

Phase 1 Heritage Impact Assessment of a proposed new
sand mine development on the farm Jammerdrif 540/RE
near Wepener, FS Province.

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29 / 03 / 2020

Summary

At the request of Lefatse Environmental Consultants a Phase 1 Heritage Impact Assessment was carried out over a 35 ha area covering an old disused farm Jammerdrif 540/RE. The site is located on the banks of the Caledon River, about 6 km west of Wepener, eastern Free State Province. It is situated within the outcrop area of the Beaufort Group (Karoo Supergroup), and is represented by Early Triassic sedimentary rocks of the palaeontologically significant Tarkastad Subgroup. The proposed development will primarily affect geologically recent (Holocene –Recent) alluvial overburden that has been severely degraded by previous sand mining activities, including an existing open pit sand mine area in the section south of the R26. The geologically recent alluvial sand overburden is generally considered to be culturally sterile in terms of intact Stone Age archaeological remains. Any potential indication of temporary gun positions within the the proposed Mining Right Application Area, during the Siege of Jammersbergdrif, has been obliterated by previous landscape degradation. As far as the palaeontological heritage is concerned, the proposed development may proceed with no further palaeontological assessments required, provided that all excavation activities are restricted to unconsolidated alluvium within the boundaries of the Proposed Mining Area footprint on the farm Jammerdrif 540/RE. In the unlikely event that fossils are exposed within the river sand overburden during the operational phase of the project, it is advised that a professional palaeontologist be called in to record and remove the material before further excavations takes place (Chance Find Protocol attached). As far as the archaeological heritage is concerned, The terrain within the proposed Mining Right Application on the farm Jammerdrif 540/RE, including the Proposed Mining Area area has been degraded by previous sand mining activities and is assigned a rating of Generally Protected C (GP.C). The Old Mill structure is assigned a rating of Local Significance, Grade 3A. The section between the northeastern boundary of the Proposed Mining Area and the northeastern boundary of the proposed Mining Right Application Area has been severely degraded by previous sand mining and farming activities, but since it lies proximal to the Old Mill structure, the historical bridge crossing over the Caledon River and the declared battlefield battle site on adjacent farm Anniesdale 157, it is advised that this section is preferably avoided in terms of planned future mining activities. It is the author's opinion that the proposed development may proceed, provided that all excavation activities are restricted to within the boundaries of the proposed Mining Right Application Area footprint on the farm Jammerdrif 540/RE, but limited to the northeastern boundary of the Proposed Mining Area.

Contents

Summary.....	2
Introduction.....	3
Locality data	4
Background.....	5
Field Assessment	7
Impact Statement and Recommendations	8
References.....	9
Tables & Figures.....	10

Introduction

At the request of Lefatse Environmental Consultants, a Phase 1 Palaeontological Impact Assessment was carried out over a 23 ha area covering an existing open pit sand mine on the farm Jammerdrif 540/RE. The site is located on the banks of the Caledon River, about 6 km west of Wepener, eastern Free State Province (**Fig. 1**). The assessment is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites.

The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development listed in Section 38 (1) of the NHR Act are:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site
 - a) exceeding 5000 m² in extent; or
 - b) involving three or more existing erven or subdivisions thereof; or
 - c) involving three or more subdivisions thereof which have been consolidated within the past five years;
- The rezoning of a site exceeding 10 000 m²; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

The task involved identification of possible paleontological sites or occurrences in the proposed zone, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Terms of Reference

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential heritage impacts associated with the proposed development.

Methodology

The heritage significance of the affected area is evaluated using existing field data, database information and published literature. Geological maps were used to determine fossil-bearing rocks within the study area. This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Site significance classification standards, as prescribed by SAHRA, were used for the purpose of this report (**Table 2**).

Locality data

Maps: 1:50 000 scale topographical map 2926DB Jammersdrif.

1:250 000 scale geological map 2926 Bloemfontein.

The site is located on the farm Jammerdrif 540 RE, located about 6 km due west of Wepener on the banks of the Caledon River (**Fig. 2**). Three areas are demarcated in **Figure. 3**, namely the Proposed Mining Area (red polygon), Mining Right Application Area (yellow polygon)

and a 150m-wide zone lateral to riverbank running parallel to the Mining Right Application Area (white line). **The 150 m – wide zone was surveyed to also include the demarcated proposed Mining Area as well as the Mining Right Application Area.** The study area north of the R26 forms part of an old sand mine operation that is primarily situated on top of reworked overbank sediments of the Caledon River (**Fig. 4 & 5**).

Site Coordinates:

North-eastern Boundary of the Mining Right Application Area 29°43'3.57"S 26°58'45.47"E.

South-western Boundary of the Mining Right Application Area 29°43'22.93"S 26°57'42.86"E.

Background

This segment provides overview of the heritage footprint in the region with the intention to recognize potential sites, landscapes and features that may be found within the study area.

Palaeontology

The geology of the region has been described by Theron (1963) and Johnson (2006). It is situated within the outcrop area of the Beaufort Group (Karoo Supergroup), and is represented by Early Triassic sedimentary rocks of the Tarkastad Subgroup, characterized by alternating sandstone and mudstone layers and subdivided into the lower arenaceous Katberg Formation and overlying, argillaceous Burgersdorp Formation (Johnson et al, 2006; green areas in **Fig. 6**). These sedimentary rocks form the base on which younger, superficial deposits of late Cenozoic age (*Qs*) has been deposited. Dykes and sills of resistant Jurassic dolerites largely determine landscape topography as indicated by the distinctive koppies and flat-topped inselbergs in the region (red areas in **Fig. 6**). The dolerites consist of very dark, medium – grained rock of Jurassic age and coincide with the lava flows of basalts that capped the high escarpments of the Drakensberg in KwaZulu-Natal and Lesotho. Superficial deposits in the region consist mainly of and shallow to well-developed, alluvium, colluvium and residual soils of varying depth.

An outstanding feature of the Beaufort Group is its abundance of Permian – Triassic vertebrate fossil remains, forming an almost complete record detailing millions of years of vertebrate evolution roughly between 280 and 200 million years ago. The lower beds contain reptiles, which in the higher horizons, make way for largely mammal-like reptiles and amphibians. The sedimentary bedrock in the region is assigned to the *Cynognathus* and overlying *Lystrosaurus* Assemblage Zones (Kitching 1995; Groenewald & Kitching 1995). These biozones provide important insights into the evolutionary transition of mammal-like reptiles (therapsids) (Kitching 1977; McCrae 1999; McCarthy & Rubidge 2005). Several

fossil localities have been recorded within the Wepener districts, including the farms Bokspoort, Welgevonden and Driefontein.

Another palaeontologically significant sequence not indicated by the SAHRIS palaeo-sensitivity map is represented by late Pleistocene floodplain deposits (overbank sediments containing old terrace gravels and a palaeo-donga / gully infill deposits) associated with large river systems like the nearby Caledon River.

Archaeology and History

Stone Age artifacts are generally common as surface material on the South African central plateau, but it lacks high visibility and frequently escapes the attention of the public eye. At this site, stone tools are found in extremely low density across the surface of the valley flanking the river and in addition, it does not occur within a sealed environment. Unsealed and exposed, the possibility of an intact Stone Age artifact content in the area is most unlikely. As a whole, archaeological surface material is liable to be displaced laterally over time so that their original locus may have changed. Nevertheless, the Caledon River valley has produced significant Stone Age archaeological sites such as Rose Cottage Cave, situated on the Platberg south of Ladybrand, an important site that contains rock art and an archaeological deposit with artifacts that goes back to the Middle Stone Age (Wadley 1991). Another noteworthy site is a small shelter situated on an east-facing slope of the Platberg, which contains rock paintings and a stratigraphic sequence that goes back to the mid-Holocene (ca. 5000 years Before Present). Artifacts include stone tools, worked bone, ostrich eggshell and pottery. There are also numerous Later Stone Age and Middle Stone Age open-air sites along the Caledon drainage near between Smithfield and Clarens. According to Stow (1905) the area around Jammerberg east of Wepener was once occupied by Bushmen groups under leadership of a certain captain by the name of 'Koroko'. These groups were eventually displaced following multiple episodes of resettlement by the Koranna and an influx of Nguni people as a result of the *difaqane* during the 1820's. Although these archaeological sites may not be relevant to the proposed development, their presence and location emphasize the archaeological sensitivity of the area and the relative abundance of Stone Age archaeological sites on the landscape within the Caledon River Basin.

There are a number of Iron Age sites that are not distinct enough to be given a typological label but are referred to loosely as the Caledon Valley sites by Maggs (1976). These sites occur near Ladybrand and continue to south of Wepener. Most occur within the Caledon River drainage Basin. These sites were occupied during the eighteenth and nineteenth centuries and maybe earlier as well, based on radiocarbon

dating and historical evidence (**Fig. 7 - 9**). Some of the Caledon Valley sites were occupied as late as the outbreak of the Difaqane in 1822. It is not certain when Iron Age peoples first arrived in the Caledon Valley but historical evidence indicates that Sotho groups had been here from at least 1670 AD (Maggs 1976; Walton 1956).

The colonial history of the Wepener area has its origins in the seasonal incursion of early *trekboers*, which eventually led to increased settlement of white farmers south of Modder River between the Orange and Caledon Rivers between 1825 and 1841. The town of Wepener was established in 1867 in newly conquered Basuto territory following continuous conflict between white settlers and King Moshoeshoe which eventually led to the latter having to secede large part of his territory after the Treaty of Thaba Bosiu was signed in 1866 (Oosthuizen 1969) (**Fig. 10 & 11**). During the South African War, British forces were besieged at the Jammersbergdrif crossing for 16 days by an overwhelming Boer force, until the arrival of British reinforcements forced them to retreat.

Field Assessment

The study area is underlain by well-developed overbank sediments made up of homogenous and geologically recent (< Holocene) river sand that has been extensively degraded by previous earthmoving activities (**Fig. 13 - 14**).

Palaeontology

A pedestrian survey of the terrain revealed no evidence of fossiliferous terrace gravels or paleo-donga (gully) infill deposits. No evidence was found for the accumulation and preservation of intact fossil material within the geologically recent alluvial overburden covering the footprint. The potential for disturbance or destruction of intact Quaternary palaeontological resources is considered negligible during the operational phase of the development project because of the reworked alluvium, but potentially high if mining activities are to be conducted outside the demarcated development footprint where no mining has not taking place yet. Given the thickness of the sandy overburden, it is considered unlikely that bedrock sediments, made up of potentially fossil-bearing Tarkastad Subgroup strata, will be negatively affected by the development.

Archaeology

A pedestrian survey conducted along six longitudinal transects within the study area revealed no above-ground evidence of *in situ* Stone Age archaeological material, eroding out or distributed as surface scatters on the landscape. There are no above-ground indications of rock art, graves or historically significant structures older than 60 years within the confines of the proposed mining right footprint. LIA settlements

on the southern Highveld are situated on or near the foot of dolerite koppies and rarely if ever, on the banks of large rivers and would certainly not have been located within the study area, which forms part of a meandering floodplain.

No signs of Iron Age archaeological remains were observed following the foot survey of the proposed Mining Right Application Area.

Listed below are historically significant aspects/features located in the surrounding area, but outside the confines of the study area:

- The Robertson Cemetery and Chapel situated on portion of the farm Cemetery 429 (Deed of Transfer 3516/1930) (**Fig 15. Table 1**).
- Remains of the so-called Old Mill house is located near, but on the north-eastern boundary of the Mining Right Application Area and about 300 m away from the Proposed Mining Area (**Fig. 16 & 17; Table 1**). The mill is situated about 600 m south of the old wagon bridge crossing (Jammersbergbrug) and 1 km south of the old railway bridge crossing (both situated on farm Anniesdale 157), the former's original construction being authorized in 1897 (**Fig. 18**).
- The Old Mill was apparently used for storing supplies during the siege of Jammersbergdrift (9 – 25 April 1900) The Jammersbergdrift Battlefield, which has been declared in 1973, is situated on remaining extent of the farm Anniesdale 157 (**Fig. 19**) The crossing at Jammersbergdrif has been declared as a historical battlefield site in 1973. Here in April 1900, Col. E. H. Dalgety and his Colonial Division of about 2 000 men were besieged for 16 days by Gen. C de Wet and his force of almost 6 000 Boers. Following the arrival of British reinforcements, Gen. De Wet had to retreat on 25 April 1900. The site is situated on remaining extent of the farm Anniesdale 157.
- Several, Late Iron Age stone-walled enclosures are located on dolerite outcrop, about 1 km northwest of the western boundary of the mining right footprint (**Fig. 20, Table 1**). These structures exhibit telltale signs of basic structural units including huts, large enclosures, and pieces of walling and stone circles.

Impact Statement and Recommendations

The proposed development will primarily affect geologically recent (Holocene –Recent) alluvial overburden that has been severely degraded by previous sand mining activities, including an existing open pit sand mine area in the section south of the R26 (**Fig 21 & 22 Table1**). The geologically recent alluvial sand overburden is generally considered to be culturally sterile in terms of **intact** Stone Age archaeological remains. Any potential indication of temporary gun positions within the the proposed Mining Right Application

Area, during the Siege of Jammersbergdrif (as mapped out by Amery 1906, **Fig. 23**), has been obliterated by previous landscape degradation.

As far as the **palaeontological heritage** is concerned,

- the proposed development may proceed with no further palaeontological assessments required, provided that all excavation activities are restricted to unconsolidated alluvium within the boundaries of the Proposed Mining Area footprint on the farm Jammerdrif 540/RE.
- In the unlikely event that fossils are exposed within the river sand overburden during the operational phase of the project, it is advised that a professional palaeontologist be called in to record and remove the material before further excavations takes place (see **Chance Find Protocol** below).

As far as the **archaeological heritage** is concerned,

- The terrain within the proposed Mining Right Application Area (**yellow polygon, Fig. 3**) on the farm Jammerdrif 540/RE, including the Proposed Mining Area area has been degraded by previous sand mining activities and is assigned a rating of Generally Protected C (GP.C) (**Table 2**).
- The Old Mill structure is assigned a rating of Local Significance, Grade 3A.
- **The section between the northeastern boundary of the Proposed Mining Area and the northeastern boundary of the proposed Mining Right Application Area** has been severely degraded by previous sand mining and farming activities, but since it lies proximal to the Old Mill structure, the historical bridge crossing over the Caledon River and the declared battlefield battle site on adjacent farm Anniesdale 157, it is advised that this section is preferably avoided in terms of planned future mining activities.
- the proposed development may proceed, provided that all excavation activities are restricted to within the boundaries of the proposed Mining Right Application Area footprint on the farm Jammerdrif 540/RE, but limited to the northeastern boundary of the Proposed Mining Area (**red polygon, Fig. 3, Table 1**).

References

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DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project.



29 / 03 / 2020

Tables & Figures

Table 1. GPS Coordinates of structures recorded during survey.

Structure	Coordinates	
Stone-walled complex (Iron Age)	29°43'12.86"S	26°57'3.68"E
Stone-walled complex (Iron Age)	29°43'14.54"S	26°56'47.83"E
Stone-walled historical building (Old Mill)	29°43'0.60"S	26°58'53.95"E
Cemetery and chapel	29°42'40.45"S	26°58'48.97"E
Jammersbergdrif crossing	29°42'46.34"S	26°59'12.00"E

Railway crossing	29°42'35.09"S	26°59'12.68"E
Mining Right Application Area south of R26	29°43'27.80"S	26°57'39.37"E
Northeastern boundary of the proposed Mining Area	29°43'14.17"S	26°58'44.21"E

Table 2. Field rating categories for archaeology as prescribed by SAHRA.

Field Rating	Grade	Significance	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.C)	-	Low significance	Destruction

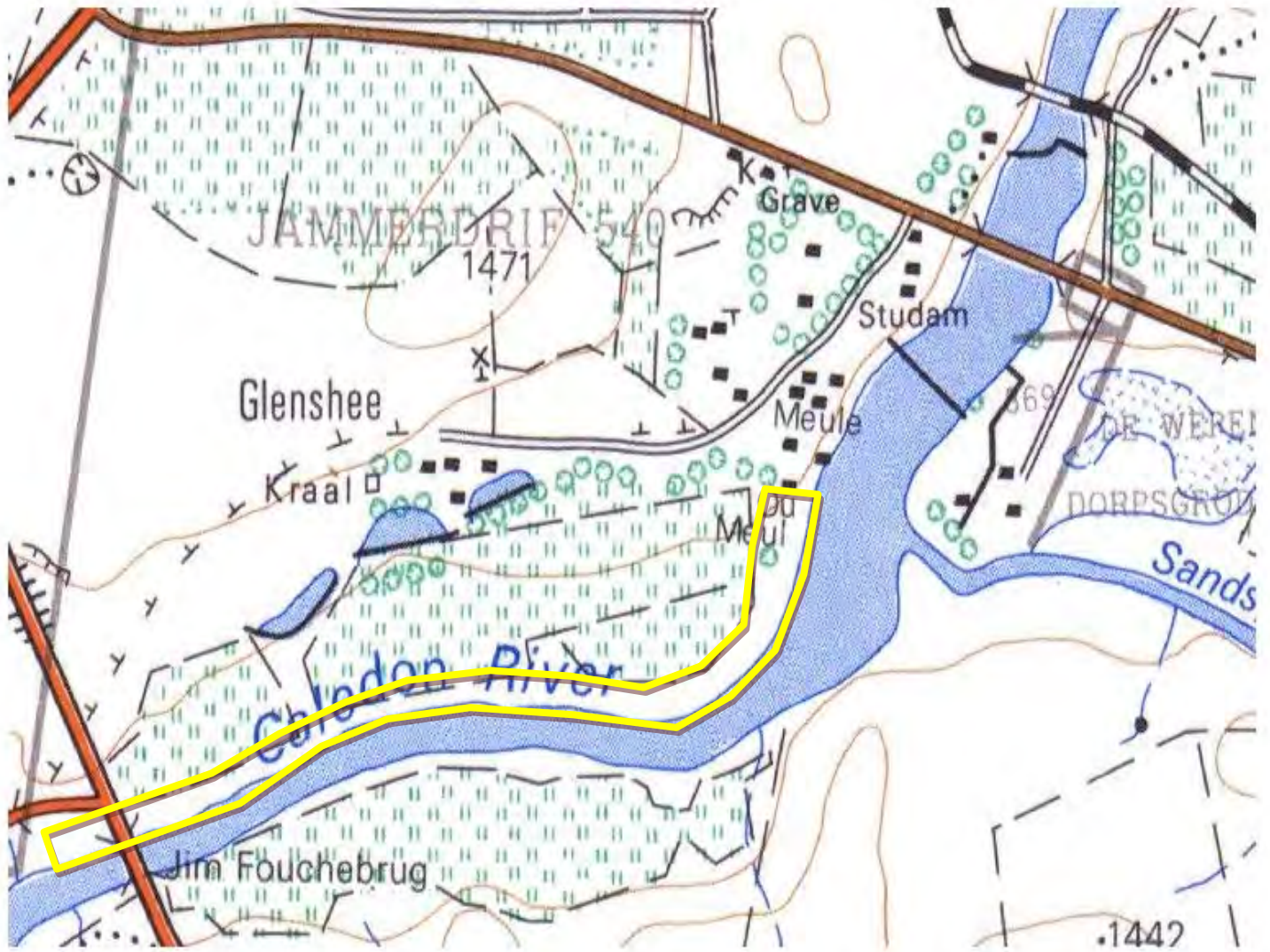


Figure 1. Map of the proposed development footprint (yellow strip marked on Portion of 1:50 000 scale topographic map 2926DB Jammersdrif).



Figure 2. Aerial view of the proposed development footprint in relation to the location of Wepener.

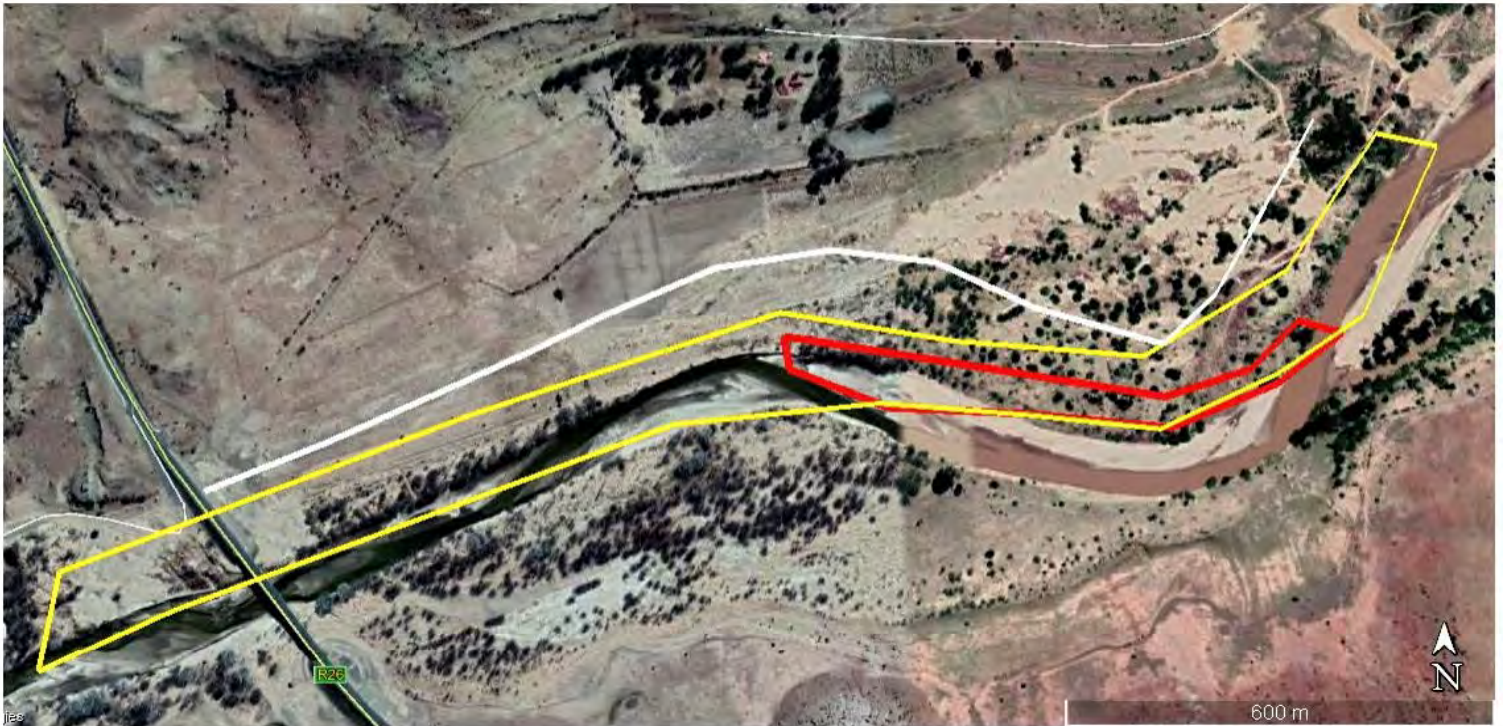


Figure 3. Aerial view of footprint area, including proposed mining area (red polygon), mining right area (yellow polygon) and 150m wide zone lateral to riverbank (white line).



Figure 4. General view of the site, looking north along the riverbed of the Caledon River.



Figure 5. General view of the site, looking north in the direction of the remains of a poplar grove flanking the riverbank.

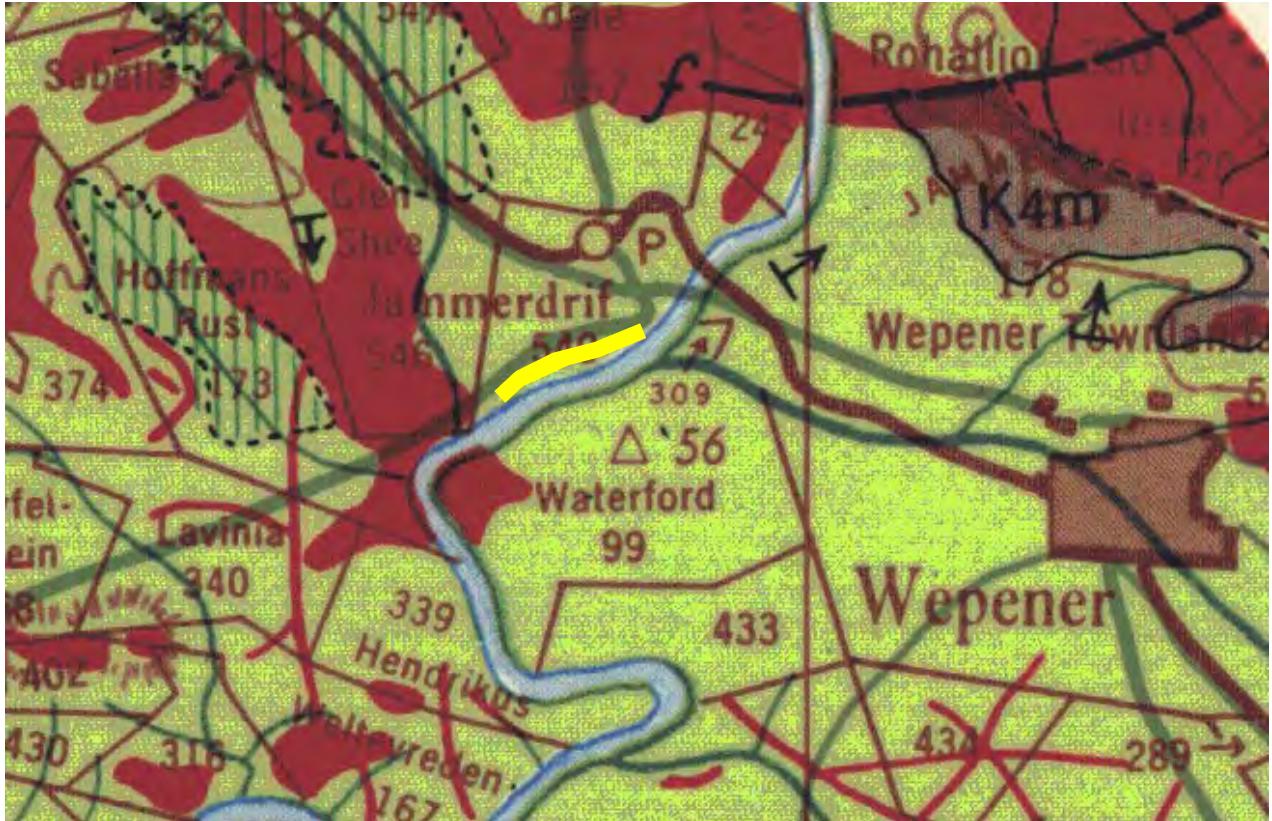


Figure 6. According to the 1:250 000 scale geological map 2926 Bloemfontein, the site (yellow line) is situated within the outcrop area of the Beaufort Group (Karoo Supergroup), and is represented by Early Triassic sedimentary rocks of the Tarkastad Subgroup, characterized by alternating sandstone and mudstone layers and subdivided into the lower, arenaceous Katberg Formation and overlying, argillaceous Burgersdorp Formation.



Figure 7. Aerial view of a cluster of Late Iron Age stone-walled enclosures located on dolerite outcrop about 1 km northwest of the western boundary of the mining right footprint.

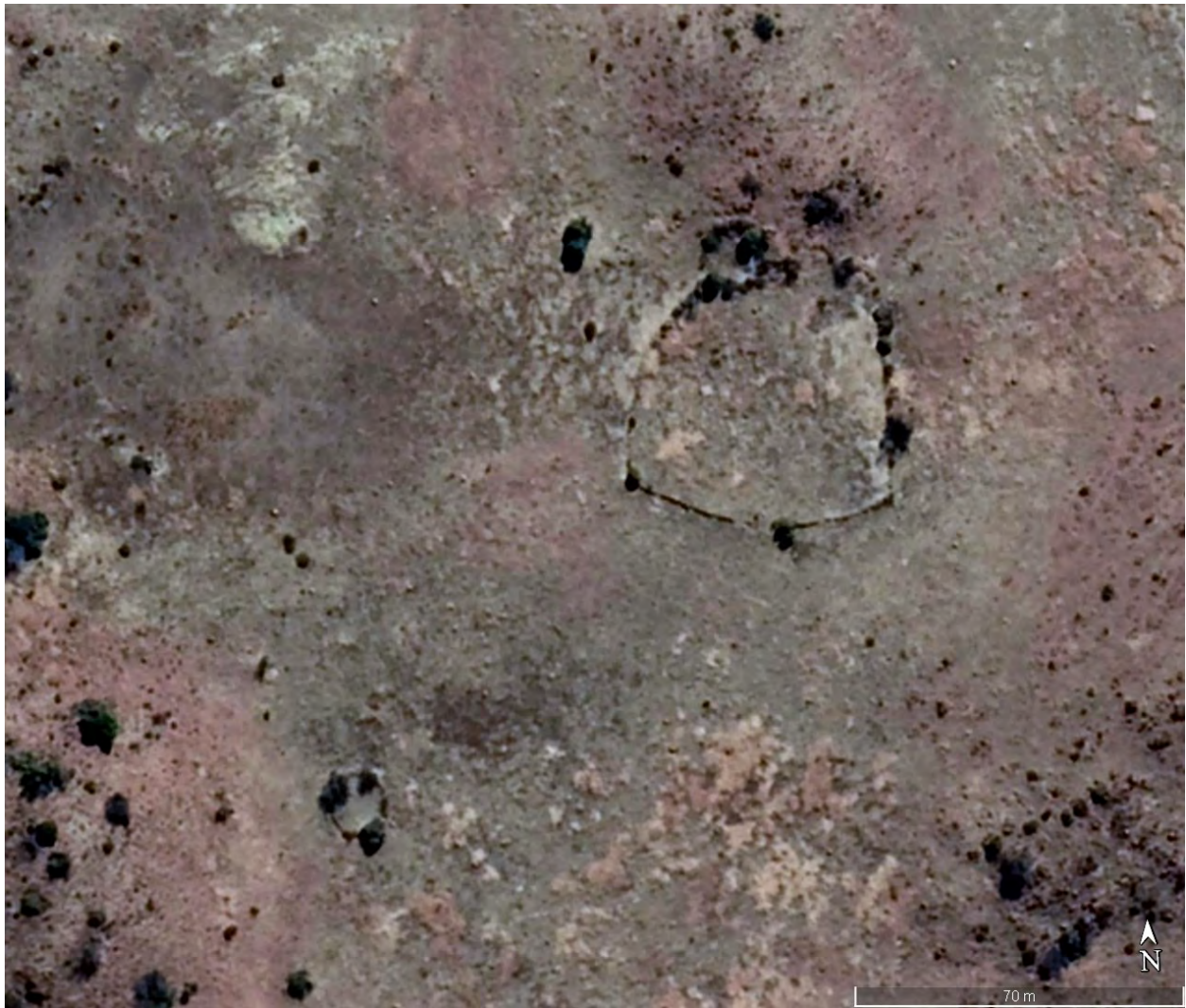


Figure 8. Aerial view of a cluster of Late Iron Age stone-walled enclosures located on dolerite outcrop about 1 km northwest of the western boundary of the mining right footprint.

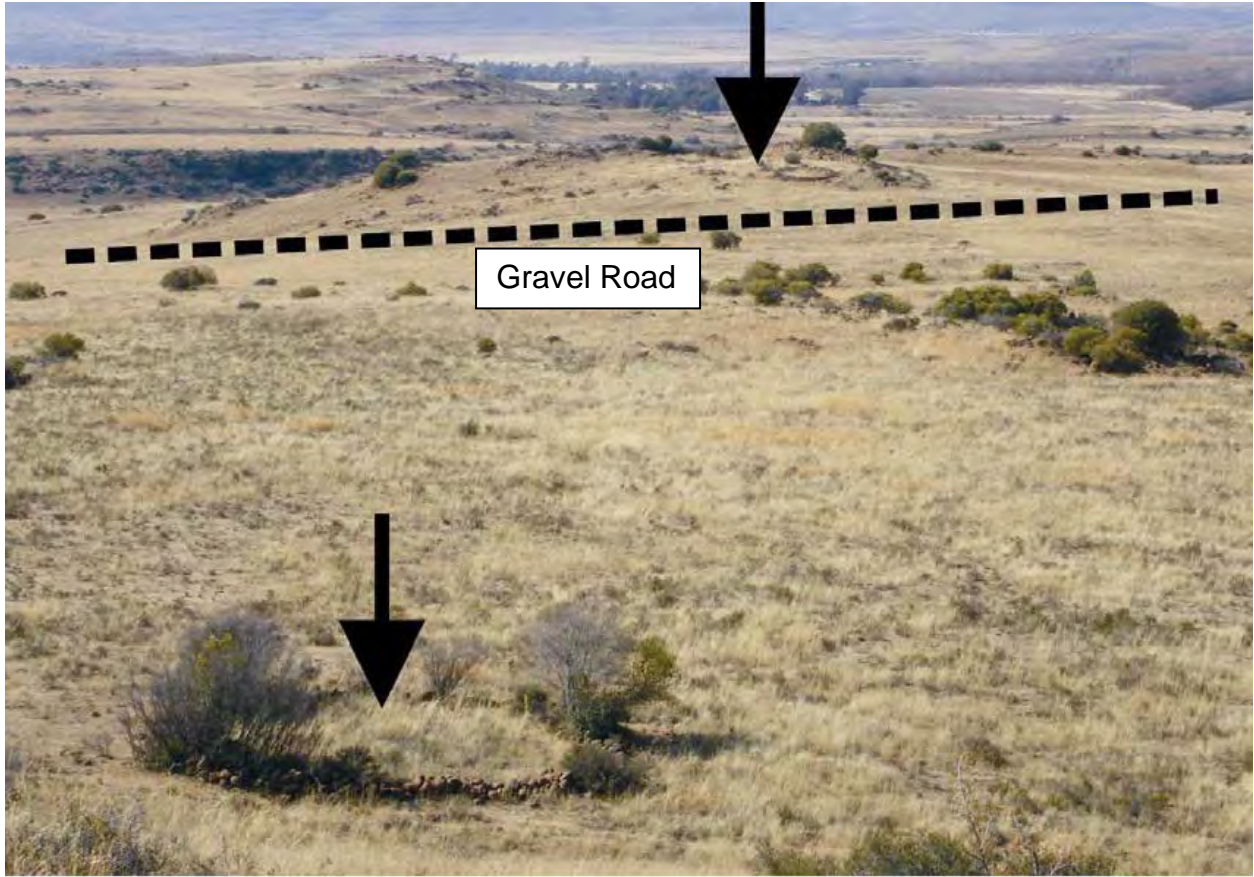


Figure 9. General view of the two Late Iron Age sites, looking east towards the Caledon River.

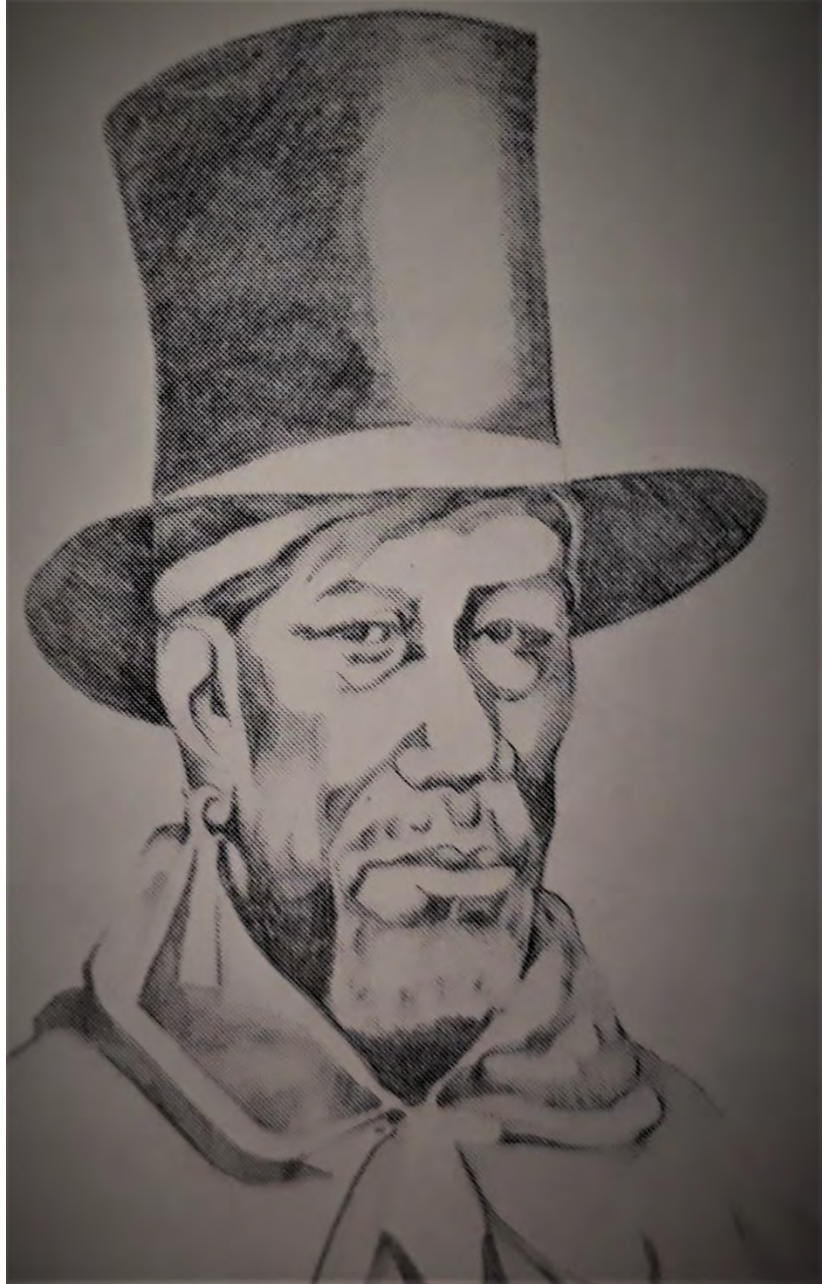


Figure 10. Sketch of King Moshoeshoe I, leader of the Basuto people, ca. 1786 – 1870.

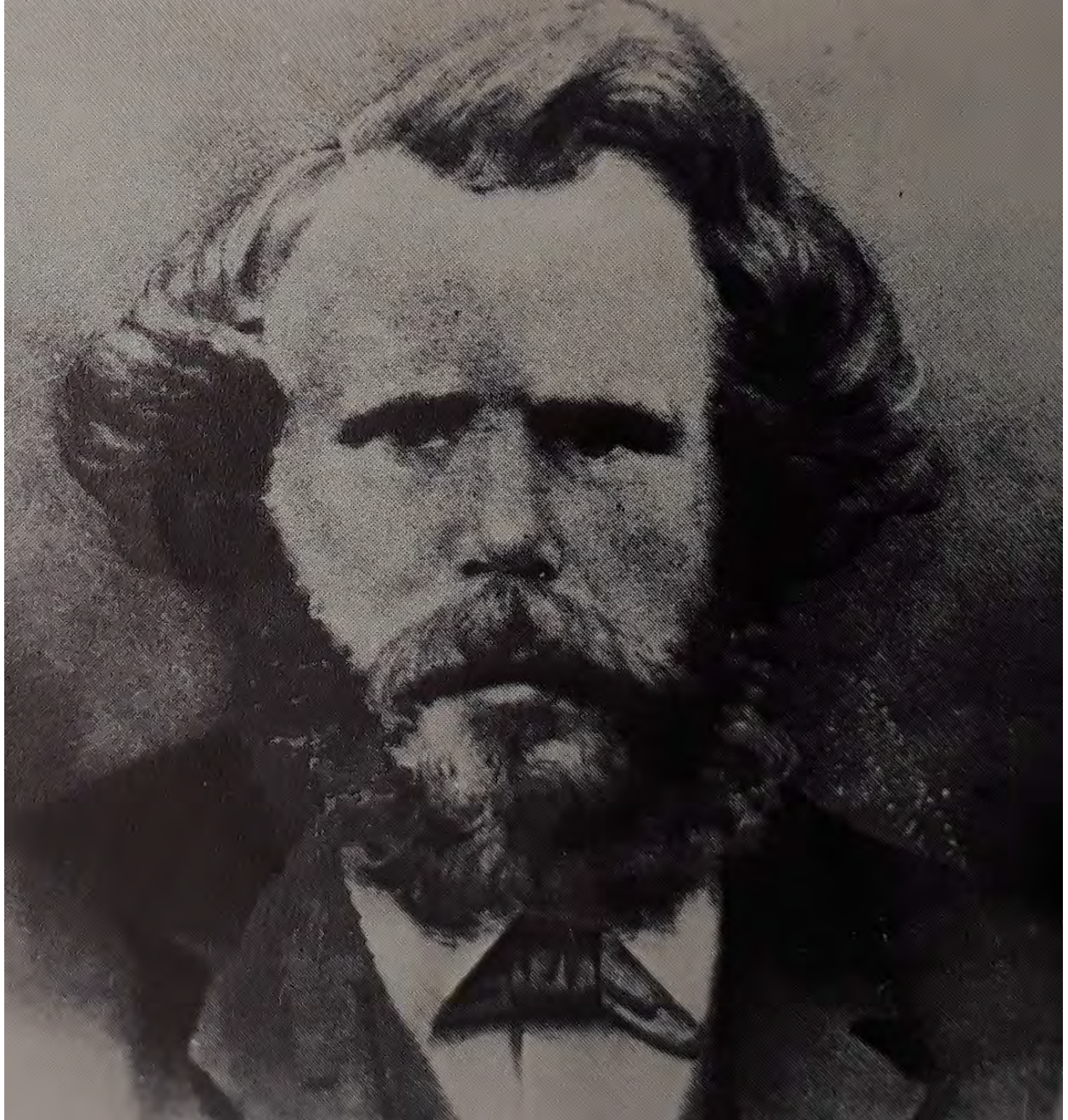


Figure 11. The town of Wepener was named in honour of Lourens Jacobus Wepener (1812-1865) who died during the battle of Thaba Bosiu.



Figure 12. General view of the designated mining area, looking northeast (left) and east (right).



Figure 13. Variable views of previously excavated, grass-covered sandy overbank sediments within the proposed mining area.
Scale 1 = 10 cm.



Figure 14. Exposed, degraded terrain resulting from previous sand mining activities (left) and current construction activities (right), showing well-developed alluvial sand packages of up to 4m in depth, exposed within the overbank sediments within the proposed mining area.
Scale 1 = 10 cm.

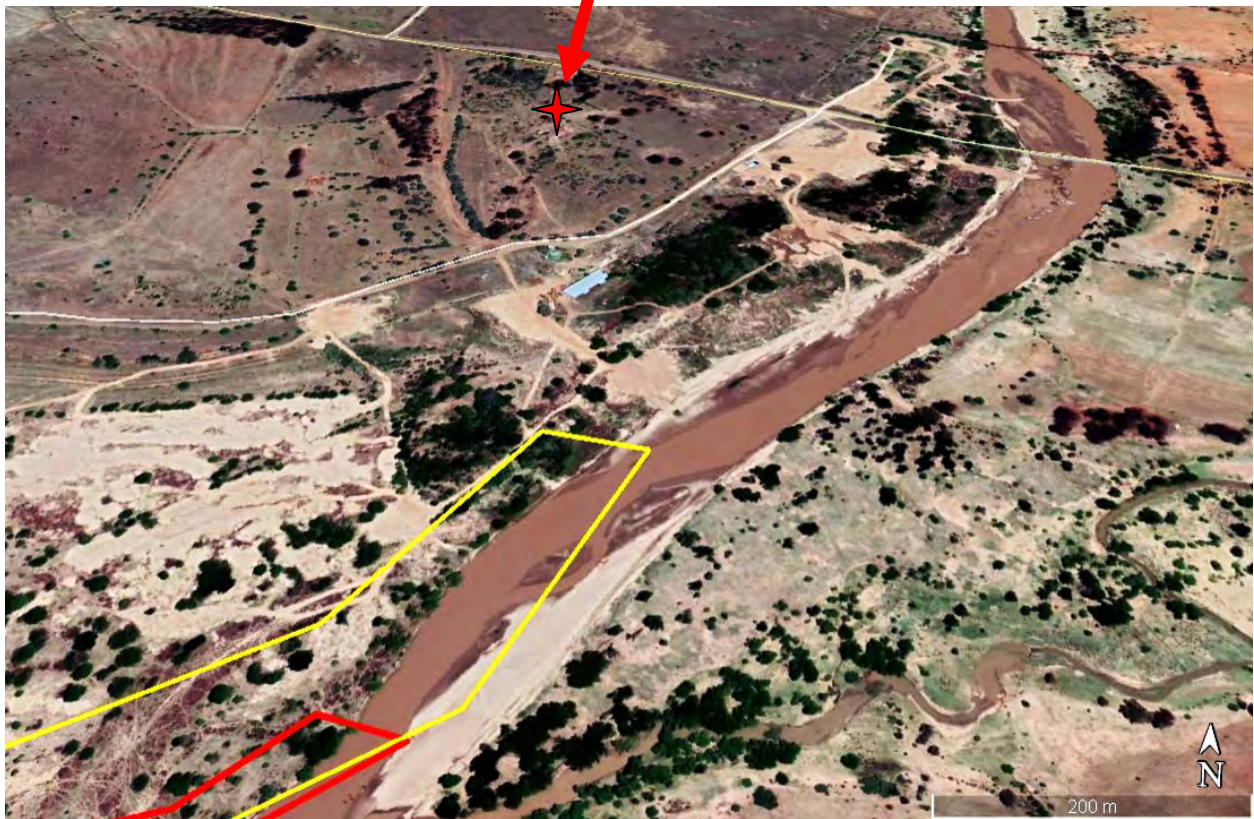


Figure 15. Position of the Robertson Cemetery and Chapel.



Figure 16. Remains of the old mill, looking north towards the old bridge crossing, located near but just outside the north-eastern boundary of the mining right footprint and about 300 m away from the proposed mining area.

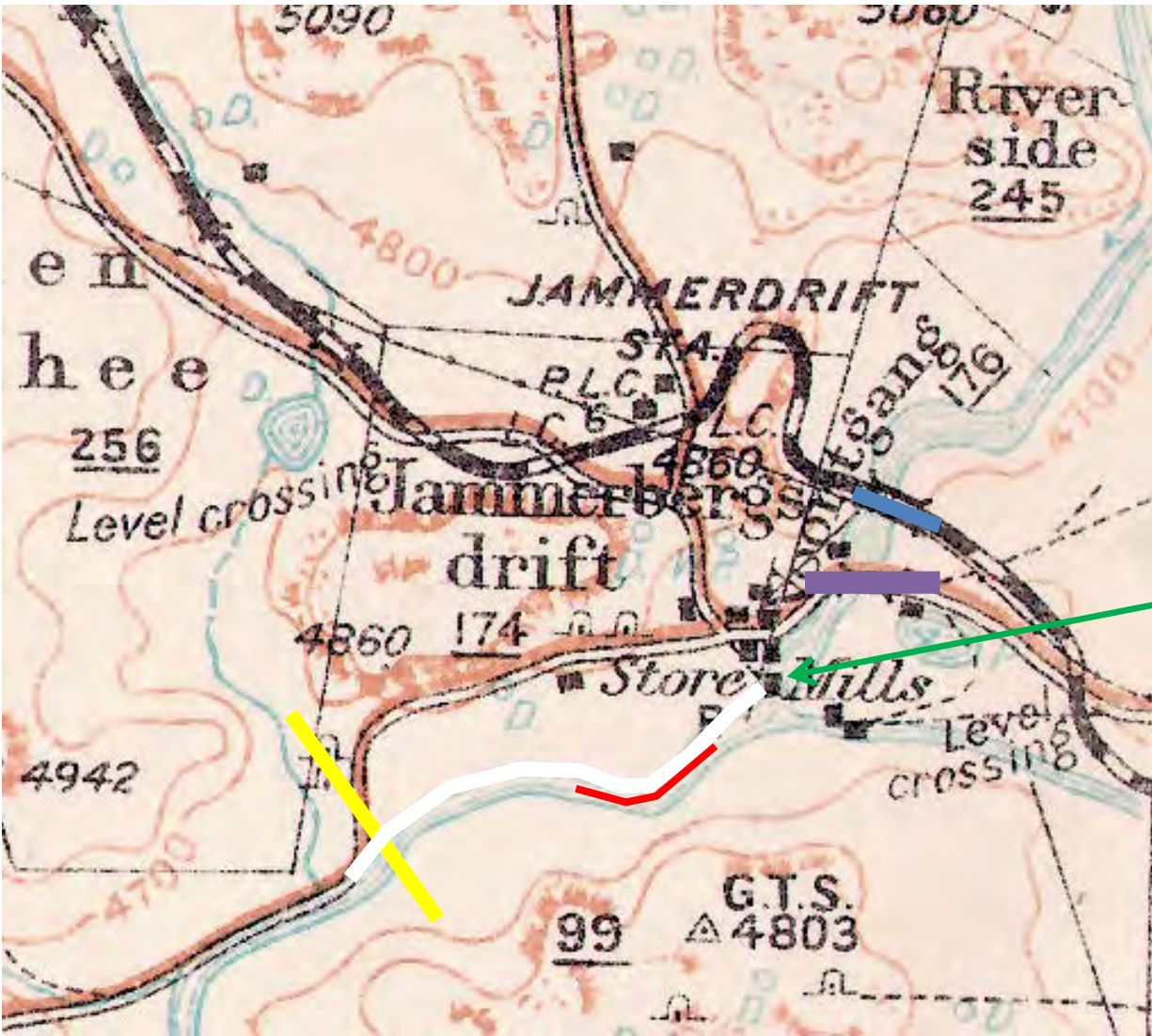


Figure 17. Historical map of the area, circa 1911, with position of the mill (green arrow), old train bridge (blue line), old road and bridge crossing (purple line) and current modern bridge (R26, yellow line) indicated. Mining right application area is indicated by white line, proposed mining area is indicated by red line.

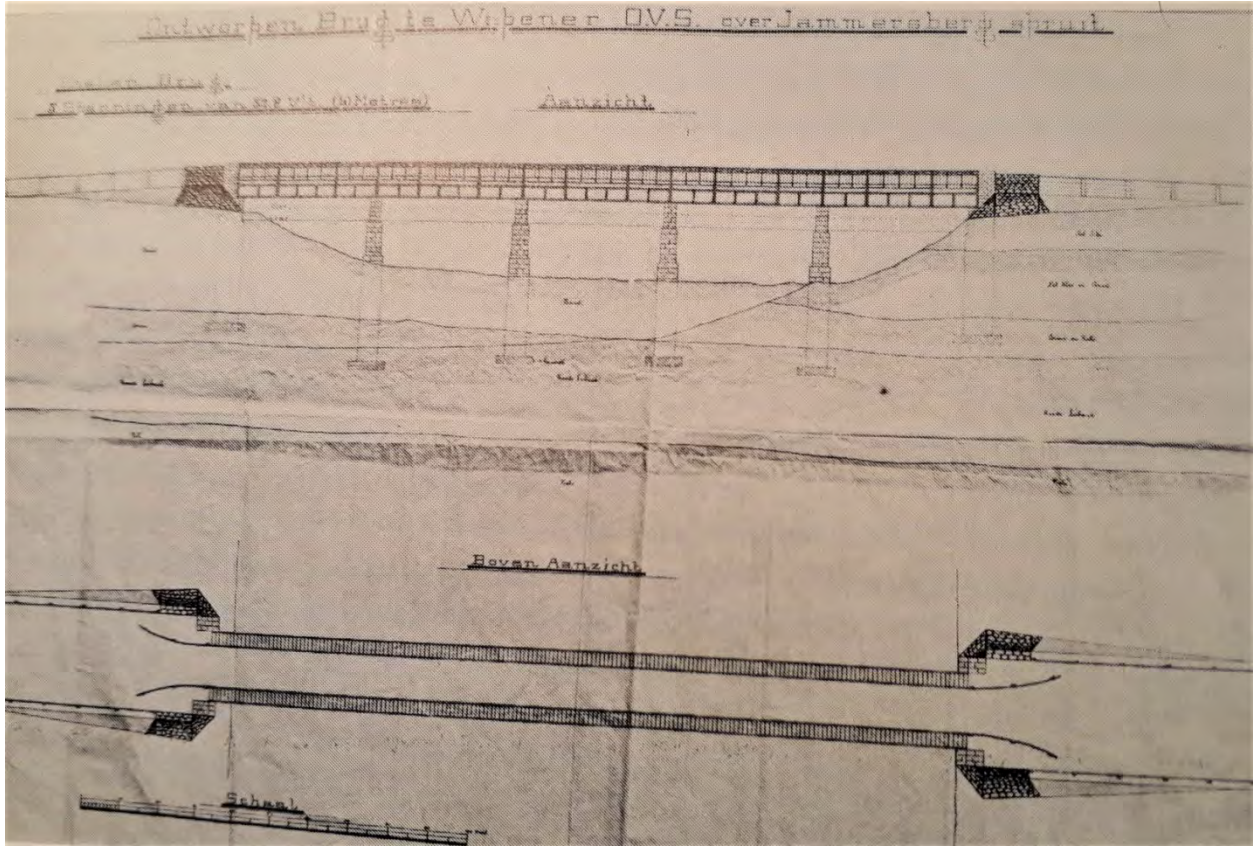


Figure 18. Historical plans for the Jammersbergbrug and railway bridge crossing, both situated on farm Anniesdale 157.

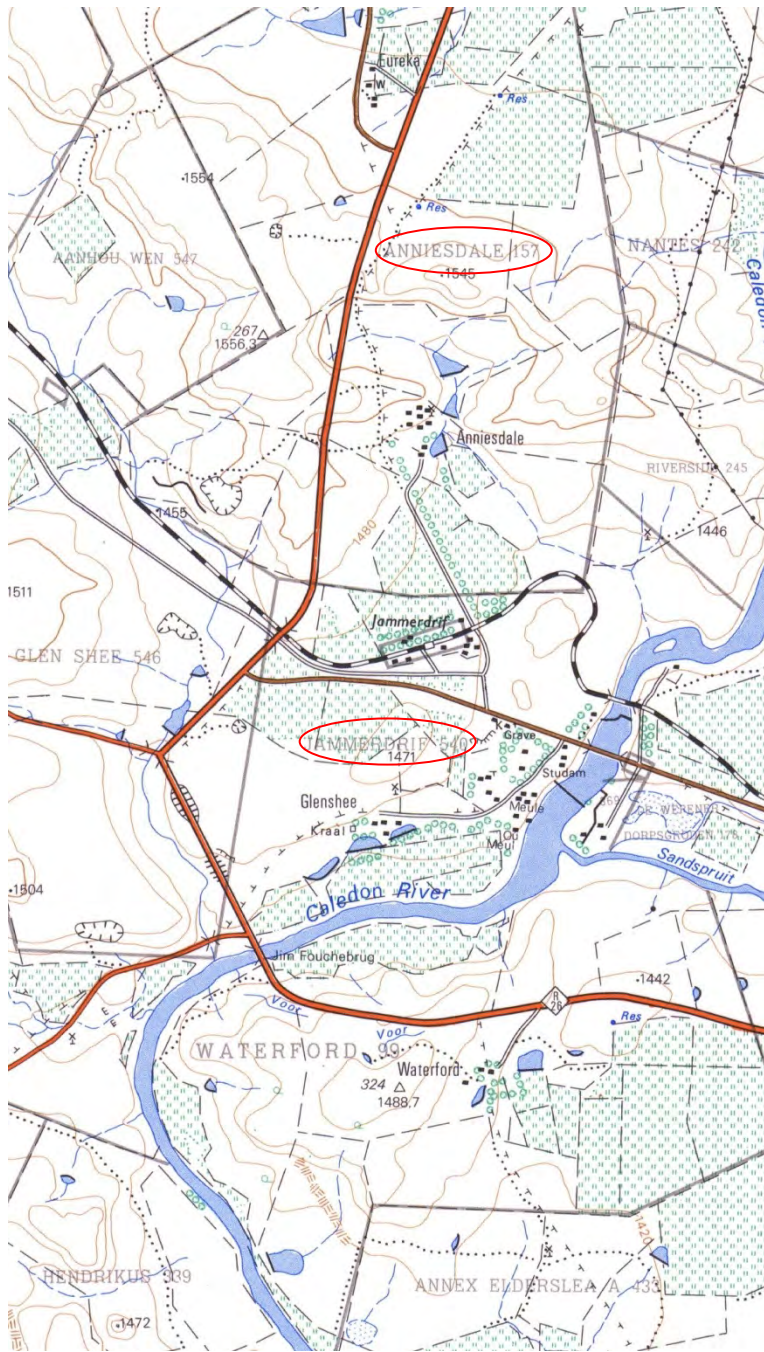


Figure 19. Portion of 1:50 000 scale topographic map 2926DB Jammersdrif of the farms Jammersdrif 540 and Anniesdale 157.

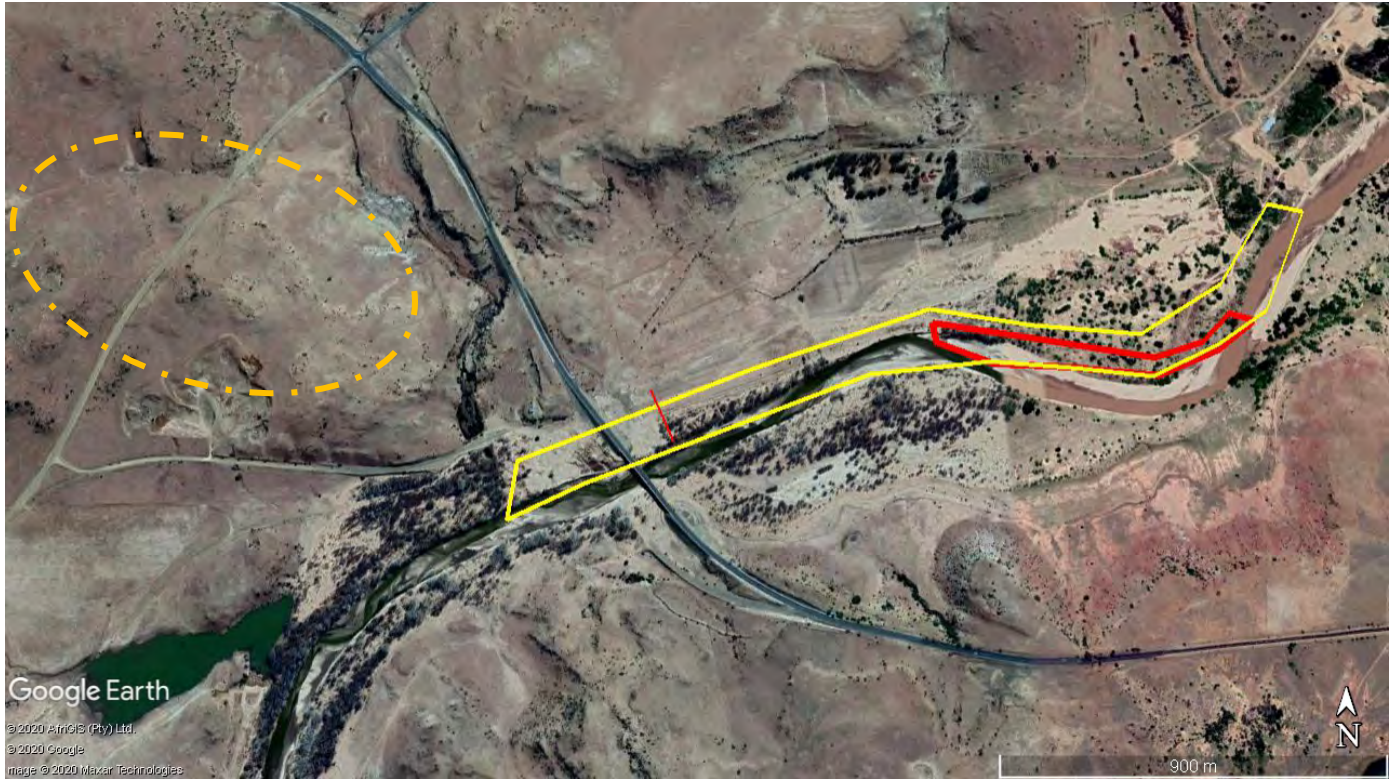


Figure 20. LIA stone-walled enclosures are located on dolerite outcrop, about 1 km northwest of the western boundary of the mining right footprint (stippled line).



Figure 21. Existing open pit sand mine area in the section south of the R26.

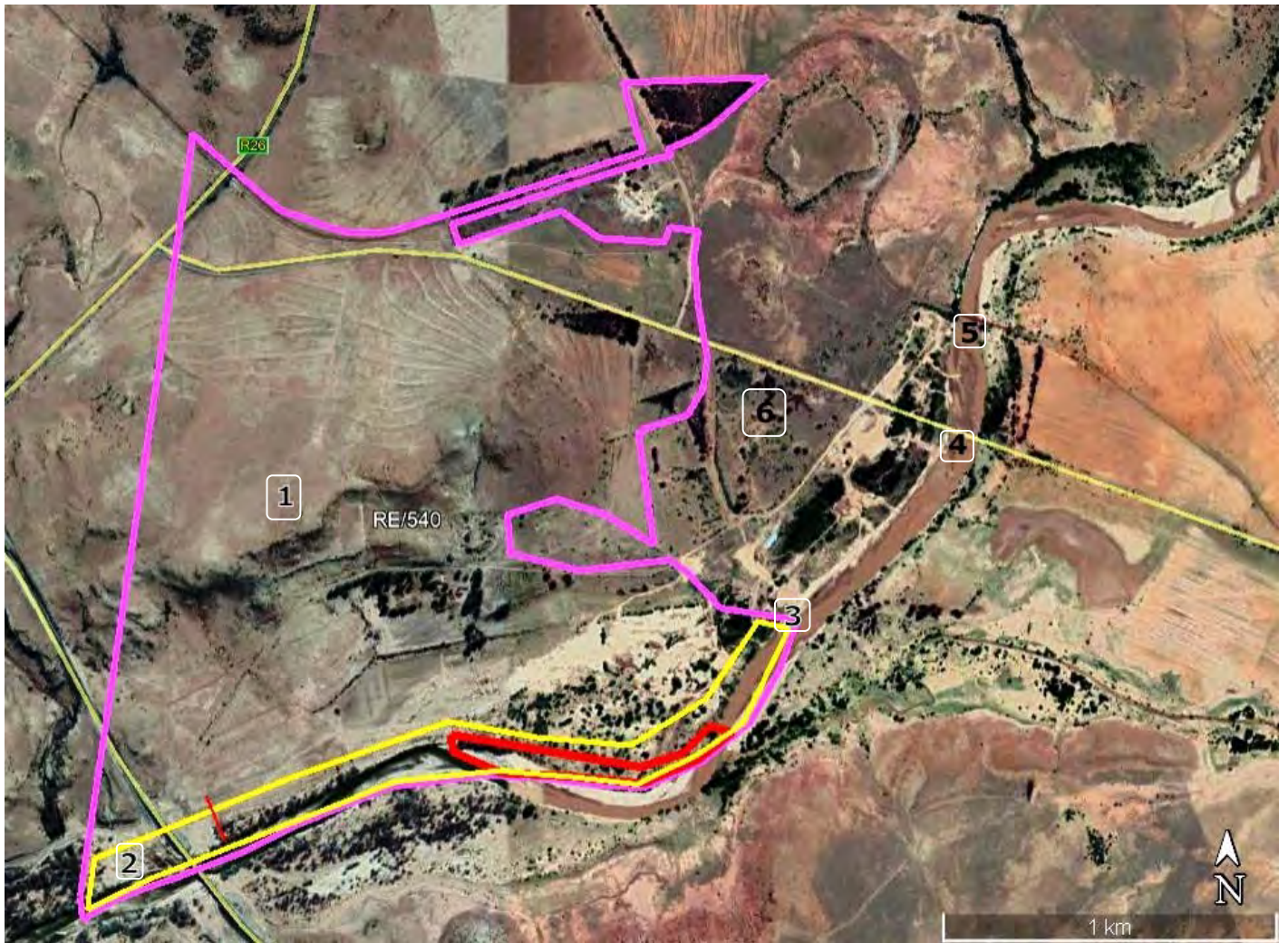


Figure 22. Aerial view showing positions (1) Jammersdrif 540 boundary (pink polygon), (2) proposed Mining Right Application Area (yellow polygon), (3) Old Mill house, (4) Jammersbergdrif Bridge, (5) Railway crossing, (6) Robertson cemetery and chapel.

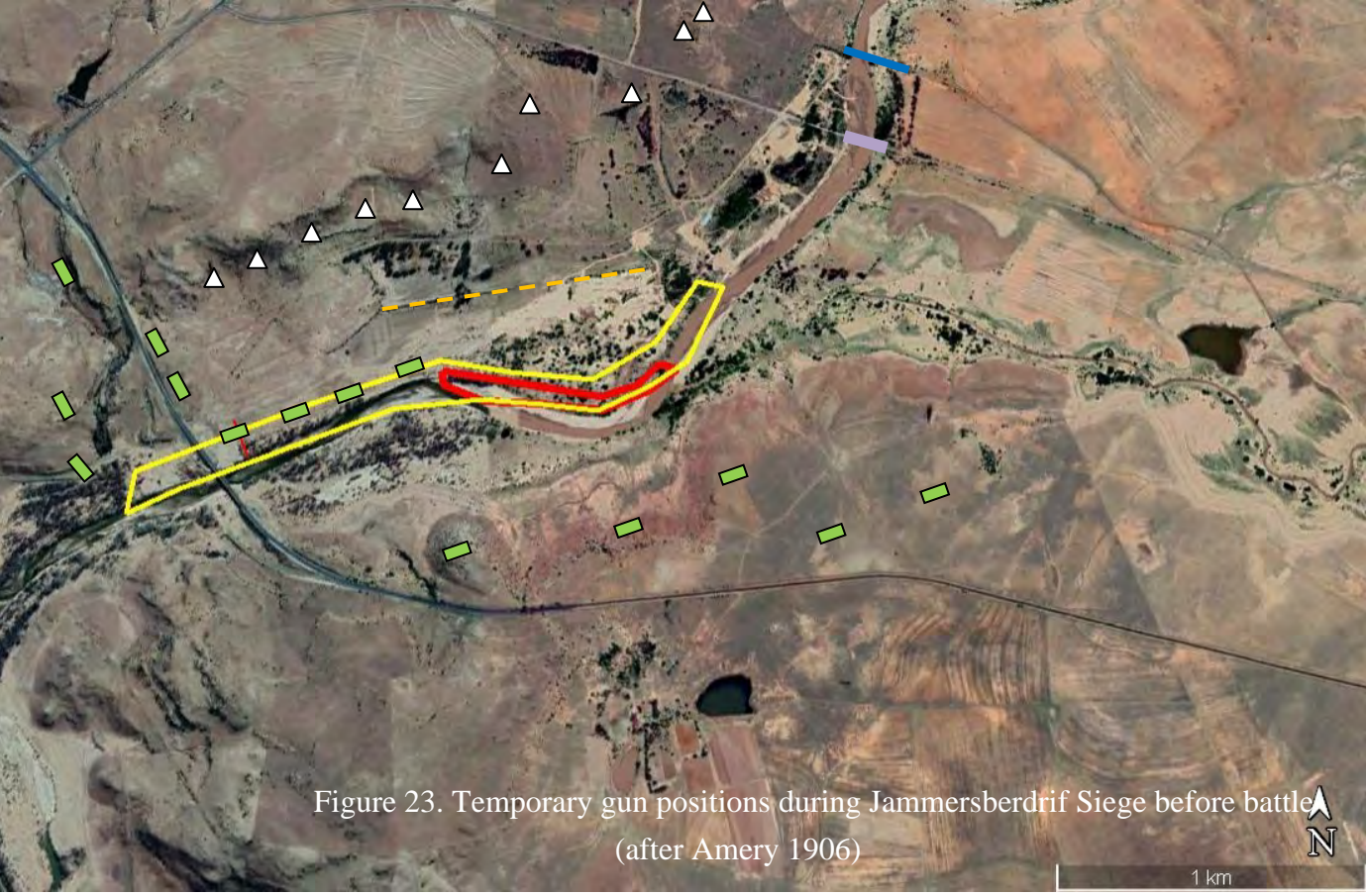


Figure 23. Temporary gun positions during Jammersberdrif Siege before battle
(after Amery 1906)



1 km

Appendix 1: Chance Finds Protocol for Developer

Palaeontology

Any excavations that *exceeds 1 m into bedrock*, will impact *in situ* sedimentary strata which could be palaeontologically sensitive in terms of potential impact on fossils. . “Fossil” means the remains or traces of plants and animals that lived long ago which has been buried and dug up, and most fossils are found where they became buried in layers of sand or mud a long time ago (**Fig. 1 - 3**). “Strata” means layers. And “stratigraphy” is the study and working out of the sequence of the layers of sediment that settled into low-lying areas long ago. “Sediment” means of sand, mud, etc, which settled down. It may still be loose (**see Fig. 7**) or may have consolidated to form rock (**see Fig. 3**). In some fossils the original bone was not lithified. It disappeared completely but left an impression or mould in the sediment (**Fig. 4**). Sometimes leaf impressions are purely a kind of mould and/or cast of a leaf, but often some of the original leaf is left behind in a carbonized form in the impression (**Fig. 5**). Trace fossils, such as footprints, burrows, and trails footprints and tracks provide information such as animal gait, lifestyle and social behavior (**Fig. 6**).

In this case Dr Ragna Redelsdorf at SAHRA must be alerted accordingly since freshly exposed sedimentary rock will require contracting **a professional palaeontologist for appropriate monitoring for fossil remains by** during the construction phase.

If any newly discovered palaeontological resources prove to be significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA;

The decision regarding the EA Application must be communicated to SAHRA and uploaded to the SAHRIS Case application.

If, in the event that localized fossil material is discovered exposed or eroding out of *intact superficial overburden* during the construction phase, it will in all probability resemble modern-looking, but more or less lithified animal bones and teeth and it will most likely be those belonging to bovids (Bovidae: the biological family of ruminant mammals that includes wildebeest, buffalo, antelopes, etc.) (**Fig. 7 - 9**).

In the unlikely event of fossil discovery within previously undisturbed Quaternary overburden, a professional palaeontologist must be called in immediately to confirm and record the finds.

If any newly discovered palaeontological resources prove to be significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA;

The decision regarding the EA Application must be communicated to SAHRA and uploaded to the SAHRIS Case application.

In the meantime, *ex situ* remains must be wrapped in paper towels or heavy duty tin foil and stored in a safe place. The material should not be washed or cleaned in any way. *In situ* material must be kept in place and protected from further damage by covering it with light but rigid object like a box, bucket or metal sheet until further confirmation by the palaeontologist.

Archaeology

If any evidence of archaeological sites or remains, e.g. stone tool artifacts (**Fig. 10 & 11**), ostrich eggshell fragments, charcoal and ash heaps, or remnants of stone-made structures (**Fig. 12**) or unmarked graves (**Fig. 13**) are found during the proposed development, SAHRA APM Unit (Phillip Hine 021 462 5402) must be alerted.

In the meantime, *potential archaeological structures such as stone-build enclosures, buildings or graves* must be avoided by a no-go buffer zone until further confirmation by the archaeologist. Smaller *in situ* material must be kept in place and protected from further damage by covering it with light but rigid object like a box, bucket or metal sheet.

If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately. A professional archaeologist must be contracted as soon as possible to inspect the findings.

If the newly discovered heritage resources prove to be of archaeological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA;

The decision regarding the EA Application must be communicated to SAHRA and uploaded to the SAHRIS Case application.



Figure 1. Fossilized skull of a Gorgonopsian, a carnivore which belonged to a large group of animals known as therapsids (or “mammal-like reptiles”). Most therapsids died out in the End-Permian extinction about 252 million years ago.



Figure 2. Petrified tree trunks.



Figure 3. World's oldest known dinosaur egg of *Massospondylus* with perfectly preserved fossilized embryo, around 200 Ma years old, Golden Gate.



Figure 4. The original skull decomposed or dissolved, but left its shape in the sediments, forming a mould. Then sand or other minerals filled the mould and hardened to form an exact replica of the original. When the rock was chopped open, both mould and cast were revealed.



Figure 5. Fossilized leaf impression in mudrock.



Figure 6. Fossilized footprints and tracks provide information such as animal gait and social behavior..



Figure 7. Example of intact bovid skeletal remains exposed within Quaternary overbank deposits (alluvium) from the Vaal River.



Figure 8. Side view (buccal view) of bovid lower dentition removed from jaw bone. Dentition is one of the most commonly preserved elements amongst Quaternary fossil remains



Figure 9. Example of post-cranial bovid skeletal elements including from left to right:
femur, humerus, radius, tibia, scapula and vertebrae (x 3).



Figure 10. Example of general appearance of Stone Age artifacts rarely found intact as open sites and largely derived as isolated scatter on the landscape



Figure 11. Example of rare stone tool knapping site occasionally found near dolerite intrusions in the region.



Figure 12. Example of historical stone-build enclosure frequently found in the region.



Figure 13. Typical example of unmarked grave recorded around Bloemfontein - distinctive mound with occasional head markers and a characteristic **dolerite cobble** dome.