PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED LANSERIA OUTFALL SEWER PIPELINE IN JOHANNESBURG, GAUTENG PROVINCE

Prepared for:

PSG Heritage (Pty) Ltd

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By

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EXECUTIVE SUMMARY

Nemai Consulting was appointed by **Johannesburg Water** (JW) as the Independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Authorisation (EA) for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. According to the National Heritage Resources Act (Act No 25 of 1999, section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to assess the impact of the construction and operation of the development site on the palaeontological resources.

The development footprint for the two rout alternatives to site 1 and three route alternatives to site 2 in this study is completely underlain by the Archaean granites of the Halfway House dome. These Granites consists of a coarse-grained plutonic igneous rock type and thus the potential for any fossil materials occurring within this rock unit is zero. The palaeontological heritage of all route alternatives (total of 5) of the two sites will thus be equal and none of the routes is a preferred rout.

The proposed development is thus unlikely to pose a threat to local fossil heritage. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development.

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1 INTRODUCTION

Nemai Consulting was appointed by **Johannesburg Water** (JW) as the Independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Authorisation (EA) for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province.

The Lanseria Outfall Sewer basin is situated in the north-western portion of the City of Johannesburg Metropolitan Municipality (CoJ). Substantial pressure exists for the development of the largely undeveloped Lanseria area, initiated by the extension of the CoJ urban development boundary in 2008. Future land use comprises of mixed residential, commercial and industrial developments.

1.1 Background to the Project (Information Provided By JW)

JW are presently undertaking the design of a regional Lanseria Waste Water Treatment Works (WwTW) in which the EIA Process is considering two sites. The new Lanseria WwTW will treat waste water from a large area as demarcated by the JW Masterplan for this area, west of the existing Northern WwTW. The Lanseria WwTW will be constructed in three phases of 50 Ml/d each.

The project involves the design and construction of a proposed outfall sewer that will transport sewage from the existing Zandspruit Sewer Pump station to the future Lanseria WwTW. Beside this route, new collector sewers (not part of this study) will add to the flow in the outfall sewer. The construction of the Lanseria Outfall Sewer will provide a chance for JW to decommission some of the existing sewer pumping stations in the drainage area.

The Lanseria Outfall Sewer, in the northern part of CoJ will be located in the JW Lanseria Sewage Drainage Basin. Following the Klein Jukskei and Jukskei Rivers the upstream end of the Lanseria Outfall Sewer originates at the existing Zandspruit Sewer Pump Station and runs north-north-westerly to the proposed Lanseria WwTW (options are available to both site alternatives).

The Lanseria Outfall Sewer will be approximately 11 to 19.5km in length. The upstream portion of the alternative pipeline alignments (40% to 50% of the total pipe length) runs within an area characterized by smallholdings, low-density residential developments and small to large commercial concerns. This section of the alternative pipeline alignments follows the Klein Jukskei River and the Jukskei River. The remainder of the alternative pipeline alignments, traverse through areas such as Northern Farms, Blair Atholl Golf Estate, industrial developments, the Lion Park Quarry and the Lanseria Airport.

During the EIA Process, Nemai Consulting will be considering alternative route alignments for the outfall sewer:

Route to Site 1 (Figure 1):

- Alternative 1 - Gravitational Route
- Alternative 2 - Gravitational Route

Route to Site 2 (Figure 2):

- Alternative 1 - Gravitational Route
- Alternative 2 - Pumped and Gravitational Route
- Alternative 3 - Tunnelled Route (planned to go underneath the Lanseria Airport)

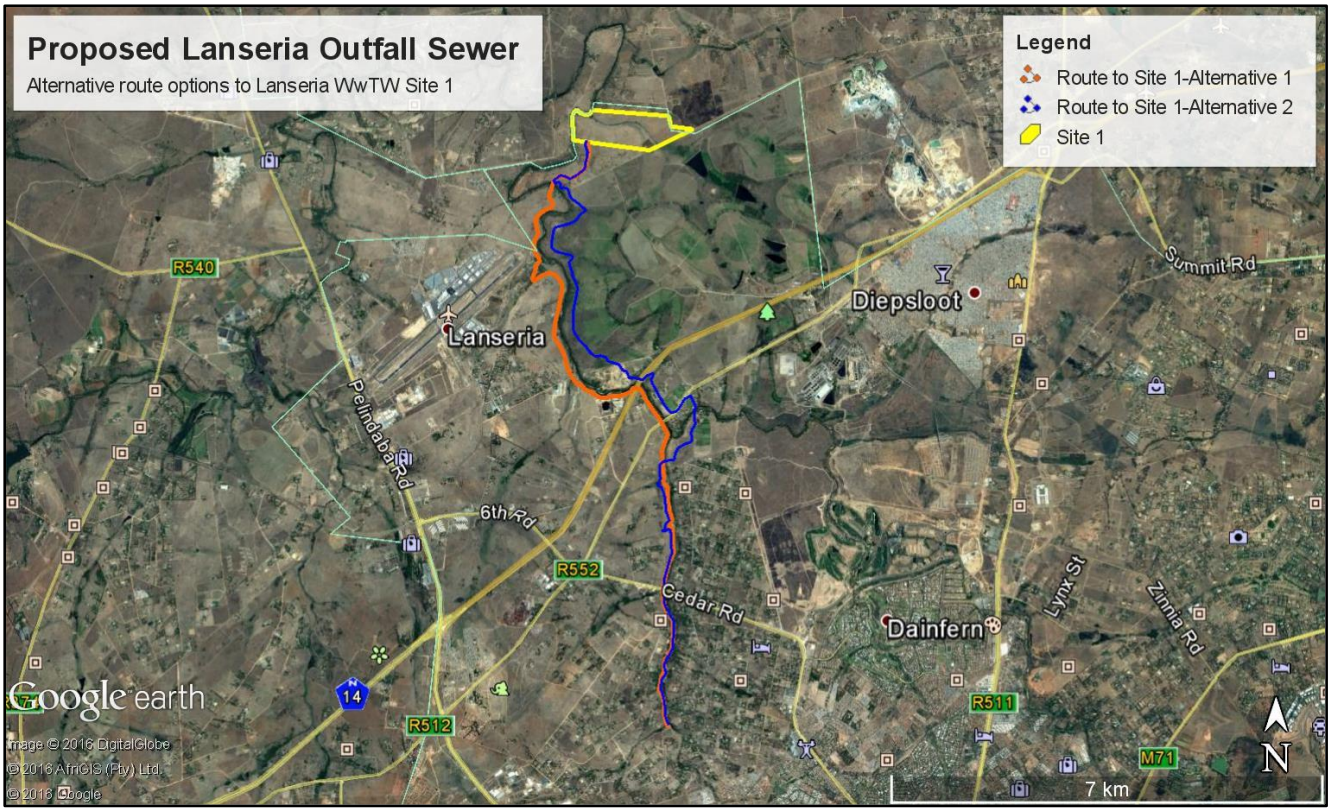

Figure 1: Google Earth image of the proposed outfall sewer pipeline routes to the future WwTW (Site 1 with 2 alternative routes) (Map provided by Nemai Consulting).

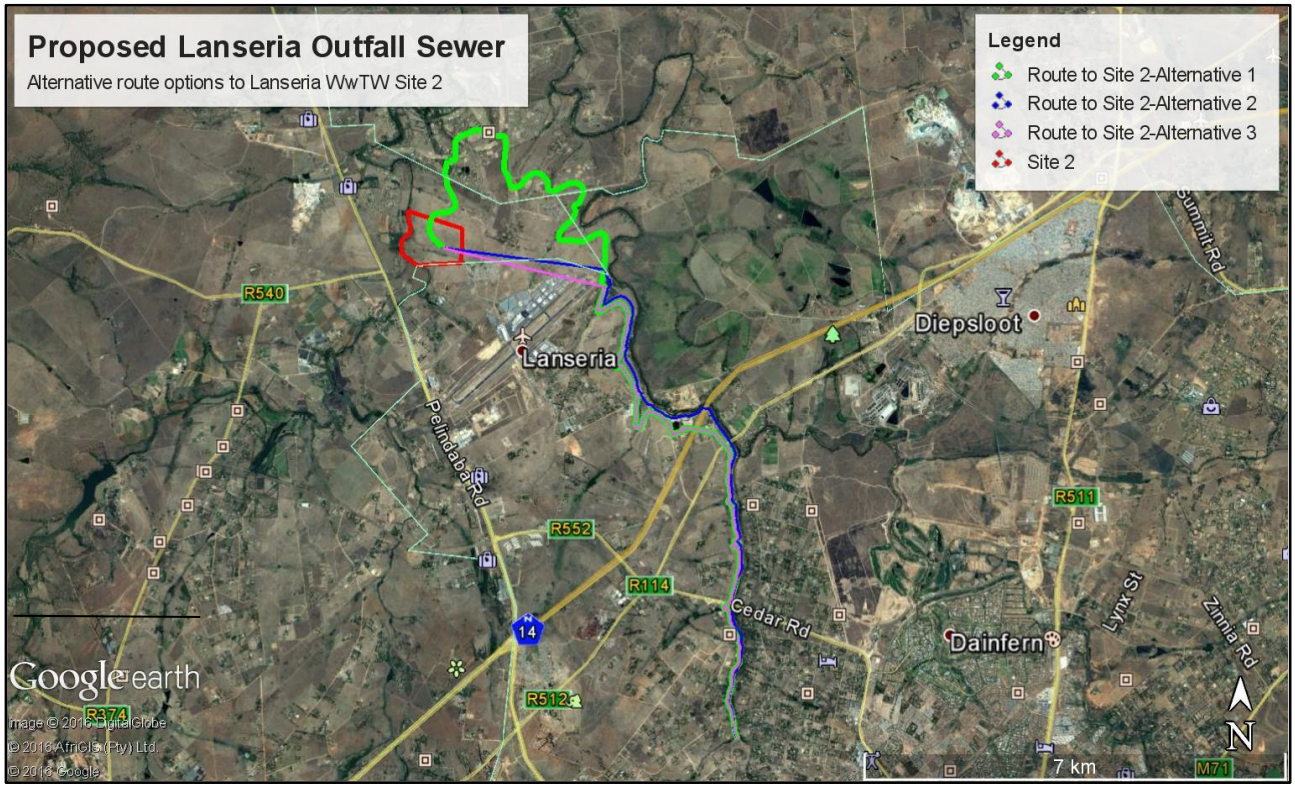

Figure 2: Google Earth image of the proposed outfall sewer pipeline routes to the future WwTW (Site 2, with 3 alternative routes). (Map provided by Nemai Consulting).

2 SCOPE

According to the South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites (APM) Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports, the aims of the palaeontological impact assessment are:

- To identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- To assess the level of palaeontological significance of these formations;
- To comment on the impact of the development on these exposed and/or potential fossil resources; and
- To make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is therefore to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA) and the EIA Report, to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; fossil sensitivity maps; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area on a desktop level. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of the palaeontological sensitivity of the rocks and the nature and scale of the development itself (extent of new bedrock excavated).

If rocks of moderate to high palaeontological sensitivity are present within the study area, a Phase 1 field-based assessment by a professional palaeontologist is necessary. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.

When specialist palaeontological mitigation is suggested, it may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is still exposed and available for study. Mitigation usually involves the careful sampling, collection and recording of fossils, as well as relevant data concerning the surrounding sedimentary matrix. Excavation of the fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. With appropriate mitigation, many developments involving bedrock excavation will have a *positive* impact on our understanding of local palaeontological heritage.

2.1 ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist.
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.

- Impact studies and other reports (*e.g*. of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

3 LEGISLATION

3.1 GENERAL MANAGEMENT GUIDELINES

The National Heritage Resources Act (Act 25 of 1999) (NHRA) states that, any person who intends to undertake a development categorised as-

(a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

  (i) exceeding 5 000 m^2 in extent; or

  (ii) involving three or more existing erven or subdivisions thereof; or

  (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

  (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA.SAHRA;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Cultural Heritage in South Africa is governed by the NHRA. This Palaeontological Scoping Study forms part of the HIA and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

3.1.1 SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999

In Section 3 of NHRA, various categories of heritage resources are recognized as part of the National Estate. This include among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- 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;
    - Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
    - Trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
    - Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

- Serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order; and/or
- Carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary.

4 GEOGRAPHICAL LOCATION OF THE SITE

The Lanseria Outfall Sewer, in the northern part of the CoJ will be located in the JW Lanseria Sewage Drainage Basin. The Outfall Sewer will be approximately 11 to 19.5km in length. Sewage will be transported from the existing Zandspruit Sewer Pump station to the future Lanseria WwTW along the Klein Jukskei and Jukskei Rivers.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

5.1 GEOLOGY

The proposed development sites (two rout alternatives to site 1 and three route alternatives to site 2, see Fig.1&2) are completely underlain by granites from the Halfway House Granite dome (3 200 Ma) (Fig. 3-4). The dome comprises a variety of Archaean granitic rocks intruded into mafic–ultramafic greenstone remnants e.g., tonalitic gneisses, migmatites, gneisses, and porphyritic granodiorites. It is named after Halfway House between Pretoria and Johannesburg (Kent 1980).

5.2 PALAEONTOLOGICAL HERITAGE

The Halfway House Granite is a coarse-grained plutonic igneous rock type. It has formed by crystallisation directly from a liquid magma deep within the Earth's crust. The potential for any fossil materials occurring within this rock unit is thus zero.

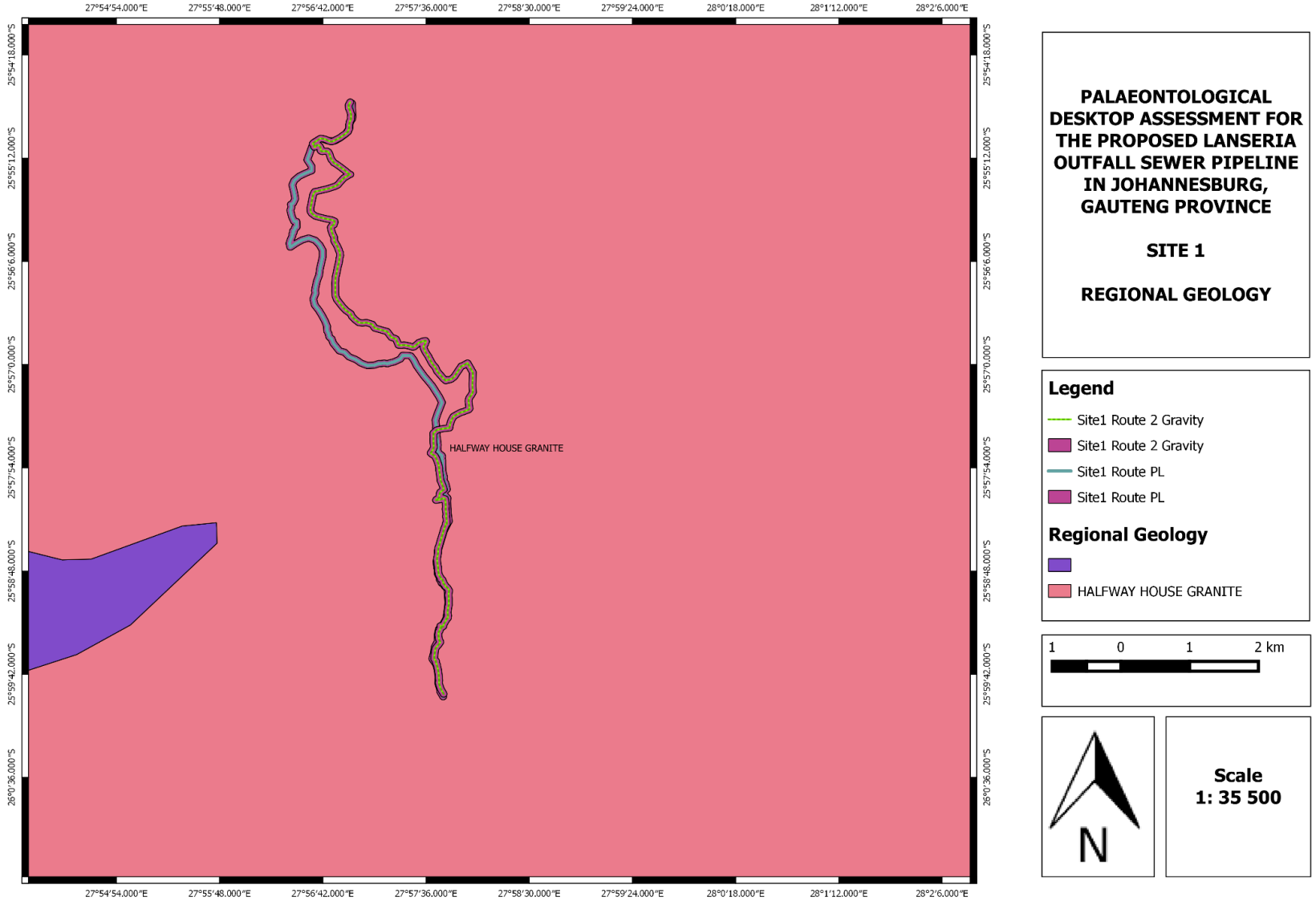

Figure 3. The surface geology of route alternatives to Site 1 (Alternative 1 Gravitational Route and Alternative 2 - Gravitational Route) of the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. The site is completely underlain by the Halfway House Granite Dome.

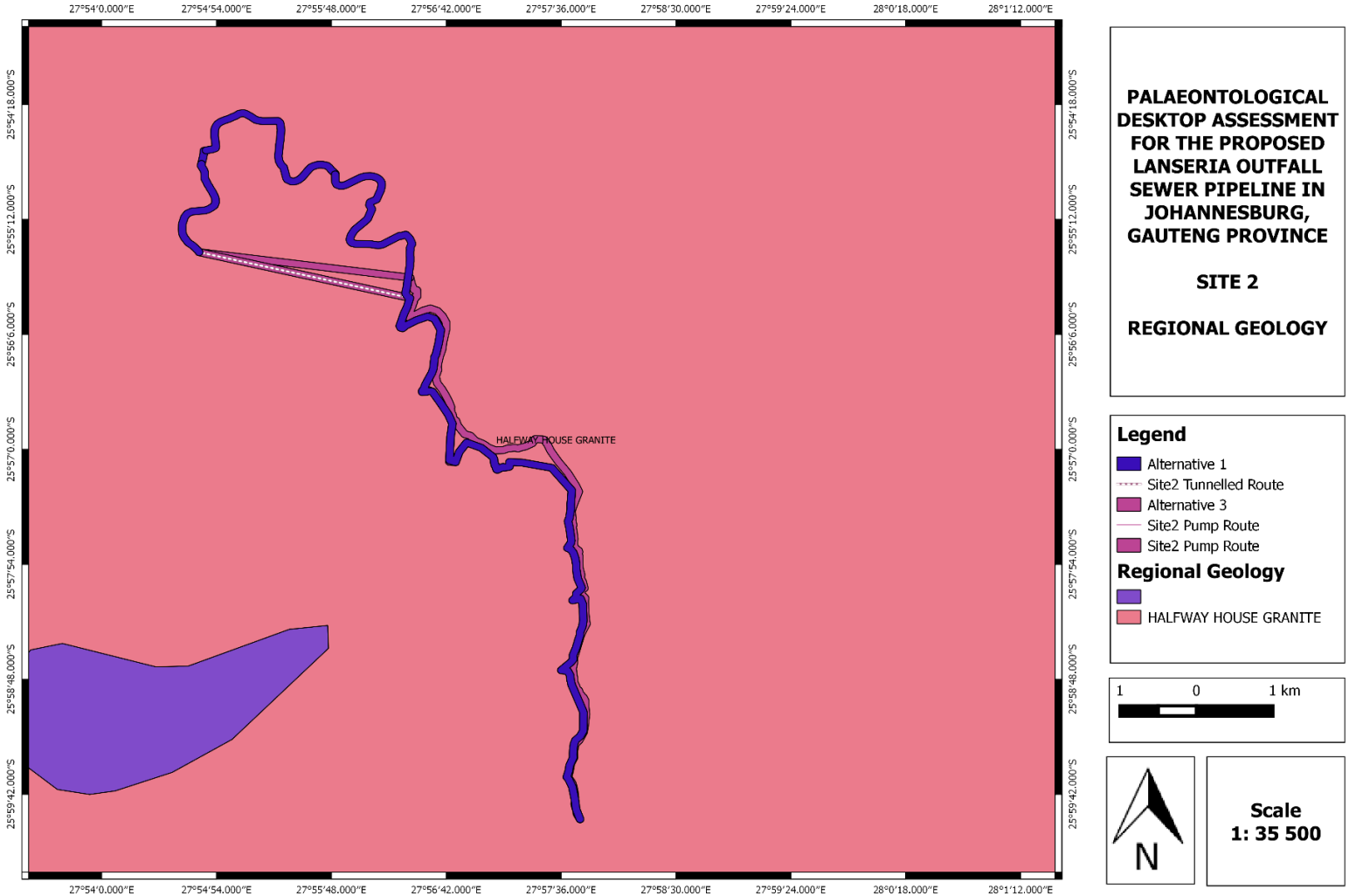

Figure 4. The surface geology of route alternatives to Site 2 (Alternative 1 - Gravitational Route, Alternative 2 - Pumped and Gravitational Route, Alternative 3 - Tunnelled Route (planned to go underneath the Lanseria Airport) of the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. The site is completely underlain by the Halfway House Granite Dome.

6 CONCLUSIONS AND RECOMMENDATIONS

The development footprint for the two rout alternatives to site 1 and three route alternatives to site 2 in this study is completely underlain by the Archaean granites of the Halfway House dome. These Granites consists of a coarse-grained plutonic igneous rock type and thus the potential for any fossil materials occurring within this rock unit is zero. The palaeontological heritage of all route alternatives (total of 5) of the two sites will thus be equal and none of the routes is a preferred rout.

The proposed development is thus unlikely to pose a substantial threat to local fossil heritage. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development.

7 METHODOLOGY FOR IMPACT ASSESSMENT

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria -

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summarised explanation of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 1**.

Impacts relevant to the two rout alternatives to site 1 and three route alternatives to site 2 is highlighted in yellow in the following tables.

Table 1: Impact Assessment Criteria

CRITERIA	CATEGORIES	EXPLANATION
Overall nature	**Negative**	Negative impact on affected biophysical or human environment.
	Positive	Benefit to the affected biophysical or human environment.
Type	**Direct**	Are caused by the action and occur at the same time and place.
	Indirect or Secondary	Are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. May include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
	Cumulative	Is the impact on the environment, which results from the incremental impact of the action when added to other past,

		present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
Spatial Extent over which impact may be experienced	**Site**	Immediate area of activity incorporating a 50m zone which extends from the edge of the affected area.
	Local	Area up to and/or within 10km of the 'Site' as defined above.
	Regional	Entire community, drainage basin, landscape etc.
	National	South Africa.
Duration of impact	**Short-term**	Impact would last for the duration of activities such as land clearing, land preparation, fertilising, weeding, pruning and thinning. Quickly reversible.
	Medium-term	Impact would after the project activity such as harvesting. Reversible over time.
	Long-term	Impact would continue beyond harvesting/ extraction of the trees.
	Permanent	Impact would continue beyond decommissioning.
Severity	**Low, Medium, High Negative**	Based on separately described categories examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning or slightly alters the environment itself.
	Low, Medium, High Positive	
Reversibility	**Completely Reversible**	The impact can be completely reversed with the implementation of correct mitigation and rehabilitation measures.
	Partly Reversible	The impact can be partly reversed providing mitigation measures are implemented and rehabilitation measures are undertaken
	Irreversible	The impact cannot be reversed, regardless of the mitigation or rehabilitation measures.
Irreplaceable Loss	**Resource will not be lost**	The resource will not be lost or destroyed provided mitigation and rehabilitation measures are implemented.

	Resource may be partly destroyed	Partial loss or destruction of the resource will occur even though all management and mitigation measures are implemented.
	Resource cannot be replaced	The resource cannot be replaced no matter which management or mitigation measures are implemented.
Probability of occurrence	**Unlikely**	<40% probability.
	Possible	40% probability.
	Probable	>70% probability.
	Definite	>90% probability.
Mitigation Potential **[i.e. the ability to manage or mitigate an impact given the necessary resources and feasibility of application.]**	**High or Completely Mitigatible**	Relatively easy and cheap to manage. Specialist expertise or equipment is generally not required. The nature of the impact is understood and may be mitigated through the implementation of a management plan or through 'good housekeeping'. Regular monitoring needs to be undertaken to ensure that any negative consequences remain within acceptable limits. The significance of the impact after mitigation is likely to be low or negligible.
	Moderate or Partially Mitigatible	Management of this impact requires a higher level of expertise and resources to maintain impacts within acceptable levels. Such mitigation can be tied up in the design of the Project. The significance of the impacts after mitigation is likely to be low to moderate. May not be possible to mitigate the impact entirely, with a residual impact(s) resulting.
	Low or Unmitigatible	Will not be possible to mitigate this impact entirely regardless of the expertise and resources applied. The potential to manage the impact may be beyond the scope of the Project. Management of this impact is not likely to result in a

		measurable change in the level of significance.
Impact Significance	**Negligible**	-
	Low	Largely of HIGH mitigation potential, after considering the other criteria.
	Moderate	Largely of MODERATE or partial mitigation potential after considering the other criteria.

Summary of Impact Table 1

As the Halfway House Granites is unfossiliferous the probability that fossils will be affected is unlikely and thus the impact will have a low severity with a negligible significance on fossil heritage.

POTENTIAL IMPACTS (in order of impact as described in Impact Matrix)	ASPECT (refer to Impact Matrix)	Nature	Type	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	MITIGATION POTENTIAL	IMPACT SIGNIFICANCE		MITIGATION MEASURES
											Without Mitigation	With Mitigation	
CONSTRUCTION PHASE													
Impacts on palaeontological resources	Heritage Resources	**Negative**	Direct	Site	Permanent	**Low**	Irreversible	Resource cannot be replaced	unlikely	High	**Low**	**Low**	No mitigation as the sites are unfossiliferous

8 REFERENCES

ALMOND, J., PETHER, J., and GROENEWALD, G. 2013.South African National Fossil Sensitivity Map. Fossil Heritage Layer Browser, SAHRA and Council for Geoscience.

KENT, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei and Venda. SACS, Council for Geosciences, Pp 535-574.

MCARTHY, T. and Rubidge, B. 2005. The Story of Earth Life: A southern African perspective on a 4.6-billion-year journey. Struik, Pp 333.

SG 2.2 SAHRA APMHOB Guidelines, 2012. Minimum standards for palaeontological components of Heritage Impact Assessment Report, Pp 1-15.

SNYMAN, C.P. 1996. Geologie vir Suid-Afrika, Departement Geologie, Universiteit van Pretoria, Pretoria, Volume 1, Pp 513.

VAN DER WALT, M., DAY, M., RUBIDGE, B. S., COOPER, A. K. & NETTERBERG, I., 2010. Utilising GIS technology to create a biozone map for the Beaufort Group (Karoo Supergroup) of South Africa. Palaeontologia Africana, 45: 1-5.

VISSER, D.J.L. 1984.Geological Map of South Africa 1:100 000.South African Committee for Stratigraphy. Council for Geoscience. WALRAVEN, F. 1978. Geological Map 2528 Pretoria, 1:250 000.Council for Geoscience, Pretoria.

9 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty years. She has been conducting Palaeontological Impact Assessments since 2014.

10 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 favourable 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 favourable 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 realise that a false declaration is an offence 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;

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SIGNATURE:  _____