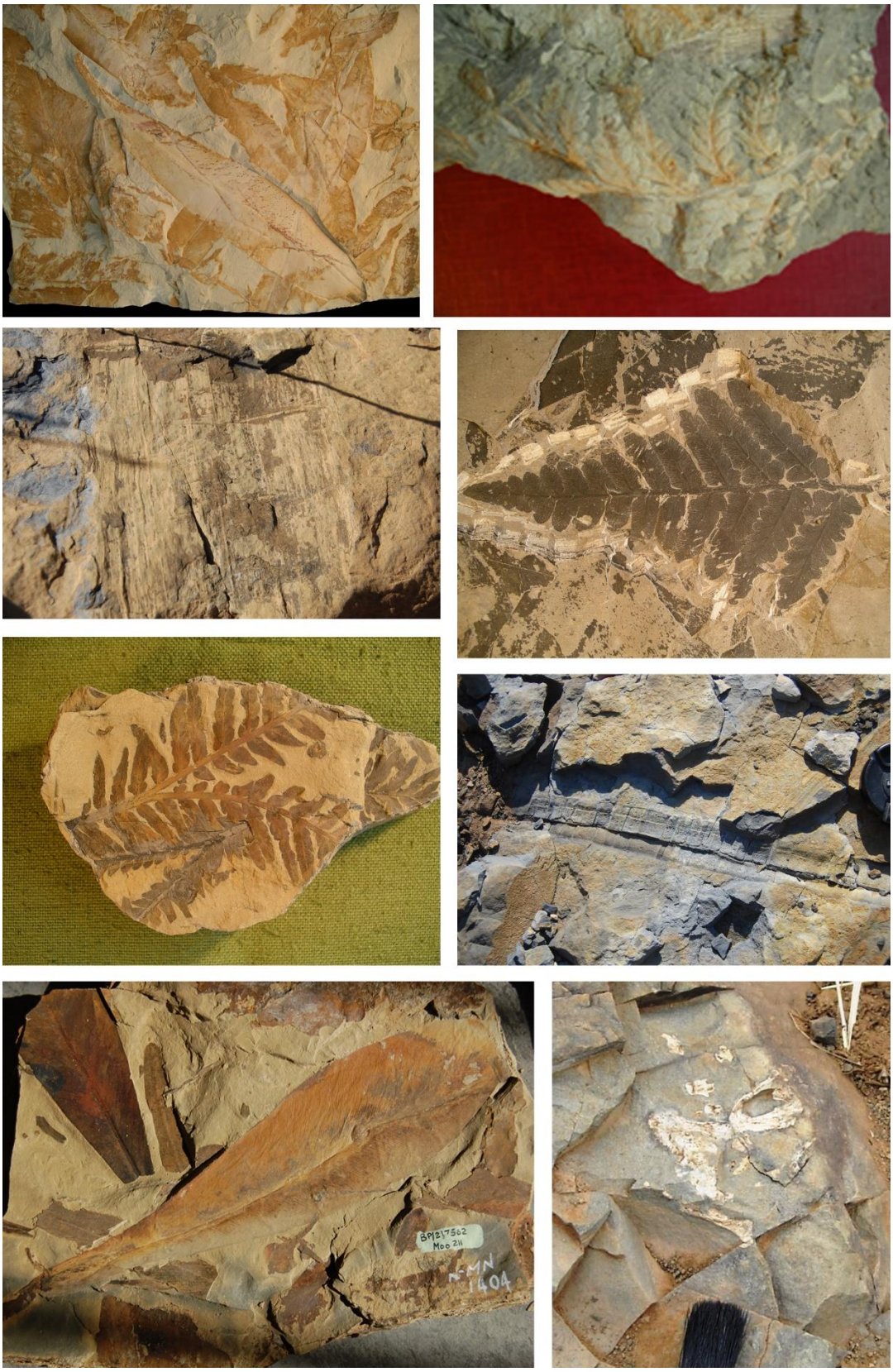

Figure 8: Examples of fossil plants (and bones) from the Permian* Glossopteris *flora.

Figure 9: Examples of silicified wood fragments from a fluvial deposit.

Appendix B: Details of specialists

Curriculum vitae (short) - Marion Bamford PhD
January 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	7	0
Masters	10	4
PhD	12	5
Postdoctoral fellows	10	3

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

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 27; Google scholar h index = 32;
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 – March 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.

Field Experience

Honours Fieldtrip – Karoo biostratigraphy – April 2017

Research fieldwork – Elliot Formation with Prof Choiniere – April 2018, November 2018; April 2019

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