

**Phase 1 Palaeontological Impact Assessment of a
proposed new water pipeline and associated
infrastructure between Ventersburg and the
Koppie Alleen pump station, FS Province.**

Report prepared for
Enviroworks Environmental Consultants

by

Dr L. Rossouw
PO Box 38806
Lagenhovenpark
Bloemfontein 9330

25 January 2017

Executive Summary

A Phase 1 Palaeontological Impact Assessment was carried for a proposed new water pipeline and associated infrastructure between Ventersburg and the Koppie Alleen pump station in Riebeeckstad, Free State Province. The geology of the region covered by the pipeline route is primarily represented by the Middle Permian Volksrust Formation (*Pvo*) and the overlying Late Permian Adelaide Subgroup (*Pa*). The overlying Adelaide Subgroup contains some of the richest Permo-Triassic tetrapod fauna from Pangaea/Gondwana and provides key evidence for evolution of mammalian characteristics among therapsids. The alluvial deposits of the Vaal and a number of its ancient tributaries, including the Vet, Doring and Sand Rivers located to the north, west and south of the study area, are well known for their unique record of the Pliocene and the Pleistocene fossil localities. As a result of its proximity to an existing water pipeline, the proposed new pipeline section is located adjacent to previously disturbed sedimentary bedrock and substantial, but degraded Quaternary overburden. The proposed new pipeline section is also underlain in places by palaeontologically insignificant dolerites. Given the nature, scale and condition of the proposed impact area the chances of impact on palaeontological material is considered low to unlikely. There are no major palaeontological grounds to suspend the proposed development provided that

- all excavation activities are confined to within the confines of the development footprint and
- in the event of chance exposure of fossil finds during the construction phase of the development, the relevant heritage authorities must be informed as soon as possible.

Table of Contents

Executive Summary.....	2
Introduction.....	4
Methodology.....	6
Locality data.....	6
Background.....	6
Field Assessment.....	8
Impact Statement.....	9
Recommendation.....	10
References.....	10
Figures.....	12

Introduction

A Phase 1 Palaeontological Impact Assessment was carried for a proposed new water pipeline and associated infrastructure between Ventersburg and the Koppie Alleen pump station in Riebeeckstad, 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 archaeological and 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 archaeological and 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 relevant to the pipeline development listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the NHR Act are as follows:**

34. (1) 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.

35 (4) No person may, without a permit issued by the responsible heritage resources authority—

- destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- *b)* destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

36 (3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- (c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- 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).

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 impacts associated with the proposed development.

Methodology

The significance of the affected area was carried out on the basis of existing field data, database information geological maps and published literature. 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.

Locality data

The proposed pipeline route covers portions of the 1:50 000 scale topographic maps 2726 DD Riebeeckstad, 2727CC Hennenman and 2827AA Ventersburg (**Fig. 1**). The proposed development will involve the following (**Fig. 2, Table 2**):

- New 4.0km long parallel pipeline to the existing pipeline from Mmamahabane Township in Ventersburg to the Ventersburg SW reservoir;
- Construction of a new 5Ml reservoir at the Ventersburg SW reservoir;
- New 6km long parallel pipeline to the existing pipeline from the Ventersburg SW reservoir to Phomolong;
- New 7.9km long parallel pipeline to the existing pipeline from Phomolong to Hennenman;
- New 5.3km parallel pipeline to the existing pipeline from Hennenman to the Brabant pump station;
- Construction of two new 12Ml reservoirs at Brabant and upgrading of the Brabant pump station;
- New 9.3km long parallel pipeline to the existing pipeline section between Brabant and Koppie-Alleen;
- Upgrading of the pump station at Koppie-Alleen

Background

The geology of the region covered by the pipeline route has been described by (Schutte 1994 and Nolte 1995) and is shown on the 1: 250 000 geological maps 2726 Kroonstad and 2826 Winburg (Council for Geoscience, Pretoria 2000). From oldest to

youngest, the deposits of the Karoo Supergroup in the region are assigned to Upper Ecca and Lower Beaufort Group rocks, respectively represented by the Middle Permian Volksrust Formation (*Pvo*) and the overlying Late Permian Adelaide Subgroup (*Pa*), the latter being represented by thick sandstone and relatively thin mudstone sequences (Johnson *et al.* 2006) (**Fig. 3**). The predominantly argillaceous Volksrust Formation consists of a monotonous sequence of grey marine shales with thin, bioturbated, siltstone and sandstone lenses, exposed towards the northwest of the study area. It represents a transgressive sequence consisting largely of mud deposited from suspension when large, swampy deltas were formed after Gondwana started to drift from the Antarctic region and rivers flowing into the inland Karoo Sea, deposited huge amounts of sediment along its shorelines consisting of alternating sandstone and mudstone layers. It consists of a monotonous sequence of grey shale and fossils are significant, but rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant remains, petrified wood, and low-diversity marine to non-marine trace fossil assemblages.

The overlying Adelaide Subgroup contains some of the richest Permo-Triassic tetrapod fauna from Pangaea/Gondwana and provides key evidence for evolution of mammalian characteristics among therapsids. The rocks in this outcrop area are assigned to one of eight different biostratigraphic units or assemblage zones (Rubidge 1995), namely the *Dicynodon* Assemblage Zone, recently revised (Kitching 1995; Van der Walt *et al.* 2010; Viglietti *et al.* 2016) (**Fig. 4**). The sediments assigned to this AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel sandstones (McCarthy and Rubidge, 2005; Johnson *et al.*, 2006). Dicynodonts are well-known herbivorous therapsids from the Karoo Basin with at least 35 dicynodont genera recorded in the Beaufort Group. 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. Other vertebrate fossils include fish, amphibians and amniotes. Molluscs, insects, plant (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) can also occur.

The sedimentary bedrocks form the base on which younger, superficial deposits of Quaternary age, including surface calcretes, alluvium and thick deposits of aeolian

sand have been deposited. Intrusive dykes and sills of resistant Jurassic dolerites are common and largely determine the landscape topography in the region.

The alluvial deposits of the Vaal and a number of its ancient tributaries, including the Vet, Doring and Sand Rivers located to the north, west and south of the study area, are well known for their unique record of the Pliocene and the Pleistocene fossil localities. Pliocene, river-deposited fossil occurrences have been identified in terrace gravels along the Vet River southwest of Welkom and the Sand River near Virginia (**Fig. 5 nos. 1 & 2**). The discovery of *in situ* proboscidian fossil material, consisting of a lower molar, the proximal half of an ulna and a large part of a tusk from fluvial sediments over 40 meters, above the riverbed of the Sand River near Virginia, has highlighted the potential antiquity of the gravel terraces flanking the modern Sand River. The fossiliferous fluvial deposits are tentatively dated to the Pliocene based on the occurrence of specimens included in this taxon, in beds of early to middle Pliocene age from the Vaal River terraces and Langebaanweg. More recent exploratory surveys along the tributaries indicate moderately fossiliferous overbank sediments and erosional gullies that frequently contain fossil remains of a variety of Quaternary-aged mammals (Brink *et al.* 1999; De Ruiter *et al.* 2011) (**Fig. 5 nos. 3 - 8**). Ancient pan sites at Mahemspan near the Vaal River and Whites near Hennenman have equally produced abundant Quaternary-aged mammal fossil remains (**Fig. 5 no. 9**).

Field Assessment

From its connection point at Mmamahabane, the pipeline traverses the N1 national road and then bypasses the southern and southwestern outskirts of Ventersburg parallel to an existing pipeline (**Fig. 6**) to connect with the Ventersburg SW reservoir, where an additional 5MI reservoir will be constructed (**Fig. 7**). From here to Phomololong, Hennenman and the Brabant pump station, the new pipeline is primarily located next to the R70 provincial road on degraded farmland and adjacent to the old trench lines of an existing water pipeline (**Fig. 8**). From the Brabant pump station, the pipeline continues west on degraded farmland and urbanized sections, adjacent to the R70 and an existing pipeline until it reaches the Koppie Alleen pump station facility in Riebeeckstad (**Fig. 8**).

Impact Statement

Pipeline from Mmamahabane Township to the Ventersburg SW reservoir

The section is underlain by palaeontologically insignificant dolerites. Impact on intact Quaternary sediments (unconsolidated topsoils) within the footprint will be low to moderate, but impact on potential *in situ* Quaternary fossils is considered unlikely.

Construction of a new 5MI reservoir at the Ventersburg SW reservoir

The section is underlain by palaeontologically insignificant dolerites. Impact on intact Quaternary sediments (unconsolidated topsoils) within the footprint will be low to moderate, but impact on potential *in situ* Quaternary fossils is considered unlikely.

Pipeline from the Ventersburg SW reservoir to Phomolong and Hennenman

As a result of its proximity to existing water pipeline the proposed new pipeline section is located adjacent to previously disturbed sedimentary bedrock (*Pa*) and substantial but degraded Quaternary overburden. The sedimentary rocks (*Pa*) are considered to be of high palaeontological sensitivity, but given the nature, scale and condition of the proposed impact area the chances of impact on palaeontological material is considered low with the caveat that fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution). Impact on potential *in situ* fossils on the whole is considered unlikely.

Pipeline from Hennenman to the Brabant pump station

As a result of its proximity to an existing water pipeline the proposed new pipeline section is located adjacent to previously disturbed sedimentary bedrock and substantial but degraded Quaternary overburden. The Brabant pump station is underlain by palaeontologically insignificant dolerites. Impact on potential *in situ* fossils on the whole is considered unlikely.

Construction of two new 12MI reservoirs at Brabant and upgrading of the Brabant pump station

The proposed development area is underlain by palaeontologically insignificant dolerites. Impact on intact Quaternary sediments (unconsolidated topsoils) within the footprint will be low to moderate, but impact on potential *in situ* Quaternary fossils is considered unlikely.

Pipeline between Brabant and Koppie-Alleen and upgrading of the pump station at Koppie-Alleen

As a result of its proximity to an existing water pipeline, the proposed new pipeline section is located adjacent to previously disturbed sedimentary bedrock (*Pa* and *Pvo*) and substantial, but degraded Quaternary overburden. The bedrock sediments are considered to be of high to moderate palaeontological sensitivity, but given the nature, scale and condition of the proposed impact area the chances of impact on palaeontological material is considered low with the caveat that fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution). Impact on potential *in situ* fossils on the whole is considered unlikely. The pump station complex at Koppie-Alleen is located on severely degraded terrain underlain by palaeontologically insignificant dolerites. Impact on *intact* Quaternary sediments at Koppie-Alleen will be very low and impact on potential *in situ* fossils is considered unlikely.

Recommendation

There are no major palaeontological grounds to suspend the proposed development provided that

- all excavation activities are confined to within the confines of the development footprint and
- in the event of chance exposure of fossil finds during the construction phase of the development, the relevant heritage authorities must be informed as soon as possible.

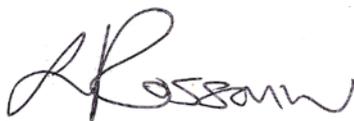
References

- Brink, J.S., Berger, L.R., Churchill, S.E. 1999. Mammalian Fossils From Erosional Gullies (Dongas) In The Doring River Drainage, Central Free State Province, South Africa, pp. 79-90. **In:** Becker, C., Manhart, H., Peters, J., Schibler, J. (eds), *HistoriaAnimalium ex Ossibus. Beiträge zur Paläoanatomie, Archäologie, Ägyptologie, Ethnologie und Geschichte der Tiermedizin: Festschrift für Angela Von Den Driesch zum 65. Geburtstag*. Rahden/Westf.: Verlag Marie Leidorf GmbH.
- De Ruiter, D.J., Churchill, S.E., Brophy, J.K. & Berger, L.R. 2011. Regional Survey of Middle Stone Age Fossil Vertebrate Deposits in the Virginia-Theunissen area of the Free State, South Africa. *Navorsing van die Nasionale Museum* 27(1): 1-20.

- Johnson *et al.* 2006. Sedimentary rocks of the Karoo Supergroup. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.
- Kitching, J.W. 1977. The distribution of Karoo Vertebrate Fauna. Bernard Price Institute for Palaeontological Research. Memoir 1, 1 – 131.
- Kitching, J.W. 1995. Biostratigraphy of the *Dicynodon AZ*. In: B.S. Rubidge (ed). *Biostratigraphy of the Beaufort Group*. SA Comm for Stratigraphy 1 pp. 1 – 46.
- Klein, R.G. 1984. The large mammals of southern Africa: late Pliocene to recent, pp. 107-146. In: Klein, R.G. (ed.), *Southern African prehistory and palaeoenvironments*. Rotterdam: A.A. Balkema.
- Nolte, C.C. 1995. The geology of the Winburg area. *Geological Survey of South Africa*. Council for Geoscience.
- Schutte, I.C. 1994. Geologie van die gebied Kroonstad. Explanation to 1: 250 000 scale geological sheet 2726 Kroonstad, 84 pp. Council for Geoscience, Pretoria.

DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant in the field of palaeontology. 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 and have no conflicting interests in the undertaking of the activity.



25 / 01 / 2017

Figures

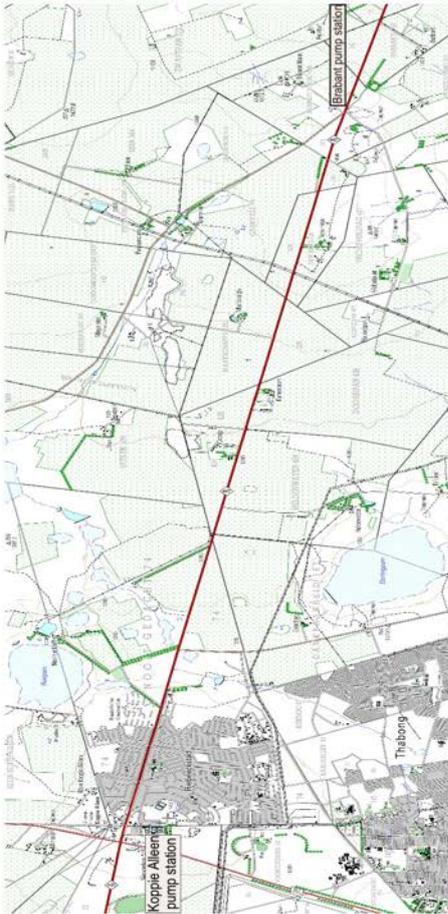


Figure 1. The proposed pipeline route covers portions of 1:50 000 topographic sheets 2726 DD Riebeeckstad (left), 2727CC Henne-man (center) and 2827AA Venterburg (right).

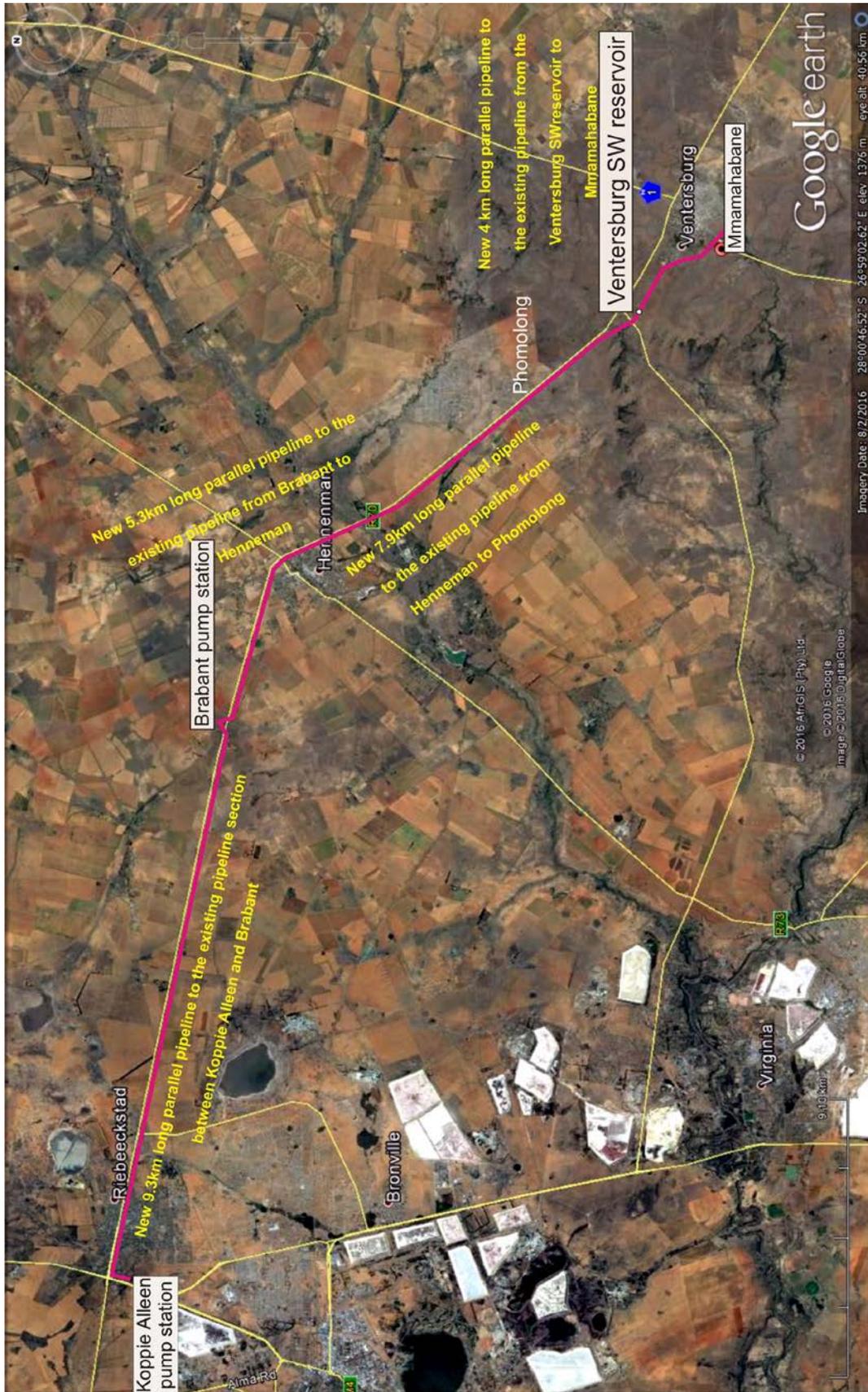


Figure 2. Aerial view of the proposed footprint between Ventersburg and Riebeeckstad.

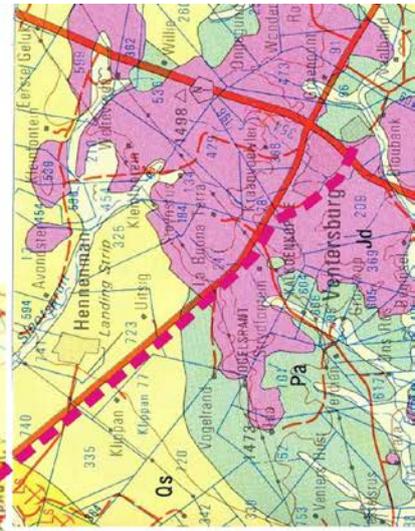
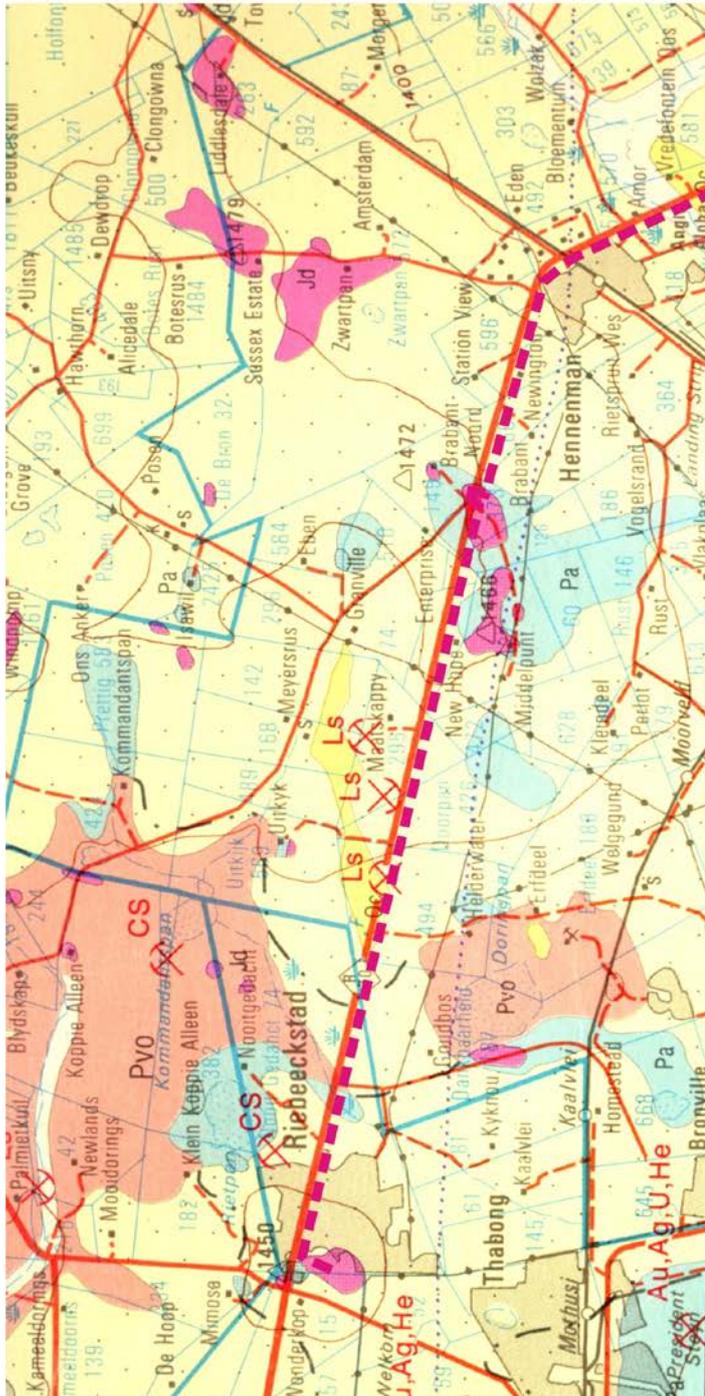


Figure 3. The pipeline route is shown on the 1: 250 000 geological maps 2726 Kroonstad and 2826 Winburg (Council for Geoscience, Pretoria 2000). From oldest to youngest, the deposits of the Karoo Supergroup in the region are assigned to Upper Ecca and Lower Beaufort Group rocks, respectively represented by the Middle Permian Volksrust Formation (*Pvo*) and the overlying Late Permian Adelaide Subgroup (*Pa*). The sedimentary bedrocks form the base on which younger, superficial deposits of Quaternary age have been deposited (*Qs*, *flying bird symbol*). Weather-resistant and intrusive dolerite dykes and sills are common (*Jd*).

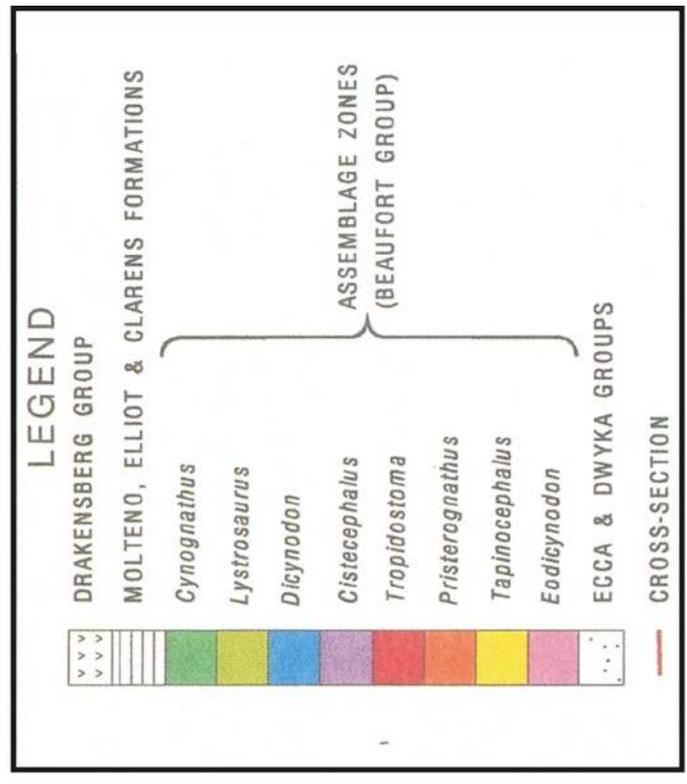
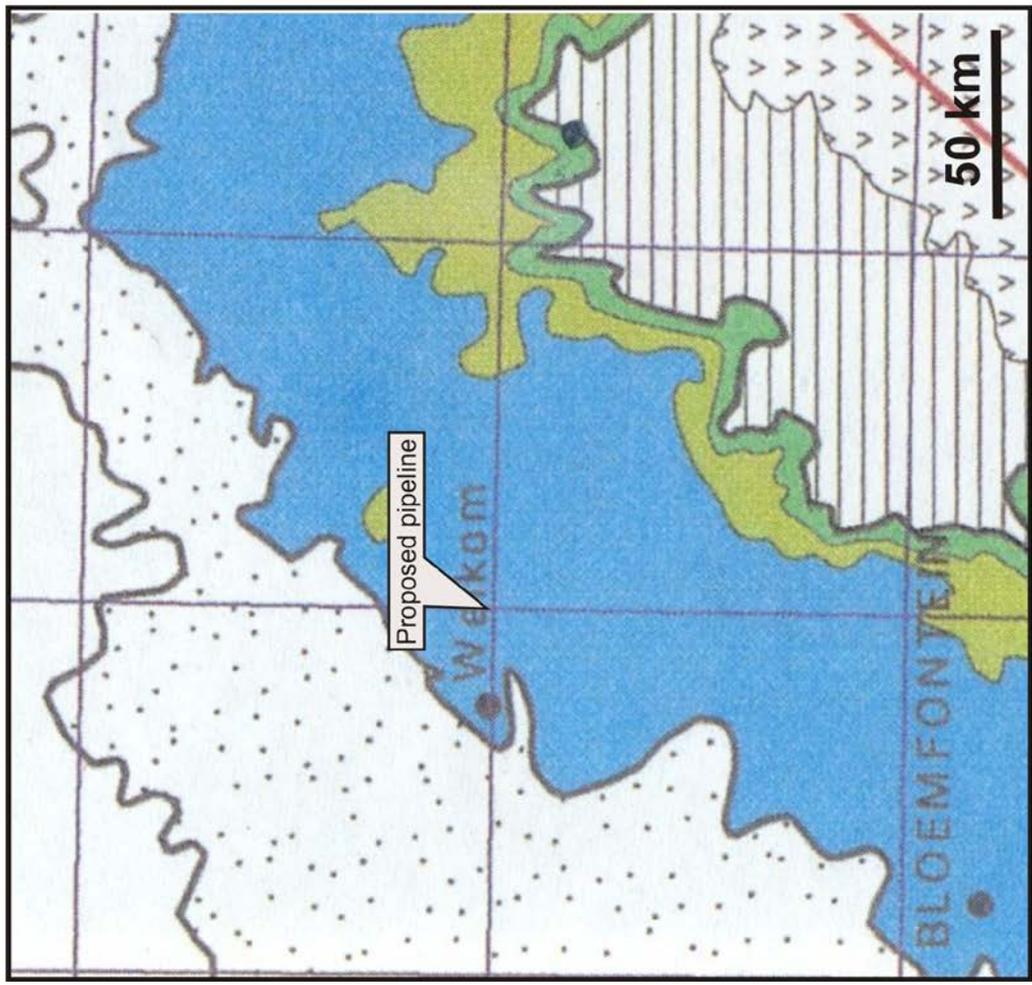


Figure 4. Geographical distribution of vertebrate biozones of the Beaufort Group around Welkom (Rubidge 1995)

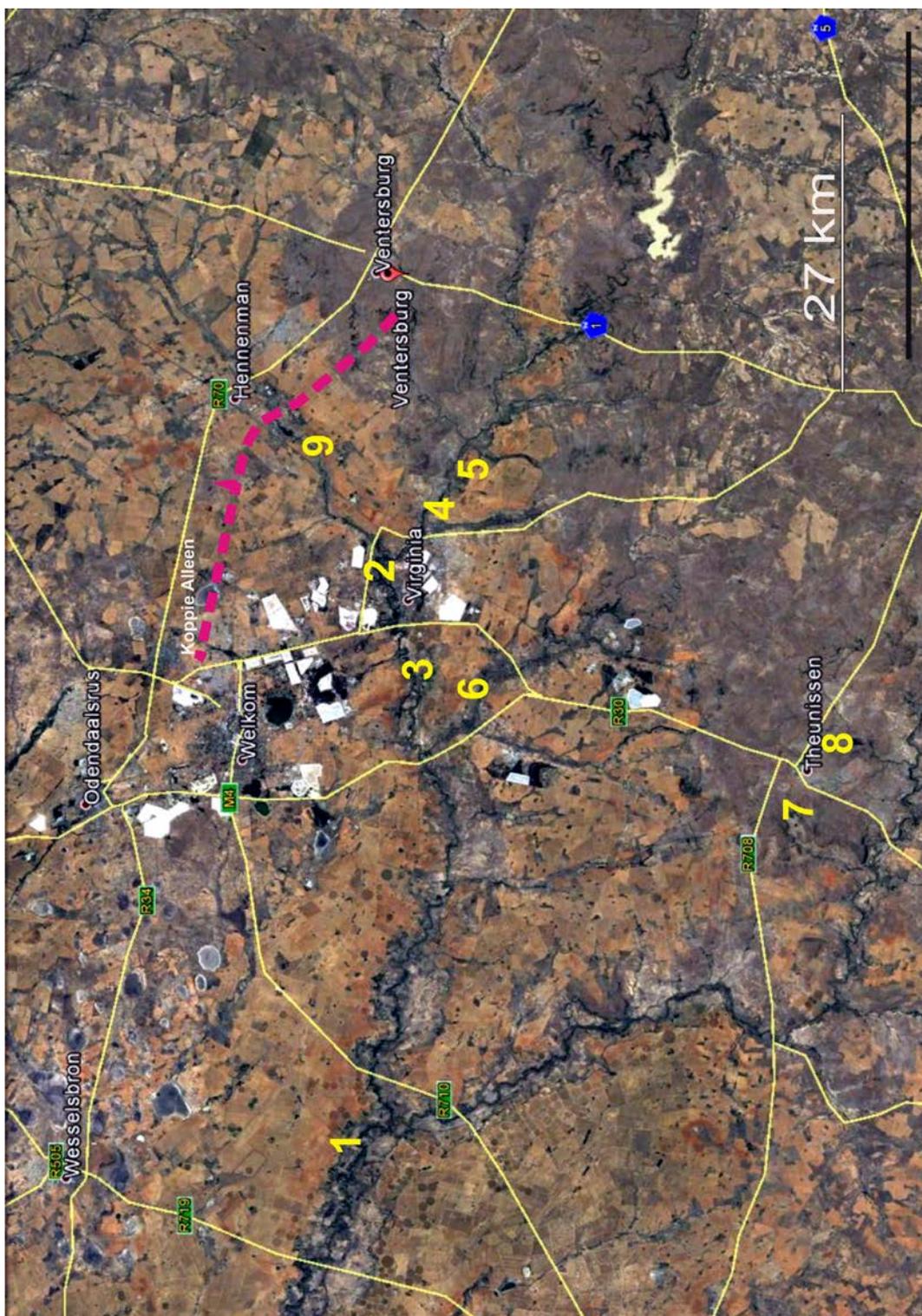


Figure 5. Locality map of known palaeontological sites in the region. The proposed pipeline route is indicated by the red line.



Figure 6. The connection point at Mmamahabane for the new pipeline section between Ventersburg and the Ventersburg SW reservoir, looking northwest towards the N1 (top left) and the 4 km long section that runs parallel to an existing pipeline between Mmamahabane and the Ventersburg SW reservoir, looking southeast (top right), northwest (bottom left) and east (bottom right).

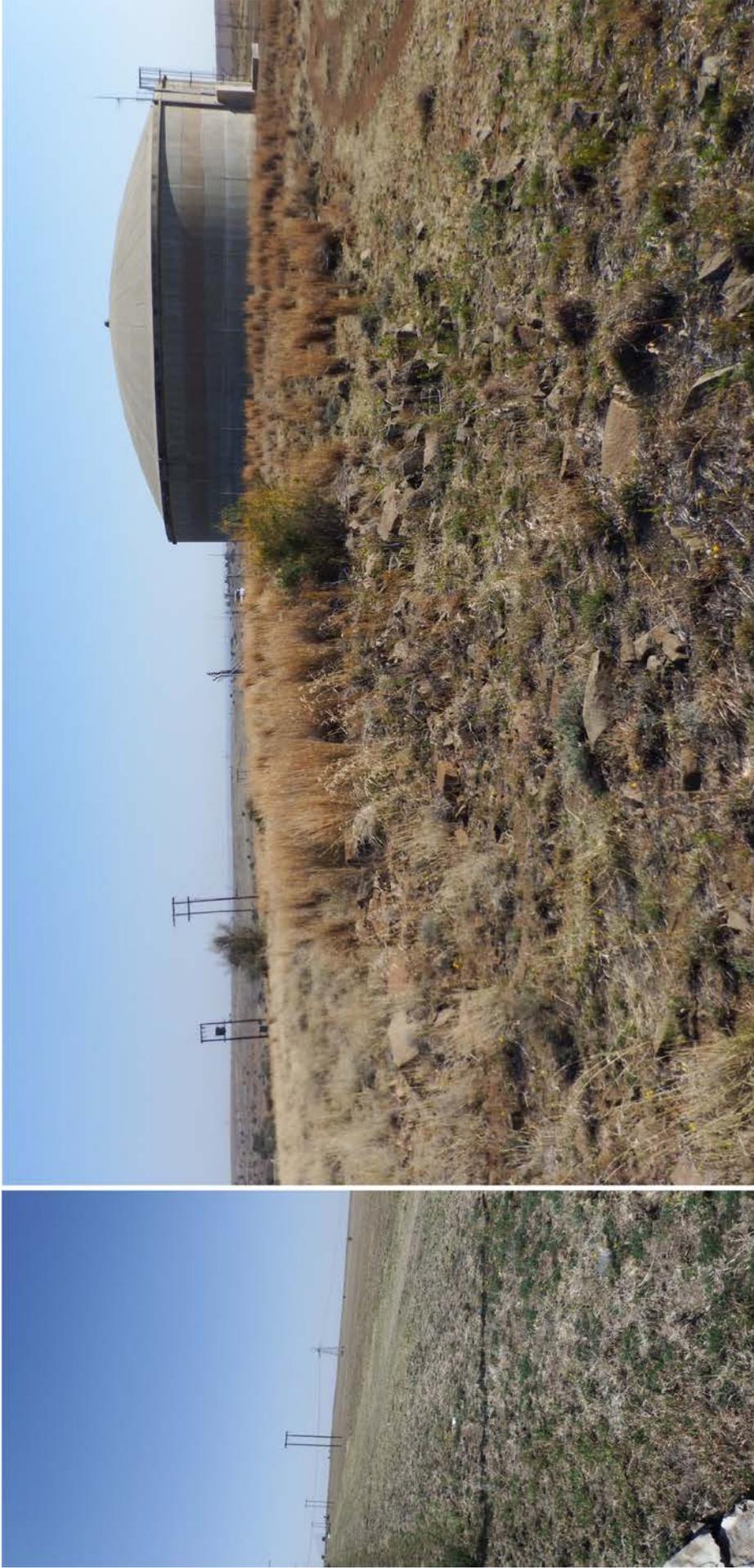


Figure 7. The construction site of the proposed new 5MI reservoir at the existing Ventersburg reservoir.



Figure 8. The proposed pipeline footprint running parallel to the existing pipeline next to the R70 between Phomolong and Hennenman (top left), the connection point at the Brabant pump station (top right), its position next to the R70 passing through Hennenman and Riebeeckstad (center left and right) and general view of the terrain at the the Koppie Alleen pump station (bottom left).