

Phase 1 Palaeontological and Archaeological Impact  
Assessment of the proposed township extension at  
Warden, Phumelela Local Municipality, Free State  
Province.

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## Executive Summary

- A Phase 1 Palaeontological and Archaeological Impact Assessment was carried out at a 280 ha site demarcated for the development of 2860 erven at the Ezenzeleni Township at Warden, in the north-eastern Free State.
- Infrastructure development will involve construction activities extending over a relatively large surface area. That may impact on thinly capped and potentially fossil-bearing rock units of the Normandien Formation.
- Palaeontological monitoring in the form of a site visit is recommended for the period before or during the start of the construction phase while fresh, potentially fossiliferous bedrock is still exposed for study and recording.
- Unconsolidated Quaternary sediments overlying bedrock in and around the study area are made up of disturbed residual soils and are not fossiliferous. There is currently no record of Quaternary palaeontological exposures in the vicinity.
- The foot survey revealed no evidence of intact Stone Age localities or artefacts distributed as surface scatters on the landscape. There are also no indications of prehistoric structures or remains within or in the immediate vicinity of the survey area. Impact on potentially intact Stone Age archaeological remains, Rock Art localities or Iron Age structures is considered unlikely.
- A small informal graveyard is located amongst informal dwellings and cattle kraals, south of the main road that separates the study area from the Ezenzeleni Township.
- It is recommended that a graveyard management plan is included as part of the overall management plan for the project. Preservation of the site will require that the area is properly demarcated with at least a **20m buffer zone placed around the graveyard during the construction phase of the proposed project.**
- There are **no major archaeological or palaeontological grounds** to suspend the proposed development.
- **The site** has been sufficiently recorded, mapped and documented in terms of conditions necessary for a Phase 1 heritage impact assessment and **can be accessed for development.**
- Recommended Grading: General Protection C (Field Rating IV C)

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## **Introduction**

At the request of Phethogo Consulting in Bloemfontein, a Phase 1 Palaeontological and Archaeological Impact Assessment was carried out at a 280 ha site demarcated for the development of 2860 erven at the Ezenzeleni Township at Warden in the north-eastern Free State (**Fig. 1-2**) The extent of the proposed development (over 5000 m<sup>2</sup>) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African National Heritage Resources Act (Act No. 25 of 1999). The site visit and subsequent assessment took place during October 2013. The task involved identification of possible archaeological and 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.

### **Methodology**

The desktop study provides an assessment of known and potential palaeontological and archaeological heritage within the study area, with recommendations for mitigation where considered necessary. The assessment is based on existing field data and published scientific literature. The geology represented within the study area was determined from published literature and associated geological maps. Relevant archaeological and palaeontological information were assimilated for the report and integrated with data acquired during the on-site inspection.

## **Description of the Affected Area**

### **Details of development and the area surveyed**

#### Details of area surveyed

Maps: 1:50 000 topographical map 2728DD Warden

1:250 000 geological map 2728 Frankfort

General Site Coordinates (**Fig. 3**):

The affected area is made up of 280 ha open grassland north of the Cornelius Spruit and south and east of the Ezenzeleni Township outside Warden (**Fig. 3 - 4**). The town of Warden was established in 1913.

## Geology

From oldest to youngest, the geology around Warden is made up of Late Permian sandstones (Normandien Formation *Pn*: type profile from nearby Normandien Pass between Memel and Harrismith), early Triassic sandstones of the Tarkastad Subgroup (*Trt*), Jurassic dolerite intrusions (*Jd*, Karoo Dolerite Suite), Quaternary alluvium (flying bird symbol, **Fig. 5**) and residual soils (Muntingh 1989).

The study area is primarily underlain by Normandien Formation strata and superficial Quaternary deposits (**Fig. 6 – 7**), while Tarkastad Subgroup outcrop is exposed about 4 km northeast of Warden. According to Groenwald (1990) the Normandien Formation was deposited by meandering streams flanked by wide, semi-arid floodplains, whereas outcrops of the overlying Tarkastad Subgroup is represented by coarse to fine-grained sandstones of the Verkykerskop Formation and mudstones and subordinate sandstones of the Driekoppen Formation.

## Background History

### Karoo Fossils

Biostratigraphically, rocks belonging to the Normandien Formation are assigned to the Dicynodon Assemblage Zone (**Fig. 8**). In the north and northeastern Free State the Dicynodon AZ strata overly northern *Ecce* series strata. The Assemblage Zone (AZ) is characterized by the presence of both *Dicynodon* and *Theriognathus* (Kitching 1995) (**Fig. 9**). According to Groenwald (1990), three fossil species, namely *Dicynodon lacerticeps*, *Theriognathus platyceps* and *Prorubidgea maccabei*, are present in the Schoondraai Member of the Normandien Formation, of which several localities are found between Warden and Memel (**Fig. 10**). Vertebrate fossils are absent in the Verkykerskop and Driekoppen Formations (Tarkastad Subgroup).

### Karoo Dolerites

Dolerite (*Jd*), in the form of dykes and sills are not palaeontologically significant and construction activities on intrusive dolerite bedrock, will not result in **any palaeontological impact**.

### Late Cenozoic Deposits

Small, fossil-rich alluvial exposures of the Cornelia Formation have been recorded near the Vaal River, about 65 km north of Warden (**Fig. 11**). These Quaternary deposits are characterized by several distinct fossil mammal species, including

*Stylochoerus compactus*, *Connochaetes laticornutus* and *Megalotragus eucornutus* (Butzer *et al.* 1974; Brink & Rossouw 2000). There is currently no record of Cornelia Formation sediments in the vicinity of Warden.

The archaeological landscape of the region is characterized by large numbers of stone built Late Iron Age settlements made of dry stone walling and rock shelters containing paintings and stone tool assemblages (Harding 1951 a,b; Maggs 1976). The region is characterized by a marked proliferation of Late Iron Age settlements after 1640 AD which led to their southerly expansion of Sotho-Tswana peoples into the north-eastern Free State (Maggs 1976). The settlements spread out to the south and east, but did not extend further than the Vet River and the Drakensberg escarpment. Stone walling structures located near Warden are assigned to the characteristic Type V settlement units by Maggs (1976) (**Fig. 12**).

Rock paintings have been recorded in the Warden district on the farm Goedgegeven 164 and further south near Bethlehem where paintings were found together with Later Stone Age artefacts on the farms Saulspoort and Trekpad.

## **Results of Survey**

Potentially fossil-bearing bedrock (Normandien Formation) is largely covered by a thin mantle of Quaternary-age residual soils (topsoils), with outcrops visible along the Cornelius Spruit south of the study area. There is no evidence of intact or capped Stone Age artefacts, Iron Age structures or Quaternary fossils within the confines of the footprint. There are no indications of prehistoric structures or rock engravings within the footprint area. There is also no evidence of historical buildings older than 60 years within the confines of the footprint. The study area has largely been disturbed by ongoing construction activities and informal residential developments such as kraals and cattle pens (**Fig. 13**). A small informal graveyard is located amongst informal dwellings and cattle kraals, south of the main road that separates the study area from the Ezenzeleni Township, ( **Fig 14.**; centroid coordinates S27 50 34.1 E28 58 50.4). The surface area of the graveyard is 100 m<sup>2</sup>. It contains 9 unmarked graves, including 2 rectangular ones covered by cement slabs and 7 oval-shaped ones covered by an assortment of rocks and cobble stones. The graveyard not marked on the 1:50 000 scale topographic map of Warden. Exhumation of graves less than 60 years old would fall under the Exhumations Ordinance, Ordinance No.12 of 1980.

## **Statement of Significance**

Potential impacts are summarized in **Table 1**.

It is expected that infrastructure development will involve construction activities extending over a relatively large surface area. Such construction activities may impact on thinly capped and potentially fossil-bearing rock units of the Normandien Formation in Areas A & B marked in Fig. 3. Potential negative impacts of the proposed project on the palaeontological heritage of the area may occur when excavations into fossil-bearing strata are required during the construction phase of the project. Conversely, the discovery of otherwise unobservable fossil material discovered as a result of the proposed development, can be seen as beneficial to the scientific community.

The proposed development is considered long term with the possible consequence that any damage or destruction to potential palaeontological material within the affected area will be permanent. However, fossils are not evenly distributed in their occurrence in sedimentary strata so the probability of finding fossil exposures on the landscape is generally low. Nevertheless, the affected area is underlain by sedimentary strata known for its palaeontological record, and considering the scale of the area in question, it is probable that fossils may occur within sedimentary bedrock underlying the project area.

Unconsolidated Quaternary sediments overlying bedrock in and around the study area are made up of disturbed residual soils and are not fossiliferous. There is currently no record of Quaternary palaeontological exposures in the vicinity.

The foot survey revealed no evidence of intact Stone Age localities or artefacts distributed as surface scatters on the landscape. There are also no indications of prehistoric structures or remains within or in the immediate vicinity of the survey area. Impact on potentially intact Stone Age archaeological remains, Rock Art localities or Iron Age structures is considered unlikely.

## **Recommendation**

### **Karoo Vertebrate Palaeontology**

Palaeontological monitoring in the form of a site visit is recommended for the period before or during the start of the construction phase while fresh, potentially fossiliferous bedrock is still exposed for study and recording. It is also recommended that the responsible environmental officer for the project must closely monitor all activities where deep trench excavations could affect underlying bedrock strata during

the construction phase of the project in order to halt excavations should any fossils be discovered and to inform SAHRA accordingly.

### **Graveyard**

It is recommended that a graveyard management plan is included as part of the overall management plan for the project. Preservation of the site will require that the area is properly demarcated with at least a **20m buffer zone placed around the graveyard during the construction phase of the proposed project**. The graveyard will have to be fenced off as it defines the area, and will also ensure that the graveyard is treated with respect. It will be necessary to ensure that the fence is maintained, so that the site is not used for inappropriate activities.

There are no major archaeological or palaeontological grounds to suspend the proposed development. The site has been sufficiently recorded, mapped and documented in terms of conditions necessary for a Phase 1 heritage impact assessment and can be accessed for development.

Recommended Grading for the site: General Protection C (Field Rating IV C).

## **References**

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## Tables & Figures

**Table 1.** Summary of potential impacts at the site.

<b>Rock type / Age</b>	<b>Duration of Development</b>	<b>Overall Palaeontological significance</b>	<b>Overall Archaeological significance</b>	<b>Palaeontological Impact at site</b>	<b>Archaeological Impact at site</b>
Residual soils (Quaternary)	Permanent	Low	Low	Low	Low
Mudstone, Sandstone; Normandien Formation, <i>Pne</i> (Permian)	Permanent	Moderate - High	None	Low- Moderate	None

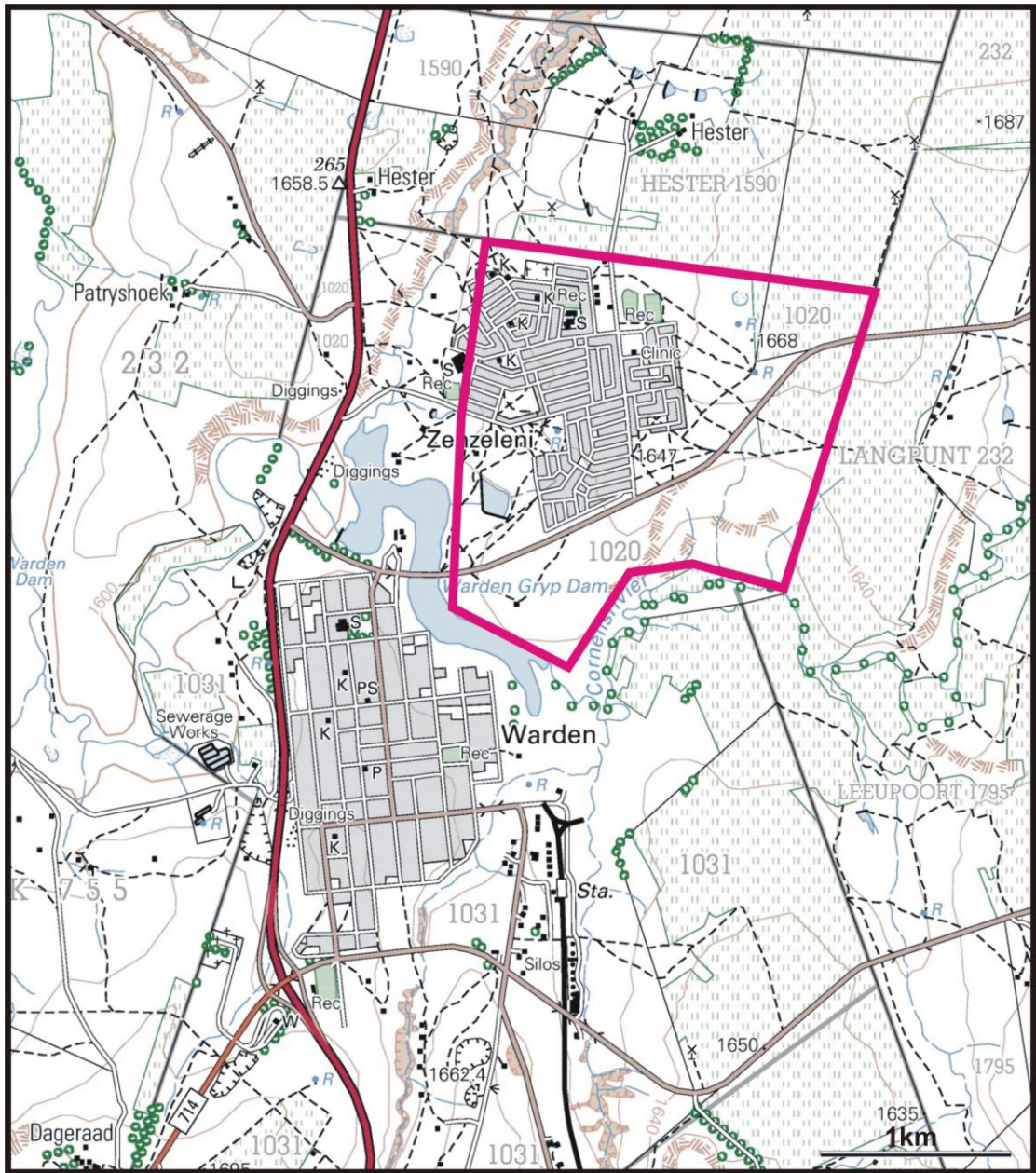


Figure 1. Portion of 1:50 000 scale topographic map 2728DD Warden of the study area (magenta line).





Figure 3. Aerial view of the proposed study area.

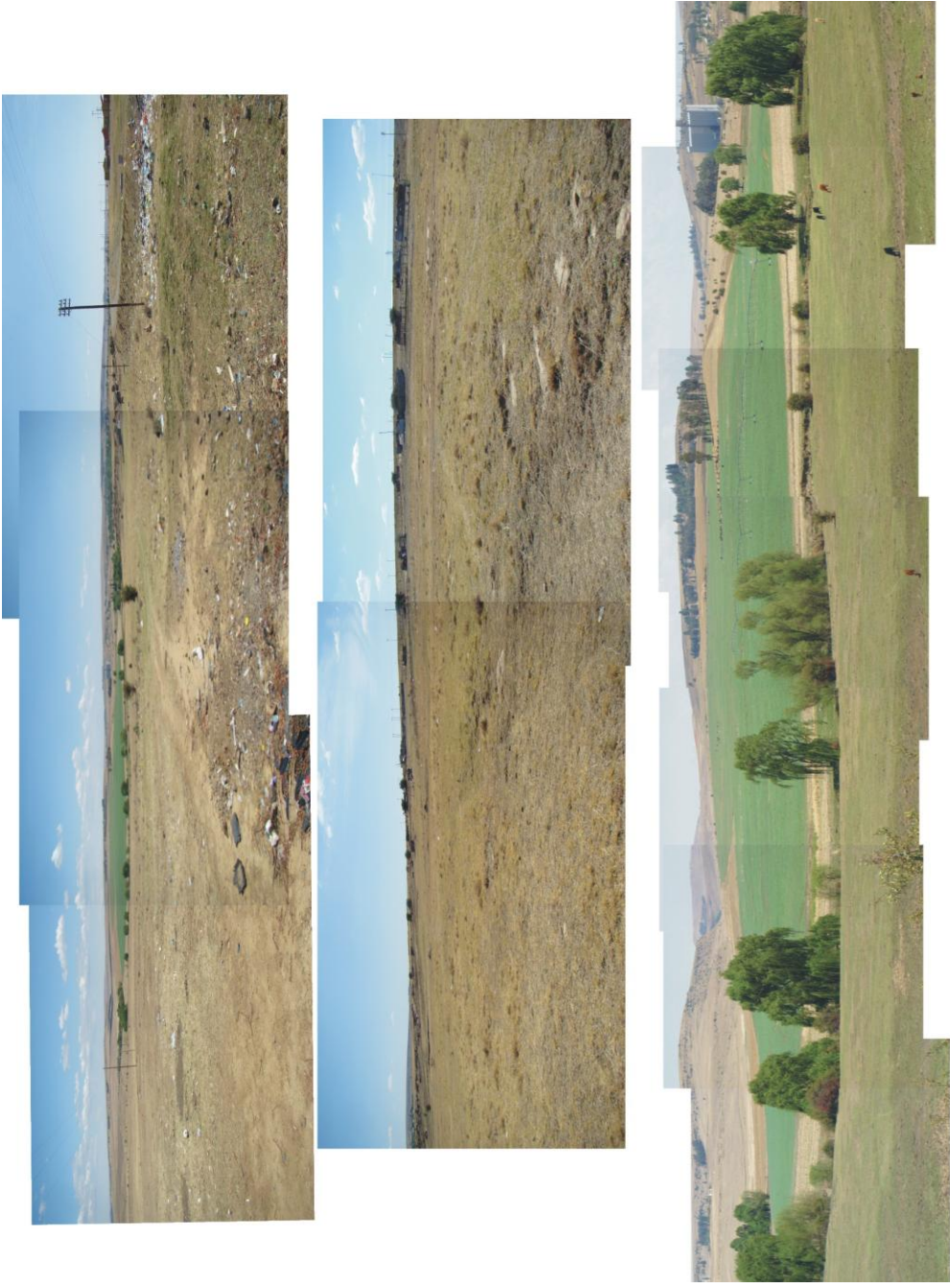
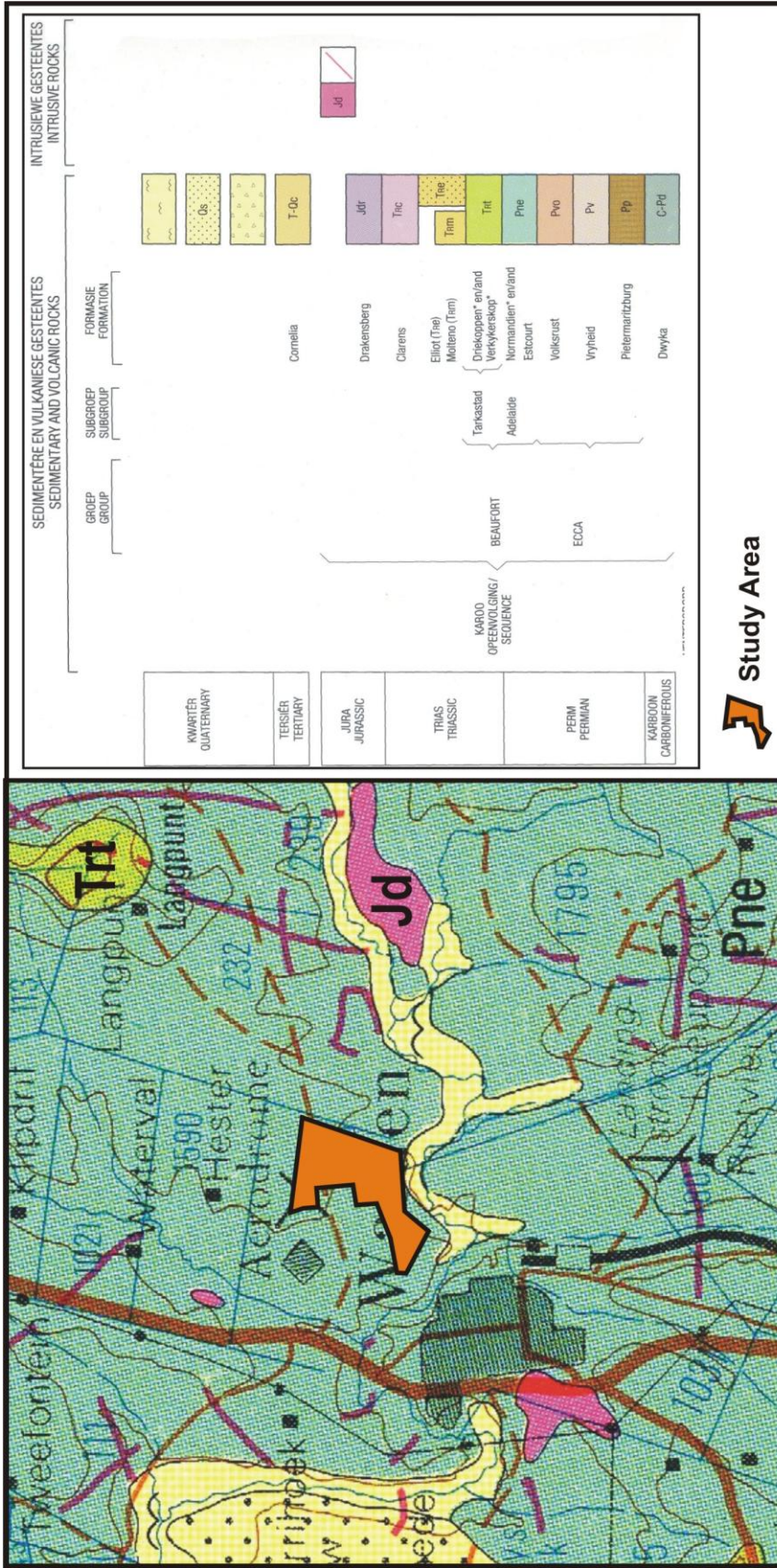


Figure 4. Panoramic view of the study area, looking southwest towards Warden (top), west (middle) and south towards the Cornelius Spruit (bottom).



**Study Area**

Figure 5. Portion of 1:250 000 scale geological map 2728 Frankfort. The affected area is made up of Permian Triassic sandstones (Normandien Formation, *Pne*, Beaufort Group) and Jurassic dolerite intrusions (*Jd*, Karoo Dolerite Suite). The overlying Tarkastad Subgroup (*Tri*) is represented by coarse to fine-grained sandstones of the Verkyerskop Formation and mudstones and subordinate sandstones of the Driekoppies Formation. Quaternary alluvium (flying bird symbol) and residual soils represent the most recent geological deposits.



Figure 6. Exposures of Normandien Formation outcrop underlying the study area.





Figure 7. The terrain is capped by a thin mantle of grass-covered, Quaternary sediments (residual soils).

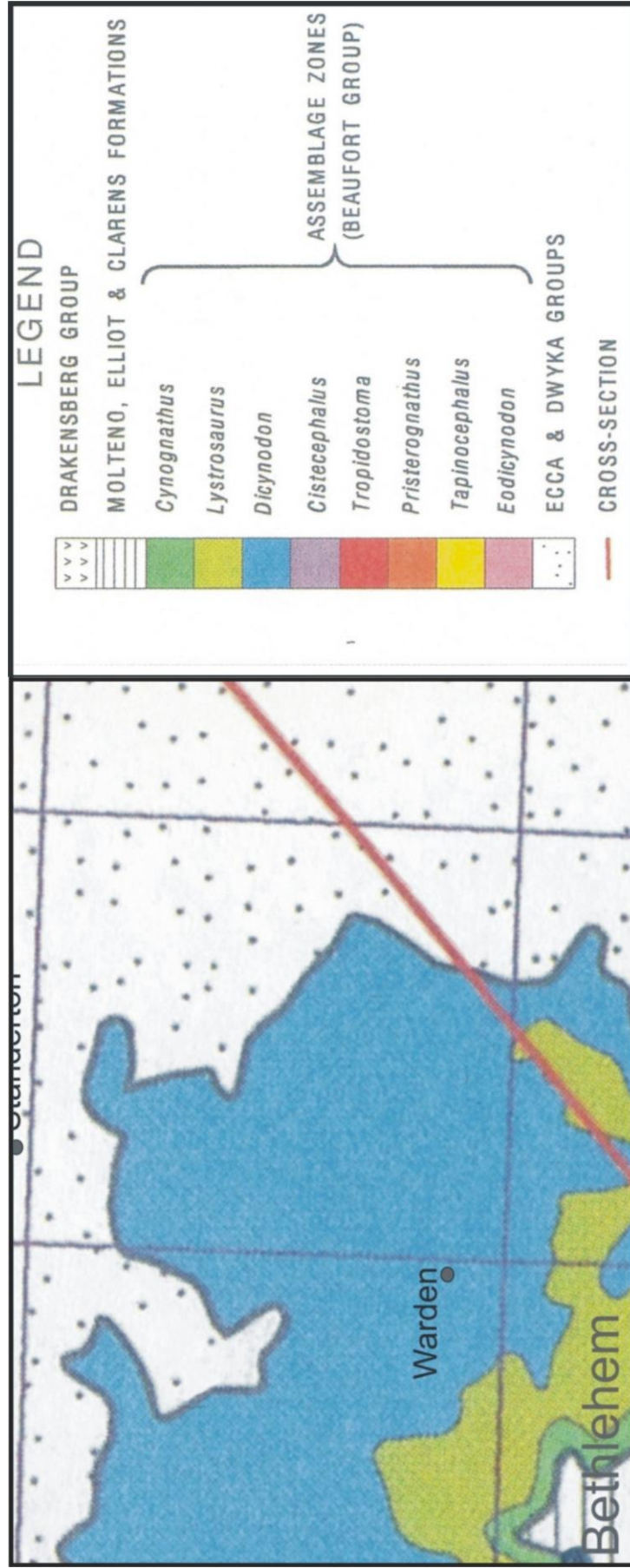


Figure 8. Geographical distribution of vertebrate biozones of the Beaufort Group around Warden (after Rubidge 1995).

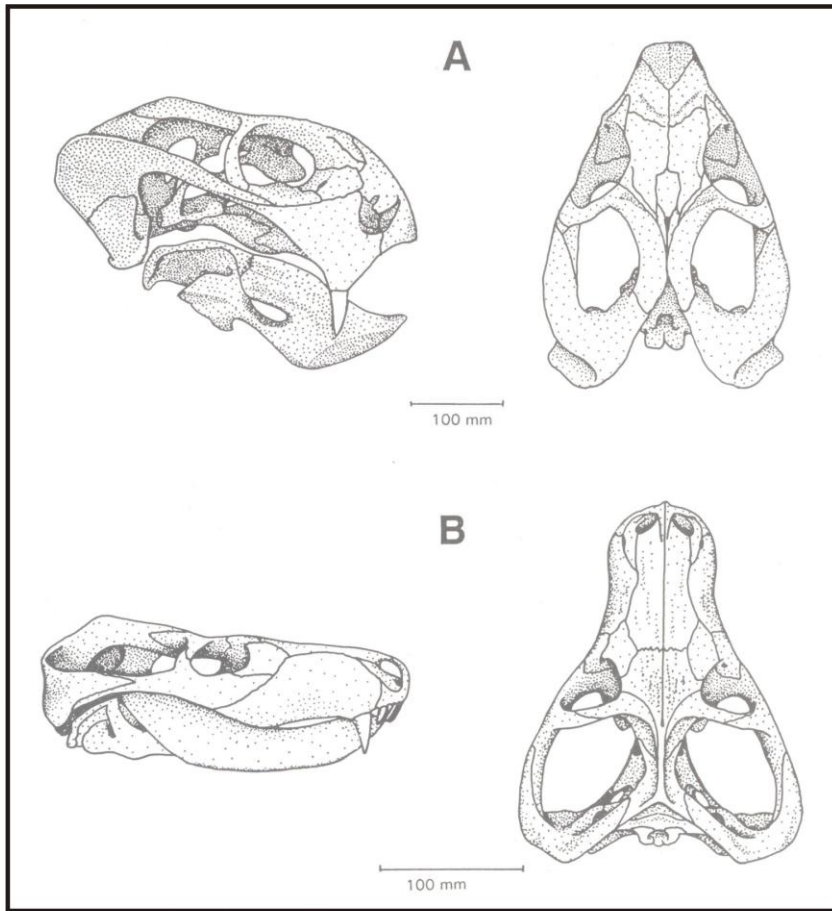


Figure 9. Lateral and dorsal views of biozone-defining fossils of the Dicynodon AZ.  
A) Dicynodon; B) Theriognathus (after Kitching 1995).

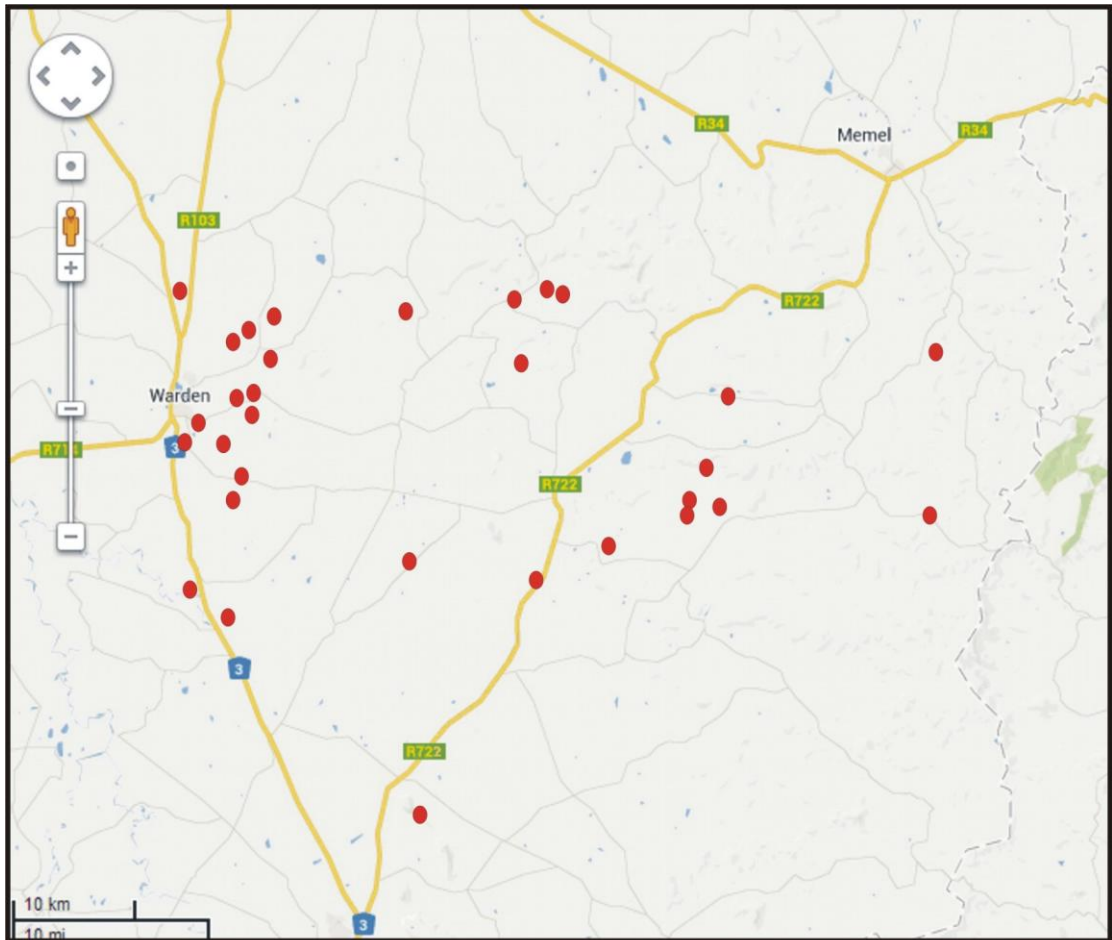


Figure 10. Distribution of Karoo vertebrate fossil localities between Warden and Memel (after Kitching 1977 and Groenewald 1990).



Figure 11. Fossil and artefact rich dongas at the Quaternary-age Cornelia Formation type site locality near Cornelia.

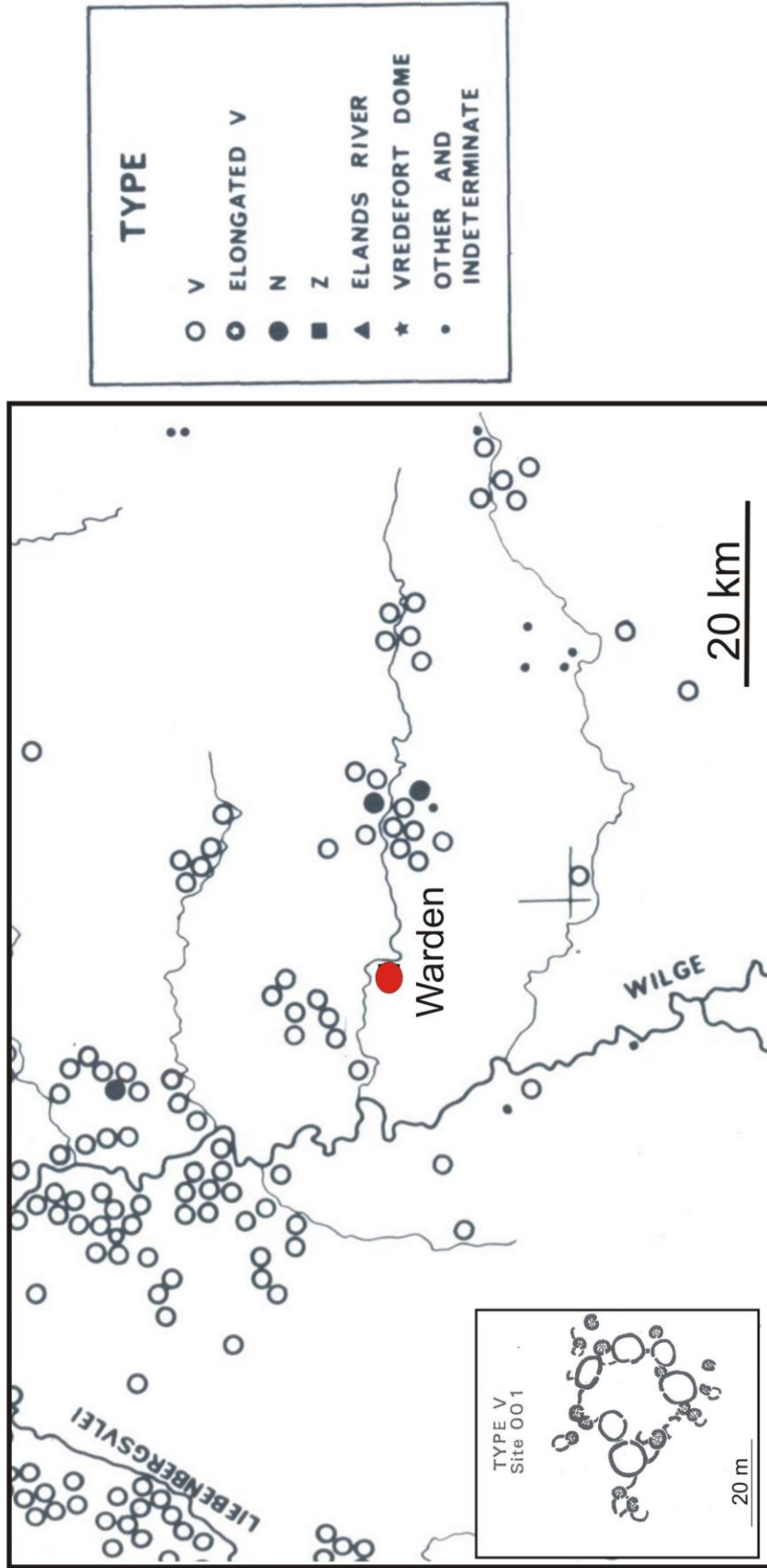


Figure 12. Distribution of Iron Age settlement types in the vicinity of Warden. The majority of the stone walling structures located in the vicinity of Warden are assigned to the characteristic Type V settlement (after Maggs 1976).



Figure 13. The terrain around Ezenzeleni  
The area has been severely disturbed  
as a result of prior and ongoing  
construction activities.

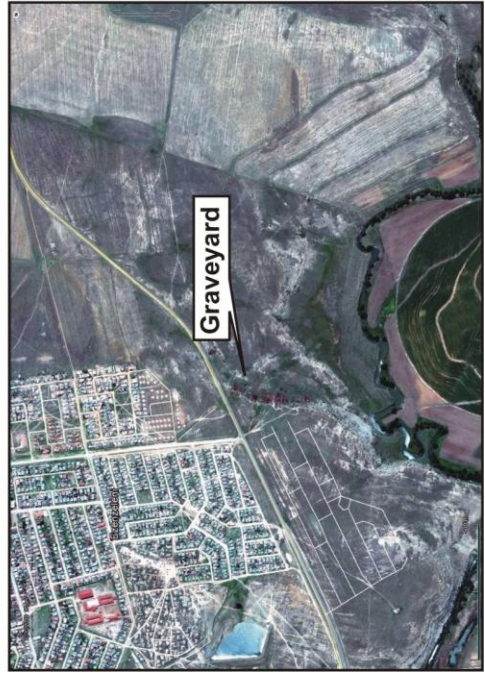


Figure 14. An informal graveyard located in Area B (see Fig 3; centroid coordinates 27°25'28.62"S 29° 8'25.52"E).