APPENDIX I4

HERITAGE IMPACT ASSESSMENT

PROPOSED MOKOLO AND CROCODILE RIVER (WEST) WATER AUGMENTATION PROJECT (PHASE 2A) (MCWAP-2A): WATER TRANSFER INFRASTRUCTURE AND BORROW PITS, LIMPOPO PROVINCE.

Phase 1 – Heritage Impact Assessment – Final Report

Issue Date: **12 July 2018**
Revision No.: **3**
Project No.: **317 HIA**

Declaration of Independence

I, Polke Birkholtz, declare that –

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Directors: HS Steyn, PD Birkholtz, W Fourie

- General declaration:
- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd

CONTACT PERSON: Polke Birkholtz – Archaeologist/Heritage Specialist/Project Manager

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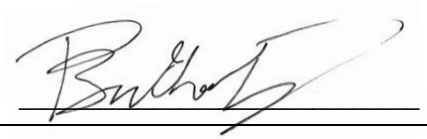
SIGNATURE: 

Report Title	Proposed Mokolo And Crocodile River (West) Water Augmentation Project (Phase 2A) (Mcwap-2A): Water Transfer Infrastructure and Borrow Pits, Limpopo Province.		
Control	**Name**	**Signature**	**Designation**

Author	Polke Birkholtz		Archaeologist/Heritage Specialist/Project Manager – PGS Heritage

DETAILS OF CLIENT:

CLIENT: **Nemai Consulting (Pty) Ltd**

CONTACT PERSON: **Mr. Donavan Henning**

The heritage impact assessment report has been compiled taking into account the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

NEMA Regs (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Page iii and Section 1.2
The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to **Appendix D**
A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 3
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Executive Summary and Section 10
An identification of any areas to be avoided, including buffers	Executive Summary & Section 10
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;	Refer Figures 27 to 30
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Sections 5, 6 & 7
Any mitigation measures for inclusion in the EMPr	Section 9
Any conditions for inclusion in the environmental authorisation	Sections 9 & 10
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Sections 9 & 10
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Executive Summary & Section 10
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	
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process was conducted as part of the EIA and EMP process.
A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments regarding heritage that require input from a specialist have been received.
Any other information requested by the competent authority.	Not applicable.

EXECUTIVE SUMMARY

Introduction

PGS Heritage (Pty) Ltd was appointed by Nemai Consulting (Pty) Ltd to undertake a Phase 1 Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) for the proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure and Borrow Pits, Limpopo Province.

General Desktop Study

An archival and historical desktop study was undertaken to provide a historic framework for the project area and surrounding landscape. This was augmented by a study of available historical and archival maps and an assessment of previous archaeological and heritage studies completed for the area. The desktop study revealed that the surroundings of the study area is characterised by a long and significant history, whereas previous archaeological and heritage studies from this area have revealed a number of archaeological and heritage sites.

Palaeontology

Ms. Elize Butler of Banzai Consulting was commissioned to undertake a paleontological desktop study for the proposed MCWAP-2A development (refer **Appendix C**). Please note that at the time that this study was undertaken, Alternative D4 did not yet exist. As a result, this palaeontological study did not assess Alternative D4.

She found that the proposed Mokolo Crocodile River (West) Water Augmentation Project is underlain by various geological sediments. The table below indicates these geological sediments as well as their respective palaeontological sensitivities.

Table 1 – Geological sediments underlying the project area

Era	Supergroup/Sequence	Group	Subgroup	Formation	Sensitivity
Mokolien		Waterberg	Kransberg		Low
			Matlabas		
			Nylstroom		
Vaalian	Bushveld Complex; Lebowa Granite Suite				Zero
	Transvaal Supergroup	Pretoria		Black Reef	Moderate
		Chuniespoort	Malmani		High
Randian		Buffelsfontein			Moderate

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a **high Palaeontological sensitivity**. The proposed development of the central pipe line is underlain by the Malmani Subgroup development and thus has a high palaeontological sensitivity. It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

Fieldwork

The field assessment of the largest portion of the proposed pipeline routes were undertaken by driving along the adjacent and available roads, including the track running along the railway line servitiude. A concerted effort was made to conduct walkthroughs of those sections of the pipeline footprints not accessible by road. Furthermore, and whenever possible, all potential heritage sites identified during the assessment of the historic maps and SAHRIS were also visited in the field. Additionally, with the exception of a few areas defined

in Section 3.1 that were not covered, all the non-pipeline footprints (i.e. borrow pits, construction camps etc.) were assessed by way of intensive walkthroughs.

A total of 18 archaeological and heritage sites were identified during the fieldwork. These were numbered from MCWAP Site 1 to MCWAP Site 18. These identified sites included the following:

- Five black homesteads where the potential risk for the presence of unmarked stillborn graves exist. See MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16

- Five sites containing confirmed graves and possible graves. See MCWAP Site 2, MCWAP Site 4, MCWAP Site 7, MCWAP Site 13 and MCWAP Site 14.

- Three historic farmsteads which are older than 60 years. See MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15.

- Two Stone Age sites. See MCWAP Site 8 and MCWAP Site 18.

- Two metalworking sites associated with the Iron Age. See MCWAP Site 9 and MCWAP Site 10.

- Memorial where cremated ash may have been placed. See MCWAP Site 17.

Impact risk assessments were undertaken to calculate the impact risk of the proposed development on these identified heritage sites.

General Recommendations

The following general mitigation measures are required:

- Whenever possible, all heritage sites identified during this study with a significance of Medium and higher, must be preserved *in situ* by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprints and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required (refer **Section 9.2**).
- All those areas that could not be accessed during the fieldwork, must be assessed in the field by a heritage specialist / archaeologist before construction commences. These areas were not assessed in the field due to a number of reasons, including cases where the landowners were not willing to provide permission to any of the

project consultants to undertake fieldwork on their land, cases where landowners did not respond to messages requesting access to their properties, development footprints and properties for which no landowner details were provided as well as those areas that were not assessed in the field due to the temporal and budget restrictions. Refer **Section 1.3** for a detailed list of all the components of the study area that could not be accessed during the fieldwork.

- The archaeological research assessment of the Motlhabatsi (Matlabas) drainage basin that was undertaken by Jan Aukema for his masters degree from the University of the Witwatersrand, revealed a substantial number of sites. The proposed Central Pipeline Route passes through a section of the Matlabas drainage basin that represented the area of study for Jan Aukema's archaeological research. As the exact coordinates and site localities for the numerous archaeological sites identified by Aukema are not presently available, it is very difficult to accurately establish the distances between the closest of Aukema's archaeological sites and present study area. From the site distribution map published by Huffman (1990:118), it would appear that the following sites are located closest to the present study area: Wn1 on the farm Welgevonden, Ho1 on the farm Haarlem Oost and Gr1 on the farm Groenrivier. It is recommended that all components of the proposed development footprints must be assessed in the field by way of walkthroughs undertaken by a heritage specialist / archaeologist before construction commences.

- Although significant sections of the pipeline footprints were assessed by vehicle along the railway and road servitudes, the landscape within which this development is proposed is not characterised by a plethora of archaeological and heritage sites. This statement is supported by the fact that although an intensive field assessment was undertaken, which included walkthroughs of almost all the non-pipeline development footprints (i.e. borrow pits, construction camps etc.), only 18 heritage sites could be identified across the entire length of the proposed development footprint which extends over an area in excess of 150km. As a result, it is not deemed necessary for additional walkthroughs to be undertaken apart from the ones required for those areas which were not included in the current fieldwork (see previous bullet item) and the ones required by the previous General Recommendation in proximity to the Matlabas River. Rather, it is recommended that an archaeological and heritage workshop be conducted with the project Environmental Control Officer (ECO) before construction commences to allow the ECO to undertake constant monitoring of construction activities and identify any archaeological and heritage sites which may be located along the pipeline route and which were not identified during the current fieldwork. Additionally, an archaeological watching brief can augment the work of the ECO during construction.

- An assessment of the South African Heritage Resources Information System (SAHRIS) of SAHRA was undertaken to establish whether any previous archaeological and heritage impact assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints. One of these previous reports from the immediate surroundings of the study area identified a cemetery containing four graves located approximately 65m north-west of proposed Borrow Pit 13-14, and 55m south-west of the access road to this borrow pit. The coordinates for this site are as follows: S 23.711420 E 27.497340. Due to the closeness of this cemetery to this borrow pit, the construction team and Environmental Control Officer must be made aware of the position of this site to ensure that it is not disturbed or damaged during construction.

- It is important to note that the impact assessment risk calculations undertaken for the identified heritage sites are based on the current layout of the proposed pipeline and its alternatives. Should the position and layout of any of the footprints change, the impact assessment calculations will have to be modified.

Conclusions

On the condition that the general recommendations are adhered to, and in cognisance of the assumptions and limitations, no heritage reasons can be given for the development not to continue.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;

- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Table 2 – List of abbreviations used in this report

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation

ECO	Environmental Control Officer
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
IAP	Interested and Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

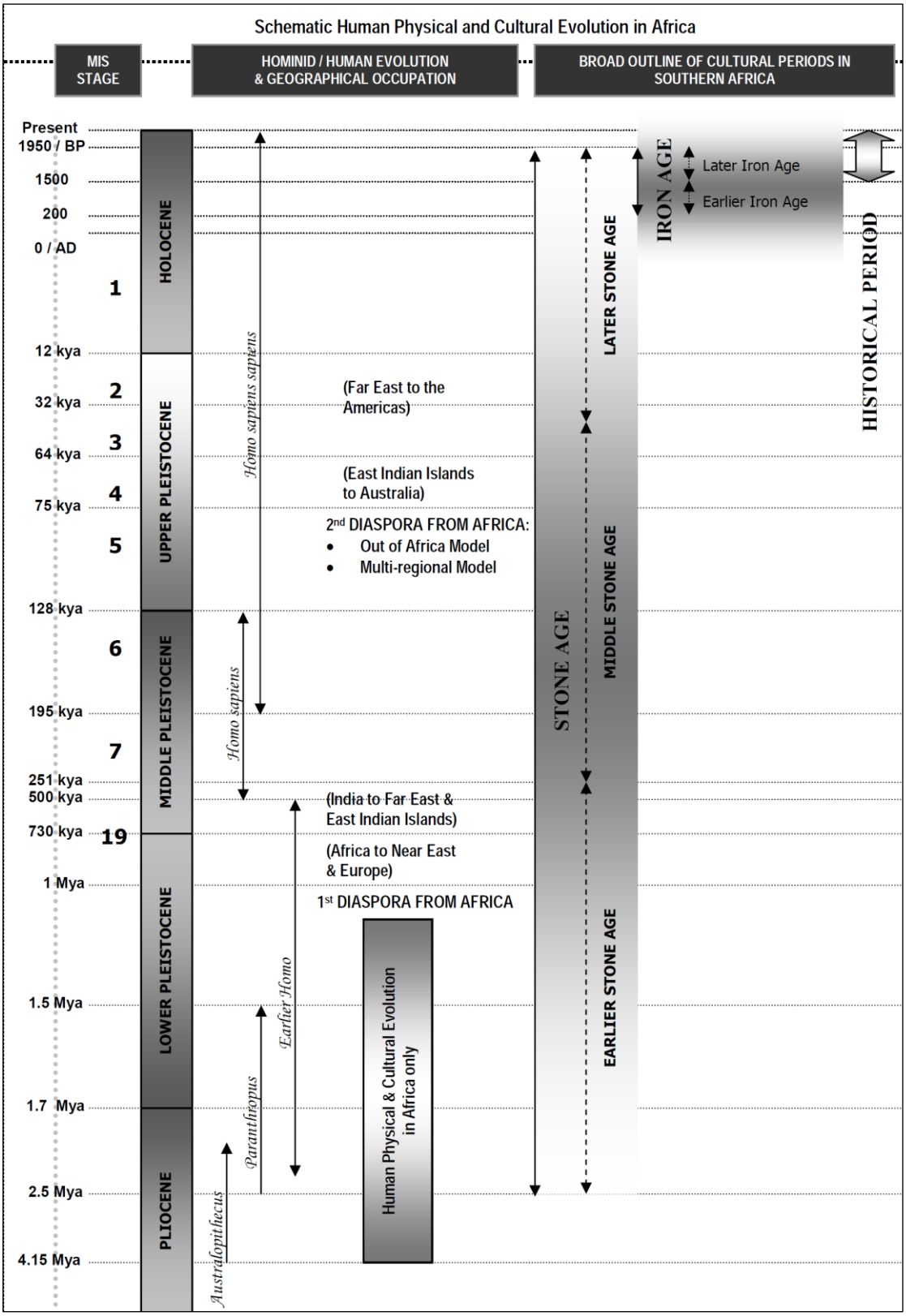


Figure 1 – Human and Cultural Timeline in Africa (Morris, 2008)

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by Nemai Consulting (Pty) Ltd to undertake a Phase 1 Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) for the proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure and Borrow Pits, Limpopo Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed footprint areas. The HIA aims to inform the EIA to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This HIA Report was compiled by PGS Heritage (Pty) Ltd.

The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Mr. Polke Birkholtz, the project manager and principal heritage specialist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is also accredited with the CRM Section of the same association. He has 18 years of experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History and a B.A. (Hons.) in Archaeology (cum laude) from the same institution.

Mrs. Lineree de Jager, an archaeologist from PGS Heritage (Pty) Ltd, assisted with the fieldwork.

Messrs. Derrick James and John Anderson were the archaeological field assistants. Derrick has eight and John 14 years' experience as a field assistant for archaeological fieldwork and mitigation.

1.3 Assumptions and Limitations

The following assumptions and limitations regarding this study and report exist:

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

  Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

- The proposed study area comprises a pipeline footprint that is associated with a number of pipeline development alternatives as well as a significant number of non-pipeline development footprints (i.e. borrow pits, construction camps, borrow pit access roads etc.). As such, the study area assessed for this project is very extensive. Coupled with the extensiveness of the study area footprints, landowner permission had to be arranged by PGS Heritage with every farmer before any of the study area footprints could be accessed in the field. Although of course crucial and necessary, this represented a logistically challengeing task which was also time-consuming. With this as background, and within the budgetary and temporal constraints of the project, no walkthroughs of the entire pipeline route could be undertaken. With the exception of the areas mentioned below, the entire pipeline footprint with its associated pipeline alternatives were assessed by driving along the available roads as well as the railway line servitude. This said, walkthroughs were undertaken of pipeline sections where no road access was available. Furthermore, and excluding those listed below, walkthroughs were undertaken of all the non-pipeline footprints (i.e. borrow pits, construction camps).

- Due to various reasons, not all components were assessed in the field. These reasons include cases where the landowners were not willing to provide permission to any of the project consultants to undertake fieldwork on their land, cases where landowners did not respond to messages requesting access to their properties, cases where landowners were not available on their farms to allow access, development footprints and properties for which no landowner details were provided as well as those areas that were not assessed in the field due to the temporal and budget restrictions.

  The areas not assessed during the fieldwork, comprise the following: Remainder of the farm Mooivallei 342 KQ, Portion 6 of the farm Paarl 124 KQ, Portion 7 of the farm Paarl 124 KQ, Remainder of the farm Paarl 124 KQ, Portion 1 of the farm Leeuwbosch 129 KQ (that section of the property that is rented out by the landowner), Borrow Pit 41,

Remainder of the farm Zyverbult 324 LQ, Portion 4 of the farm Rhenosterpan 361 LQ, Borrow Pit SS1, Borrow Pit 13, Borrow Pit 14, Borrow Pit 41, Borrow Pit 51, New Paul Hugo Weir, Sandrivier Gauging Weir and the Bierspruit Gauging Weir. Furthermore, the newly proposed deviation of Alternative D1 which is termed Alternative D4, was also not assessed. As indicated in the general recommendations (refer **Section 9.1**), all these areas must be assessed in the field by an archaeologist / heritage specialist before construction commences.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA), Act 107 of 1998
- National Heritage Resources Act (NHRA), Act 25 of 1999
- Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

- National Environmental Management Act (NEMA) Act 107 of 1998
    - Basic Assessment (BEA) – Section (23)(2)(d)
    - Scoping Report (SR) – Section (29)(1)(d)
    - Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    - Environmental Management Plan (EMPr) – Section (34)(b)
- National Heritage Resources Act (NHRA) Act 25 of 1999
    - Protection of Heritage Resources – Sections 34 to 36; and
    - Heritage Resources Management – Section 38
- Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    - Section 39(3)

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…” The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA. This study falls under s38(8) and requires comment from the relevant heritage resources authority.

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Locality

Pipeline Coordinates	Northernmost point: S 23.707746 E 27.335162	Easternmost point: S 24.205520 E 27.449919
	Southernmost point: S 24.633336 E 27.316941	Westernmost point: S 24.492391 E 27.247477
Location	The proposed MCWAP-2A pipeline and associated infratrustructure extends from south of Thabazimbi to west of Lephalale, and is located in the Limpopo Province.	
Property	A high number of properties and farms are affected by the proposed development. The list of properties is included in the Environmental Reports.	
Topographic Map	2327CB, 2327CD, 2327DA, 2427AB, 2427AC, 2427AD and 2427CB	
Study Area Extent	The proposed pipeline, with its development alternatives, extend over an area roughly 150km in length. This excludes the extents of the associated non-pipeline footprints such as borrow pits, construction camps, settling dams and and so forth.	

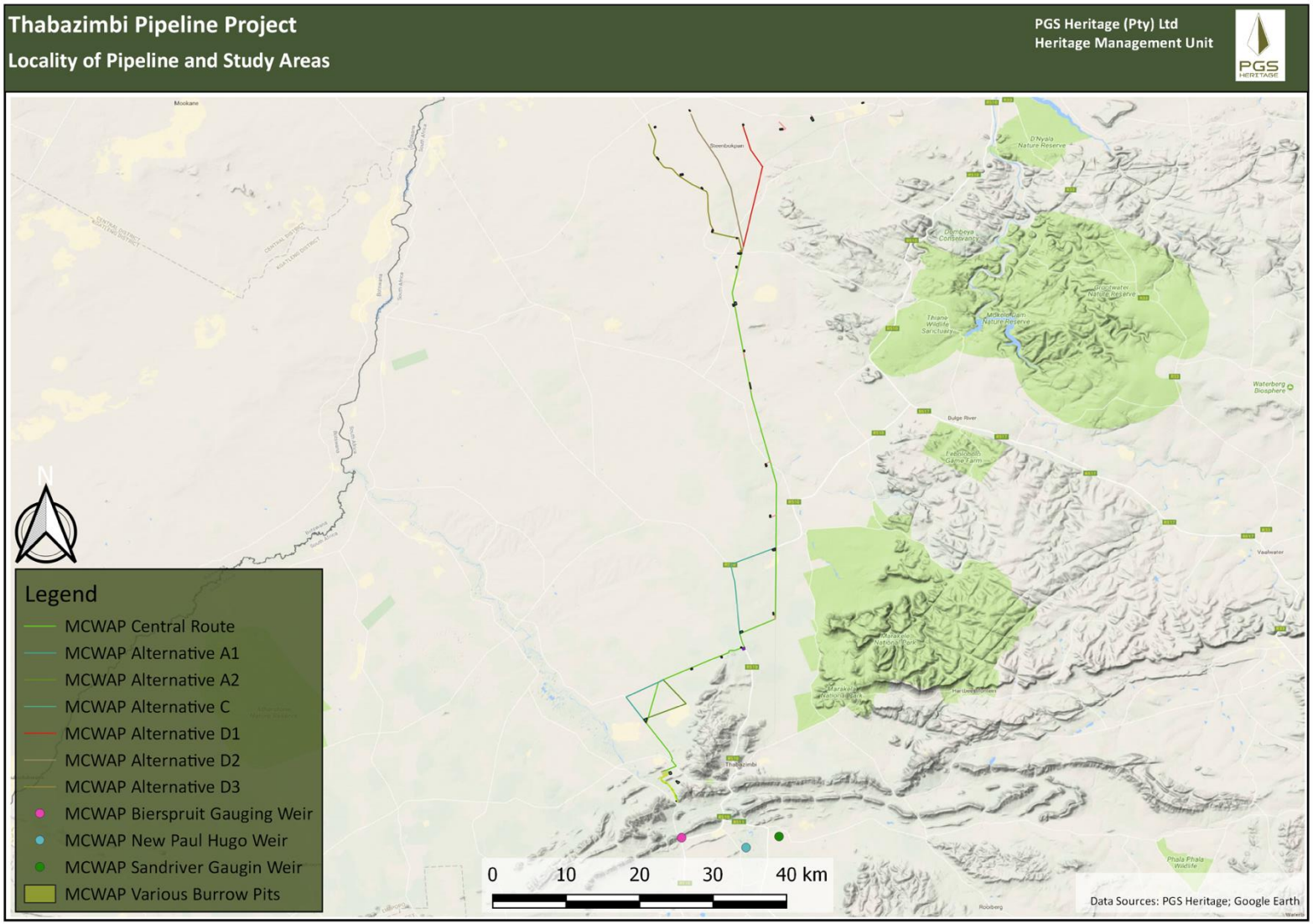


Figure 2 – Locality of study area

2.1 Technical Project Description

This section was obtained from the Environmental Scoping Report compiled by Nemai Consulting (Pty) Ltd as well as the Specialist Briefing Presentation.

Major developments are planned for the Waterberg coalfields that are located in the Lephalale area. As a direct result of the aforementioned developments, the demand for water in the Lephalale area is expected to significantly increase into the future.

Due to the limited availability of water in the Lephalale area, the Department of Water and Sanitation conducted a feasibility study (completed in 2010) of the Mokolo Crocodile River (West) Water Augmentation Project to establish how the future water demands could be met. The phases of the proposed project include the following:

- Mokolo Crocodile River (West) Water Augmentation Project Phase 1: Augment the supply from Mokolo Dam to supply in the growing water use requirement for the interim period until a transfer pipeline from the Crocodile River West can be implemented. The solution must over the long term optimally utilise the full yield from Mokolo Dam and will be operated as a system together with Mokolo Crocodile River (West) Water Augmentation Project Phase 2A. Phase 1 is operational since June 2015.

- Mokolo Crocodile River (West) Water Augmentation Project Phase 2A (MCWAP-2A): Transfer water from the Crocodile River (West) to the Steenbokpan and Lephalale areas, including the implementation of the River Management System in the Crocodile River (West) and its tributaries. Phase 2A is the focus of this Environmental Impact Assessment.

The overall MCWAP-2A consists of the following components:

- Water Transfer Infrastructure (WTI) - transfer of water from Crocodile River (West) to Lephalale;
- Borrow Pits - sourcing of construction material; and
- River Management System - manage abstractions from, and the river flow in, the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Weir, the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West), the stretch of Elands River from Vaalkop Dam to Crocodile confluence, and also the required flow past Vlieëpoort.

The proposed MCWAP-2A WTI component, comprises of the following:

- Vlieëpoort Weir and Abstraction Works

- Balancing Reservoir, Desilting Works, High Lift Pump Station
- Transfer and Delivery Systems
- Break Pressure Reservoir
- Operational Reservoir
- Gauging Weirs
- Roads

Additionally, a total of 23 Borrow Pits are also proposed. The details of these 23 Borrow Pits are provided below.

No.	Name	Borrow Pit Area (ha)	Management Area (ha)**	Volume (m^3)	Average Depth (m)
1	BP SS1	0.3	1.3	8 000	2.7
2	BP25	14.8	17.3	370 000	2.5
3	BP30	7.2	8.9	170 000	2.4
4	BP35	4.3	5.7	65 000	1.5
5	BP28	4.6	6.1	105 000	2.3
6	BP33	7.6	9.4	223 500	2.9
7	BP41	5.3	6.8	180 000	3.4
8	BP38	7.0	8.7	100 000	1.4
9	BP39	4.5	6.0	105 000	2.3
10	BP42	3.3	4.6	150 000	4.5
11	BP44	5.1	6.6	140 000	2.7
12	BP43	4.3	5.7	110 000	2.6
23	BP53	2.3	3.5	60 000	2.6
14	BP52	7.2	8.9	100 000	1.4
15	BP50	4.4	5.8	100 000	2.3
16	BP48	10.7	12.8	100 000	0.9
17	BP49	5.2	6.7	100 000	1.9
18	BP15	3.3	4.6	100 000	3.0
19	BP46	2.5	3.8	100 000	4.0
20	BP59	3.0	4.3	100 000	3.3
21	BP13	7.7	9.5	100 000	1.3
22	BP14	12.6	14.9	100 000	0.8
23	BP51	3.8	5.2	100 000	2.6

A layout map of the proposed MCWAP-2A development as provided by Nemai Consulting (Pty) Ltd is depicted on the next page. Further details regarding the proposed development is available in the Draft EIA Report by Nemai Consulting (Pty) Ltd.

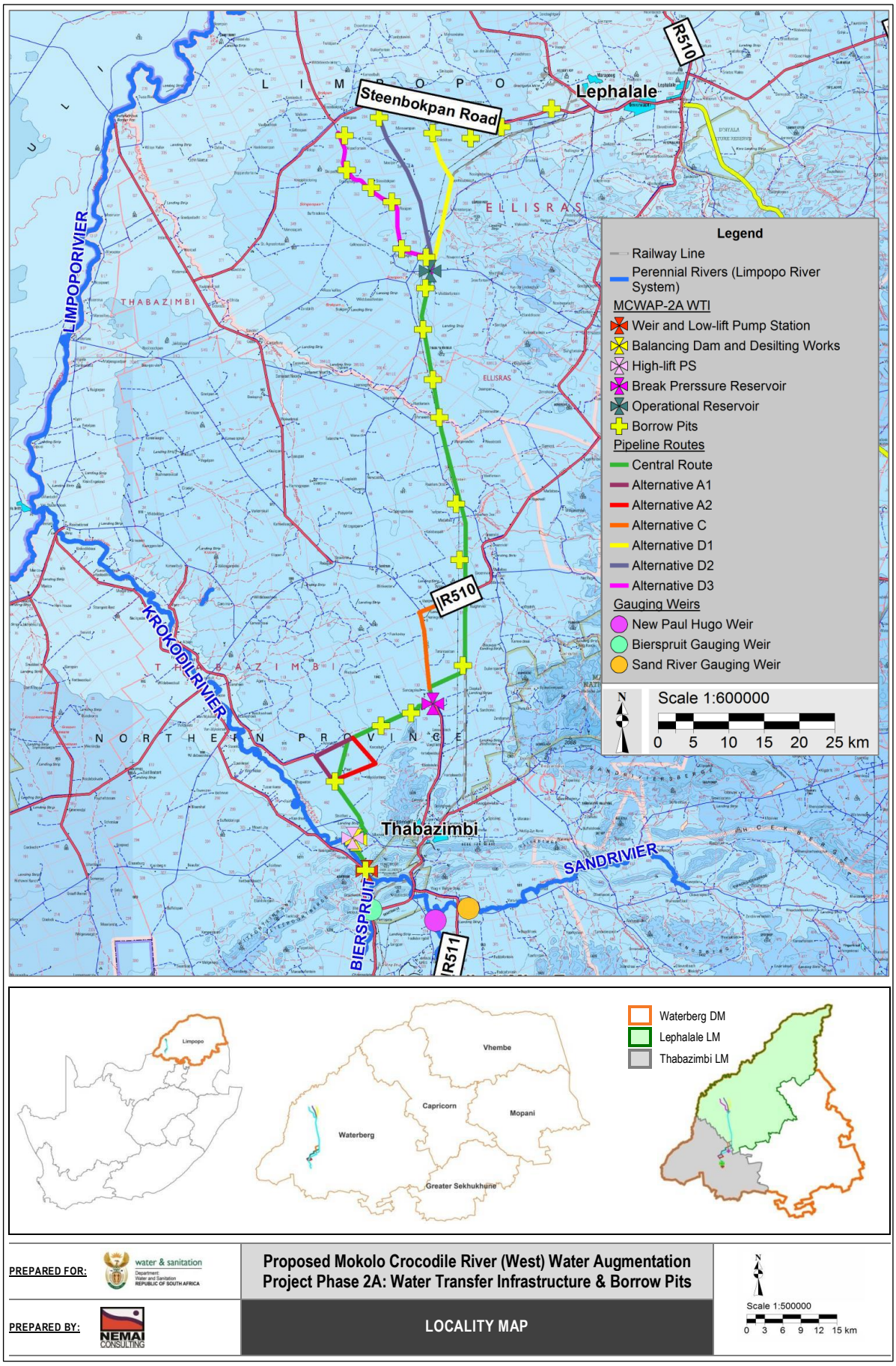


Figure 3 – Proposed MCWAP-2A locality map.

During the review of the Draft EIA Report for the proposed MCWAP-2A: Water Transfer Infrastructure concerns were raised by landowners with regards to the potential impacts of pipeline construction on a pan that is located on the Farm Taaiboschpan. The wetland specialist had considered the impacts on this pan as part of his assessment. However, as further mitigation, a deviation of the pipeline route was identified to avoid the pan by more than 500m. The new route, which is termed Alternative D4 (shown in the map below), was considered by the project team. Alternative D4 will terminate at a different point along the pipeline that was previously authorised as part of MCWAP Phase 1.

Alternative D4 affects the Farm Enkeldraai, and the landowner of this property (Mr. T.J. Sauer) indicated that the pipeline can traverse his farm. He was also notified of the intended route deviation.

Alternative D4 was incorporated into the Final EIA Report as the preferred option for the northern part of the pipeline route alternatives.

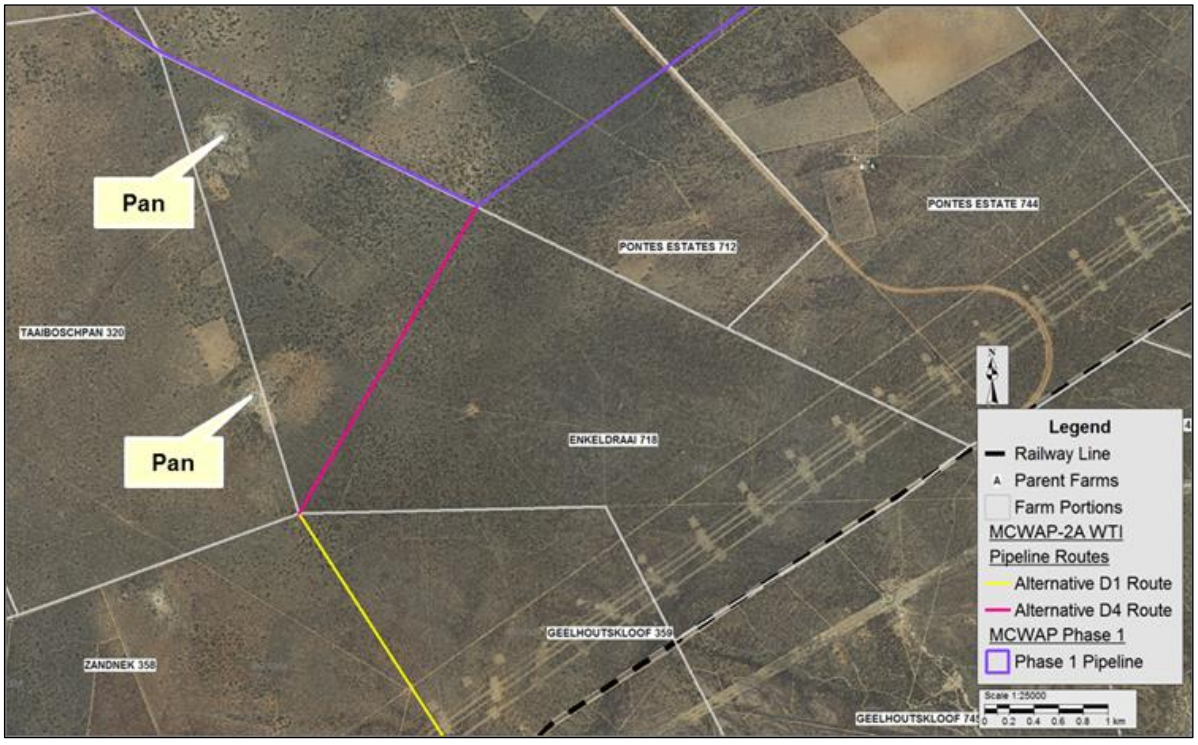


Figure 4 – This image depicts the proposed deviation of Alternative 1 (yellow line). This deviation is termed Alternative 4, and is depicted in red on this image. Figure supplies by Nemai Consulting (Pty) Ltd

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS Heritage for the proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure and Borrow Pits, Limpopo Province. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

Step I – Desktop Study: A detailed archaeological and historical overview of the study area and surroundings was undertaken. This work was augmented by an assessment of reports and data contained on the South African Heritage Resources Information System (SAHRIS). Additionally, an assessment was made of the available historic topographic maps. All these desktop study components were undertaken to support the fieldwork. Lastly, a palaeontological desktop study was also undertaken by Ms. Elize Butler of Banzai Environmental.

Step II – Field Survey: The field assessment of the largest portion of the proposed pipeline routes were undertaken by driving along the adjacent and available roads, including the track running along the railway line servitiude. A concerted effort was made to conduct walkthroughs of those sections of the pipeline footprints not accessible by road. Furthermore, and whenever possible, all potential heritage sites identified during the assessment of the historic maps and SAHRIS were also visited in the field. Additionally, with the exception of a few areas defined in Section 3.1 that were not covered, all the non-pipeline footprints (i.e. borrow pits, construction camps etc.) were assessed by way of intensive walkthroughs.

A fieldwork team comprising an archaeologist (Polke Birkholtz) and two experienced field assistants (Derrick James and John Anderson) conducted fieldwork from Monday, 11 June to Friday, 15 June 2018. A second fieldwork trip was undertaken from Monday, 25 June to Thursday, 28 June 2018. This latter fieldwork trip comprised two fieldwork teams, one of which comprised an archaeologist (Polke Birkholtz) and a fieldwork assistant (Derrick James) and the second team comprising an archaeologist (Lineree de Jager) and a fieldwork assistant (John Anderson).

Step III – Report: The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources regarding the heritage impact assessment criteria and report writing, as well as mapping and recommendations.

The significance of heritage sites was based on five main criteria:

- site integrity (i.e. primary vs. secondary context),

- amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- uniqueness and
- potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 2**).

Table 3 – Site significance classification as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium	Recording before destruction
Generally Protected C (GP.C)	Grade 4D	Low	Destruction

3.2 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria.

A summary of each of the qualitative descriptors, along with the equivalent quantitative rating scale for each of the aforementioned criteria, is given in **Error! Reference source not found.3**.

Table 4 – Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated corridor / proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

Significance Assessment

The significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, 10 structures younger than 60 years might be affected by a proposed development, and if destroyed the impact can be considered as VERY LOW in that the structures are all of Low Heritage Significance. If two of the structures are older than 60 years and of historic significance, and as a result of High Heritage Significance, the impact will be considered to be HIGH to VERY HIGH.

A more detailed description of the impact significance rating scale is given in **Error! Reference source not found.4** below.

Table 5 – Description of the significance rating scale

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale.

The spatial assessment scale is described in more detail in **Error! Reference source not found.5**.

Table 6 – Description of the spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the site.

Temporal/Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal or duration scale is rated according to criteria set out in **Error! Reference source not found.6**.

Table 7 – Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium-term	The environmental impact identified will operate for the duration of life of the project.
4	Long-term	The environmental impact identified will operate beyond the life of operation of the project.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

The probability or likelihood of an impact occurring will be outlined in **Table** *8 – Description of the degree of probability of an impact occurring***7** below.

Table 8 – Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely

RATING	DESCRIPTION
3	Could happen
4	Very likely
5	It's going to happen / has occurred

Degree of Certainty

It is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used, as discussed in **Table 8**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making.

Table 9 – Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Table 10 – Example of rating scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Local	Medium	Could Happen	**Low**

			Term		
Impact on heritage structures	2	3	3	3	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, which is divided by 3 to give a criterion rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The criteria rating of 2.67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 11 – Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for heritage structures above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

4 CURRENT STATUS QUO

4.1 General description of the Study Area

The MCWAP-2A WTI Final Scoping Report of Nemai Consulting (Pty) Ltd provides the following general description of the study area:

"*The project is located within the western part of the Limpopo Province. The footprint of the proposed Water Transfer Infrastructure traverses the Thabazimbi Local Municipality and Lephalale*
Local Municipality, which fall within the Waterberg District Municipality.

The proposed pipeline route commences from the Vlieëpoort Mountains at the weir site in the Crocodile River, in the south-western point of the project area. From there it runs in a predominantly northern direction along existing roads, farm boundaries and a railway line, until it reached its destination near Steenbokpan. Thabazimbi is situated approximately 10 km to the north-east of the Vlieëpoort weir site and Lephalale is situated approximately 30 km to the east of the Alternative D1 pipeline route's terminal point. The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming."

In terms of disturbance, the southern end of the study area, and especially the Mooivallei area, is characterised by ploughed and center pivot agriculture. The central and northern sections of the study area is characterised by primarily game farms. Some small pockets of disused agricultural lands are found near the northern end of the study area.

In terms of topography and surface geology, the southern end of the study area includes both level areas as well as ridges. With the exception of a low ridge near the farm Leeuwbosch, the remainder of the study area is located on a topographically flat landscape characterised by sandy soils.

With the exception of agricultural fields and other more disturbed landscapes, vegetation cover remained dense throughout the fieldwork, which would have restricted visibility in the identification of archaeological and heritage sites.

Figure 5 – General view of a section of the northern end of study area. Sections of the northern end of the study area are characterised by woodland vegetation, with large Marula trees commonly found.

Figure 6 – A number of pans such as the one depicted here are found along especially the northern end of the study area.

Figure 7 – General view of a section of the more central regions of the study area showing sandy soils and low bushes.

Figure 8 – A significant section of the central portion of the proposed pipeline will be constructed along the railway line between Thabazimbi and Lephalale. The development will be kept outside of the railway servitude.

Figure 9 – General view of a section of the southern end of the proposed development. The southern section, and especially those areas located on the farm Mooivallei, are used for ploughed and centre pivot agricultural activities.

Figure 10 – Sections of the study area are characterised by very dense vegetation. This photograph was taken in the south-central section of the study area.

5 DESKTOP STUDY FINDINGS

5.1 Archaeological and Historical overview of the Study Area and Surroundings

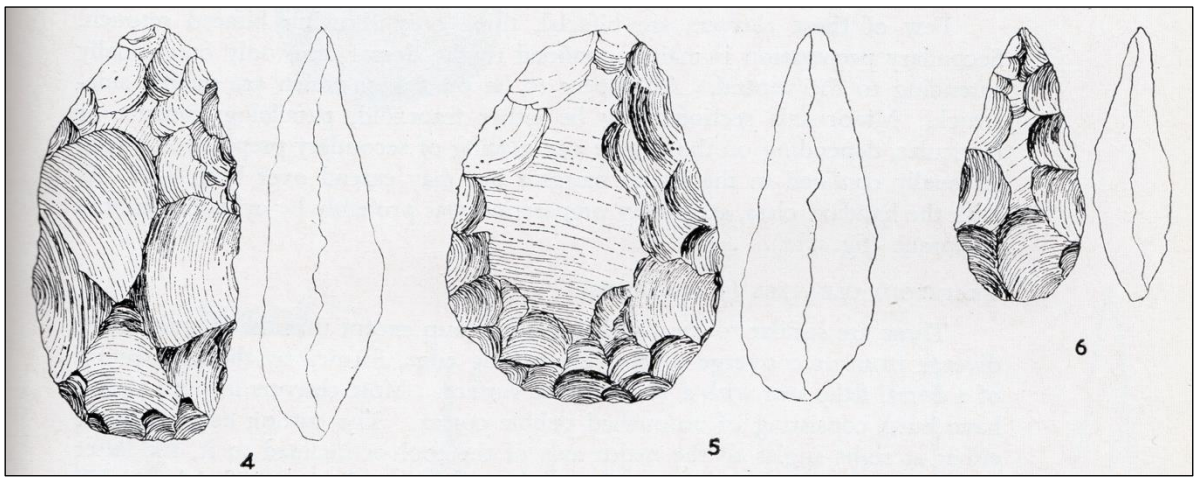
DATE	DESCRIPTION
The Study Area and Surroundings during the Stone Age	
The South African Stone Age is the longest archaeologically-identified phase identified in human history and lasted for millions of years.	
2.5 million to 250 000 years ago	The Earlier Stone Age is the first and oldest phase identified in Southern Africa's archaeological history and comprises two technological phases. The earliest of these phases is known as Oldowan which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago. No Earlier Stone Age sites are known from the study area and its immediate surroundings. This dearth in archaeological sites associated with the Early Stone Age was also observed during an intensive archaeological and heritage survey undertaken within the Marakele National Park by a team that included the author (Birkholtz & Steyn, 2002). At its closest point, this park is located approximately 1km east of the present study area. One of the nearest known researched and published Early Stone Age sites to the present study area, is an open site named Blaaubank. This site is located in a gravel donga near Rooiberg some 38km east by southeast of the present study area. Lithics associated with both the Early and Middle Stone Ages were identified at this site (Wadley et.al., 2016). Earlier Stone Age material was also excavated by Revil Mason in the Olieboomspoort Shelter (Mason, 1969). This highly significant Stone Age site is located approximately 23km east of the closest point along the present study area footprints. Klein (2000) suggests that the Earlier Stone Age habitation of the Olieboompoort Cave possibly commenced between 1 million and 500-400 thousand years ago.
	

Figure 11 – Example of Early Stone Age Later Acheulian handaxes identified at Blaaubank near Rooiberg. Cropped section of an illustration published in Mason (1962:199).	
250 000 to 40 000 years ago	The Middle Stone Age (MSA) dates to between 250 000 to 40 000 years BP. MSA dates of around 250 000 BP originate from sites such as Leopards Kopje in Zambia, while the late Pleistocene (125 000 BP) yields a number of important dated sites associated with modern humans (Deacon & Deacon, 1999). The MSA is characterised by flake and blade industries, the first use of grindstones, wood and bone artefacts, personal ornaments, use of red ochre, circular hearths and a hunting and gathering lifestyle. A number of MSA sites are known from the surroundings of the study area, many of which were identified during previous heritage and archaeological studies. For example, a total of seven MSA sites were identified in an area roughly 5.8km north-west of the northern section of the study area. For the most part these latter sites comprise findspots consisting of one or two lithics (Higgitt et. al., 2013). A similarly low density of lithics were identified around a pan during the present study area as well (see MCWAP Site 18). Further south, and south of the present study area, number of Middle Stone Age occurrences and findspots were identified during the archaeological and heritage survey of the Amandelbult Mining Lease Area in 1994 (Van Schalkwyk et.al., 1994). These occurrences were all identified to the west of the R510 tar road between Rustenburg and Thabazimbi. During the present fieldwork, a low density surface scatter of MSA lithics was identified within the southern components of the study area (refer MCWAP Site 8). MSA artefacts have also been recovered from the Olieboomspoort Shelter (located 23km east of the study area) as well as a number of other rock shelters from the wider surroundings such as New Belgium 608 LR, Schurfpoort 112 KR and Goergap 113 KR (Birkholtz and Steyn, 2002).
40 000 years ago to the historic past	The Later Stone Age Is the third phase identified in South Africa's archaeological history. It is associated with an abundance of very small stone artefacts known as microliths. In Southern Africa, the Later Stone Age is characterised by the appearance of rock art in the form of paintings and engravings. One of the nearest known researched and published Later Stone Age sites to the present study area, is Olieboomspoort, located approximately 23km east of the closest point along the present study area. Various scientists have undertaken archaeological excavations at this site, with the work of Dr. Maria van der Ryst focussing on the last 2 000 years of the site's extensive Holocene occupational sequence. She observes that "*apart from the remarkably large lithic assemblage and many thousands of ostrich eggshell beads and blanks produced at OBP, favourable preservation conditions resulted in the recovery of a wide range of tool types made from organic materials, as well as a representative assemblage of macroscopic plant taxa.*" (Van der Ryst, 2006). Interestingly, research on the Later Stone Age in the Waterberg Plateau suggests a discontinuity between Middle Stone Age and Later Stone Age settlement of several thousand years, with settlement of the area by Later Stone Age hunter gatherers occurring in the 11th and 12th Centuries and coinciding with settlement by Iron Age peoples (Van der Ryst 1998). While the relationship between Stone Age people and Iron Age settlers was initially characterised by peaceful interaction and trade, the

relationship seems to have degraded into one of subjugation of the former, a process that was exacerbated by an influx of increasing numbers of white settlers into the area as well. The farm Vaalpenspan 90 KQ, which adjoins a section of the Pipeline Alternative C, is a reminder of the marginalised remnants of the hunter gatherers, 'Vaalpense' being the name given to people of mixed agropastoralist and hunter gatherer descent (Van der Ryst, 1998) Birkholtz & Steyn, 2002).

One of the nearest and possibly also one of the more significant Later Stone Age rock art sites to the present study area, is in all likelihood Nelson's Kop. Located 4.9km north-east of the closest component of the present study area (namely Borrow Pit 51) and situated 32km east by north-east of Steenbokpan, Nelson's Kop is a rock engraving site comprising animal spoor and incisions (Van Schalkwyk, 2005) (Birkholtz, 2015). The presence of rock engravings, stone walling and Iron Age ceramics at Nelson's Kop indicates that it was associated with both the Stone Age and Iron Age.

Further south, roughly 5.8km south-west of the southern section of the study area (the closest point being the Bierspruit Gauging Weir), a cave containing the remnants of Later Stone Age rock art was identified during an archaeological survey of the farms Buffelsfontein 353 KQ and Tygerskloof 354 KQ (Huffman, 2004). Furthermore, the Waterberg Mountains located east of the study area, is known for its many rock art sites. These include rock art sites containing shaded paintings such as at Haakdoorndraai (Pager, 1973) and the depiction of a fat-tailed sheep at Dwaalhoek 185 KQ (Van der Ryst 1998). These two rock art sites are located some distance east of the present study area.

Figure 12 – Example of the cupules found at Nelson's Kop. Photograph taken by Marko Hutten in

2015. Scale in 1cm and 5cm increments.

The Study Area and Surroundings during the Iron Age

The arrival of early farming communities during the first millenium, heralded in the start of the Iron Age for South Africa. The Iron Age is that period in South Africa's archaeological history associated with pre-colonial farming communities who practiced cultivation and pastoralist farming activites, metal working, cultural customs such as lobola and whose settlement layouts show the tangible representation of the significance of cattle (known as the Central Cattle Pattern) (Huffman, 2007).

The Iron Age of Southern Africa is divided into an Early Iron Age (AD 200 – AD 900), Middle Iron Age (AD 900 – AD 1300) and Late Iron Age (AD 1300 – AD 1840) (Huffman, 2007).

The tangible remains of the Iron Age are frequently identified in the general surroundings of the study area, and these may include potsherds, stonewalled settlements, grinding stones and metal smelting and forging sites.

AD 150 – AD 650	The Bambata facies of the Benfica Sub-Branch of the Kalundu Ceramic Tradition represents the earliest known Iron Age period within the surroundings of the greater area. The decoration on the ceramics from this facies is characterised by "...*fine decoration, multiple bands and cross-hatching on long rim, alternating blocks of stamped and incised lines in neck*." (Huffman, 2007:215). Olieboomspoort, located 23km east of the closest point along the present study area footprints, contains a relatively large collection of Bambata ceramics. Smaller collections of Bambata ware were also identified at other Waterberg sites, such as Goergap and Skeurkrans (Van der Ryst, 2006). These two farms are however located some distance east of the present study area.
AD 500 – AD 750	The Happy Rest facies of the Happy Rest Sub-Branch of the Kalundu Ceramic Tradition represents the second known Iron Age period within the surroundings of the study area, and especially so the northern end of the study area. The decoration on the ceramics from this facies is characterised by "...*thickened rim, multiple bands of mixed decoration techniques, ladder stamping*." (Huffman, 2007:221).
AD 750 – AD 1000	The Diamant facies of the Kalundu Ceramic Tradition represents the third known Iron Age period within the surroundings of the entire study area. The decoration on the ceramics from this facies is characterised by "...*tapered rims with broadly incised herringbone*." (Huffman, 2007:225). During an archaeological assessment of the drainage basin of the Motlhabatsi (Matlabas) River undertaken by Jan Aukema for the purposes of his Master's Thesis from the University of the Witwatersrand, a number of Diamant facies sites were identified near the south-western foot of the Waterberg. One of these sites, Kb1, dates to AD 570 + 50 (Pta-3616) and contains ceramics showing stylistic similarities to both Happy Rest and Klein Afrika (Huffman, 1990). Site KB1 is located approximately 14km east of the closest point along the present study area. The name of this ceramic facies is derived from the farm name on which a number of these sites were first identified, namely Diamant 228 KQ.

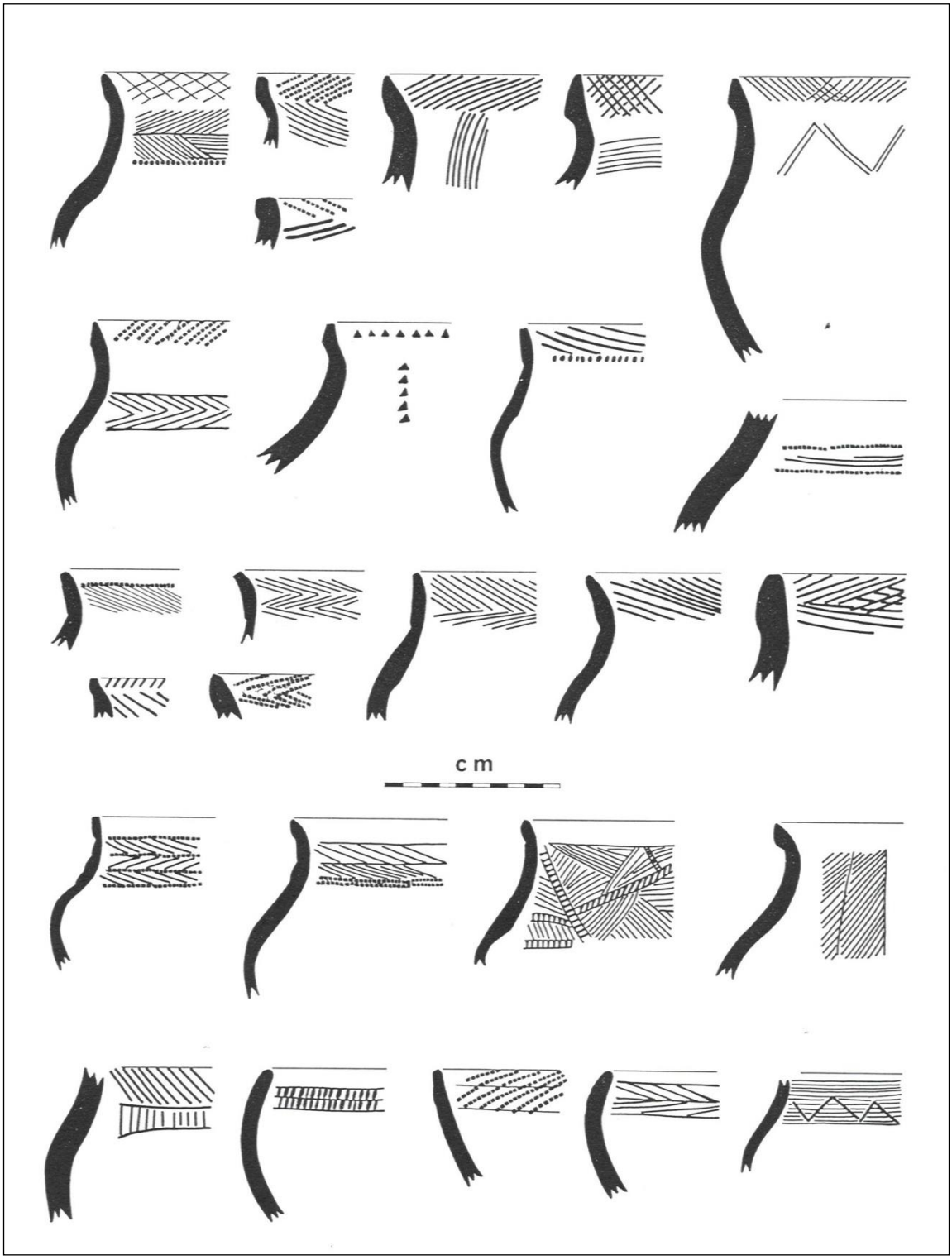


Figure 13 – Example of ceramics associated with the Diamant facies (Huffman, 1989:72).

AD 1000 – AD 1300	The Eiland facies of the Kalundu Ceramic Tradition represents the fourth known Iron Age period within the surroundings of the greater area. The decoration on the ceramics from this facies is characterised by "...*fine herringbone with stamping*." (Huffman, 2007:221). Examples of Eiland traditional sites were found on the farms Kirstenbos (east of the Lephalala River) (Van der Ryst, 1998) and Wentzel (near the

	Limpopo-Motlhabatsi confluence) (Huffman, 1990). This latter Eiland site was identified during a survey of the drainage basin of the Motlhabatsi (Matlabas) River undertaken by Jan Aukema and had been dated to AD 990 ± 50 (Pta-4513). Wentzel is located approximately 25km south-west of the closest point along the present study area. During the same survey, a number of other Eiland sites were located closer to the study area (Huffman, 1990). In his Motlhabatsi research, Jan Aukema discerned three phases belonging to the Early Iron Age (EIA), the first and second phases of which were excavated from Diamant (see previous section). Dates ranging between 1400 to 1200 years ago were associated with these first two phases. The third phase in the Early Iron Age sequence, shows similarities with the Eiland tradition, and is associated with dates of approximately 1000 years ago. Moving away from the Motlhabatsi drainage basin, Aukema identified at least three different settlement phases in the Iron Age sequence of the Waterberg Plateau. This three-phased sequence was based on his research of the Lephalala Drainage Basin. The first of the three phases in the Iron Age sequence of Aukema, is the Eiland tradition. The subsequent two Iron Age phases identified in the Waterberg Plateau by Aukema are both associated with the Late Iron Age. As such, Aukema saw the Eiland tradition as the final expression of the Early Iron Age in the region (Huffman, 1990).
AD 1350 – AD 1750	Ongoing research in KwaZulu-Natal has focused on the second phase of the Blackburn sequence, known as Moor Park. During the fourteenth century, the Moor Park farmers were the first to colonize the higher altitude grasslands of South Africa's interior. In doing so, they opened up possibilities for greater economic specialization and interdependence, not least because of the impossibility of smelting iron where suitable fuel was lacking. The same lack of timber also encouraged the adoption of stone as a building material (Mitchell and Whitelaw, 2005). The Moor Park facies of the Blackburn Branch of the Urewe Tradition is associated with pottery characterised by punctates, rim notching and appliqué (Huffman, 2007). A number of migrations of Nguni speakers from present-day Kwazulu-Natal into the interior of South Africa, the surroundings of present-day Pretoria and also further north-west into the Waterberg, are known to have occurred. These migrations were not single-entity movements of people but rather '…*uncoordinated movements…(of)…several small groups*…" driven into the interior by reasons which included weather conditions. In terms of the study area and surroundings, the Moor Park facies is especially associated with a second such Nguni migration which is associated with the Manala and Ndzundza Ndebele under their leader Musi (Huffman, 2007). The Moor Park facies also represent the second Iron Age settlement phase identified by Jan Aukema in the Waterberg Plateau, and in this area can be associated with settlements on mountaintops, stonewalling and undecorated ceramics (Huffman, 1990). Examples of Moor Park sites in the surroundings of the study area, include Buffelsfontein, approximately 25km east of the present study area.

AD 1500 – AD 1700	The Madikwe facies of the Moloko Branch of the Urewe Ceramic Tradition represents the fifth known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by "...*multiple bands of cord impressions, incisions, stabs and punctates separated by colour*." (Huffman, 2007:201). Within the surroundings of the southern section of the study area, the Madikwe facies is associated with the earliest arrival of Sotho-Tswana people. Further north, the Letsibogo facies also represents an early Sotho-Tswana facies associated with the surroundings of the study area. The third and final phase in the Iron Age sequence of the Waterberg Plateau identified by Jan Aukema is represented by multichrome Moloko ceramics that can be linked to the Sotho-Tswana. This phase can be dated to the later eighteenth to early nineteenth centuries (Van der Ryst, 1998).
AD 1550 – AD 1750	As indicated above, the Letsibogo facies of the Moloko Branch of the Urewe Ceramic Tradition represents a second early Sotho-Tswana facies that is associated with the northern end of the study area and its surroundings. The decoration on the ceramics from this facies is characterised by "...*lines of punctuates separating black and red zones*." (Huffman, 2007:189). As is the case with the Madikwe facies, the Letsibogo facies represents one of three separate facies derived from the co-called Icon facies, the third being Olifantspoort. Letsibogo sites are primarily found in southern Botswana (north of the study area) as well as in the Blouberg (north-east of the study area). The closest known Letsibogo-type sites were identified in an area roughly 20km north and north-east of the study area (Huffman & Van der Walt, 2013).
Ethnographic and Oral Historical Information on the Nguni and Sotho-Tswana Chiefdoms living within the Study Area and Surroundings during the Late Iron Age and the early Historic Period	
Oral histories and ethnographic sources provide information on the groups that occupied (and moved through) the study area and surroundings during the last years of the Late Iron Age and the beginning of the Historic Period. In this section, available information on some of these groups will be provided.	
AD 1600 – AD 1800s	As mentioned before, Aukema's preliminary research findings point towards the identification of three settlement phases. The second phase can be associated with the influx of Northern Ndebele in the region for the period between the sixteenth and seventeenth centuries AD (Van der Ryst, 1998). This movement of Northern Ndebele into the area during these centuries is supported by various sources. Jackson (1983) for example mentions that the predecessors of the Langa Ndebele migrated from the Hlubi territory in present day KwaZulu-Natal somewhere around 1650 AD. According to De Beer (1986), a group of Hlubi migrated from Kwazulu-Natal into the area surrounding Pretoria. Oral history also indicates that their area of influence stretched all the way to the Waterberg, with the Crocodile and Limpopo Rivers as the western and northern borders of their land with the Tswana. De Beer also mentions the migration of other Hlubi groups such as the Langa to areas such as present-day Mokopane, and furthermore states that all these Hlubi migrations must have occurred after 1600 AD. Parsons (1995) mentions the movement of Ndebele from the area where Pretoria is situated today, on to the Waterberg Plateau

	during the period 1600 to 1750. Oral tradition indicates that the Waterberg plateau was ruled by the Kekana and Langa Ndebele chiefdoms at the end of the seventeenth century (Van der Ryst, 1998). The influence of the Langa, particularly, in terms of the present study area can be seen during the period 1830-1840, when a war was being fought with the BaPhalane (see below) who at the time were settled on the western side of the Odi River. As mentioned before, the Nguni migration into the surroundings of the study area can also be associated with the Manala and Ndzundza Ndebele under their leader Musi (Huffman, 2007).
AD 1600 – AD 1800s	It must be noted, however, that these Ndebele migrations into the surroundings of the study area did not represent the only Late Iron Age groups associated with the surroundings of the study area. It is especially the Sotho-Tswana (Kwena and Kgatla groupings) and their origins that are of importance here as well. Around 1500 AD two groupings, or 'chiefdoms' as Legassick (1969:100) calls them, started to diffuse from two core areas. These two groupings came to be known as the Kwena and Kgatla lineages. The first important core area was situated at a place referred to as Rathateng, near the confluence of the Marico and Crocodile Rivers. A number of diffusions and migrations occurred from this Kwena nucleus area (Legassick, 1969; Pistorius, 1995). While one group (Hurutshe) moved northwards towards the Limpopo, another group migrated south across the Vaal. The third group trekked upstream all along the Crocodile River to present-day Brits and the general vicinity. On the map published by Legassick (1969:124) a fourth group referred to as the 'Gananwa', also moved from the Rathateng core area east over the Crocodile River and then north-eastward. The Kgatla lineage is seen as originating at a place called Mabyanamatshwaana, near Brits. From here consequent migrations and diffusions occurred in various directions (Pistorius, 1995). Both Legassick (1969) and Hall (1981) refer to places such as Schilpadfontein (Pretoria district) and Dirolong (Rustenburg district) as possible areas of origin. It must be stressed that, according to Hall (1981), the Iron Age residents of his study area south and south-east of the Marakele National Park, were Kgatla. According to the literature cited by him the Kgatla have been staying in this area even before 1800 AD. It is interesting to note the comment made by Breutz (1989) that the earliest Kgatla chiefs lived to the north of the Tswana, and quite possibly south-east of Thabazimbi near the Rooiberg tin mines. During the Mfecane many of these Kgatla groups were disturbed, but later returned (Hall, 1981). The Kgatla is derived from the Bahurutshe, which in turn is derived of Tswana. Some time in history they moved from Lehurutshe eastward and settled somewhere between the Magaliesberg Mountains and the Waterberg Mountains. Here they split into four groupings, more or less at the same time. These are the Bakgatla-ba-ga-Mosetlha, Bakgatla-ba-ga-Kgafela, Bakgatla-ba-ga-Mmakau and the Bakgatla-ba-ga-Motsha (Van Zyl, 1958). In terms of the present study area, the first two of these groupings will be discussed in more detail below.
AD 1700s – AD 1800s	Van Zyl (1958) traces the history of the Kgatla, and specifically the Bakgatla-ba-ga-Mosetlha history, by reconstructing the succession of

	chiefs as laid down through oral history. In chronological order, they were Mokgatla (who is seen by some as the founder of the Kgatla), Phulane, Mosetlha (the founder of the Bakgatla-ba-ga-Mosetlha), Mushi, Malebe (Mathibe), Sikwane, Nchaupe I (Tlhabane), Makapane (Mmankala), Thipe, Nchaupe II (Solomon Makapan) and Mathibe (Hendrik Makapan). Although the aim of section is not to go into any detail regarding the succession history of the Bakgatla-ba-ga-Mosetlha, it is worthwhile to mention the chiefs as it provides a framework for the history of these people as related in oral tradition. Mosetlha, the founder of the Bakgatla-ba-ga-Mosetlha, for example, had a capital (known as Malebone), which was situated a few kilometers west of where Bela-Bela is situated today. At one stage he fought with the Ndebele of Mokopane. Nothing much is remembered about Mushi's reign, apart from the fact that he lived in more or less the same area as Mosetlha. Malebe moved to Vaalboschbult (Khupong) near the Pienaars River. He had two sons Sikwane and Makanye with his first wife. It was Sikwane who succeeded his father as chief. At the time of Sikwane's death, his son Nchaupe I, was too young to govern and his uncle, Makanye, acted as regent. During this time Mzilikazi's Khumalo-Ndebele came through the area and Makanye moved northwest with his people. Once they crossed the Ngotwane River, dissent and uncertainty as to where they should go occurred. While Makanye and a small following moved further north to Ngamiland (present-day Botswana), Nchaupe I moved back in the direction of where the group used to stay. He kept to the north of the Waterberg Mountains, ending up with the Langa Ndebele, where they stayed for quite some time before moving to their old homes south of the Waterberg Mountains.
AD 1700s – AD 1800s	The history of the Kwena baPhalane starts with the BaKwena living in modern day Botswana. The chief was Pukwe, who had two sons, Motshodi and Letlape. A division and rift occurred between the two brothers, and Letlape and his followers left and crossed the Odi (Crocodile) River. Letlape was succeeded by his son Mokoke, and they lived at the junction of the Thokwe (Sand) River and the Odi (Crocodile) River. This was at the beginning of the eighteenth century (Breutz, 1953). According to Breutz (1989), this settlement was called Tlhapelabjale (on the farms Wachteenbietjiedraai and Klipgat). It is interesting to note that the Transvaal Native Affairs Department (1905) indicates that they settled at Gopane, near the junctions of the Bier Spruit and the Crocodile River. It is interesting to note that other sources suggest that the settlement of the Kwena baPhalane on the western bank of the Crocodile River, may either have been on the farms Buffelshoek 351 KQ or Haakdoorndrift 373 KQ. The Bierspruit Gauging Weir is located on the western boundary of the farm Buffelshoek, with the New Paul Hugo Weir located on the eastern boundary of the farm Haakdoorndrift. During this time Moloke and his followers hunted many impala (phalane), and as a result called themselves the baPhalane. Looking for a suitable place to settle, they moved east of present-day Thabazimbi through Botlhapatshwene (Makips Nek on the farm McKip-zyn-rand). During this stage they attacked the baPule (or baModikele) living at Krantzberg (Modikele). The baPule were integrated into the tribe. The baPhalane

	also fought other groups in the area, such as the baNku, baNareng, ba Mokopane and baLaka (Ndebele) (Breutz, 1953). Between ca. 1790 and 1820 the BaPhalane lived at Mmapela in the baLaka (Ndebele) country. In approximately 1820, during the reign of Mafodi, they moved back to the Thokwe River, on the western side of the Odi River. Between 1830 and 1840, the baPhalane waged a war with the baMmapela (Ndebele) during which many people were killed. Another war was fought during this time with the BaKgatla-ba-ga-Kgafela. The remainder of the baPhalane fled to a hill known as Modise wa Mogopa, which is located some distance to the south.
AD 1700s – AD 1800s	The Bakgatla-ba-ga-Kgafela represents one of the Late Iron Age groups that can be associated with the close to immediate surroundings of the present study area. According to available oral history, the Bakgatla-ba-ga-Kgafela frequently moved around within the general area located between the Waterberg to the north-east and Pilanesberg to the south-west. During the period between the late 1600s and 1869, the Bakgatla-ba-ga-Kgafela had relocated 20 times. This said, the north-eastern Pilanesberg near present-day Moruleng was frequently settled during this period. Two of the Bakgatla-ba-ga-Kgafela settlements were located in closer proximity to the present study area. The first of these was Sefikile hill, on the farm Spitskop 410 KQ, and which is located roughly 30km south-west of the present study area. The oral history tells us that during the end of the eighteenth century Kgosi Pheto, the chief of the Bakgatla-ba-ga-Kgafela, settled at Sefikile hill. They remained here until the death of Pheto in c. 1805 (Hall et.al., 2008). During a heritage survey, Dr. J.C.C. Pistorius identified the occurrence of damaged stone walled sites and a graveyard along the base of Sefikile hill at Sefikile village (Pistorius 2012). It can be assumed that the damaged stone walled sites can be associated with the settlement of the Bakgatla-ba-ga-Kgafela at this hill. The second settlement of the Bakgatla-ba-ga-Kgafela in proximity to the study area occurred during the early 1820s, when Kgosi Pilane moved his people to the farm Schildpadnest 385 KQ. They named their settlement here Mmamodimokwana (Hall et.al., 2008). The farm Schildpadnest is located approximately 12km south of the closest point along the study area footprint, namely the Bierspruit Gauging Weir. It was here, at Schildpadnest, that the Bakgatla-ba-ga-Kgafela were attacked by Mzilikazi's Khumalo Ndebele (Matabele) in c. 1828.
AD 1800s	Breutz (1953) mentions that the baModikele is derived from both the 'Transvaal Ndebele' (Mapela) and Khumalo Ndebele (Matabele). These Matabele deserted Mzilikazi before his invasion of the western parts (before ca. 1828), and settled in the Krantzberg. A section of them joined the BaPhalane under Mokoke, while the rest stayed at Krantzberg (Modikele Hill) and became known as the BaModikele. The BaModikele later settled at Tsopane in the Waterberg District (Breutz, 1953). During his travels through the interior of southern Africa from 1834 to 1836, Dr. Andrew Smith came upon a group of impoverished "Baquans" who mentioned the existence of a group known as "Mooricail" living high up along the "Maclamatsi" River (Kirby, 1940:185). Kirby (1940) is of the opinion that the group is in fact the baModikele, and that the river was the Matlaba (Matlabas). Smith also mentions that the "Bamooricail" were emigrants of the "Bakala"(Kirby, 1940).

The Study Area and Surroundings during the Mfecane	
The Mfecane (Difaqane) is a period of upheaval during the end of the Iron Age and the start of the Historical Period. These years of unrest originated primarily in the migration of three Nguni groups from present day Kwazulu-Natal into the present day Free State as a result of the conquests of the Zulu under King Shaka. The three Nguni groups were the Hlubi of Mpangazitha, the Ngwane of Matiwane and the Khumalo Ndebele (Matabele) of Mzilikazi. There is quite some evidence, in the form of defensive hilltop settlement and aggregation, that the Late Iron Age in the region was a time of upheaval and conflict, initially as a result of the influx of the Ndebele and later by European settlers (Hall, 1985). The Difaqane period in the study area and surroundings saw Mzilikazi first establishing himself along the Magaliesberg Mountains between 1827 and 1832, before relocating to the Marico River valley in 1832. Their settlement and movement during this period unsettled many Sotho and Tswana groups who fled east to seek refuge (Huffman 1990).	
1820s – 1830s	The period between 1821 and the late 1830s in the interior of southern Africa was characterised by the migration of Khumalo-Ndebeles (Matabele) under Mzilikazi through the region. This period, known as the difaqane, is often associated with disturbances and warfare. The Khumalo-Ndebele used to live on the tributaries of the Black Umfolozi, in present day Kwazulu-Natal, before migrating into the central regions of South Africa. Rasmussen (1978) mentions that these Ndebele arrived in the interior during 1821. In c. 1828, the Bakgatla-ba-ga-Kgafela were attacked by by Mzilikazi's Khumalo Ndebele (Matabele) at Schildpadnest, located some 12km south of the present study area. The important period for the present study comprise the years 1832 to 1837, during which the Khumalo-Ndebeles and Mzilikazi settled in the Marico River Valley. Coetzee (n.d.) has it that when Mzilikazi settled near the Marico River, many of the Tswana who used to stay there, fled seeking refuge in the mountains of the Kransberg, located a short distance east of the study area. In fact, as a result of the events of the difaqane, Kransberg became vernacularly known as 'Marakeli', which means 'Place of Refuge'. The Marakele National Park still commemorates this name. Another indication of the impact of the Difaqane on the study area and surroundings, is a cave known as Gatkop (Hall, 1985), which is located approximately 28.5 kilometers south-east of the closest point along the study area. This site was documented by Simon Hall during his research of the Rooiberg Iron Age. Oral history has it that the cave was used as a place of refuge from Matabele. Wooden kraals and pottery was still visible when Hall visited the site (Hall, 1981). Not all historians are convinced that the period of disturbances associated with the movement of the Khumalo-Ndebele through the interior of southern Africa, can be seen as the main element of difaqane, and neither can it be viewed in isolation. Historians and archaeologists such as Margaret Kinsman, Guy Hartley, Simon Hall and Neil Parsons have shown that the period of disturbances associated with the 1830s is not only the result of the migration of Khumalo-Ndebeles, but also of years of disturbances prior to that, as a result of African migrations and conflict, as well as the influx of Europeans (Parsons, 1995).

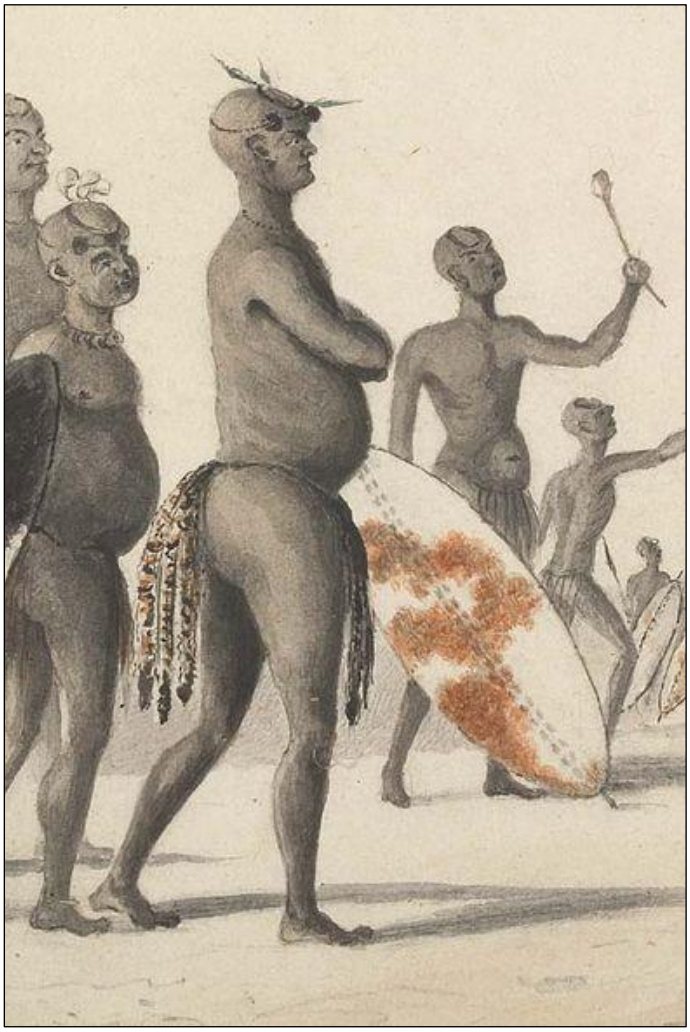


Figure 14

King Mzilikazi of the Matabele. This depiction was made by Captain Cornwallis Harris in c. 1838 (www.sahistory.org.za).

The Study Area and Surroundings during the early Historical Period

The Historical Period within the study area and surroundings commenced with the arrival of newcomers to this area. The first arrivals would almost certainly have been travellers, traders, missionaries, hunters and fortune seekers. However, with time, this initial trickle was replaced by a flood of white immigrants during the 1830s, when a mass migration of roughly 2 540 Afrikaner families (comprising approximately 12 000 individuals) from the frontier zone of the Cape Colony to the interior of Southern Africa took place. The people who took part in this Great Trek were later to be known as Voortrekkers (Visagie, 2011).

1808	In 1808 an expedition under the leadership of Dr. Andrew Cowan and Lieutenant Donovan (both of the 83rd Regiment), accompanied by two soldiers and fifteen Khoi assistants (Becker, 1985), left Cape Town on a perilous overland journey to Delagoa Bay (Le Roux, 1940) (Becker, 1985) (Bergh, 1999). Both Cowan and Donovan were inexperienced in African travel, and quite naive about the potential dangers of such a journey (Le Roux, 1940). Upon reaching Griekwatown (Klaarwater) they were joined by the much more experienced Reverend R. Anderson as well as a guide and interpreter by the name of Kruger (Le Roux, 1940; Changuion & Bergh, 1999). From Griekwatown the expedition travelled over Lataku to the land of the

	Bamangkwetsi, and eastwards across the Notwani and Marico Rivers into the Waterberg. In the Waterberg, both Reverend Anderson and Kruger left the expedition. Whether this was due to their lack of confidence in the leadership of the expedition, or as a result of their fears for the potential dangers which may lie ahead, is uncertain. All that is known is that Anderson brought with him the last letter written by Dr. Cowan, which is dated 24 December 1808, and indicates the position of the expedition at the time of the departure of Anderson and Kruger as 24º 30' South, and 28º East (Le Roux, 1940) (Bergh, 1999). From the Waterberg, the expedition moved northwards towards the Limpopo River, never to be heard of again (Le Roux, 1940). What exactly happened to the expedition remains a mystery. Although some evidence indicates that both Cowan and Donovan died of fever somewhere near the banks of the Limpopo River (Le Roux, 1940), others suggest that they were killed by one of the black groups residing in the area (Becker, 1985). However, it is accepted that the expedition came to an end near Lotsane. In fact, some fifty years later a number of items that could be linked to the expedition (i.e. regimental buttons, pocket knives etc.) were found in this area (Le Roux, 1940) (Changuion & Bergh, 1999).
1825 & 1830	David Hume was a Scottish trader who undertook a number of journeys into the interior of southern Africa. On two of these journeys (1825 and 1830) he passed close to the surroundings of the present study area. The journey of 1825 took him northwards to Shoshong and eastwards into the Waterberg. From the Waterberg he travelled southwards through the area where Pretoria is situated today, ending back at Kuruman (Changuion & Bergh, 1999). Hume's journey of 1830 took him along the Limpopo to its confluence with the Ngotwane (Notwani) River, and upstream along the Mahalapye. After travelling further north to Moutloutse (Macloutsie), he returned along the Limpopo to its confluence with the Ngotwane River, from where he travelled back to Kuruman over the Waterberg and Magaliesberg Mountains (Le Roux, 1940) (Bergh, 1999).
1836	The first Voortrekker parties started crossing over the Vaal River (Bergh, 1999). In the same year, Captain William Cornwallis Harris undertook a journey into the interior of Southern Africa. His route took him through the Magaliesberg Mountains and northwards all along the Crocodile River, up to its confluence with the Marico, from where the party journeyed northeastwards to eventually turn back near present-day Lephalale (Harris, 1987) (Bergh, 1999).
Late 1830s - 1870s	These years saw the first arrival of Voortrekkers and general establishment of farms in the general region (Bergh, 1999). However, the establishment of farms by the Voortrekkers in the direct vicinity of the study area appears to have been isolated and sporadic during these early years with some settlement only taking place during the 1870s. According to Pont (1965), some of the earliest Europeans in the Waterberg district included a certain Daniël Janse van Rensburg, who established himself in this area in 1837. Between 1839 and 1840, White farmers from Potchefstroom arrived and settled in the Waterberg. In the ensuing years many others joined them

	(Changuion & Bergh, 1999). These first pioneers did not immediately commence farming activities, and provided for themselves primarily through hunting. The hunting of elephants and hippo was especially favoured (Pont, 1965). The fact that the surroundings of the study area used to be a preferred historical hunting ground for the Voortrekkers and their descendants is confirmed by Coetzee (n.d.) who mentions that S.J.P. Kruger, who later became President of the South African Republic, used to hunt in the vicinity of Thabazimbi as well as further north. At first, most of the early farms were established near the Waterberg Mountains and the rivers. Although farming activities eventually developed in the area, diseases such as tsetse and malaria also hindered these developments, and it took some time before farming was undertaken in earnest (Pont, 1965). The first farming activities undertaken in the area centred around cattle farming, and it was only later that agriculture was also practised (Naudé, 1998). An interesting activity from this time is the exploitation of salt located at various saltpans in the region. Oral historical evidence suggest that President Kruger asked poor Whites to settle in the vicinity of these pans, and to exploit the salt. The activity of salt exploitation led to the establishment of localised bartering systems (Naudé, 1998).

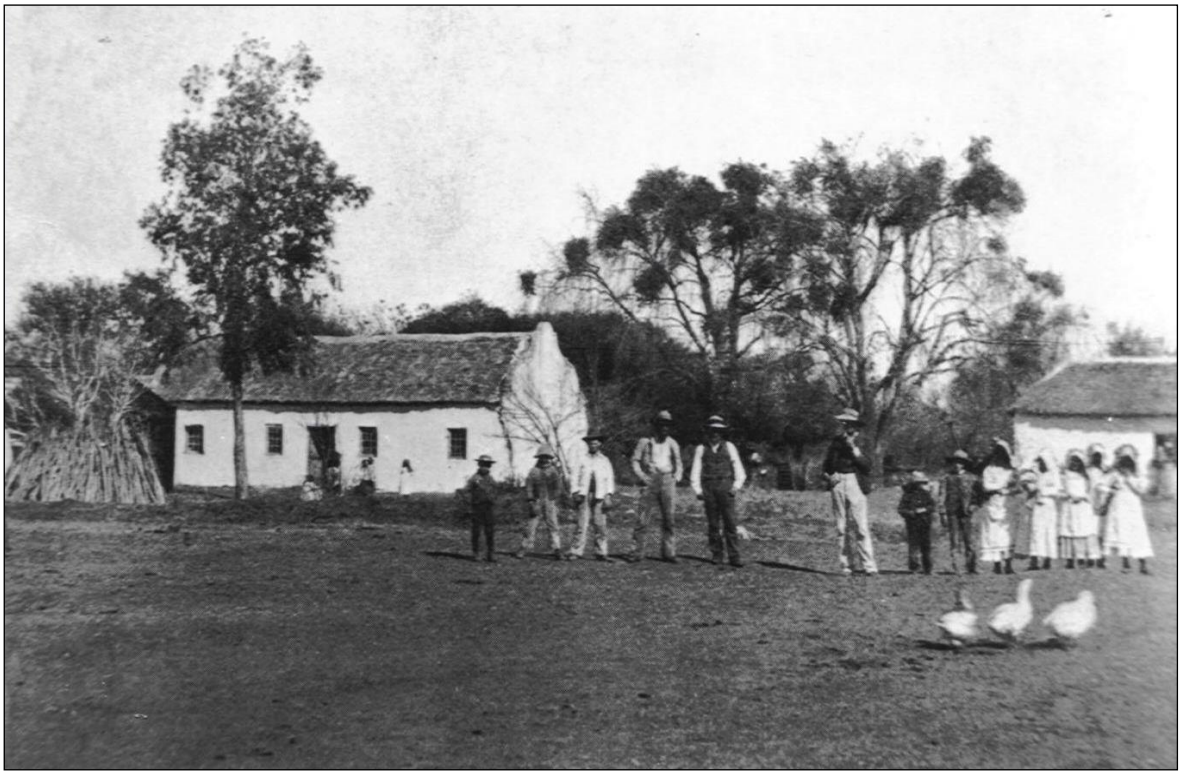


Figure 15 – A typical farmstead in the Waterberg during the late nineteenth century.

1848	The area that was later to be known as the district of Soutpansberg was established in this year (Bergh, 1999). The northern section of the study area fell within this district.
1850s	The region where the northern section of the pipeline route is to be built, fell within the Waterberg District of the Zuid-Afrikaansche Republiek (Bergh, 1999). This section of the study area remained within this district until c. 1990 when the Ellisras District was established. During the 1850s

	the adult European population for the Waterberg district as a whole consisted of about 150 individuals. By 1873 approximately 575 Europeans lived in the district. The southern end of the study area fell within the Rustenburg District. Both the district and town of Rustenburg was established in 1851. It would remain within this district until 1977, when it was allocated within the newly established district of Thabazimbi (Bergh, 1999).
1869	Carl Gottlieb Mauch was a German geologist who travelled extensively through the interior of South Africa as well as further north in present-day Zimbabwe. In 1865 he set foot on the continent at Durban, from where he commenced with his various travels (Le Roux, 1940). The important period of Mauch's life in terms of the present study, is the journey undertaken by him in 1869. In the translated version of his journals edited by Burke (1969), it becomes clear that Mauch visited the areas that form part of the surroundings of the present study area. For instance, in an entry dated Thursday, 9 December 1869, Mauch wrote the following: "*…I suddenly found myself at the foot of the Marikele Point, which forms a mighty mountain mass with its three peaks…"* (Burke, 1969:33) and makes reference to some abandoned settlements he encountered a few kilometres from "*Marikele Point*": "*On a rocky path I arrive at some old and abandoned kraals, that is, stone walls erected in a circle within which the huts had been built."* (Burke, 1969:33). Mauch later became the first European to document the Zimbabwe Ruins (Le Roux, 1940).
 *Figure 16* *Carl Gottlieb Mauch, who was one of the early European visitors to the surroundings of the study area (Burke, 1969).*	
1874 – October 1899	During the reign of Nchaupe I, in 1874, his heir, Makapane, and a number of his followers moved to Mabotse on the farm Waterval, which was located approximately 25 miles north west of Rooiberg. The missionary Reichelmann moved with them. This move occurred largely due to fear for the Boers as well as a lack of water (Van Warmelo, 1944) (Van Zyl, 1958). According to the Transvaal Native Affairs Department (1905), Makapane came in conflict with the Boers, and as a result the BaKgatla fortified

	themselves in the Ratlohane Mountains (Kransberg) on the Matlaba (Matlabas?) River. It was apparently here that Makapane died. The Kransberg is where Marakele National Park is currently located, a short distance east of the closest point along the study area footprints. A year after the death of Makapane, his followers left this area and settled at Ntshwahatsane on the farm Klippoortje (Van Warmelo, 1944) (Van Zyl, 1958). At the time of Makapane's death, his son Makhotshane, was still too young to govern, and as a result his brother Mathibe ruled as regent. During Mathibe's reign he moved the people to the Rietspruit in the Waterberg. When Makhotshane (Van Zyl (1958) refers to him as Thipe) became old enough to rule (ca. 1885), Mathibe and his following left and settled at Matlalastad in the Waterberg (Transvaal Native Affairs Department, 1905). Van Zyl (1958) mentions that Mathibe and his following settled on the farm Noodshulp, directly south-west of Bela-Bela. According to the Transvaal Native Affairs Department (1905), Makhotshane was forced to move with his following from Rietspruit to Makapanstad, Pretoria District. In October 1899, Makhotshane's brother, Solomon Makapane succeeded him after Makhotshane's wife, Ntebeng, acted as regent (Van Zyl, 1958).
The Study Area and Surroundings during the South African War	
On 11 October 1899 war broke out between Britain and the two Boer republics of the Orange Free State and Transvaal (*Zuid-Afrikaansche Republiek*). Although the present study area and surroundings were never part of the main theatre of war, enough actions and events occurred here to warrant discussion in more detail.	
11 October 1899 – 5 June 1900	During the first part of the war, the Waterberg Commando was placed under the command of General F.A. Grobler. At first, the main objective of the commando was to attack Fort Tuli north of the Limpopo River. However, it was decided from higher up that Grobler should send 500 of his men to Colesberg near the Orange River, while the rest of the commando should be divided into three camps situated at Soutpan, the lower-Lephalala river as well as at a spot between the Matlabas (Motlhabatsi) and Mokolo Rivers. It is clear that the three camps occupied by the Waterberg Commando during the early part of the war, were located in the surroundings of the study area. The reason for the placement of these defensive camps in these far north-western sections of the Transvaal Republic, was partly to provide protection against British attacks from the north-west and north, but primarily was intended as defence against attacks by the BaKgatla-ba-ga-Kgafela. The South African War of 1899 to 1902 was definitely not only a white man's war, even though for many decades historians have refrained from paying attention to the reality that the war had a significant influence on, and was partaken in, by Coloureds, Indians and Africans (Nasson, 1999). In recent years historians have started to investigate and study the role of persons of colour in the conflict, and the influence the conflict had on them. In terms of the study area, it is especially the role of the BaKgatla, which is worth mentioning. At the end of the nineteenth century, the BaKgatla-ba-ga-Kgafela under Linchwe I, were divided into two components. While one section lived under British administration in the Bechuanaland Protectorate, the second component lived within the borders of the South African Republic

	at Saulspoort (Pilanesberg). When hostilities broke out, Linchwe I was placed in a difficult situation and found it hard to decide between the two sides. In the end he chose the British side, and this participation reached a climax at the Battle of Derdepoort on 25 November 1899, when Kgatla forces attacked the Boer laager located there. Subsequently, Kgatla regiments were sent into the South African Republic and they attacked Boer forces, as well as raided the tribes believed to be assisting the Boers (such as the Fokeng, Phalane and Kwena) (Morton, 1985).
5 June 1900 – September 1900	After the fall of Pretoria on 5 June 1900, many of the burghers in the Waterberg and Soutpansberg commando's drifted back home. On 22 August 1900, approximately 10 000 British troops occupied Warmbad (present-day Bela-Bela). They were hindered by between 3 000 to 4 000 Transvaal and Free State burghers, but still managed to occupy the town.
September 1900 – May 1902	In September 1900 command of the Boer forces north of Pretoria was removed from Grobler and handed to General Christiaan Frederick Beyers. A power struggle evolved between General Grobler, Assistant-General De Beer and the newly appointed General Beyers. This period, until the end of the war, was characterised by a change in military strategy applied by the Boer forces. Rather than attempting to face an ever increasing British military force in formal set battles, the Boer Commanders decided to exploit the mobility of the Boer commando's on horse-back by using hit-and-run tactics that became known as the guerrilla phase of the war. A British force consisting of some 1 300 mounted men and 9 artillery pieces under the command of Lieutenant-Colonel Plumer left Pretoria on 26 March 1901. The objective of the force was to attack the areas north of Pretoria. The 1st of April 1901 saw Plumer in Nylstroom (present-day Modimolle), and by 5 April he was in Potgietersrus (present-day Mokopane). The most important set battle during this time in the Waterberg, occurred at Sandrivierspoort and Tambotierand, which commenced on 20 June 1901. These battlefields were located approximately 66km east of the present study area. In the diary of one Lieutenant E.I.D. Gordon, of the 12th Mounted Infantry, a map is shown which gives an indication of some of the activities during the Boer War in the Waterberg. On this map he indicates a spot, which appears to be on the Mamba River as a place where a Boer laager was captured. Odendaal (n.d.) mentions that women and children were placed in camps or laagers by Beyers, and that one such a camp, located on the Mamba (Mahoppa) River, was captured by the British. A burgher by the name of Ernst Krogh, who was killed during this attack, was also buried here (Odendaal, n.d.). This incident is supported by Lee (1973), who also mentions that the laager could have been located on the Matlabas River. Another interesting fact is that the British force consisted primarily of Black soldiers (Lee, 1973). As part of the so-called 'scorched earth' policy initiated by Lord Kitchener, many Boer farmhouses were destroyed. This would certainly also have been true for the surroundings of the study area as well. Another aspect characteristic of the 'scorched earth' policy was the system of concentration camps (also referred to as refugee camps) in which Boer as well as Black women and children were held. The closest of any of these camps to the southern section of the study area, was the one at Modimolle and which was in existence from May 1901 to March 1902. This camp, which was established by the British authorities and used for the keeping of Boer women and children, resulted in the death of 525

	persons, 429 of whom were under the age of 15 years (www.angloboerwar.com). In terms of the participation of the Bakgatla-ba-ga-Kgafela in the war, by 1901 the Kgatla regiments attacked Boer farms, and forces, as far as Pretoria and Thabazimbi to the north. By the end of the war, the Kgatla forces were effectively in control of the land reaching from Rustenburg in the south, to the present-day border between South African and Botswana in the north (Morton, 1985). This indicates that during the last years of the war, the study area and surroundings were primarily controlled by the Bakgatla. This ascertion is supported by Odendaal (n.d.), who mentions that one of Linchwe's regiments reached as far as Vaalpenskraal (possibly Vaalpenspan?) on the Matlabas River. The farm Vaalpenskraal is located on the Crocodile River some 29km from the closest point of the study area, whereas the farm Vaalpenspan is located in proximity to the Matlabas River immediately adjavent to a section of the present study area. Many of the Boer farmhouses were burnt down during these attacks, and the raiding of cattle and sheep often occurred.
May 1902	The Anglo-Boer War came to an end with the signing of the Peace Treaty of Vereeniging in May 1902.
After 1902	That the war caused a lot of suffering and bitterness is quite evident and the treatment of the National Scouts by the Boer communities from the Waterberg region serves as an example of this. The National Scouts were burghers who joined forces with the British (Odendaal, n.d.). These National Scouts were hated by those who had fought to the bitter end, and it is mentioned that in certain churches from the region some of the bitter enders did not want to attend Holy Communion with erstwhile National Scouts (Pont, 1965). This feeling of discontent felt towards those who had fought on the British side, is captured by the following section taken from the Nederduitsch Hervormde Gemeente Waterberg register: "*…aan de leden der Gemeente die zich gedurende de laaste oorlog aan de zijde van de vijand hebben geschaard, kennis te geven voor de Kerkraad te komen ten einde zich te verantwoorden…*" (Pont, 1965:77). Another interesting aspect relating to the history of the South African War in these parts, is the so-called Gamlanders or Gamjanners. The Gamlanders were burghers who had decided not to further participate in the war. These boers laid down their arms to Chief Khama of the Bechuanaland Protectorate and also settled there for the remainder of the war (Odendaal, n.d.).
The Study Area and Surroundings during the Twentieth Century	
The general surroundings of the study area underwent significant changes and development during the twentieth century, including the further establishment of farms and agricultural development as well as extensive development in the form of iron ore mining, railway and transportation development as well as the establishment of nearby towns such as Lephalale and Thabazimbi.	
1902 - 1920	This section was partially compiled during the compilation of a Cultural Resource Management Plan for the Marakele National Park, of which the author of this report was co-author (Birkholtz & Steyn, 2002). While it primarily refers to farms located within this national park, this section provides an understanding of the settlement of farms from the surroundings of the study area during the early twentieth century.

In terms of the farms located on or near the central sections of the study area, Coetzee (n.d.) mentions that Europeans settled on the farms Groothoek, Kareehoek and Matlabas from 1907. It is however interesting to note the comment made by Naudé (1998) that a homestead was built on the farm Kareehoek as early as 1890. These different dates may be explained if one considers the work of Morton (1985) who mentions that during, and at the end of, the South African War (1899-1902) many of the Boer families evacuated their homes and farms. In many instances it was only after the conclusion of the First World War (1914-1918) that these farms were settled by White farmers again. Morton (1985:188) talks of '*the second Boer colonization*' in these regions.

This said, it becomes apparent that many of the farms located in and directly adjacent to the study area were only settled after the end of the South African War. Coetzee (n.d.), for example, mentions that a Mr. Dreyer and Mr. Zagrys Grobler settled at Kareehoek after the end of the war. Although they moved away for a while, they returned to Kareehoek around 1908 -1909. Another new resident on Kareehoek, in 1912, was Grobler's son. During this time all these farms were bought from the government.

The land situated on the mountains where the Marakele National Park is currently located was very cheap, largely due to the fact that it could not be productively used for cattle farming. In 1930, the farm Aapiesrivierpoort could be bought for R1 per acre, while the land on the farms Matlabas Zyn Kloof and Boschfontein was for sale for 25 c per acre (Coetzee, n.d.). In 1922 the farm Diamant was sold for a 1000 pounds by the Dutch Reformed Church (Pont, 1965).

During the late 1920s Mr. Hendrik Pelzer settled on the farm Duikerspan. Although Blaauwpan did not have any occupants, the farms Geelhoutbos, Kareehoek, Matlabas and Kransberg were all settled by this time (Coetzee, n.d.). Research undertaken at the Deeds Office has shown that the first title deed for the farm Geelhoutbosch 269 KQ is registered in the name of Willem Schalk Jacobus van Heerden in 1913.

A number of small schools for the farmer's children were established in the region, namely at Groenvlei, Geelhoutbos, Kareehoek and Matlabas. The only established school by 1914 was situated at Kareehoek, and the first teacher here was from the Netherlands (Coetzee, n.d.).

During the early years, the closest church was situated in Nylstroom (present-day Modimolle). Pont (1965) has it that the Dutch Reformed Church of Waterberg, based in Nylstroom, later held church meetings in the wards. One of these places was Dwarsrivier in the Matlabas area.

According to Mr. Tom Dreyer (pers.com.) the situation improved when Mr. Michael Erasmus donated a large piece of land at Groenrivier to the Reformed Church, which was established here in 1917. The farmers from the vicinity travelled with ox-wagons to this area, and the church activities already commenced on the Friday, lasting the whole weekend. This is supported by Mr. Faan Erasmus (pers. com.) who mentions that the people travelled from far away in their ox-wagons and camped at the church stand at Groenrivier, located on the Matlabas River. During dry periods the river was completely dry, and although the people still attended the church they left the oxen harnessed to the wagons for the

	entire church service. In terms of the farms mentioned in this section, the present study area footprint passes through the farms Matlabas, Blaauwpan and Groenvlei. The nearest of the other farms mentioned in this section is Duikerspan, which is located approximately 940m east of the closest point along the present study area footprints. The farms Kareehoek and Geelhoutbosch are located approximately 4.5km south-east and 4.8km east of the closest points along the study area footprints. The farm Aapiesrivierspoort is located 9.7km to the south-east, with the farm Matlabas Zyn Kloof located adjacent to Aapiesrivierspoort and at a similar distance from the present study area. Diamant is located approximately 9.9km east of the study area whereas the farm Groothoek is located 15.6km south-east of the closests points along the study area footprints.
1919	Although iron had been mined and processed from the surroundings of the study area during the Iron Age, the first white person to pay any attention to the iron ore in proximity to present-day Thabazimbi, was a prospector by the name of J.H. Williams. While on a hunting trip in 1919, he pitched his tent at the spot where the Crocodile River runs out of the gorge known as Vlieëpoort. While hunting around this area, Williams soon realised that the mountains here were rich in iron ore. As a result, he obtained discoverer's rights to extensive sections of these iron ore deposits (Coetzee, n.d.). The proposed pipeline development starts near the Vlieëpoort, where Williams made these discoveries.
1920s	Coal was first discovered in the vicinity of Lephalale during drilling activities for water (Erasmus, 2004).
1924	In this year the famous geologist Hans Merensky was shown a sample of platinum ore that a Mr. Andries Lombard had found near Lydenburg. Merensky managed to trace a platinum reef all along the outer edge of the Bushveld Complex from Lydenburg to Rustenburg. This reef was to be known as Merensky Reef (Carruthers, 2007). The discovery of the Bushveld Complex was of extensive economic significance for South Africa. As indicated by Wikipedia, the Bushveld Igneous Complex, "…*contains the world's largest reserves of platinum-group-metals (PGMs) – platinum, palladium, osmium, iridium, rhodium, and ruthenium – along with vast quantities of iron, tin, chromium, titanium and vanadium*." The complex was traced along two zones or belts, known as the Western and Eastern Belt. The Western Belt is of significance for the present study. The relevant government survey reports of the time indicated that the Western Belt, "…*extends for about 100 miles as follows: from Brits towards Rustenburg and then northwards, skirting the Pilanesberg on its western side and continuing almost as far as the Crocodile River*." See for example The Official Year Book of the Union (1938:862).

Figure 17

Dr. Hans Merensky, the geologist who discovered the platinum reef at Lydenburg and Rustenburg (Machens, 2009).

1925-1929	The platinum discovery made by Hans Merensky led to a platinum boom in the South Africa. This saw the floating of more than 50 mining companies in the Rustenburg and Lydenburg districts. Some of the smaller concerns closed down reasonably quickly (Wagner, 1973). Similarly, the identification of the Bushveld Complex meant that the surroundings of the study area were increasingly prospected and mined. One of the most significant mining companies from this area was Potgietersrust Platinums Limited. Registered on 27 August 1925, the company was established with capital to the value of £1, 962,500 in 7.85 million shares valued at 5 shillings each. The company was originally established to work the platinum deposits near Mokopane, but between 1926 and 1929 also acquired the Rustenburg properties of the Premier Rustenburg Platinum Limited, Steelpoort Platinum Syndicate Limited and Eerstegeluk Platinum Mines Limited. The closest property of Potgietersrust Platinums Limited to the present study area, was the farm Schilpadnest 385 KQ (South African Mining Yearbook, 1942) (Wagner, 1973), located 12km south of the closest point along the study area footprints, namely the Bierspruit Gauging Weir.
Early 1930s	In 1930 Iscor decided to mine the iron ore discovered by Williams just over a decade before. Iscor obtained the discoverer rights from Dunswart Iron and Steelworks Limited, which acquired the discoverer rights from a Mr. Delfos, who in turn bought them from the discoverer, J.H. Williams (Coetzee, n.d.). C.J.N. Jourdan of the Department of Mines was delegated to join Iscor and manage the commencement of the first iron ore mining activities in this area. Accompanied by a Messrs. Sheller and Sacht, who were respectively appointed as mine manager and mine secretary, Jourdan arrived at the proposed mine on 30 November 1930 (Coetzee, n.d.). Prospecting activities commenced in March 1931. Initially, the mine workers established themselves in tents on the northern slope of the

	mountain. However, the tents were eventually replaced by shacks and with time houses were also built on this same end of the mountain. It was here, on the same northern slope of the mountain, that the present-day town of Thabazimbi was eventually formally established (Coetzee, n.d.).

Figure 18 – Two early photographs of Thabazimbi. The top image depicts the five first houses built here, whereas the bottom image depicts the town's old northern entrance (Coetzee, n.d.:44).

1934	The railway line from Northam to Thabazimbi was completed on 26 February 1934 (Bergh, 1999) (www.wikipedia.org). This would have accelerated mining exploration and development in the study area and surroundings.
1941 - 1952	Exploration activities during this time revealed vast reserves of medium grade coal in the vicinity of where Ellisras (present-day Lephalale) would later be established (Lang, 1995).
4 May 1953	Although mining houses had been built from the early 1930s onwards at the northern foot of the mountain, the town of Thabazimbi was only officially proclaimed on 4 May 1953. The town's name is derived from the isiZulu word for 'iron mountain' (Erasmus, 2004).
December 1960	The town of Ellisras was laid out on the farm Waterkloof. The name of the town was derived from the two owners of the farm at the time, namely Patrick Ellis and Piet Erasmus (Erasmus, 2004).

1960 - 1980	During this period the railway line which had reached Thabazimbi in 1934, was extended northwards from Thabazimbi to Ellisras (present-day Lephalale). Significant sections of the proposed pipeline runs along this Thabazimbi-Lephalale railway line.
1973	Iscor commenced with extensive exploration work near the northern end of the study area which located "...*exploitable measures estimated at around two billion tons, of which 500 million was classified as blend coking coal*." (Lang, 1995:184).
1980	The Grootegeluk Mine commenced production during this year (Mining Mirror, 2007). The residential areas of Onverwacht and Marapong for white and black staff members respectively appear to have been established at roughly the same time (The Finweek, 1980). These areas are located north-east of the northern end of the study area.
1986	The town of Ellisras (present-day Lephalale) received municipal status in this year (Erasmus, 2004).
Late 1980s	During the mid-1980s, the 2 Transvaal Scottish Regiment was deployed on the border with Botswana and had its battalion headquarters at Ellisras. The deployment took place during the Border War and counter-insurgency efforts of the South African Army at the time. It represented the first deployment of a South African Citizen Force on the borders with Botswana and Zimbabwe during this war (Mitchell, 1994).
2002	The name of the town of Ellisras was changed to Lephalale (Erasmus, 2004).

5.2 Previous Heritage Impact Assessment Reports from the Study Area and Surroundings

An assessment of the South African Heritage Resources Information System (SAHRIS) of SAHRA was undertaken to establish whether any previous archaeological and heritage impact assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints.

This assessment has revealed that a number of previous reports had study areas which either incorporated sections of the present study area, or adjoined it. However, as part of these previous studies, no archaeological or heritage sites were identified within the present study area. The closest of any of these previously identified sites to the present study area, is a cemetery containing four graves that was identified during a survey of the proposed Matimba B Power Station (Van Schalkwyk, 2005).

All these previous studies located on the SAHRIS system, will be briefly discussed in chronological order below. In each case, the results of each study is shown in bold.

- KUSEL, U. 2003. Cultural Heritage Resources Scoping Report Proposed housing Development for Regorogile (Rosseauspoort 319 KQ Sec 5). *African Heritage Consultants CC*. **No indication of archaeological or historical sites or material was found on the proposed development area in this HIA.**

- VAN SCHALKWYK, J. 2005. Heritage Impact Scoping Report for the Proposed New Matimba B Power Station, Lephalale District, Limpopo Province. *An unpublished report for Bohlweki Environmental.* **Four heritage sites were identified. These include: a cemetery containing four graves (two of which date to the 1930s), a single grave dated to 1958, a small scatter of undiagnostic Iron Age ceramics and finally, Nelsonskop, where cupules, incisions, stone walling and ceramics were identified. It is important to note that the coordinates for the cemetery containing four graves is located approximately 65m north-west of proposed Borrow Pit 13-14, and 55m south-west of the access road to this borrow pit. The coordinates for this site are as follows: S 23.711420 E 27.497340.**

- KUSEL, U. 2007. Cultural Heritage Resources Impact Assessment Of Hanover 341 KQ In The Thabazimbi Area Limpopo Province. *African Heritage Consultants CC*. **No indication of any important cultural heritage resources or graves could be found on the proposed development area in this HIA.**

- PISTORIUS, J. 2007. A Phase 1 Heritage Impact Assessment Study for a Proposed New 132kV Power Line Running from the New Matlabas Substation to the Proposed New Bulge Substation in the Limpopo Province of South Africa. *Unpublished Report for Landscape Dynamics.* **No heritage resources of significance were found in this HIA**.

- NEL, J. 2011. Addendum to Phase 1 Archaeological Impact Assessment for the Boikarabelo Coal Mine (Proposed Railway Link From the Farm Kruishout To The Farm Buffelsjagt) Lephalale Local Municipality, Waterberg District, Limpopo Province. *Digby Wells Environmental.* **Eleven cultural resources were identified and recorded, including: five burial sites, three MSA lithic concentrations, two isolated potsherds and one dilapidated homestead.**

- HIGGETT, N. 2012. Ledjadja Coal (PTY) LTD - Phase 1 Archaeological Impact Assessment For MBET Pipeline. *Digby Wells Environmental.* **Four archaeological resources were identified. These include one Stone Age find spot and three historical structures: a cement foundation, a mud brick house and pre-1960's farmstead.**

- HUTTEN, M. 2012. Heritage Impact Assessment for the Proposed Development of Kambaku Private School on the Farm Vlakplaaats 137 KQ, approximately 15km North of Thabazimbi, Limpopo Province. *Hutten Heritage Consultants*. **No heritage resources were identified by the HIA.**

- VAN SCHALKWYK, J. 2012. Heritage Impact Assessment for the Proposed Mixed Use Development and Solar Park On Portion 1 of the Farm Steenbokpan 295lQ and the Remainder of Farm Vangpan 294lQ in the Lephalale Region, Limpopo Province. *An unpublished report for Interdesign Landscape Architects.* **Three features of cultural heritage significance were identified. These include: a single European grave dated 1923, an informal burial place with three marked graves and a small memorial dedicated to a person who died in an aeroplane crash in 1995.**

- COETZEE, F. 2014. Cultural Heritage Assessment for the Proposed Mara Trails Camp, on the Farm Jagtersrus 418 KQ, in the Marakele Park (Pty) Ltd, Section of the Marakele National Park, Limpopo Province. *Department of Anthropology & Archaeology, University of South Africa.* **No heritage resources sites were identified in the HIA**.

- HUTTEN, M. 2015. Heritage Impact Assessment for the Proposed Extended Delta Solar Park west of Lephalale, Limpopo Province. *Hutten Heritage Consultants.* **No heritage resource sites or finds of any value or significance were identified in the indicated study area**.

- GAIGHER, S. 2016. Heritage Impact Assessment (HIA) Report for the Proposed Re-alignment of the Railway Line at the proposed 37 open pit, Amandelbult Mine, Limpopo Province. *G&A Heritage*. **No sites of heritage significance were identified on site**.

- KRUGER, N. 2017. Archaeological Impact Assessment (AIA) for the Improvement of National Route R510 Section 2 from Km 6.3 at Bierspruit Bridge to Km 33.4 near Thabazimbi, Thabazimbi Local Municipality, Waterberg District Municipality, Limpopo

Province. *Exigo Sustainability.* **Two heritage sites were identified: one site with three historical houses and one cemetery.**

- COETZEE, F. 2018. Cultural Heritage Impact Assessment: Phase 1 Investigation for Proposed Development of New Access Roads and Upgrades to Marataba Tails Lodge and Marataba Safari Lodge within the Marataba Section of the Marakele National Park, Lephalale Local Municipality, Waterberg District Municipality, Limpopo Province. **A total of three sites were recorded: one being foundations of an erstwhile Reformed Church, one Iron Age site and one historical structure.**

- SUTTON, M. 2018. Heritage Impact Assessment for the Proposed Medupi Power Station Flue Gas Desulphurisation Retrofit Project and associated infrastructure, Lephalale, Limpopo Province, South Africa. *NGT Holdings (PTY) LTD*. **Three heritage sites were identified: One site consists of two old brick structures on the farm Kromdraai and the other two sites are possible grave sites.**

- KRUGER, N. 2018. Archaeological Impact Assessment (AIA) of Demarcated Areas on Portions of Rooipan 357lQ and Zandfontein 382lQ for the Proposed Transnet Waterberg Rail Corridor Expansion Project (Diepspruit Loop) in the Waterberg District Municipality, Limpopo Province. *Exigo Sustainability.* **No sites or features of heritage potential were located in the project area.**

- KRUGER, N. 2018. Archaeological Impact Assessment (AIA) Of Demarcated Areas on a Portion of Blaauwpan 133KQ for the Proposed Transnet Waterberg Rail Corridor Expansion Project (Marakele Loop) in the Waterberg District Municipality, Limpopo Province. *Exigo Sustainability.* **No sites or features of heritage potential were located in the project area.**

5.3 Archival and Historical Maps

An assessment of available archival and historical maps was undertaken as a way to identify potential heritage sites located within the study area and its immediate surroundings. The First and Second Editions of the following topographical map sheets were assessed for this study:

- First Edition of the 2427CB Topgoraphical Map Sheet that was surveyed in 1963
- Second Edition of the 2427CB Topgoraphical Map Sheet that was surveyed in 1980
- First Edition of the 2427AD Topgoraphical Map Sheet that was surveyed in 1963
- Second Edition of the 2427AD Topgoraphical Map Sheet that was surveyed in 1980
- First Edition of the 2427AB Topgoraphical Map Sheet that was surveyed in 1963
- Second Edition of the 2427AB Topgoraphical Map Sheet that was surveyed in 1984
- First Edition of the 2327CD Topgoraphical Map Sheet that was surveyed in 1969

- Second Edition of the 2327CD Topgoraphical Map Sheet that was surveyed in 1980
- First Edition of the 2327CB Topgoraphical Map Sheet that was surveyed in 1969
- Second Edition of the 2327CB Topgoraphical Map Sheet that was surveyed in 1980
- First Edition of the 2327DA Topgoraphical Map Sheet that was surveyed in 1969

A total of 12 possible heritage sites were identified on these maps within the study area and its immediate surroundings. These possible heritage sites (referred to as Map Sites below) were visited in the field, and whenever a heritage site could be confirmed at any of these localities, it was recorded and included in the fieldwork results.

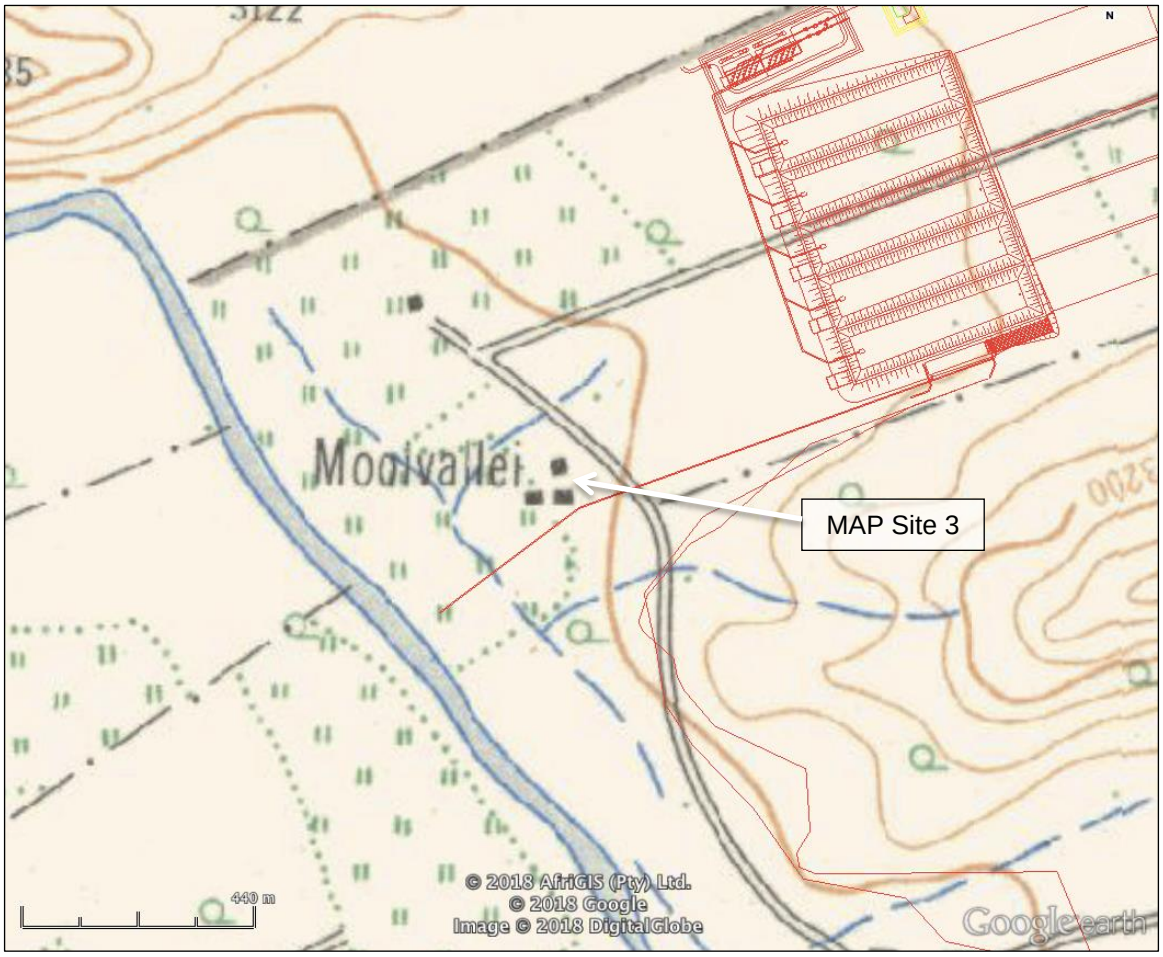


Figure 19 – An example of one of the identified Map Sites, namely the farmstead on the farm Mooivallei that was identified as Map Site 3. During the fieldwork, this farmstead was recorded and included in the fieldwork results section as MCWAP Site 5. The historic map sheet section depicted here is the First Edition of the 2427CB Topographical Sheet that was surveyed in 1963. The study area footprints are shown in red.

The table below provides details on the possible heritage sites identified on these maps as well as the corresponding results from the field assessment of these possible site localities. The coordinates for each of the identified Map Sites are also shown in the table.

Table 12 – The possible heritage sites identified on the historic topographic maps

Possible Sites	Coordinates	Description	Fieldwork Results
Map Site 1	S 24.626858 E 27.313477	Four huts are depicted on the First Edition map sheet.	No heritage sites could be identified within the study area.
Map Site 2	S 24.615508 E 27.308845	One building is depicted on the First Edition map sheet.	No old buildings could be identified within the study area.
Map Site 3	S 24.600419 E 27.293282	The farmstead at Mooivallei is depicted here and comprises three buildings on the First Edition map.	The farmstead is still located here and was included in this report as MCWAP Site 5.
Map Site 4	S 24.476914 E 27.282550	The farmstead at Paarl is depicted here and comprises two buildings and three huts on the First Edition map.	This section of the study area could not be visited during the fieldwork.
Map Site 5	S 24.386956 E 27.398150	The farmstead at Tarentaalpan is located here and comprises two buildings on the First Edition map.	The farmstead is still located here and was included in this report as MCWAP Site 6.
Map Site 6	S 23.810742 E 27.354243	A hut is depicted here on the First Edition map. A medium-sized pan is also depicted a short distance to the east.	No heritage sites could be identified within the study area.
Map Site 7	S 23.747990 E 27.412792	A pan is depicted here on the First Edition map.	No heritage sites could be identified within the study area.
Map Site 8	S 24.613285 E 27.307900	The map site depicted here is located a short distance north-west of Map Site 2, and forms part of the same site. On the Second Edition map the site is depicted as comprising a number of buildings located on both sides of the road.	No old buildings could be identified within the study area.
Map Site 9	S 24.593664 E 27.295717	A cluster of buildings is depicted here on the Second Edition map.	No heritage sites could be identified within the study area.
Map Site 10	S 24.322247 E 27.390787	A building forming part of the Honingvley farmstead is depicted here on the Second Edition map.	No heritage sites could be identified within the study area.
Map Site 11	S 23.778196	A hut is depicted here on the First Edition map.	The poorly preserved remains of a homestead was identified here and the

	E 27.298467		site was included in this report as MCWAP Site 12.
Map Site 12	S 23.779634 E 27.301050	A hut is depicted here on the Second Edition map.	No heritage sites could be identified within the study area.

5.4 Previous Archaeological Research from the Surroundings of the Study Area

A number of previous archaeological research projects have been undertaken in the wider surroundings of the study area. These include the work by Professor Revil Mason on the Smithfield Assemblage at Olieboomspoort Cave (Van der Ryst, 1998), Simon Hall's research on the Iron Age sequence of the Rooiberg area for his masters degree from the University of the Witwatersrand (Hall, 1981), the archaeological research on the Later Stone Age of the Waterberg Plateau by Maria van der Ryst for her masters degree from the University of the Witwatersrand (Van der Ryst, 1998) as well as Maria van der Ryst's work on the last 2 000 years Later Stone Age occupation of Olieboomspoort for her PhD from the University of the Witwatersrand (Van der Ryst, 2007).

The study areas for these research projects, however, were located some distance away from the present study area. For example, Simon Hall's area of study was located approximately 50km south-east of the closest point along the present study area, with the archaeological site at Olieboomspoort, the focus of the research of Mason and Van der Ryst, located 23km east of the closest point along the study area.

In all likelihood, the nearest archaeological research project to the present study area was the archaeological assessment of the Motlhabatsi (Matlabas) drainage basin that Jan Aukema did for his masters degree from the University of the Witwatersrand. A substantial number of sites, which can be associated with the first and second phases of the Early Iron Age, were revealed from the Motlhabatsi basin. Diamant, one of the earliest Iron Age sites that could be located (see Kb1), provided a radiocarbon date of A.D. 570 ± 50 (Pta-3616). In addition, Aukema found that ceramics from this early phase could be compared with the ceramics from Happy Rest and Klein Afrika. The second phase from Diamant was dated to A.D. 700 ± 45 (Pta-5216) and A.D. 710 ± 50 (Pta-3620), with ceramics which could be compared with Hall's so-called Rooiberg Unit 1.
Aukema also identified an Early Iron Age Phase 3 (Eiland) site on the farm Wentzel (WI 2), near the Limpopo-Motlhabatsi confluence, which was dated to A.D. 990 ± 50 (Pta-4513). Most of the Eiland sites located during the survey were found in the higher-lying river valleys in poorer sourveld.

Aukema believed that the settlement of people from the Eiland Tradition in the higher lying areas was human-induced rather than for purposes of defence or security. Furthermore, pastoralism

took place at a significant scale resulting in overgrazing which later caused the influx of pioneer bush species, followed by tsetse fly from adjacent endemic areas. Tsetse fly are restricted by altitude, and as a result the higher lying river valleys would be free of tsetse flies.

Several Moloko sites were also located within the Motlhabatsi basin (i.e. Sn1, Cb1, Ea1 and Mn1), which indicated that the agropastoralists moved back into the lower-lying areas during the Later Iron Age. One of these Moloko sites, located at Leamington (Ln1), provided a date of A.D. 1650 ± 40 (Pta-4473).

According to the data from Aukema's research, which correspond with the above-mentioned date, a number of stone-walled sites (i.e. Kb3, Kb4, Br1-3, Kh1-3) were occupied on the hill tops of the Waterberg. Aukema excavated one of these sites at Malore Hill in the Lapalala Wilderness (A.D. 1700 ± 50 (Pta-5129)), and closer to the present study, site Kb8 on the farm Buffelsfontein, which yielded the date A.D. 1550 ± 70 (Pta-3612).

Characteristically of these and other similar sites, they were located in defensive positions and often had an extra defensive "perimeter" wall along the cliff edge. The walling from these sites were often with upright monolithic-like stones, and formed "…*complex arrangements of lanes, arcs and oval enclosures*." (Huffman, 1990:117). At the Buffelsfontein site, Aukema also found beehive-shaped huts which were placed to the back of the residential areas. The ceramics found at these sites were also not Moloko but rather consisted of undecorated globular pots. It is postulated that the hut type and location to the back of the residential area, as well as the undecorated ceramics seem to indicate an association with Nguni speakers. It was further postulated that as the available oral history seemed to indicate that the Waterberg fell under the control of the Kekana and Langa Ndebele, these Nguni-related stone-walled sites "…*were probably built by the ancestors of the present day Northern Transvaal Ndebele living in the Potgietersrus/Pietersburg are*a." (Huffman, 1990:117).

The information derived from Aukema's research also suggest that the Ndebele and Sotho-Tswana both inhabited the same area contemporarily, which may be the reason why the Sotho-Tswana settlements from this era is represented by a very defensive layout on hill tops.

The research also yielded nineteenth century Moloko sites, such as the site located on a saddle of Malore Hill, which has been dated to A.D. 1830 ± 45 (Pta-5139) and as postulated by Huffman (1990) correlates with the oral historical evidence that substantial numbers of people sought refuge in the mountains of the Waterberg during the difaqane (Huffman, 1990)

The proposed Central Pipeline Route passes through a section of the Matlabas drainage basin that represented the area of study for Jan Aukema's archaeological research. As the exact coordinates and site localities for the numerous archaeological sites identified by Aukema are not presently available, it is very difficult to accurately establish the distances between the closest of

Aukema's archaeological sites and present study area. From the site distribution map published by Huffman (1990:118), it would appear that the following sites are located closest to the present study area: Wn1 on the farm Welgevonden, Ho1 on the farm Haarlem Oost and Gr1 on the farm Groenrivier.

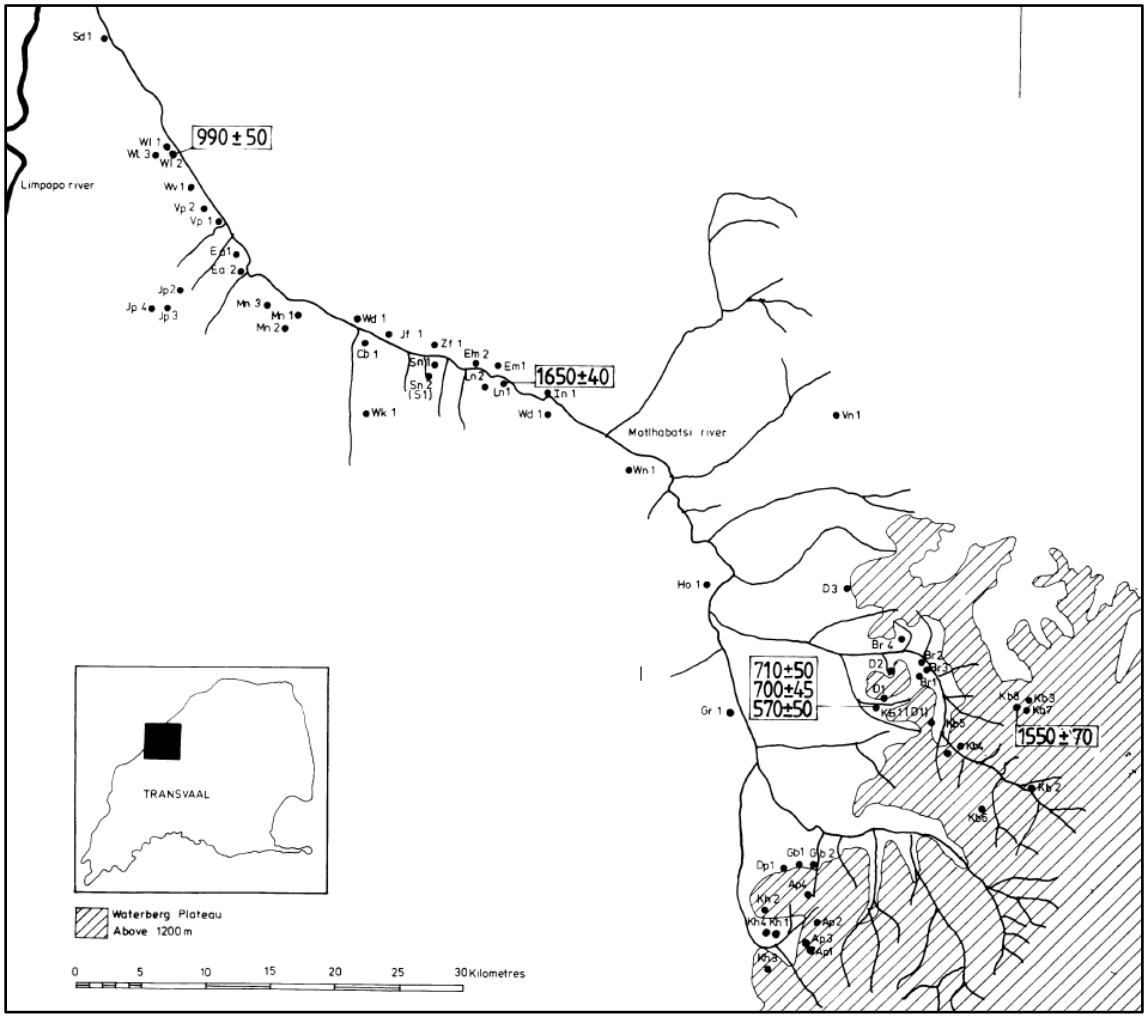


Figure 20 – Section of the map that depicts the distribution of archaeological sites identified by Jan Aukema along the drainage basin of the Motlhabatsi (Matlabas) River (Huffman, 1990:118).

6 FIELDWORK FINDINGS

6.1 Introduction

The field assessment of the largest portion of the proposed pipeline routes were undertaken by driving along the adjacent and available roads, including the track running along the railway line servitiude. With the exception of a few areas defined in Section 3.1 that were not covered, all the non-pipeline footprints (i.e. borrow pits, construction camps etc.) were assessed by way of intensive walkthroughs.

A fieldwork team comprising an archaeologist (Polke Birkholtz) and two experienced field assistants (Derrick James and John Anderson) conducted fieldwork from Monday, 11 June to Friday, 15 June 2018. A second fieldwork trip was undertaken from Monday, 25 June to Thursday, 28 June 2018. This latter fieldwork trip comprised two fieldwork teams, one of which comprised an archaeologist (Polke Birkholtz) and a fieldwork assistant (Derrick James) and the second team comprising an archaeologist (Lineree de Jager) and a fieldwork assistant (John Anderson). The track logs (in orange) for the survey are indicated in the subsequent six pages (refer Figures 18 to 25).

The fieldwork resulted in the identification of a total of eighteen (18) heritage sites. Maps depicting the distribution of these identified heritage sites are shown in Figures 26 to 29.

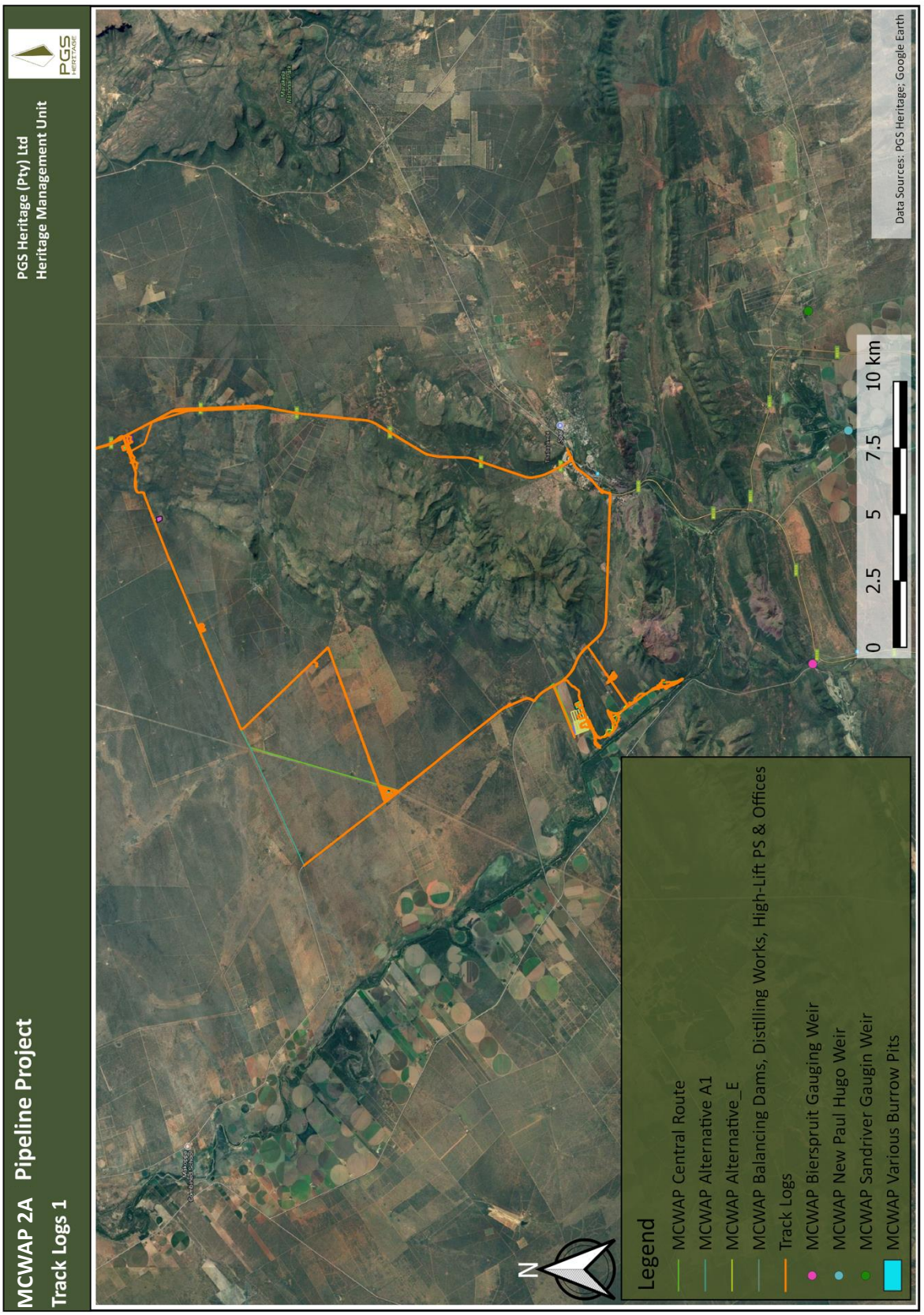


Figure 21 – General view of the southern end of the study area showing both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

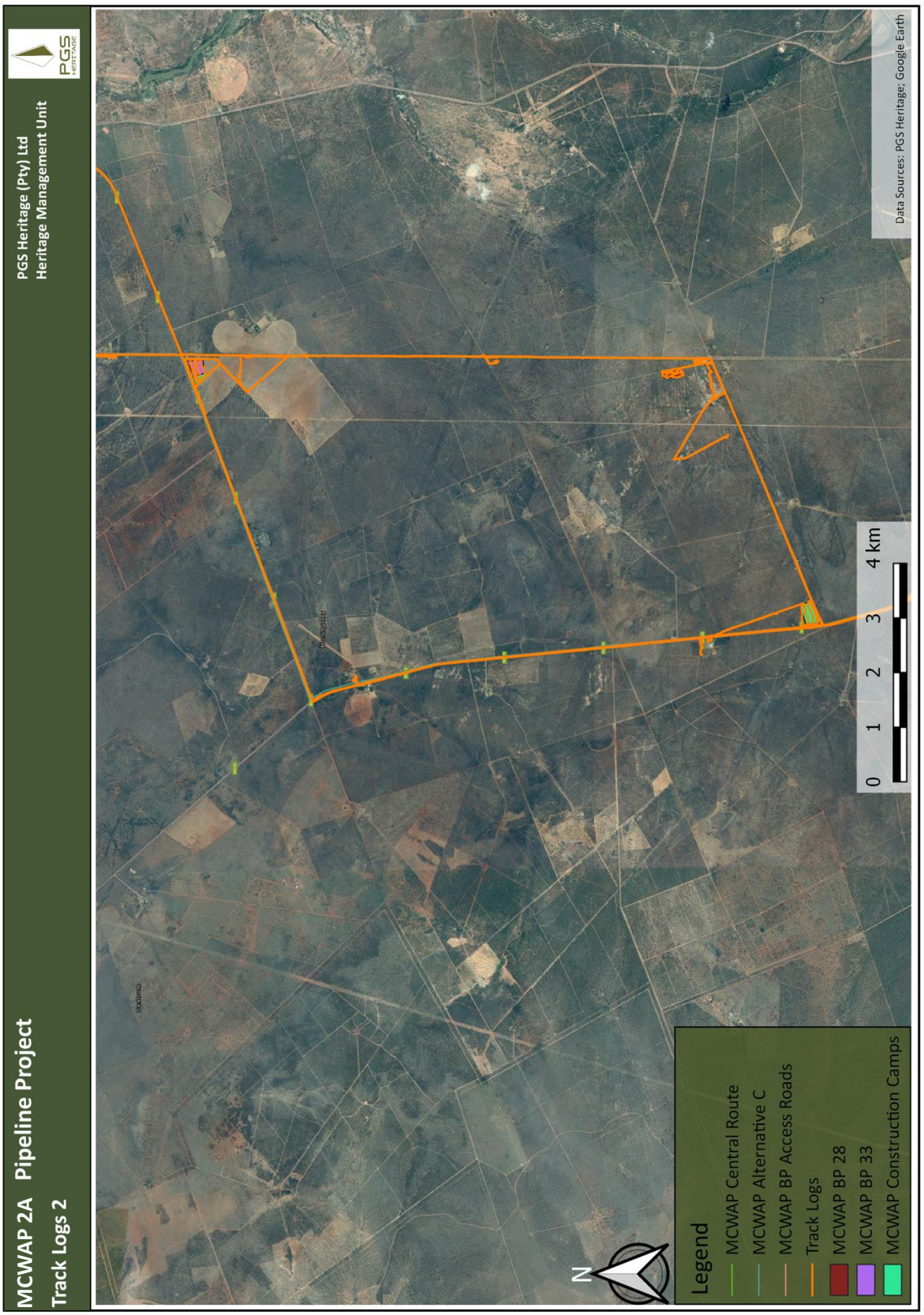


Figure 22 – General view of the south-central section of the study area showing both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

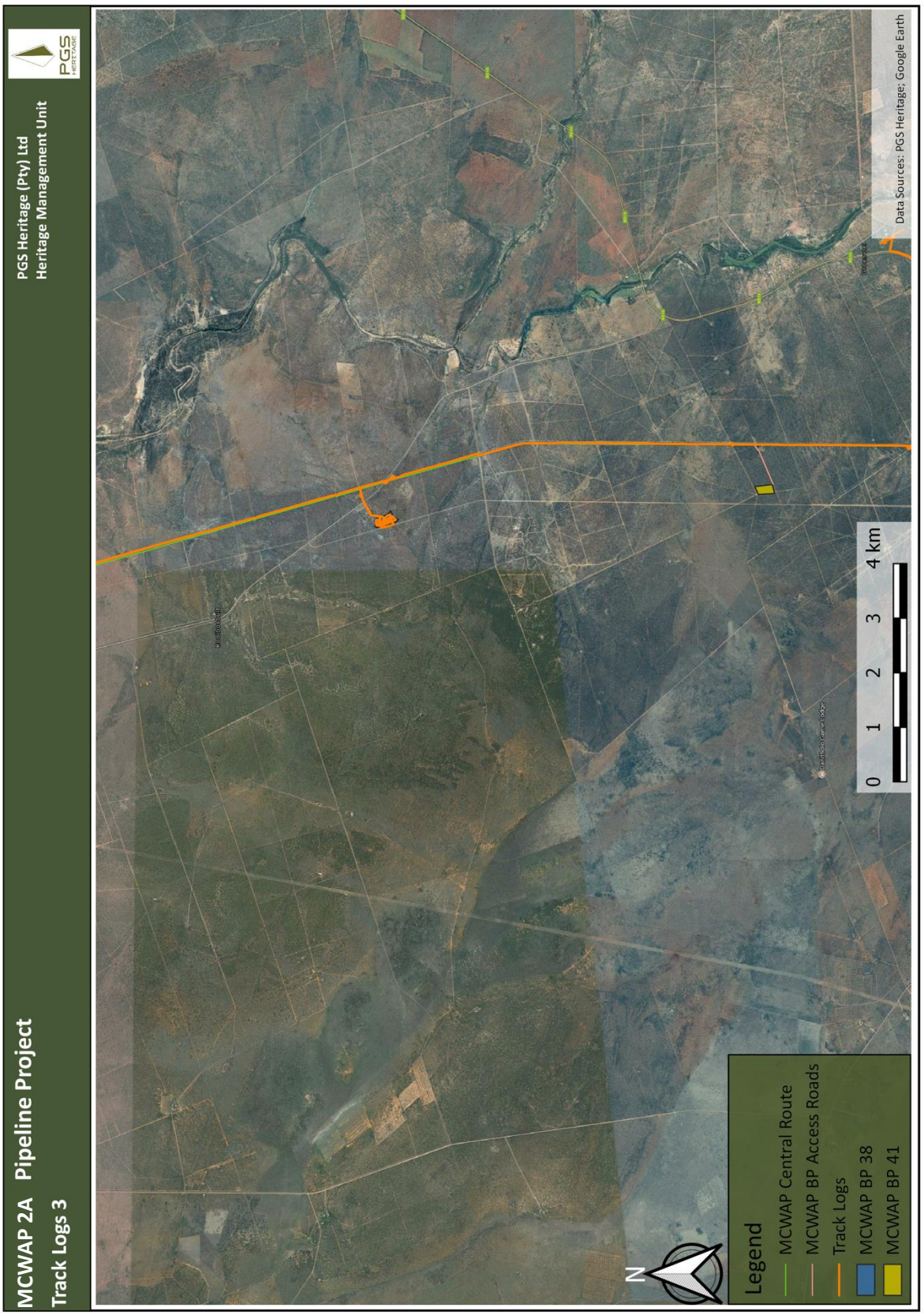


Figure 23 – General view of the central section of the study area showing both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

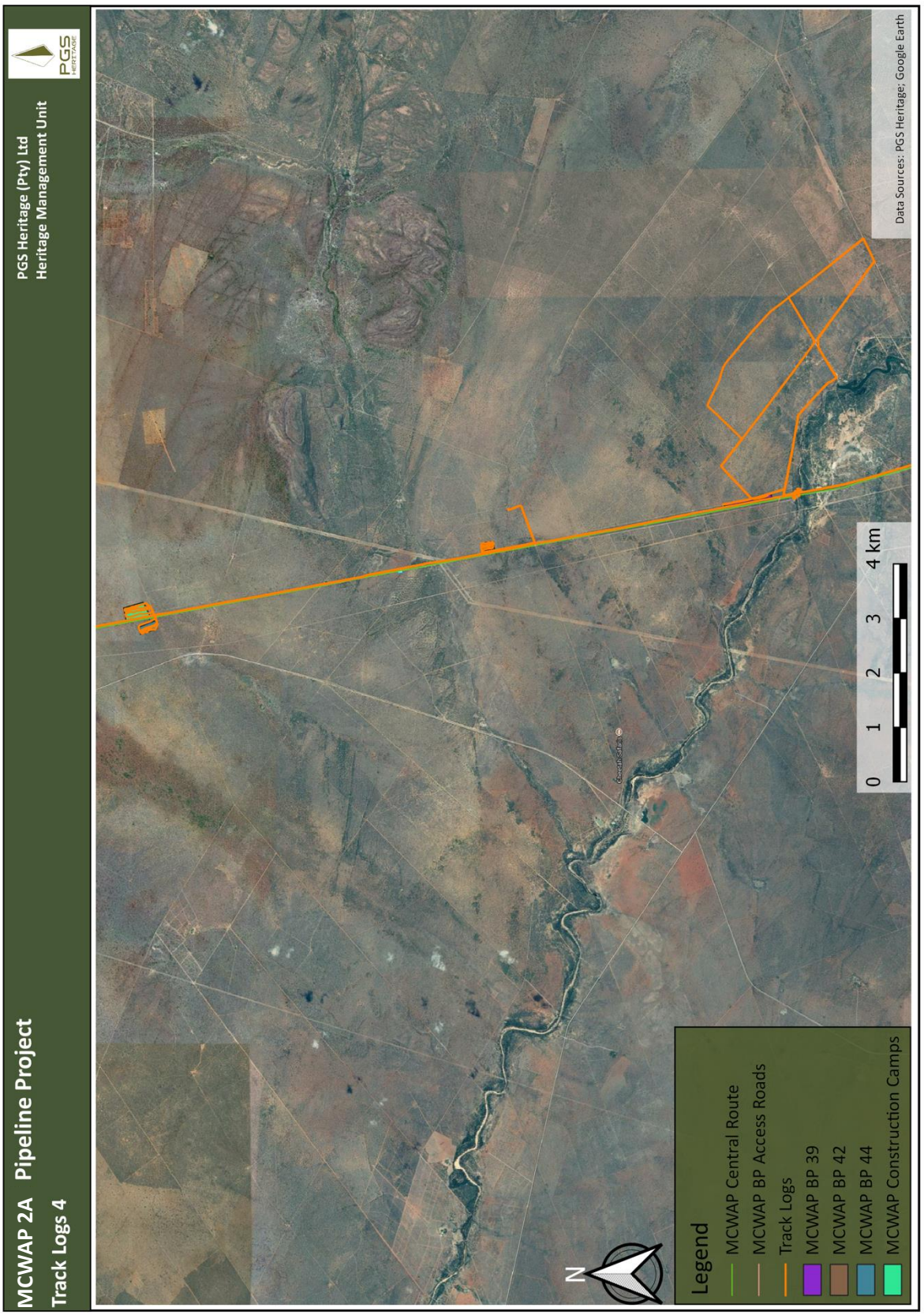


Figure 24 – Another general view of the central section of the study area showing the proposed development north and south of the Matlabas River. This image depicts both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

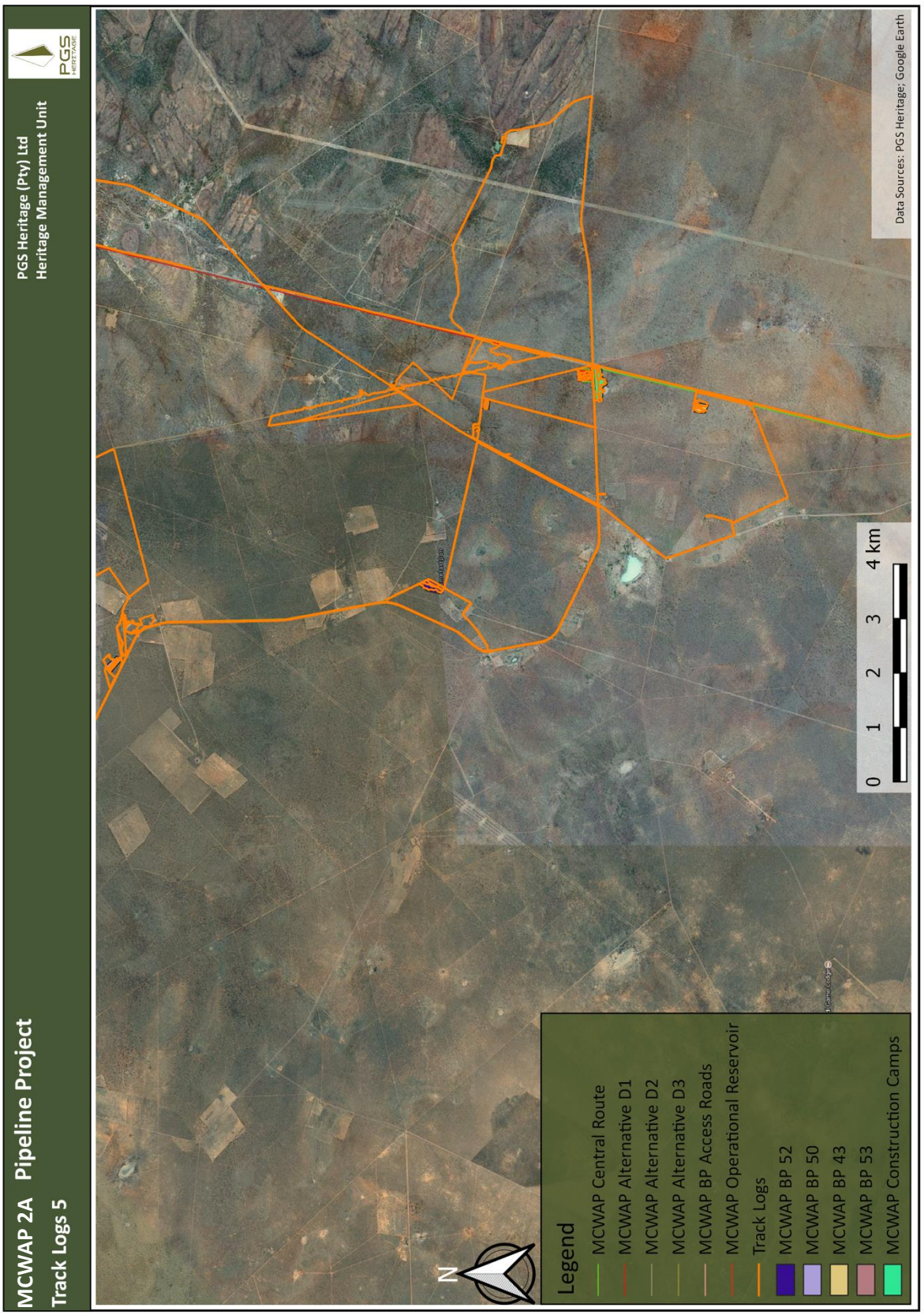


Figure 25 – General view of the north-central section of the study area showing both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

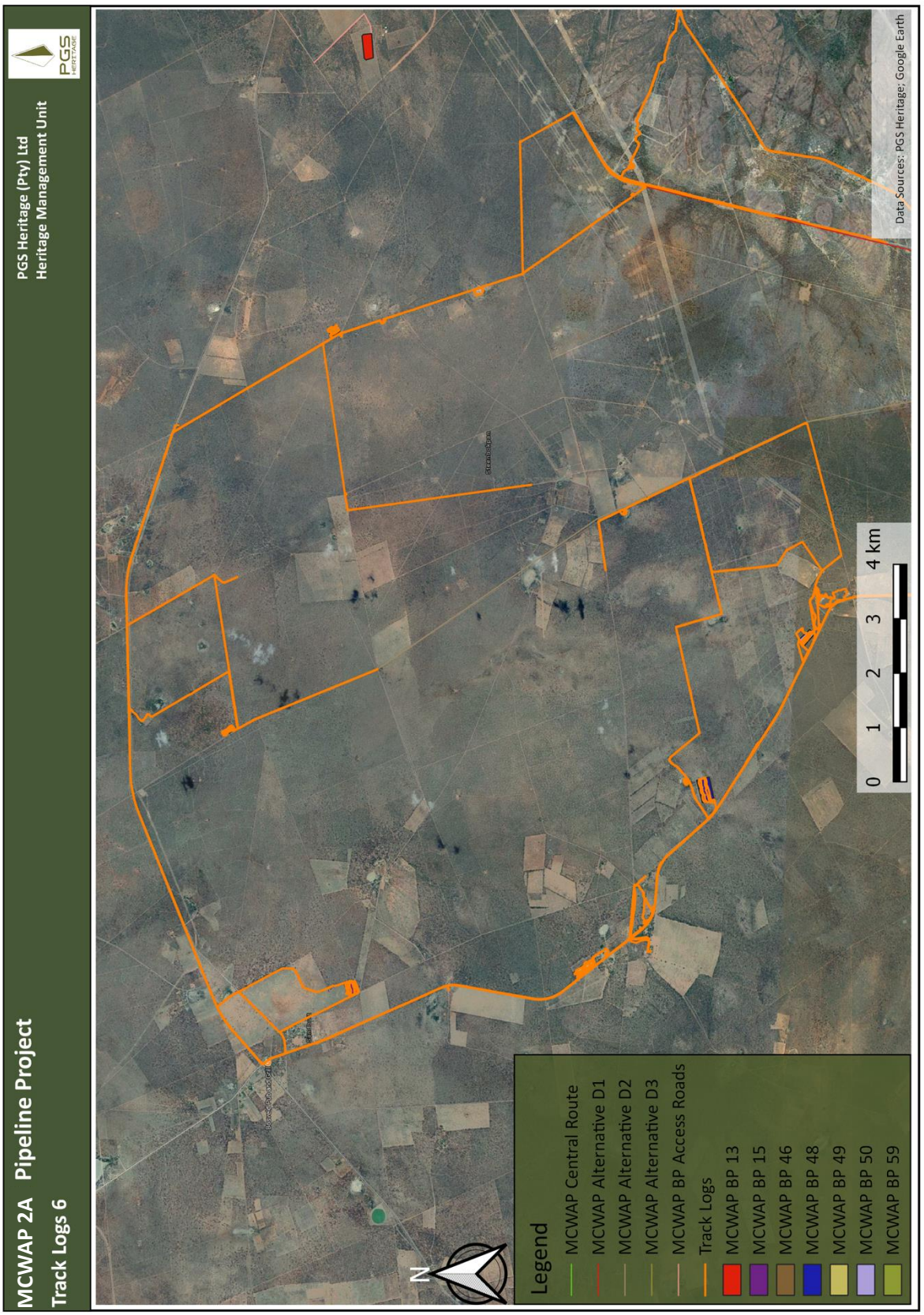


Figure 26 – General view of the northern end of the study area showing both the proposed development footprints and the track logs that were recorded during the fieldwork. The track logs are depicted in orange.

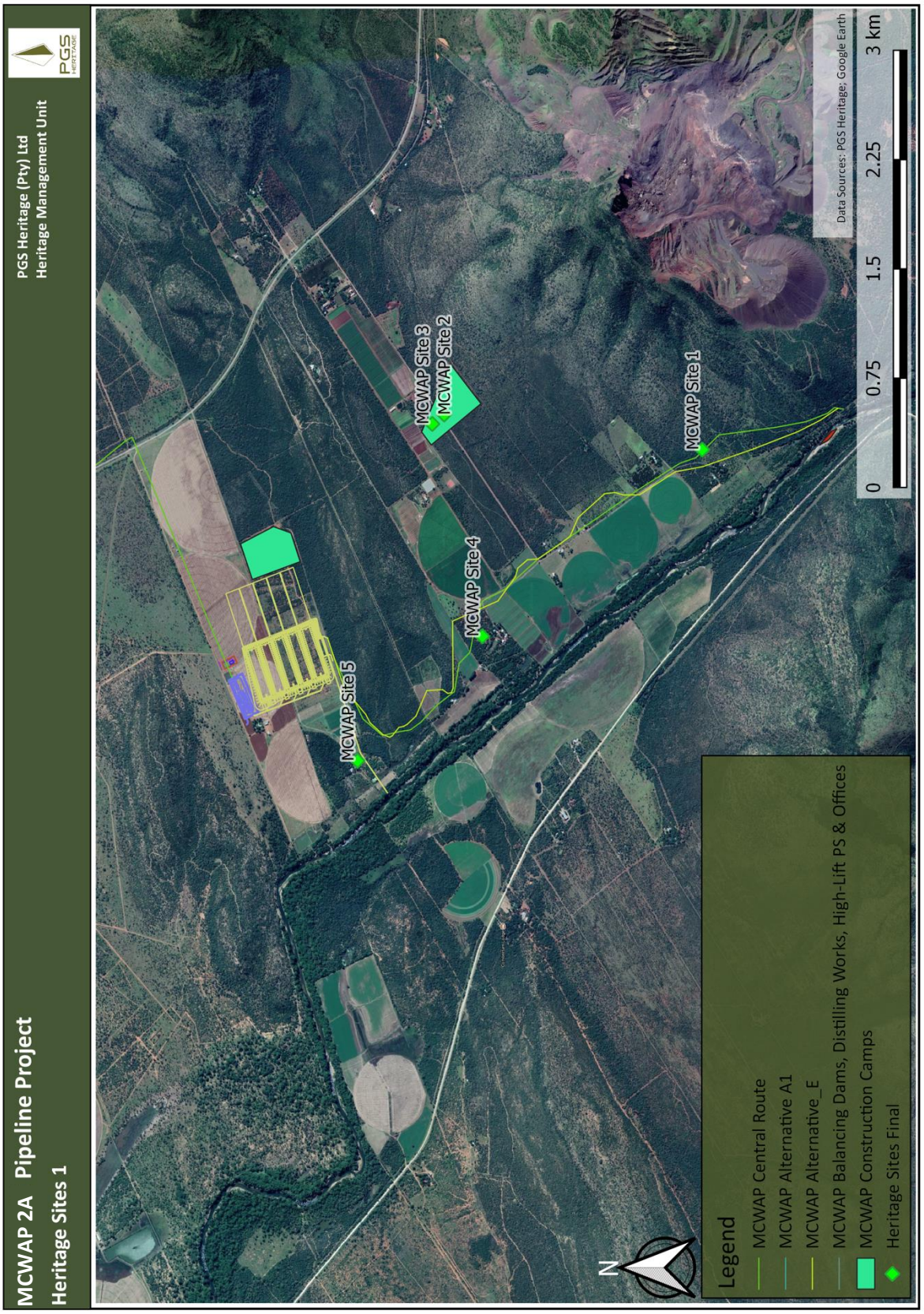


Figure 27 – General view of the southern end of the study area showing the distribution of heritage sites identified during the fieldwork.

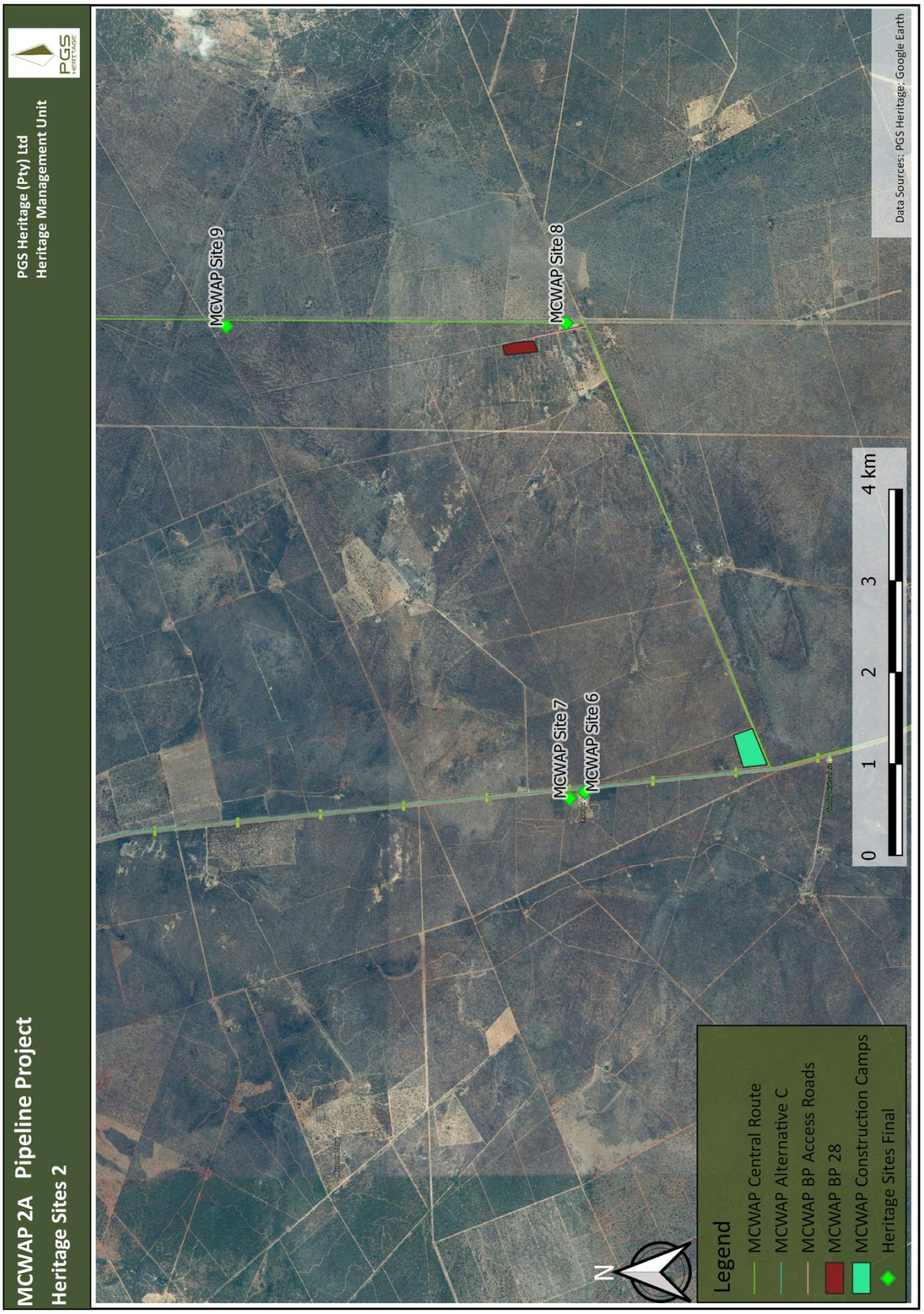


Figure 28 – General view of the south-central section of the study area showing the distribution of heritage sites identified during the fieldwork.

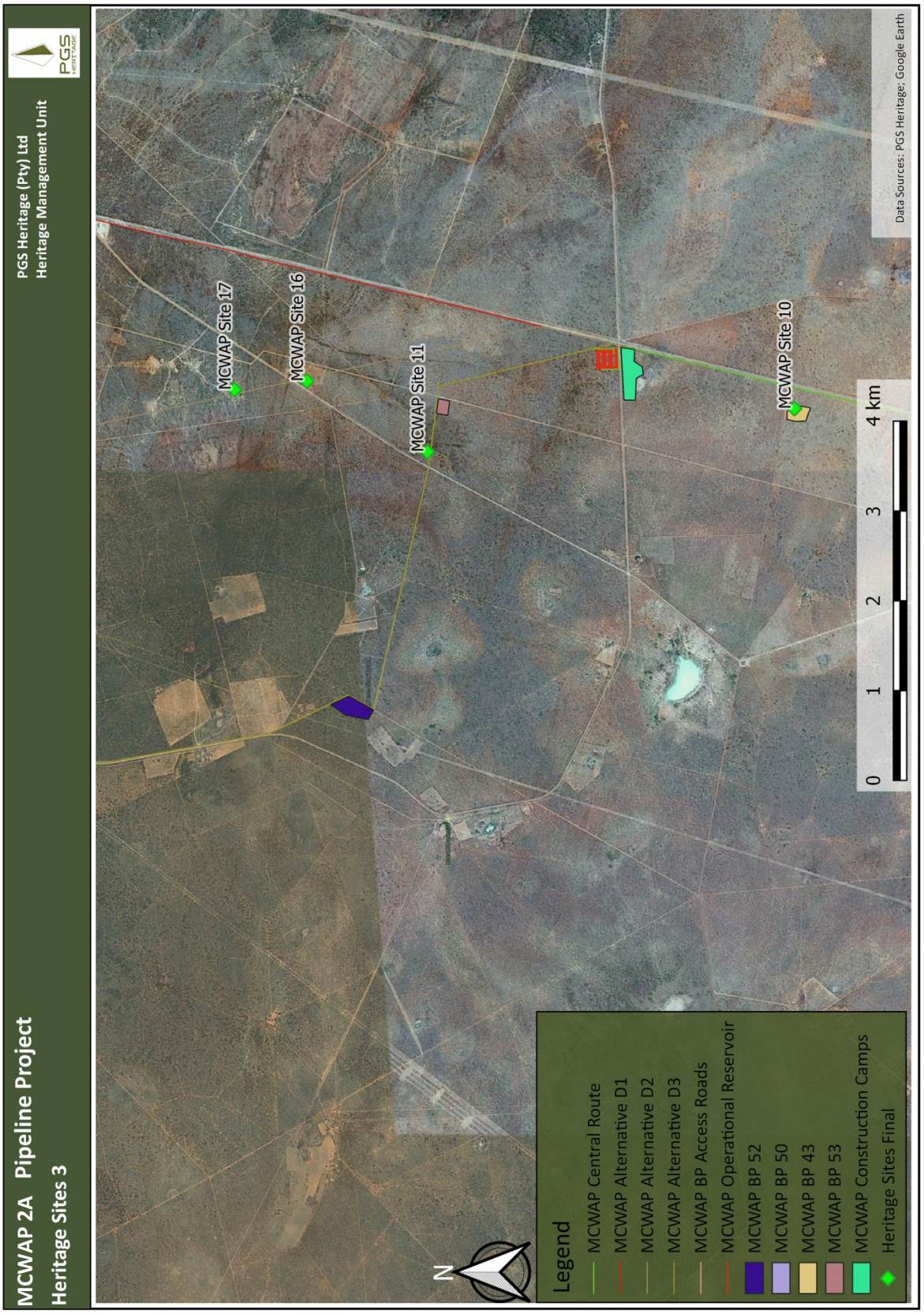


Figure 29 – General view of the north-central section of the study area showing the distribution of heritage sites identified during the fieldwork.

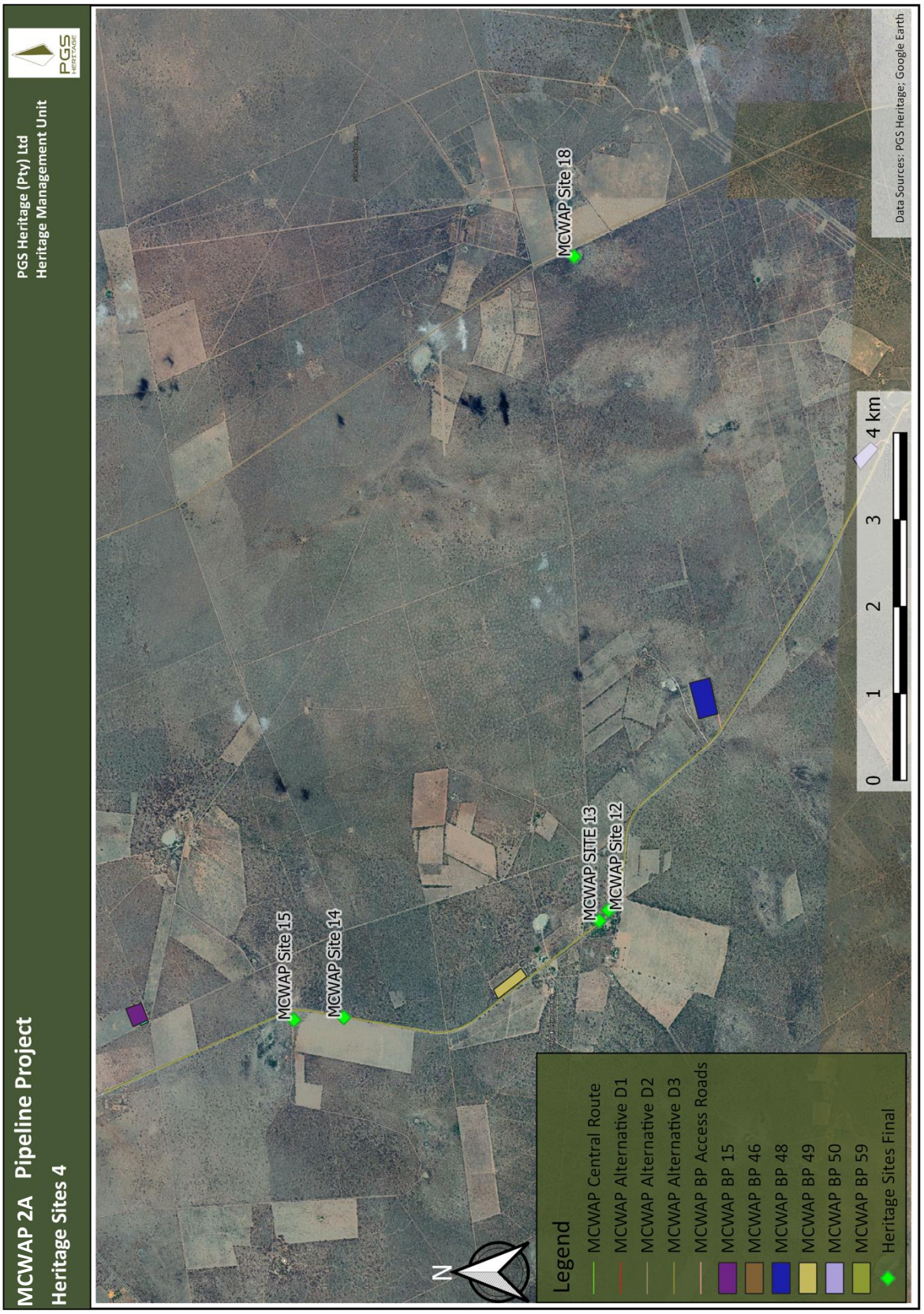


Figure 30 – General view of the northern end of the study area showing the distribution of heritage sites identified during the fieldwork.

6.2 Heritage Sites identified during the Fieldwork

6.2.1 MCWAP Site 1

GPS Coordinates

S 24.623765
E 27.314196

Site Description

The site comprises a number of features and objects which all suggest that a number of black homesteads used to be located here. The site is poorly preserved and is overgrown with bush, scrub and trees.

All that remains of these homesteads are a number of ash middens, sections of stone foundation structures, at least one oval-shaped stone concentration which may be a grave as well as cultural material in the form of metal, glass and imported ceramic fragments. Examples of these artefacts observed on the surface of the site include a metal lock plate for a door, medicine bottles and broken sections of imported ceramic plates. Bone fragments were also evident across the surface of the site.

With one possible grave in the form of an oval-shaped stone concentration identified during the fieldwork, the likelihood for more graves to be located here remains high. Additionally, based on the information that is presently available, it seems highly likely for the site to have been occupied by black people, quite possibly black farm workers. Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads. These stillborn babies were frequently buried along the sides, or underneath, the parents' dwelling. This seems to be especially true for older sites. As this site is not occupied anymore, no direct information with regards to the presence (or not) of stillborn graves is currently available.

Neither the First Edition of the 2427CB Topographical Sheet that was surveyed in 1963 nor the Second Edition of the same topographical sheet that was surveyed in 1980, depict any homesteads or structures at this site locality. In the wider surroundings, farmworker houses and farmhouses are shown, but the closest of these to the present study area is a farmhouse located approximately 200m to the south-west.

At present it would be very difficult to accurately date the site. The complete lack of plastic artefacts suggest that the site is not very recent. As a result, it is possible for the site to be at least a few decades old, but this is of course not certain. The site is certainly not older than 100 years, but may be just older than 60 years.

Site Extent

The site extends over an area approximately 100m x 50m.

Position of Site relative to Proposed Development

The site coordinates is located 9m north-east of the Central Pipeline. Taking the extent of the site into account, this proposed pipeline passes directly over the site.

Site Significance

Until such time that the presence of graves at this site has been confirmed or disproved, the site must be viewed as containing graves. All graves have high levels of emotional, religious and in some cases historical significance. As such the site is of **Generally Protected A (GP. A)** or **High/Medium Significance**. This indicates that the site may not be impacted upon without prior mitigation.

Please refer **Section 8** for the required mitigation measures.

Figure 31 – General view of MCWAP Site 1. One of the middens found on the surface of the site is depicted. Scale in 10cm increments.

Figure 32 – View of a section of stone walling from the site. These stone wall sections are quite likely all that remains of the dwellings. Scale in 10cm increments.

Figure 33 – View of the oval-shaped stone feature which may possibly be a grave. Scale is in 10cm increments.

Figure 34 – Sample of artefacts observed on the surface of the site. Scale in 1cm increments.

6.2.2 MCWAP Site 2

GPS Coordinates

S 24.606290
E 27.316570

Site Description

The site comprises two stone concentrations located a few meters apart. Although no grave goods could be identified, the two stone-packed features may be graves.

Neither the First Edition of the 2427CB Topographical Sheet that was surveyed in 1963 nor the Second Edition of the same topographical sheet that was surveyed in 1980, depict any cemeteries or structures at this site locality.

Site Extent

The site extends over an area approximately 15m x 15m.

Position of Site relative to Proposed Development

The site is located within one of the proposed Construction Camps.

Site Significance

Until such time that the presence of graves at this site has been proven or disproven, the site must be viewed as containing graves. It is important to understand that graves and cemeteries have significant heritage value and as a result the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way.

Please refer **Section 8** for the required mitigation measures.

Figure 35 – General view of the area where the two possible graves were identified.

Figure 36 – Closer view of a section of one of the stone-packed features.

6.2.3 MCWAP Site 3

GPS Coordinates

S 24.60551
E 27.31593

Site Description

The site comprises a large irregular-shaped stone concentration with no clear function or origin. A lower grinder was identified adjacent to the stone concentration. It is not presently certain whether the stone concentration represents the remains of a homestead or not. For the purposes of this study, a worst case scenario will be assumed namely that a homestead was located here. The presence of the lower grinder supports this, and also indicates that a black homestead was located here. Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads. These stillborn babies were frequently buried along the sides, or underneath, the parents' dwelling. This seems to be especially true for older sites. As this site is not occupied anymore, no direct information with regards to the presence (or not) of stillborn graves is currently available. Apart from the lower grinder, no cultural material could be observed.

Neither the First Edition of the 2427CB Topographical Sheet that was surveyed in 1963 nor the Second Edition of the same topographical sheet that was surveyed in 1980, depict any cemeteries or structures at this site locality.

Site Extent

The site extends over an area approximately 25m x 25m.

Position of Site relative to Proposed Development

The site is located within one of the proposed Construction Camps.

Site Significance

Until such time that the presence of graves at this site has been proven or disproven, the site must be viewed as containing graves. It is important to understand that graves and cemeteries have significant heritage value and as a result the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way. Please refer **Section 8** for the required mitigation measures.

Figure 37 – General view of the stone concentration. Scale is in 10cm increments.

Figure 38 – This lower grinder represents the only cultural material observed on the surface of the site. Scale is in 1cm increments.

6.2.4 MCWAP Site 4

GPS Coordinates

S 24.608850
E 27.301470

Site Description

A cemetery is located within an agricultural field that is irrigated by center pivot. The cemetery was evidently historically used as a burial ground by the Burger family, and contains three graves all associated with this family. All the graves from this cemetery are orientated from west to east, with the headstones on the west. The three graves will be individually discussed below.

- The first of the three graves to be individually discussed, has a formal rectangular granite headstone with a rectangular granite-lined grave dressing. The surface of the dressing is covered with pebbles. The inscription appearing on the granite headstone is illustrated and shown below.

HIER RUS
ONS GELIEFDE EGGENOOT EN VADER
CHRISTIAAN JOHANNES
BURGER
GEB. 22 OKT. 1879
OORL. 7 OKT. 1945
JOB. 19 V.25 – MAAR EK WEET MY VERLOSSER LEEF EN HY SAL AS LAASTE OOR DIE STOF OPSTAAN
GES. 12 V. 3 – GEDENK O SIEL DIE ANDER LEWE JOU TOEGEWESE ERFENIS
RUS IN VREDE
BURGER

- The second of the three graves has a rectangular cement lined dressing with pebbles placed on the dressing surface. It has a rectangular book-shaped granite headstone.The inscription appearing on this headstone is illustrated and shown below.

ONS SEUNTJIE EN BOETIE
LOURENS MARTHINUS
BURGER

GEB 27-11-1958
OORL 28-11-1959

- The third grave has na oval granite headstone with pebbles placed on the surface of the grave. The inscription appearing on this headstone is illustrated and shown below.

BABA BURGER
A.P. SARIE
3 : 8 : 47 - 8 : 8 : 47
LAAT DIE KINDERTJIES
NA MY TO KOM

Site Extent

The site extends over an area approximately 10m x 10m.

Position of Site relative to Proposed Development

The site is located approximately 69m south by south-west of the Central Pipeline.

Site Significance

It is important to understand that graves and cemeteries have significant heritage value. Such graves and cemeteries also have significant value to the relevant families. As a result, the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way.

Please refer **Section 8** for the required mitigation measures.

Figure 39 – General view of the cemetery at MCWAP Site 4. Scale is in 10cm increments.

6.2.5 MCWAP Site 5

GPS Coordinates

S 24.600409

E 27.293109

Site Description

The site comprises the original farm dwelling on Portion 2 of the farm Mooivalei 342 KQ. It is a brick structure with a corrugated iron roof and has steel windows and wood and steel doors. A number of structures are associated with the farmstead, including a brick rondavel with a corrugated roof, a rectangular brick shed with a corrugated iron roof and an open-sided shed.

According to the landowner, Mr. J.L. van den Berg, the farm dwelling was built by his parents in c. 1941. Mr. Van den Berg added that his family has been living on the farm Mooivalei for many years, and that the Burger family whose graves are buried at MCWAP Site 4, are related to him.

The First Edition of the 2427CB Topographical Sheet that was surveyed in 1963 depicts three buildings here. Five buildings are depicted on the Second Edition of the same map sheet that was surveyed in 1980. The depiction of the site on the 1963 map sheet indicates that the farmhouse and some of its associated structures are at least 55 years old. As indicated by the farm owner, the farmhouse was built in c. 1941. It is therefore clear that the building is older than 60 years.

Site Extent

The site extends over an area approximately 50m x 50m.

Position of Site relative to Proposed Development

The site is located approximately 47m north-west of the pipelines between the Balancing Dams and Desilting Works and the Crocodile River.

Site Significance

The farmhouse, and possibly some of its associated structures, are older than 60 years. The site is relatively unique in that not many other farmsteads of a similar age were identified during the fieldwork. As a result, the site is deemed to be of **Medium Significance** and is rated as **Generally Protected B (GP.B)**. Please refer **Section 8** for the required mitigation measures.

Figure 40 – General view of the farmhouse at MCWAP Site 5.

Figure 41 – General view of the rondavel at MCWAP Site 5.

6.2.6 MCWAP Site 6

GPS Coordinates

S 24.386829
E 27.398175

Site Description

The site comprises one of the original farm dwellings on the farm Tarantaalpan 132 KQ. Different phases in the construction of the dwelling can be identified, with the original core of the building comprising a rectangular structure with a hipped corrugated iron roof. At a later stage, two protruded sections were added to the northern and southern ends of the core. The building has steel-framed windows and a chimney on its north-western end. A medium sized baobab tree (*Adansonia digitata*) is located a short distance south-west of the dwelling and was very likely planted by a resident or owner of the farmhouse.

The First Edition of the 2427AD Topographical Sheet that was surveyed in 1963 depicts two buildings here. The same buildings are again depicted on the Second Edition of the same map sheet that was surveyed in 1980. The depiction of the site on the 1963 map sheet indicates that the farmhouse is at least 55 years old. As a result, the building is can very likely be older than 60 years.

Site Extent

The site extends over an area approximately 25m x 25m.

Position of Site relative to Proposed Development

The site is located approximately 46m west of the proposed Pipeline Alternative C.

Site Significance

The farmhouse is quite likely older than 60 years. The site is relatively unique in that not many other farmsteads of a similar age were identified during the fieldwork. As a result, the site is deemed to be of **Medium Significance** and is rated as **Generally Protected B (GP.B)**. Please refer **Section 8** for the required mitigation measures.

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Figure 42 – View of the front of the farmhouse at MCWAP Site 6. The baobab tree that is associated with the house can just be seen on the left.

Figure 43 – The western facade of the farmhouse at MCWAP Site 6.

6.2.7 MCWAP Site 7

GPS Coordinates

S 24.385215
E 27.397481

Site Description

The site comprises two unmarked stillborn graves located at the Dibyane residence on the farm Tarantaalpan 132 KQ. The positions of both unmarked stillborn graves were indicated by Mr. David Dibyane, who identified the two stillborn babies as Ellie and Liesbet Dibyane and who indicated that they passed away approximately 20 to 30 years ago. Both stillborn graves are associated with the same rectangular mud-brick dwelling and appear to have been buried either underneath this dwelling or along its foundations walls. One of the stillborn graves was indicated to be located near the northern end of the structure, with the second stillborn grave located near the south-eastern corner of the structure.

Site Extent

The site extends over an area approximately 20m x 20m.

Position of Site relative to Proposed Development

The site is located approximately 99.6m west of the proposed Pipeline Alternative C.

Site Significance

It is important to understand that graves and cemeteries have significant heritage value. Such graves and cemeteries also have significant value to the relevant families. As a result, the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way.

Please refer **Section 8** for the required mitigation measures.

Figure 44 – Mr. David Dibyane stands in front of one of the two unmarked stillborn graves. It would appear that the deceased was either buried underneath the building or immediately adjacent to its outside wall. The scale is in 10cm increments.

Figure 45 – View of the second stillborn grave located at MCWAP Site 7. Scale in 10cm increments.

6.2.8 MCWAP Site 8

GPS Coordinates

S 24.384822
E 27.448700

Site Description

A low density surface scatter of Middle Stone Age lithics were identified along the eastern bank of an existing borrow pit immediately west of the railway line.

The lithics observed on the surface of the site include three broken blades as well as two Middle Stone Age cores. No hammerstones could be observed at the site. The highest density observed at the site is two lithics per / $m^{2.}$

With the lithics found on the side of a borrow pit, it seems evident that the cultural material from the site are for the most part in secondary context.

Site Extent

The site extends over an area approximately 120m in length all along the eastern side of the borrow pit and is approximately 50m wide.

Position of Site relative to Proposed Development

The site is located less than 1m west of the Central Pipeline.

Site Significance

The site comprises a relatively low density surface scatter of Middle Stone Age lithics. Although the site was evidently disturbed by the excavation of the borrow pit, it represents one of only a few Stone Age sites identified during the fieldwork. The possibility exists for undisturbed lithics to be exposed during the construction of the pipeline. As such, the site is of **Generally Protected B (GP. B)** or **Medium Significance**.

Please refer **Section 8** for the required mitigation measures.

Figure 46 – General view of the area where most of the lithics from MCWAP Site 8 were found. Scale in 10cm increments.

Figure 47 – Sample of lithics identified at MCWAP Site 8. Scale in 1cm increments.

6.2.9 MCWAP Site 9

GPS Coordinates

S 24.348194
E 27.448361

Site Description

An Iron Age metalworking site was originally recorded by Botes (2010), who indicated that the site had been disturbed by infrastructural development. During the present fieldwork, the site was again visited. Only a small number of undecorated potsherds as well as a lump of clay could be identified on the surface of the site. This latter clay fragment may have originated from an iron smelting furnace or thick tuyère, albeit this is not certain at present.

Position of Site relative to Proposed Development

The site is located approximately 70m west of the Central Pipeline.

Site Significance

At present only a small number of undecorated potsherds were observed on the surface of the site. However, the possibility exists for associated cultural material and features (such as furnaces) to be present as well. As such, the site is of **Generally Protected B (GP. B)** or **Medium Significance**.

Please refer **Section 8** for the required mitigation measures.

Figure 48 – General view of MCWAP Site 9.

Figure 49 – Sample of cultural material observed on the surface of the site.

6.2.10 MCWAP Site 10

GPS Coordinates

S 23.913256
E 27.396624

Site Description

A scatter of slag was identified over a relatively small area. No associated cultural material such as potsherds or tuyères could be identified on the surface of the site.

The site is located in an area where the vegetation almost exclusively consists of juvenile Tamboti trees (*Spirostachys africana*). As a result, it seems likely for the immediate surroundings of the study area to have been disturbed. This may explain the lack of associated cultural material.

Site Extent

The site extends over an area approximately 15m by 15m in extent.

Position of Site relative to Proposed Development

The site is located within the proposed Borrow Pit 43.

Site Significance

At present only slag is visible on the surface of the site. However, the possibility exists for associated cultural material and features to be present as well. Furthermore, although large numbers of metal working sites are known from the Southern Waterberg, such sites are not so well documented from the wider surroundings of Steenbokpan. As such, the site is of **Generally Protected B (GP. B)** or **Medium Significance**.

Please refer **Section 8** for the required mitigation measures.

Figure 50 – General view of the general characteristics of the immediate surroundings of the site. As can be seen, this landscape is almost exclusively comprised of juvenile Tamboti trees.

Figure 51 – General view of the surface of the site showing the scatter of slag.

6.2.11 MCWAP Site 11

GPS Coordinates

S 23.873112
E 27.391921

Site Description

The poorly preserved remains of two mud-brick structures are located here. These structures appear to have been the remains of a black homestead. The site is in a poor condition and all that remains are the rectangular mud-brick foundations of the two structures. Cultural material such as imported ceramic fragments, metal and glass objects and bone were observed on the surface of the site. An ash midden was also identified a short distance east of the structures.

Neither the First nor Second Editions of the 2327CD Topographical Sheets depict any homesteads or structures in proximity to this site.

Based on the information that is presently available, it seems highly likely that the site was built and used by black people, possibly black farm workers. Past experience has shown that in some cases stillborn babies were buried in close proximity to the homes of their parents and especially along the sides of the parents' dwelling. This seems to be especially true for older sites. As this site is no longer occupied, no direct information regarding the presence (or not) of stillborn graves is known.

Site Extent

The site extends over an area approximately 50m by 50m in extent.

Position of Site relative to Proposed Development

The site is located 37m north of Pipeline Alternative D3.

Site Significance

Until such time that the presence of graves at this site has been confirmed or disproved, the site must be viewed as containing graves. All graves have high levels of emotional, religious and in some cases historical significance. As such, the site is of **Generally Protected A (GP. A)** or **High/Medium Significance**. This indicates that the site may not be impacted upon without prior mitigation. Please refer **Section 8** for the required mitigation measures.

Figure 52 – General view of the remains of the two mud-brick structures from MCWAP Site 11.

Figure 53 – Imported ceramic fragment observed on the surface of the site. Scale in 1cm increments.

6.2.12 MCWAP Site 12

GPS Coordinates

S 23.778520
E 27.298500

Site Description

The site comprises a number of features and objects which all suggest that a black homestead(s) used to be located here.

Evidence for the presence of a former homestead(s) include an ash midden as well as cultural material in the form of metal and glass fragments. Examples of these artefacts observed on the surface of the site include a metal handle, tins and glass bottle fragments. A hedge of trees that were evidently planted in a rectangular shape, also forms part of the site. Similar rectangular planted hedges are found in a number of other places on the same farm.

The First Edition of the 2327CD Topographical Map Sheet that was surveyed in 1969 depicts a building in close proximity to the site. This building is again depicted on the Second Edition of the same map sheet that was surveyed in 1980. It is therefore clear that the site is at least 49 years old.

Based on the information that is presently available, it seems highly likely that the site was built and used by black people, possibly black farm workers. Past experience has shown that in some cases stillborn babies were buried in close proximity to the homes of their parents and especially along the sides of the parents' dwelling. This seems to be especially true for older sites. As this site is no longer occupied, no direct information regarding the presence (or not) of stillborn graves here is known.

Site Extent

The site extends over an area approximately 70m x 70m.

Position of Site relative to Proposed Development

The site coordinates is located 19.3m north-east of the proposed Pipeline Alternative D3. Taking the extent of the site into account, this proposed pipeline passes directly over the site.

Site Significance

Until such time that the presence of graves at this site has been confirmed or disproved, the site must be viewed as containing graves. All graves have high levels of emotional, religious and in some cases historical significance. As such the site is of **Generally Protected A (GP. A)** or **High/Medium Significance**. This indicates that the site may not be impacted upon without prior mitigation.

Figure 54 – General view of the midden that forms part of MCWAP Site 11. Scale is in 10cm increments.

Figure 55 – View of a section of the planted hedge which is associated with the site..

Figure 56 – Sample of cultural material observed on the surface of the site. Scale in 1cm increments.

6.2.13 MCWAP Site 13

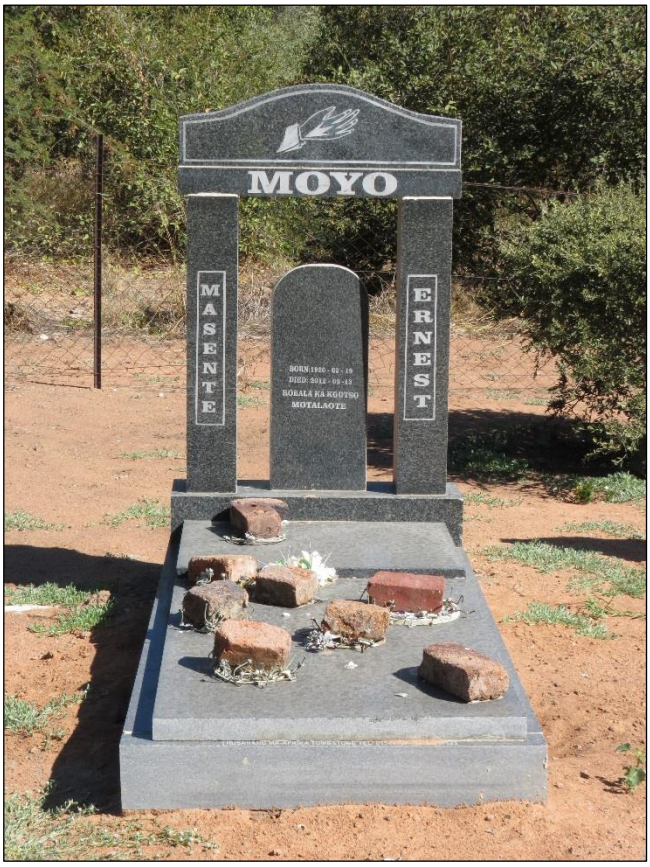
GPS Coordinates

S 23.777485
E 27.297290

Site Description

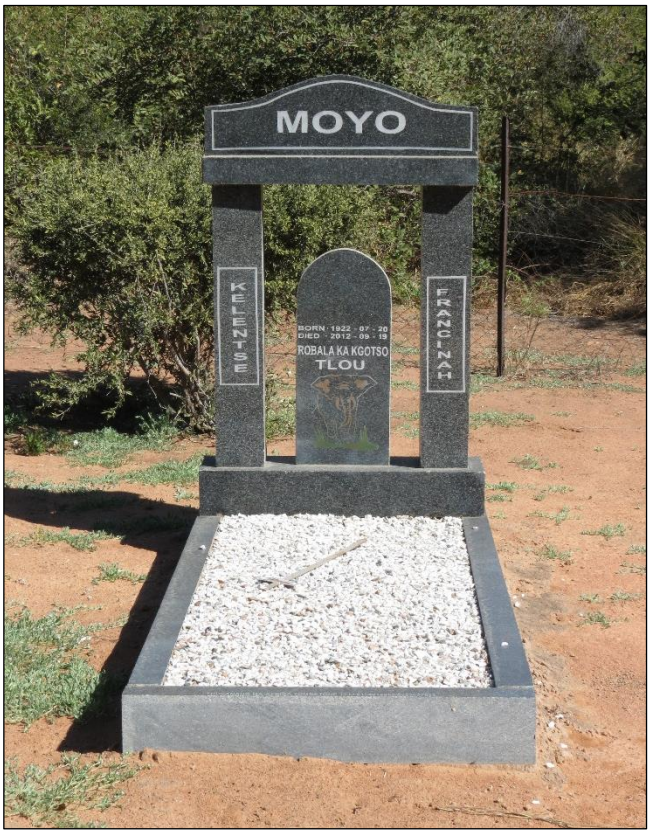
A cemetery is located a short distance north-east of the gravel road between Vaalwater and Lephalale. The cemetery was evidently used as a burial ground by the Moyo family, and contains two graves associated with this family. All the graves from this cemetery are orientated from west to east, with the headstones on the west. The two graves will be individually discussed below.

- The first of the two graves to be individually discussed, has na elaborate granite headstone comprising a central upright slab that is flanked by two pillars suporting a horizontal slab. The dressing itself comprises a rectangular granite slab. Grave goods observed on the grave dressing include flowers as well as bricks. The bricks are likely used to support flower vases. The inscription appearing on the granite headstone is illustrated and shown below.



MOYO
MASENTE
ERNEST
BORN 1920 - 02 - 19
DIED 2012 - 03 - 13
ROBALA KA KGOTSO
MOTALAOTE

- The second of the two graves to be individually discussed, has an identifical granite headstone as the previous grave. The dressing on this grave is granite-lined with pebbles placed across the grave surface. The inscription appearing on the granite headstone is illustrated and shown below.



MOYO
KELENTSE
FRANCINAH
BORN 1922 - 07 - 20
DIED 2012 - 09 - 19
ROBALA KA KGOTSO
TLOU

Site Extent

The site extends over an area approximately 10m x 10m.

Position of Site relative to Proposed Development

The site is located approximately 15.7m north-east of the proposed Pipeline Alternative D3.

Site Significance

It is important to understand that graves and cemeteries have significant heritage value. Such graves and cemeteries also have significant value to the relevant families. As a result, the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way. Please refer **Section 8** for the required mitigation measures.

6.2.14 MCWAP Site 14

GPS Coordinates

S 23.748636
E 27.286384

Site Description

Five cement headstones were identified on the western edge of the gravel road between Vaalwater and Steenbokpan. The site is located approximately 4.5km south by south-east of Steenbokpan.

Four of the headstones were found to be lying flat on the groundwith one headstone still upright, albeit this upright headstone was evidently also disturbed as it is very loose. No inscriptions could be seen on any of the headstones.

It is not presently clear whether these headstones still mark the position of a cemetery, or whether they were removed from a cemetery located somewhere else. Until such time that suitable mitigation can be undertaken, the site must be viewed as containing graves.

No graves or homesteads are depicted on the First and Second Editions of the 2327CB Topographical Map Sheets. The only associated feature depicted on both these maps is an extensive agricultural field located west of the gravel road.

Site Extent

The site extends over an area approximately 10m x 10m.

Position of Site relative to Proposed Development

The site is located 9.5m west of the Pipeline Alternative D3.

Site Significance

Until such time that the presence of graves at this site has been proven or disproven, the site must be viewed as containing graves. It is important to understand that graves and cemeteries have significant heritage value and as a result the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way. Please refer **Section 8** for the required mitigation measures.

Figure 57 – General view of the disturbed headstones identified on the side of the gravel road.

Figure 58 – Closer view of the disturbed headstones.

6.2.15 MCWAP Site 15

GPS Coordinates

S 23.743007
E 27.286116

Site Description

The site comprises one of the original farm dwellings on the farm Schuldpadfontein 328 LQ. It comprises a rectangular brick building that sits on a stone foundation. The building has a hipped corrugated iron roof. An unplastered brick verandah is located on the north-eastern façade of the building and was likely added at a later stage. A third phase in the construction of the building comprises a brick addition that was added to the north-western façade of the dwelling.

The farmhouse is associated with two brick rondavels located a short distance to the east. One of these rondavels has a thatch roof with the roof on the other rondavel completely missing.

The First Edition of the 2327CB Topographical Sheet that was surveyed in 1969 depicts a building here. The same building is again depicted on the Second Edition of the same map sheet that was surveyed in 1980. The depiction of the site on the 1969 map sheet indicates that the farmhouse is at least 49 years old. As a result, the building is can very likely be older than 60 years.

Site Extent

The site extends over an area approximately 50m x 50m.

Position of Site relative to Proposed Development

The closest component of the site to the proposed development is one of the rondavels, which is located approximately 90m west of the proposed Pipeline Alternative D3.

Site Significance

The farmhouse is quite likely older than 60 years. The site is relatively unique in that not many other farmsteads of a similar age were identified during the fieldwork. As a result, the site is deemed to be of **Medium Significance** and is rated as **Generally Protected B (GP.B)**. Please refer **Section 8** for the required mitigation measures.

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Figure 59 – General view of the farmstead at MCWAP Site 15. The rondavels are visible on the left, with the more recent brick addition on the right.

Figure 60 – The north-eastern facade of the farmhouse at MCWAP Site 15.

6.2.16 MCWAP Site 16

GPS Coordinates

S 23.859948
E 27.399643

Site Description

The poorly preserved remains of a structure is located here. It is not presently certain what the original function of this structure was, however it is possible that it was a black homestead.

The site is in a poor condition and all that remains are heaps of cement bricks. Very little evidence for cultural material could be seen. This said, a large ash midden was observed.

Neither the First or Second Editions of the 2327CD Topographical Sheets depict any homesteads or structures in proximity to this site.

Based on the information that is presently available, it seems possible that the site was used by black people, possibly black farm workers. Past experience has shown that in some cases stillborn babies were buried in close proximity to the homes of their parents and especially along the sides of the parents' dwelling. This seems to be especially true for older sites. As this site is not occupied anymore, no direct information with regards to the presence (or not) of stillborn graves is available.

Site Extent

The site extends over an area approximately 50m x 50m.

Position of Site relative to Proposed Development

The site is located 35m west of Pipeline Alternative D2.

Site Significance

Until such time that the presence of graves at this site has been confirmed or disproved, the site must be viewed as containing graves. All graves have high levels of emotional, religious and in some cases historical significance. As such the site is of **Generally Protected A (GP. A)** or **High/Medium Significance**. This indicates that the site may not be impacted upon without prior mitigation. Please refer **Section 8** for the required mitigation measures.

Figure 61 – General view of the remains of a cement brick structure from MCWAP Site 16.

Figure 62 – The ash midden from MCWAP Site 16.

6.2.17 MCWAP Site 17

GPS Coordinates

S 23.852039
E 27.398706

Site Description

The site comprises a small, loosely packed stone concentration that supports a cross made from two branches bound together with wire. The site is located near a low rocky ridge and is situated approximately 42m north-east of the fenced farmhouse / hunting camp on the farm.

Although the stone concentration with wooden cross appears to be a grave, no inscriptions or grave goods could be identified.

It is not presently known if the site simply represents a memorial to a deceased loved one or if it marks the position where the ash of a deceased loved one was placed.

Site Extent

The site extends over an area approximately 5m x 5m.

Position of Site relative to Proposed Development

The site is located 45.5m east of Pipeline Alternative D2.

Site Significance

Until such time that the exact origin and function of the site can be confirmed, the site must be viewed as of very high emotional and possibly religious significance. As a result the site is deemed to be of **High/Medium Significance** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected in any way.

Please refer **Section 8** for the required mitigation measures.

Figure 63 – General view of the grave-like feature at MCWAP Site 17.

Figure 64 – Closer view of the grave-like feature at MCWAP Site 17.

6.2.18 MCWAP Site 18

GPS Coordinates

S 23.774630
E 27.372313

Site Description

A very low density surface scatter of three Stone Age lithics were identified around a small pan.

Site Extent

The site extends over an area approximately 50m x 50m.

Position of Site relative to Proposed Development

The site is located 127m west by south-west of Pipeline Alternative D2.

Site Significance

The site comprises only a low density surface scatter of a small number of lithics. As such, the site is of **Generally Protected C (GP. C)** or **Low Significance**. This indicates that no mitigation is required.

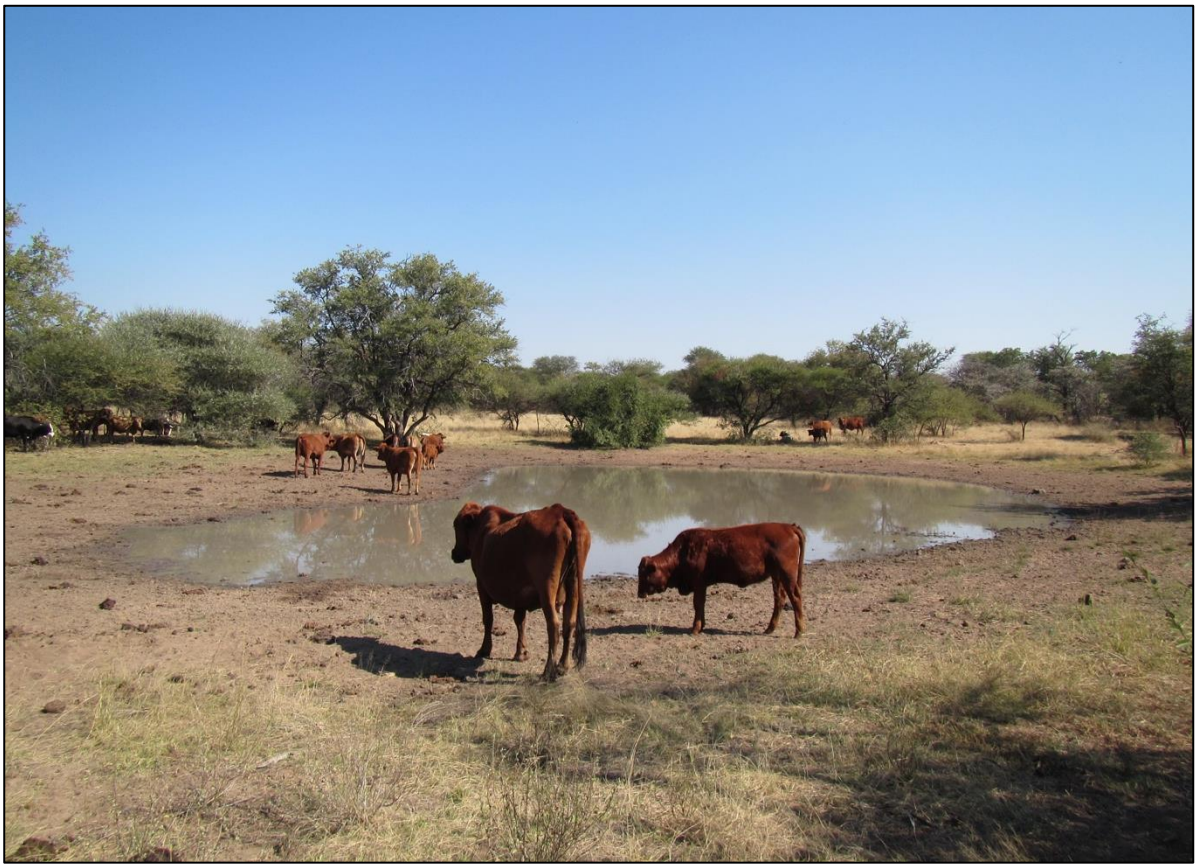

Figure 65 – General view of the pan where MCWAP Site 18 was identified.

Figure 66 – Three lithics identified at MCWAP Site 18. Scale in 1cm increments.

7 PALAEONTOLOGY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Desktop Assessment Report for the proposed MCWAP-2A Project. According to the National Heritage Resources Act (No 25 of 1999, section 38), a palaeontological impact assessment is key to detect the presence of fossil material within the proposed development footprint and it is thus necessary to evaluate the impact of the construction on the palaeontological resources.

The proposed MCWAP-2A development is underlain by various geological sediments. These geological sediments are shown in the table below.

Table 13 – Geological sediments underlying the project area

Era	Supergroup/Sequence	Group	Subgroup	Formation	Sensitivity
Mokolien		Waterberg	Kransberg		Low
			Matlabas		
			Nylstroom		
Vaalian	Bushveld Complex; Lebowa Granite Suite				Zero
	Transvaal Supergroup	Pretoria		Black Reef	Moderate
		Chuniespoort	Malmani		High
Randian		Buffelsfontein			Moderate

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and

reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a **high Palaeontological sensitivity**. The proposed development of the central pipe line is underlain by the Malmani Subgroup development and thus has a high palaeontological sensitivity. It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

The impact risk is classified according to 5 classes as described in the table below.

Table 14 - Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for heritage resources above, an impact rating of 3.74 will fall in the Impact Class 4, which will be considered to be a High impact.

Table 15 - Impact rating on palaeontological resources

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	HIGH	Study Area	Permanent	Very likely	Moderate
Impact on palaeontology	4	5	5	4	3.74

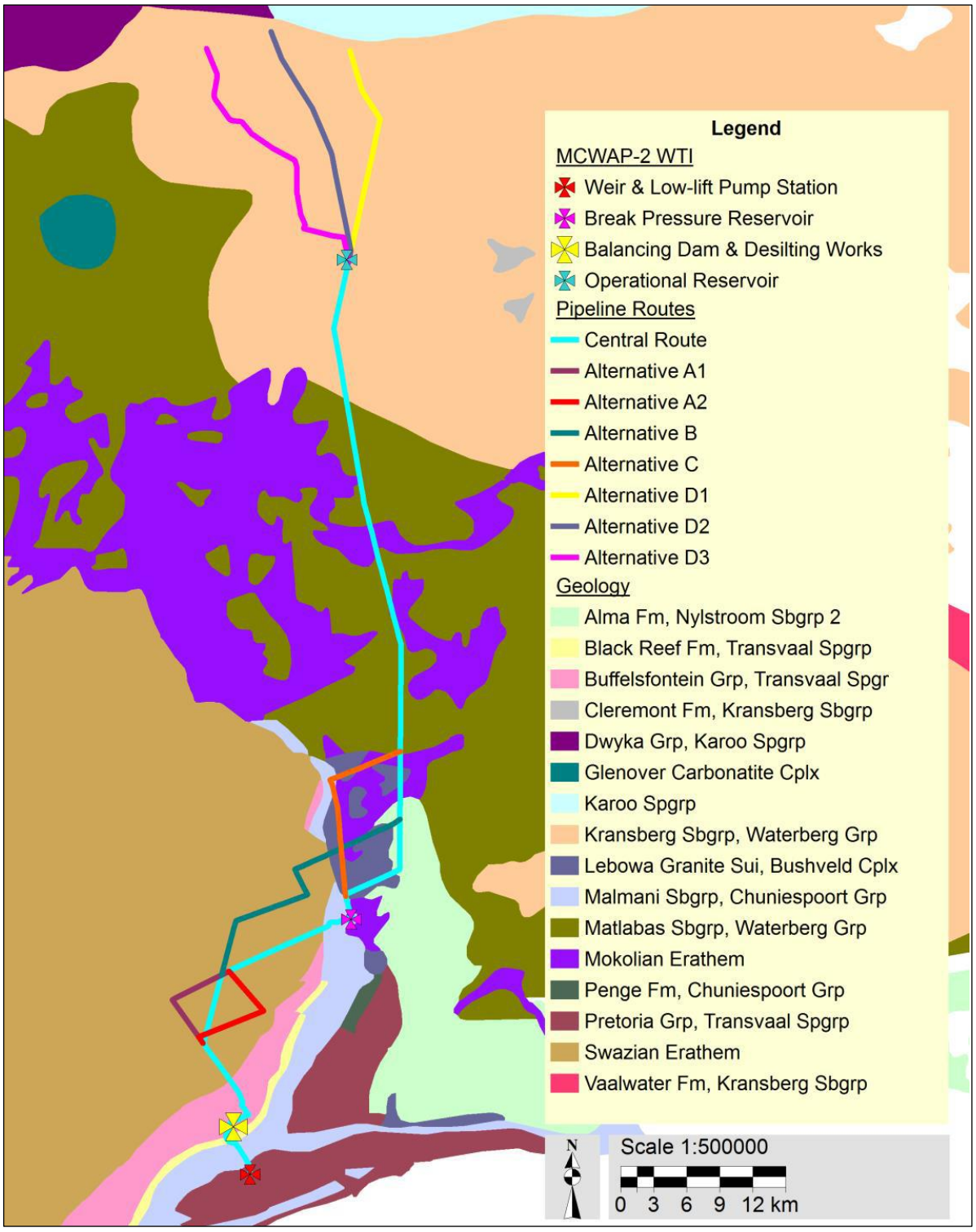

Figure 67 – Simplified geology of the development area. This map was obtained from the Final Scoping Report (Nemai Consulting, 2018).

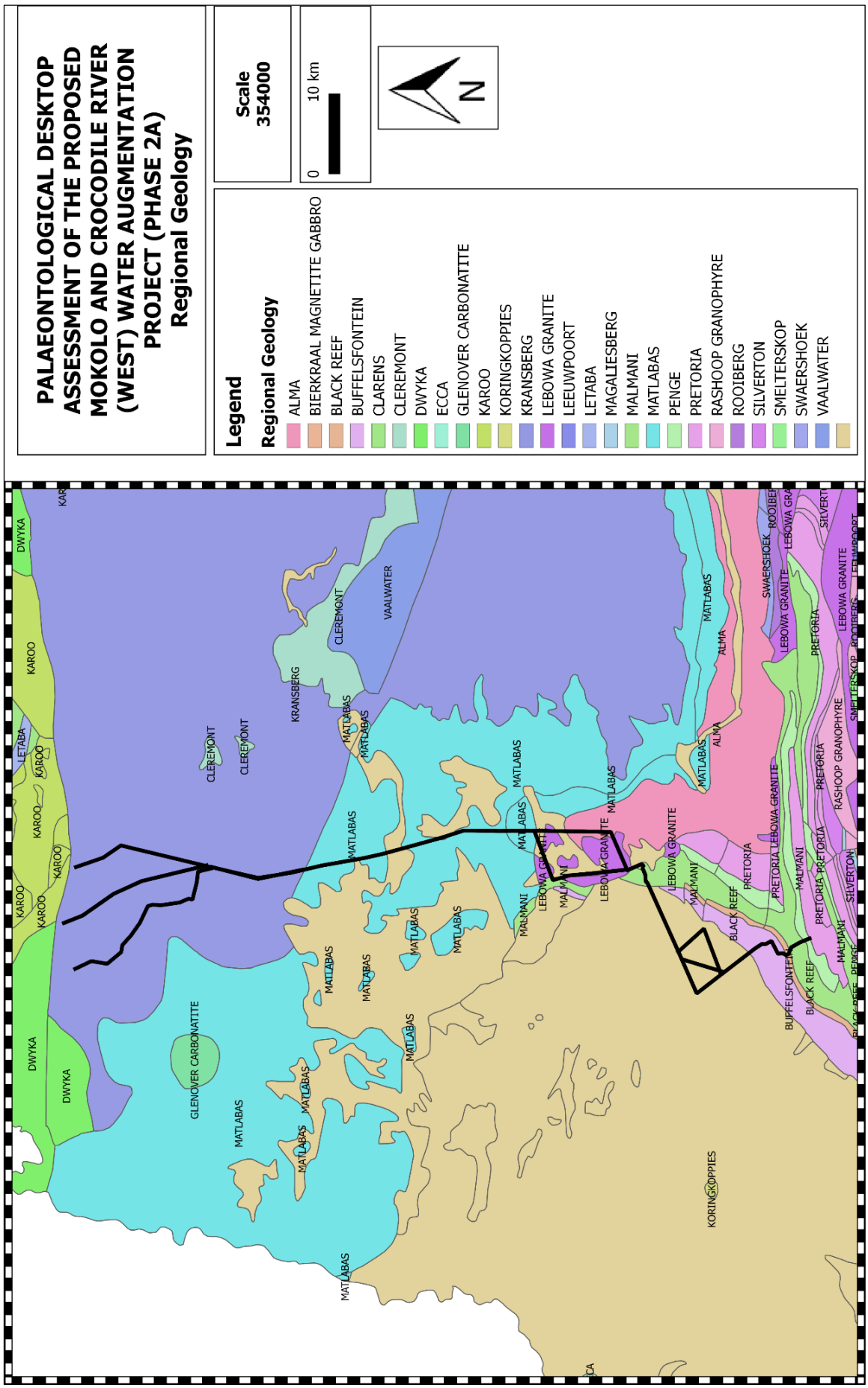

Figure 68 – The surface geology of the development area (Banzai Environmental, 2018).

8 IMPACT ASSESSMENT

8.1 General Observations

In this section, an assessment will be made of the impact of the proposed development on the identified heritage sites. The following general observations will apply for this impact assessment:

- Only the impact of the development footprint areas that were surveyed during the fieldwork, are included in this assessment.
- The exact alignment of the actual pipeline footprint can still be altered within the 100m wide corridor. However, for the purposes of the present study and these impact assessment calculations, it was assumed that the pipeline development (and its alternatives) will be constructed along the same route as depicted on the project development plans provided to PGS Heritage. As a result, the distances between these identified sites and the proposed pipeline footprints were taken as the expected distances between these identified sites and the construction footprint.
- Only sites with a significance of Medium and higher are included in these impact assessment calculations.

8.2 Risk Calculation for the Impact of the Development on the identified Heritage Sites

8.2.1 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 1

In this section the impact of the proposed development on MCWAP Site 1 will be assessed. This site is located 9m north-east of the proposed Central Route and 116m east of Pipeline Alternative E. Although the coordinates recorded for the site position is 9m from the Central Route, the site extent is approximately 100m by 50m. This means that the site will be impacted upon by the proposed development of the Central Route. No impact is expected from the development of Pipeline Alternative E. The impact risk represented by the development of the Central Line on MCWAP Site 1 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 2.2

Table 16 - Risk Calculation for the Development Impact on MCWAP 1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Medium Term	Could Happen	**Moderate**
Impact on MCWAP 1	4	4	3	3	**2.2**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 1 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.2 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 2

In this section the impact of the proposed development on MCWAP 2 will be assessed. The site is located within one of the proposed Construction Camps. As a result, the site is expected to be destroyed by the development of this particular Construction Camp. The impact risk represented by the development of this Construction Camp on MCWAP Site 2 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \times \frac{4}{5}$$

IMPACT RISK = 3.2

Table 17 - Risk Calculation for the Development Impact on MCWAP 2

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Long Term	Very Likely	**High**
Impact on MCWAP 2	4	4	4	4	**3.2**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 2 falls within Impact Class 4, which represents a High Impact Risk. Mitigation would be required.

8.2.3 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 3

In this section the impact of the proposed development on MCWAP 3 will be assessed. The site is located within one of the proposed Construction Camps. As a result, the site is expected to be

destroyed by the development of this particular Construction Camp. The impact risk represented by the development of this Construction Camp on MCWAP Site 2 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \text{ X } \frac{3}{5}$$

IMPACT RISK = 2.4

Table 18 - Risk Calculation for the Development Impact on MCWAP 3

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Long Term	Could Happen	**Moderate**
Impact on MCWAP 3	4	4	4	3	**2.4**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 3 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.4 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 4

In this section the impact of the proposed development on MCWAP 4 will be assessed. The site is located approximately 69m south by south-west of the Central Pipeline.

The impact risk represented by the development of this Central Pipeline on MCWAP Site 4 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \text{ X } \frac{2}{5}$$

IMPACT RISK = 1.5

Table 19 - Risk Calculation for the Development Impact on MCWAP 4

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Medium Term	Unlikely	**Low**
Impact on MCWAP 4	4	4	3	2	**1.5**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 4 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.5 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 5

In this section the impact of the proposed development on MCWAP 5 will be assessed. The site is located approximately 47m north-west of the pipelines between the Balancing Dams and Desilting Works and the Crocodile River. The impact risk represented by the development of these pipelines on MCWAP Site 5 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 1.8

Table 20 - Risk Calculation for the Development Impact on MCWAP 5

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Local	Medium Term	Could Happen	**Low**
Impact on MCWAP 5	3	3	3	3	**1.8**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 5 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.6 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 6

In this section the impact of the proposed development on MCWAP 6 will be assessed. The site is located approximately 46m west of the proposed Pipeline Alternative C. The impact risk represented by the development of this pipeline alternative on MCWAP Site 6 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 1.8

Table 21 - Risk Calculation for the Development Impact on MCWAP 6

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Local	Medium Term	Could Happen	**Low**
Impact on MCWAP 6	3	3	3	3	**1.8**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 6 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.7 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 7

In this section the impact of the proposed development on MCWAP 7 will be assessed. The site is located approximately 99.6m west of the proposed Pipeline Alternative C. The impact risk represented by the development of this pipeline alternative on MCWAP Site 7 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \times \frac{2}{5}$$

IMPACT RISK = 1.5

Table 22 - Risk Calculation for the Development Impact on MCWAP 7

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Medium Term	Unlikely	**Low**
Impact on MCWAP 7	4	4	3	2	**1.5**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 7 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.8 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 8

In this section the impact of the proposed development on MCWAP 8 will be assessed. The site is located less than 1m west of the Central Pipeline. The impact risk represented by the development of this pipeline alternative on MCWAP Site 8 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 4)}{3} \text{ X } \frac{4}{5}$$

IMPACT RISK = 2.7

Table 23 - Risk Calculation for the Development Impact on MCWAP 8

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Local	Long Term	Very Likely	**Moderate**
Impact on MCWAP 8	3	3	4	4	**2.7**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 8 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.9 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 9

In this section the impact of the proposed development on MCWAP 9 will be assessed. The site is located approximately 70m west of the Central Pipeline. The impact risk represented by the development of this pipeline alternative on MCWAP Site 9 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 3)}{3} \text{ X } \frac{4}{5}$$

IMPACT RISK = 1.2

Table 24 - Risk Calculation for the Development Impact on MCWAP 9

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Local	Medium Term	Unlikely	**Low**

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
Impact on MCWAP 9	3	3	3	2	**1.2**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 9 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.10 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 10

In this section the impact of the proposed development on MCWAP 10 will be assessed. The site is located within the proposed Borrow Pit 43. The impact risk represented by the development of this borrow pit on MCWAP Site 10 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 4)}{3} \text{ X } \frac{4}{5}$$

IMPACT RISK = 2.7

Table 25 - Risk Calculation for the Development Impact on MCWAP 10

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Local	Long Term	Very Likely	**Moderate**
Impact on MCWAP 10	3	3	4	4	**2.7**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 10 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.11 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 11

In this section the impact of the proposed development on MCWAP 11 will be assessed. The site is located 37m north of Pipeline Alternative D3. The impact risk represented by the development of this pipeline alternative on MCWAP Site 11 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 3)}{3} \text{ X } \frac{3}{5}$$

IMPACT RISK = 2.0

Table 26 - Risk Calculation for the Development Impact on MCWAP 11

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Local	Medium Term	Could Happen	**Moderate**
Impact on MCWAP 11	4	3	3	3	**2.0**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 11 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.12 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 12

In this section the impact of the proposed development on MCWAP 12 will be assessed. The site coordinates are located 19.3m north-east of the proposed Pipeline Alternative D3. Taking the extent of the site into account, this proposed pipeline passes directly over the site. The impact risk represented by the development of this pipeline alternative on MCWAP Site 12 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 4)}{3} \text{ X } \frac{3}{5}$$

IMPACT RISK = 2.2

Table 27 - Risk Calculation for the Development Impact on MCWAP 12

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Local	Long Term	Could Happen	**Moderate**
Impact on MCWAP 12	4	3	4	3	**2.2**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 12 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.13 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 13

In this section the impact of the proposed development on MCWAP 13 will be assessed. The site is located approximately 15.7m north-east of the proposed Pipeline Alternative D3. The impact risk represented by the development of this pipeline alternative on MCWAP Site 13 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \text{ X } \frac{3}{5}$$

IMPACT RISK = 2.2

Table 28 - Risk Calculation for the Development Impact on MCWAP 13

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Medium Term	Could Happen	**Moderate**
Impact on MCWAP 13	4	4	3	3	**2.2**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 13 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.14 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 14

In this section the impact of the proposed development on MCWAP 14 will be assessed. The site is located 9.5m west of the Pipeline Alternative D3. The impact risk represented by the development of this pipeline alternative on MCWAP Site 14 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \text{ X } \frac{3}{5}$$

IMPACT RISK = 2.4

Table 29 - Risk Calculation for the Development Impact on MCWAP 14

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional / Provincial	Long Term	Could Happen	**Moderate**
Impact on MCWAP 14	4	4	4	3	**2.4**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 14 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.15 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 15

In this section the impact of the proposed development on MCWAP 15 will be assessed. The site is located approximately 90m west of the proposed Pipeline Alternative D3. The impact risk represented by the development of this pipeline alternative on MCWAP Site 15 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 4 + 3)}{3} \times \frac{2}{5}$$

IMPACT RISK = 1.3

Table 30 - Risk Calculation for the Development Impact on MCWAP 15

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Regional / Provincial	Medium Term	Unlikely	**Low**
Impact on MCWAP 15	3	4	3	2	**1.3**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 15 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

8.2.16 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 16

In this section the impact of the proposed development on MCWAP 16 will be assessed. The site is located approximately 35m west of Pipeline Alternative D2. The impact risk represented by the development of this pipeline alternative on MCWAP Site 16 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 2.0

Table 31 - Risk Calculation for the Development Impact on MCWAP 16

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Local	Medium Term	Could Happen	**Moderate**
Impact on MCWAP 16	4	3	3	3	**2.0**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 16 falls within Impact Class 3, which represents a Moderate Impact Risk. Mitigation would be required.

8.2.17 Risk Calculation for the Impact of the Proposed Development on MCWAP Site 17

In this section the impact of the proposed development on MCWAP 17 will be assessed. The site is located approximately 45.5m east of Pipeline Alternative D2. The impact risk represented by the development of this pipeline alternative on MCWAP Site 17 is calculated below.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 3)}{3} \times \frac{2}{5}$$

IMPACT RISK = 1.3

Table 32 - Risk Calculation for the Development Impact on MCWAP 17

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Local	Medium Term	Unlikely	**Moderate**
Impact on MCWAP 17	4	3	3	2	**1.3**

This calculation has revealed that the impact risk of the proposed development on MCWAP Site 17 falls within Impact Class 2, which represents a Low Impact Risk. No mitigation would be required.

9 MITIGATION AND RECOMMENDATIONS

9.1 General Mitigation Measures and Recommendations

The following general mitigation measures are required:

- Whenever possible, all heritage sites identified during this study with a significance of Medium and higher, must be preserved *in situ* by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprints and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required (refer **Section 8.2**).

- All those areas that could not be accessed during the fieldwork, must be assessed in the field by a heritage specialist / archaeologist before construction commences. These areas were not assessed in the field due to a number of reasons, including cases where the landowners were not willing to provide permission to any of the project consultants to undertake fieldwork on their land, cases where landowners did not respond to messages requesting access to their properties, development footprints and properties for which no landowner details were provided as well as those areas that were not assessed in the field due to the temporal and budget restrictions. Refer **Section 1.3** for a detailed list of all the components of the study area that could not be accessed during the fieldwork.

- The archaeological research assessment of the Motlhabatsi (Matlabas) drainage basin that was undertaken by Jan Aukema for his masters degree from the University of the Witwatersrand, revealed a substantial number of sites. The proposed Central Pipeline Route passes through a section of the Matlabas drainage basin that represented the area of study for Jan Aukema's archaeological research. As the exact coordinates and site localities for the numerous archaeological sites identified by Aukema are not presently available, it is very difficult to accurately establish the distances between the closest of Aukema's archaeological sites and present study area. From the site distribution map published by Huffman (1990:118), it would appear that the following sites are located closest to the present study area: Wn1 on the farm Welgevonden, Ho1 on the farm Haarlem Oost and Gr1 on the farm Groenrivier. It is recommended that all components of the proposed development footprints must be assessed in the field by way of walkthroughs undertaken by a heritage specialist / archaeologist before construction commences.

- Although significant sections of the pipeline footprints were assessed by vehicle along the railway and road servitudes, the landscape within which this development is proposed is not characterised by a plethora of archaeological and heritage sites. This statement is supported by the fact that although an intensive field assessment was undertaken, which included walkthroughs of almost all the non-pipeline development footprints (i.e. borrow pits, construction camps etc.), only 18 heritage sites could be identified across the entire length of the proposed development footprint which extends over an area in excess of 150km. As a result, it is not deemed necessary for additional walkthroughs to be undertaken apart from the ones required for those areas which were not included in the current fieldwork (see previous bullet item) and the ones required by the previous General Recommendation in proximity to the Matlabas River. Rather, it is recommended that an archaeological and heritage workshop be conducted with the project Environmental Control Officer (ECO) before construction commences to allow the ECO to undertake constant monitoring of construction activities and identify any archaeological and heritage sites which may be located along the pipeline route and which were not identified during the current fieldwork. Additionally, an archaeological watching brief can augment the work of the ECO during construction.

- An assessment of the South African Heritage Resources Information System (SAHRIS) of SAHRA was undertaken to establish whether any previous archaeological and heritage impact assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints. One of these previous reports from the immediate surroundings of the study area identified a cemetery containing four graves located approximately 65m north-west of proposed Borrow Pit 13-14, and 55m south-west of the access road to this borrow pit. The coordinates for this site are as follows: S 23.711420 E 27.497340. Due to the closeness of this cemetery to this borrow pit, the construction team and Environmental Control Officer must be made aware of the position of this site to ensure that it is not disturbed or damaged during construction.

- It is important to note that the impact assessment risk calculations undertaken for the identified heritage sites are based on the current layout of the proposed pipeline and its alternatives. Should the position and layout of any of the footprints change, the impact assessment calculations will have to be modified.

9.2 Site-Specific Mitigation Measures

The site-specific mitigation measures outlined in this section are required when the preservation of the identified heritage sites with a significance of Medium and higher, as well as their associated buffer areas, is not possible.

9.2.1 Mitigation Measures required for MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16

In this section, the required mitigation measures for these five sites will be outlined.

The following initial mitigation measure is required for the five sites:

- A social consultation process to assess whether any local residents or the wider public is aware of the presence of graves here.

Depending on the outcome of the social consultation process, three different outcomes would be the result, namely:

- Outcome 1: The social consultation absolutely confirms that no graves are located here.
- Outcome 2: The social consultation absolutely confirms that graves are located here.
- Outcome 3: The social consultation does not yield any confident results.

The following mitigation measures would be required for sites falling under Outcome 1:

- No further mitigation would be required.

The following mitigation measures would be required for sites falling under Outcome 2:

- A grave relocation process must be undertaken.
- A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation.
- Bilingual site and newspaper notices indicating the intent of the relocation.
- Permits from all the relevant and legally required authorities.
- An exhumation process that keeps the dignity of the remains and family intact.
- An exhumation process that will safeguard the legal rights of the families as well as that of the mining company.
- The process must be done by a reputable company well versed in the mitigation of graves.

The following mitigation measures would be required for sites falling under Outcome 3:

- Test excavations to physically confirm the presence or absence graves.
- If no evidence for graves are found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required.
- If evidence for stillborn babies are found, the site will fall within Outcome 2 as outlined

above. This means that a full grave relocation process must be implemented.

Additionally, the following mitigation measures must be undertaken for all four these sites:

- All structures and site layouts from each site must be recorded using standard survey methods and/or measured drawings. The end result would be a site layout plan.
- A mitigation report must be compiled for these sites within which all the mitigation measures and its findings will be outlined. The recorded drawings from the previous item must also be included in this mitigation report.
- The completed mitigation report must be submitted to the relevant heritage authorities.

9.2.2 Mitigation Measures required for MCWAP Site 2, MCWAP Site 4, MCWAP Site 7 and MCWAP Site 13

The following mitigation measures would be required:

- A grave relocation process must be undertaken.
- A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation.
- Bilingual site and newspaper notices indicating the intent of the relocation.
- Permits from all the relevant and legally required authorities.
- An exhumation process that keeps the dignity of the remains and family intact.
- An exhumation process that will safeguard the legal rights of the families as well as that of the mining company.
- The process must be done by a reputable company well versed in the mitigation of graves.

9.2.3 Mitigation Measures required for MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15

The following mitigation measures would be required:

- An architectural historian must conduct a site assessment of these buildings and confirm the site-specific mitigation measures that would be required. These mitigation measures are expected to be as follows:
    - The building(s) must be photographically recorded and described.
    - All the buildings must be recorded with as-built drawings: (a) floor plans; (b) elevations; (c) sections (d) and compiled into a report.
    - A public participation process would be required: (a) copies of advertisements in local papers; (b) photographs of site notices on fences and (c) copies of any comments and letters from interested and affected parties.

- A permit application must be lodged with the relevant heritage authority to allow for the disturbance / destruction of these buildings.

9.2.4 Mitigation Measures required for MCWAP Site 8

In this section, the required mitigation measures for MCWAP Site 8 will be outlined.

- An archaeological watching brief must be implemented during the construction phase. This watching brief is aimed at monitoring the construction and excavation work for any subterranean archaeological deposits and features which may be exposed during these development activities.
- The above-mentioned watching brief must be implemented for all construction work undertaken within 100m of the position of MCWAP Site 8.

9.2.5 Mitigation Measures required for MCWAP Site 9 and MCWAP Site 10

In this section, the required mitigation measures for MCWAP Site 9 and MCWAP Site 10 will be outlined. The following mitigation measures would be required:

- The site must be recorded with photographs and a layout plan.
- A permit application must be lodged with the South African Heritage Resources Agency (SAHRA) to allow for the subsequent mitigation measures to be implemented.
- Once the permit is received, archaeological mitigation of the site can be undertaken. Such archaeological mitigation may include Surface Collection, Shovel Test Pits (STP's) and archaeological excavation. These techniques will be used to further assess and interpret the site.
- A Phase 2 Archaeological Mitigation report must be compiled.
- The abovementioned report and destruction permit application must be lodged with the South African Heritage Resources Agency (SAHRA).
- The mitigation proposed here may only be undertaken under the auspices of a suitably qualified and experienced archaeologist.

9.2.6 Mitigation Measures required for MCWAP Site 14

In this section, the required mitigation measures for MCWAP Site 14 will be outlined.

The following initial mitigation measure is required:

- A social consultation process to assess whether any local residents or the wider public is aware of the presence of graves here.

Depending on the outcome of the social consultation process, three different outcomes would be the result, namely:

- Outcome 1: The social consultation absolutely confirms that no graves are located here.
- Outcome 2: The social consultation absolutely confirms that graves are located here.
- Outcome 3: The social consultation does not yield any confident results.

The following mitigation measures would be required for sites falling under Outcome 1:

- No further mitigation would be required.

The following mitigation measures would be required for sites falling under Outcome 2:

- A grave relocation process must be undertaken.
- A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation.
- Bilingual site and newspaper notices indicating the intent of the relocation.
- Permits from all the relevant and legally required authorities.
- An exhumation process that keeps the dignity of the remains and family intact.
- An exhumation process that will safeguard the legal rights of the families as well as that of the mining company.
- The process must be done by a reputable company well versed in the mitigation of graves.

The following mitigation measures would be required for sites falling under Outcome 3:

- Test excavations to physically confirm the presence or absence graves.
- If no evidence for graves are found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required.
- If evidence for stillborn babies are found, the site will fall within Outcome 2 as outlined above. This means that a full grave relocation process must be implemented.

Additionally, the following mitigation measures must be undertaken:

- The site layout must be recorded using standard survey methods and/or measured drawings. The end result would be a site layout plan.
- A mitigation report must be compiled within which all the mitigation measures and its findings will be outlined. The recorded drawings from the previous item must also be included in this mitigation report.
- The completed mitigation report must be submitted to the relevant heritage authorities.

9.2.7 Mitigation Measures required for MCWAP Site 17

In this section, the required mitigation measures for MCWAP Site 17 will be outlined. The following mitigation measures are required:

- The landowner of the property on which this site is located, must be consulted to establish the exact function, origin and meaning of the site.
- Depending on the results of the consultation with the relevant landowner, further mitigation measures may be deemed necessary.

10 CONCLUSIONS AND RECOMMENDATIONS

Introduction

PGS Heritage (Pty) Ltd was appointed by Nemai Consulting (Pty) Ltd to undertake a Phase 1 Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) for the proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure and Borrow Pits, Limpopo Province.

General Desktop Study

An archival and historical desktop study was undertaken to provide a historic framework for the project area and surrounding landscape. This was augmented by a study of available historical and archival maps and an assessment of previous archaeological and heritage studies completed for the area. The desktop study revealed that the surroundings of the study area is characterised by a long and significant history, whereas previous archaeological and heritage studies from this area have revealed a number of archaeological and heritage sites.

Palaeontology

Ms. Elize Butler of Banzai Consulting was commissioned to undertake a paleontological desktop study for the proposed MCWAP-2A development (refer **Appendix C**). Please note that at the time that this study was undertaken, Alternative D4 did not yet exist. As a result, this palaeontological study did not assess Alternative D4.

She found that the proposed Mokolo Crocodile River (West) Water Augmentation Project is underlain by various geological sediments. The table below indicates these geological sediments as well as their respective palaeontological sensitivities.

Table 33 – Geological sediments underlying the project area

Era	Supergroup/Sequence	Group	Subgroup	Formation	Sensitivity
Mokolien		Waterberg	Kransberg		Low
			Matlabas		
			Nylstroom		
Vaalian	Bushveld Complex; Lebowa Granite Suite				Zero
	Transvaal Supergroup	Pretoria		Black Reef	Moderate
		Chuniespoort	Malmani		High
Randian		Buffelsfontein			Moderate

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a **high Palaeontological sensitivity**. The proposed development of the central pipe line is underlain by the Malmani Subgroup development and thus has a high palaeontological sensitivity. It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site

visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

Fieldwork

The field assessment of the largest portion of the proposed pipeline routes were undertaken by driving along the adjacent and available roads, including the track running along the railway line servitiude. A concerted effort was made to conduct walkthroughs of those sections of the pipeline footprints not accessible by road. Furthermore, and whenever possible, all potential heritage sites identified during the assessment of the historic maps and SAHRIS were also visited in the field. Additionally, with the exception of a few areas defined in Section 3.1 that were not covered, all the non-pipeline footprints (i.e. borrow pits, construction camps etc.) were assessed by way of intensive walkthroughs.

A total of 18 archaeological and heritage sites were identified during the fieldwork. These were numbered from MCWAP Site 1 to MCWAP Site 18. These identified sites included the following:

- Five black homesteads where the potential risk for the presence of unmarked stillborn graves exist. See MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16

- Five sites containing confirmed graves and possible graves. See MCWAP Site 2, MCWAP Site 4, MCWAP Site 7, MCWAP Site 13 and MCWAP Site 14.

- Three historic farmsteads which are older than 60 years. See MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15.

- Two Stone Age sites. See MCWAP Site 8 and MCWAP Site 18.

- Two metalworking sites associated with the Iron Age. See MCWAP Site 9 and MCWAP Site 10.

- Memorial where cremated ash may have been placed. See MCWAP Site 17.

Impact risk assessments were undertaken to calculate the impact risk of the proposed development on these identified heritage sites.

General Recommendations

The following general mitigation measures are required:

- Whenever possible, all heritage sites identified during this study with a significance of Medium and higher, must be preserved *in situ* by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprints and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required (refer **Section 9.2**).

- All those areas that could not be accessed during the fieldwork, must be assessed in the field by a heritage specialist / archaeologist before construction commences. These areas were not assessed in the field due to a number of reasons, including cases where the landowners were not willing to provide permission to any of the project consultants to undertake fieldwork on their land, cases where landowners did not respond to messages requesting access to their properties, development footprints and properties for which no landowner details were provided as well as those areas that were not assessed in the field due to the temporal and budget restrictions. Refer **Section 1.3** for a detailed list of all the components of the study area that could not be accessed during the fieldwork.

- The archaeological research assessment of the Motlhabatsi (Matlabas) drainage basin that was undertaken by Jan Aukema for his masters degree from the University of the Witwatersrand, revealed a substantial number of sites. The proposed Central Pipeline Route passes through a section of the Matlabas drainage basin that represented the area of study for Jan Aukema's archaeological research. As the exact coordinates and site localities for the numerous archaeological sites identified by Aukema are not presently available, it is very difficult to accurately establish the distances between the closest of Aukema's archaeological sites and present study area. From the site distribution map published by Huffman (1990:118), it would appear that the following sites are located closest to the present study area: Wn1 on the farm Welgevonden, Ho1 on the farm Haarlem Oost and Gr1 on the farm Groenrivier. It is recommended that all components of the proposed development footprints must be assessed in the field by way of walkthroughs undertaken by a heritage specialist / archaeologist before construction commences.

- Although significant sections of the pipeline footprints were assessed by vehicle along the railway and road servitudes, the landscape within which this development is proposed is not characterised by a plethora of archaeological and heritage sites. This statement is supported by the fact that although an intensive field assessment was undertaken, which included walkthroughs of almost all the non-pipeline development footprints (i.e. borrow pits, construction camps etc.), only 18 heritage sites could be identified across the entire length of the proposed development footprint which extends over an area in excess of 150km. As a result, it is not deemed necessary for additional walkthroughs to be undertaken apart from the ones required for those areas which were not included in the

current fieldwork (see previous bullet item) and the ones required by the previous General Recommendation in proximity to the Matlabas River. Rather, it is recommended that an archaeological and heritage workshop be conducted with the project Environmental Control Officer (ECO) before construction commences to allow the ECO to undertake constant monitoring of construction activities and identify any archaeological and heritage sites which may be located along the pipeline route and which were not identified during the current fieldwork. Additionally, an archaeological watching brief can augment the work of the ECO during construction.

- An assessment of the South African Heritage Resources Information System (SAHRIS) of SAHRA was undertaken to establish whether any previous archaeological and heritage impact assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints. One of these previous reports from the immediate surroundings of the study area identified a cemetery containing four graves located approximately 65m north-west of proposed Borrow Pit 13-14, and 55m south-west of the access road to this borrow pit. The coordinates for this site are as follows: S 23.711420 E 27.497340. Due to the closeness of this cemetery to this borrow pit, the construction team and Environmental Control Officer must be made aware of the position of this site to ensure that it is not disturbed or damaged during construction.

- It is important to note that the impact assessment risk calculations undertaken for the identified heritage sites are based on the current layout of the proposed pipeline and its alternatives. Should the position and layout of any of the footprints change, the impact assessment calculations will have to be modified.

Conclusions

On the condition that the general recommendations are adhered to, and in cognisance of the assumptions and limitations, no heritage reasons can be given for the development not to continue.

11 REFERENCES

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11.3 Historical Topographic Maps

All the historic topographical maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

11.4 Internet

www.angloboerwar.com

www.sahistory.org.za

www.wikipedia.org

Appendix A

Legislative Requirements – Terminology and Assessment Criteria

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation -

i. NEMA;
ii. National Heritage Resources Act (NHRA) Act 25 of 1999; and
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002.

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. GNR 982 of 2014 (Government Gazette 38282) promulgated under the NEMA:
    a) Basic Assessment Report (BAR) – Regulations 19 and 23
    b) Environmental Scoping Report (ESR) – Regulation 21
    c) Environmental Impacts Report (EIR) – Regulation 23
    d) EMPr – Regulations 19 and 23
ii. NHRA:
    a) Protection of Heritage Resources – Sections 34 to 36; and
    b) Heritage Resources Management – Section 38
iii. MPRDA Regulations of 2014:
    a) Environmental reports to be compiled for application of mining right – Regulation 48.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34 (1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…”. The NEMA (Act No 107 of 1998) states that an integrated EMP should, (23 -2 (b)) “…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”. In accordance with legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and the Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive legally compatible HIA report is compiled.

Appendix B

Project team CV's

POLKE DOUSSY BIRKHOLTZ

Professional Heritage Specialist / Professional Archaeologist / Director PGS Heritage

Name: *Polke Doussy Birkholtz*

Date & Place of Birth: *9 February 1975 – Klerksdorp, North West Province, South Africa*

Place of Tertiary Education & Dates Associated:

Institution: University of Pretoria
Qualification: BA (Cum Laude) - Bachelor of Arts Degree Specializing in Archaeology, History and Anthropology
Date: 1996

Institution: University of Pretoria
Qualification: BA Hons (Cum Laude) - Bachelor of Arts with Honours Degree Specializing in Archaeology
Date: 1997

Institution: National College of Photography
Qualification: Photography
Date: 1998

Qualifications:

BA	-	Degree specialising in Archaeology, History and Anthropology
BA Hons	-	Professional Archaeologist

Memberships:

Association of Southern African Professional Archaeologists (ASAPA)
Professional Member of the CRM Section of ASAPA

Overview of Post Graduate Experience:

1997 – 2000 – Member/Archaeologist – Archaeo-Info
2001 – 2003 – Archaeologist/Heritage Specialist – Helio Alliance
2000 – 2008 – Member/Archaeologist/Heritage Specialist – Archaeology Africa
2003 - Present – Director / Archaeologist / Heritage Specialist – PGS Heritage

Languages: English: Speak, Read & Write & Afrikaans: Speak, Read & Write

Total Years' Experience: 18 Years

Conference Papers:

- *Taking Small Steps in Augrabies Falls National Park. With Nico Schwartz and Lynne Simpson. South African National Parks: Towards Best Practice. Communities and Conservation. 15 – 19 May 2000. Berg en Dal Rest Camp, Kruger National Park.*

Books:

- *The Story of Voorspoed: A Historical and Archaeological appraisal of the Voorspoed Diamond Mining Company Limited (1906 -1912). Book written by Polke Birkholtz for De Beers Consolidated Mines.*

Experience Related to the Scope of Work:

- Polke has worked as a **HERITAGE SPECIALIST / ARCHAEOLOGIST / HISTORIAN** on more than 300 projects, and acted as **PROJECT MANAGER** on almost all of these projects. His experience include the following:

    - Development of New Sedimentation and Flocculation Tanks at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Greenline*.
    - EThekwini Northern Aqueduct Project, Durban, KwaZulu-Natal. Heritage Impact Assessment for *Strategic Environmental Focus*.
    - Johannesburg Union Observatory, Johannesburg, Gauteng Province. Heritage Inventory for *Holm Jordaan*.
    - Development at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Aurecon*.
    - Comet Ext. 8 Development, Boksburg, Gauteng Province. Phase 2 Heritage Impact Assessment for *Urban Dynamics*.
    - Randjesfontein Homestead, Midrand, Gauteng Province. Baseline Heritage Assessment with Nkosinathi Tomose for Johannesburg City Parks.
    - Rand Leases Ext. 13 Development, Roodepoort, Gauteng Province. Heritage Impact Assessment for *Marsh*.
    - Proposed Relocation of the Hillendale Heavy Minerals Plant (HHMP) from Hillendale to Fairbreeze, KwaZulu-Natal. Heritage Impact Assessment for *Goslar Environmental*.
    - Portion 80 of the farm Eikenhof 323 IQ, Johannesburg, Gauteng Province. Heritage Inventory for *Khare Incorporated*.
    - Comet Ext. 14 Development, Boksburg, Gauteng Province. Heritage Impact Assessment for *Marsh*.
    - Rand Steam Laundries, Johannesburg, Gauteng Province. Archival and Historical Study for *Impendulo* and *Imperial Properties*.
    - Mine Waste Solutions, near Klerksdorp, North West Province. Heritage Inventory for *AngloGold Ashanti*.
    - Consolidated EIA and EMP for the Kroondal and Marikana Mining Right Areas, North West Province. Heritage Impact Assessment for *Aquarius Platinum*.
    - Wilkoppies Shopping Mall, Klerksdorp, North West Province. Heritage Impact Assessment for *Centre for Environmental Management*.
    - Proposed Vosloorus Ext. 24, Vosloorus Ext. 41 and Vosloorus Ext. 43 Developments, Ekurhuleni District Municipality, Gauteng Province. Heritage Impact Assessment for *Enkanyini Projects*.
    - Proposed Development of Portions 3, 6, 7 and 9 of the farm Olievenhoutbosch 389 JR, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Marsh*.
    - Proposed Development of Lotus Gardens Ext. 18 to 27, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Pierre Joubert*.
    - Proposed Development of the site of the old Vereeniging Hospital, Vereeniging, Gauteng Province. Heritage Scoping Assessment for *Lekwa*.
    - Proposed Demolition of an Old Building, Kroonstad, Free State Province. Phase 2 Heritage Impact Assessment for *De Beers Consolidated Mines*.
    - Proposed Development at Westdene Dam, Johannesburg, Gauteng Province. Heritage Impact Assessment for *Newtown*.

- West End, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Kathu Supplier Park, Kathu, Northern Cape Province. Heritage Impact Assessment for *Synergistics*.
- Matlosana 132 kV Line and Substation, Stilfontein, North West Province. Heritage Impact Assessment for *Anglo Saxon Group* and *Eskom*.
- Marakele National Park, Thabazimbi, Limpopo Province. Cultural Resources Management Plan for *SANParks*.
- Cullinan Diamond Mine, Cullinan, Gauteng Province. Heritage Inventory for *Petra Diamonds*.
- Highveld Mushrooms Project, Pretoria, Gauteng Province. Heritage Impact Assessment for *Mills & Otten*.
- Development at the Reserve Bank Governor's Residence, Pretoria, Gauteng Province. Archaeological Excavations and Mitigation for the *South African Reserve Bank*.
- Proposed Stones & Stones Recycling Plant, Johannesburg, Gauteng Province. Heritage Scoping Report for *KV3*.
- South East Vertical Shaft Section of ERPM, Boksburg, Gauteng Province. Heritage Scoping Report for *East Rand Proprietary Mines*.
- Soshanguve Bulk Water Replacement Project, Soshanguve, Gauteng Province. Heritage Impact Assessment for *KWP*.
- Biodiversity, Conservation and Participatory Development Project, Swaziland. Archaeological Component for *Africon*.
- Camdeboo National Park, Graaff-Reinet, Eastern Cape Province. Cultural Resources Management Plan for *SANParks*.
- Main Place, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Modderfontein Mine, Springs, Gauteng Province. Detailed Archival and Historical Study for *Consolidated Modderfontein Mines.*
- Proposed New Head Office for the Department of Foreign Affairs, Pretoria, Gauteng Province. Heritage Impact Assessment for *Holm Jordaan Group*.
- Proposed Modification of the Lukasrand Tower, Pretoria, Gauteng Province. Heritage Assessment for IEPM.
- Proposed Road between the Noupoort CBD and Kwazamukolo, Northern Cape Province. Heritage Impact Assessment for *Gill & Associates*.
- Proposed Development at the Johannesburg Zoological Gardens, Johannesburg, Gauteng Province. Detailed Archival and Historical Study for *Matakoma.*

- Polke's **KEY QUALIFICATIONS:**

  - Project Management
  - Archaeological and Heritage Management
  - Archaeological and Heritage Impact Assessment
  - Archaeological and Heritage Fieldwork
  - Archival and Historical Research
  - Report Writing

- Polke's **INFORMATION TECHNOLOGY EXPERIENCE:**

  - *MS Office – Word, Excel, & Powerpoint*
  - *Google Earth*
  - *Garmin Mapsource*
  - *Adobe Photoshop*
  - *Corel Draw*

I, Polke Doussy Birkholtz, hereby confirm that the above information contained in my CV is true and correct.

PD Birkholtz

1 December 2017
Date

Appendix C

Palaeontological Desktop Study

PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED MOKOLO AND CROCODILE RIVER (WEST) WATER AUGMENTATION PROJECT (PHASE 2A) (MCWAP-2A): WATER TRANSFER INFRASTRUCTURE

Issue Date: 1 July 2018
Revision No.: 0.1
Client: Nemai Consulting
PGS Project No:

PGS HERITAGE
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Offices in South Africa, Kingdom of Lesotho and Mozambique

Head Office:
906 Bergarend Streets
Waverley, Pretoria,
South Africa

Directors: HS Steyn, PD Birkholtz, W Fourie

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: 

ACKNOWLEDGEMENT OF RECEIPT

Report Title	**Palaeontological Desktop Assessment of the Proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2a) (Mcwap-2a):** Water Transfer Infrastructure		
Control	**Name**	**Signature**	**Designation**
Author	Elize Butler		Palaeontologist
Reviewed			Principal Heritage Specialists – PGS Heritage
Client			Nemai

CLIENT: **Nemai Consulting**

CONTACT PERSON:

SIGNATURE: _____

The palaeontological desktop assessment report has been compiled taking into account the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

NEMA Regs (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Page 2 of Report – Contact details and company
The expertise of that person to compile a specialist report including a curriculum vita	Section 2
A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 6
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
An identification of any areas to be avoided, including buffers	Section 6
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;	No sensitive areas identified refer to **Error! Reference source not found.**
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6
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 7
Any mitigation measures for inclusion in the EMPr	Section 8
Any conditions for inclusion in the environmental authorisation	Section 8
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 8
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	
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable.
A summary and copies if any comments that were received during any consultation process	Not applicable.
Any other information requested by the competent authority.	Not applicable.

EXECUTIVE SUMMARY

Nemai Consulting was employed by Department of Water and Sanitation (DWS) and Trans-Caledon Tunnel Authority (TCTA) (implementing agent) as the independent EAP to undertake the environmental assessment for the proposed MCWAP-2A WTI. In turn Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Desktop Assessment Report for the proposed Mokolo and Crocodile River (West) Water Augmentation Project. According to the National Heritage Resources Act (No 25 of 1999, section 38), a palaeontological impact assessment is key to detect the presence of fossil material within the proposed development footprint and it is thus necessary to evaluate the impact of the construction on the palaeontological resources.

The proposed Mokolo Crocodile River (West) Water Augmentation Project is underlain by various geological sediments namely:

- Mokolien Era, Waterberg Group, Kransberg Subgroup,
  Matlabsa Subgroup,
  Nylstroom Subgroup

  With a Low Palaeontological sensitivity
- Bushveld complex; Lebowa Granite Suite unfossiliferous
- Transvaal Supergroup Pretoria Group Black Reef Formation
  - Buffelsfontein Group

  With a Moderate Palaeontological Sensitivity

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and

reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a **high Palaeontological sensitivity**. The proposed development of the central pipe line is underlain by the Malmani Subgroup development and thus has a high palaeontological sensitivity. It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

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TERMINOLOGY AND ABBREVIATIONS

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MTS	Main Transmission Substation
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

Substantial developments are scheduled for the Waterberg coalfields (Lephalale region, Limpopo Province) which will increase the demand for water significantly. Due to the scarcity of water in the Lephalale area, the Department of Water and Sanitation compiled a feasibility study of the Mokolo Crocodile River (West), which was completed in 2010. The Water Augmentation Project was conducted to establish how the future water demands could be met. The project was divided into the following phases:

- Mokolo Crocodile River (West) Water Augmentation Project Phase 1: Expand the supply from Mokolo Dam to provide in the growing water use requirement for the short-term period until a transfer pipeline from the Crocodile River West can be implemented. Over the long term the solution must optimally utilise the full yield from Mokolo Dam and will be operated as a system together with Mokolo Crocodile River (West) Water Augmentation Project Phase 2A. Phase 1 has been operational since June 2015.
- Mokolo Crocodile River (West) Water Augmentation Project Phase 2A: The removal of water from the Crocodile River (West) to the Steenbokpan and Lephalale regions, as well as the implementation of the River Management System in the Crocodile River (West) and its branches. **Phase 2A is the focus of this Environmental Impact Assessment.** The overall Mokolo Crocodile River (West) Water Augmentation Project Phase 2A comprises of the following components:
    - Water Transfer Infrastructure - transfer of water from Crocodile River (West) to Lephalale;
    - Borrow Pits - sourcing of construction material; and
    - River Management System - manage abstractions from, and the river flow in, the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Weir, the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West), the stretch of Elands River from Vaalkop Dam to Crocodile confluence, and also the required flow past Vlieëpoort.

1.1 Project Description

The most important scheme components for the proposed Water Transfer Infrastructure include:
Vlieëpoort Abstraction Weir on the Crocodile River (West);

- Low-lift Pumping Station;
- Low-lift Rising Main (2 pipes);
- Sedimentation Works;
- Balancing Reservoir;
- High-lift Pumping Station;
- High-lift Rising Main to Break Pressure Reservoir;
- Break Pressure Reservoir;

- Gravity Pipeline from Break Pressure Reservoir to Operational Reservoir;
- Operational Reservoir;
- Gravity pipeline from Operational Reservoir to Medupi Tee-off via Steenbokpan; and
- Auxiliary infrastructure (gauging weirs, River Management System, access roads, accommodation, offices, workshops and security measures).

ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Alternatives include the following:

Alternative water resources -

- Ground water;
- Re-use of effluent in the project area;
- Mokolo Dam;
- Crocodile water;
- Return flows in Crocodile River (West) and Vaal River Catchments;
- Creating more storage by raising of existing dams and/or building new dams;
- Abstraction point at Faure Weir; and
- Water transfer from rivers beyond the borders of South Africa.

The alternatives to the project components that are further discussed in the Scoping Report include route options for the transfer and delivery systems.

As a standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives.

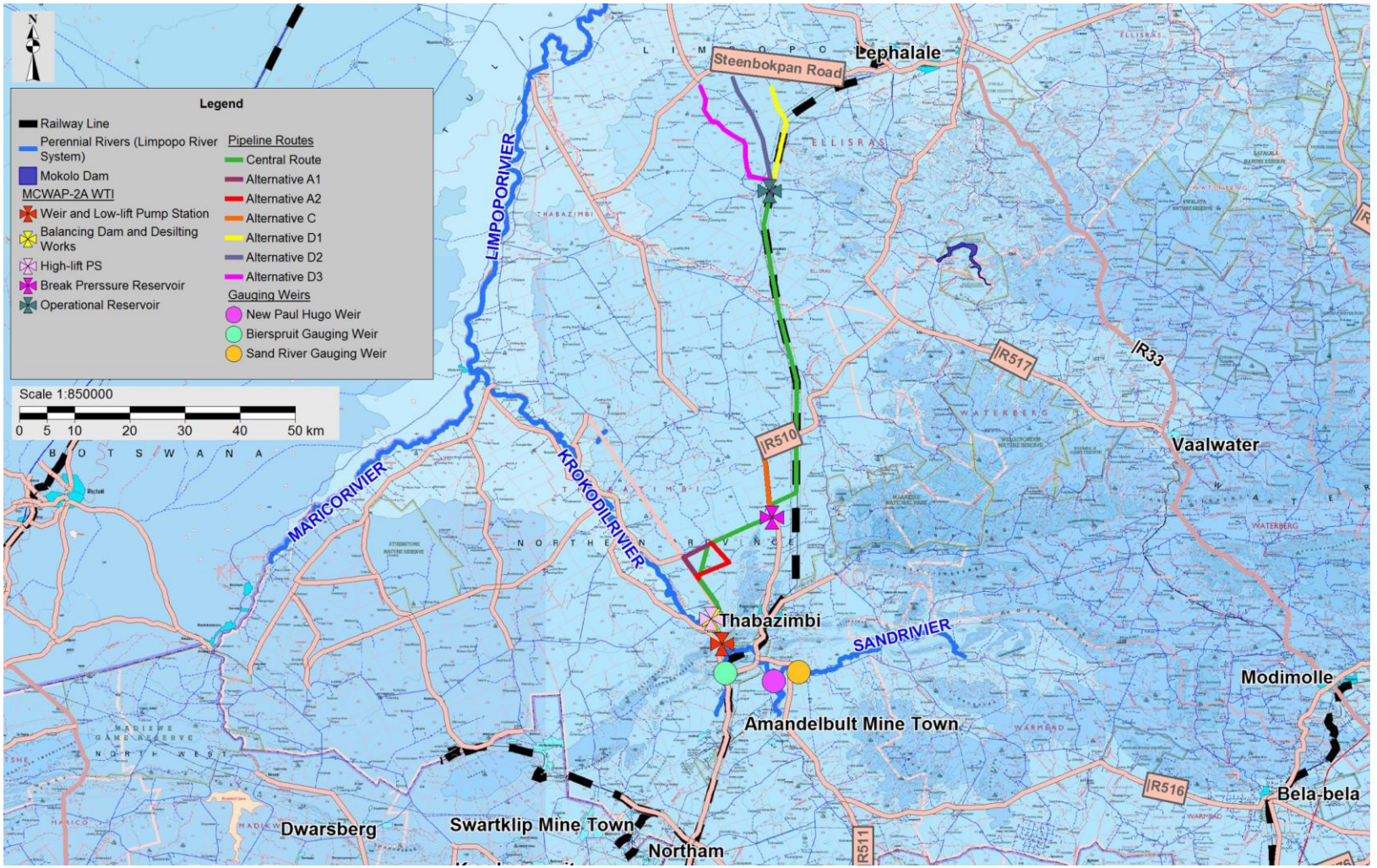

Figure 1: Locality map.

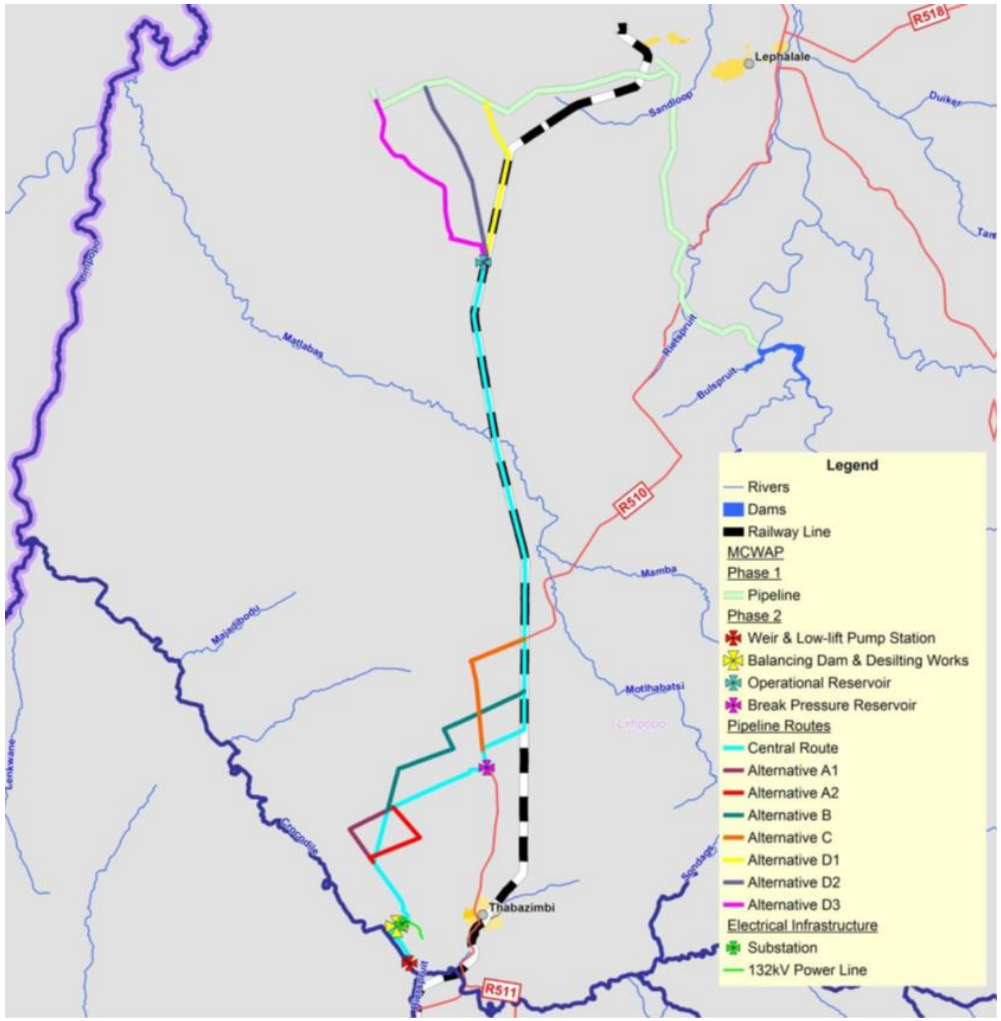

Figure 2: MGWAP phases 1 and 2.

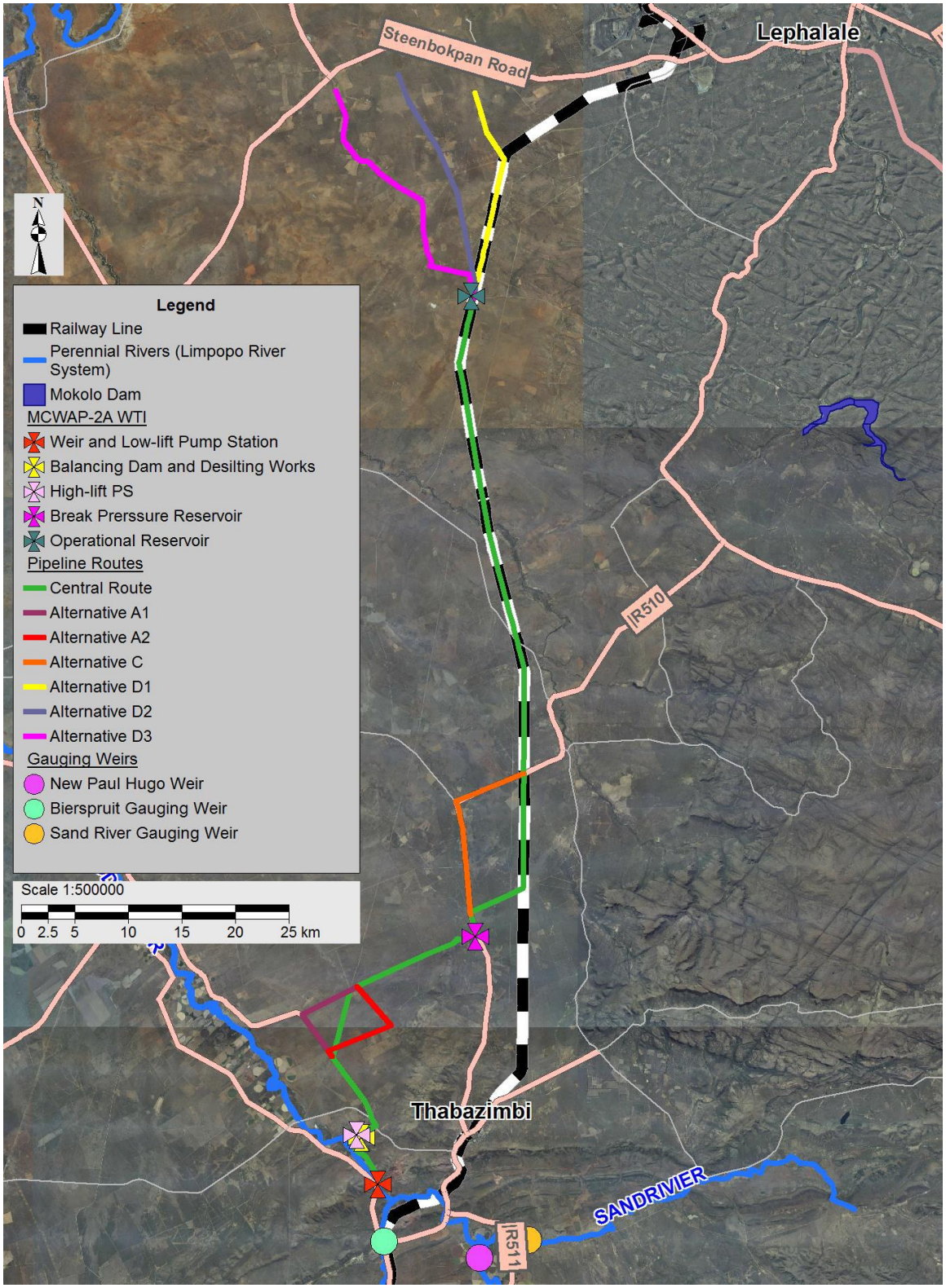

Figure 3. Orthophotograph of MCWAP-2A WTI.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 12 years. She has been conducting Palaeontological Impact Assessments since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, moved, broken or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Desktop Assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 OBJECTIVE

The objective of a Palaeontological Desktop Assessment is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are: 1) to identify the palaeontological importance of the exposed and subsurface rock formations in the development footprint 2) to evaluate the palaeontological importance of the formations 3) to determine the impact of the development on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

When a palaeontological desktop study is compiled, the potentially fossiliferous rocks (i.e. groups, formations, etc.) present within the study area are established from 1:250 000 geological maps. The topography of the development area is identified using 1:50 000 topography maps as well as Google Earth Images of the development area. Fossil heritage within each rock section is obtained from previous palaeontological impact studies in the same region, the PalaeoMap from SAHRIS; and databases of various institutions (identifying fossils found in locations specifically in areas close to the development area). The palaeontological importance of each rock unit of the development area is then calculated. The possible impact of the proposed development footprint on local fossil heritage is established on the following criteria: 1) the palaeontological importance of the rocks and 2) the type and scale of the development footprint and 3) quantity of bedrock excavated.

In the event that rocks of moderate to high palaeontological sensitivity are present within the study area, a field-based assessment by a professional palaeontologist is required. Based on both the desktop data and field examination of the rock exposures, the impact significance of the planned development is measured with recommendations for any further studies or mitigation. In general, destructive impacts on palaeontological heritage only occur during construction. The excavations will transform the current topography and may destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

Mitigation comprises the sampling, collection and recording of fossils and may precede construction or, more ideally, occur during construction when potentially fossiliferous bedrock is exposed. Preceding the excavation of any fossil heritage a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact is possible because our knowledge of local palaeontological heritage may be increased.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

Table 1: Geological and Palaeontological History.

Era	Supergroup/Sequence	Group	Subgroup	Formation	Fossil Heitage	Geology	Sensitivity
Mokolien		Waterberg	Kransberg		Terrestrial cyanobacteria Playa depsits	Continental “red beds” - mainly braided stream deposits (sand beach, tidal flat, lacustrine, aeolian and probable marine shelf sediments stones, conglomerates with minor mudrocks),	Low
			Matlabsa				
			Nylstroom	Alma			
	Bushveld Magnetic Province Lebowa Ganite				Unfossiliferous	Intrusive igneous rocks	Very Low
	Transvaal	Pretoria		Black Reef	Possible stromatolitic carbonates	Siliciclastic sediments (mature sandstones plus minor mudrocks, conglomerates) deposited during a fluvial to shallow marine transition	Moderate
		Chuniespoort	Malmani		Stromatolithic carbonates, organic walled microfossils	Minor secondary cherts, mudrocks and carbonaceous shale, limestone quartzite	High
		Buffelsfontein			Stromatolites described from near Thabazimbi	Basic volcanic rocks and subordinate sedimentary rocks	Moderate

Figure 4. Example of a well-preserved stromatolite.

Stromatolites (**Figure 4**) are layered mounds, columns and sheet-like sedimentary rocks. Originally, they were formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

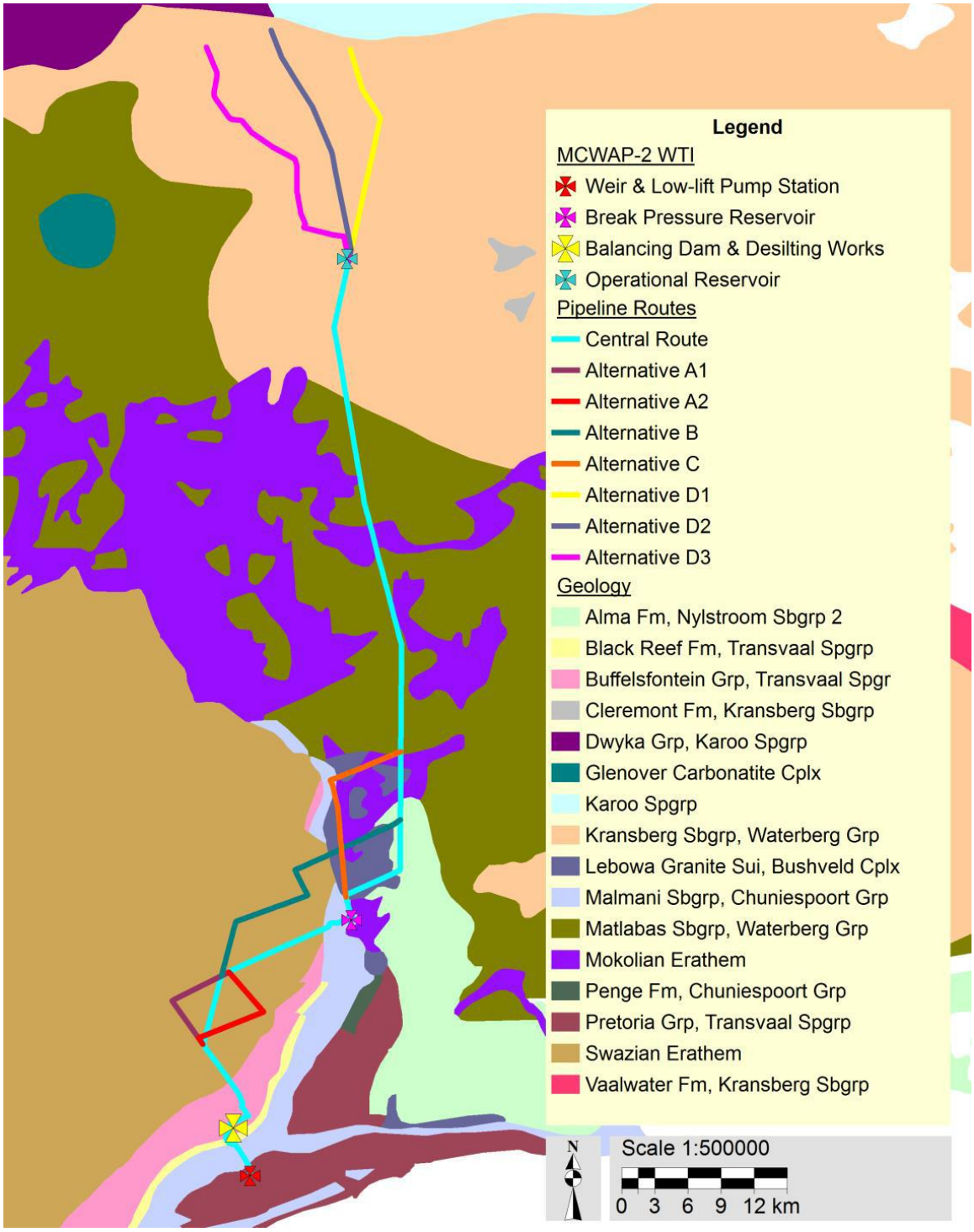

Figure 5. Simplified Geology of the proposed development area. (Map obtained from Scoping Report).

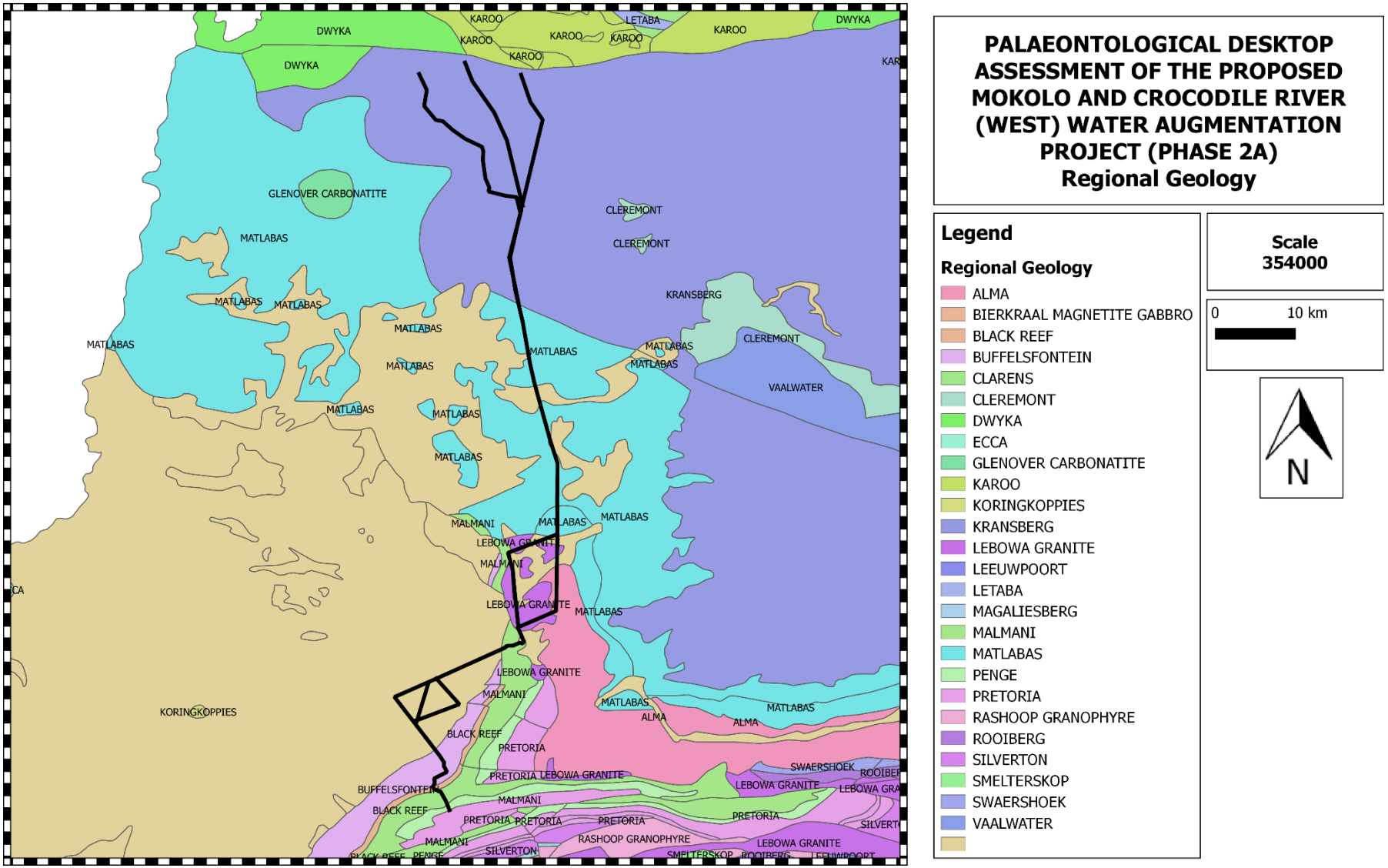

Figure 6. The surface geology of the proposed Mokolo and Crocodile River (west) Water Augmentation Project

Map drawn QGIS Desktop 2.18.14.

6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed project is located within the western part of the Limpopo Province. Infrastructure of the project is generally located on privately-owned properties, which are used for agricultural and game-farming. The footprint of the proposed Water transfer Infrastructure crosses the Thabazimbi Local Municipality and Lephalale Local Municipality, which is located within the Waterberg District Municipality.

The proposed pipeline route begins at the weir site in the Crocodile River (Vlieëpoort Mountains) in the south-western area of the project area From there it runs generally in a northern direction along existing roads, farm boundaries and a railway line, until it reached its destination near Steenbokpan. Thabazimbi is located approximately 10 km to the north-east of the Vlieëpoort weir site while Lephalale is located approximately 30 km to the east of the Alternative D1 pipeline route's terminal point.

6.1 Methods

A Palaeontological desktop study was conducted to assess the potential risk to palaeontological material (fossil and trace fossils) in the proposed area of development. The author's experience, aerial photos (using Google, 2018), topographical and geological maps and other reports from the same area were used to assess the proposed area of the development. No consultations were undertaken for this PIA.

6.2 Assumptions and Limitations

The accurateness of Palaeontological Desktop Impact Assessments is reduced by old fossil databases that do not always include relevant locality or geological formations. The geology in various remote areas of South Africa may be less accurate because it is based entirely on aerial photographs. The accuracy of the sheet explanations for geological maps is inadequate as the focus was never intended to be on palaeontological material.

The entire South Africa has not been studied palaeontologically. Similar Assemblage Zones but in different areas, might provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations generally assume that unexposed fossil heritage is present within the development area. Thus, the accuracy of the Palaeontological Impact Assessment is improved by a field-survey.

6.3 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors, along with the equivalent quantitative rating scale for each of the aforementioned criteria, is given in **Table 2.**

Table 2: Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated site/ proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

6.3.1 Significance Assessment

The Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of an area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed, the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common.

A more detailed description of the impact significance rating scale is given in **Table 3** below.

Table 3: Description of the significance rating scale

RATING	DESCRIPTION

5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

6.3.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in the table below.

Table 4: Description of the Spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site.
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the site.

6.3.3 Temporal/Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal or duration scale is rated according to criteria set out in **Table .**

Table 5: Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium-term	The environmental impact identified will operate for the duration of life of the project.
4	Long-term	The environmental impact identified will operate beyond the life of operation of the project.
5	Permanent	The environmental impact will be permanent.

6.3.4 Degree of Probability

The probability, or likelihood, of an impact occurring will be described as shown in **Table** below.

Table 6: Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very likely
5	It's going to happen / has occurred

6.3.5 Degree of Certainty

As with all studies, it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used, as discussed in **Table .** The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 7: Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

6.3.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE}(4) + \textit{Spatial (2)} + \text{Temporal (5)})}{3} \times \frac{\text{Probability (4)}}{5}$$

An example of how this rating scale is applied is shown below:

Table 8: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	**Study Area**	**Permanent**	**Very likely**	**High**
Impact on heritage sites	4	2	5	4	2.93

Note: The significance, spatial and temporal scales are added to give a total of 11, which is divided by 3 to give a criterion rating of 3.67. The probability (4) is divided by 5 to give a probability rating of 0.8. The criteria rating of 3.67 is then multiplied by the probability rating (0,8) to give the final rating of 2.93

The impact risk is classified according to 5 classes as described in the table below.

Table 1: Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for heritage resources above, an impact rating of 2.9 will fall in the Impact Class 3, which will be considered to be a MODERATE impact.

7 FINDINGS

The proposed Mokolo Crocodile River (West) Water Augmentation Project is underlain by various geological sediments namely:

- Mokolien Era, Waterberg Group, Kransberg Subgroup,

Matlabsa Subgroup,
Nylstroom Subgroup

With a Low Palaeontological sensitivity

- Bushveld complex; Lebowa Granite Suite unfossiliferous
- Transvaal Supergroup Pretoria Group Black Reef Formation
- Buffelsfontein Group

With a Moderate Palaeontological Sensitivity

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a **high Palaeontological sensitivity**. The proposed development of the central pipe line is underlain by the Malmani Subgroup development and thus has a high palaeontological sensitivity. It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

Table 2: Impact rating on palaeontological resources

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Study Area	Permanent	Very likely	Moderate
Impact on palaeontology	4	2	5	4	2.93

8 RECOMMENDATIONS

It is thus recommended that an EIA level palaeontology report will be conducted to assess the value and prominence of fossils in the central pipe line development area and the effect of the proposed development on the palaeontological heritage. This consists of a Phase 1 field-based assessment by a professional palaeontologist. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

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