

**Desktop Heritage Assessment of the Solaire Direct
Solar Photovoltaic Facility of 10MW near
Reddersburg, Free State Province.**

Report prepared for
CSIR Environmental Management Services
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Summary

- The affected area is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), and is primarily represented by late Permian sedimentary rocks.
- These sediments form the base on which younger, superficial deposits of Quaternary age have been deposited.
- The proposed development will affect Late Permian strata and possibly Late Quaternary fossil-bearing sediments along the Fouriespruit, which could also contain Stone Age artefacts.
- Although productive Permian localities are generally located in areas of high relief such as mountain slopes, the nature of the proposed development construction phase suggests high-level impact on and possible exposure of potential sub-surface palaeontological resources.
- The most appropriate recommendation for **palaeontological mitigation** of the whole affected area will be to, as part of a Phase 1 impact assessment, monitor fresh exposures and bedrock excavations into potential fossil-bearing strata **during the construction phase of development.**
- Excavations into sedimentary bedrock should be considered on condition that access by a palaeontologist is facilitated at the appropriate stage during development and that appropriate and effective mitigation measures such as inspection of fresh excavations are undertaken by a professional palaeontologist in order to determine whether, as is probable, **palaeontological** remains or features are exposed *in situ*.
- It is also advised that newly uncovered objects of **palaeontological** significance, found during the course of excavation activities into sedimentary bedrock must be reported to SAHRA and may require a Phase 2 rescue operation at the cost of the developer.

- The desktop study also indicates that, except for along the river bank on the northern boundary where superficial alluvial sediments occur (**Fig. 5, Zone 2**), the proposed development is not likely to impact on potential **archaeological** sites or structures.
- If the area demarcated in Zone 2 is to be included in the proposed development, archaeological inspection of the alluvial deposits (erosional gullies) distributed along the southern bank of the Fouriespruit must, as part of a **Phase 1 archaeological impact assessment**, be conducted at the earliest practicable opportunity **before the commencement of any development** in order to identify, map and report potential archaeological resources within the relevant area.

Introduction

The report is a preliminary assessment of potential heritage impact with regard to the proposed development of the Solaire Direct Solar Photovoltaic Facility of 10MW near Reddersburg in the Free State Province. The present study was commissioned by CSIR Environmental Management Services in February 2012 and the assessment was carried out in accordance with National Heritage Resources Act 25 of 1999.

Methodology

The palaeontological and archaeological significance of the affected area were evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

Site Information

1 to 50 000 topographical map: 2926 CA Reddersburg

General site coordinates: 29°38'15.69"S, 26°10'11.87"E

The affected area is located on the farm Gotzke's Rust 49, about 2km north of Reddersburg town (Fig. 1). The site represents approximately 100 ha of used farmland with low relief, demarcated by the Fouriespruit on its northern boundary (Fig. 2 A), a municipal dam in the Fouriespruit on its western boundary (Fig. 2 B), a sewage plant on its southern boundary (Fig. 2 C) and a gravel road on its eastern boundary (Fig. 2 D). An overhead transmission line runs through the eastern portion of site.

Local Geology

The geology of the affected area has been described by Theron (1966) and Johnson (2006). It is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), and is primarily represented by late Permian, Balfour Formation sedimentary rocks, which are made up of thick sandstone and relatively thin mudstone layers (*Pa*, **Fig. 3**). These sedimentary rocks form the base on which younger, superficial deposits of Quaternary age have been deposited (Partridge *et al.* 2006). Dykes and sills of resistant Jurassic dolerites (*Jd*) determine the relief of the surrounding area to the

northwest (**Fig. 3**). The igneous Jurassic dolerites are not fossiliferous and can be excluded from further consideration in the present palaeontological assessment.

Palaeontology

Background

The Karoo geological strata within the affected area are assigned to the *Dicynodon* Assemblage Zone (AZ) (**Fig. 4 & 5**). This biozone is characterized by the presence of a distinctive and fairly common dicynodont genus (Kitching 1995). Therapsids from this biozone occur generally well-preserved in mudrock horizons and are usually found as dispersed and isolated specimens associated with an abundance of calcareous nodules (Kitching 1995). Other vertebrate fossils include fish, amphibians and amniotes. Molluscs, insects, plant (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) are also occur in the biozone. The sediments assigned to the *Dicynodon* AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel sandstones. Farms in the Reddersburg district, where Karoo vertebrate fossils have been found previously, include Vogelfontein 72 (2926 CA), Kleinplaas 152 (2926 CA), Kliphuis 325 (2926 CB), and Hexrivier 405 (2926 CC). Quaternary palaeontological sites are occasionally found exposed along Pleistocene alluvial terraces and dongas along rivers and streams (**Fig. 6**). Quaternary alluvial deposits, especially near water courses and drainage lines, have the potential to yield microfossil and fossil vertebrate remains. An abundance of Quaternary palaeontological material have previously been recorded in younger valley sediments and dongas adjoining rivers and streams in the Karoo Basin. There is currently no record of the presence of Quaternary palaeontological sites within the confines of the affected area.

Potential Palaeontological Impact

Impact on potential palaeontological resources within the footprint is summarized in **Table 1**. The development footprint will impact on fossil-bearing Adelaide Subgroup strata (**Fig. 5, Zone 1**). Although productive Permian localities are generally located in areas of high relief such as mountain slopes, the nature of the proposed development construction phase suggests high-level impact on and possible exposure of potential sub-surface palaeontological resources. The partially overlying superficial and alluvial

deposits adjoining the Fouriespruit along the northern boundary of the affected area, are also considered sensitive because they have the potential to yield Quaternary fossil vertebrate remains (**Fig. 5, Zone 2**)

Archaeology

Background

Impact on potential archaeological resources within the footprint is summarized in **Table 1**. The area around Reddersburg has produced a long record of archaeological heritage including Middle and Later Stone Age assemblages and surface sites, rock art and historical structures (Goodwin & van Riet Lowe 1929; Walton 1955). A Later Stone Age site as well as several rock art localities have been recorded on the farm Kliphuis 325 (2926 CB). Rock engravings are known from Boezakfontein 497 (2926 CA) and the remains of some of the earliest trekboer dwellings north of the Orange River have been recorded on the farms Damplaats (Clifton) (2926 CA) and Hexrivier 405 (2926 CC). There is currently no record of Stone Age sites, rock art localities or historical structures within the confines of the affected area.

Potential Archaeological Impact

Impact on potential archaeological resources within the footprint is summarized in **Table 1**. The affected area away from the Fouriespruit is currently used as grazing camps for small livestock farming and agricultural purposes and is not considered to be an archaeologically sensitive area. However, Stone Age artefacts are common occurrences in younger valley sediments and dongas adjoining rivers and streams in the region. As a result, the Quaternary alluvial deposits (erosional gullies) distributed along the southern bank of the Fouriespruit (**Fig. 5, Zone 2; Fig. 6**) are considered to be potentially sensitive areas. Exposed dolerite intrusions may be marked with rock engravings.

Palaeontological Impact Statement

The desktop study indicates that part of the proposed development is likely to impact on fossil-bearing bedrock and superficial alluvial sediments. Effective mitigation of

potential palaeontological impact for this project is only feasible once the positions of individual structures and access roads have been finalised.

It is anticipated that the planned development, which calls for excavation in underlying bedrock in the course of constructing:

- an array of photovoltaic panels mounted on steel structures, fixed into the ground either through concrete foundation or a deep seated anchor screw;
- A subsurface electrical grid connected to a substation;
- A substation and control facility that will have an approximate footprint of 2500m²
- Access roads and a guard house;
- Water supply for domestic needs of security and operational staff on site,

will require a **Phase 1 palaeontological impact assessment**.

Archaeological Impact Statement

The desktop study also indicates that, except for along the river bank on the northern boundary where superficial alluvial sediments occur (**Fig. 5, Zone 2**), the proposed development is **not likely to impact on potential archaeological sites** or structures.

Recommendation

Irreplaceability of resource loss caused by Impacts

Tangible heritage is by definition an irreplaceable resource. It is therefore crucial that

- palaeontological inspection of fresh excavations is conducted at the earliest practicable opportunity during the construction phase before new excavations are in-filled or backfilled or fresh bedrock have the chance to weather or be otherwise damaged by further development.
- If the area demarcated in Zone 2 is to be included in the proposed development, archaeological inspection of the alluvial deposits (erosional gullies) distributed along the southern bank of the Fouriespruit is conducted at the earliest practicable opportunity before the commence of any development in order to identify, map and report potential archaeological resources within the relevant area.

Reversibility of Impacts

The intent of mitigation and lessening of impact is to recover *in situ* fossils and cultural material before possible damage or destruction.

In the case of palaeontological impact, the rescue of fossil material can in most cases be done only after the commencement of the development (i.e. excavation activities) when potentially fossil-bearing strata and sediments are freshly exposed. The most appropriate **recommendation for palaeontological mitigation will be to, as part of a Phase 1 impact assessment, monitor fresh exposures and bedrock excavations into potential fossil-bearing strata during the construction phase of development.** Excavations into sedimentary bedrock should be considered on condition that access by a palaeontologist is facilitated at the appropriate stage during development and that appropriate and effective mitigation measures such as inspection of fresh excavations are undertaken by a professional palaeontologist in order to determine whether, as is probable, palaeontological remains or features are exposed *in situ*. It is also advised that newly uncovered objects of palaeontological significance, found during the course of excavation activities into sedimentary bedrock must be reported to SAHRA and may require a Phase 2 rescue operation at the cost of the developer.

The most appropriate **recommendation for archaeological mitigation will be to, as part of a Phase 1 impact assessment, conduct a pedestrian survey of the specific area where Quaternary alluvial deposits (erosional gullies) are distributed along the southern bank of the Fouriespruit,** prior to the commencement of the proposed development.

References

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Declaration

L. Rossouw does independent specialist consulting and is in no way connected with the proponents of the development, other than delivery of consulting services.

Table 1. Geology and potential heritage associated with the affected area.

Area	Geological Unit	Rock types and Age	Potential Fossils / Biostratigraphy	Potential archaeology	Potential Impact
Zone 2	Superficial deposits	Alluvium. Quaternary to Recent	Vertebrate skeletal remains; freshwater molluscs, coprolites, pollen and phytoliths	Stone Age sites / assemblages	Medium to low
Zone 1	Karoo Dolerite (<i>Jd</i>)	Intrusive igneous bedrock. Jurassic	No fossils	Rock engravings on exposed outcrop	Low
Zone 1	Adelaide Subgroup (<i>Pa</i>) Balfour Formation	Fluvial and lacustrine mudstones and sandstones. Late Permian	<i>Dicynodon</i> Assemblage Zone Therapsids, amphibians, fish, amniotes, invertebrates, plant fossils, trace fossils.	None	Medium to high

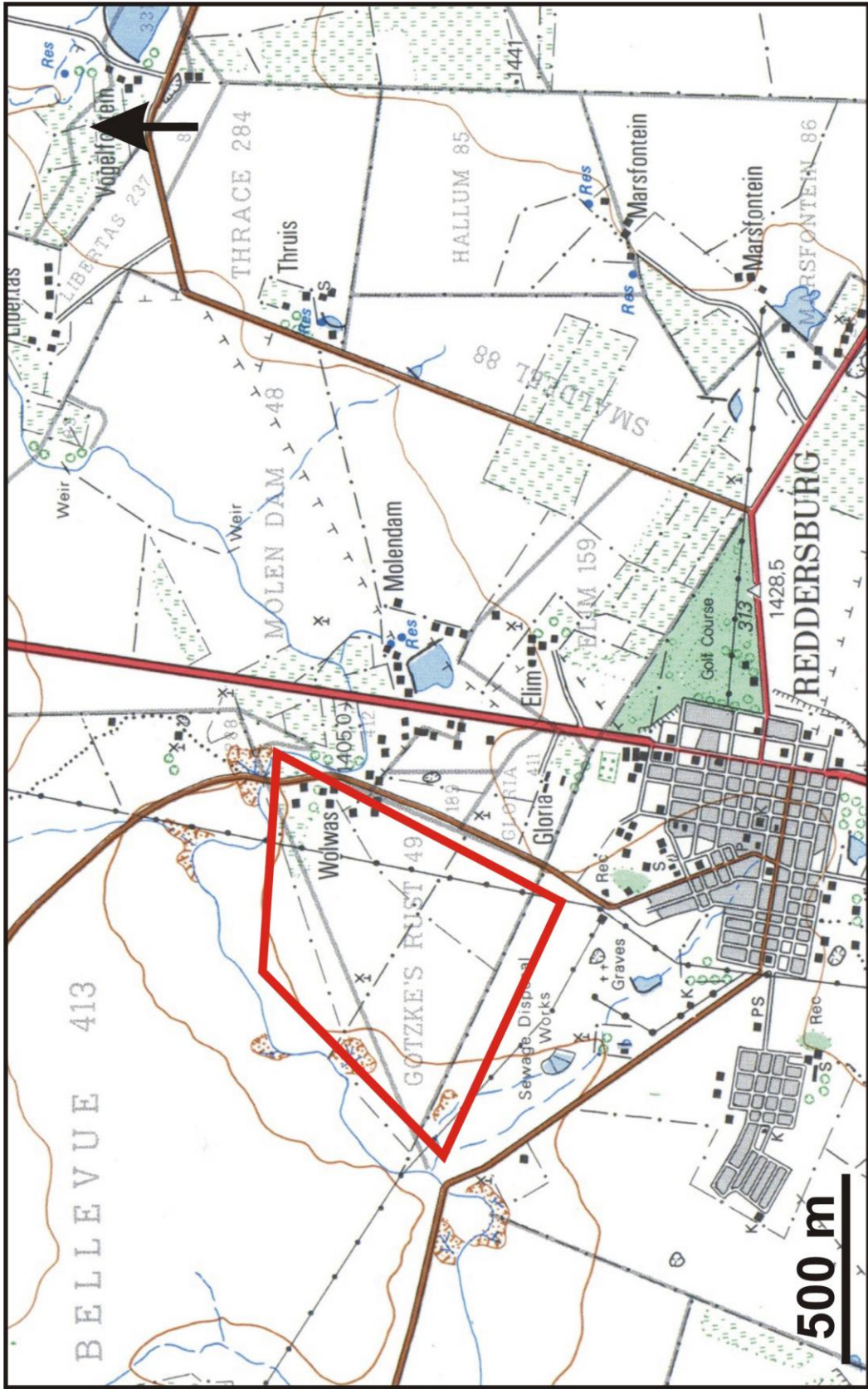
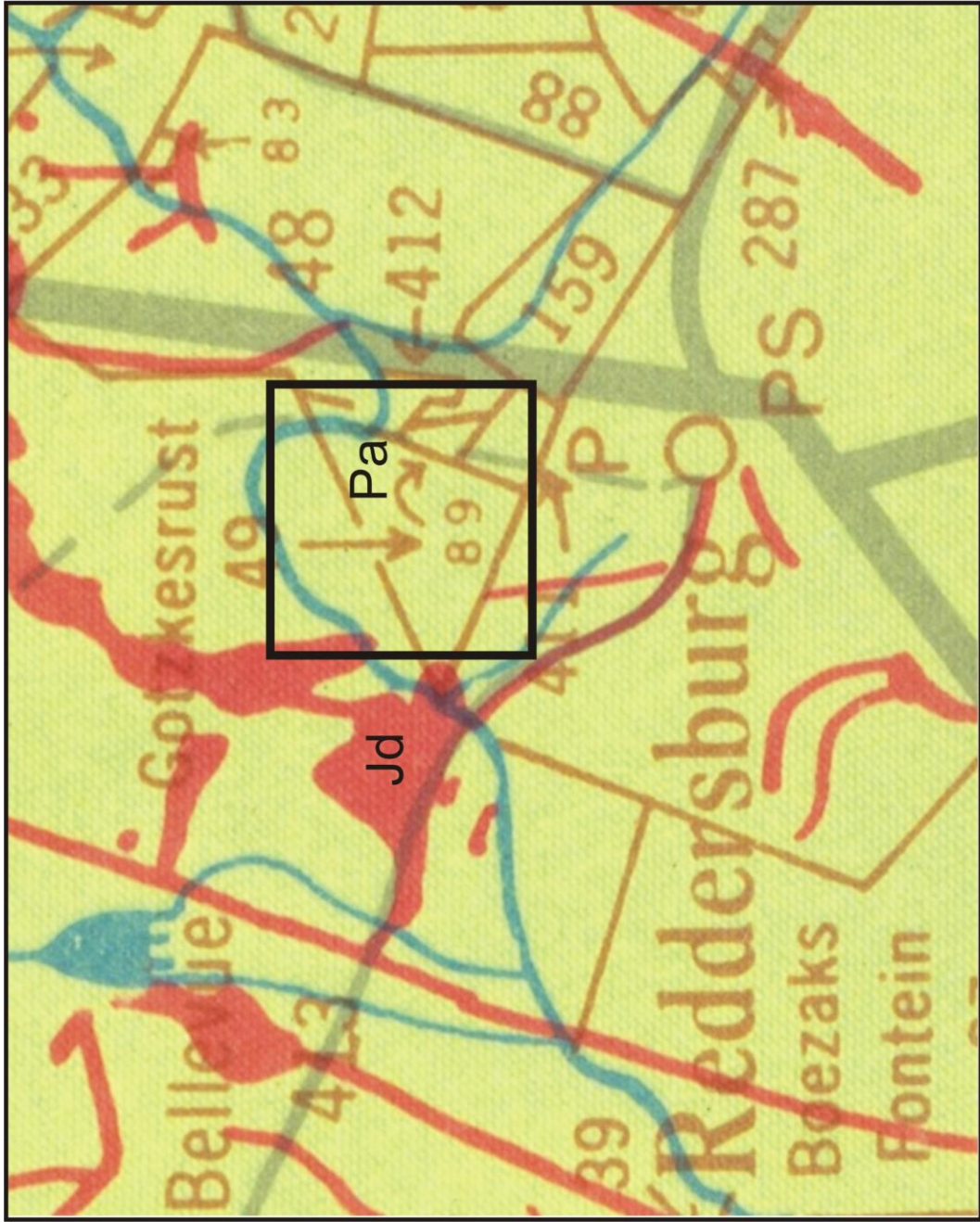


Figure 1. Portion of 1:50 000 scale topographic map (2926 CA Reddersburg) of the study area.



Figure 2. Aerial view of the affected area.



Jd Dolerite dykes and sills

Pa Adelaide Subgroup (Beaufort Group)

Figure 3. Portion of the 1:250 000 scale geological map Bloemfontein 2926 showing the regional geology around Reddersburg and the study area (black square).

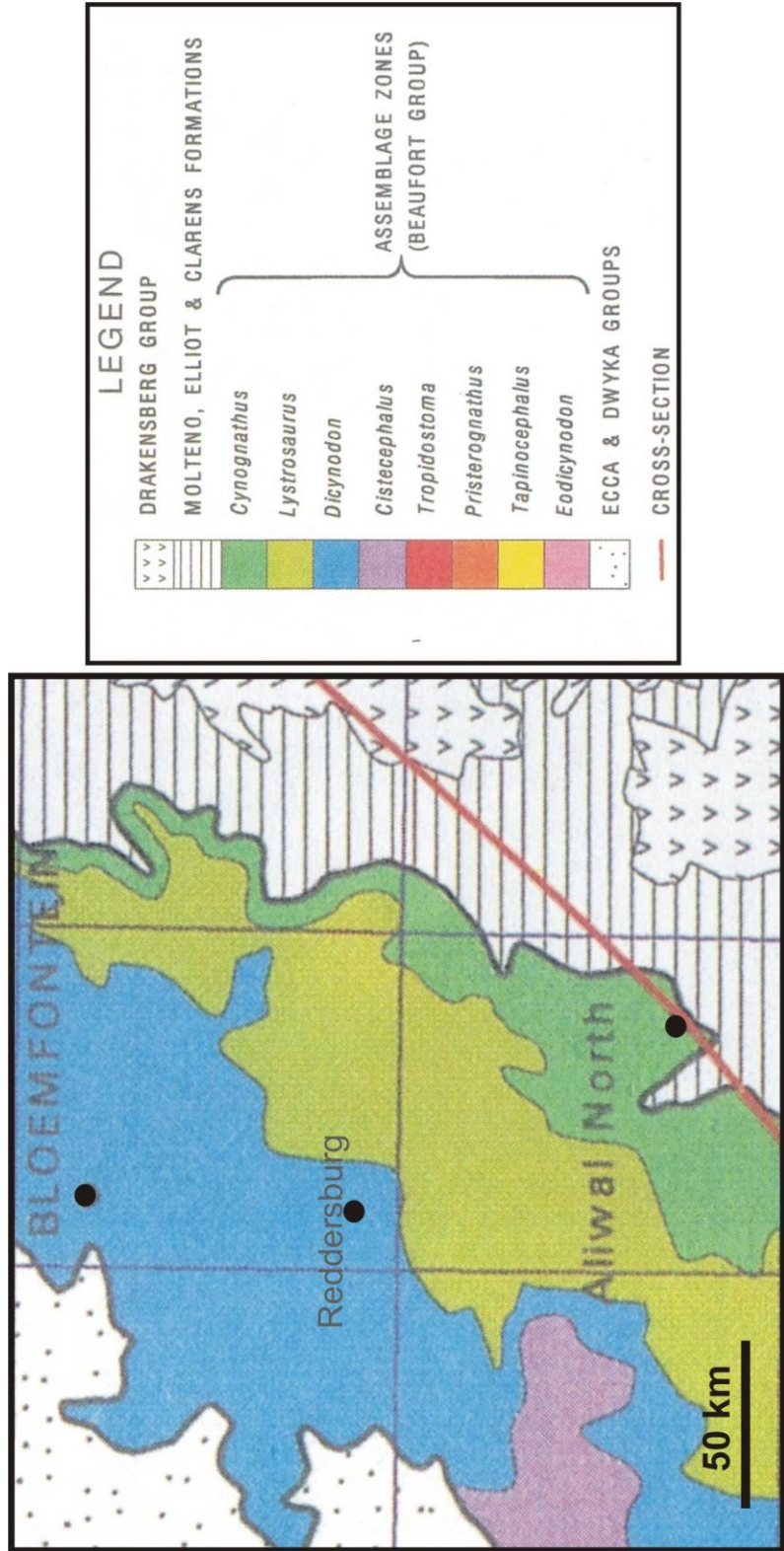


Figure 4. Geographical distribution of vertebrate biozones of the Beaufort Group around Reddersburg (Rubidge 1995).



Figure 5. Identification of potentially sensitive areas.



Figure 6. Partially overlying superficial and alluvial deposits adjoining the Fouriespruit along the northern boundary of the affected area. The arrows show erosional gullies that could possibly yield Quaternary fossil vertebrate remains and Stone Age artefacts.