PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED UPGRADING OF THE HANKEY SANITATION SYSTEM, KOUGA LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE

Compiled for:

JG Afrika

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Prepared by

Banzai Environmental

31 October 2020

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

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Email: elizebutler002@gmail.com

SIGNATURE: 

The heritage impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1 and 11	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 11	
(g) An identification of any areas to be avoided, including buffers	None Section 1 and 11	
(h) A map superimposing the activity including the associated structures and infrastructure on the	Section 5 – Geological and	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
environmental sensitivities of the site including areas to be avoided, including buffers;	Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) 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 1 and 11	
(k) Any mitigation measures for inclusion in the EMPr	Section 1 and 11	
(l) Any conditions for inclusion in the environmental authorisation	Section 12	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 12	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 11	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities 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	Section 1 and 11	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by JG Afrika to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed upgrade of the sanitation system in Hankey, within the Kouga Local Municipality, Eastern Cape Province. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PDA) is necessary to determine the presence of fossils within the planned development. This study is thus necessary to identify and evaluate the effect of the construction on the palaeontological heritage.

The proposed development is underlain by Late Caenozoic superficial sediments; a very small portion in the east falls in the Kirkwood Formation and the westerly portion falls in the Enon Formation of the Uitenhage Group. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of by Late Caenozoic superficial sediments is moderate; that of the Kirkwood Formation is very High, and the Palaeontological Sensitivity of the Enon Formation is Low.

The Kirkwood Formation is located in the far north as well as the south eastern margin of the development footprint. Several pipeline and pumpstation layout alternatives have been proposed for the project, but as No visible evidence of fossiliferous outcrops was identified there is no preferred option for the alternatives from a palaeontological point of view. An overall medium palaeontological sensitivity is thus allocated to the development footprint.

The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a medium significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the EC in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the EC must report to SAHRA (Contact details: Eastern Cape Provincial Heritage Resources Authority (ECPHR); Corner Scholl and Amalinda Drive, East London, 5247, email: info@ecphra.org.za; Tel 043 7450888; Web: www.ecphra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist

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Appendix A: CV

1 INTRODUCTION

Information provided by Terratest (Pty) Ltd
The upgrading works (Figures 1-3) will include the augmentation of the existing sewage bulk infrastructure in the residential areas of Hankey, Hankey Town, Old Town Hankey, and Phillipsville, by providing an additional pump station, a new rising main and a new waterborne gravity sewerage system for these areas. The areas to be serviced consist of some 449 erven. The total length of the lines will equate to approximately 11 000 m. In addition, a detention pond will be constructed adjacent to the pump station to deal with any sewage spillage because of major equipment or electrical failure. Sewage will be pumped through a UPVC (Un-plasticised Poly Vinyl Chloride-lined) pipeline, from the pump station, to the existing Hankey Wastewater Treatment Works (WWTW). The length of the rising main will be approximately 2 400 m. This rising main will have to cross the Klein River, running through Hankey, and the provincial surfaced road R331. An existing gravel road will also be upgraded to provide sufficient access to the pump station and detention pond.

In terms of the pump station and pond, the preferred location is approximately 50 m from the Klein River while the alternative location is within the 1:100-year floodline (Figure 4).

The majority of the development site falls within the urban area according to the Kouga Municipality Spatial Development Framework (SDF) (Report EC03/2014/7, dated 2015) and encompasses four (4) residentials areas as mentioned in Section 2. A short section, approximately 800m, of the proposed rising main will be located outside the urban area at the northern extent of the development footprint towards the WWTW. Furthermore, the proposed pump station, detention pond and short sections of the sewer rising main and gravity network will be constructed and installed in an area zoned as Public Open Space (Kouga Municipality SDF, 2015).

About 800m, of the proposed rising main will be situated outside the urban area at the northern extent of the development footprint towards the WWTW. Furthermore, the proposed pump station, detention pond and short sections of the sewer rising main and gravity network will be constructed and installed in an area zoned as Public Open Space (Kouga Municipality SDF, 2015).

The proposed pump station and detention pond will be situated in the centre of the Hankey residential town areas, on the northern embankment of the Klein River, approximately 1.7 km before the Klein River discharges into the Gamtoos River. The proposed location is upstream (outside) of the 1:100-year demarcated floodline, nested between the “Narrow Gauge” Steel Rail Bridge, and the R331 Provincial Road Bridge, crossing the Klein River. The approximate co-ordinates of the proposed pump station, which can also be roughly considered as the central point of the project site, are:
Latitude: 33°50'3.38" S; Longitude: 24°52'41.75" E.

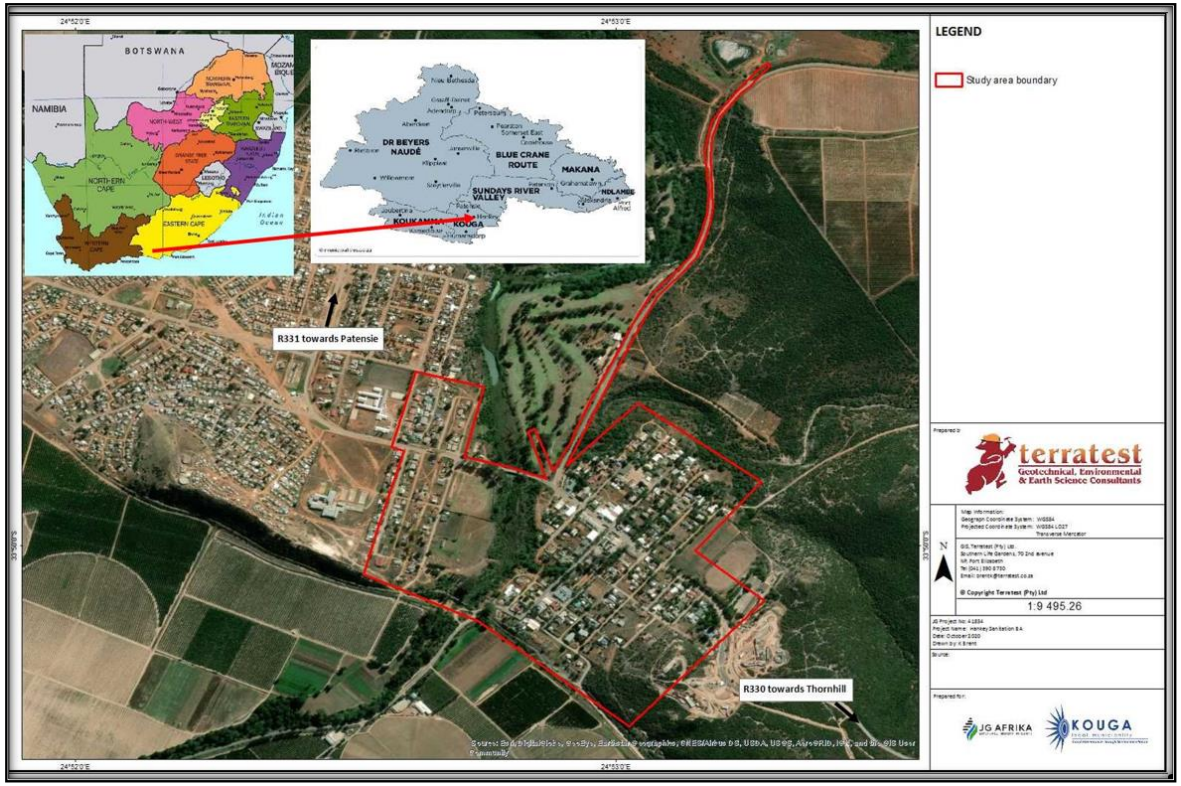


Figure 1: Aerial photo indicating the location of the study area within Hankey, where the sewage infrastructure is proposed to be upgraded.

Figure 2: Close-up Google Earth Image (2020) indicating the proposed infrastructure upgrade in Hankey, Kouga Local Municipality, Eastern Cape Province.

In terms of the sewer pipeline crossing the Klein River, three options are proposed:

1) **Preferred Option**: The preferred option is to have the pipeline installed on the existing rail bridge, crossing the river and gravitate to the proposed pump station. The pipeline will be connected using stainless steel brackets to avoid corrosion and will also be installed using either stainless steel piping or a HDPE pipeline and coated for UV resistance and environmental conditions. Due to a constant grade being used to cross the river, a 200 mm diameter pipeline can be used even though this reduces the self-cleaning velocity of the pipeline. This is due to KLM then being able to use their normal sewer maintenance procedures to clean the pipeline if it gets blocked (via their sewer jetting equipment), compared to needing a flushing chamber as well as a macerator associated with the alternative option of a new open trench excavation within the river (See Option 3).

2) **Alternative Option 2**: The second option is to construct a new pipe bridge across the Klein River. The only difference to option 1 is that construction activities will be required on the embankments of the Klein River to install the pipe bridge support piers. Furthermore, the construction of a support pier required for the pipe bridge will have a reduced impact on the riverbed as compared to the construction via an open trench (See Option 3).

3) **Alternative Option 3**: The third option entails an open trench excavation within the river (conventional excavation with river diversion during construction). A more expensive construction method would be Horizontal Directional Drilling, which would require an excavation pit on either side of the river whereby a drilling rig would be used for the installation. The gravity pipe and rising main will be installed in a double barrel system where the two 160mm HDPE pipes would be installed in parallel in the same trench.

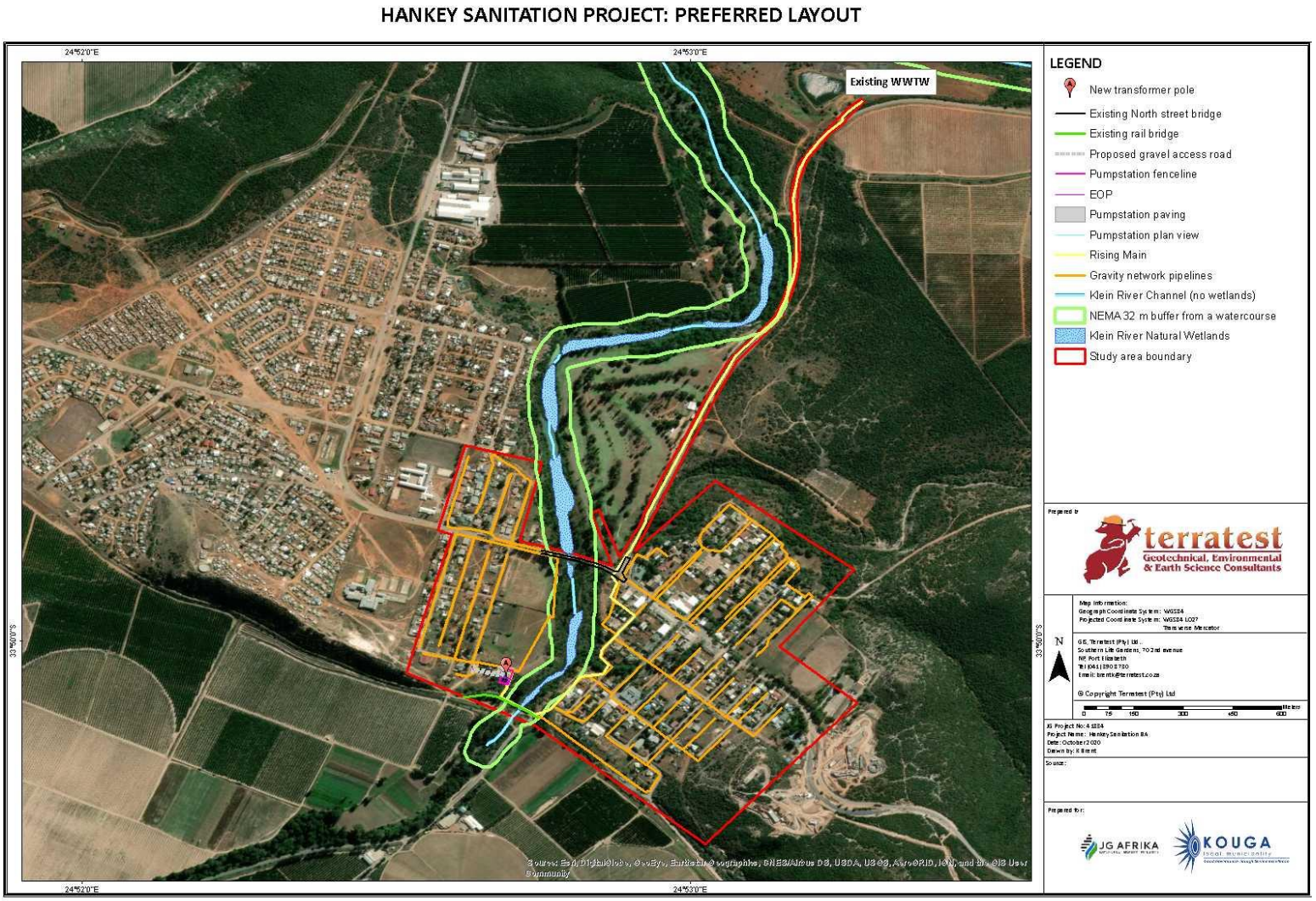


Figure 3: Preferred layout of the Hankey Sanitation Project

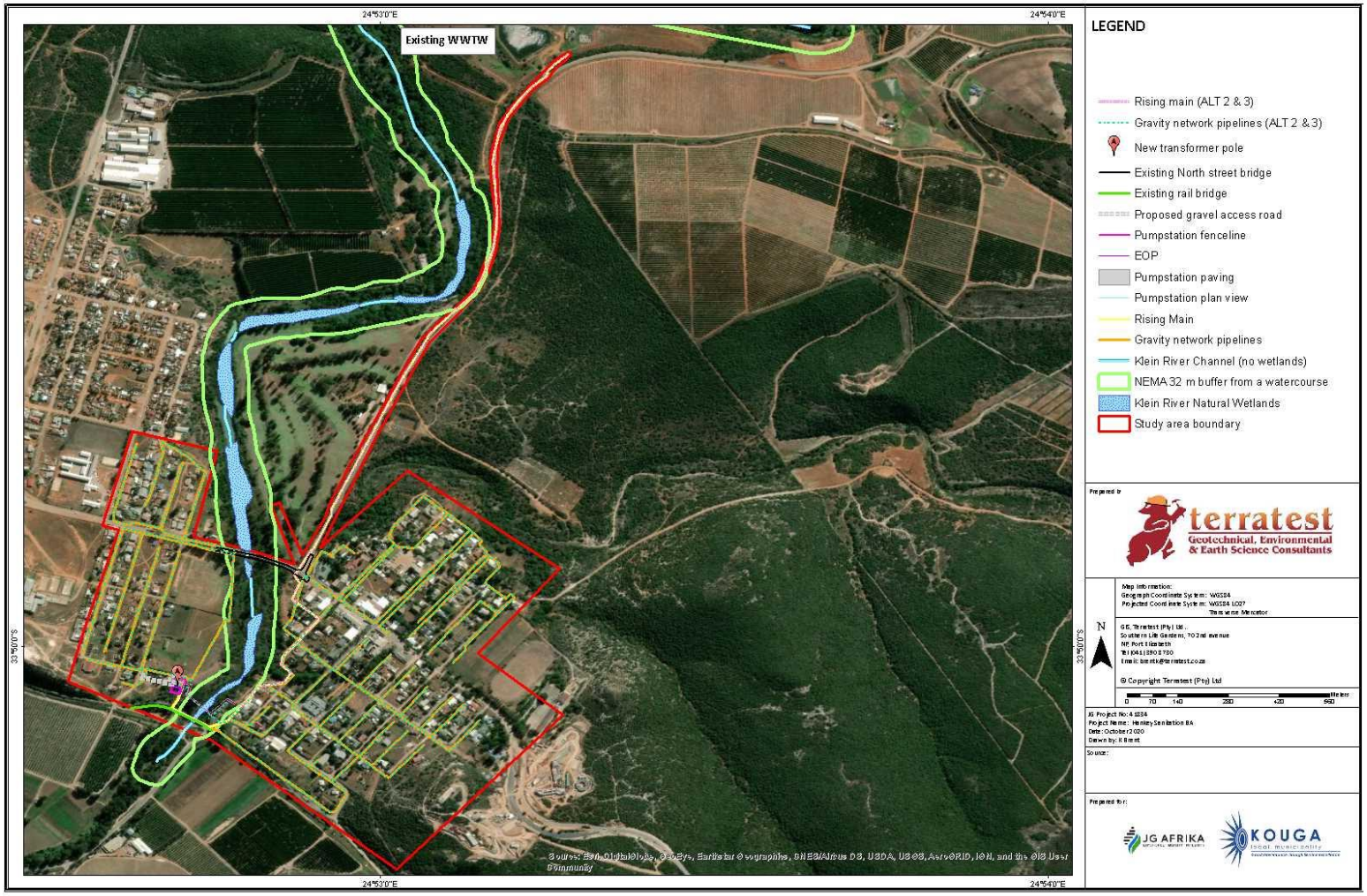


Figure 4: Hankey Sanitation Project- Alternatives

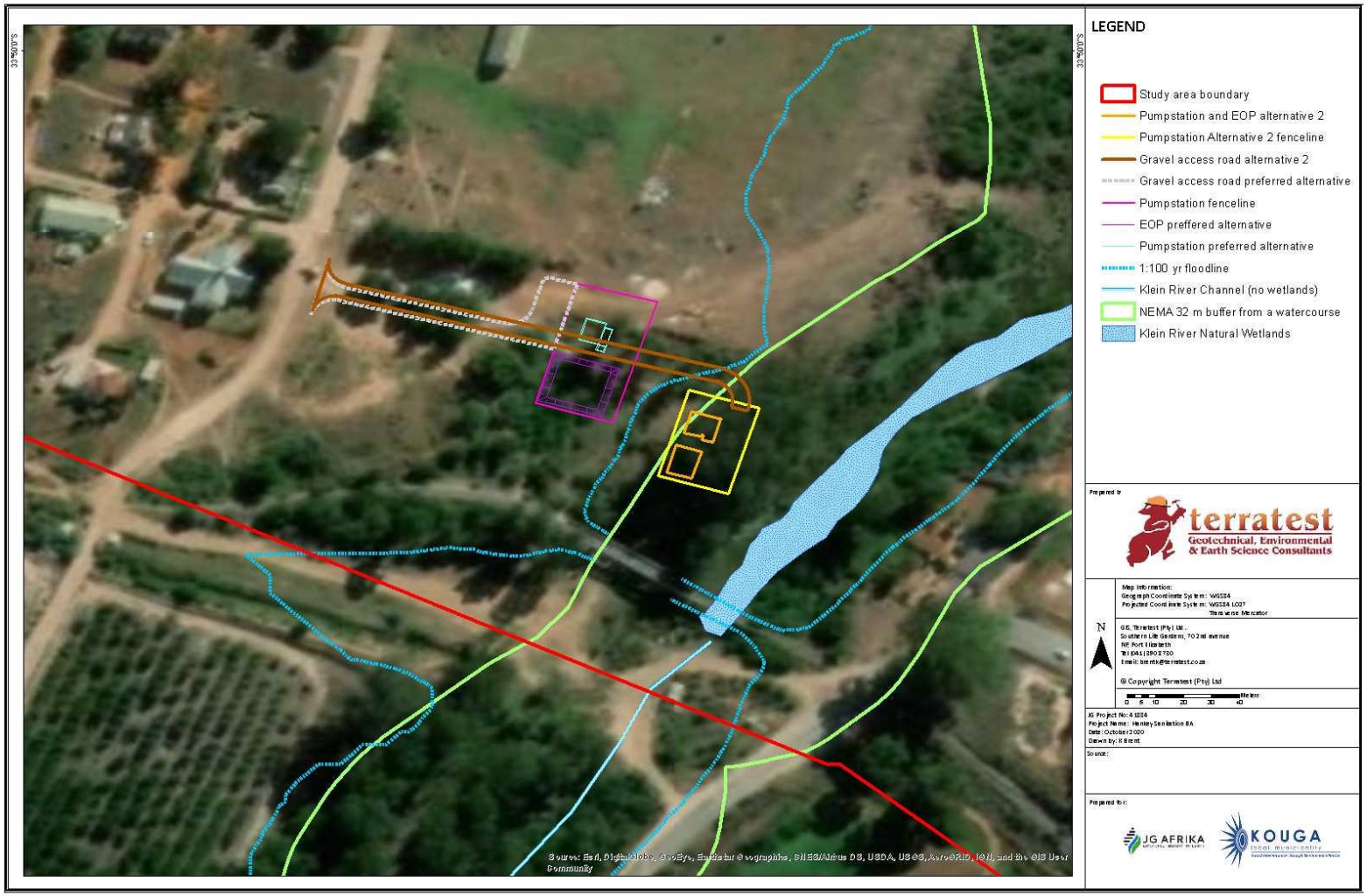


Figure 5: Hankey Sanitation Project- Pumpstation Alternatives

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler). has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-five years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact Assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- 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 a site—
    a. (exceeding 5 000 m^2 in extent; or
    b. involving three or more existing erven or subdivisions thereof; or
    c. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    d. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority

e. the re-zoning of a site exceeding 10 000m² in extent;

- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Description and location of the proposed development and provide geological and topographical maps;
- Provide Palaeontological and geological history of the affected area;
- Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.

- Fair assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed upgrade of the sanitation system in Hankey, within the Kouga Local Municipality, Eastern Cape Province is depicted on the 1:250 000 3324 Port Elizabeth Geological map (Council of Geoscience) (Figure 6). The proposed development is underlain by Late Caenozoic superficial sediments (alluvium, pale yellow with single flying bird figure); a very small portion in the east falls in the Kirkwood Formation (J-Kk; orange) and the westerly portion falls in the Enon Formation (Je; red) of the Uitenhage Group. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of by Late Caenozoic superficial sediments is moderate; that of the Kirkwood Formation is very High, and the Palaeontological Sensitivity of the Enon Formation is Low.

The Late Caenozoic superficial deposits are the youngest geological deposits formed during the most recent geological period (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of clay, gravel, sand, silt, that form relatively thin, discontinuous patches of sediments or larger spreads onshore. These sediments comprise of beach sand, channel, floodplain and stream deposits, talus gravels and glacial drift sediments. In the development footprint the are represented as alluvium.

The Late Caenozoic superficial deposits are the youngest geological deposits formed during the most recent geological are of most importance due to the palaeoclimatic changes that are reflected in the different geological formations (Hunter et al., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

Late Caenozoic fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits cut by dongas. In the past palaeontologists did not focus on Caenozoic superficial deposits although they sometimes comprise of significant fossil deposits. These fossil

assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

Torien and Hill (1989) described the regional geology of the Port Elizabeth area in the 3324 Port Elizabeth sheet explanation (Council of Geoscience). According to this overview the Uitenhage Group includes three formations: Enon, Kirkwood and Sundays River formations, which are characterizing by different depositional environments in a mostly contemporaneous fluvial system. The Kirkwood Formation consist of mostly sandstone and silty mudstone. Characteristic of this Formation is the easily weathered, variegated reddish brown, greenish grey or pinkish palaeosols. The sandstones are pale grey, as well as variations of white and yellow. The Kirkwood Formation depicts palaeosols and flood-plain deposits which are mostly associated with meandering river systems, lacustrine, and probably coastal, settings.

The **Kirkwood Formation** from the Early Cretaceous is known for its terrestrial biotas. Fossils of this formation include vascular plants (charcoal, lignite beds, and petrified logs), while tetrapod vertebrates include dinosaurs. Freshwater invertebrates are also present in this formation. Various dinosaur remains have been described from the Kirkwood Formation and include leg bones, teeth and vertebrae. The best-preserved Kirkwood dinosaur is *Nquebasaurus* which was described by De Klerk *et al* (2000). However, most of the dinosaur fossils found in the Kirkwood Formation is fragmentary. Gymnosperms dominated the woody vegetation and include conifers, extinct cycad-like bennettitaleans and true cycads. Freshwater algae include bryophytes, charophytes, and pteridophytes (ferns) while pollens and spores are commonly found. Amber (without imbedded insects) and charcoal are common. Other vertebrate fossil groups from the Kirkwood Formation include crocodiles, frogs, turtles, and lizards, mammals and freshwater fish. Non-marine invertebrate fossils include freshwater or estuarine molluscs, insects and several groups of small crustaceans have been described from this formation. Trace fossils include borings into petrified tree trunks.

The Enon Formation (Je) consists of boulder conglomerates and suggests a high energy depositional environment, in alluvial fans or braided rivers. This formation comprises of conglomerates, subordinate lenticular sandstone and claystones. Isolated rare bone fragments have been uncovered in this formation as well as charred wood (McLachlan and McMillan, 1976).

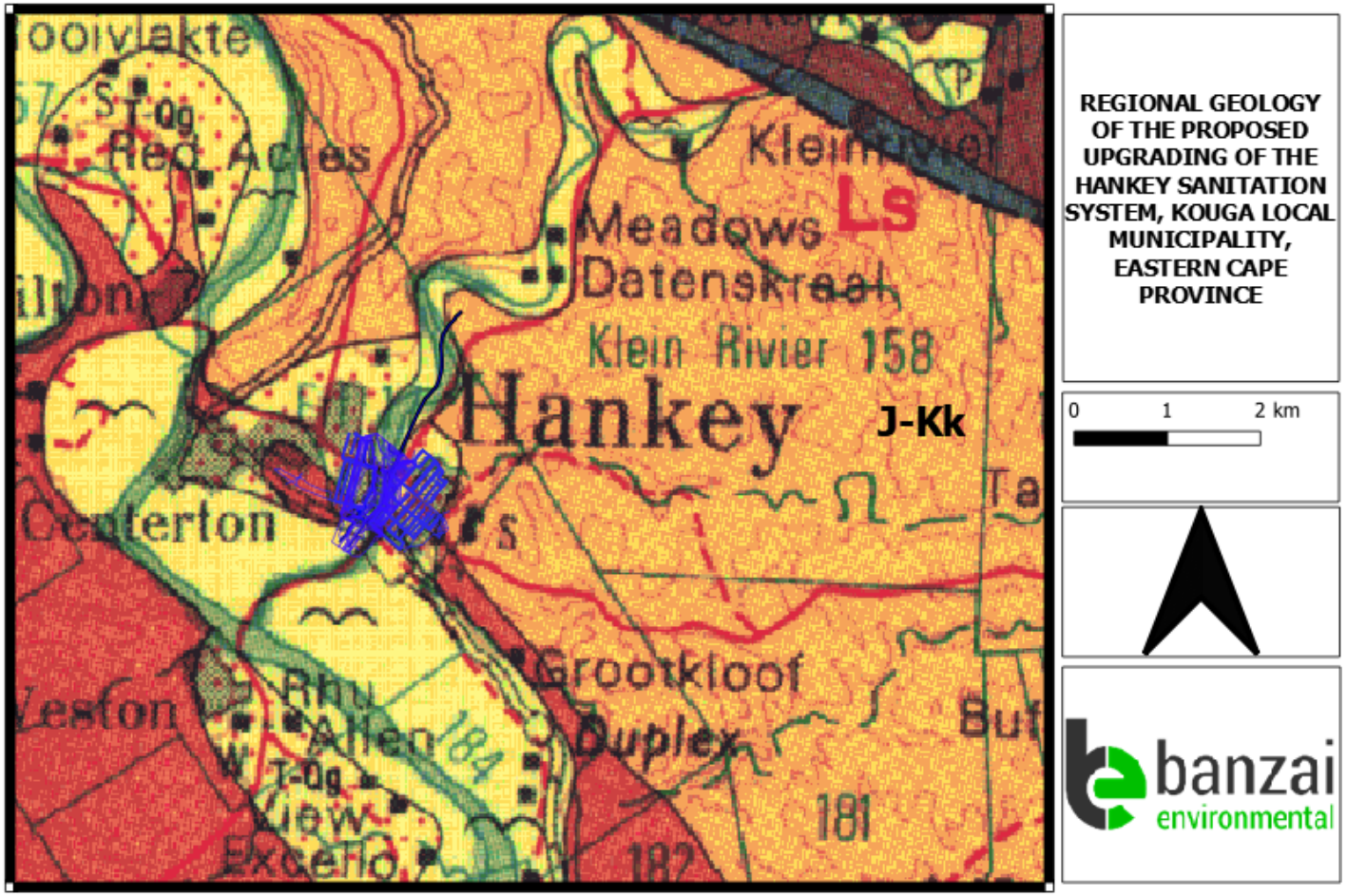
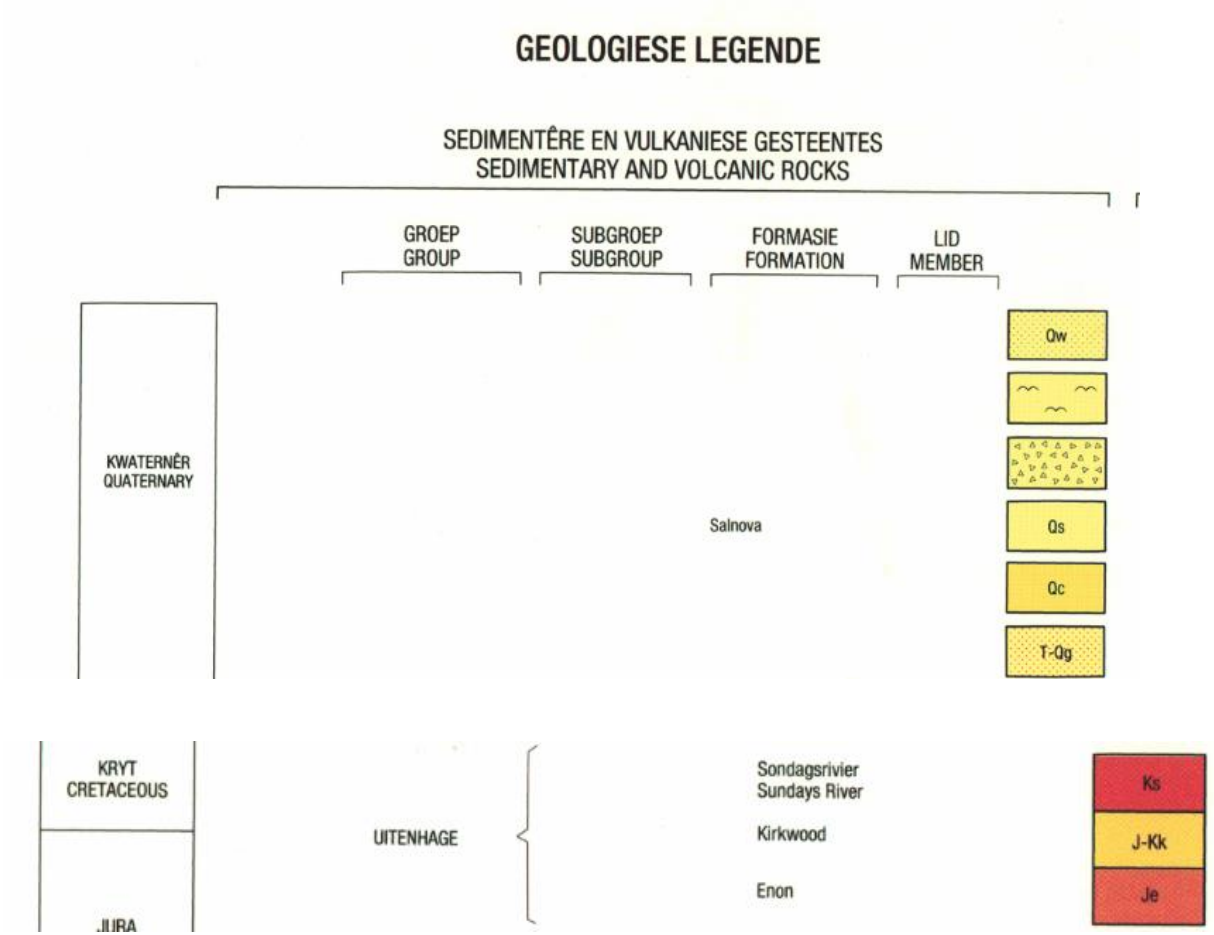


Figure 6: Extract of the 1:250 000 3324 Port Elizabeth Geological map (Council of Geoscience) indicating the regional geology of the sanitation system upgrade in Hankey, within the Kouga Local Municipality, Eastern Cape Province. Map drawn by QGIS 2.18.28.


GEOLOGIESE LEGENDE
SEDIMENTÊRE EN VULKANIESE GESTEENTES
SEDIMENTARY AND VOLCANIC ROCKS
GROEP
GROUP
SUBGROEP
SUBGROUP
FORMASIE
FORMATION
LID
MEMBER
KWATERNÊR
QUATERNARY
Salnova
Qw
Qs
Qc
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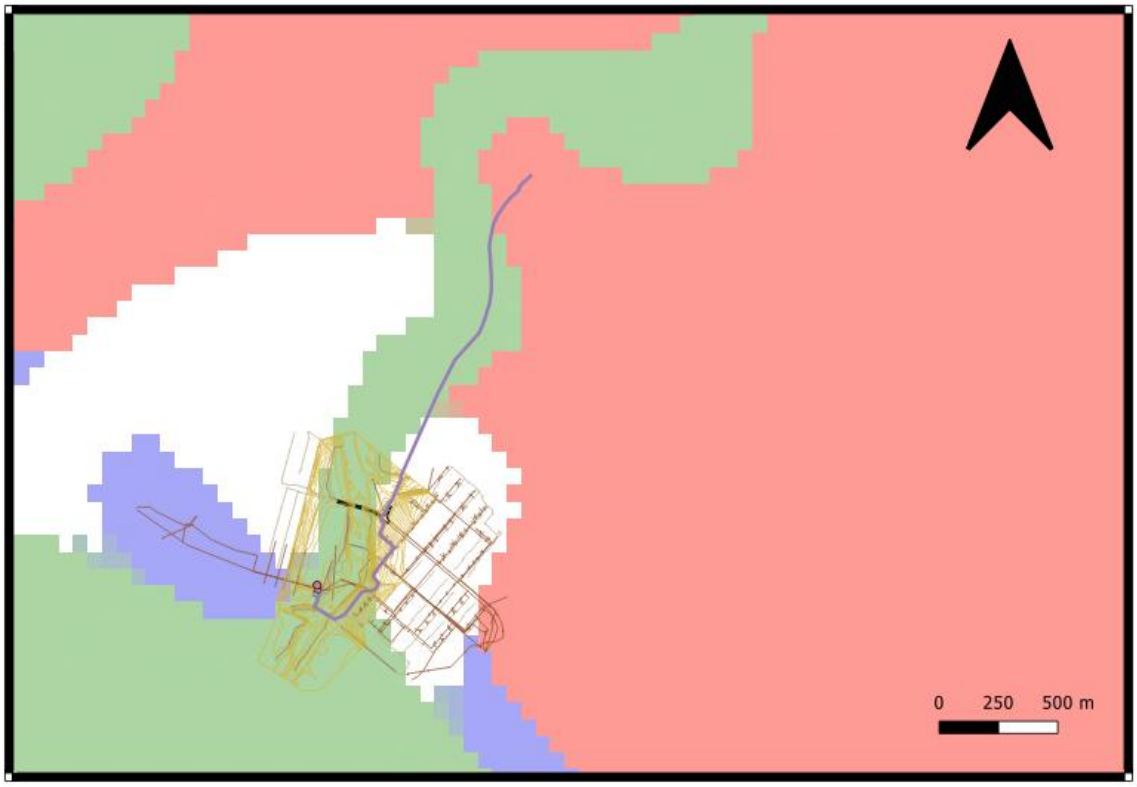

Figure 7: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the location of the proposed development.

Colour	Sensitivity	Required Action
RED	**VERY HIGH**	**Field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	**MODERATE**	**desktop study is required**
BLUE	**LOW**	**no palaeontological studies are required however a protocol for finds is required**
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS palaeo sensitivity map (Figure 7) there is a High chance of finding fossils in the Kirkwood Formation with a moderate chance in the Caenozoic Superficial sediments and a Low chance in the Enon Formation.

6 GEOGRAPHICAL LOCATION OF THE SITE

Hankey is a small town, west of Port Elizabeth. The town forms part of the Kouga Local Municipality, Sarah Baartman District in the Eastern Cape. The approximate co-ordinates of the proposed pump station, which can also be roughly considered as the central point of the project site, are: Latitude: 33°50'3.38" S; Longitude: 24°52'41.75" E.

7 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This include all trace fossils and fossils. All available information is consulted to compile a desktop study and includes: Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is sourced to provide information on the existence of fossils in an area which was not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. **A field-assessment will thus improve the accuracy of the desktop assessment.**

8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984);
- 1: 250 000 3324 Port Elizabeth Geological map (Council of Geoscience);
- A Google Earth map with polygons of the proposed development was obtained from JG Afrika.
- PIAs in the immediate area of the development footprint include Prevec (2016)

9 SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 8 October 2020. Photographs of the Kirkwood Formation is presented here as the area has a high Palaeontological Sensitivity. The Kirkwood Formation underlies a town development and is highly disturbed. No visible evidence of fossiliferous outcrops was identified. Mr Henk Butler (Geologist) is thanked for the photos taken as well as geological knowledge assisting in this site assessment.

Figure 8: Hankey Sanitation System Upgrade WWTW in the north of the development footprint.

This area is underlain by the Kirkwood Formation
GPS coordinates 33°49'8.83"S 24°53'14.92"E

Figure 9: Low vegetation and no fossiliferous outcrops present in the north of the development footprint.

This area is underlain by the Kirkwood Formation

GPS coordinates -33° 49' 8.79"S, 24° 53' 14.99"E

Figure 10: View in a south westerly direction in Mimosa Avenue.

This area is underlain by the Kirkwood Formation

GPS coordinates 33° 50' 5.56"S, 24° 53' 9.78"E

Figure 11:View along the R330 on the outskirts of Hankey.

Area is underlain by the Kirkwood Formation.

GPS coordinates *-33° 50' 8.89, S 24° 53' 12.54"E*

The following photos was kindly provided by JG Afrika and Terratest.

Figure 12: North western view at 33° 50’03.71S 24 °52’41.30E

This area of the development is underlain by the Late Caenozoic Superficial Sediments

Figure 13: South-western view at 33° 50’ 03.52”S, 24° 52’ 40.79”E

Figure 14: Eastern view of steel bridge (below bridge).
No fossiliferous outcrop were identified
at 33° 50’ 06.61”S, 24° 52’ 43.46”E

Figure 15: Northern view from steel bridge at 33° 50’ 04.30”S, 24° 52’ 45.41”E

Figure 16: Northern view of the alignment at 33° 49’ 56.12”S, 24° 52’ 51.70”E

Figure 17: Northern view where the proposed rising main will cross the R331 at 33° 49’ 53.77”S, 24° 52’ 52.32”E

Figure 18: Northern view of the alignment left along the DR01812 at 33° 49’ 50.02”S, 24° 52’ 54.52”E

10 IMPACT ASSESSMENT METHODOLOGY

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 2: The Rating System-

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).

3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (**Extent (1) + probability (3) + reversibility (4) + irreplaceability (4) + duration (4) + cumulative effect) (4) x magnitude/intensity (2) = 40.** The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.

51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

10.1 Summary of Impact Tables

The expected duration of the impact is assessed as potentially permanent to long term. Only the site will be affected. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as having a low probability. The significance of the impact occurring will be medium.

11 FINDINGS AND RECOMMENDATIONS

The proposed development is underlain by Late Caenozoic superficial sediments; a very small portion in the east falls in the Kirkwood Formation and the westerly portion falls in the Enon Formation of the Uitenhage Group. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of by Late Caenozoic superficial sediments is moderate; that of the Kirkwood Formation is very High, and the Palaeontological Sensitivity of the Enon Formation is Low.

The Kirkwood Formation is located in the far north as well as the south eastern margin of the development footprint. Several pipeline and pumpstation layout alternatives have been proposed for the project, but as No visible evidence of fossiliferous outcrops was identified there is no preferred option for the alternatives from a palaeontological point of view. An overall medium palaeontological sensitivity is thus allocated to the development footprint.

The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a medium significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the EC in charge of these

developments. These discoveries ought to be protected (if possible, *in situ*) and the EC must report to SAHRA (Contact details: Eastern Cape Provincial Heritage Resources Authority (ECPHR); Corner Scholl and Amalinda Drive, East London, 5247, email: info@ecphra.org.za; Tel 043 7450888; Web: www.ecphra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist

12 CHANCE FINDS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

12.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

12.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

12.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

12.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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Appendix A – Elize Butler CV

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	26 years in Palaeontology

EDUCATION:

B.Sc Botany and Zoology, 1988
University of the Orange Free State

B.Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA)	2006-currently

EMPLOYMENT HISTORY

Part-time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part-time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

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