



Mpumalanga Department of Public Works, Roads and Transport (DPWRT)

**The Upgrading of Rural Access Road D281 between Volksrust and Daggakraal (17 Km) in
the Gert Sibande District of Mpumalanga Province**

Heritage Desktop Assessment

Issue Date: 19 April 2016

Revision No.: 2

Project No.: 123HIA

Declaration of Independence

The report has been compiled by PGS Heritage an appointed Heritage Specialist for NCC Environmental Services. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment Process which includes this Heritage Report.

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Report Title	Heritage Desktop Assessment for the Upgrading of Rural Access Road D281 between Volksrust and Daggakraal (17 Km) in the Gert Sibande District of Mpumalanga Province		
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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 2 of Report – Contact details and company
The expertise of that person to compile a specialist report including a curriculum vitae	Section 1.2– refer to Appendix F
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2 of the report
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4.1
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 4.1
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 3.2
An identification of any areas to be avoided, including buffers	Section 3.2
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;	Section 4.1
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3 page 12
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4.2 and Section 5
Any mitigation measures for inclusion in the EMPr	Section 6
Any conditions for inclusion in the environmental authorisation	Section 7
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 5 and 7
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 handled 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 not comments regarding heritage resources that require input from a specialist have been raised.
Any other information requested by the competent authority.	Not applicable.

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd (PGS) was appointed by NCC Environmental Services (Pty) Ltd (NCC) to undertake a Heritage Desktop Assessment (HDA) that forms part of the Environmental Management Plan (EMP) for the upgrading of Rural Access Road D281 between Volksrust and Daggakraal (17 Km) in the Gert Sibande District of Mpumalanga Province.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The archival work (**Section 3** of the report) has shown that the proposed road upgrade may impact on heritage resources present in the area. This has been confirmed through archival research and evaluation of aerial photography of the sites.

During the fieldwork (**Section 4** of the report) seven heritage features were identified of which **DGK001-004** can be assessed as a single cluster and **DGK005-DGK007** as separate entities.

DGK001-005 contain graves and vary between two graves (**DGK002** and **DGK003**), four to six each (**DGK001** and **DGK004**) and twelve graves at **DGK005**. The area around **DGK004** also contains numerous ruins of homestead foundations and stone built stock pens.

DGK006 is a formal fenced cemetery some 50 meters from the D281, while **DGK007** is the statue and monument dedicated to Dr. Pixley Ka-Isaka Seme one of the founding members of the African National Congress. The monument is some 90 meters to the west of the D281.

Evaluation of the possible impacts on the heritage resources (**Section 5** of the report) has shown that the impact on sites **DGK001-005** will most probably be *High* without the implementation of mitigation measures. The possible impacts envisaged on DGK006 and 007 were evaluated as being of *Medium* significance without mitigation measures.

Palaeontology

- It is therefore recommended that excavations into or disturbances of *in situ* Volksrust Formation sediments at Borrow Pit 1, 2 and 4, are accompanied by a palaeontological inspection at the earliest practicable opportunity during the construction phase of the development before fresh bedrock have the chance to weather or be otherwise damaged by further development.
- Alternatively, it is advised that, if possible, the borrow pit activities are purposely restricted to the palaeontologically insignificant dolerite outcrops that are located around Borrow Pit 1 at Oudenhoutskloof.

By implementing the proposed mitigation measures (**Section 6** of the report) the overall impact on the heritage resources can be reduced to a *Low* impact.

No heritage resources were identified at borrow pit area 4.

By implementing the proposed mitigation measures (**Section 6** of the report) the overall impact on the heritage resources can be reduced to a *Low* impact.

No heritage resources were identified at borrow pit area 4.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels. It follows that if the management measures outlined in this report are implemented there is no reason why the construction activity for the upgrade of the D281 should not be approved.

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1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by NCC Environmental Services (Pty) Ltd (NCC) to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Management Plan (EMP) for the upgrading of Rural Access Road D281 between Volksrust and Daggakraal (17 Km) in the Gert Sibande District of Mpumalanga 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 re-alignment areas. The HIA aims to inform the EMP 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 Heritage Impact Assessment Report was compiled by PGS Heritage (PGS).

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. Wouter Fourie, the Project Coordinator, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

Refer to **Appendix E** for CV.

1.3 Assumptions and Limitations

The aim of the assessment is to identify the possible types of heritage resources that might be present in the study area, as well as possible heritage sensitive areas for the locality of such resources.

Not detracting in any way from the fieldwork undertaken, it is necessary to realise that the heritage sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the 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.

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:

- i. National Environmental Management Act (NEMA) Act 107 of 1998
- ii. National Heritage Resources Act (NHRA) Act 25 of 1999
- 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 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998
 - a. Basic Assessment Report (BAR) – Regulations 19 and 23
 - b. Environmental Scoping Report (ESR) – Regulation 21
 - c. Environmental Impacts Assessment (EIA) – Regulation 23
 - d. Environmental Management Programme (EMPr) – Regulations 19 and 23
- ii. National Heritage Resources Act (NHRA) Act 25 of 1999
 - a. Protection of Heritage Resources – Sections 34 to 36; and
 - b. Heritage Resources Management – Section 38
- iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002

a. Section 39(3)

The NHRA (Act 25 of 1999) stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA (Act 25 of 1999) 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...” In addition, the NEMA (No 107 of 1998) and the GNR 982 (Government Gazette 38282, 14 December 2014) state that, “the objective of an environmental impact assessment process is to, ... identify the location of the development footprint within the preferred site ... focussing on the geographical, physical, biological, social, economic, cultural and heritage aspects of the environment” (GNR 982, Appendix 3(2)(c) emphasis added). In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive and legally compatible HIA report is compiled.

1.5 Terminology and Abbreviations

Archaeological resources

This includes:

- i. 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;
- ii. 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;
- iii. 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;
- iv. 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:

- i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- ii. carrying out any works on or over or under a place;
- iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- iv. constructing or putting up for display signs or boards;
- v. any change to the natural or existing condition or topography of land; and
- vi. 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 20 000 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 20 000-300 000 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.

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
HDA	Heritage Desktop Assessment
HIA	Heritage Impact Assessment
I&AP	Interested & 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

Refer to **Appendix C** for further discussions on heritage management and legislative frameworks

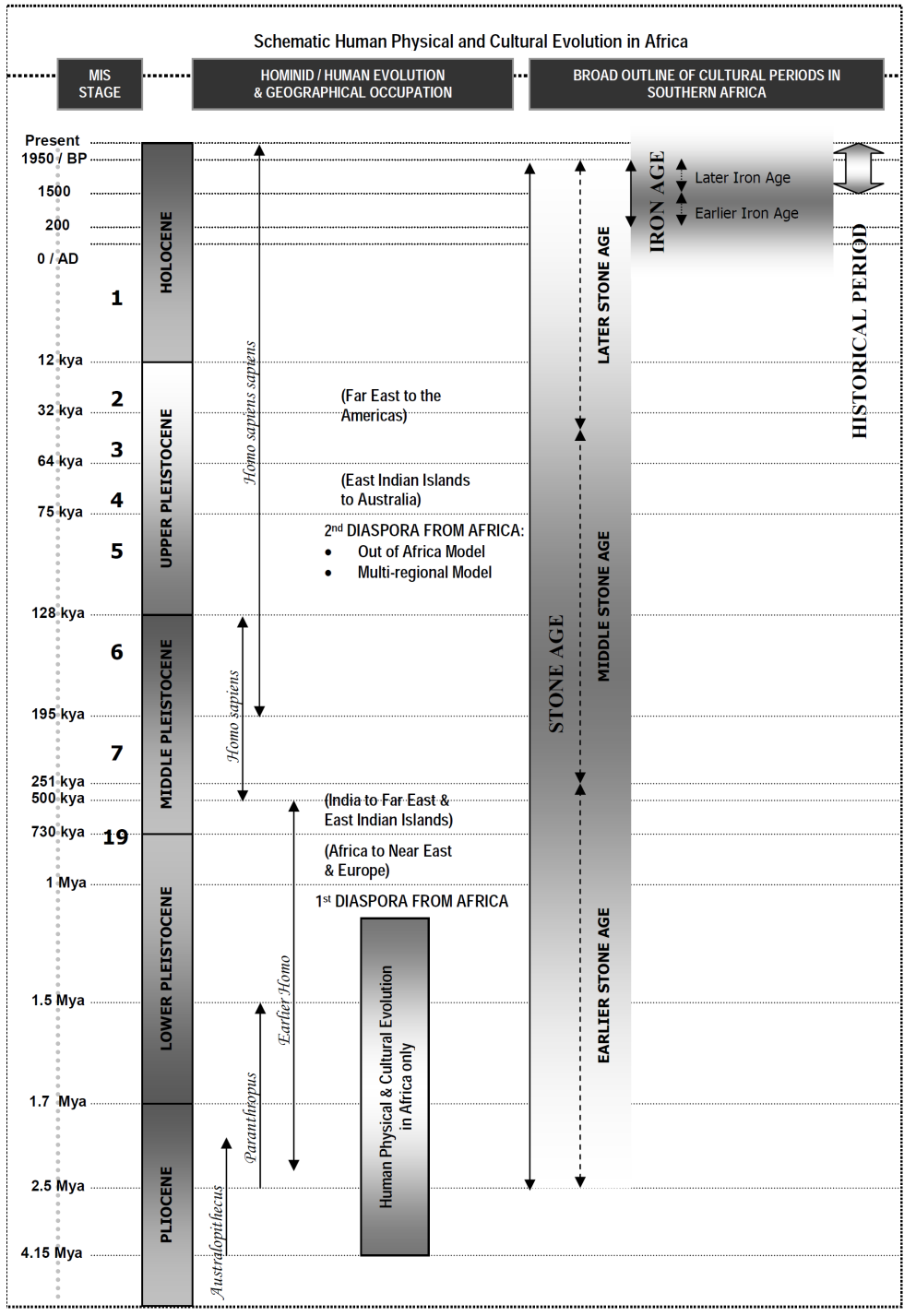


Figure 1 – Human and Cultural Time line in Africa (Morris 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Location	Coordinates: E29.93941,S27.16143
	The existing D281 between the Daggakraal Junction in the northern part of the Daggakraal to the connection with the N11 is an existing dirt road.
Land Description	The existing D281 between the Daggakraal Junction in the northern part of the Daggakraal to the connection with the N11 is an existing dirt road.



Figure 2 –Junction of D281 and N11 (southern end of D281)



Figure 3 – D281 close to northern most section of construction. Monument of Dr. Seme in background



Figure 4 – View of borrow pit 1, west of D281



Figure 5 – View of borrow pit 1, west of D281



Figure 6 – View of borrow pit area 2



Figure 7 – View of northern section of borrow pit area 2



Figure 8 – View of central section of D281



Figure 9 – Some of the homestead close to the D281 construction area



Figure 10 – Borrow pit area 4



Figure 11 – View of old borrow pit at borrow pit area 4

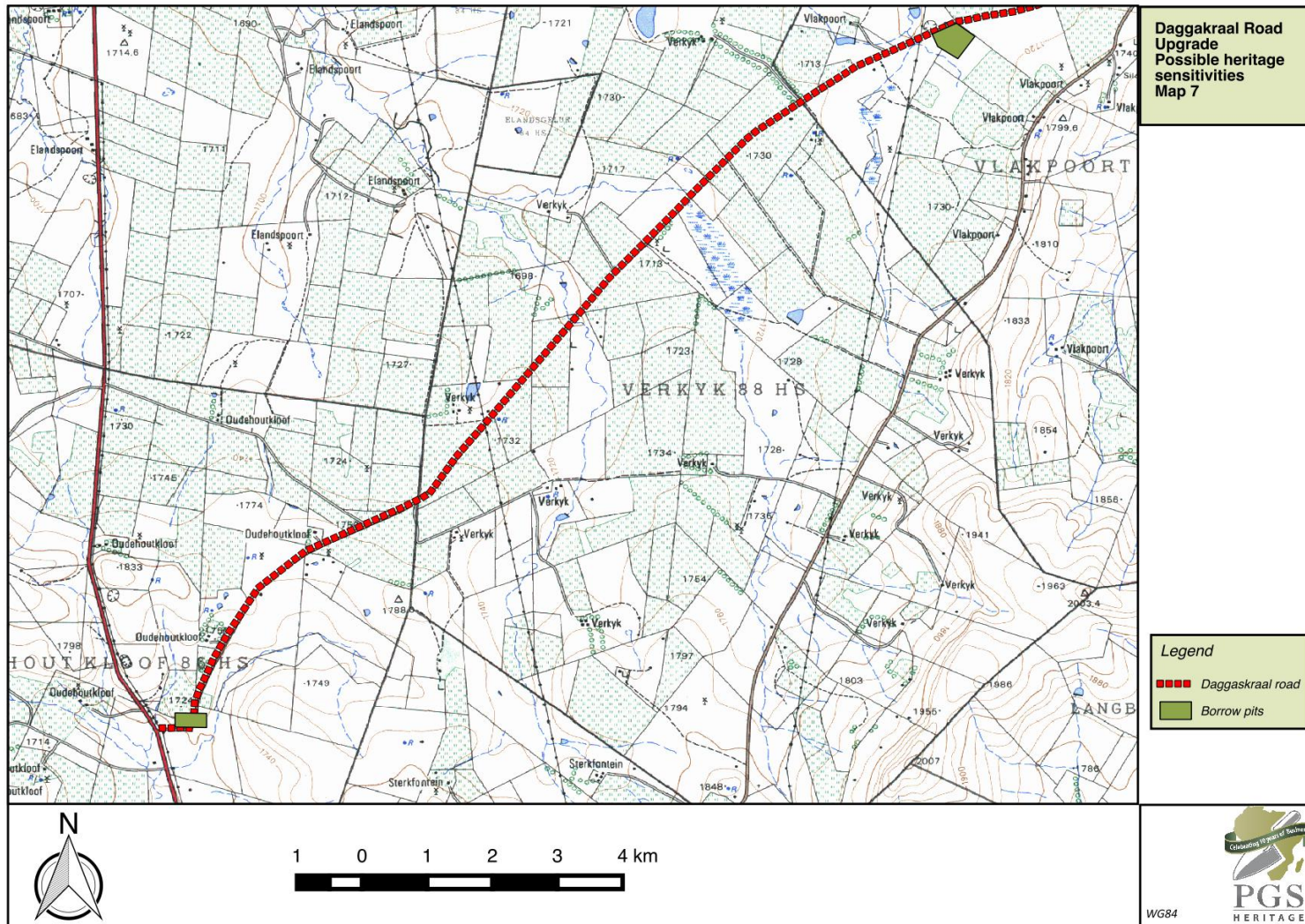
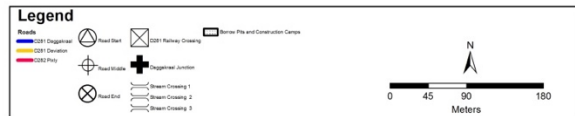
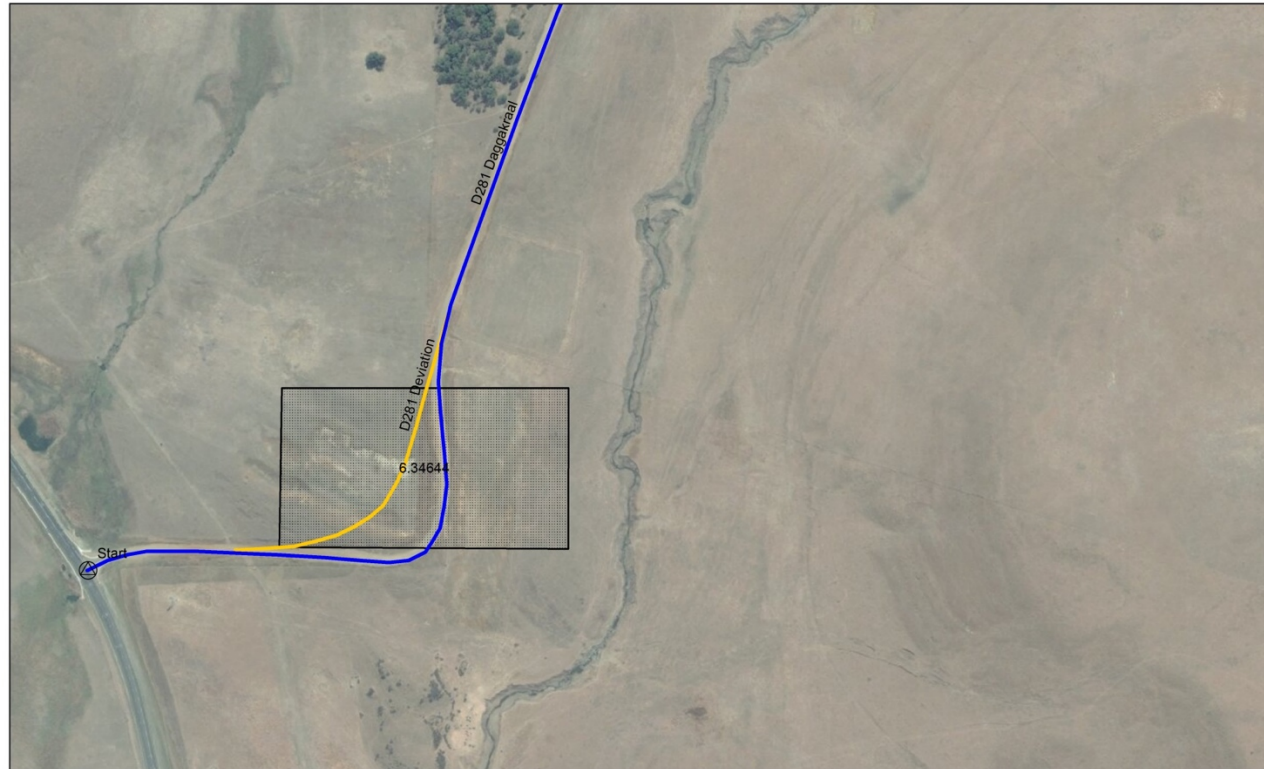


Figure 12 – Alignment of road to be upgraded as well as the position of the possible borrow pits

Daggakraal Proposed Road Expansion

Borrow Pit and Construction Camp One



Real growth for people, planet and business.
GIS and Cartography: NCC Environmental Services (Pty) Ltd

Figure 13 – Proposed borrow pit close to Volksrust N11 intersection

Daggakraal Proposed Road Expansion

Borrow Pit and Construction Camp Two



Real growth for people, planet and business.
GIS and Cartography: NCC Environmental Services (Pty) Ltd

Figure 14 – Proposed borrow pit on D281 road

Proposed Road Expansion, Daggakraal, Mpumalanga, South Africa
Borrow Pit & Construction Camp Four

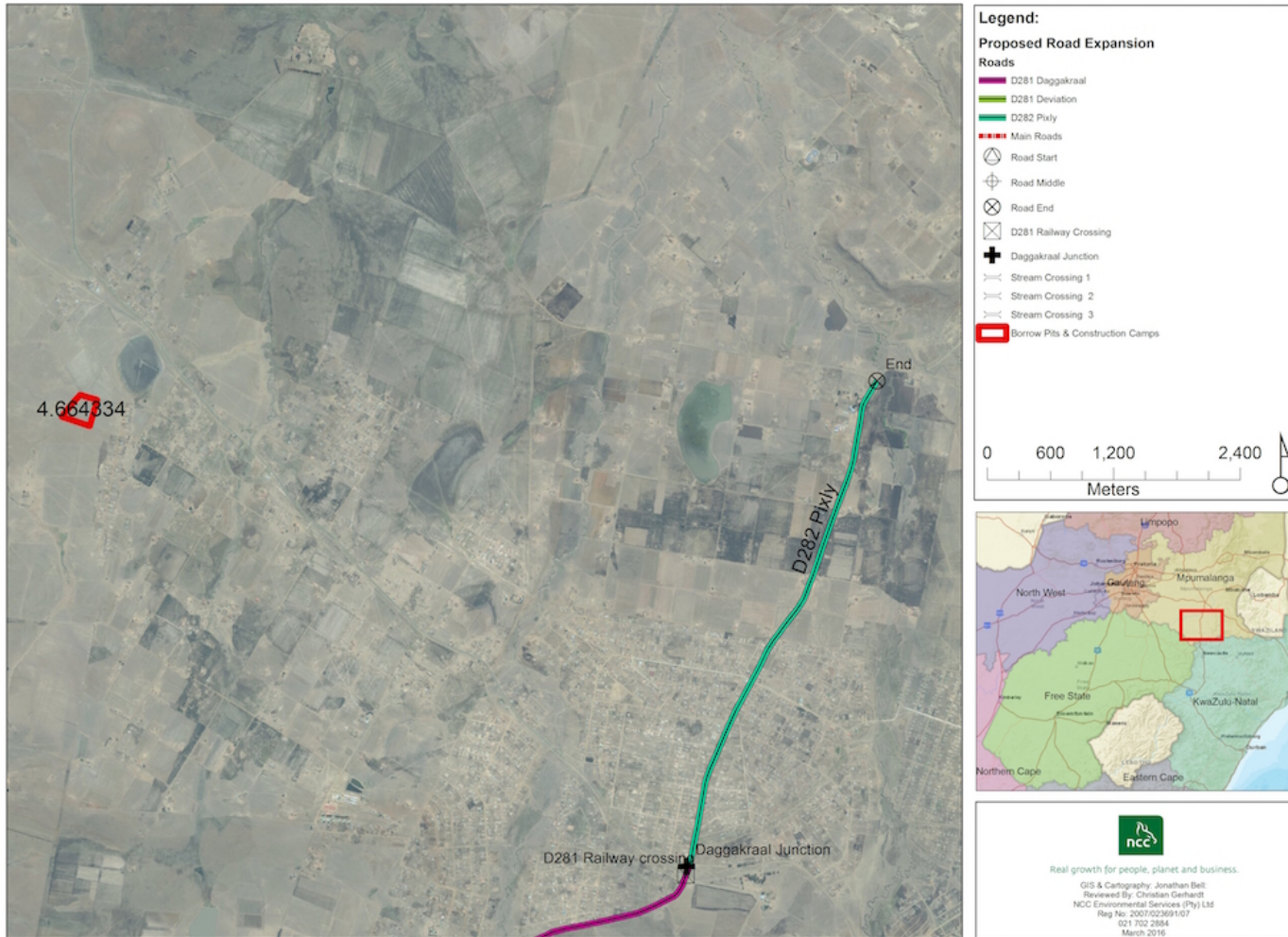


Figure 15 – Proposed borrow pit area 4

2.2 Technical Project Description

The construction of a tar road on an existing gravel road and associated activities such as borrow pits and construction camp establishment.

3 CURRENT STATUS QUO

3.1 Archival findings

The archival research focused on available information sources that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying.

Evaluation of the historical background of the study area is required to establish the possible heritage resources to be found.

3.1.1 Stone Age

Earlier Stone Age 2 000 000	150 000 Before Present
Middle Stone Age 150 000	30 000 BP
Later Stone Age 30 000	until c. AD 200

The lack of shelters and overhangs combined with inclement weather conditions of the Mpumalanga escarpment has not produced major Stone Age site during surveys of undulating grass lands in this region.

3.1.2 Early Farming Communities

Early Iron Age AD 200	AD 1000
Late Iron Age AD 1000	AD 1830

Enquiry with the Natal Museum Archaeological database produced no known archaeological sites close to the study area. Further to this an evaluation of the general ecological

conditions of the study area provides a guideline towards the type of archaeological sites to be expected within the general.

3.1.3 Historic Period

Since the arrival of the white settlers - c. AD 1840 in this part of the country. The southern Mpumalanga region of Amersfoort and Volksrust played a major part in the first few months of the South African War (1899-1902), with specific reference to the movement of British troops from the then Natal Colony through the areas of Newcastle, Charlestown and Volksrust. This area playing a major role as the spring board for the movement of General Buller into the then Zuid Afrikaanse Republic (ZAR) in the winter of 1900.

Volksrust

Volksrust was proclaimed as town in 1889 by the ZAR and probably received its name due to the Battle of Amajuba that happened in 1881 (First Anglo-Boer War) south of the current town, and refers to the place where the Boer forces (burghers) rested.

During the June 1900 the town was occupied by the British forces under command of General Redverse Buller, during the South African War. (Van der Westhuizen, 2000)

Amersfoort

The town of Amersfoort was established on a farm donated for the establishment of a Dutch Reformed Church in 1876 and in 1888 the ZAR Volksraad approved the development of the town.

The town was occupied on the 7th of August 1900 by the British forces under Gen Buller, after advancing from their encampment on Mezig some 15 kilometers to the southwest of Amersfoort. (Van der Westhuizen, 2000)

Daggakraal

Daggakraal is known for its association with Dr. Pixley Ka Isaka Seme who was a founder member and first Treasurer of the South African Native National Congress that became the African National Congress at a later stage. He was also president of the ANC from 1930 to 1937 and is commemorated in the name of the Pixley Ka Isaka Seme Local Municipality (*Dr. Pixley Ka Isaka Seme Local Municipality – Integrated Development Plan 2013/2014*).

On January 8 th , 1912, Pixley Ka Isaka Seme and two his colleagues Richard Msimang and George Montsio founded what was known as the South African Native National Congress, or SANNC – if the name is unfamiliar that is because in 1923 it became known as the African National Congress (<http://pzacad.pitzer.edu/NAM/general/student-essays/saetang.htm>) .



Figure 16 – Dr. Pixley Ka-Isaka Seme (<http://www.sahistory.org.za/people/pixley-ka-isaka-seme>)

Pixley Ka Isaka Seme bought land on behalf of the associations of Daggakraal, KwaNgema and Driefontein and these purchases probably gave great impetus to the enactment of the Native Land Act of 1913 which forbade the purchase of land by a black person in South Africa.

The farm Daggakraal was bought by Seme from a farmer Willem Gouws, and settled in Gouws' farmhouse. This farmhouse became the offices of the SANNC and the later ANC, this being one of the first offices of the ANC (wa Afrika, 2014).

3.1.4 Activity And Movement of Military Forces in and around Study Area

With the occupation of Volksrust in June 1900 the movement of British forces to the north of Volksrust intensified with skirmishes at Sandspruit Station and Paardekop pushing the Boer forces northwards towards Amersfoort. The retreating Boer forces established a stronghold at Grasskop just to the south of the study area during June 1900. This prominent

hill just south of proposed Substation Site D provided a good position for the Boer heliograph that made communication with Majuba, Sandspruit and Bloukop possible (Figure 18).

By mid-June 1900 Buller's forces advanced on Sandspruit Station and Paardekop to the south west of the study area and by the end of July 1900 engaged the Boer forces at Grasskop which caused the Boer forces to retreat towards Amersfoort (Figure 18). (Van der Westhuizen, 2000 & Breytenbach 1986).

Buller garrisoned on the farm Mezig in the western section of the study area after the occupation of Paardekop Station up to the occupation of Amersfoort in early August 1900. The old farmhouse present on Mezig was utilised as field hospital for the British forces during the stay on the farm (Figure 17).



Figure 17 – View of old ruins of British hospital on the farm Mezig

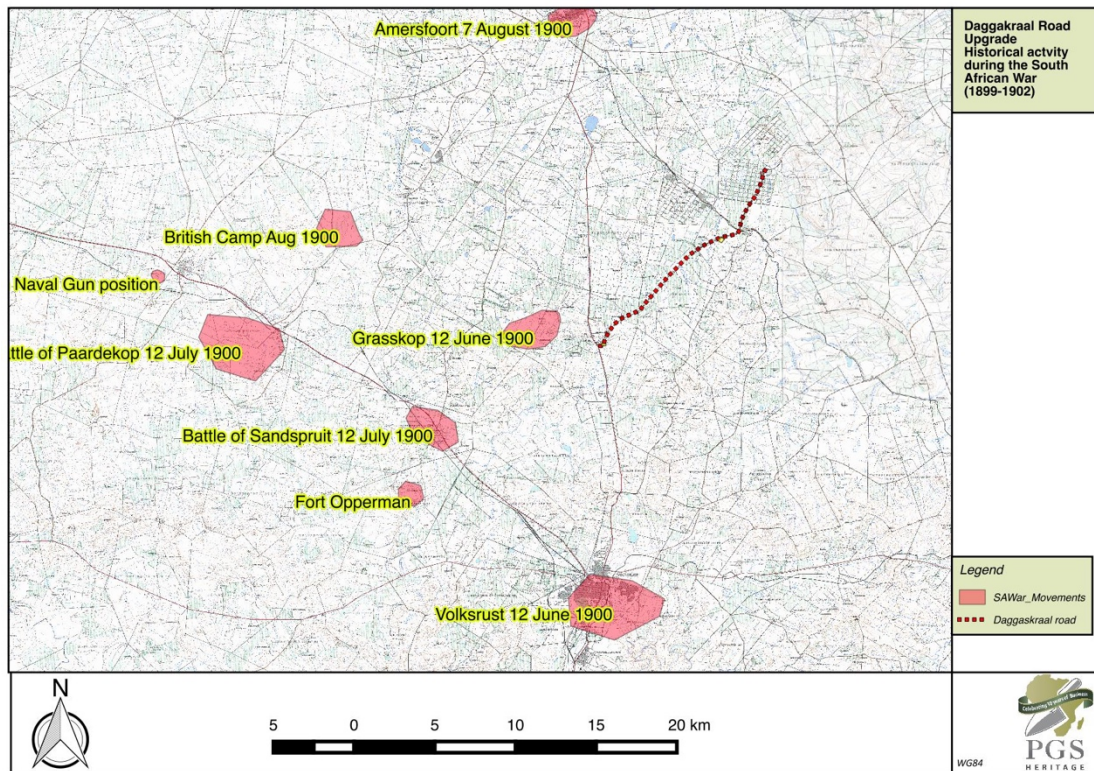


Figure 18 – Known large scale activity of the South African War around the study area

3.2 Palaeontology of the area

A palaeontological desktop assessment was commissioned from Dr. Lloyd Rossouw, and accredited Palaeontological from the Bloemfontein Museum (Appendix F). The following section is taken directly from his study.

Sedimentary bedrock strata in the region are largely represented by Ecca Group mudrocks, siltstones and sandstones of the Middle Permian, Volksrust Formation (Pvo) and Adelaide Subgroup sandstones (Pne) (Muntingh 1989) (**Figure 19**). The argillaceous Volksrust Formation consists of blue-grey to dark grey silty shale with thin siltstone sandstone lenses and beds that represent a major transgressive sequence related to open shelf and possibly also near shore conditions (Johnson et al. 2006). Sedimentary bedrock is intruded by numerous dolerite dykes and sills (Jd) and are capped in places by scree and geologically recent superficial sediments (residual soils derived from the in situ weathering of the parent rocks, alluvium and aeolian sand).

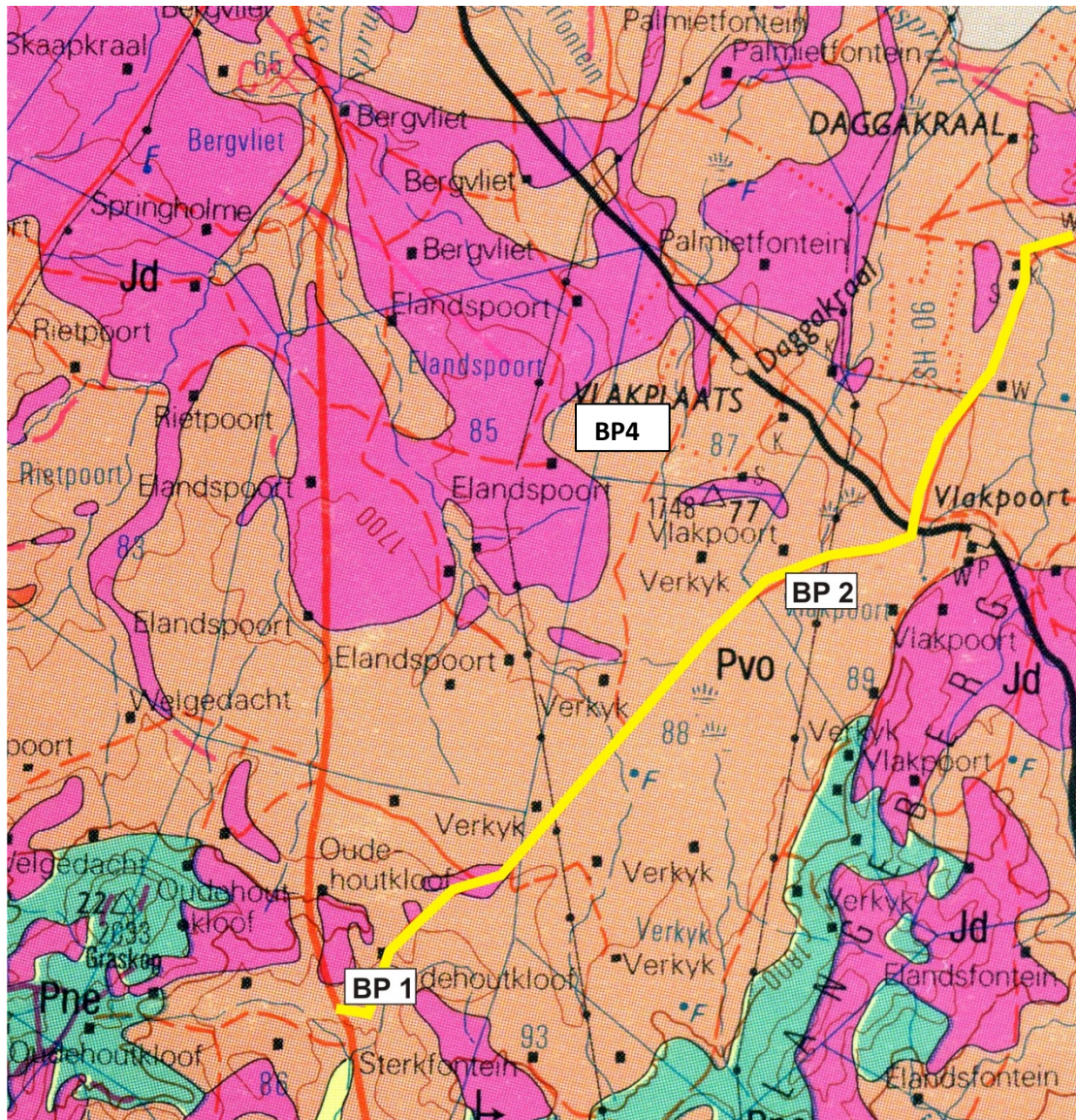


Figure 19 Geological map of the area between Volksrust and Amersfoort (portion of 1:250 000 scale geological map Frankfort 2728). From oldest to youngest, the regional geology is represented by Permian Ecca Group Volksrust Formation (Pvo) shales and Adelaide Subgroup sandstones (Pne) of the Karoo Supergroup. Sedimentary bedrock is intruded by numerous dolerite dykes and sills (Jd).

3.2.1 Karoo Sediments

According to the 1:250 000 scale geological map of the area (1:250 000 scale geological map Frankfort 2728), the proposed development footprint is underlain by the Volksrust Formation. Fossils from the Volksrust Formation are significant, but rarely recorded (MacRae, 1999). It is characterized by the presence of plant fossils primarily represented by glossopterids, cordaitaleans and possibly other seed fern groups. Rare temnospondyl amphibian remains, fish, invertebrates including bivalves and insects, plant fossils and petrified wood (glossopterids and possibly other seed fern groups) as well as trace fossil assemblages (Anderson and Anderson 1985; Bamford 2003; Cairncross *et al.* 2005; Ponomarenko & Mostovski 2005).

3.2.2 Post-Karoo Sediments

Localized fossil-rich alluvial exposures, assigned to the Quaternary Cornelia Formation, are found about 100 km west of the affected area at Cornelia in the north-eastern Free State (Butzer *et al.* 1974; Brink & Rossouw 2000). There is currently no record of localized Quaternary fossil exposures from alluvial contexts in the Daggakraal area.

3.3 Conclusions

This archival study has revealed important aspects about the history of the area. Certainly some of the key aspects emanating from this study are firstly, the association of the area with Dr. Pixley Ka-Isaka Seme as well as the military activity during the South African War.

3.3.1 Possible finds

Evaluation of aerial photography has indicated the following area that may be sensitive from a social heritage perspective – specifically the possibility of graves close to the road reserve. Figure 20 to Figure 26 indicates the desktop mapping completed.

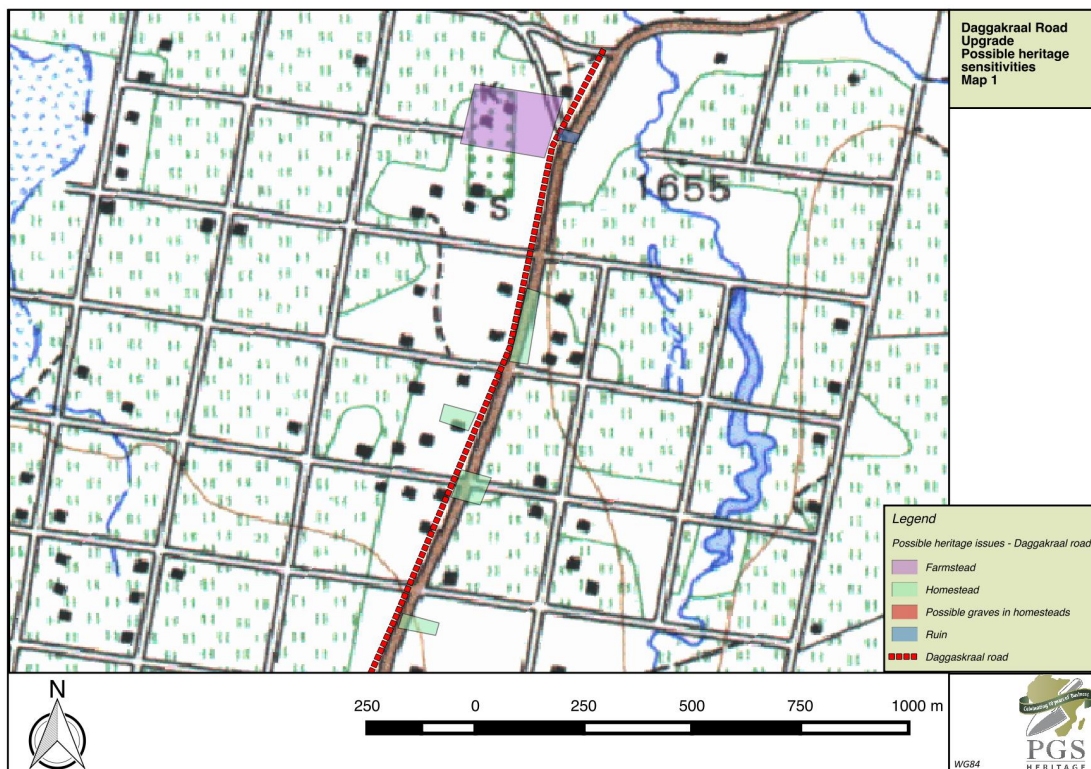


Figure 20 – Possible heritage sensitive areas in proposed road upgrade area

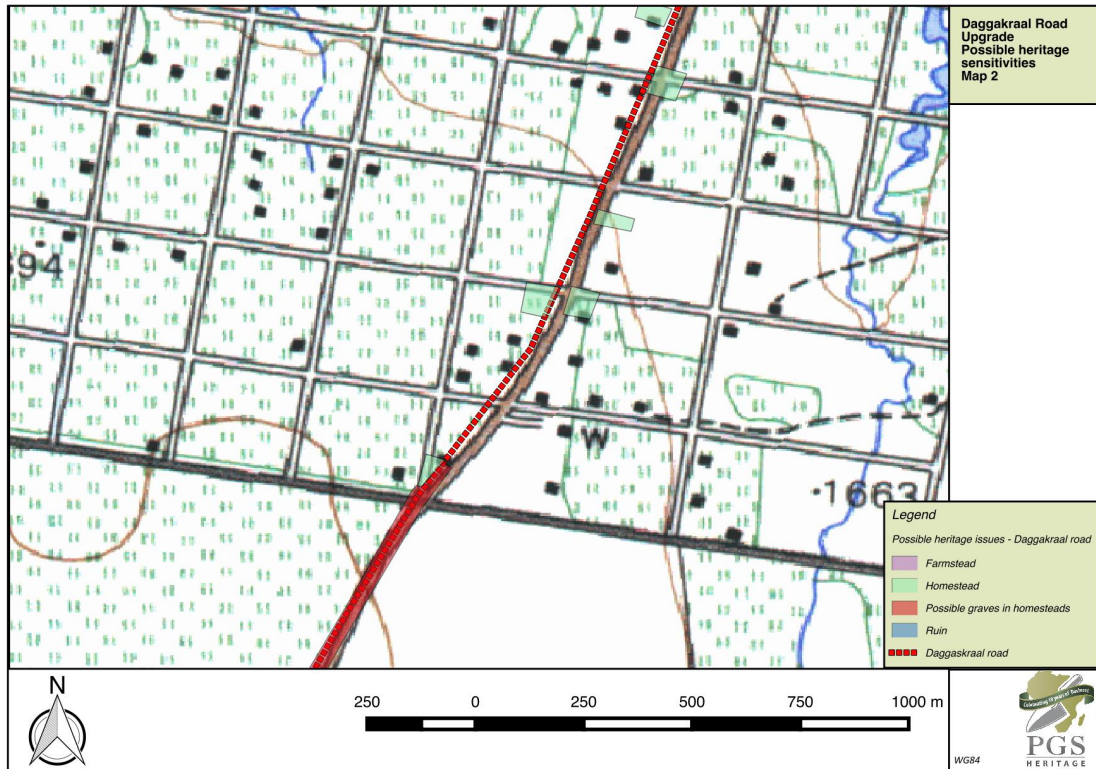


Figure 21 – Possible heritage sensitive areas in proposed road upgrade area

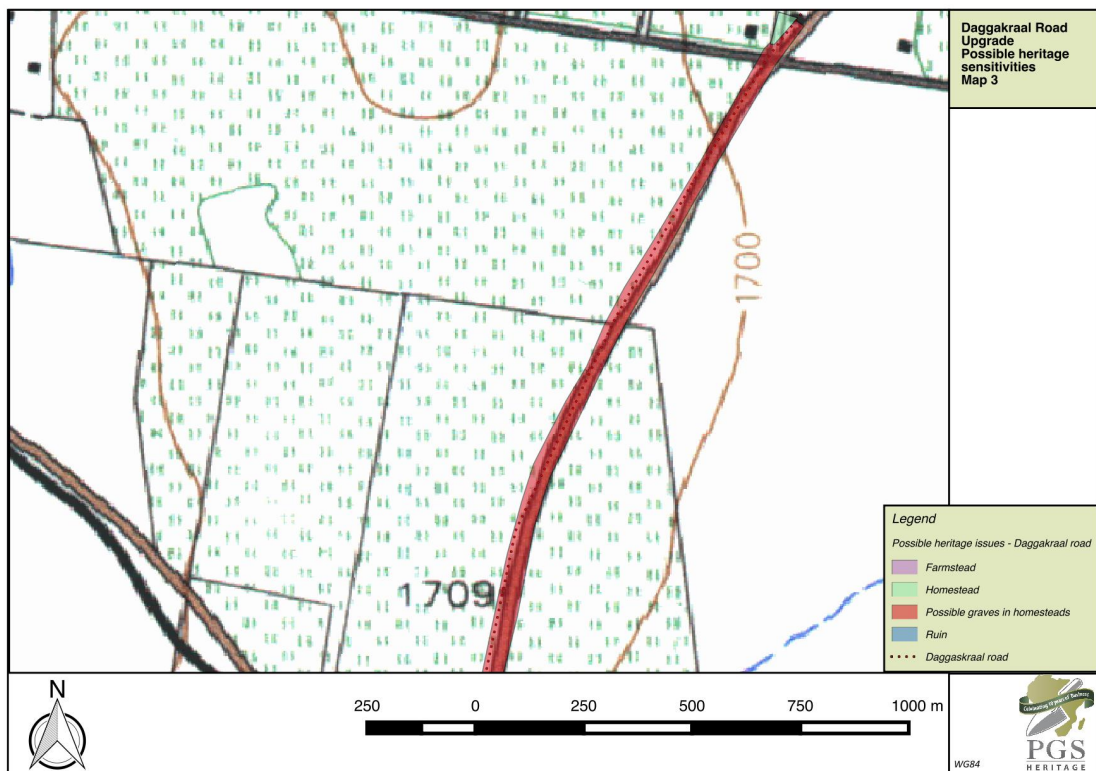


Figure 22 – Possible heritage sensitive areas in proposed road upgrade area

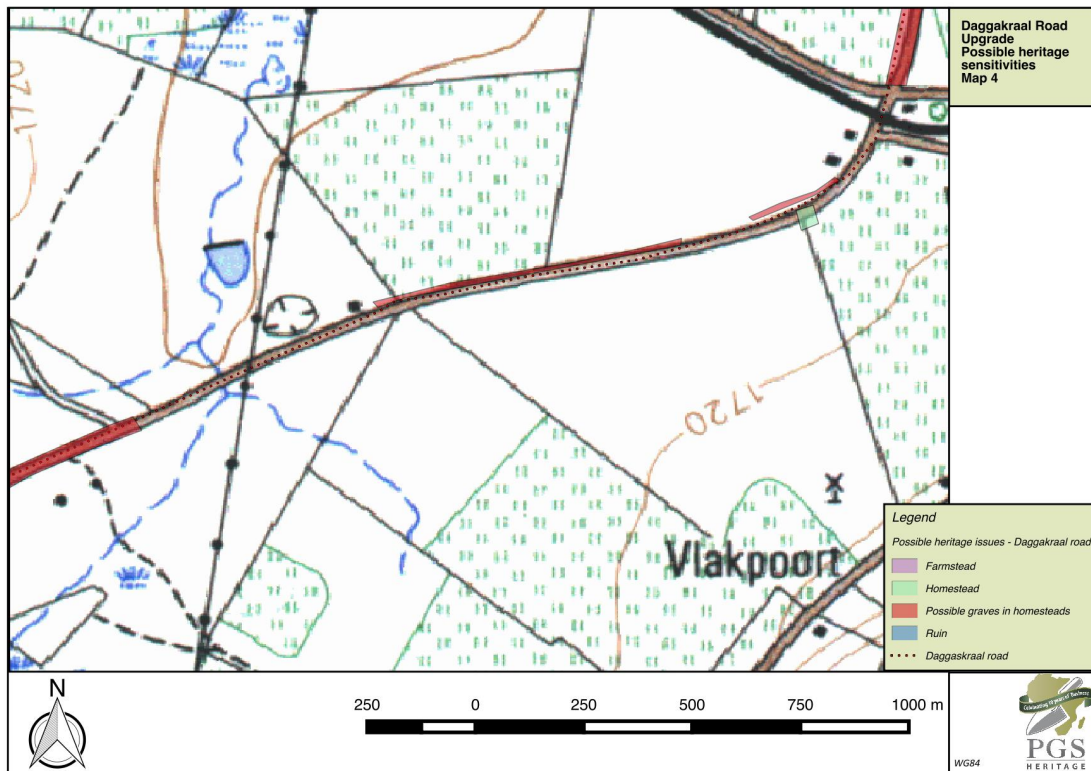


Figure 23 – Possible heritage sensitive areas in proposed road upgrade area

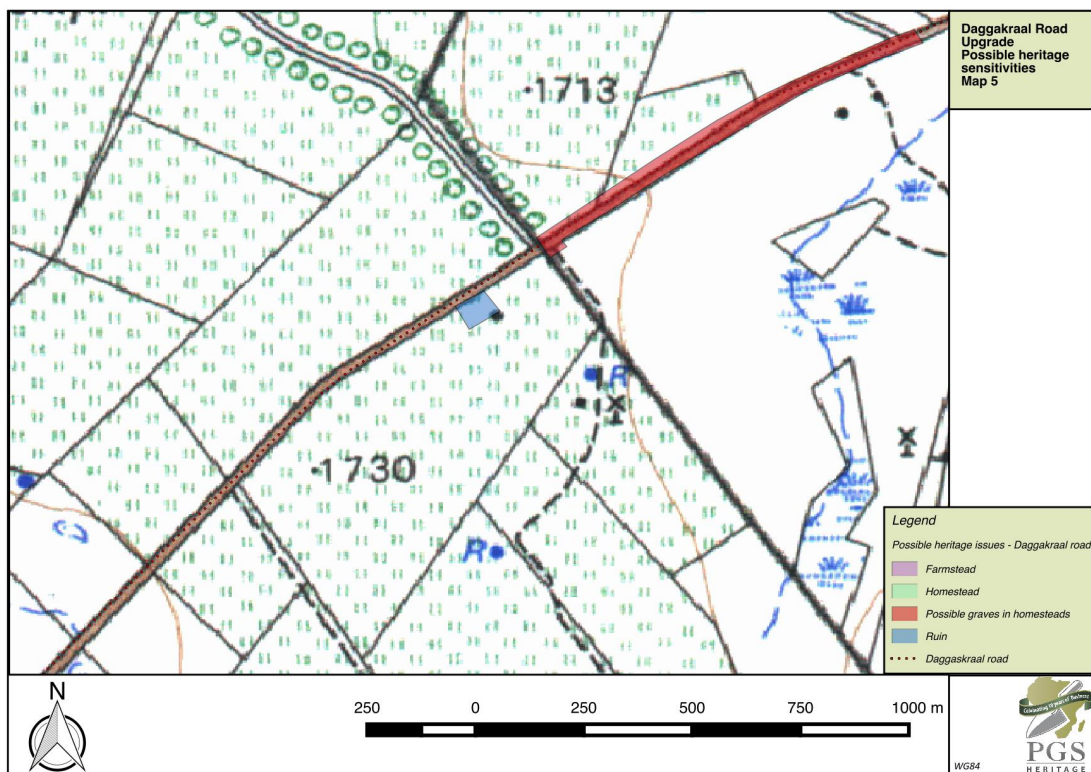


Figure 24 – Possible heritage sensitive areas in proposed road upgrade area

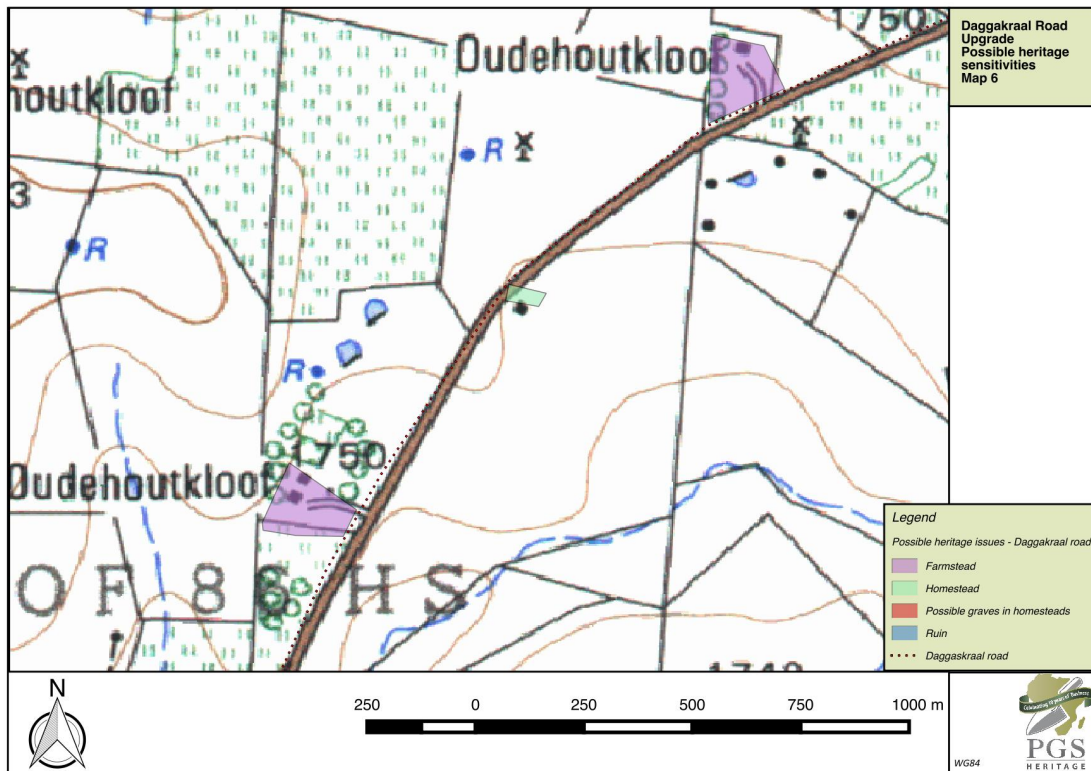


Figure 25 – Possible heritage sensitive areas in proposed road upgrade area

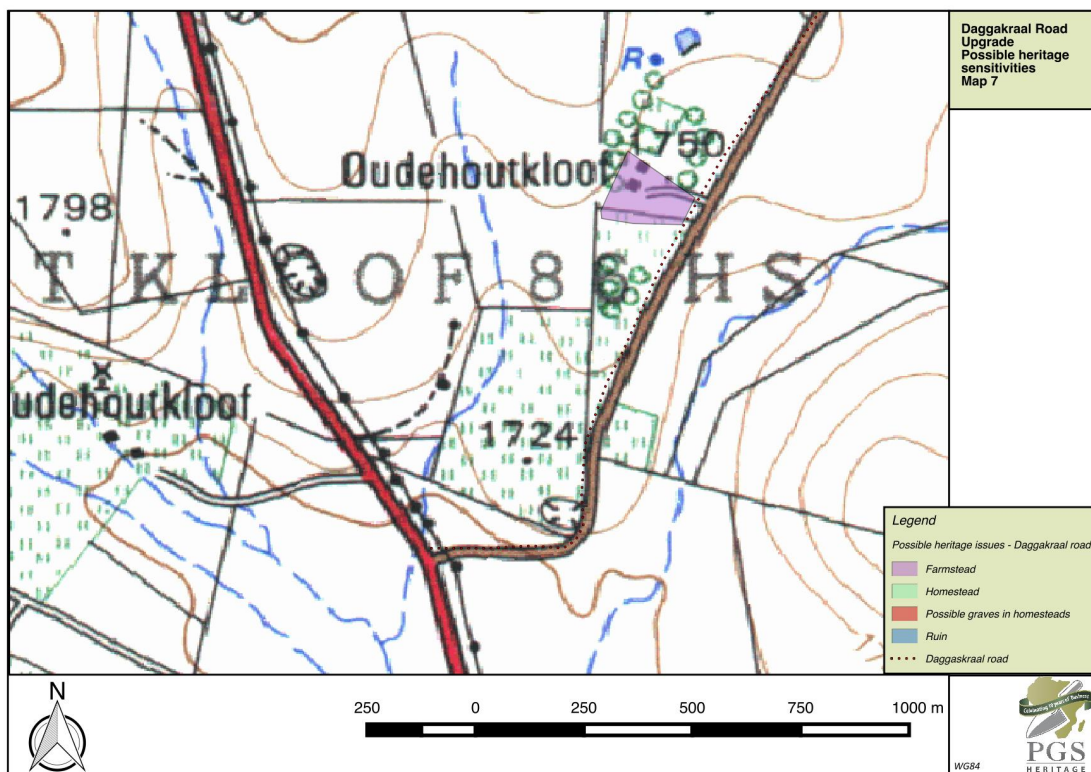


Figure 26 – Possible heritage sensitive areas in proposed road upgrade area

The analysis of the studies conducted in the area assisted in the development of the following settlement type to heritage find matrix in **Table 1**.

Table 1: Landform to heritage matrix

LAND FORM TYPE	HERITAGE TYPE
Farmsteads	Possible historic structures and graves
Homesteads	Possible historic structures and graves
Dense settlement areas	Possible graves in homestead yards
Ruins	Possible historic structures and graves

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA.

- Archaeological walk through of the areas where the project will be impacting;
- Palaeontological desktop assessment of the areas and selective site visits where required by the palaeontologist;

4 FIELDWORK FINDINGS

As site visit and field survey was completed on the 25th of February 2016 by an archaeologist of PGS. The fieldwork was tracklogged (

Figure 27) and sites documented with site photos and GPS coordinates captured with “GPS Tracks” software.

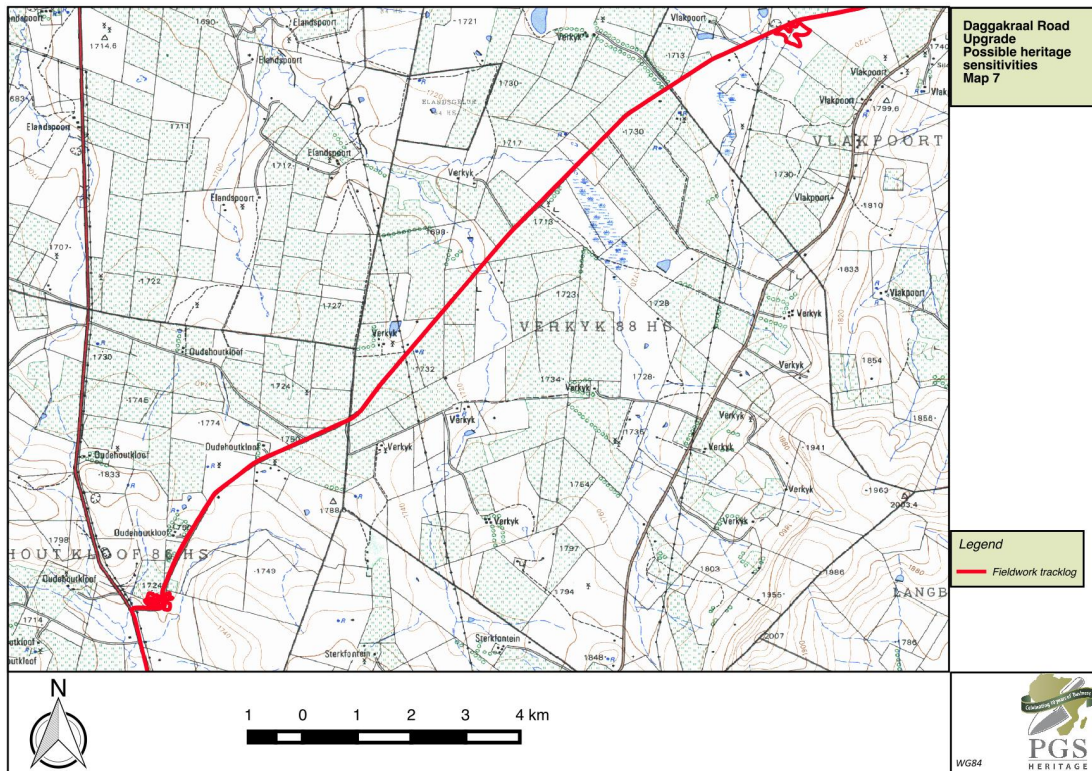


Figure 27 – Tracklogs of fieldwork

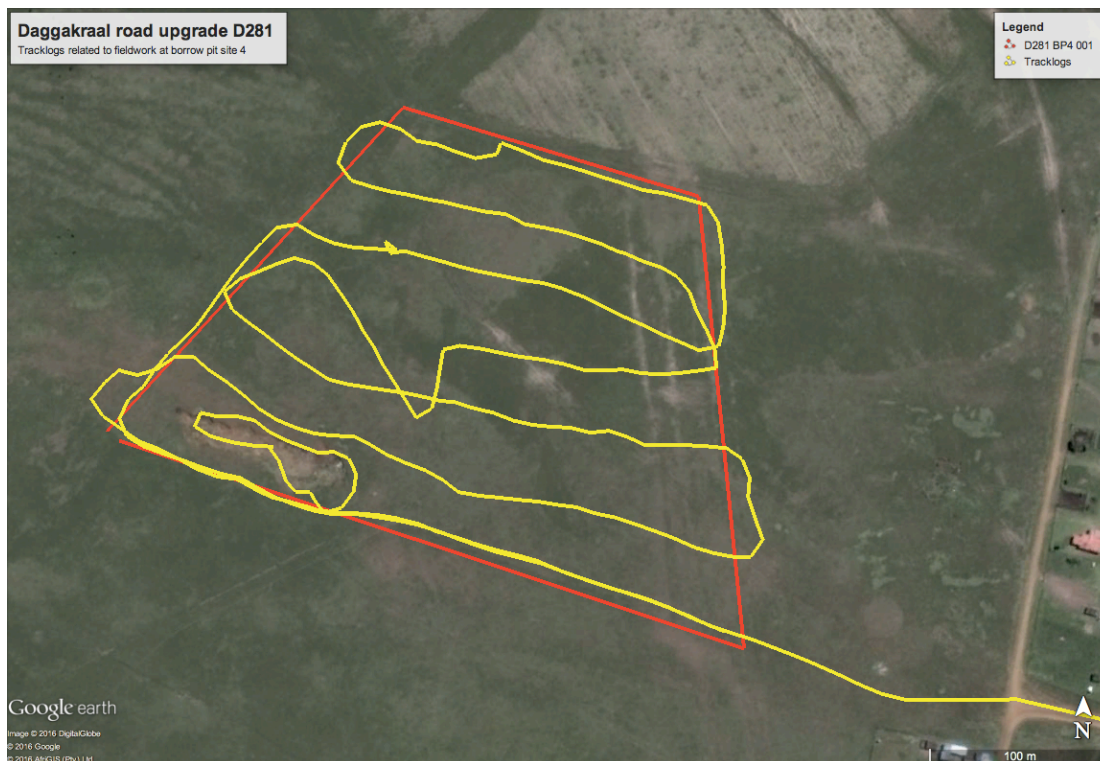


Figure 28 – Tracklogs of fieldwork at borrow pit area 4

4.1 Identified heritage sites

During the fieldwork seven heritage features were identified of which **DGK001-004** can be assessed as a single cluster and **DGK005-DGK007** as separate entities.

4.1.1 DGK001 – DGK005

Coordinates:

Name	X	Y
DGK001	S27° 12' 53.7"	E29° 53' 14.2"
DGK002	S27° 12' 53.0"	E29° 53' 14.0"
DGK003	S27° 12' 52.4"	E29° 53' 14.1"
DGK004	S27° 12' 51.5"	E29° 53' 10.7"
DGK005	S27° 12' 51.4"	E29° 53' 18.1"

The sites are situated just inside or on the northern boundary of the proposed borrow pit and Construction Camp One. All of the sites contain graves and vary between two graves (**DGK002** and **DGK003**), four to six each (**DGK001** and **DGK004**) and twelve graves at **DGK005**.



Figure 29 - View of DGK001 (borrow pit in background)



Figure 30 - View of DGK002 – two grave dressings visible



Figure 31 - View of DGK004 (graves visible on right side of the picture)

The area around **DGK004** also contains numerous ruins of homestead foundations and stone built stock pens.



Figure 32 - View of stock enclosures just south of DGK004 (borrow pit in background)



Figure 33 - View of DGK005

Size:

The area containing sites **DGK001-004** covers approximately 100x50m. While **DGK005** is approximately 30x30 meters.

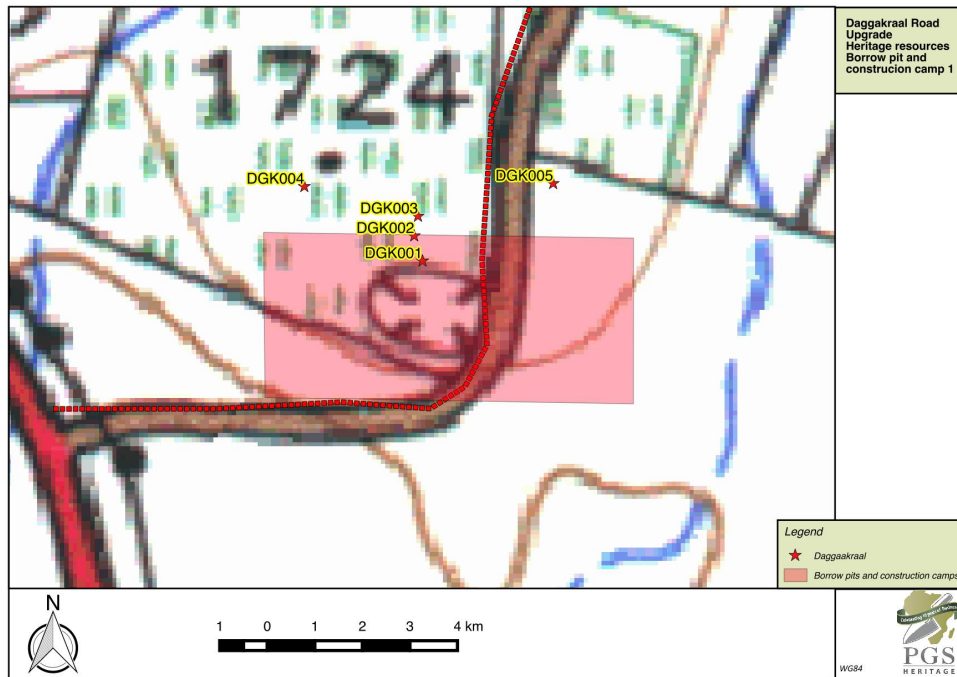


Figure 34 – The locality of DGK001-005 in relation to borrow pit and camp 1

Heritage Significance:

Due to the social significance associated with graves and cemeteries and the protection afforded to these site under Section 35 of the NHRA the sites is given a heritage grading of 3B (Locally significant of high significance).

Management:

- It is recommended that the borrow pit and camp placement take the position of the site in consideration and keep at least a buffer of 20 meters from the closest structures/graves.
- During construction activities the sites must be clearly marked as no-go areas.

4.1.2 DGK006

Coordinates:

S27° 09' 06.8" E29° 57' 15.8"

The site is situated some 70 meters to the east of the D281 and is a formal cemetery containing more than 100 graves. It has a proper fence with gate.

Size:

The site is approximately 100x100meters

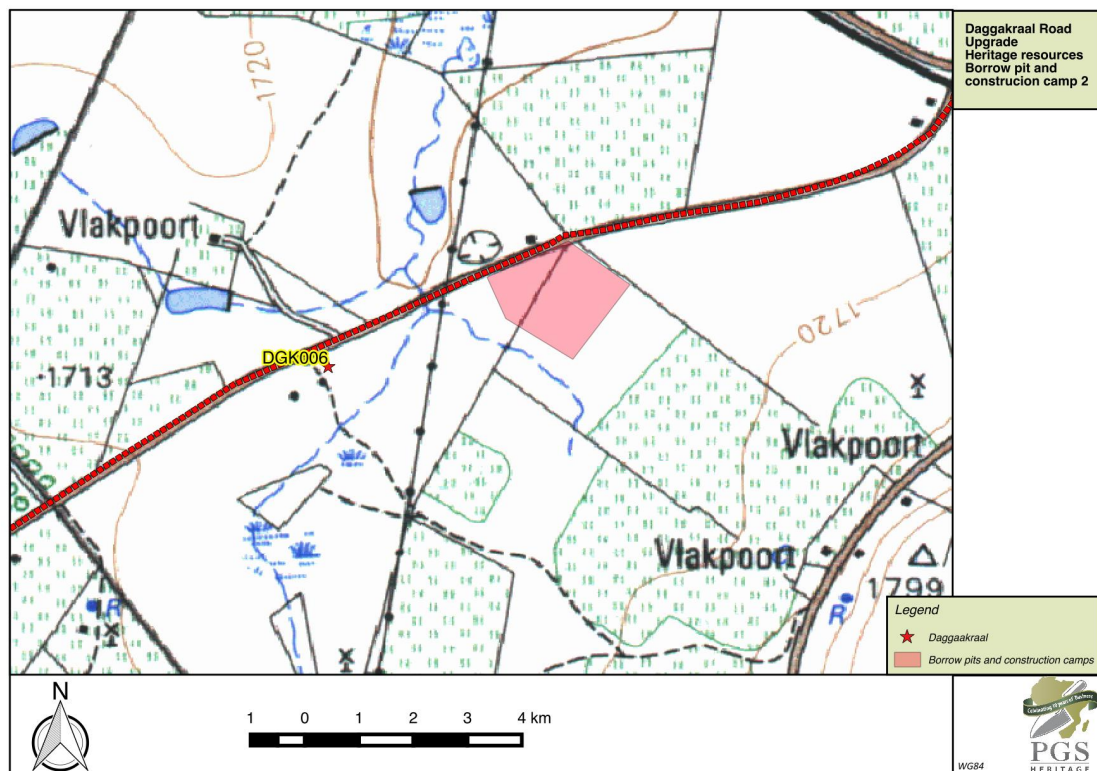


Figure 35 – DGK006 in relation to borrow pit and camp 2

Heritage Significance:

Due to the social significance associated with graves and cemeteries and the protection afforded to these site under Section 35 of the NHRA the sites is given a heritage grading of 3B (Locally significant of high significance).

Management:

The implementation of a grave management process that will include a no-go buffer of at least 20 meters from the closest structure will reduce the impact significance to low.

4.1.3 DGK007

Coordinates:

S27° 06' 36.4" E29° 59' 11.5"

The site is the statue and monument erected in honour of Dr. Pixley Ka Isaka Seme. Situated approximately 100 meters from the D281. This statue was unveiled in March 2012 as part of the African National Congress' centenary celebrations.

Size:

The site is approximately 100x100meters



Figure 36 - View of DGK007



Figure 37 - View of DGK007 from the D281

Heritage Significance:

The site is a monument erected in honour of Dr. Pixley Ka Isaka Seme and protected under Section 3 and Section 35 of the NHRA the sites is given a heritage grading of 3A (Locally significant of high significance). All though the site is not a declared provincial heritage site, such a declaration is a probability in future.

Management:

The site should be demarcated as a no-go area with a 70 meter buffer for construction.

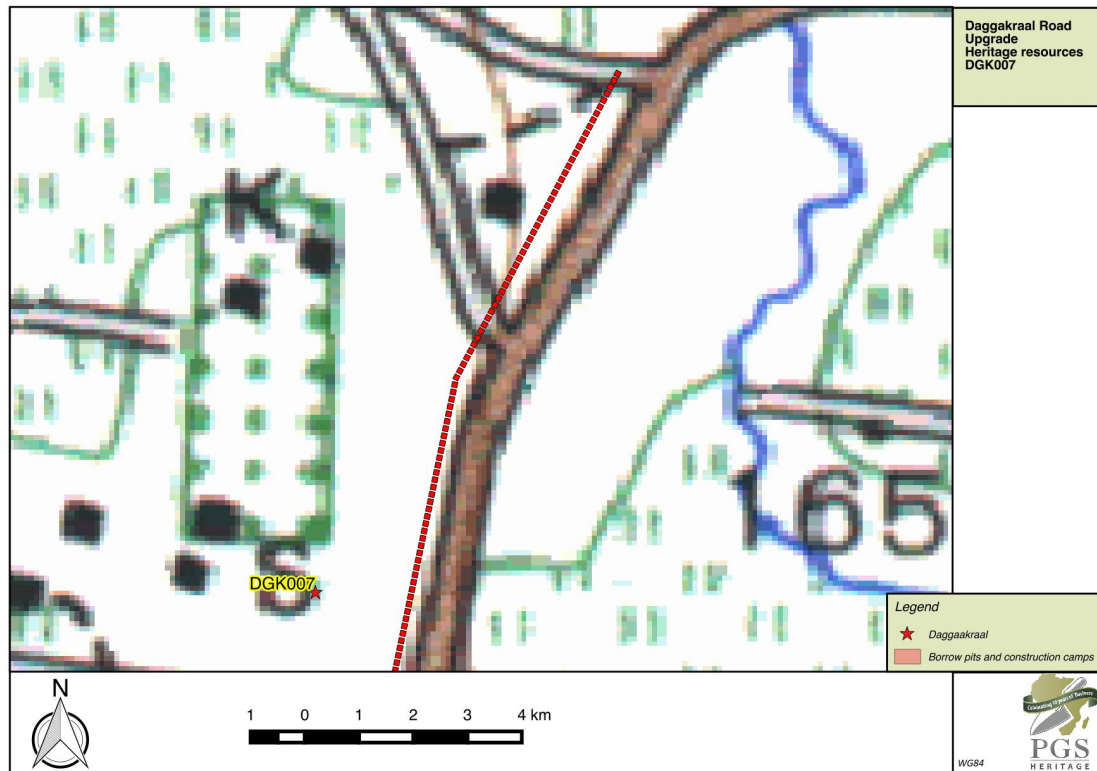


Figure 38 – Locality map of DGK007 in relation to the D281 road

4.2 Palaeontology

Table 2 -Potential fossil heritage of relevant geological units

Geological Unit	Rock types and Age	Fossils Recorded / Biostratigraphy
Superficial deposits	Alluvium. Quaternary to Recent	Vertebrate remains; coprolites, freshwater molluscs, micro plant fossils (pollen, phytoliths)
Karoo Dolerite (<i>Jd</i>)	Intrusive igneous bedrock. Jurassic	No fossils
Karoo Supergroup Ecca Group Volksrust Formation (<i>Pvo</i>)	Blue-grey to dark grey silty shale with thin siltstone sand sandstone lenses and beds - transgressive sequence related to open shelf and possibly also near shore conditions Permian	Temnospondyl amphibian remains, invertebrates, plant remains, petrified wood, marine and non-marine trace fossils

5 IMPACT ASSESSMENT

The following section provides an assessment of the possible impacts on the identified heritage resources. This assessment is based on the assessment criteria as contained in Appendix B of this document.

During the fieldwork seven heritage features were identified of which **DGK001-004** can be assessed as a single cluster and **DGK005-DGK007** as separate entities.

5.1 DGK001-004 and DGK005

Possible impact on cemeteries and graves						
IMPACT	SEVERITY	DURATION	SPATIAL	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of graves and cemeteries – Pre-Mitigation	High	High	Low	High	High	High
Destruction of graves and cemeteries – Post Mitigation	Low	Medium	Low	Low	Low	Low
<p>DGK001-004, consist of a cluster of cemeteries straddling the boundary of the proposed southern borrow pit at Construction Camp 1. The sites are situated on a small rise just above the existing borrow pit and should not be impacted by the proposed excavating activities.</p> <p>DGK005 is cemetery situated just north of the proposed southern borrow pit at Construction Camp 1, but on the eastern side of the D281.</p> <p>The severity of the impact will be high as impacts will result in the definite destruction of the sites. As sacred sites have been assigned heritage significance grading of 3A the severity rating is assigned as High.</p> <p>The implementation of a grave management process that will include a buffer of at least 20 meters from the closest structure will reduce the impact significance to low.</p> <p>In the event that the sitting of the borrow pit cannot be adjusted and the graves and cemeteries impacted, a comprehensive grave relocation process with a social consultation component will result in the mitigation of the possible impact on graves and cemeteries and result in a low impact rating.</p>						

5.2 DKG006

Possible impact on cemeteries and graves						
IMPACT	SEVERITY	DURATION	SPATIAL	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of graves and cemeteries – Pre-Mitigation	Medium	Low	Low	Low	Medium	Medium
Destruction of graves and cemeteries – Post Mitigation	Low	Low	Low	Low	Low	Low
<p>DKG006 is a formal fenced cemetery situated some 70 meters to the east of the D281. Although sited substantially from the D281, the open terrain between the road and the cemetery could be utilised as temporary staging area during construction.</p> <p>The severity of the possible impact, without mitigation measures in place, will be Medium as impacts could result in the possible damage of the sites.</p> <p>The implementation of a grave management process that will include a buffer of at least 20 meters from the closest structure will reduce the impact significance to low.</p>						

5.3 DKG007

Possible impact on monument						
IMPACT	SEVERITY	DURATION	SPATIAL	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of graves and cemeteries – Pre-Mitigation	Medium	Low	Low	Low	Medium	Medium
Destruction of graves and cemeteries – Post Mitigation	Low	Low	Low	Low	Low	Low
<p>The Pixley ka Seme monument (DKG007) is formal fenced and situated some 90 meters to the west of the. Although sited substantially from the D281, the open terrain between the road and the monument could be utilised as temporary staging area during construction.</p>						

The severity of the impact will be Medium as impacts could result in the possible damage of the sites.
The site should be demarcated as a no-go area with a 70 meter buffer for construction.

5.4 Palaeontology

Possible impact on palaeontology						
IMPACT	SEVERITY	DURATION	SPATIAL	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of palaeontology – Pre-Mitigation	Medium	Permanent	Low	Low	Medium	High
Destruction of palaeontology – Post Mitigation	Low	Low	Low	Low	Low	Low

The Volksrust Formation is considered to be of moderate palaeontological sensitivity with a high likelihood that, although rarely recorded, fossils will be present. Undifferentiated superficial overburden (residual soils and alluvium) that generally covers the landscape along the road footprint will probably negate direct (negative) impact on the underlying fossil-bearing sediments during the upgrade and subsequent operational phase of the road, but excavation activities at Borrow pit 1 (GPS coordinates 27°12'55.82"S 29°53'15.47"E) and Borrow Pit 2 and 4 (GPS coordinates 27° 8'59.12"S 29°57'39.71"E) will very likely impact on intact Volksrust Formation strata.

- It is therefore recommended that excavations into or disturbances of in situ Volksrust Formation sediments at Borrow Pit 1, 2 and 4, are accompanied by a palaeontological inspection at the earliest practicable opportunity during the construction phase of the development before fresh bedrock have the chance to weather or be otherwise damaged by further development.
- Alternatively it is advised that, if possible, the borrow pit activities are purposely restricted to the palaeontologically insignificant dolerite outcrops that are located around Borrow Pit 1 at Oudenhoutskloof.

6 MANAGEMENT RECOMMENDATIONS

The following site specific management will be required:

6.1 DGK001-005

- It is recommended that the borrow pit and camp placement take the position of the site in consideration and keep at least a buffer of 20 meters from the closest structures/graves.
- During construction activities the sites must be clearly marked as no-go areas.
- In the event that the sitting of the borrow pit cannot be adjusted and the graves and cemeteries impacted, a comprehensive grave relocation process with a social consultation component will result in the mitigation of the possible impact on graves and cemeteries and result in a low impact rating.

6.2 DGK006

The implementation of a grave management process that will include a no-go buffer of at least 20 meters from the closest structure will reduce the impact significance to low.

6.3 DGK007

The site should be demarcated as a no-go area with a 70 meter buffer for construction.

6.4 Palaeontology

- It is therefore recommended that excavations into or disturbances of *in situ* Volksrust Formation sediments at Borrow Pit 1, 2 and 4, are accompanied by a palaeontological inspection at the earliest practicable opportunity during the construction phase of the development before fresh bedrock have the chance to weather or be otherwise damaged by further development.
- Alternatively it is advised that, if possible, the borrow pit activities are purposely restricted to the palaeontologically insignificant dolerite outcrops that are located around Borrow Pit 1 at Oudenhoutskloof.

7 CONCLUSIONS AND RECOMMENDATIONS

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The archival work (**Section 3** of the report) has shown that the proposed road upgrade may impact on heritage resources present in the area. This has been confirmed through archival research and evaluation of aerial photography of the sites.

During the fieldwork (**Section 4** of the report) seven heritage features were identified of which **DGK001-004** can be assessed as a single cluster and **DGK005-DGK007** as separate entities.

DGK001-005 contains graves and vary between two graves (**DGK002** and **DGK003**), four to six each (**DGK001** and **DGK004**) and twelve graves at **DGK005**. The area around **DGK004** also contains numerous ruins of homestead foundations and stone built stock pens.

DGK006 is a formal fenced cemetery some 50 meters from the D281, while **DGK007** is the statue and monument dedicated to Dr. Pixley Ka-Isaka Seme one of the founding members of the African National Congress. The monument is some 90 meters to the west of the D281.

Evaluation of the possible impacts on the heritage resources (**Section 5** of the report) has shown that the impact on sites **DGK001-005** will most probably be *High* without the implementation of mitigation measures. The possible impacts envisaged on **DGK006** and **007** were evaluated as being of *Medium* significance without mitigation measures.

Palaeontology

- It is therefore recommended that excavations into or disturbances of *in situ* Volksrust Formation sediments at Borrow Pit 1, 2 and 4, are accompanied by a palaeontological inspection at the earliest practicable opportunity during the construction phase of the development before fresh bedrock have the chance to weather or be otherwise damaged by further development.

- Alternatively it is advised that, if possible, the borrow pit activities are purposely restricted to the palaeontologically insignificant dolerite outcrops that are located around Borrow Pit 1 at Oudenhoutskloof.

By implementing the proposed mitigation measures (**Section 6** of the report) the overall impact on the heritage resources can be reduced to a *Low* impact.

No heritage resources were identified at borrow pit area 4.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels. It follows that if the management measures outlined in this report are implemented there is no reason why the construction activity for the upgrade of the D281 should not be approved.

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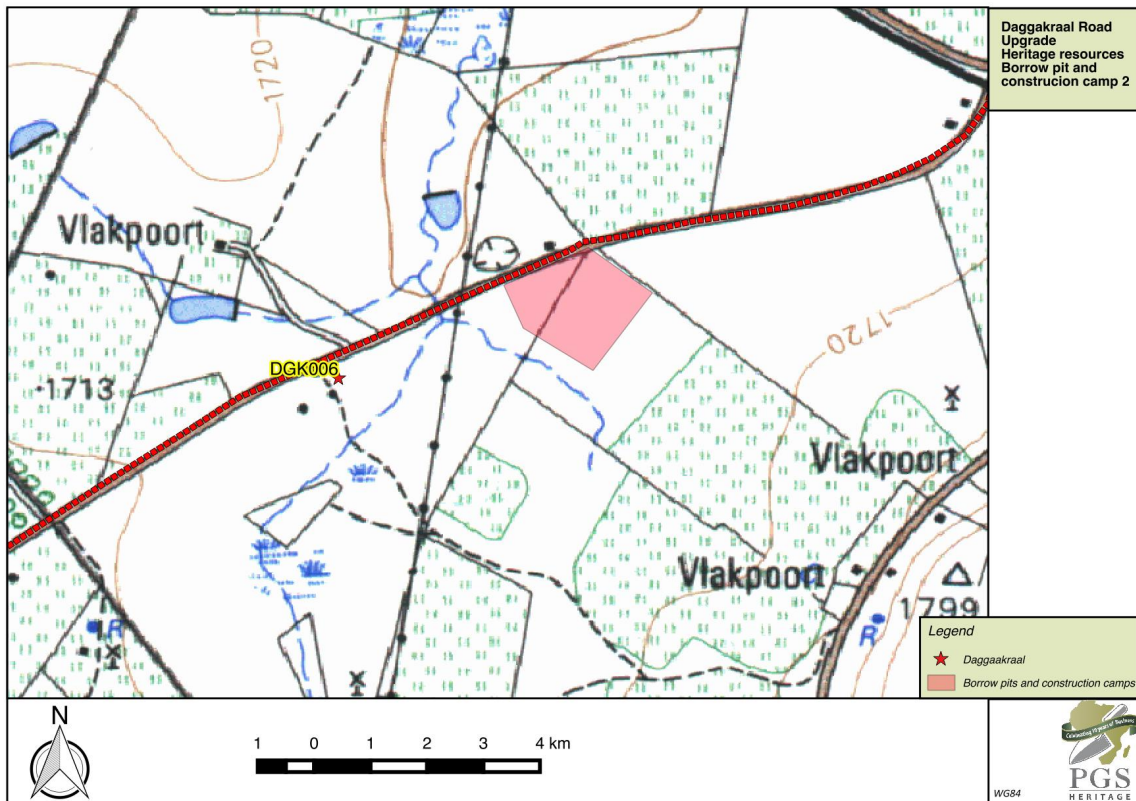
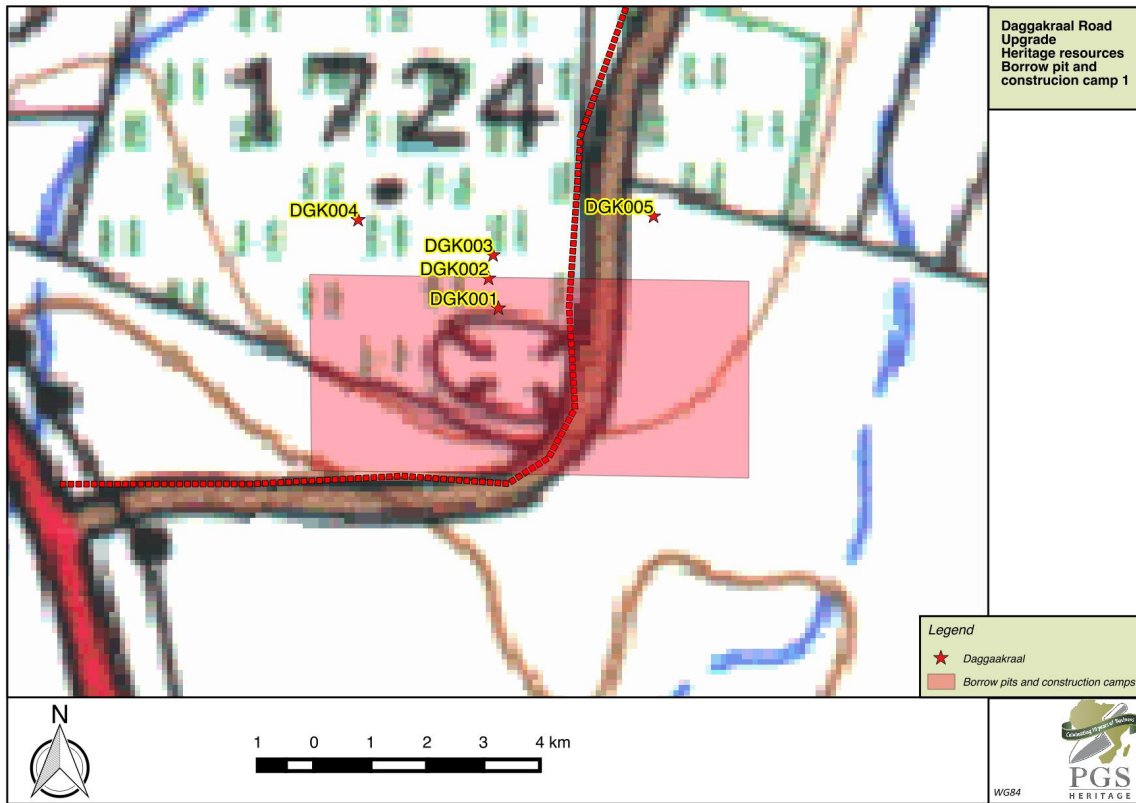
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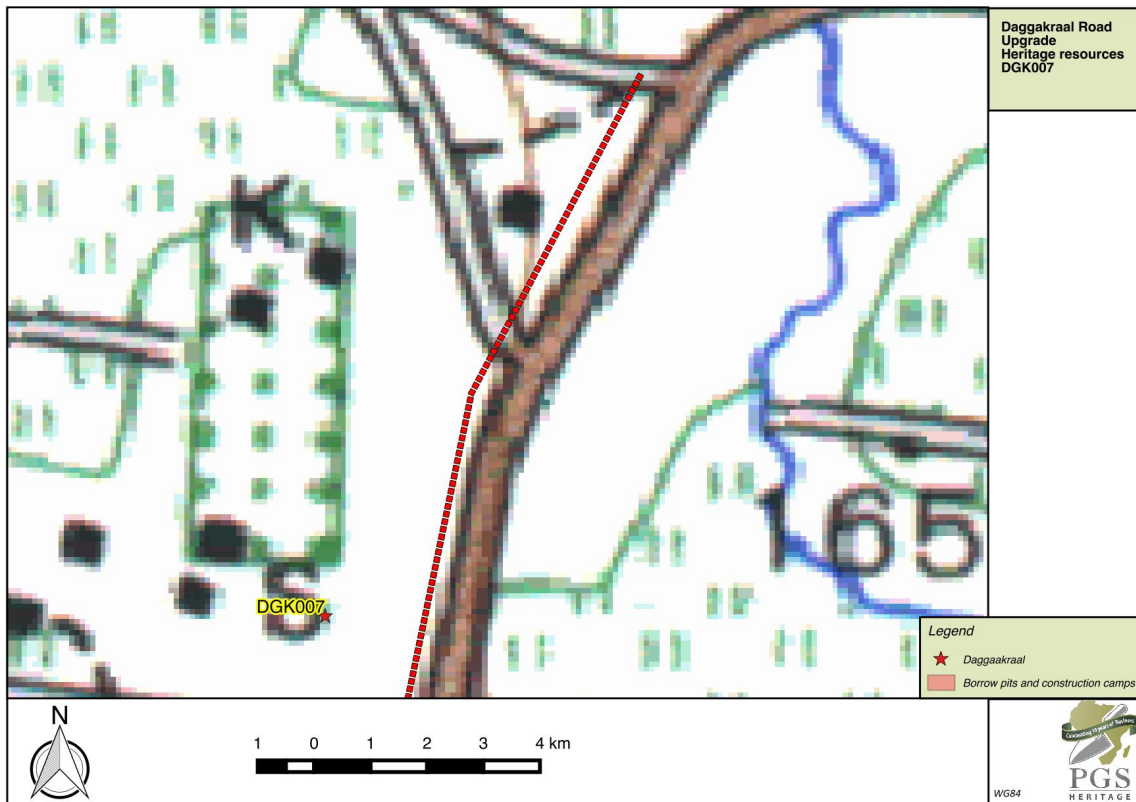
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LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the heritage legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess such material are required to register it. The management of heritage resources is integrated with environmental resources and this means that, before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have an interest in the graves: they must be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle should be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the construction company's cost. Thus, the construction company will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;

- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 Of 2003) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 Of 2003) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administered by a local authority. Graves in the category located inside a formal cemetery administered by a local authority will also

require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

HERITAGE ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report compiled by PGS Heritage (PGS) for the **proposed Daggakraal road upgrade** have assessed the significance of the heritage resources found on site by utilising the classification standards as prescribed by SAHRA .

The significance of heritage sites was based on four 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.

Table 3: Site significance classification standards 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 Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	-	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium Significance	Recording before destruction

Generally Protected C (GP.A)	-	Low Significance	Destruction
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The Significance Rating Scales for the proposed prosPecting activities on heritage resources

IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology will be 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.

<i>PART A: DEFINITION AND CRITERIA*</i>		
Definition of SIGNIFICANCE		Significance = consequence x probability
Definition of CONSEQUENCE		Consequence is a function of severity, spatial extent and duration
Criteria for ranking of the SEVERITY of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	H	Medium	Medium	Medium
	Medium term	M	Low	Low	Medium
	Short term	L	Low	Low	Medium

SEVERITY = M

DURATION	Long term	H	Medium	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Low	Medium	Medium

SEVERITY = H

DURATION	Long term	H	High	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Medium	Medium	High
			L	M	H
			Localised - Within site boundary - Site	Fairly widespread - Beyond site boundary - Local	Widespread - Far beyond site boundary - Regional/ national
SPATIAL SCALE					

PART C: DETERMINING SIGNIFICANCE

PROBABILITY (of exposure to impacts)	Definite/ Continuous	H	Medium	Medium	High
	Possible/ frequent	M	Medium	Medium	High
	Unlikely/ seldom	L	Low	Low	Medium
			L	M	H
CONSEQUENCE					

PART D: INTERPRETATION OF SIGNIFICANCE

Significance	Decision guideline
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

*H = high, M= medium and L= low and + denotes a positive impact.

Appendix E

Curriculum vitae

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia*:

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave “rescue” excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including:

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
 - Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
 - Involvement with various Heritage Impact Assessments, outside South Africa, including:
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude): Archaeology and Geography - 1997

BA: Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

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CRM Accreditation (ASAPA):

- Principal Investigator - Grave Relocations
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Key Work Experience

2003- current: Director – Professional Grave Solutions (Pty) Ltd

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2005-2007: Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004: CEO– Matakoma Consultants

1998-2000: Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng

DPWRT – Upgrade of D281

17 August 2020

1997-1998: Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique and the Democratic Republic of the Congo

Appendix F
Palaeontological Desktop Assessment

Palaeontological desktop study of the Daggakraal road upgrade between Volksrust and Amersfoort, Mpumalanga Province.

Report prepared for PGS Heritage by Paleo Field Services, PO Box 38806 Langenhovenpark 9330.

1. SUMMARY

The proposed development footprint is underlain by Ecca Group sedimentary rocks of the Volksrust Formation. The Volksrust Formation is considered to be of moderate palaeontological sensitivity. Undifferentiated superficial overburden (residual soils and alluvium) that generally covers the landscape along the road footprint will probably negate direct (negative) impact on the underlying fossil-bearing sediments during the upgrade and subsequent operational phase of the road, but excavation activities at Borrow pit 1 and Borrow Pit 2 will very likely impact on intact Volksrust Formation strata.

2. INTRODUCTION

The report is a preliminary assessment of potential palaeontological impact with regard to planned upgrade of a 17 km - long gravel road section from the N11 national road to Daggakraal between Vredefort and Amersfoort in Mpumalanga Province (1 to 50 000 scale topographic map 2729BB Amersfoort, **Fig. 1**). The proposed development also includes two borrow pit areas for the extraction of road-building material.

3. METHODOLOGY

The assessment was carried out in accordance with National Heritage Resources Act 25 of 1999 with the aim to assess the potential impact on palaeontological heritage resources that may result from the proposed development. The palaeontological significance of the affected areas were evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

4. GEOLOGY

Sedimentary bedrock strata in the region are largely represented by Ecca Group mudrocks, siltstones and sandstones of the Middle Permian, Volksrust Formation (*Pvo*) and Adelaide Subgroup sandstones (*Pne*) (Muntingh 1989) (**Fig. 2**). The argillaceous Volksrust Formation consists of blue-grey to dark grey silty shale with thin siltstone sandstone lenses and beds that represent a major transgressive sequence related to open shelf and possibly also near shore conditions (Johnson *et al.* 2006). Sedimentary bedrock is intruded by numerous dolerite dykes and sills (*Jd*) and are capped in places by scree and geologically recent superficial sediments (residual soils derived from the *in situ* weathering of the parent rocks, alluvium and aeolian sand).

5. PALAEOLOGY

5.1. Karoo Sediments

According to the 1:250 000 scale geological map of the area (1:250 000 scale geological map Frankfort 2728), the proposed development footprint is underlain by the Volksrust Formation. Fossils from the Volksrust Formation are significant, but rarely recorded (MacRae, 1999). It is characterized by the presence of plant fossils primarily represented by glossopterids, cordaitaleans and possibly other seed fern groups. Rare temnospondyl amphibian remains, fish, invertebrates including bivalves and insects, plant fossils and petrified wood (glossopterids and possibly other seed fern groups) as well as trace fossil assemblages (Anderson and Anderson 1985; Bamford 2003; Cairncross *et al.* 2005; Ponomarenko & Mostovski 2005).

5.2. Post-Karoo Sediments

Localized fossil-rich alluvial exposures, assigned to the Quaternary Cornelia Formation, are found about 100 km west of the affected area at Cornelia in the north-eastern Free State (Butzer *et al.* 1974; Brink & Rossouw 2000). There is currently no record of localized Quaternary fossil exposures from alluvial contexts in the Daggakraal area.

6. IMPACT STATEMENT

The Volksrust Formation is considered to be of moderate palaeontological sensitivity with a high likelihood that, although rarely recorded, fossils will be present. Undifferentiated superficial overburden (residual soils and alluvium) that generally covers the landscape along the road footprint will probably negate direct (negative) impact on the underlying fossil-bearing sediments during the upgrade and subsequent operational phase of the road, but excavation activities at Borrow pit 1 (GPS coordinates 27°12'55.82"S 29°53'15.47"E) and Borrow Pit 2 (GPS coordinates 27° 8'59.12"S 29°57'39.71"E) will very likely impact on intact Volksrust Formation strata.

7. RECOMMENDATIONS

Any developments that could destroy, or damage subsurface fossils as well as excavations exposing fresh fossiliferous bedrock are of conservation and research interest. However, in most cases sampling of fossils for the purpose of palaeontological mitigation cannot usually be conducted prior to the commencement of construction / excavation activities until potentially fossil-bearing strata are properly exposed.

- It is therefore recommended that excavations into or disturbances of *in situ* Volksrust Formation sediments at Borrow Pit 1 and 2, are accompanied by a palaeontological inspection at the earliest practicable opportunity during the construction phase of the development before fresh bedrock have the chance to weather or be otherwise damaged by further development.
- Alternatively it is advised that, if possible, the borrow pit activities are purposely restricted to the palaeontologically insignificant dolerite outcrops that are located around Borrow Pit 1 at Oudenhoutskloof.

8. REFERENCES

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9. TABLES AND FIGURES

Table 1. Potential fossil heritage of relevant geological units.

Geological Unit	Rock types and Age	Fossils Recorded / Biostratigraphy
Superficial deposits	Alluvium. Quaternary to Recent	Vertebrate remains; coprolites, freshwater molluscs, micro plant fossils (pollen, phytoliths)
Karoo Dolerite (<i>Jd</i>)	Intrusive igneous bedrock. Jurassic	No fossils
Karoo Supergroup Ecca Group Volksrust Formation (Pvo)	Blue-grey to dark grey silty shale with thin siltstone sand sandstone lenses and beds - transgressive sequence related to open shelf and possibly also near shore conditions Permian	Temnospondyl amphibian remains, invertebrates, plant remains, petrified wood, marine and non-marine trace fossils

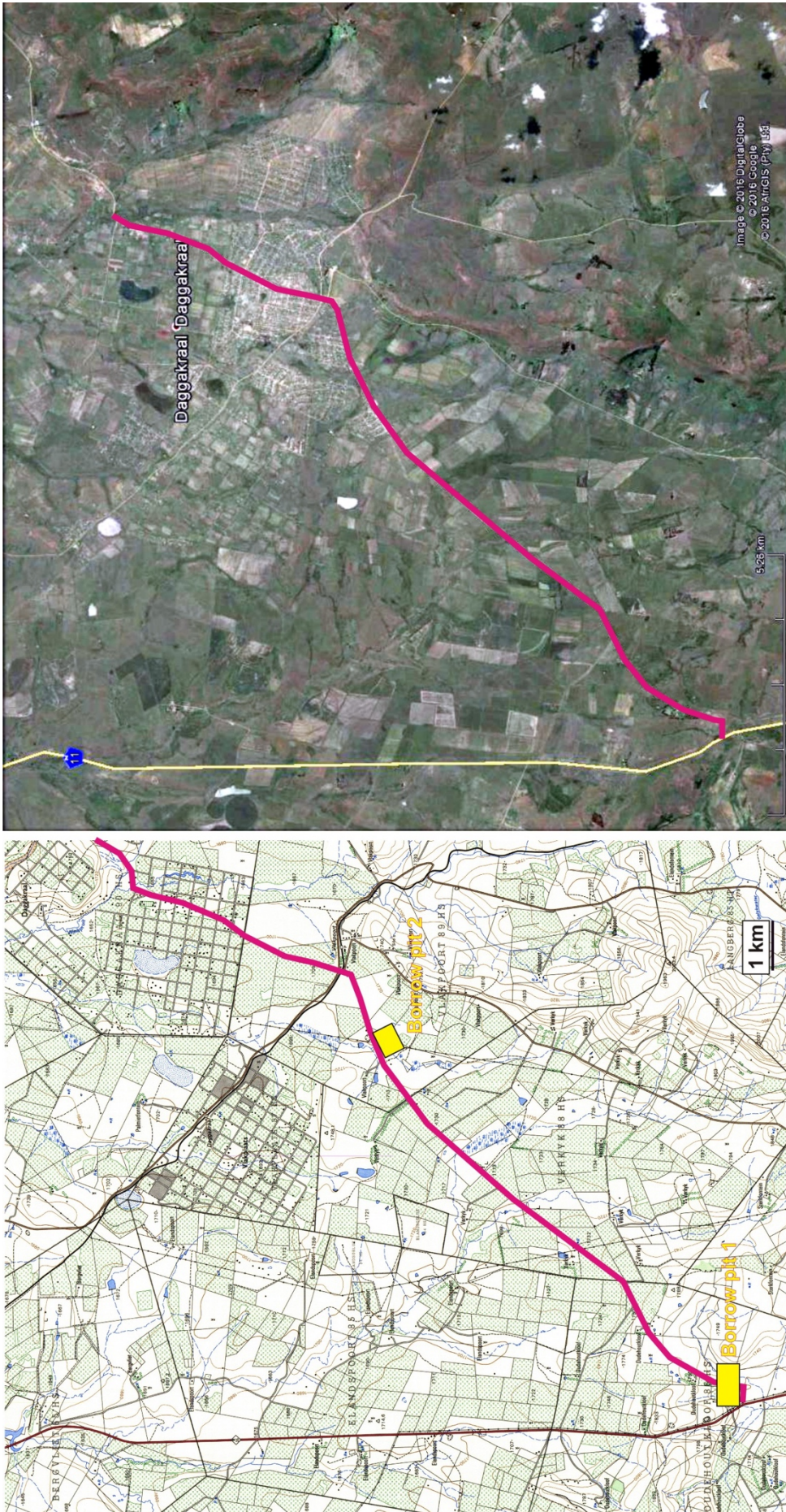


Figure 1. Topographic map (left, portion of 1:50 000 scale 2729BB Amersfoort) showing the position of the road with aerial view (right)

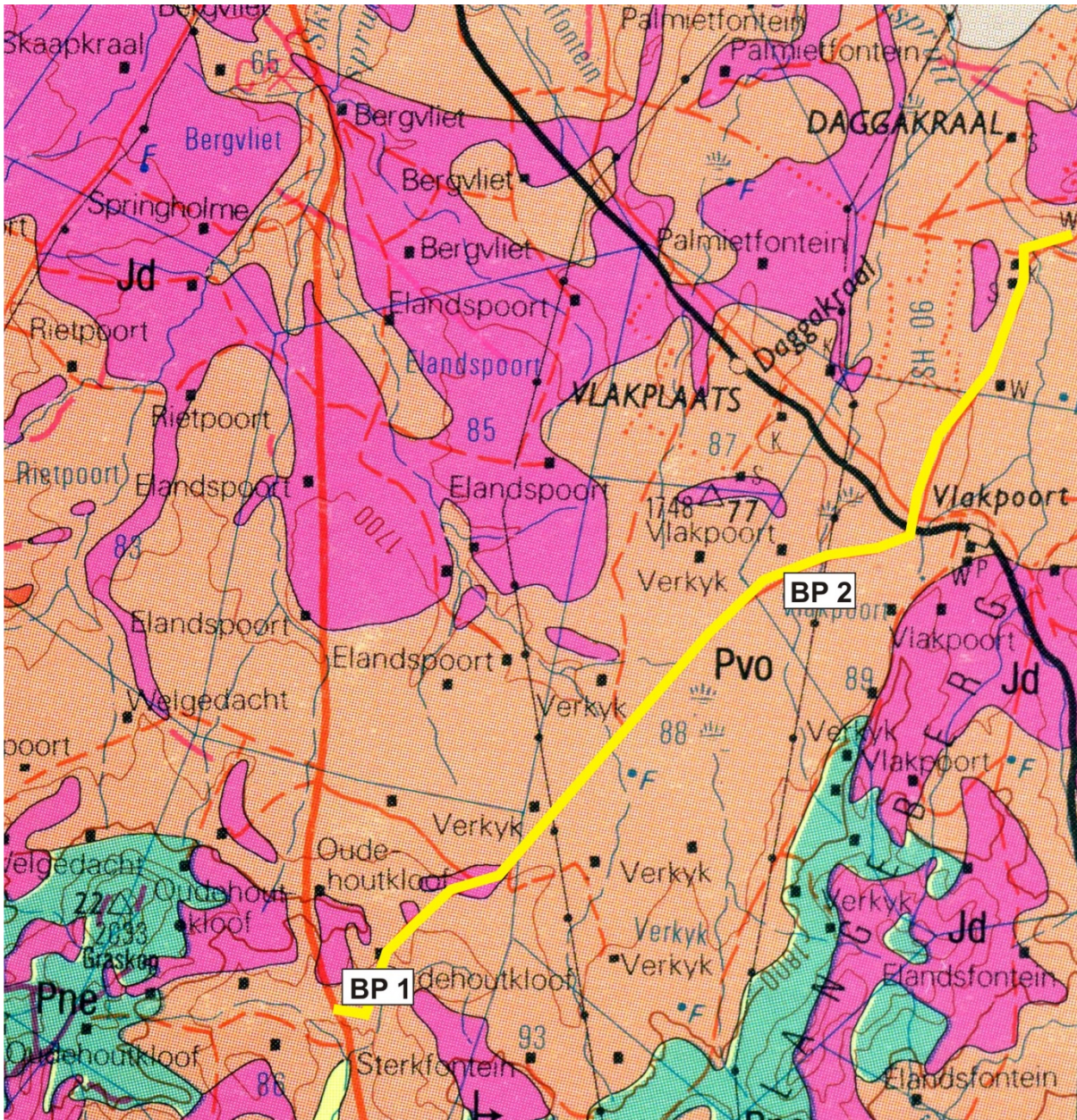


Figure 2. Geological map of the area between Volksrust and Amersfoort (portion of 1:250 000 scale geological map Frankfort 2728). From oldest to youngest, the regional geology is represented by Permian Ecca Group Volksrust Formation (Pvo) shales and Adelaide Subgroup sandstones (Pne) of the Karoo Supergroup. Sedimentary bedrock is intruded by numerous dolerite dykes and sills (Jd).