

**PALAEONTOLOGICAL IMPACT
ASSESSMENT REPORT ON THE
SITE OF A PROPOSED EXPANSION
OF THE MEYERTON WASTER
WATER TREATMENT WORKS TO
BE LOCATED ON PORTIONS 65
AND 66 OF THE FARM
KOOKFONTEIN 545 IQ, GAUTENG
PROVINCE**

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**PALAEONTOLOGICAL IMPACT ASSESSEMENT REPORT
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Prepared for:

MSA GROUP

By

Dr B.D. Millstead

EXECUTIVE SUMMARY

The Meyerton Waste Water Treatment Works (MWWTW) is an existing facility operated by the Midvaal Local Municipality and has been operational since the 1970's. Due to continuing urban growth in the area the facility no longer has adequate capacity and an expansion is required to avoid discharge of inadequately treated effluent into the environment.

The MWWTW lies on Portions 65 and 66 of the farm Kookfontein 545 IQ, approximately 15km north of Vereeniging and 1.5km from the outskirts of Meyerton, Gauteng Province.

The MSA Group was appointed by the Midvaal Local Municipality as independent Environmental Assessment Practitioner to apply for the Waste Management License which is required for the expansion of the MWWTW. The MSA Group has retained BM Geological Services to conduct that Palaeontological Heritage Impact Assessment Study for the area to be affected by Phases 2 and 3 of the expansion program. A site investigation of the proposed project area was conducted on the 9th October 2012 by Dr B.D. Millstead. The site was traversed extensively by foot to determine the palaeontological importance of the area and to quantify the impact that that proposed mining activities would have on the palaeontological heritage.

Three stratigraphic units are identified as underlying the project site, these being (in descending stratigraphic order):-

- Regolith (covering the entire area)
- Vryheid Formation mudstones
- Malmani Subgroup carbonates

The regolith was found to have been either previously extensively disturbed and in part to represent landfill of a pre-existing quarry. No fossil materials were identified within the regolith cover and should any be discovered at a later date, the disturbed nature of the regolith would indicate that the fossils would be of limited scientific value.

No fossil material was identified in the Vryheid Formation within the project area. It is also significant that the Vryheid Formation strata occurring close enough to the surface to be disturbed by the expansion project are heavily weathered. As such, should any fossil material be discovered at a later juncture it is likely to be so degraded as to be unlikely to have any scientific significance.

The Malmani Subgroup strata may be expected to contain stromatolitic horizons, but this unit will not be impacted by the proposed development.

As no fossils were located on the project site **no palaeontological reason was identified that should negatively impact on the proposed project**. Similarly, a parallel assessment of the anticipated impact of the project on the palaeontological heritage of the site using standardised assessment criteria has provided a Project Significance rating value of '5'. This significance rating indicates that the anticipated impacts of the project are of low significance should have no significant influence on the proposed development project.

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1. INTRODUCTION

The Meyerton Waste Water treatment Works (MWWTW) is an existing facility operated by the Midvaal Local Municipality and has been operational since the 1970's. Due to continuing urban growth in the area the existing facility has become overloaded in terms of its capacity to handle wastewater (domestic sewerage and industrial effluent) and an expansion of the facility is required to avoid discharge of inadequately treated effluent into the environment.

The site of the proposed expansion of the MWWTW lies entirely within the boundaries of the existing MWWTW, which is located on Portions 65 and 66 of the farm Kookfontein 545 IQ. The site lies approximately 15km north of Vereeniging and 1.5km from the outskirts of Meyerton, in the local municipality of Midvaal and the district municipality of Sedibeng, Gauteng Province (Figure 1).

The Midvaal Local Municipality appointed The MSA Group as Independent Environmental Assessment Practitioner to apply for the Waste Management License which is required for the expansion of the MWWTW. The MSA Group has been instructed by the South African Heritage Resources Agency (SAHRA) to include a Palaeontological Heritage Impact Assessment Report as part of the Environmental Impact Assessment Report that forms part of the application process. MSA Group has retained BM Geological Services to conduct that Palaeontological Heritage Impact Assessment Study.

2. TERMS OF REFERENCE

The terms of reference for this study were as follows:-

- Identify all palaeontological materials located in the area of the project area.
- Quantify the palaeontological heritage significance of any fossil materials identified.
- Describe the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Propose suitable mitigation measures to minimise possible negative impacts, if any are identified, on the palaeontological heritage of the site.

3. LEGISLATIVE REQUIREMENTS

South Africa's cultural resources are primarily dealt with in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

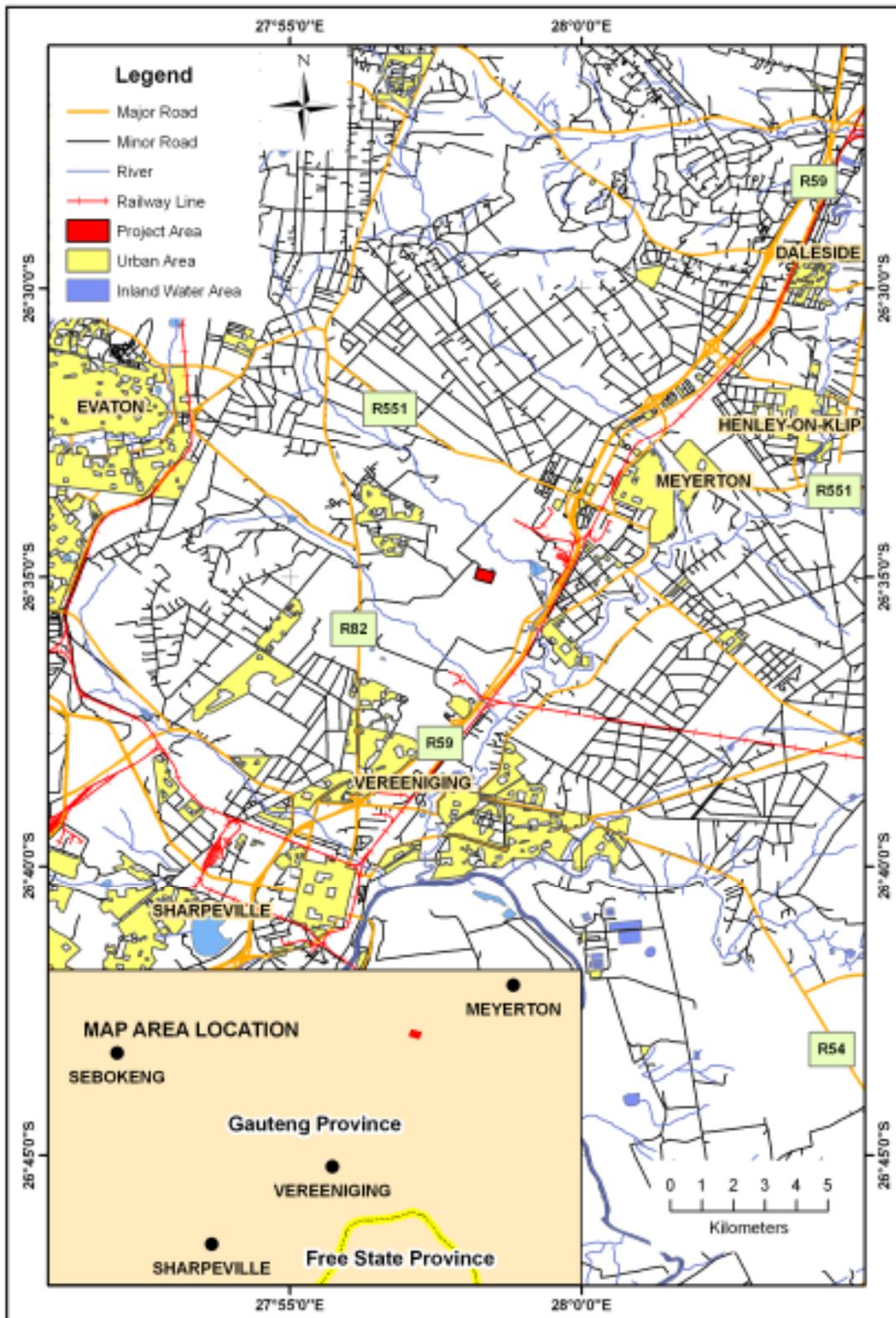


Figure 1: Location map showing the position of the Meyerton Waste Water Treatment Works.

3.1 The National Heritage Resources Act

The following are protected as cultural heritage resources by the National Heritage Resources Act:

- a. Archaeological artifacts, structures and sites older than 100 years
- b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
- c. Objects of decorative and visual arts
- d. Military objects, structures and sites older than 75 years
- e. Historical objects, structures and sites older than 60 years
- f. Proclaimed heritage sites
- g. Grave yards and graves older than 60 years
- h. Meteorites and **fossils**
- i. Objects, structures and sites of scientific or technological value.

The Act also states that those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities. The national estate includes the following:

- a. Places, buildings, structures and equipment of cultural significance
- b. Places to which oral traditions are attached or which are associated with living heritage
- c. Historical settlements and townscapes
- d. Landscapes and features of cultural significance
- e. Geological sites of scientific or cultural importance
- f. Sites of Archaeological and palaeontological importance**
- g. Graves and burial grounds
- h. Sites of significance relating to the history of slavery
- i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.)

3.1.1 Need for Impact Assessment Reports

Section 38 of the Act stipulates that any person who intends to undertake an activity that falls within the following:

- a. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
- b. The construction of a bridge or similar structure exceeding 50m in length
- c. Any development or other activity that will change the character of a site and exceed 5 000m² or involve three or more existing erven or subdivisions thereof
- d. Re-zoning of a site exceeding 10 000 m²
- e. Any other category provided for in the regulations of SAHRA or a provincial heritage 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. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

3.1.2 Legislation Specifically Pertinent to Palaeontology*

***Note:** Section 2 of the Act defines “palaeontological” material as “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains”.

Section 35(4) of this Act specifically deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

- a. 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;
- c. 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
- d. Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- e. Alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned palaeontological objects may only be disturbed or moved by a palaeontologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Further to the above point, Section 35(3) of this Act indicates that “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.”. Thus,

regardless of the granting of any official clearance to proceed with any development based on an earlier assessment of its impact on the Palaeontological Heritage of an area, the development should be halted and the relevant authorities informed should fossil objects be uncovered during the progress of the development.

3.2 The National Environmental Management Act

This Act does not provide the detailed protections and administrative procedures for the protection and management of the nation's Palaeontological Heritage that are detailed in the National Heritage Resources Act, but is more general in its application. In particular Section 2(2) of the Act states that environmental management must place people and their needs at the forefront of its concerns and, amongst other issues, serve their cultural interests equitably. Further to this point section 2(4)(a)(iii) states that disturbances of sites that constitute the nation's cultural heritage should be avoided, and where it cannot be avoided should be minimised and remedied.

Section 23(1) indicates that a general objective of integrated environmental management is to identify, predict and evaluate the actual and potential impact of activities upon the cultural heritage. This section also highlights the need to identify options for mitigating of negative effects of activities with a view to minimising negative impacts.

In order to give effect to the general objectives of integrated environmental management outlined in the Act the potential impact on cultural heritage of activities that require authorisation or permission by law must be investigated and assessed prior to their implementation and reported to the relevant organ of state. Thus, a survey and evaluation of cultural resources must be done in areas where development projects that will potentially negatively affect the cultural heritage will be performed. During this process the impact on the cultural heritage will be determined and proposals for the mitigation of the negative effects made.

4. METHODOLOGY

It was considered that the most effective methodology for determining the fossiliferous potential of the project area was to traverse the area by foot. Given the small size of the footprint of the proposed development it was possible to visit the entire site within an acceptable timeframe. The study area was visited on the 9th of October 2012 by Dr B.D. Millstead.

The path of the foot traverse was recorded as a track on a hand-held GPS and is indicated in Figure 2.

Photographs were taken and observation made were taken at a number of locations (see photograph waypoints in Figure 2). The location of the photographs was recorded using a hand-held GPS.

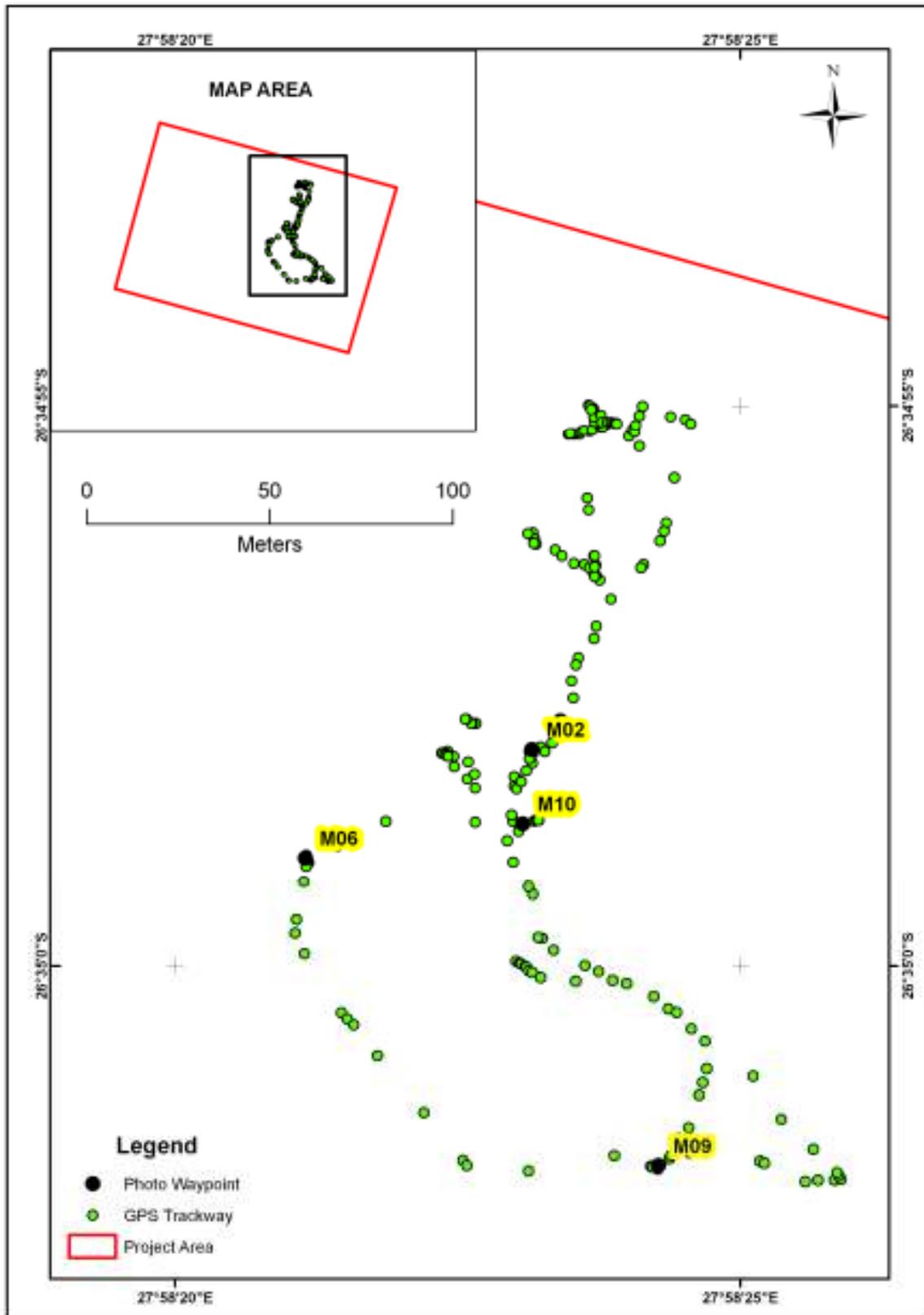


Figure 2: The location of the path taken during the site visit (GPS trackway) as well as the location of GPS waypoints where photographs were taken.

5. RELEVANT EXPERIENCE

Dr Millstead holds a Ph.D in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is currently the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Impact Assessment Report.

6. ACCESS AND INDEPENDENCE

The area to be impacted by the proposed expansion of the MWWTW was indicated by the client and delineated during the site by staff of the MWWTW. The research was conducted completely free of any hindrance. Access was freely available to all portions of the study area and the field visit was able to be conducted wherever it was deemed necessary for the satisfactory completion of the study.

The land surface is flat, featureless and effectively un-vegetated. Accordingly, as the observations were conducted on foot there were no areas that could not be easily visited and studied.

7. GEOLOGY

Figure 3 shows that the MWWTW is completely underlain by flat-lying sediments of the Vryheid Formation, Karoo Supergroup. Carbonate sediments of the Malmani Subgroup, Chuniespoort Group (Transvaal Supergroup) occur immediately to the north and west of the Vryheid Formation sequence. In this region the strata of the Malmani Subgroup have a structural dip towards the south and, thus, it is this unit that directly underlies the Karoo units in the MWWTW site. Observations recorded during the site visit indicate that there is also a substantial regolith cover over the entire extent of the project area, and thus, the older geological units do not crop out within the project area.

7.1 Regolith Cover

The entire land surface of the project area is covered with a thick cover of regolith up to several meters thick (Figures 4-6). This unconsolidated regolith is dark red in colour and contains abundant rock fragments. The abundance of rock fragment increases downwards until the regolith sequentially grades into C-Horizon soils and then deeply weathered bedrock. The age of the regolith is not known precisely, but is most probably Cainozoic.

7.2 Vryheid Formation

The Vryheid Formation consists of an interbedded sequence of mudstones, sandstones and coals of Early Permian age (South African Committee for Stratigraphy, 1980). The deltaic deposits of the Vryheid Formation are known to be

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devoid of vertebrate fossil material throughout their extent, but are locally rich with plant fossils and trace fossils are also known within the formation (e.g., Mason *et al.*,

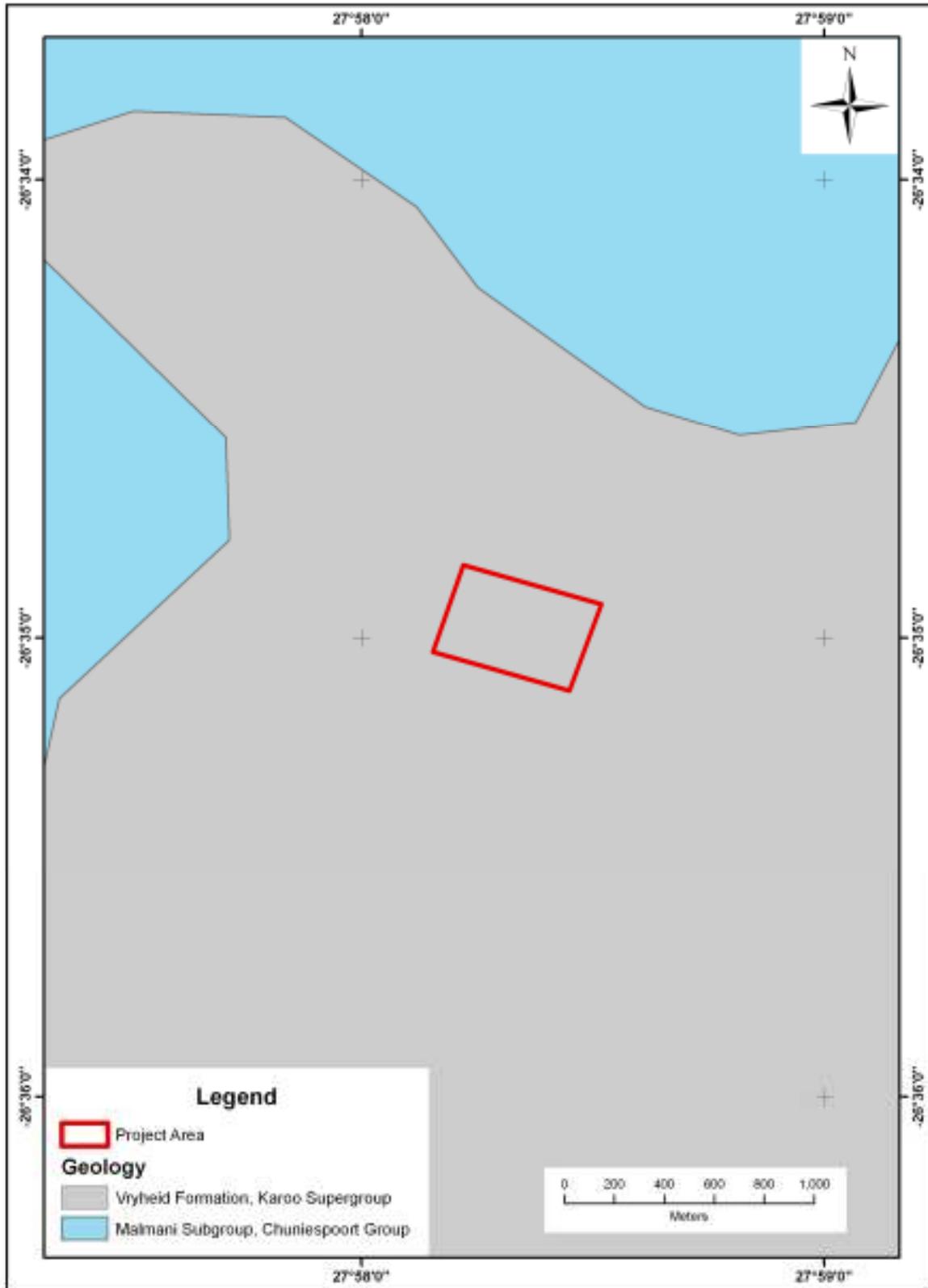


Figure 3: Geological map of the Meyerton Waste Water Treatment Works facility and surrounding environs.



Figure 4: View of the excavation for a settling tank located at waypoint M02. The highwall of the upper bench primarily consists of regolith, while the lower bench consists of mudstones of the Vryheid Formation. The light coloured mudstones of the Vryheid Formation extend from the bench surface to the base of the pit. Note workman in the bottom of the excavation for scale.

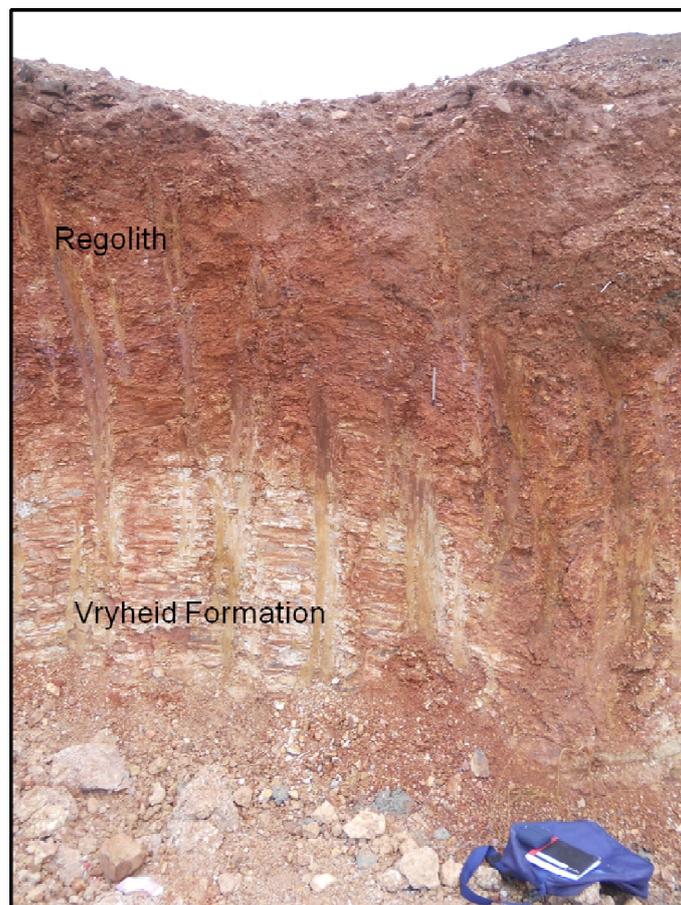


Figure 5: Close-up view of the highwall of the excavation at waypoint M02.

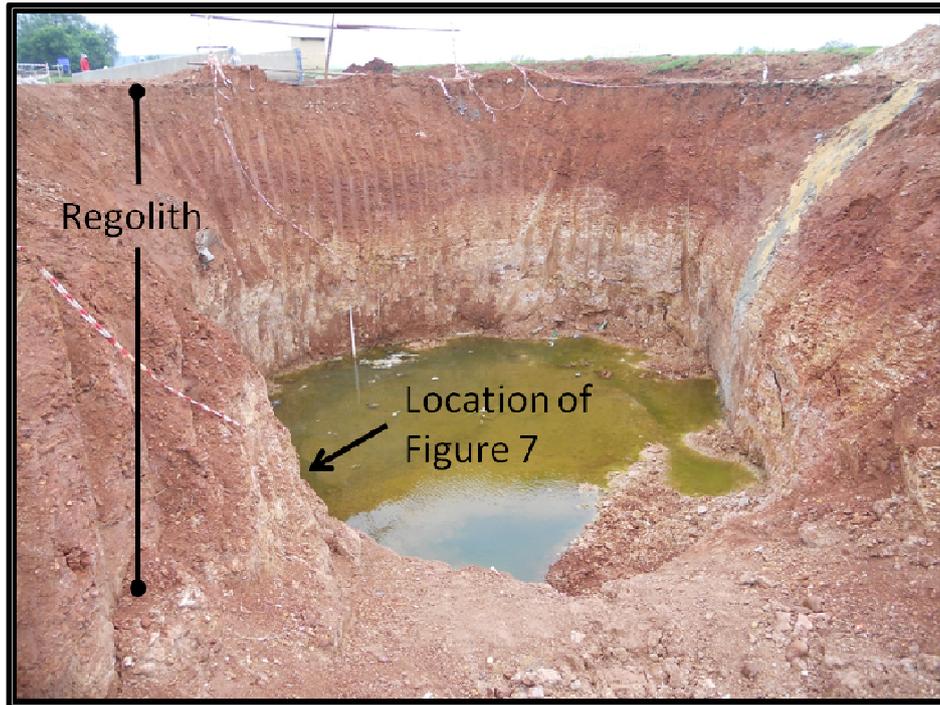


Figure 6: View of an excavation at waypoint M10 the lower bench of the excavation at waypoint M10. The upper portion of the pit wall consists of approximately 2m of maroon coloured regolith. The lower portion of the pit wall is composed of lighter coloured mudstones of the Vryheid Formation. Shown also is the location of Figure 7.

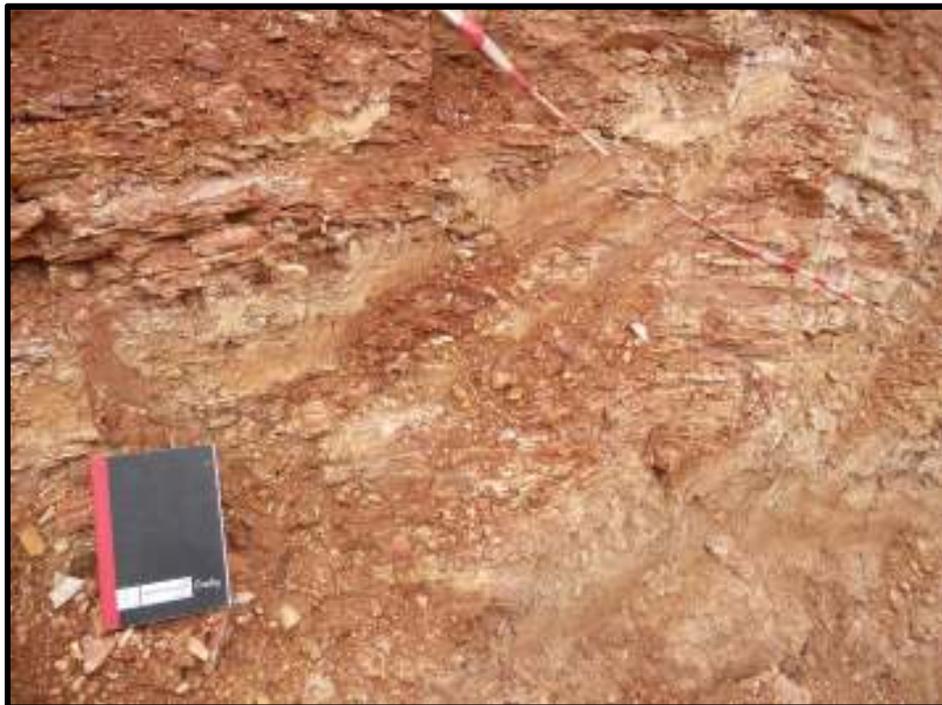


Figure 7: Close-up view of the lower part of the pit wall at waypoint M10. The extremely fractured and weathered nature of the Vryheid Formation mudstones is clearly evident.

1983; and personal observations of the author). Despite the possible presence of palaeobotanical and trace fossils within the Vryheid mudstones none was observed during the site visit. It is evident in Figure 7 that the uppermost portions of the Vryheid Formation (i.e., those sufficiently close to the surface to be disrupted by excavations associated with the proposed development) are extremely deeply weathered and indeed grade upwards into the soil profile.

7.3 Malmani Subgroup

The carbonate sediments of the Malmani Subgroup are Vaalian (Late Archaean to Early Proterozoic) in age (Erikson *et al.*, 2006). Indeed, a tuff layer in the lower portion of the subgroup has been dated at 2585 Ma (Martin *et al.*, 1998). The age of the Malmani Subgroup sediments indicates that they were deposited before the development of multicellular life forms and, as such, pre-date the development of most recognisable fossil types. The strata of the Malmani Subgroup are, however, fossiliferous and are known to be stromatolitic in many parts of the sequence. Where the sequence is stromatolitic it tends to be so over an extensive area and tends to be reasonably uniform across its extent. The shallow depth of disturbance due to excavations in the proposed expansion project means that no Malmani Subgroup strata would be directly disturbed by the project.

8. FIELD OBSERVATIONS

8.1 Geological Outcrop

No geological units were observed to crop out within the area of the proposed development. Thus, no fossil objects older than the surficial regolith will be negatively impacted by any shallow disturbances of the land surface over the entire extent of the proposed project.

8.2 Fossil Observations

No fossil material was observed within either the regolith or geological units exposed by existing building excavations.

8.3 Depth of Phase 1 Excavations

During the conduct of the site investigation, that forms the basis of this report, it was possible to observe excavations that form part of the ongoing construction of Phase 1 of the MWWTW expansion work. The deepest of these excavations (indicated as being for a settling tank by staff of the MWWTW) was approximately 5m deep. It was evident from inspection of that excavation that it is likely that the proposed Phase 2 and 3 developments will only directly impact on strata of the Vryheid Formation (Figure 4) and not the underlying Malmani Subgroup carbonates.

Pre-existing Disturbance of the Land Surface

The land surface of the footprint area for the proposed expansion to the works has been extensively disturbed. It is evident from observations made during the site visit that the surrounding land is utilised for agriculture. Given the extensive history of agriculture within the region it is likely that the land surface of the project area has been disturbed by ploughing prior to the establishment of the MWWTW.

Figure 8 shows that an extensive area within the central regions of the WWTW area formally consisted of ploughed lands that form part of the solid waste disposal treatment protocols of the WWTW. Part of this ploughed area underlies the track way of the site visit foot traverse Figure 8, but prior to the time of the site visit this area had been cleared and the ploughed lands terminated to west of the GPS trackway. This area is now flat, compacted, devoid of plant life and shows extensive evidence of vehicular traffic (Figures 9 and 10). It is evident that this area was heavily degraded in the past by the operations of the M WWTW and at present is in a heavily disturbed, non-pristine state at present. Accordingly, should any fossil material be identified within the surficial regolith they would be of negligible scientific value.

The south-eastern portion of the area investigated also consists of flat ground, with numerous mounds of earth and rock that have been excavated as part of earlier excavations on the MWWTW site (Figure 10). Long serving staff of the MWWTW who accompanied the site visit indicated that this area had previously been a quarry (excavated prior to the existence of the MWWTW). The MWWTW staff member informed that this area had apparently been in filled with landfill derived from other excavations in the area. The existence of this landfill was supported by examination of the land surface which revealed the compacted soils to be full of refuse and broken rock material.

It can be concluded from the above observations that the entire land surface comprising the footprint of the proposed MWWTW expansion project has either been historically disturbed or is composed of artificial landfill.

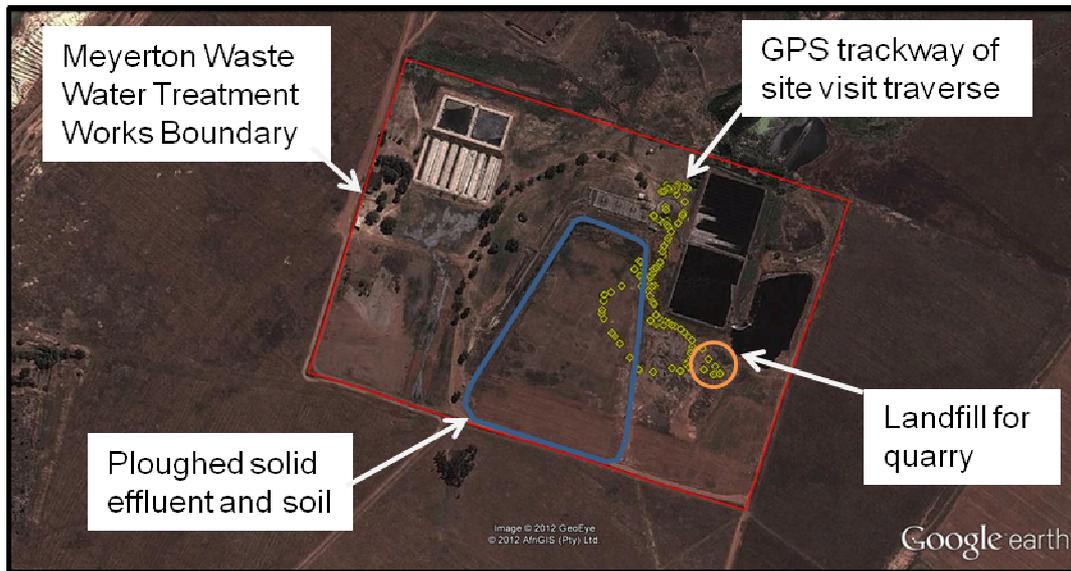


Figure 8: Google Earth satellite image of the Meyerton Waste Water Treatment Works. Shown in yellow triangles is the GPS trackway of the field visit. Outlined in the blue polygon is the ploughed area previously utilised for solid effluent disposal. At the time of the site investigation the area lying underneath the trackway was cleared, and flattened. Shown with the orange circle is the area where it was indicated that a quarry had previously existed. The maximum extent of the area disturbed by the quarry is unknown.



Figure 9: View from waypoint M 06 looking toward waypoint M09. It is evident that the entire area is in a non-pristine state and has been previously leveled, and subjected to heavy vehicular traffic.



Figure 10: View to the north-east from waypoint M09. The area in the fore- and mid-ground has been extensively cleared and leveled. This is the area that was indicated by staff of the waste water treatment works as having previously been a quarry.

QUANTIFIED IMPACT ASSESSMENT

The potential impact of the proposed expansion of the MWWTW is categorised below according to the following criteria:-

EXTENT - A value ascribed to the physical extent to which the impact manifests itself:

EXTENT	DESCRIPTION	RATING
SLE	The impact will be limited to the site	1
LAE	The impact will be limited to the local area	2
RE	The impact will be limited to the region	3
NE	The impact will be on a national scale	4
IE	The impact will occur on an international scale	5

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DURATION - The anticipated duration of the identified impact is assessed and a factor awarded in accordance with the following:

DURATION	DETAIL	DESCRIPTION	RATING
VST	Very Short Term	0 – 1 Year	1
ST	Short Term	>1 – 5 Years	2
MT	Medium Term	>5 – 15 Years	3
LT	Long Term	Impact will only cease after the operational life of the activity has ended, either because of natural process or by human intervention.	4
PT	Permanent	Mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.	5

SEVERITY - Describes the severity of the impact on the environment and is quantified on a scale of 0 -10:

SEVERITY	DETAIL	DESCRIPTION	RATING
SS	Small	Will have no effect on the environment	0
MIS	Minor	Will not result in an impact on processes	2
LOS	Low	Will cause a slight impact on processes	4
MDS	Moderate	Will result in processes continuing but in a modified way	6
HIS	High	Will result in processes being altered to the extent that they temporarily cease	8
VHS	Very High	Will result in a complete destruction of patterns and permanent cessation of processes	10

PROBABILITY - Probability describes the likelihood of the impact actually occurring, and is rated as follows:

PROBABILITY	DETAIL	DESCRIPTION	RATING
VIP	Very Improbable	Unlikely that the impact will occur	1
IP	Improbable	Low possibility of the impact occurring due to design or history	2
PP	Probable	Distinct possibility that the impact will occur	3
HP	Highly Probable	Most likely that the impact will occur	4
DP	Definite	Impact will occur regardless of any preventative measures	5

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SIGNIFICANCE - Significance (S) is calculated from the probability, extent, duration and intensity, as follows: $S = (E+D+I)*P$, where:

S = Significance weighting, E = Extent, D = Duration, I = Intensity / Severity, P = Probability

SIGNIFICANCE RATING - A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating. The significance rating should influence the development project as described below:

SIGNIFICANCE	DETAIL	DESCRIPTION	RATING
LS	Low Significance	<ul style="list-style-type: none"> Positive and negative impacts of low significance should have no significant influence on the proposed development project. 	< 30
MS	Medium Significance	<ul style="list-style-type: none"> Positive impact: Should weigh towards a decision to continue ; Negative impact: Should be mitigated before project can be approved. 	31 – 60
HS	High Significance	<ul style="list-style-type: none"> Positive impact: Should weigh towards a decision to continue, should be enhanced in final design. Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least a medium significance rating. 	> 60

The criteria assigned under each category for the proposed Meyerton WWTW expansion project are as follow:-

Criteria category	Category rating assigned	Rating assigned
Extent	SLE	1
Duration	LT	4
Severity	SS	0
Probability	VIP	1
Significance		5
Significance Rating	LS	5

The significance rating of 5 indicates that according to this classification scheme the MWWTW expansion project should have no significant effect on the palaeontological heritage of the site and, accordingly, the project should continue.

9. CONCLUSIONS

The Midvaal Local Municipality wishes to expand the existing Meyerton Waste Water Treatment Works, located between Meyerton and Vereeniging, in southern Gauteng Province in order to prevent inadequately treated sewage effluent being released into the environment. A site investigation of the area identified as being the site of Phases 2 and 3 of the expansion was conducted on the 9th October 2012. During that visit it was possible to observe the depth of disturbance to the land surface that was being caused by excavation of Phase 1 features (such as settling tanks). It was evident that the depth of excavations to be expected in the emplacement of the Phase 2 and 3 structural features would be of similar depth (i.e., 4-5m) and, as such, this was the maximum depth of disruption of the palaeontological heritage of the project.

Three stratigraphic units are identified as underlying the site of the proposed expansion of the Meyerton Waste Water Treatment Works, these being (in descending stratigraphic order):-

- Regolith (covering the entire area)
- Vryheid Formation mudstones
- Malmani Subgroup carbonates

The regolith was found to have been either previously extensively disturbed and in part to represent landfill of a pre-existing quarry. No fossil materials were identified within the regolith cover and should any be discovered at a later date, the disturbed nature of the regolith would indicate that the fossils would be of limited scientific value.

Strata of the Vryheid Formation are known to contain both plant and trace fossils elsewhere in their extent. However, no fossil material was identified in the Vryheid Formation within the project area during the site visit. It is also significant that the Vryheid Formation strata close enough to the surface to be disturbed by the expansion project are heavily weathered and, as such, should any botanical fossil material be present within the area is likely to be so degraded as to be unlikely to have any scientific significance.

The Malmani Subgroup strata may be expected to contain stromatolitic horizons, but no other fossil types. However, the unit does not crop out within the project area and will occur at such depths below surface that it will be completely unaffected by the proposed development.

In summary, **no fossils or palaeontologically significant sites were identified during this study.** Should any fossils be discovered during the construction of the structures comprising the expansion of the WWTW the pervasive disturbance of the regolith and the deep weathering of the Karoo-age strata suggests that those fossils would be little scientific value. A parallel assessment of the anticipated impact of the

project on the palaeontological heritage of the site using standardised assessment criteria has provided a Project Significance Rating value of '5'. This significance rating indicates that the anticipated impacts of the project are of low significance and should have no significant influence on the proposed development project.

10. FINDINGS AND RECOMENDATIONS

As a result of these collective observations the following findings and recommendations can be made:-

- No palaeontological reason was identified that should negatively impact the proposed expansion of the Meyerton Waste Water treatment Works.
- The Project Significance rating value of '5' calculated for this project for its affects on the palaeontological Heritage. Thus, the anticipated impacts of the project are of low significance should have no significant influence on the proposed development project
- Should SAHRA indicate that the project may proceed, on the basis of the lack of a negative impact on the palaeontological heritage of the area, and any fossil material be located during the construction of the proposed operations an appropriately experienced palaeontologist should be contacted to evaluate the material and advise on its scientific importance. Should the fossil material be of cultural heritage significance a report detailing the nature of the discovery should be made to SAHRA with recommendations for mitigation of negative effects on the fossil material. Such recommendations may include excavation of the fossils (under a permit issued by SAHRA).

11. REFERENCES

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