# HERITAGE IMPACT ASSESSMENT

In terms of Section 38(8) of the NHRA for the

## Proposed Oribi BESS and SPP

**Prepared by CTS Heritage**

CTS HERITAGE

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**For**

**EnviroNamics**

**May 2023**

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## EXECUTIVE SUMMARY

1. Site Name:

Oribi SPP and BESS

2. Location:

The Oribi PV development is about 21km north of Hammanskraal and the study area lies immediately south of the Kalkheuwel mine.

3. Locality Plan:

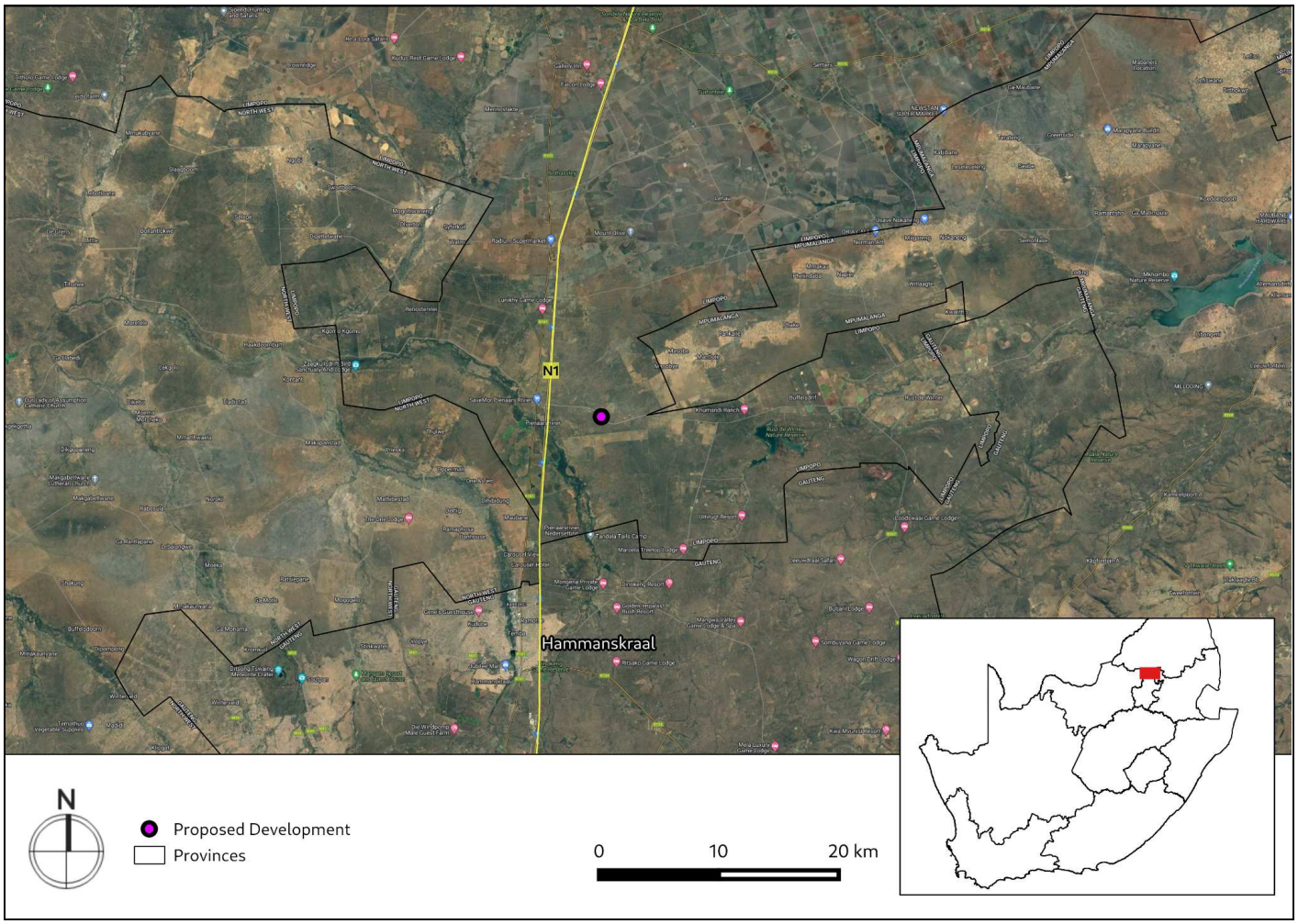


**Figure A: Location of the proposed development area**

4. Description of Proposed Development:

This report assesses the anticipated impacts to heritage resources that are likely to result from the development of the proposed Oribi SPP located near Hammanskraal.

5. Heritage Resources Identified:

No significant heritage resources were identified within the area proposed for development.

6. Anticipated Impacts on Heritage Resources:

The survey proceeded with minor constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no significant heritage resources were identified within the area proposed for development. Overall, the development area is located sufficiently far from significant access routes, and the area proposed for development is not considered to be a sensitive cultural landscape.

The proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

7. Recommendations:

Based on the outcomes of this report, it is not anticipated that the proposed development of the solar PV facility and its associated grid connection infrastructure will negatively impact on significant heritage resources. The following recommendations are made:

- The ECO for this project must be informed that the Irrigasie Formation/ Late Triassic Molteno Formation (Karoo Supergroup) has a Very High Palaeontological Sensitivity.
- The HWC Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and HWC must be alerted immediately to determine an appropriate way forward.

**Details of Specialist who prepared the HIA**

**Jenna Lavin**, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

Jenna is on the Executive Committee of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of the Association of Southern African Professional Archaeologists (ASAPA) since 2009. Recently, Jenna has been responsible for conducting training in how to write Wikipedia articles for the Africa Centre's WikiAfrica project.

Since 2016, Jenna has drafted over 250 Screening and Heritage Impact Assessments throughout South Africa.

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**APPENDICES**

# 1. INTRODUCTION

## 1.1 Background Information on Project

This report assesses the anticipated impacts to heritage resources that are likely to result from the development of the proposed Oribi SPP located near Hammanskraal.

**Table 1: Technical details for the proposed facility**

| Component | Description / dimensions |
|---|---|
| **Height of PV panels** | 6 metres |
| **Area of PV Array** | 365 Hectares (Development footprint) |
| **Number of inverters required** | Minimum 50 |
| **Area occupied by inverter / transformer stations / substations / BESS** | Central inverters+ LV/MV trafo: 750 $m^2$<br>HV/MV substation with switching station: 3,35 ha<br>BESS: 5.5 ha (within the Infrastructure & Ancillary Complex) |
| **Capacity of on-site substation** | 132kV |
| **Capacity of the power line** | 132kV |
| **Area occupied by both permanent and construction laydown areas** | Permanent Laydown Area: 365 Hectares<br>Construction Laydown Area: ~5 ha |
| **Area occupied by buildings** | Infrastructure & Ancillary Complex: ~14.9 ha |
| **Battery storage facility** | Maximum height: 8m<br>Maximum volume: 1740 $m^3$<br>Capacity ~up to 150MWh |
| **Length of access roads** | 2.61 km |
| **Width of access roads** | 10 m |
| **Length of internal roads** | 12.8 km |
| **Width of internal roads** | 4 m – 6 m |
| **Length of perimeter roads** | 24.5 km |
| **Width of perimeter roads** | 4 m – 6 m |
| **Grid connection corridor width** | 200m up to 550m |
| **Grid connection corridor length** | ~ 2.8 km |
| **Power line servitude width** | 32m |
| **Height of fencing** | Approximately 2.5 metres |

### 1.2 Description of Property and Affected Environment

The Oribi PV development is about 21km north of Hammanskraal and the study area lies immediately south of the Kalkheuwel mine. The site can be reached via the Pienaar's River turnoff along the N1 highway and is located about 3.5km east of the turnoff. Large parts of the northern and northeastern corner of the site have undergone mining or the secondary impacts of chalk mining in the past and a series of jeep tracks crisscross the study area related to the stock farming use of the Elandskraal farm. Two large Eskom overhead powerlines run near the property and encircle the study site. Besides chalk mining and cattle farming and a patch of fallow ground where crop agriculture has taken place west of the chalk mining, the western end also hosts the grounds used by Lenaka Hunting Safaris. The vegetation covering the site varies from dense grassland to acacia thorntrees and bushveld.

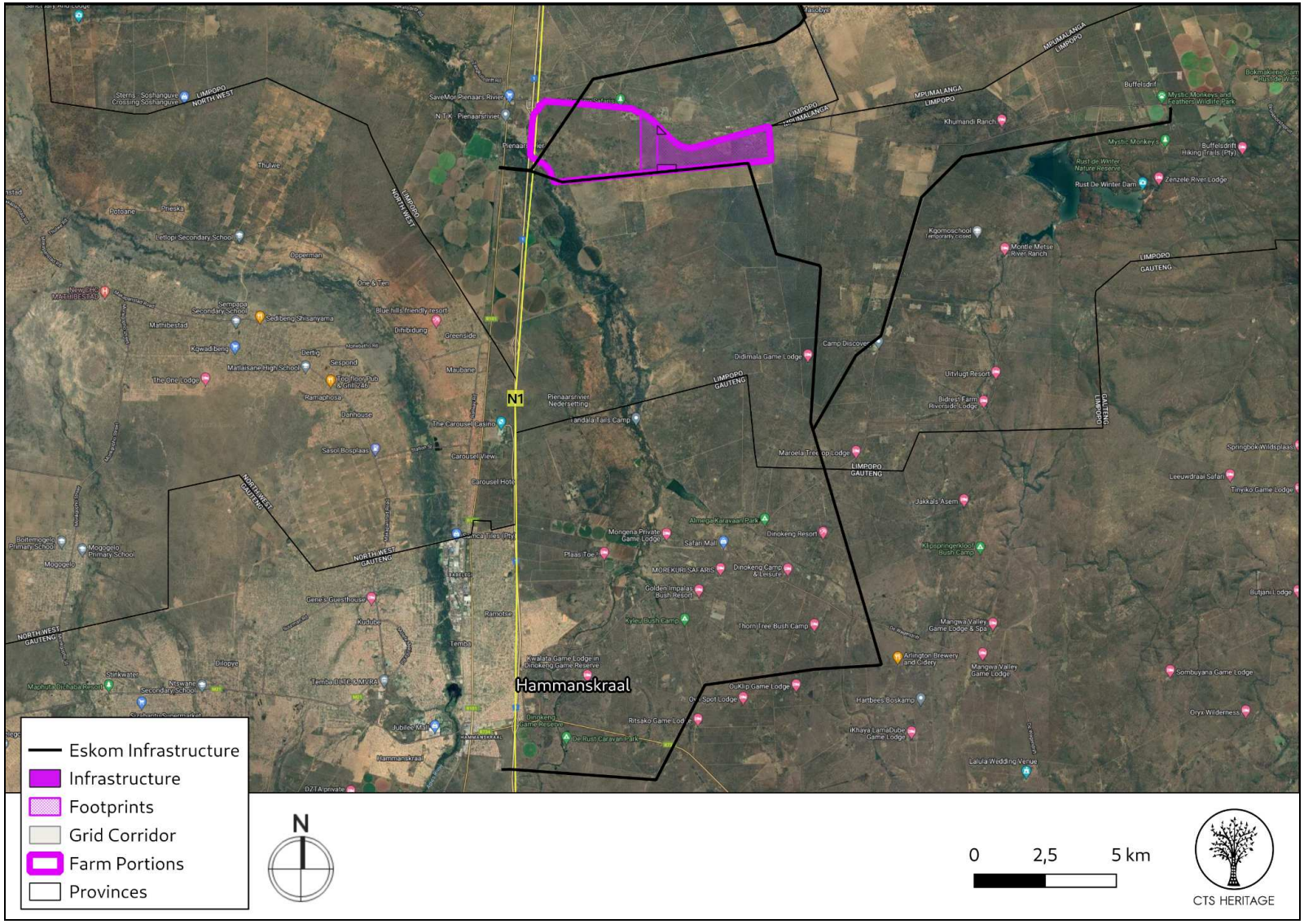


**Figure 1.1: Proposed development relative to Hammanskraal**

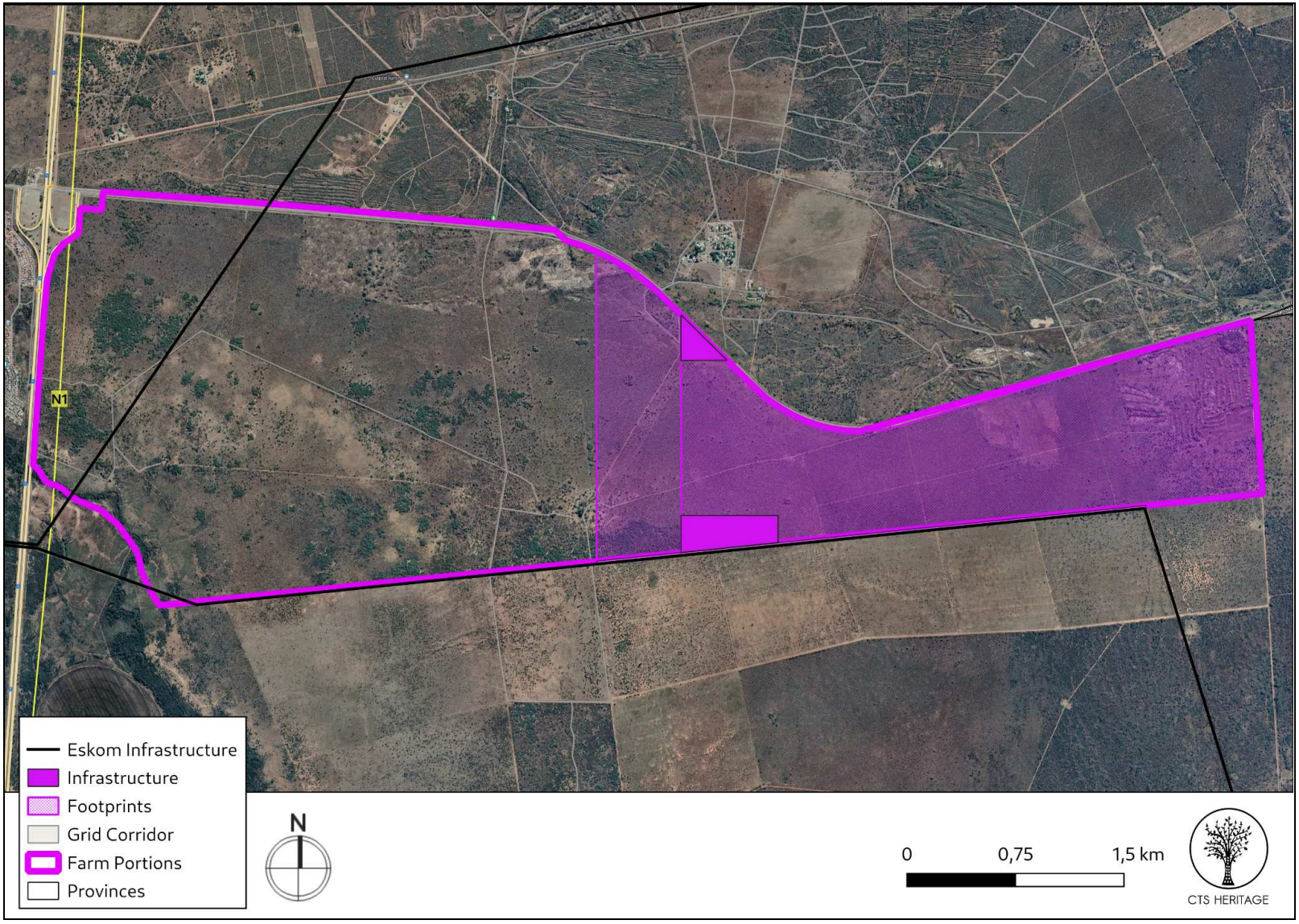


**Figure 1.2: The proposed development layout**

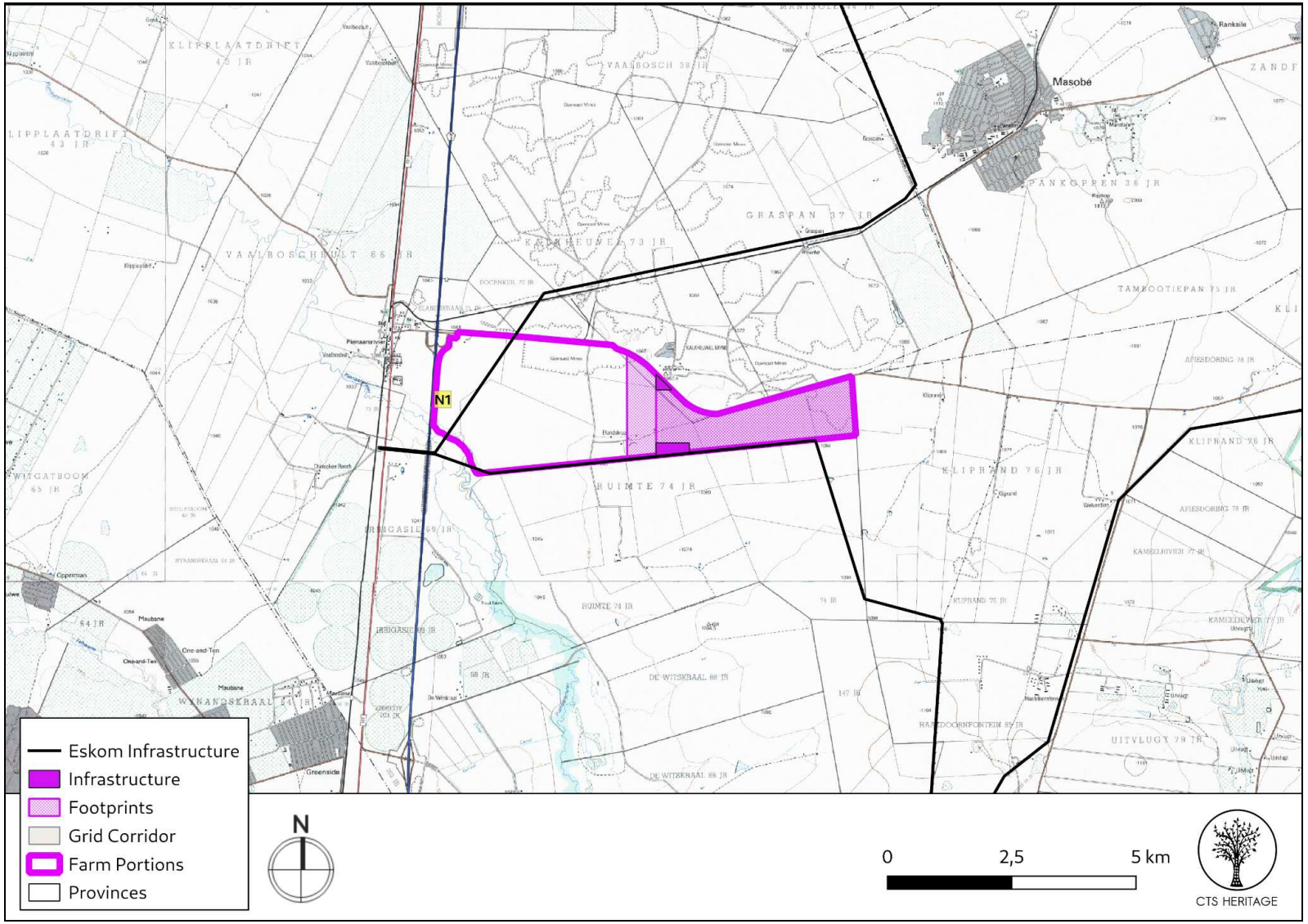


**Figure 1.3: The proposed development layout on an extract of the 1:50 000 Topo Map**

## 2. METHODOLOGY

### 2.1 Purpose of HIA

The purpose of this Heritage Impact Assessment (HIA) is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

### 2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used)
- An archaeologist conducted a survey of the site and its environs from 25 to 26 March 2023 to determine what archaeological resources are likely to be impacted by the proposed development.
- A palaeontologist conducted a field assessment of palaeontological resources likely to be disturbed by the proposed development on 27 April 2023.
- The identified resources were assessed to evaluate their heritage significance and impacts to these resources were assessed.
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner

### 2.3 Assumptions and uncertainties

- The *significance* of the sites and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

- It should be noted that archaeological and palaeontological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.

However, despite this, sufficient time and expertise was allocated to provide an accurate assessment of the heritage sensitivity of the area.

### 2.4 Constraints & Limitations

The study area is currently densely vegetated with extensive grass cover, bush and acacia thorn trees. Exposures of open ground along the jeep tracks was possible and Iron Age material was found in an area that had been opened up by farm roads. However, most of the study area is entirely covered by vegetation that surface

material could not be recorded easily. Given the nature of the PV development and the re-use of existing roads in the layout of the development, it is unlikely that significant impacts on surface scatters will occur.

### 2.5 Environamics Impact Assessment Methodology

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in the Table below.

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 total number of points scored for each impact indicates the level of significance of the impact.

#### Impact Rating System

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 project phases:

- planning
- construction
- operation
- 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** |
|---|
| Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity. |
| **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 + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.
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 effects. |

# 3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

## 3.1 Background

The area proposed for development is located in between Bela-Bela, previously known as Warmbaths, in the Limpopo Province and Hammanskraal located north of Pretoria, to the east of the N1. When the Tswana tribes first moved into the region in about the 1800s, they discovered hot springs in the area. The Voortrekker Carl Van Heerden established the first farm in what is now Bela-Bela and called it *Het Bad*. In 1873, President Burgers' Transvaal government bought the land and established a resort called *Hartingsburg* after the prominent Dutch biologist Pieter Harting. The British occupied the town during the Anglo-Boer War, and renamed the post office *Warm Baths* in 1903, and proclaimed the boundaries of Warmbaths to be the entire farm of *Het Bad.* In 1920 Warmbaths was proclaimed a township.

## 3.2 Cultural Landscape

A broad history of the area is included in Murimbika (2010) and is referred to here. According to Murimbika (2010), the broader region has also yielded some significant Iron Age Sites such as the Mzonjani facies Broederstroom site (AD 430 to AD 780). According to Murimbika (2010), the broader region was subject to a number of instances of migration and settlement from 450 AD. Evidence indicates that Sotho-Tswana groups migrated in and out of the Magaliesberg region, and such groups are responsible for the many early stone-walled settlements in this region. One of the most documented migrations is the Mfecane (forced migration or scattering) which was a period of widespread chaos and warfare among indigenous ethnic communities in southern Africa during the period between 1815 and about 1840. During this time, the Ndebele under Mzilikazi reached the Magaliesberg region and are responsible for introducing the Doornspruit-type walled settlements that are known from this region (the Doornspruit River drains into the project area). According to Murimbika (2010) this type of stone-walled settlement represents “typical Nguni-Sotho-Tswana acculturation”. Murimbika (2010) further explains that one of the most acculturated groups in the region is known as the “Po”, whose Chief Mogale lends his name to the Magaliesberg Mountains and the Mogale City Municipality. By the mid-1800’s, Voortrekkers had begun to settle in the foothills of the Magaliesberg mountains and in so doing, clashed with Mzilikazi’s Ndebele in 1837. These early colonial battles forced the Ndebele north of the Limpopo River and effectively ended the independence of African Chiefdoms in the area. The Voortrekkers went on to establish the Republic of the Transvaal.

As part of the assessment completed by Van der Walt (2007), Birkholtz completed an historical and archival study of the Bela-Bela area. This detailed archival history is not repeated here, however some important notes from Birkholtz are reiterated below as they pertain to the cultural significance of the development area:

- The route between Great Zimbabwe, the copper mines at Messina and the tin mines at Rooiberg passed through the area

- The railway line and wagon road between Pretoria and then Pietersburg passed through this area. This meant that the region had immense strategic significance during the South African War (1899-1902). Pistorius (2013) notes that historical beacons in the area include a blockhouse which served in the line of blockhouses which stretched from Naauwpoort in the Magaliesberg to Pietersburg during the Anglo Transvaal War (1899-1902).
- A Voortrekker cemetery lies along the Thabazimbi road (Berg 1992, Erasmus 1995)

These points speak to the cultural value of the N1 heading north from Pretoria as a significant historic linking route. Cognisance of this significance must be taken.

### 3.3 Archaeology

Roodt (2008) remarks that "The Bela Bela region has a rich archaeological tradition, starting from the Stone Age period, right up to the Historical period. The following Iron Age material may occur in the region: According to the most recent archaeological cultural distribution sequences by Huffman (2007), this area falls within the distribution area of various cultural groupings originating out of both the Urewe Tradition (eastern stream of migration) and the Kalundu Tradition (western stream of migration)." Previous Heritage Impact Assessments conducted in the immediate vicinity of the proposed study area (Roodt, 2008, Van der Walt, 2007 and 2021 and Huffman, 2008) have identified a number of significant archaeological sites in the vicinity of the study area, dated to the Late Iron Age (Figure 3, 3a and 3b). Huffman (2008) in his assessment of a site located to the south of Bela-Bela, identified a few Middle Stone Age artefacts however he concluded that due to their context, these artefacts were likely bought into the area from somewhere else along with road ballast and therefore, these artefacts are not conservation-worthy.

Roodt (2008) noted that, 40km north of the area proposed for development, "Buyskop contains a stonewalled archaeological site… The observed ceramic shards are both decorated and undecorated. Thus it is possible to broadly assign the site to the Blackburn Branch of the Uruwe Tradition, probably Uitkomst facies (AD 1650 – 1820), but could also represent the related Rooiberg facies (AD 1650 – 1750). Cupules (also known as 'dolly holes'), used during rainmaking rituals, were noted in two places adjacent to the existing road, which has already damaged the site. Large ash areas were noted that could be attributed to middens and kraals." The sites identified by Roodt 92008) are graded IIIB due to their moderate scientific value. Roodt (2008) concludes that "Buyskop (Buiskop) appears to have been occupied for an extensive period during the South African Iron Age. Based on ceramic analysis of decorated ceramic shards, occupation can be assigned to the period AD 1650 -1820. The ceramics are associated with the ceramic facies Uitkomst and Rooiberg, thus reflecting occupation by Sotho speaking peoples (Huffman 2007: 433). Rainmaking also occurred on the hill, archaeologically reflected by the presence of cupules."

In his assessment completed for the property located immediately east of the development area, Van Vollenhoven and Strydom (2003) noted that although no Stone Age sites are known from the vicinity of the development, they identified two stone artefacts on the property that they assessed. These they ascribed to the Middle and Later Stone Age. These artefacts were determined to have no context and as such, were determined to be Not Conservation-Worthy. Van Vollenhoven and Strydom (2003) also note that a significant number of Late Iron Age sites are known south of the development area, the best known located at Wallmansthal and associated with the Ndebele occupation of the area. Several sites preserving Moloko pottery are also known from the broader area. However, Van Vollenhoven and Strydom (2003) did not identify any Iron Age sites in their assessment of the adjacent property. Pistorius (2013) concurs with the findings of Van Vollenhoven and Strydom (2003) and notes that the most common heritage resources which do occur in the broader area are stone walled sites which date from the Late Iron Age. These LIA sites are mostly found along the base lines of kopjes and randjes in the region.

According to Roodt (1999), archaeologists from the University of the Witwatersrand conducted excavations in the mid-1990's at a site located on the Farm Irrigasie 69 JR located immediately south of the Farm Ruimte 74 JR on which this development is proposed. The location of the excavations is indicated in Figure 3 above. According to Roodt (1999), the excavations revealed a burial as well as some pottery and ostrich eggshell beads. In her assessment of a small area located on Farm Pienaarsrivierbrug 70 JR located adjacent to this development area, Roodt (1999) identified five sites of Middle and Later Stone Age artefacts. It is very likely that similar Middle and Later Stone Age artefacts will be present within the development area, as well as sites associated with the Late Iron Age occupation of the area.

### 3.4 Palaeontology

According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have Zero and Very High palaeontological sensitivity. The development area is underlain by the Irrigasie Formation of the Karoo Supergroup. This formation is known to preserve Extensive bioturbation by trace fossils as well as Dinosaur remains that include possible "*Euskelesaurus"* including so-called *Gigantoscelus*. An important plant fossil locality at Hammanskraal on the Limpopo / Gauteng border at which three insects from the Upper Permian were identified (Riek, 1976).

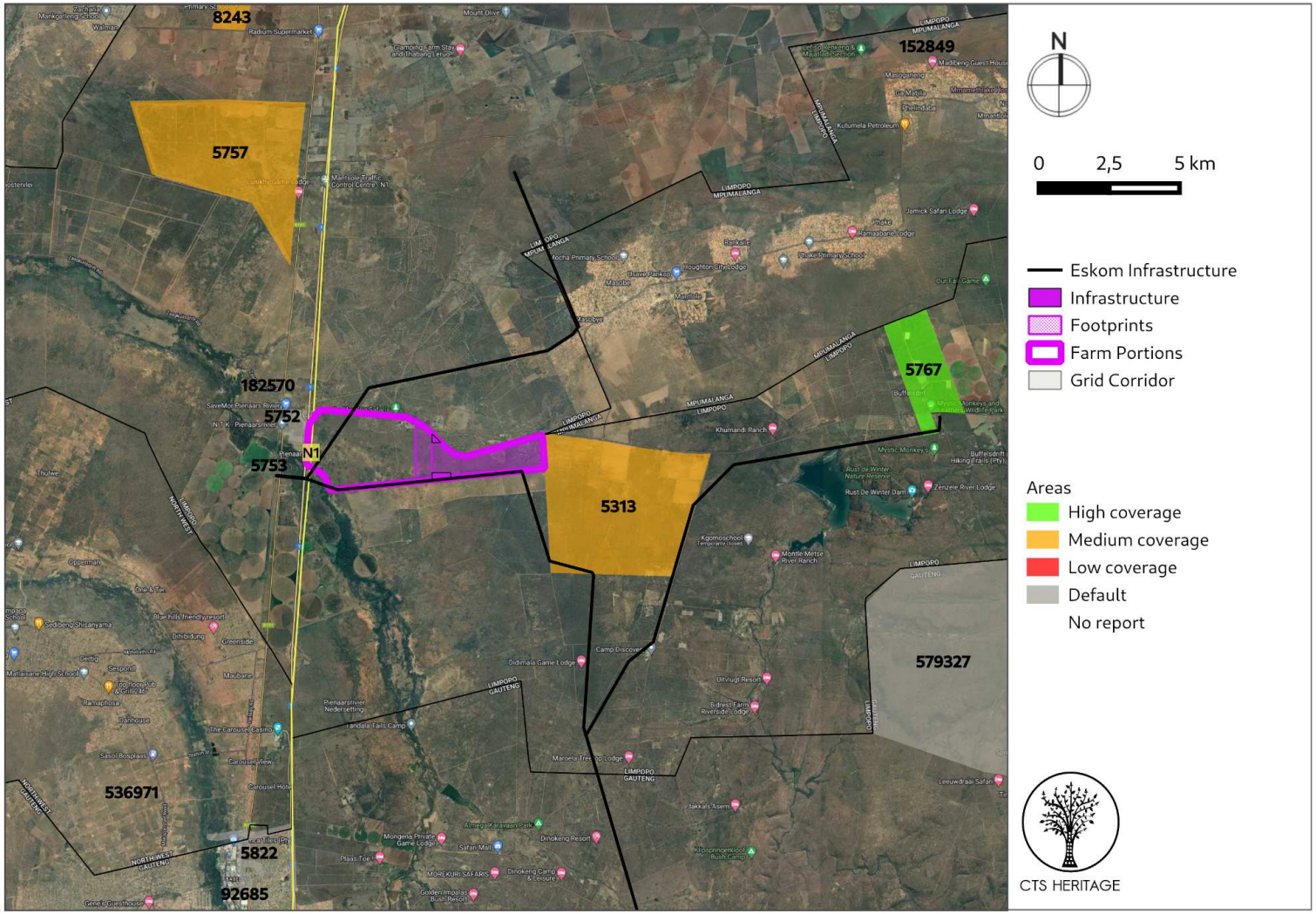


**Figure 2.1: Spatialisation of heritage assessments conducted in proximity to the proposed development**

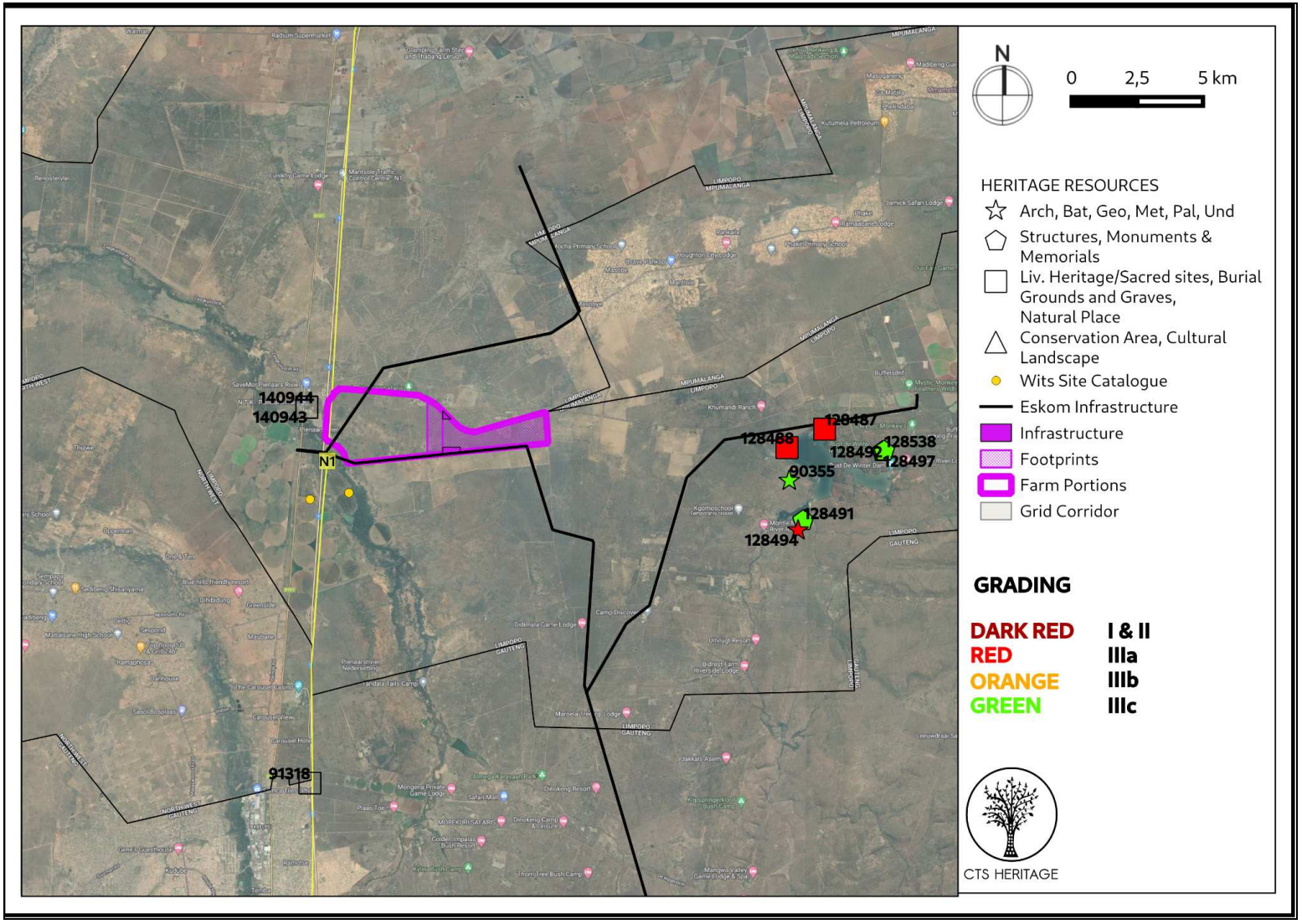


**Figure 2.2. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated within 10km. Please See Appendix 4 for full description of heritage resource types.**

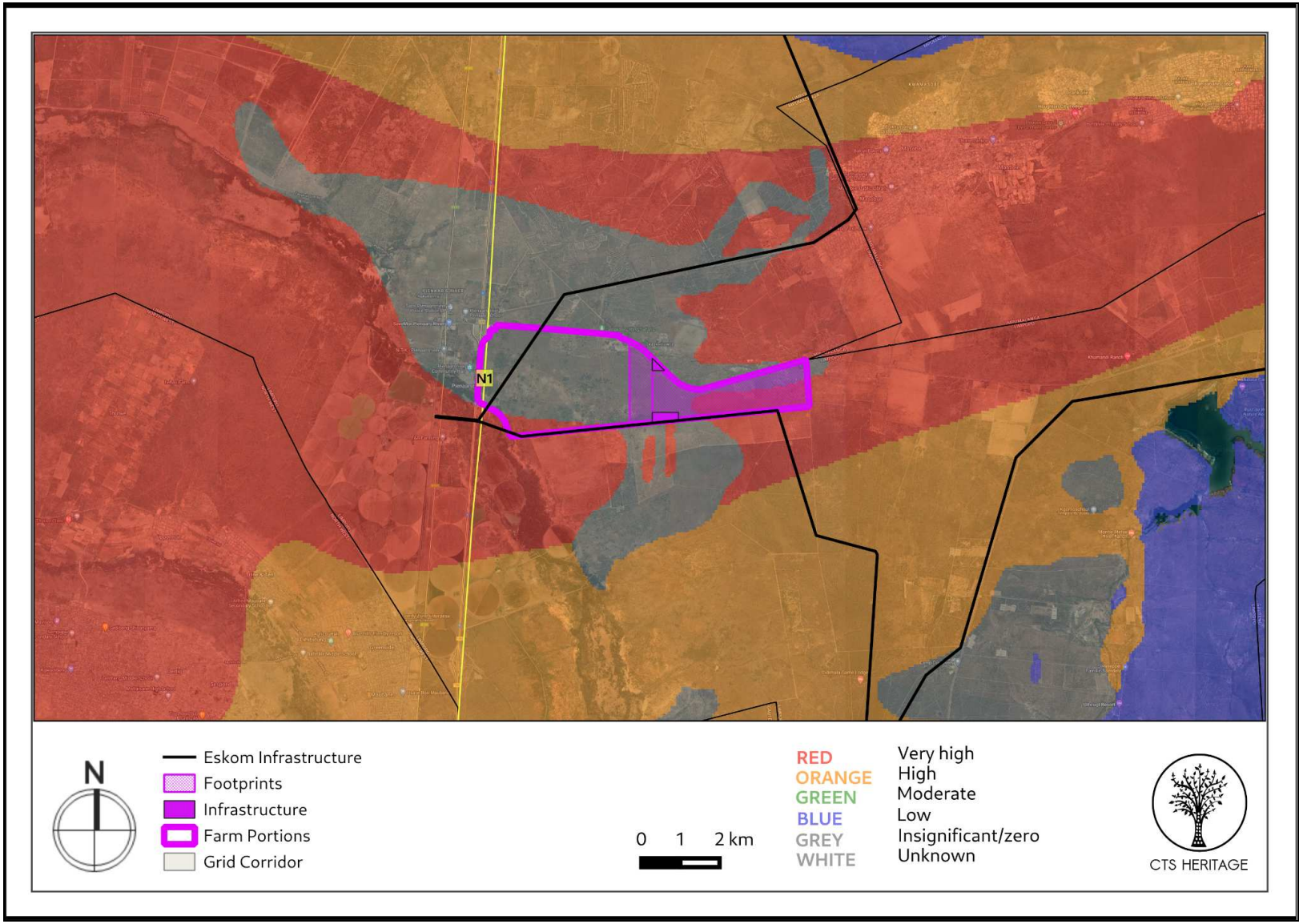


**Figure 3.1: Palaeontological sensitivity of the proposed development area**

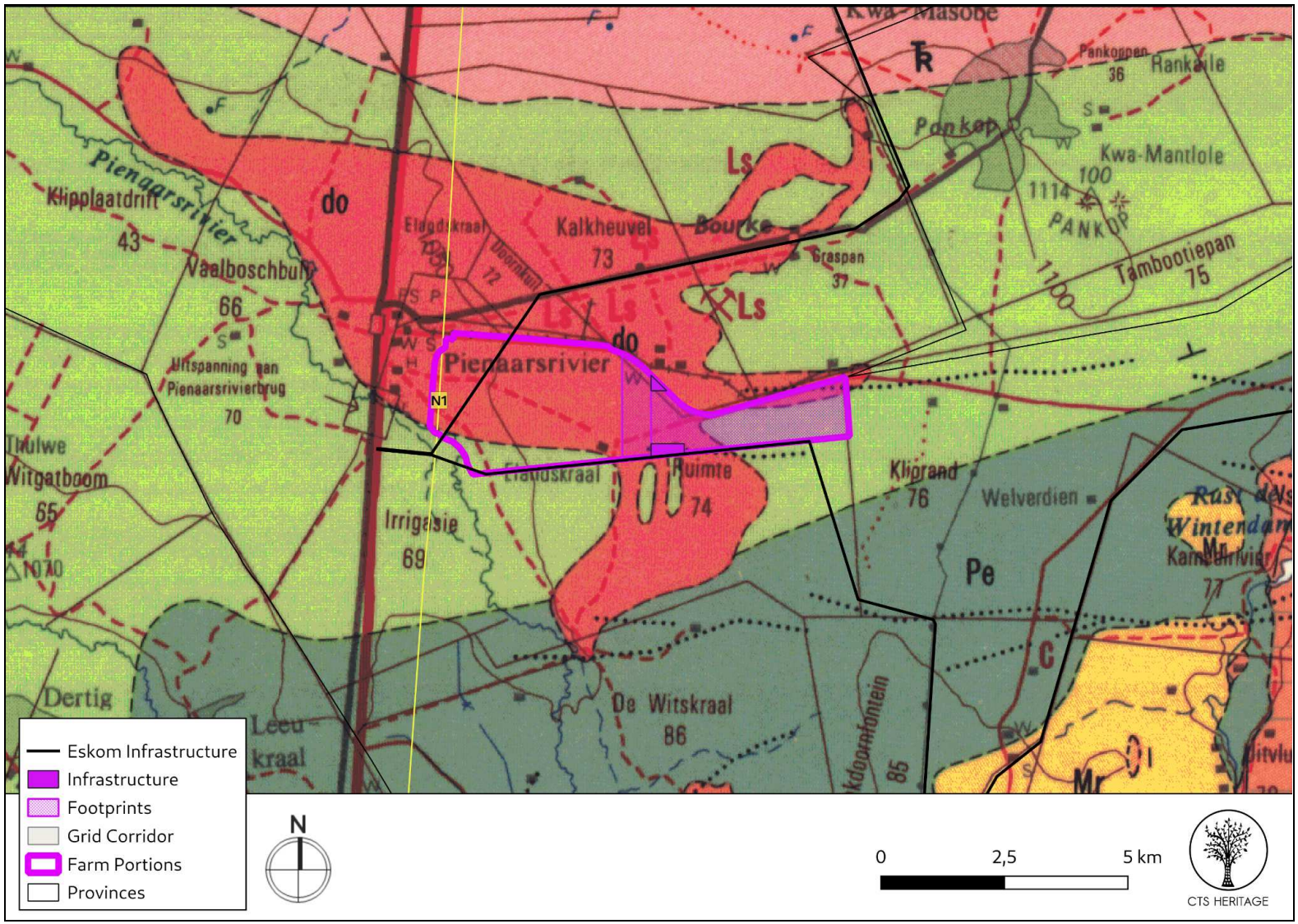


**Figure 3.2. Geology Map. Extract from the CGS Map 2528 for Pretoria indicating that the development area is underlain by Karoo dolerite sediments and Irrigasie Formation sediments of the Karoo Sequence**

## 4. IDENTIFICATION OF HERITAGE RESOURCES

### 4.1 Summary of findings of Specialist Reports

***Archaeology (Appendix 1)***

Observations of archaeological and historical material were clustered around the northeastern end of the farm where the chalk mining has occurred and deeper ground has been disturbed and opened up. Various quartzite flakes, radial cores and retouched pieces were found in and amongst the calcrete jeep tracks and spill and these are likely to have been deposited at lower layers than the rest of the study site. Broken pieces of undecorated Iron Age pottery were also found in the jeep track nearer to the Elandskraal end of the development. The Elandskraal werf itself is a double storey ruined building built in the 1940s - a number of linking jeep tracks emanate from the homestead to kraals and stock posts with further ruins of workers' cottages and farm buildings. The vegetation is very dense and it was not possible to locate much more between the two ends of the development area as the visibility of surface material was near zero outside of the jeep tracks. However, given the relatively small size of this PV area and the low depth of excavations it is unlikely that the MSA layers will be encountered outside of the chalk mine area.

The field assessment did not document any significant archaeological remains within the area proposed for development.

***Palaeontology (Appendix 2)***

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of zero and Very High fossil sensitivity (Figure 3.1). The proposed Oribi SPP is located in the Springbokflats Basin and is largely underlain by the Letaba Formation (Lebombo Group, Karoo Igneous Province) with a small portion of Irrigasie Formation (Undifferentiated Karoo) in the south west of the development footprint. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Karoo Igneous Province is Zero while that of the Irrigasie Formation is Very High (Almond and Pether, 2009; Almond *et al.*, 2013, Groenewald et al 2014). Updated Geology (Council of Geosciences) indicates that the proposed development is mainly underlain by the Lahau Formation (Lebombo Group, Karoo-Ferrar igneous intrusions) and the Late Triassic Molteno Formation (Stormberg Group, Karoo Supergroup). The potential fossiliferous sedimentary bedrocks have often been thermally metamorphized by overlying dolerite sills compromising their palaeontological sensitivity.

A medium Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a very low significance post mitigation.

### 4.2 Heritage Resources identified

No significant heritage resources were identified within the area proposed for development.

## 4.3 Mapping and spatialisation of heritage resources

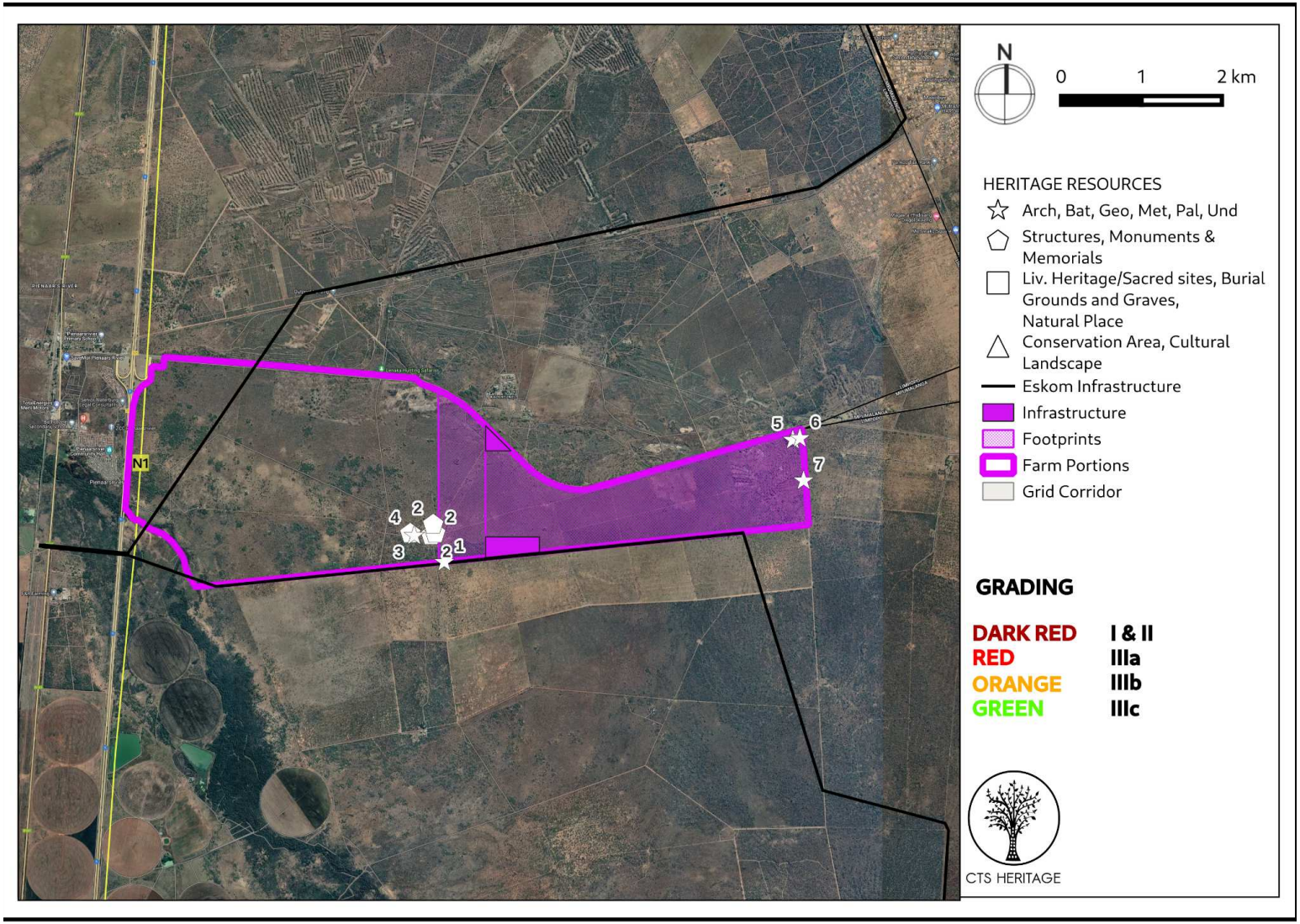


**Figure 6.1: Map of known heritage resources relative to the proposed development area**

## 5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

### 5.1 Assessment of impact to Heritage Resources

Due to the nature of heritage resources, impacts to archaeological and palaeontological heritage resources are unlikely to occur during the PLANNING, OPERATIONAL and DECOMMISSIONING phases of the project. Potential impacts to the cultural landscape throughout the OPERATIONAL phase are discussed in the section below that deals with Cumulative Impacts. The impacts discussed here pertain to the CONSTRUCTION phase of the project.

The results of the field assessment align with the findings of the desktop assessment in that the archaeological observations made on the property include dispersed, low density Middle and Later Stone artefacts and dispersed Iron Age artefacts. No significant Stone Age or Iron Age archaeology was documented within the footprint of the area proposed for development as the artefacts identified have very limited scientific value and their recording in this report is deemed sufficient. Other heritage resources identified relate predominantly to the historic agricultural practices of the area and mining activities; however these have limited cultural value and have been determined to be Not Conservation-Worthy.

The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

No impact to significant heritage resources is anticipated.

**Table 3: Assessment of impacts**

| **NATURE** | | |
|---|---|---|
| Destruction of significant archaeological and palaeontological heritage during the construction phase of development. | | |
| **GEOGRAPHICAL EXTENT** | | |
| This is defined as the area over which the impact will be experienced. | | |
| 1 | Site | The impact will only affect the site. |

| | | |
|---|---|---|
| **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). |
| **DURATION** | | |
| This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity. | | |
| 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. |
| **REVERSIBILITY** | | |
| This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity. | | |
| 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. | | |
| 4 | Complete loss of resources | The impact results 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. | | |
| 3 | Medium cumulative impact | The impact would result in minor 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 + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.<br>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. |

### 5.2 Sustainable Social and Economic Benefit

To be addressed in the EIR.

### 5.3 Proposed development alternatives

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facilities and the supporting social and economic development in the area would be lost if the status quo persists.

Location alternatives

No other possible sites were identified on the Farm Rumite No. 720. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

Generation from the facility will tie in with the existing Pelly/SAR Pienaarsrivier 132 kV Overhead Line by way of a Loop-In Loop-Out connection. The connection power line will be constructed within the limits of the grid connection corridor. The Project will inject up to 150MW into the National Grid.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey buildings, with a maximum height of 8m and a maximum volume of 1,740m$^3$ of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

Due to the limited heritage significance identified within the area proposed for development, and the distance of the proposed development from significant cultural landscape features, there is no preferred alternative from a heritage perspective.

## 5.4 Cumulative Impacts

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in this cumulative effects analysis generally includes an area of a 30km radius surrounding the proposed development – refer to below.

The geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued

that a radius of 30km would generally confine the potential for cumulative effects within this particular environmental landscape. The geographic area includes projects located within the Gauteng Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

In terms of cumulative impacts to heritage resources, impacts to archaeological and palaeontological resources are sufficiently dealt with on a case by case basis. The primary concern from a cumulative impact perspective would be to the cultural landscape. The cultural landscape is defined as the interaction between people and the places that they have occupied and impacted. In some places in South Africa, the cultural landscape can be more than 1 million years old where we find evidence of Early Stone Age archaeology (up to 2 million years old), Middle Stone Age archaeology (up to 200 000 years old), Later Stone Age archaeology (up to 20 000 years old), evidence of indigenous herder populations (up to 2000 years old) as well as evidence of colonial frontier settlement (up to 300 years old) and more recent agricultural layers.

Modern interventions into such landscapes, such as renewable energy development, constitute an additional layer onto the cultural landscape which must be acceptable in REDZ areas, however outside of REDZ areas, such projects must be very carefully considered.

The primary risk in terms of negative impact to the cultural landscape resulting from renewable energy development lies in the eradication of older layers that make up the cultural landscape. There are various ways that such impact can be mitigated, and these are dealt with in the VIA completed for this project.

In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise agricultural landscape. The landscape within which the proposed project areas are located, is not worthy of formal protection as a heritage resource and has the capacity to accommodate such development from a heritage perspective.

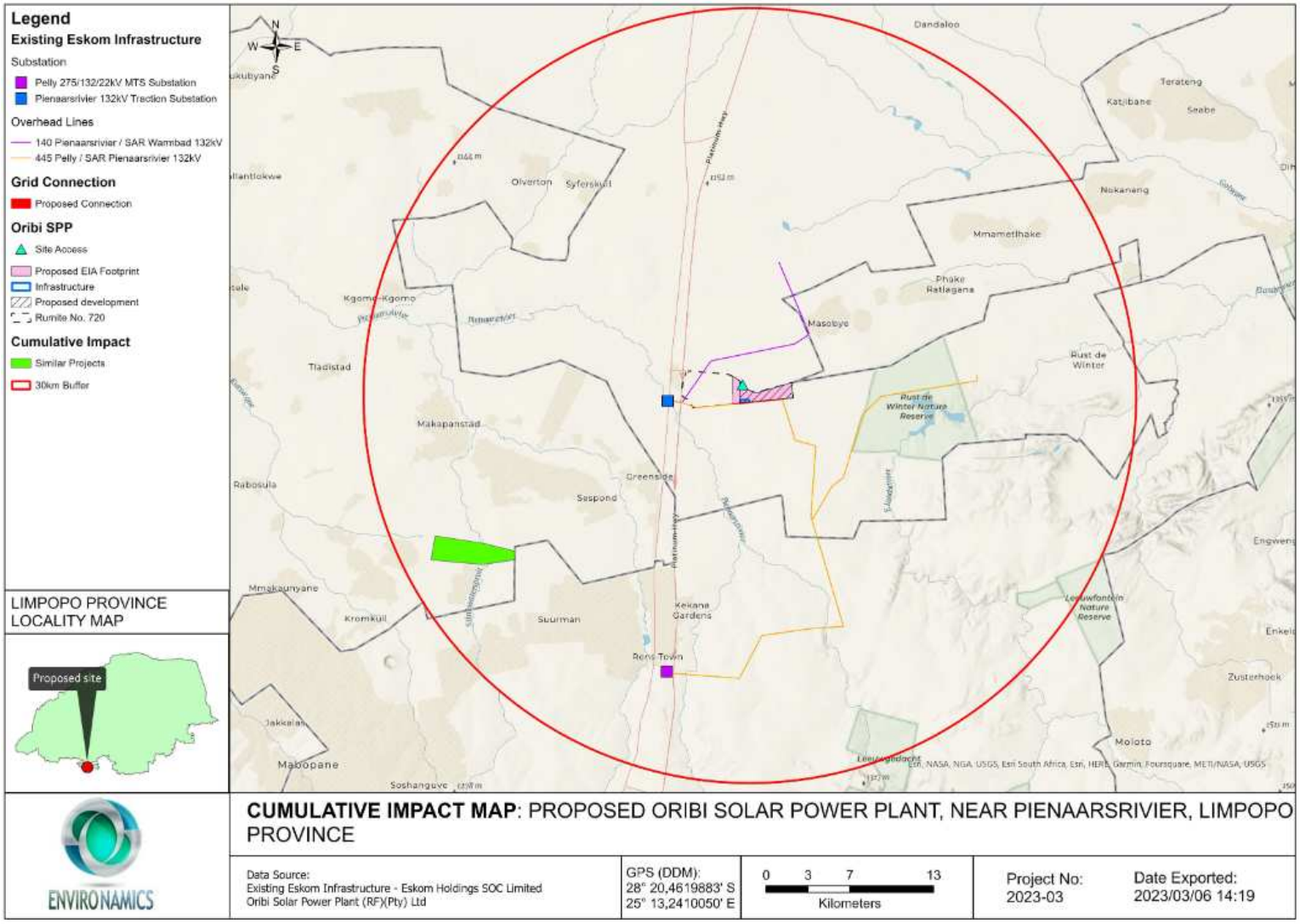


**Figure 7: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines for the Oribi SPP**

## 6. RESULTS OF PUBLIC CONSULTATION

As this application is made in terms of NEMA, the public consultation on the HIA will take place with the broader public consultation process required for the Environmental Impact Assessment process and will be managed by the lead environmental consultants on the project.

## 7. CONCLUSION

The survey proceeded with minor constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no significant heritage resources were identified within the area proposed for development. Overall, the development area is located sufficiently far from significant access routes, and the area proposed for development is not considered to be a sensitive cultural landscape.

The proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

## 8. RECOMMENDATIONS

Based on the outcomes of this report, it is not anticipated that the proposed development of the solar PV facility and its associated grid connection infrastructure will negatively impact on significant heritage resources. The following recommendations are made:

- The ECO for this project must be informed that the Irrigasie Formation/ Late Triassic Molteno Formation (Karoo Supergroup) has a Very High Palaeontological Sensitivity.
- The HWC Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and HWC must be alerted immediately to determine an appropriate way forward.

## 9. REFERENCES

| Heritage Impact Assessments | | | | |
|---|---|---|---|---|
| **Nid** | **Report Type** | **Author/s** | **Date** | **Title** |
| 159050 | HIA Phase 1 | Udo Kusel | 06/02/2014 | CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT FOR PORTION R/17 OF THE FARM HAMANSKRAAL 112 JR IN HAMMANSKRAAL GAUTENG PROVINCE |
| 182570 | HIA Phase 1 | Julius CC Pistorius | 16/09/2013 | |
| 362741 | PIA Desktop | Marion Bamford | 11/09/2014 | Palaeontological Impact Assessment for the Proposed development of the Hammanskraal Business Process Outsourcing and Technology Park, Gauteng |
| 5313 | AIA Phase 1 | Anton van Vollenhoven, JA Strydom | 01/04/2003 | Report on a Cultural Resources Survey Done on Portion 8 of the Farm Kliprand 76 JR |
| 5752 | AIA Phase 1 | Hester Marie Roodt | 01/03/1999 | Phase 1 Archaeological Impact Assessment Ruimte 74 JR Pienaarsrivier |
| 5753 | AIA Phase 1 | Hester Marie Roodt | 01/04/1999 | Phase 1 Archaeological Impact Assessment Oxidation Dam Pienaarsriver, Pienaarsrivierbrug 70 JR |
| 5757 | AIA Phase 1 | Johnny Van Schalkwyk | 28/11/2006 | Heritage Impact Assessment: Kalkfontein 42 JR |
| 5767 | AIA Phase 1 | Johnny Van Schalkwyk | 01/12/2007 | Heritage Impact Survey of Portions of the Farm Buffelsdrift 179 JR, Warmbad Magisterial District, Limpopo Province |
| 5822 | AIA Phase 1 | Johnny Van Schalkwyk | 01/02/2008 | Heritage Impact Survey Report for the Proposed Development of a Storm Water Drainage Network, Ramotse Village, in the Moretele and Wonderboom Magisterial Districts |
| 7994 | AIA Phase 1 | Jaco van der Walt | 18/08/2008 | Archaeological Impact Assessment for the Proposed Stevebikoville School, Nokeng Township, Gauteng Province |
| 8243 | AIA Phase 1 | Hester Marie Roodt | 03/03/1999 | Phase 1 Archaeological Impact Assessment: Welgegund 17 JR, Radium, Northern Province |
| 92685 | AIA Desktop | Neels Kruger | 16/07/2012 | Recommended Exemption from Archaeological Impact Assessment Study: Babelegi Steel Recycling Facility Project |

# APPENDICES

**APPENDIX 1: Archaeological Assessment (2023)**

# ARCHAEOLOGICAL SPECIALIST STUDY

In terms of Section 38(8) of the NHRA for a

## Proposed Oribi BESS and SPP


**Prepared by**

CTS HERITAGE

Jenna Lavin
And Nicholas Wiltshire

In Association with

**EnviroNamics**


April 2023

## EXECUTIVE SUMMARY

This report assesses the anticipated impacts to heritage resources that are likely to result from the development of the proposed Oribi SPP located near Hammanskraal.

The survey proceeded with no constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no significant archaeological heritage remains were documented.

As such, there is no objection to the proposed development from an archaeological perspective.

***Recommendations***

Based on the outcomes of this report, it is not anticipated that the proposed development of the solar energy facility and its associated grid connection infrastructure will negatively impact on significant archaeological heritage on condition that:

- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.



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# CONTENTS





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# 1. INTRODUCTION

## 1.1 Background Information on Project

This report assesses the anticipated impacts to heritage resources that are likely to result from the development of the proposed Oribi SPP located near Hammanskraal.

**Table 1: Technical details for the proposed facility**

| Component | Description / dimensions |
|---|---|
| **Height of PV panels** | 6 metres |
| **Area of PV Array** | 365 Hectares (Development footprint) |
| **Number of inverters required** | Minimum 50 |
| **Area occupied by inverter / transformer stations / substations / BESS** | Central inverters+ LV/MV trafo: 750 $m^2$<br>HV/MV substation with switching station: 3,35 ha<br>BESS: 5.5 ha (within the Infrastructure & Ancillary Complex) |
| **Capacity of on-site substation** | 132kV |
| **Capacity of the power line** | 132kV |
| **Area occupied by both permanent and construction laydown areas** | Permanent Laydown Area: 365 Hectares<br>Construction Laydown Area: ~5 ha |
| **Area occupied by buildings** | Infrastructure & Ancillary Complex: ~14.9 ha |
| **Battery storage facility** | Maximum height: 8m<br>Maximum volume: 1740 $m^3$<br>Capacity ~up to 150MWh |
| **Length of access roads** | 2.61 km |
| **Width of access roads** | 10 m |
| **Length of internal roads** | 12.8 km |
| **Width of internal roads** | 4 m – 6 m |
| **Length of perimeter roads** | 24.5 km |
| **Width of perimeter roads** | 4 m – 6 m |
| **Grid connection corridor width** | 200m up to 550m |
| **Grid connection corridor length** | ~ 2.8 km |
| **Power line servitude width** | 32m |
| **Height of fencing** | Approximately 2.5 metres |

## 1.2 Description of Property and Affected Environment

The Oribi PV development is about 21km north of Hammanskraal and the study area lies immediately south of the Kalkheuwel mine. The site can be reached via the Pienaar's River turnoff along the N1 highway and is located about 3.5km east of the turnoff. Large parts of the northern and northeastern corner of the site have undergone mining or the secondary impacts of chalk mining in the past and a series of jeep tracks crisscross the study area related to the stock farming use of the Elandskraal farm. Two large Eskom overhead powerlines run near the property and encircle the study site. Besides chalk mining and cattle farming and a patch of fallow ground where crop agriculture has taken place west of the chalk mining, the western end also hosts the grounds used by Lenaka Hunting Safaris. The vegetation covering the site varies from dense grassland to acacia thorntrees and bushveld.



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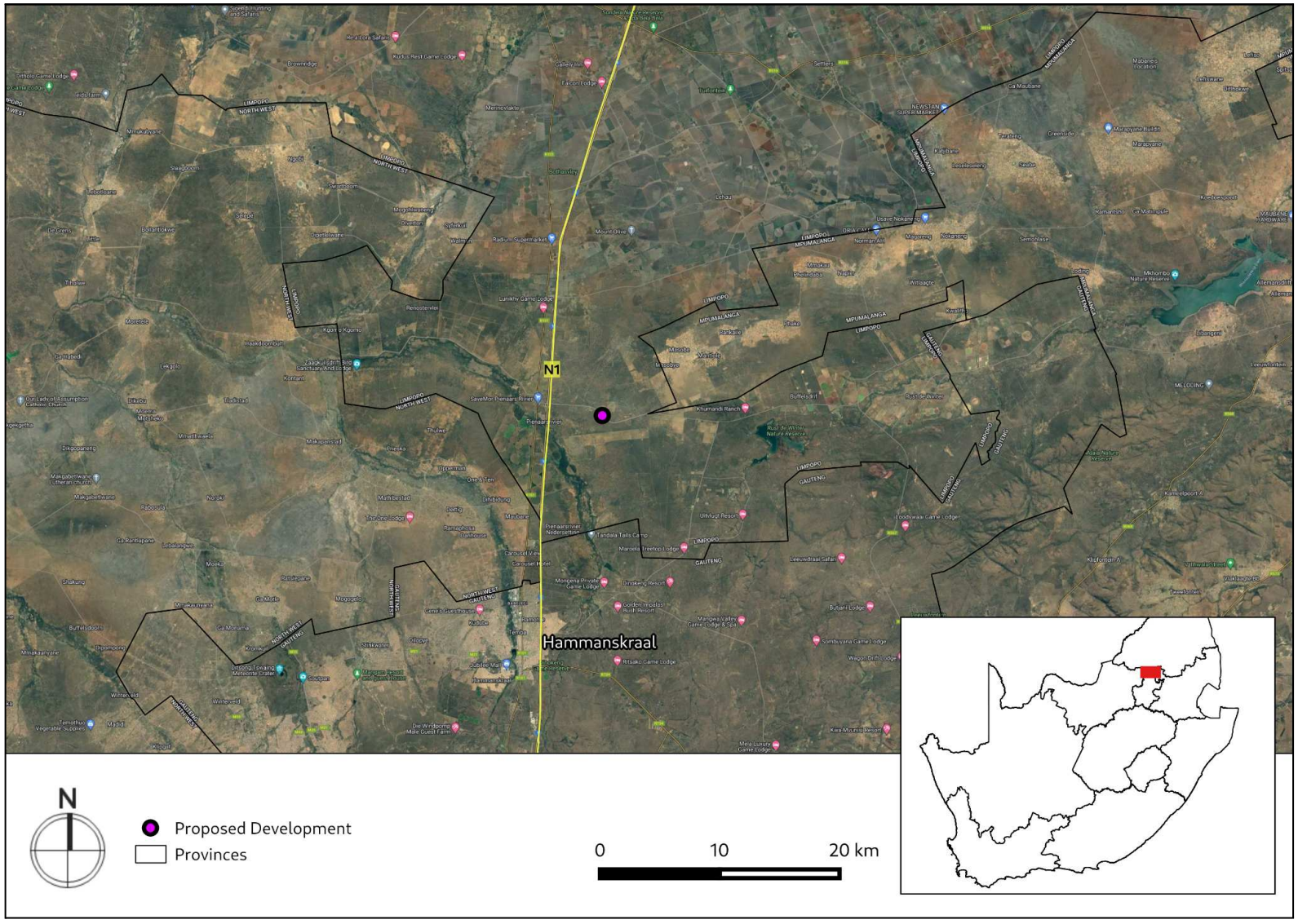


**Figure 1.1: Satellite image indicating proposed location of development**



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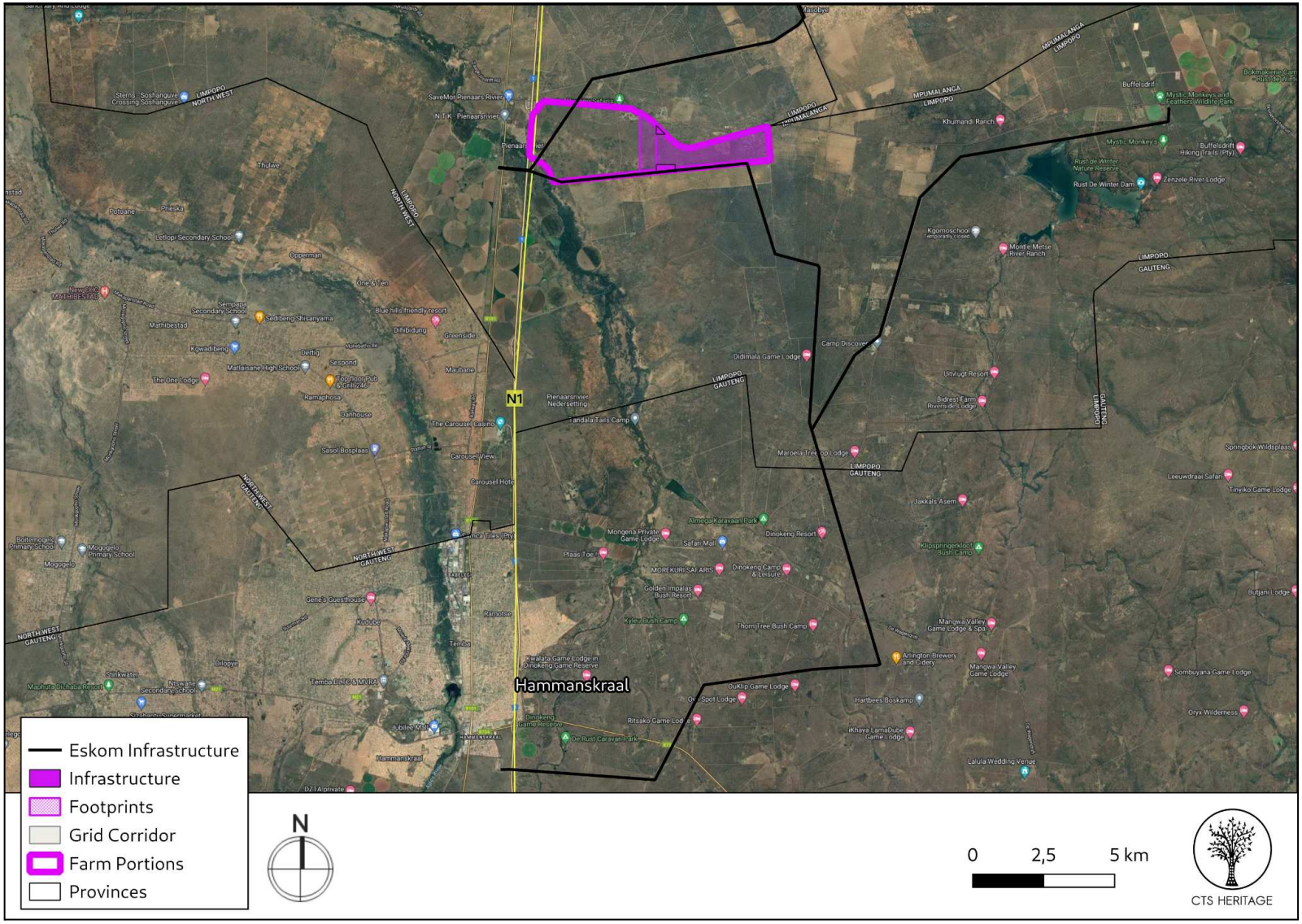


**Figure 1.2: Proposed project boundary**



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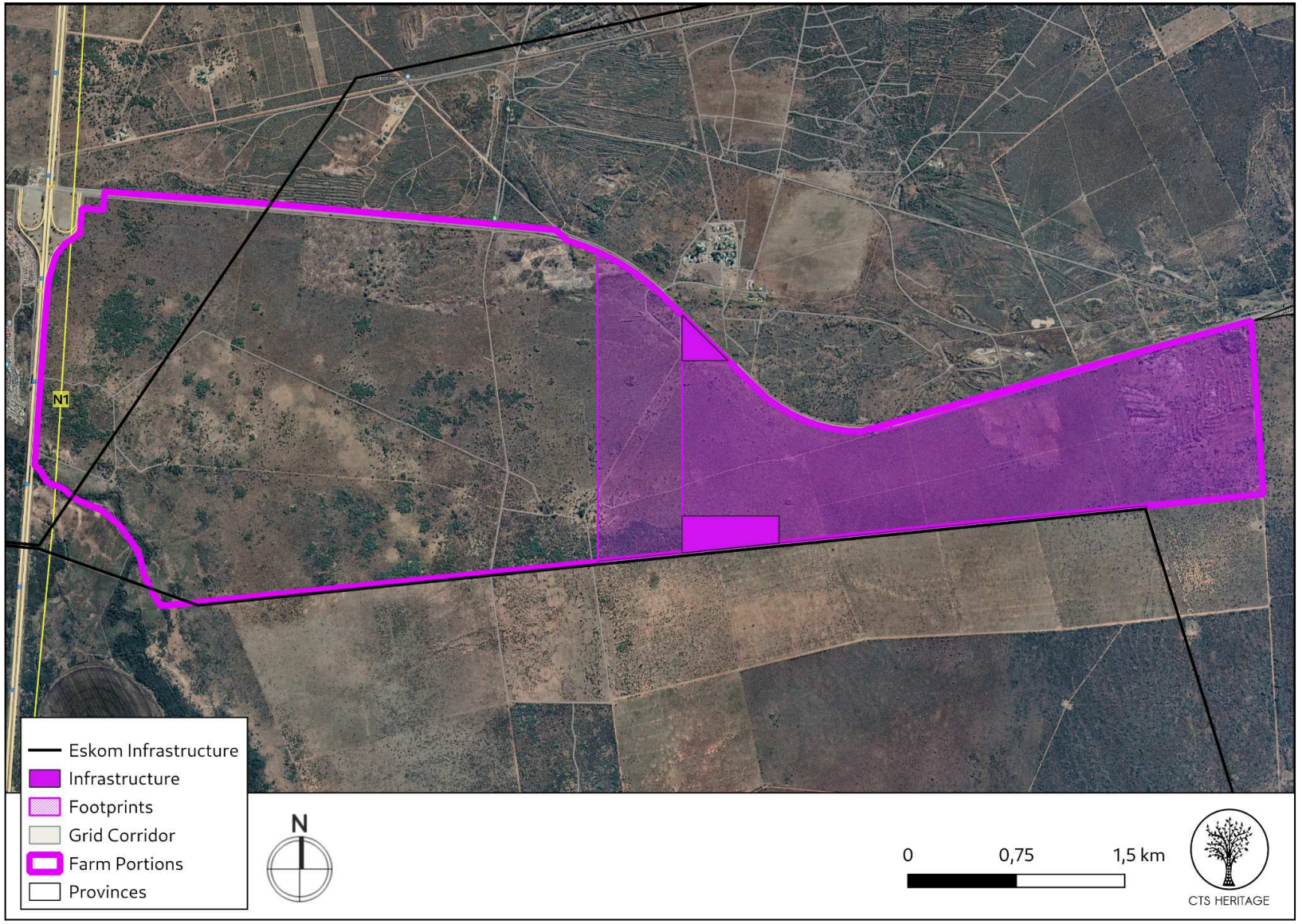


**Figure 1.3. Overview Map. Satellite image (2022) indicating the proposed development area at closer range.**



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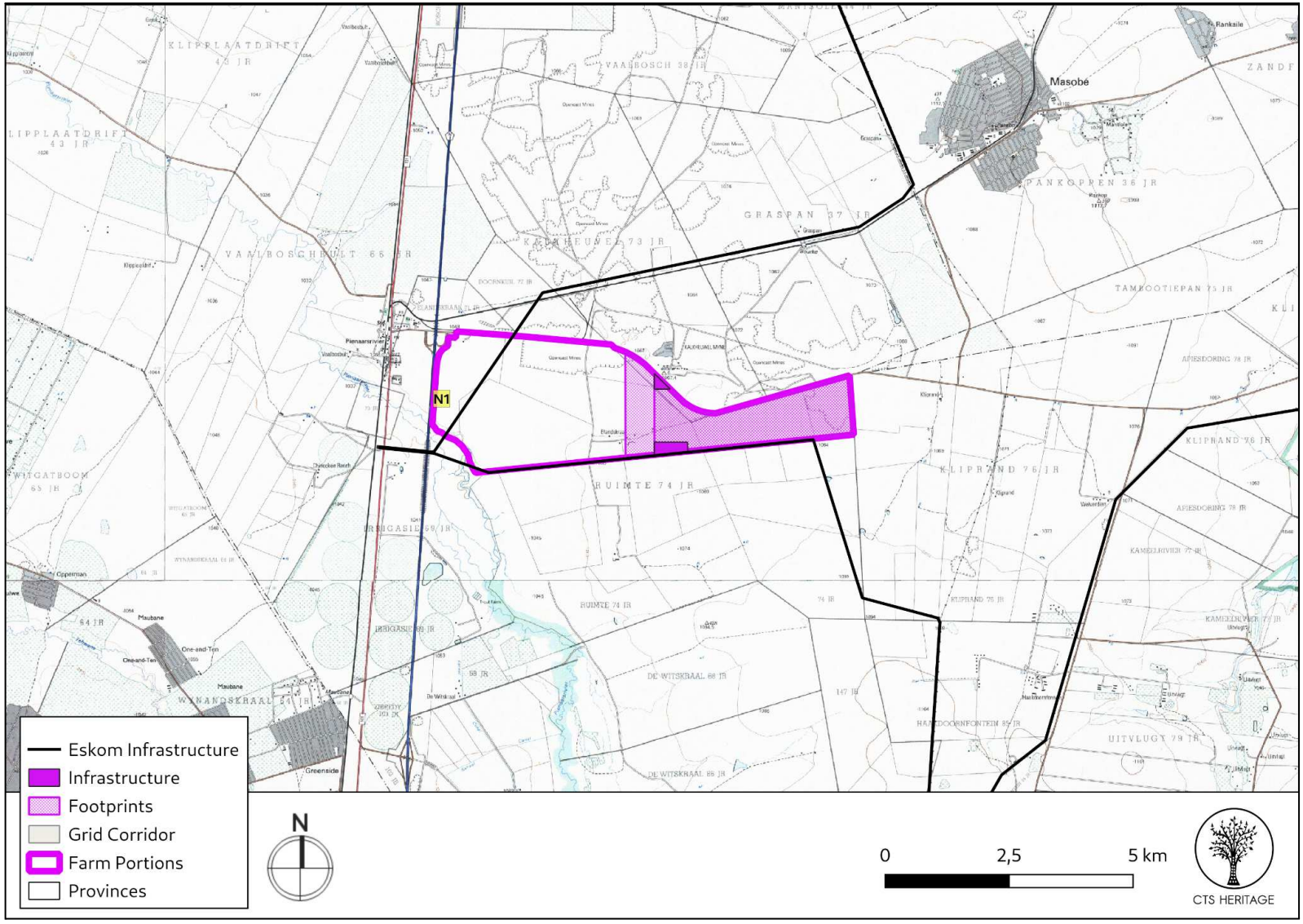


**Figure 1.4. Overview Map. Extract from the 1:50 000 Topo Map for this area**



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## 2. METHODOLOGY

### 2.1 Purpose of Archaeological Study

The purpose of this archaeological study is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999) in terms of impacts to archaeological resources.

### 2.2 Summary of steps followed

- An archaeologist conducted a survey of the site and its environs from 25 to 26 March 2023 to determine what archaeological resources are likely to be impacted by the proposed development.
- The area proposed for development was assessed on foot, photographs of the context and finds were taken, and tracks were recorded using a GPS.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

### 2.3 Constraints & Limitations

The study area is currently densely vegetated with extensive grass cover, bush and acacia thorn trees. Exposures of open ground along the jeep tracks was possible and Iron Age material was found in an area that had been opened up by farm roads. However, most of the study area is entirely covered by vegetation that surface material could not be recorded easily. Given the nature of the PV development and the re-use of existing roads in the layout of the development, it is unlikely that significant impacts on surface scatters will occur.



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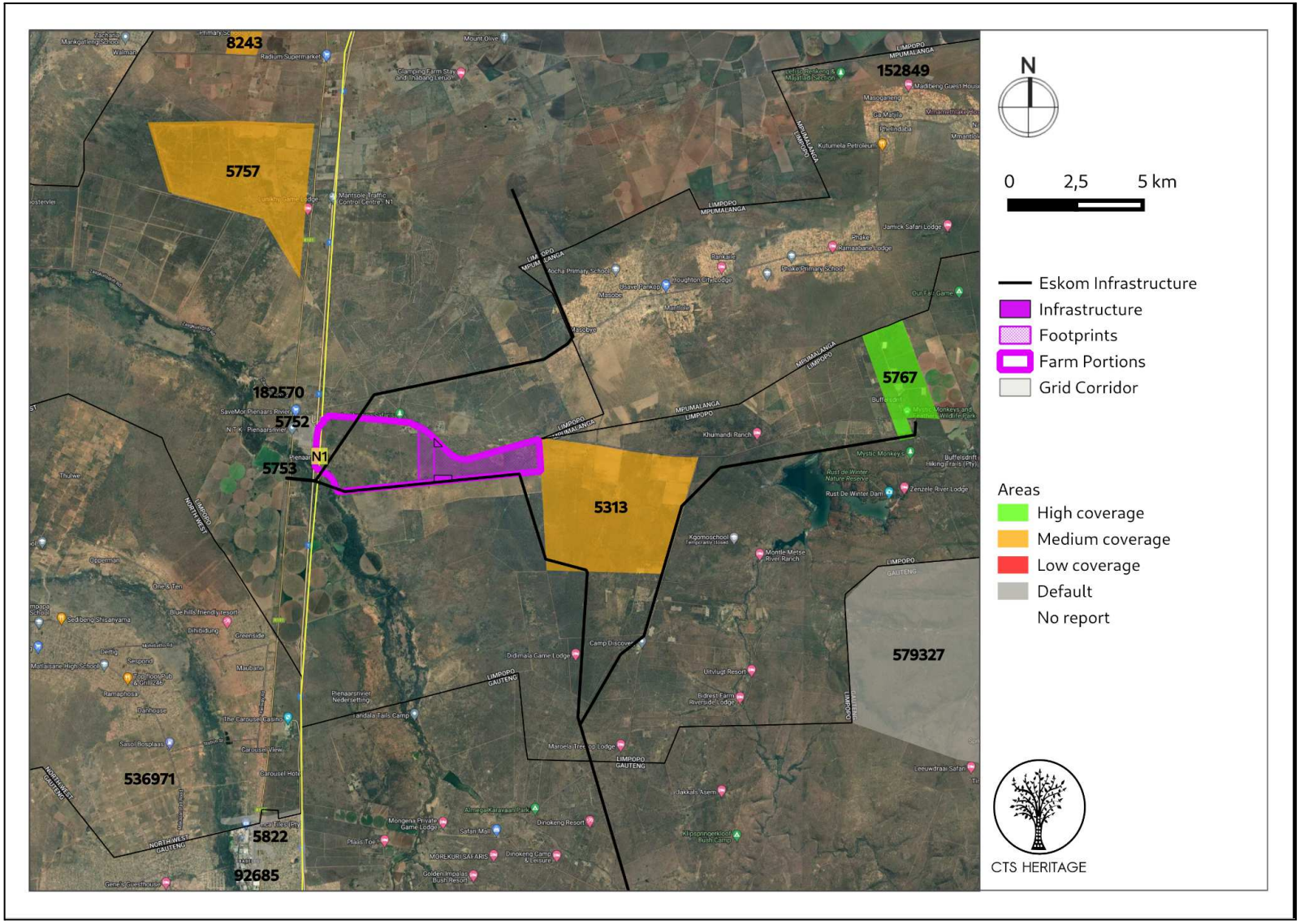


**Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted**



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## 3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area proposed for development is located in between Bela-Bela, previously known as Warmbaths, in the Limpopo Province and Hammanskraal located north of Pretoria, to the east of the N1. When the Tswana tribes first moved into the region in about the 1800s, they discovered hot springs in the area. The Voortrekker Carl Van Heerden established the first farm in what is now Bela-Bela and called it *Het Bad*. In 1873, President Burgers' Transvaal government bought the land and established a resort called *Hartingsburg* after the prominent Dutch biologist Pieter Harting. The British occupied the town during the Anglo-Boer War, and renamed the post office *Warm Baths* in 1903, and proclaimed the boundaries of Warmbaths to be the entire farm of *Het Bad.* In 1920 Warmbaths was proclaimed a township.

A broad history of the area is included in Murimbika (2010) and is referred to here. According to Murimbika (2010), the broader region has also yielded some significant Iron Age Sites such as the Mzonjani facies Broederstroom site (AD 430 to AD 780). According to Murimbika (2010), the broader region was subject to a number of instances of migration and settlement from 450 AD. Evidence indicates that Sotho-Tswana groups migrated in and out of the Magaliesberg region, and such groups are responsible for the many early stone-walled settlements in this region. One of the most documented migrations is the Mfecane (forced migration or scattering) which was a period of widespread chaos and warfare among indigenous ethnic communities in southern Africa during the period between 1815 and about 1840. During this time, the Ndebele under Mzilikazi reached the Magaliesberg region and are responsible for introducing the Doornspruit-type walled settlements that are known from this region (the Doornspruit River drains into the project area). According to Murimbika (2010) this type of stone-walled settlement represents “typical Nguni-Sotho-Tswana acculturation”. Murimbika (2010) further explains that one of the most acculturated groups in the region is known as the “Po”, whose Chief Mogale lends his name to the Magaliesberg Mountains and the Mogale City Municipality. By the mid-1800’s, Voortrekkers had begun to settle in the foothills of the Magaliesberg mountains and in so doing, clashed with Mzilikazi’s Ndebele in 1837. These early colonial battles forced the Ndebele north of the Limpopo River and effectively ended the independence of African Chiefdoms in the area. The Voortrekkers went on to establish the Republic of the Transvaal.

As part of the assessment completed by Van der Walt (2007), Birkholtz completed an historical and archival study of the Bela-Bela area. This detailed archival history is not repeated here, however some important notes from Birkholtz are reiterated below as they pertain to the cultural significance of the development area:

- The route between Great Zimbabwe, the copper mines at Messina and the tin mines at Rooiberg passed through the area
- The railway line and wagon road between Pretoria and then Pietersburg passed through this area. This meant that the region had immense strategic significance during the South African War (1899-1902). Pistorius (2013) notes that historical beacons in the area include a blockhouse which served in the line of blockhouses which stretched from Naauwpoort in the Magaliesberg to Pietersburg during the Anglo Transvaal War (1899-1902).
- A Voortrekker cemetery lies along the Thabazimbi road (Berg 1992, Erasmus 1995)



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These points speak to the cultural value of the N1 heading north from Pretoria as a significant historic linking route. Cognisance of this significance must be taken.

Roodt (2008) remarks that "The Bela Bela region has a rich archaeological tradition, starting from the Stone Age period, right up to the Historical period. The following Iron Age material may occur in the region: According to the most recent archaeological cultural distribution sequences by Huffman (2007), this area falls within the distribution area of various cultural groupings originating out of both the Urewe Tradition (eastern stream of migration) and the Kalundu Tradition (western stream of migration)." Previous Heritage Impact Assessments conducted in the immediate vicinity of the proposed study area (Roodt, 2008, Van der Walt, 2007 and 2021 and Huffman, 2008) have identified a number of significant archaeological sites in the vicinity of the study area, dated to the Late Iron Age (Figure 3, 3a and 3b). Huffman (2008) in his assessment of a site located to the south of Bela-Bela, identified a few Middle Stone Age artefacts however he concluded that due to their context, these artefacts were likely bought into the area from somewhere else along with road ballast and therefore, these artefacts are not conservation-worthy.

Roodt (2008) noted that, 40km north of the area proposed for development, "Buyskop contains a stonewalled archaeological site… The observed ceramic shards are both decorated and undecorated. Thus it is possible to broadly assign the site to the Blackburn Branch of the Uruwe Tradition, probably Uitkomst facies (AD 1650 – 1820), but could also represent the related Rooiberg facies (AD 1650 – 1750). Cupules (also known as 'dolly holes'), used during rainmaking rituals, were noted in two places adjacent to the existing road, which has already damaged the site. Large ash areas were noted that could be attributed to middens and kraals." The sites identified by Roodt 92008) are graded IIIB due to their moderate scientific value. Roodt (2008) concludes that "Buyskop (Buiskop) appears to have been occupied for an extensive period during the South African Iron Age. Based on ceramic analysis of decorated ceramic shards, occupation can be assigned to the period AD 1650 -1820. The ceramics are associated with the ceramic facies Uitkomst and Rooiberg, thus reflecting occupation by Sotho speaking peoples (Huffman 2007: 433). Rainmaking also occurred on the hill, archaeologically reflected by the presence of cupules."

In his assessment completed for the property located immediately east of the development area, Van Vollenhoven and Strydom (2003) noted that although no Stone Age sites are known from the vicinity of the development, they identified two stone artefacts on the property that they assessed. These they ascribed to the Middle and Later Stone Age. These artefacts were determined to have no context and as such, were determined to be Not Conservation-Worthy. Van Vollenhoven and Strydom (2003) also note that a significant number of Late Iron Age sites are known south of the development area, the best known located at Wallmansthal and associated with the Ndebele occupation of the area. Several sites preserving Moloko pottery are also known from the broader area. However, Van Vollenhoven and Strydom (2003) did not identify any Iron Age sites in their assessment of the adjacent property. Pistorius (2013) concurs with the findings of Van Vollenhoven and Strydom (2003) and notes that the most common heritage resources which do occur in the broader area are stone walled sites which date from the Late Iron Age. These LIA sites are mostly found along the base lines of kopjes and randjes in the region.



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According to Roodt (1999), archaeologists from the University of the Witwatersrand conducted excavations in the mid-1990's at a site located on the Farm Irrigasie 69 JR located immediately south of the Farm Ruimte 74 JR on which this development is proposed. The location of the excavations is indicated in Figure 3 above. According to Roodt (1999), the excavations revealed a burial as well as some pottery and ostrich eggshell beads. In his assessment of a small area located on Farm Pienaarsrivierbrug 70 JR located adjacent to this development area, Roodt (1999) identified five sites of Middle and Later Stone Age artefacts. It is very likely that similar Middle and Later Stone Age artefacts will be present within the development area, as well as sites associated with the Late Iron Age occupation of the area.



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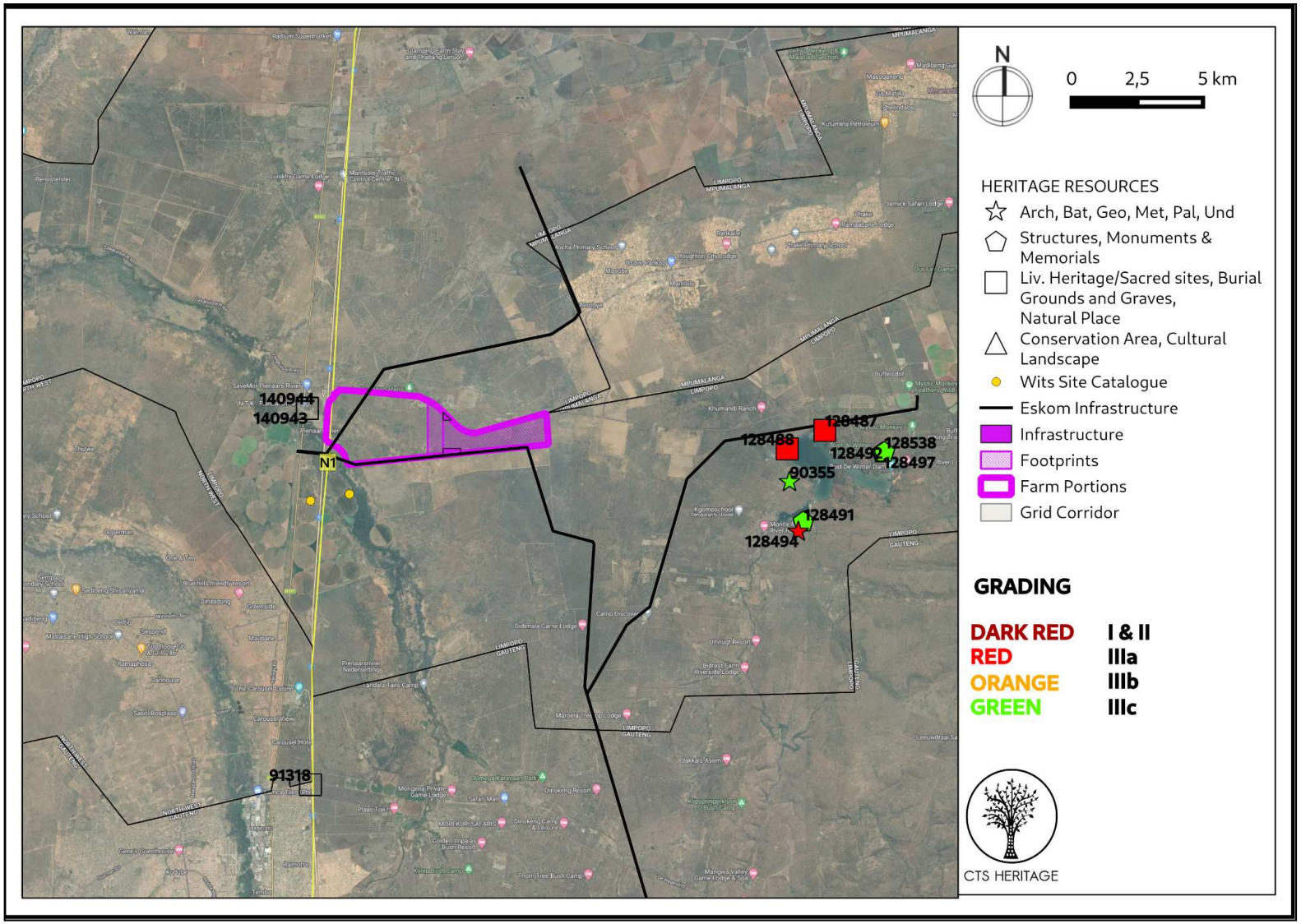


**Figure 3.1 Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated**



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## 4. IDENTIFICATION OF HERITAGE RESOURCES

### 4.1 Field Assessment

Observations of archaeological and historical material were clustered around the northeastern end of the farm where the chalk mining has occurred and deeper ground has been disturbed and opened up. Various quartzite flakes, radial cores and retouched pieces were found in and amongst the calcrete jeep tracks and spill and these are likely to have been deposited at lower layers than the rest of the study site. Broken pieces of undecorated Iron Age pottery were also found in the jeep track nearer to the Elandskraal end of the development. The Elandskraal werf itself is a double storey ruined building built in the 1940s - a number of linking jeep tracks emanate from the homestead to kraals and stock posts with further ruins of workers' cottages and farm buildings. The vegetation is very dense and it was not possible to locate much more between the two ends of the development area as the visibility of surface material was near zero outside of the jeep tracks. However, given the relatively small size of this PV area and the low depth of excavations it is unlikely that the MSA layers will be encountered outside of the chalk mine area.

**Figure 4.1: View through the game fence from the northern end of the study site.**



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**Figure 4.2: View looking over the old agricultural fields currently fallow.**

**Figure 4.3: View looking southwest along the northern boundary and down across the area west of the chalk mining.**



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**Figure 4.4: View of the area closer to the chalk mining.**

**Figure 4.5: Dense bushveld near the chalk mine.**



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**Figure 4.6: View of deep grass and bush cover typical across the study site.**

**Figure 4.7: Context photo along the powerline route on the southern side of the study site.**



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**Figure 4.8: Jeep track and acacia thorn trees near Elandskraal homestead.**

**Figure 4.9: Jeep track and acacia thorn trees near Elandskraal homestead.**



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**Figure 4.10: Deep impenetrable bush east of Elandskraal homestead.**

**Figure 4.11: Deep impenetrable bush east of Elandskraal homestead.**



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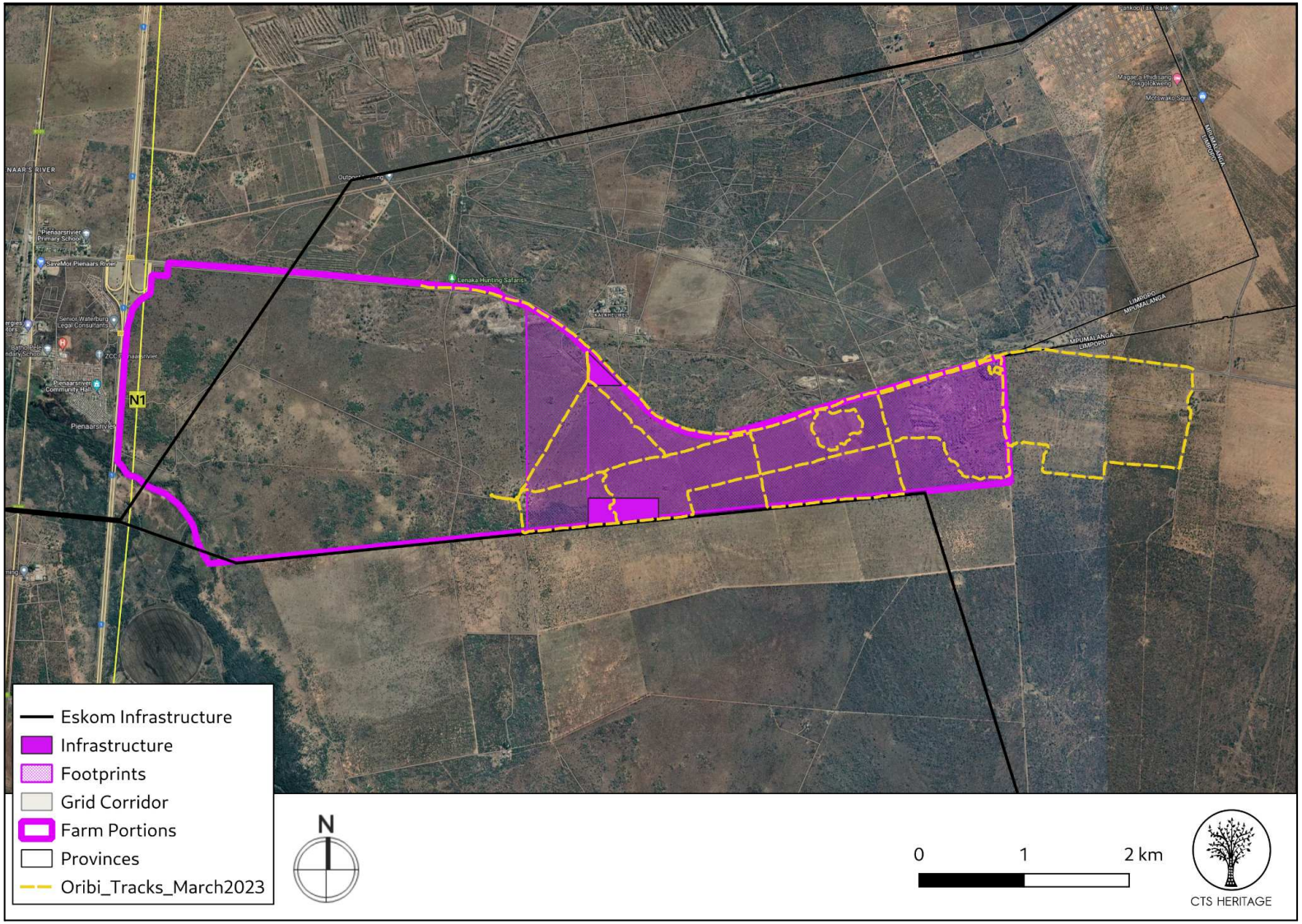


**Figure 5.1: Overall track paths of foot survey for development**



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## 4.2 Archaeological Resources identified

**Table 2: Heritage Resources identified**

| Obs# | Description | Type | Period | Density | Latitude | Longitude | Grade | Mitigation |
|---|---|---|---|---|---|---|---|---|
| 001 | Inside the jeep track. Broken bits of thick walled Iron Age pottery, undecorated, iron wire | Artefacts | Iron Age | 0 to 5 | -25.228281 | 28.342585 | NCW | NA |
| 002 | Elandskraal ruined farm buildings, brick, 1930s or 40s | Ruin | Historic | n/a | -25.225292 | 28.340955 | NCW | NA |
| 002 | Elandskraal ruined farm buildings, brick, 1930s or 40s | Ruin | Historic | n/a | -25.225077 | 28.341465 | NCW | NA |
| 002 | Elandskraal ruined farm buildings, brick, 1930s or 40s | Ruin | Historic | n/a | -25.224073 | 28.341218 | NCW | NA |
| 003 | Early Msa quartzite flake in jeep track | Artefacts | MSA | 0 to 5 | -25.225322 | 28.338875 | NCW | NA |
| 004 | Main ruined Elandskraal homestead, double storey, circa 1940. | Ruin | Historic | n/a | -25.225082 | 28.33839 | NCW | NA |
| 005 | Chalk mound in mining area, extensive mining disturbance | Observation | n/a | n/a | -25.214636 | 28.385625 | NCW | NA |
| 006 | Quartzite hafted point in disturbed context | Artefacts | MSA | 0 to 5 | -25.214453 | 28.386496 | NCW | NA |
| 007 | Fine grained quartzite cores and flakes, eroding out of calcrete track | Artefacts | MSA | 10 to 30 | -25.219182 | 28.386956 | NCW | NA |



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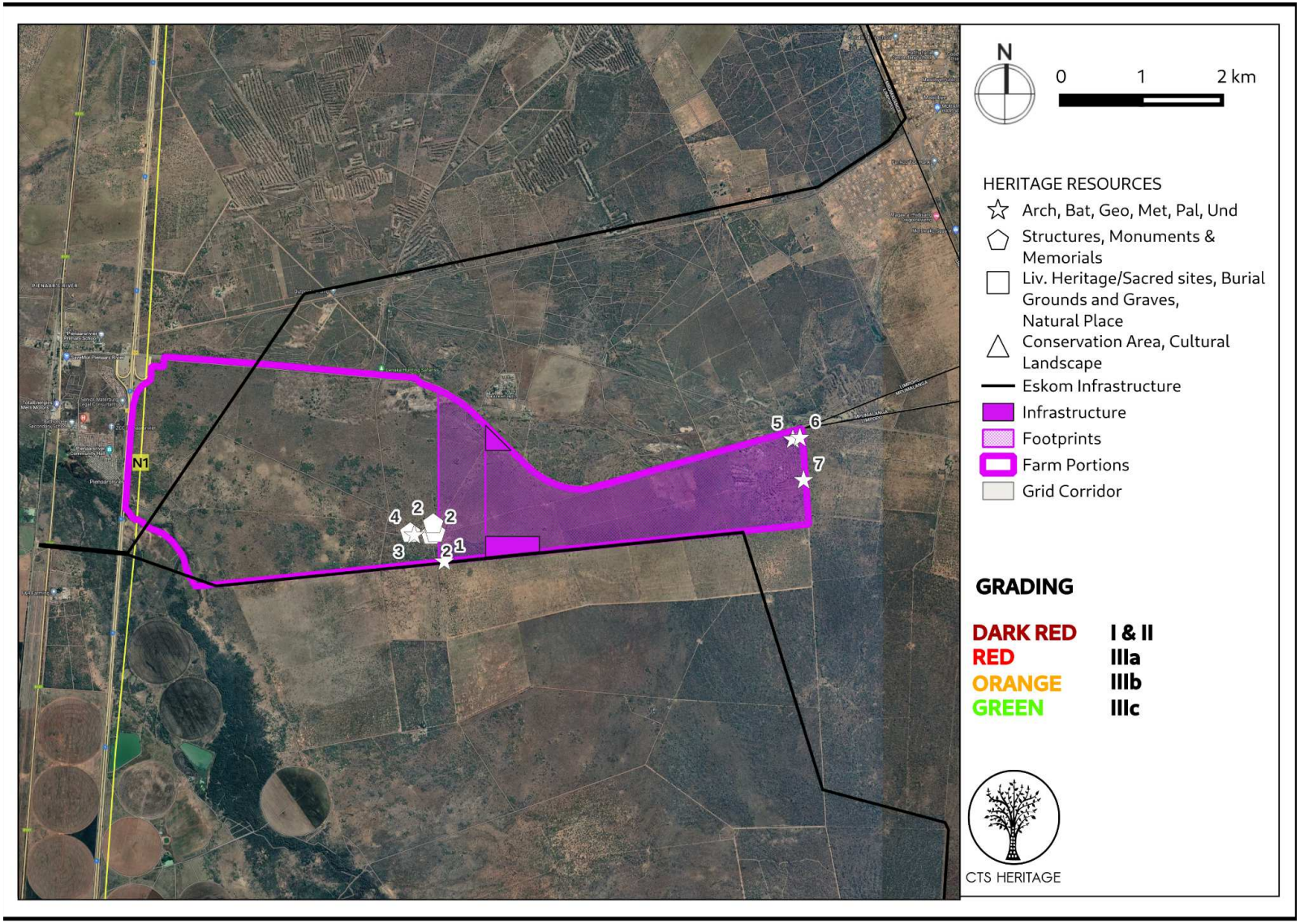


**Figure 6.1: Map of all sites and observations noted within the development area**



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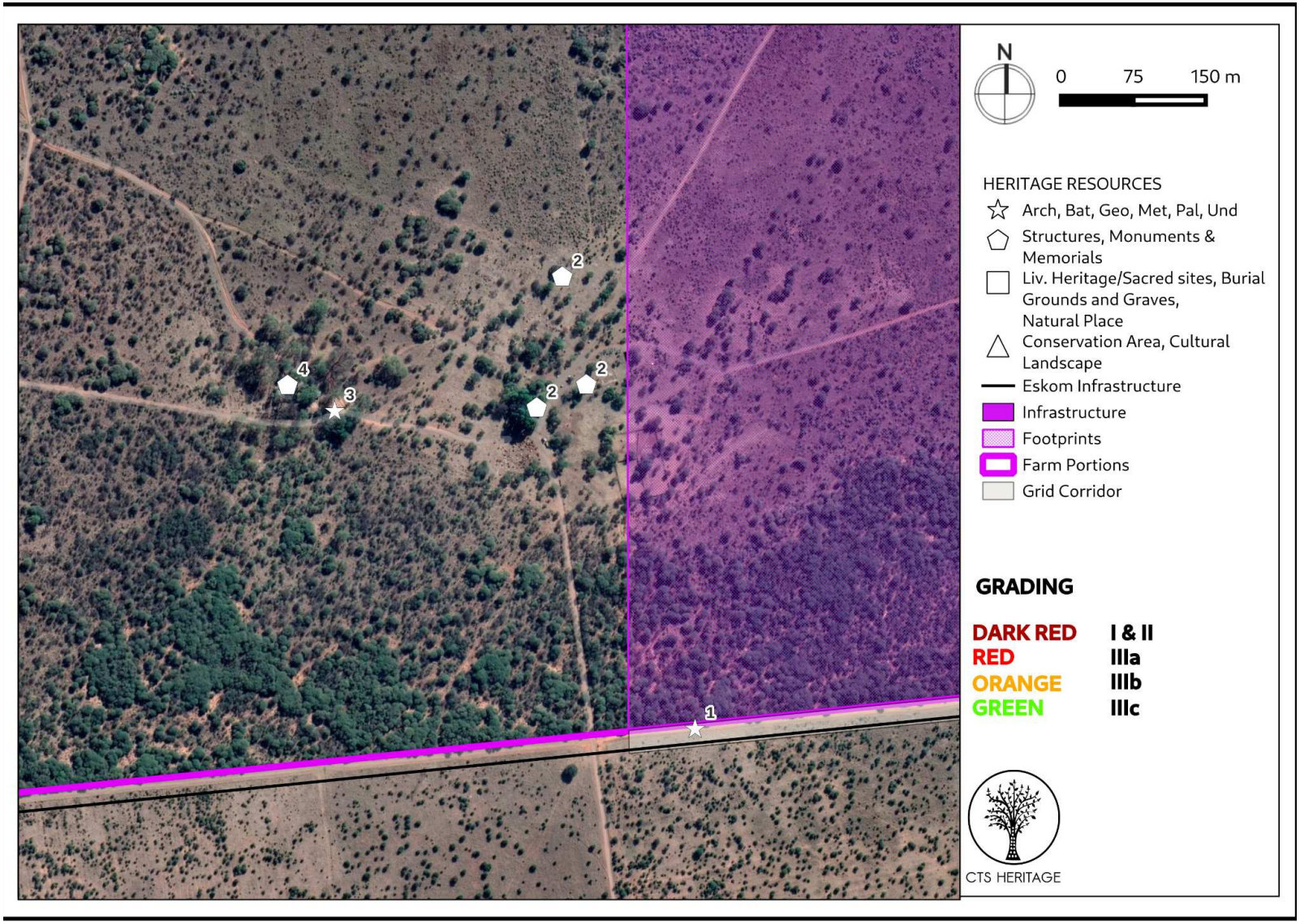


**Figure 6.2: Map of all sites and observations noted within the development area**



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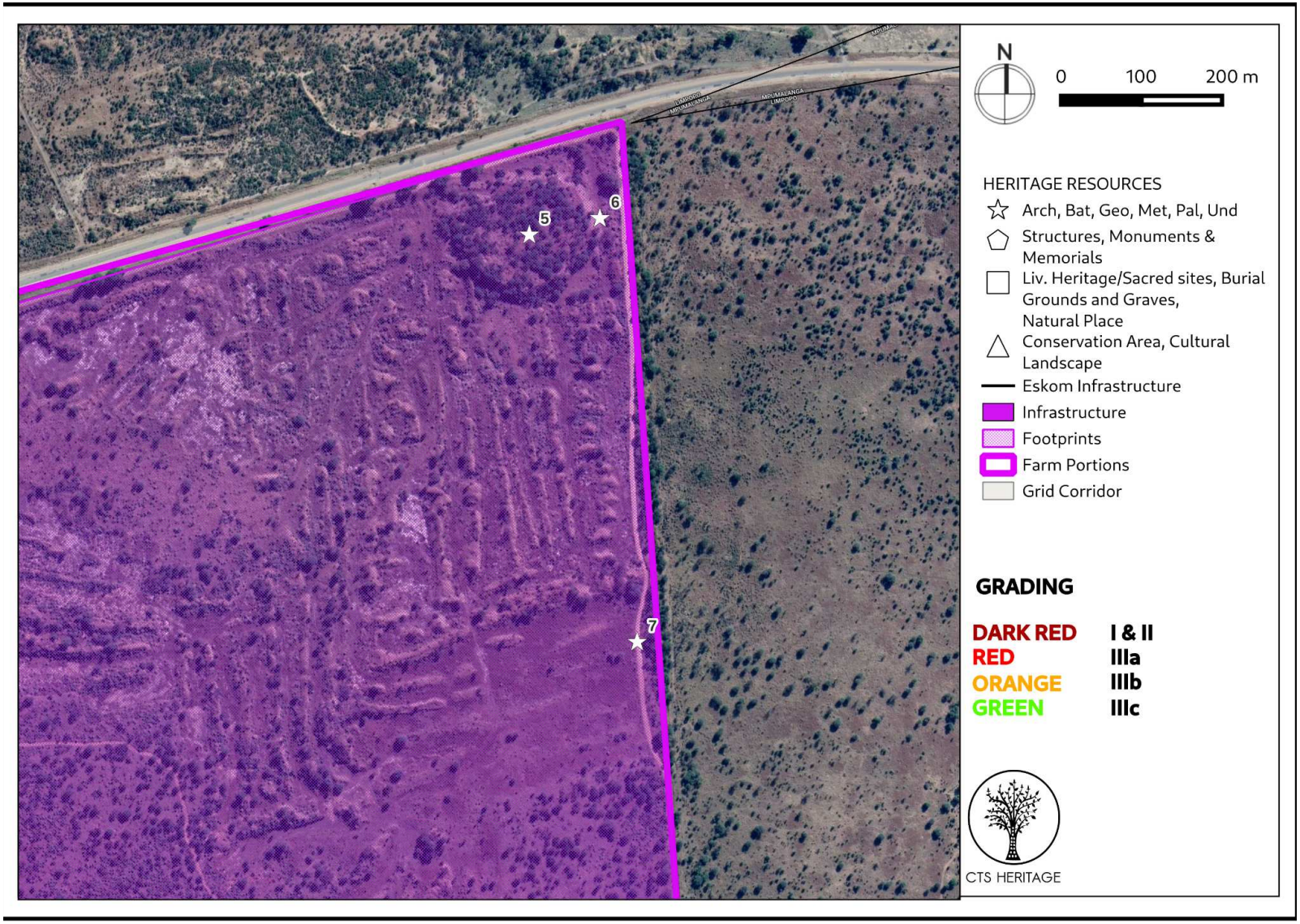


**Figure 6.3: Map of all sites and observations noted within the development area**



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## 4.3 Selected photographic record

(a full photographic record is available upon request)

**Figure 7.1: Observation 001**

**Figure 7.2: Observation 002**

**Figure 7.3: Observation 002**



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**Figure 7.4: Observation 003**

**Figure 7.5: Observation 004**

**Figure 7.6: Observation 005**



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**Figure 7.7: Observation 006**

**Figure 7.8: Observation 007**



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## 5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

### 5.1 Assessment of impact to Archaeological Resources

The results of the field assessment align with the findings of the desktop assessment in that the archaeological observations made on the property include dispersed, low density Middle and Later Stone artefacts and dispersed Iron Age artefacts. No significant Stone Age or Iron Age archaeology was documented within the footprint of the area proposed for development as the artefacts identified have very limited scientific value and their recording in this report is deemed sufficient. Other heritage resources identified relate predominantly to the historic agricultural practices of the area and mining activities; however these have limited cultural value and have been determined to be Not Conservation-Worthy.

No impact to significant archaeological heritage resources is anticipated.

## 6. CONCLUSION AND RECOMMENDATIONS

The survey proceeded with no constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no significant archaeological heritage remains were documented.

As such, there is no objection to the proposed development from an archaeological perspective.

***Recommendations***

Based on the outcomes of this report, it is not anticipated that the proposed development of the solar energy facility and its associated grid connection infrastructure will negatively impact on significant archaeological heritage on condition that:

- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.



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## 7. REFERENCES

| Heritage Impact Assessments | | | | |
|---|---|---|---|---|
| **Nid** | **Report Type** | **Author/s** | **Date** | **Title** |
| 159050 | HIA Phase 1 | Udo Kusel | 06/02/2014 | CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT FOR PORTION R/17 OF THE FARM HAMANSKRAAL 112 JR IN HAMMANSKRAAL GAUTENG PROVINCE |
| 182570 | HIA Phase 1 | Julius CC Pistorius | 16/09/2013 | |
| 362741 | PIA Desktop | Marion Bamford | 11/09/2014 | Palaeontological Impact Assessment for the Proposed development of the Hammanskraal Business Process Outsourcing and Technology Park, Gauteng |
| 5313 | AIA Phase 1 | Anton van Vollenhoven, JA Strydom | 01/04/2003 | Report on a Cultural Resources Survey Done on Portion 8 of the Farm Kliprand 76 JR |
| 5752 | AIA Phase 1 | Hester Marie Roodt | 01/03/1999 | Phase 1 Archaeological Impact Assessment Ruimte 74 JR Pienaarsrivier |
| 5753 | AIA Phase 1 | Hester Marie Roodt | 01/04/1999 | Phase 1 Archaeological Impact Assessment Oxidation Dam Pienaarsriver, Pienaarsrivierbrug 70 JR |
| 5757 | AIA Phase 1 | Johnny Van Schalkwyk | 28/11/2006 | Heritage Impact Assessment: Kalkfontein 42 JR |
| 5767 | AIA Phase 1 | Johnny Van Schalkwyk | 01/12/2007 | Heritage Impact Survey of Portions of the Farm Buffelsdrift 179 JR, Warmbad Magisterial District, Limpopo Province |
| 5822 | AIA Phase 1 | Johnny Van Schalkwyk | 01/02/2008 | Heritage Impact Survey Report for the Proposed Development of a Storm Water Drainage Network, Ramotse Village, in the Moretele and Wonderboom Magisterial Districts |
| 7994 | AIA Phase 1 | Jaco van der Walt | 18/08/2008 | Archaeological Impact Assessment for the Proposed Stevebikoville School, Nokeng Township, Gauteng Province |
| 8243 | AIA Phase 1 | Hester Marie Roodt | 03/03/1999 | Phase 1 Archaeological Impact Assessment: Welgegund 17 JR, Radium, Northern Province |
| 92685 | AIA Desktop | Neels Kruger | 16/07/2012 | Recommended Exemption from Archaeological Impact Assessment Study: Babelegi Steel Recycling Facility Project |



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## APPENDIX 2: Palaeontological Assessment (2023)

BANZAI ENVIRONMENTAL

# PALAEONTOLOGICAL IMPACT ASSESSMENT

## THE DEVELOPMENT OF ORIBI SOLAR POWER PLANT NEAR PIENAARSRIVER, LIMPOPO PROVINCE

2023

COMPILED FOR: ENVIRONAMICS

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

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: 

The Palaeontological 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**: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)*

| **Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017** | **The relevant section in the report** | **Comment where not applicable** |
|---|---|---|
| 1.(1) (a) (i) Details of the specialist who prepared the report | Page ii and Section 3 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 3 – 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 5 – Objective | - |
| (cA) An indication of the quality and age of base data used for the specialist report | Section 6 – 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 11 | - |

| | | |
|---|---|---|
| (d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment | Section 1;10 & 12 | |
| (e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used | Section 8 Approach and Methodology | - |
| (f) Details of an assessment of the specifically 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 alternative | Section 1;10 & 11 | |
| (g) An identification of any areas to be avoided, including buffers | Section 1 & 12 | |
| (h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers | Section 6 – Geological and Palaeontological history | |
| (i) A description of any assumptions made and any uncertainties or gaps in knowledge | Section 8 – 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 12 | |
| (k) Any mitigation measures for inclusion in the EMPr | Section 13 | |
| (l) Any conditions for inclusion in the environmental authorisation | Section 13 | |
| (m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation | Section 13 | |

| | | |
|---|---|---|
| (n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and | Section 1 & 12 | |
| (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 12 | - |
| (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 was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process |
| (p) A summary and copies of any comments that were received during any consultation process | N/A | Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised |
| (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 | Section 4 compliance with | |

| | | |
|---|---|---|
| applied to a specialist report, the requirements as indicated in such notice will apply | SAHRA guidelines | |

## EXECUTIVE SUMMARY

Banzai Environmental was appointed by CTS Heritage to conduct the Palaeontological Impact Assessment (PIA) to assess Oribi Solar Power Plant (SPP) near Pienaarsrivier, in the Limpopo Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The proposed Oribi SPP is located in the Springbokflats Basin and is largely underlain by the Letaba Formation (Lebombo Group, Karoo Igneous Province) with a small portion of Irrigasie Formation (Undifferentiated Karoo) in the south west of the development footprint. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Karoo Igneous Province is Zero while that of the Irrigasie Formation is Very High (Almond and Pether, 2009; Almond *et al*., 2013, Groenewald et al 2014). Updated Geology (Council of Geosciences) indicates that the proposed development is mainly underlain by the Lahau Formation (Lebombo Group, Karoo-Ferrar igneous intrusions) and the Late Triassic Molteno Formation (Stormberg Group, Karoo Supergroup). The potential fossiliferous sedimentary bedrocks have often been thermally metamorphized by overlying dolerite sills compromising their palaeontological sensitivity.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 April 2023. No fossiliferous outcrop was detected in the proposed development area. A medium Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a very low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

Recommendations:

- The ECO for this project must be informed that the Irrigasie Formation/ Late Triassic Molteno Formation (Karoo Supergroup) has a Very High Palaeontological Sensitivity.
- If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources 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) so that mitigation (recording and collection) can be carried out.
- Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
- These recommendations should be incorporated into the Environmental Management Plan for the Oribi Solar Power Plant.

**Impact Summary**

| Environmental parameter | Issues | Rating prior to mitigation | Average | Rating post mitigation | Average |
|---|---|---|---|---|---|
| Planning Phase<br>Oribi SPP | No Impact | 0 | No Impact | 0 | No Impact |
| Construction Stage<br>Oribi SPP Loss of fossil heritage | Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study | 51 | Negative Medium impact | 17 | Negative Low impact |
| Operational Phase<br>Oribi SPP | No Impact | 0 | No Impact | 0 | No Impact |
| Decommissioning Phase<br>Oribi SPP | No Impact | 0 | No Impact | 0 | No Impact |

It is therefore considered that the proposed Oribi SPP will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent.

# TABLE OF CONTENT

# List of Figures

# List of Tables



# Appendix A: CV

## 1. INTRODUCTION

The Oribi Solar Power Plant near Pienaarsrivier in the Limpopo is proposed (Figure 1-3).

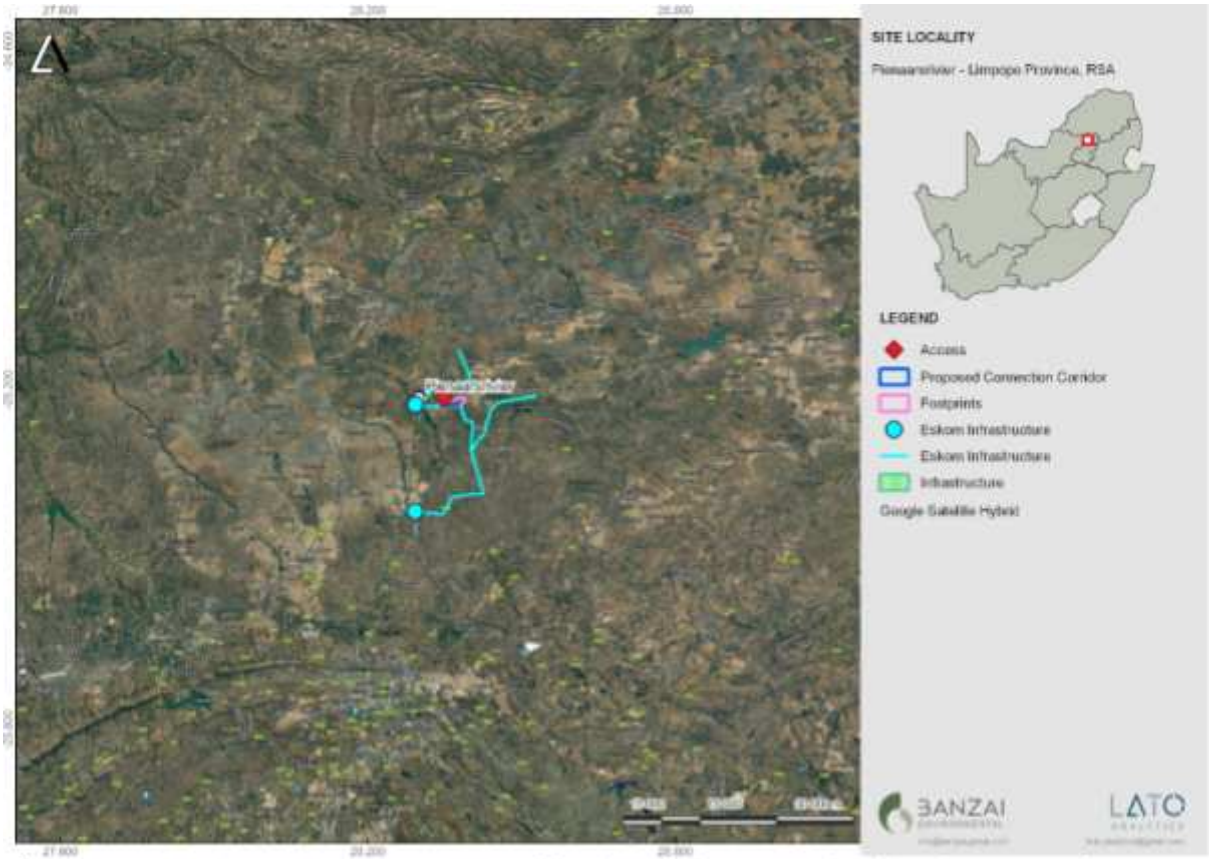



***Figure SEQ Figure * ARABIC 1:****Regional locality of the proposed Oribi Solar Power Plant near Pienaarsrivier in the Limpopo Province.*

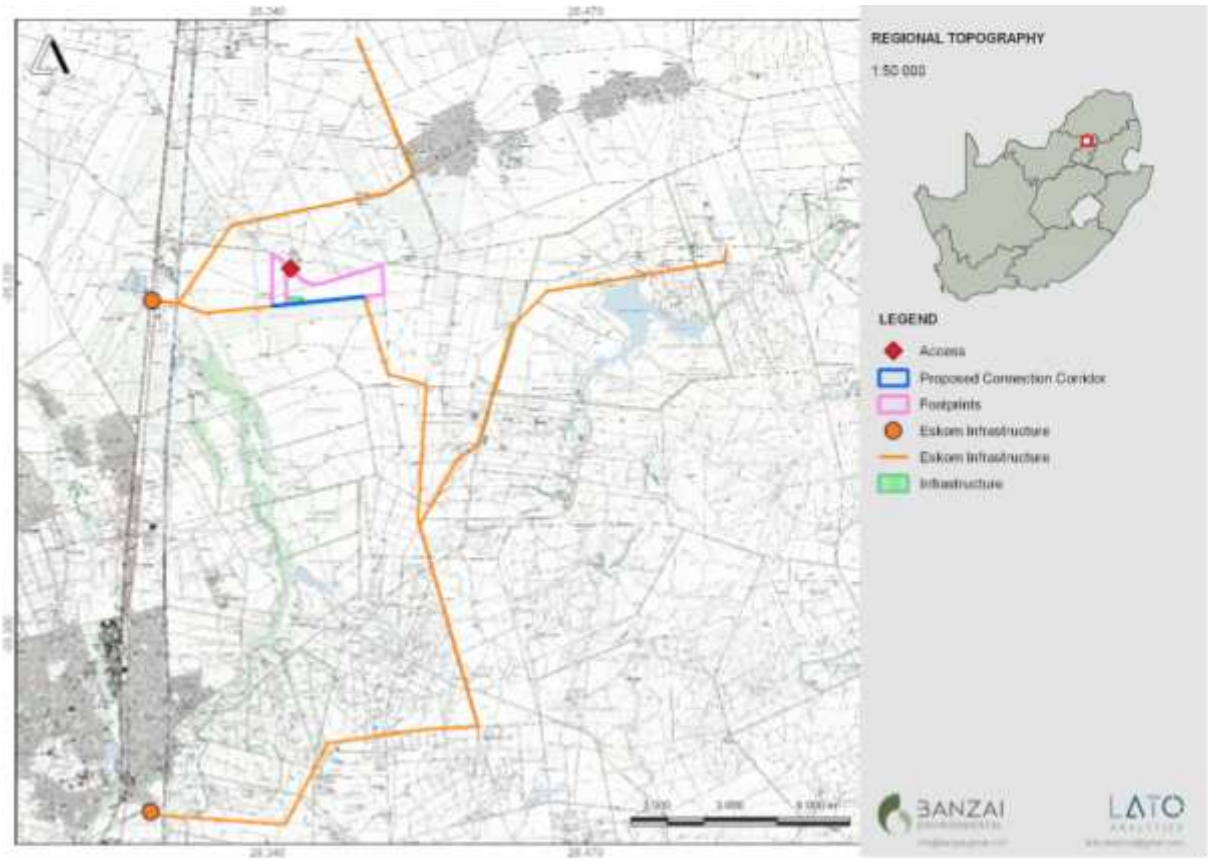



***Figure SEQ Figure * ARABIC 2**:Locality map of the proposed Oribi Solar Power Plant near Pienaarsrivier in the Limpopo Province.*

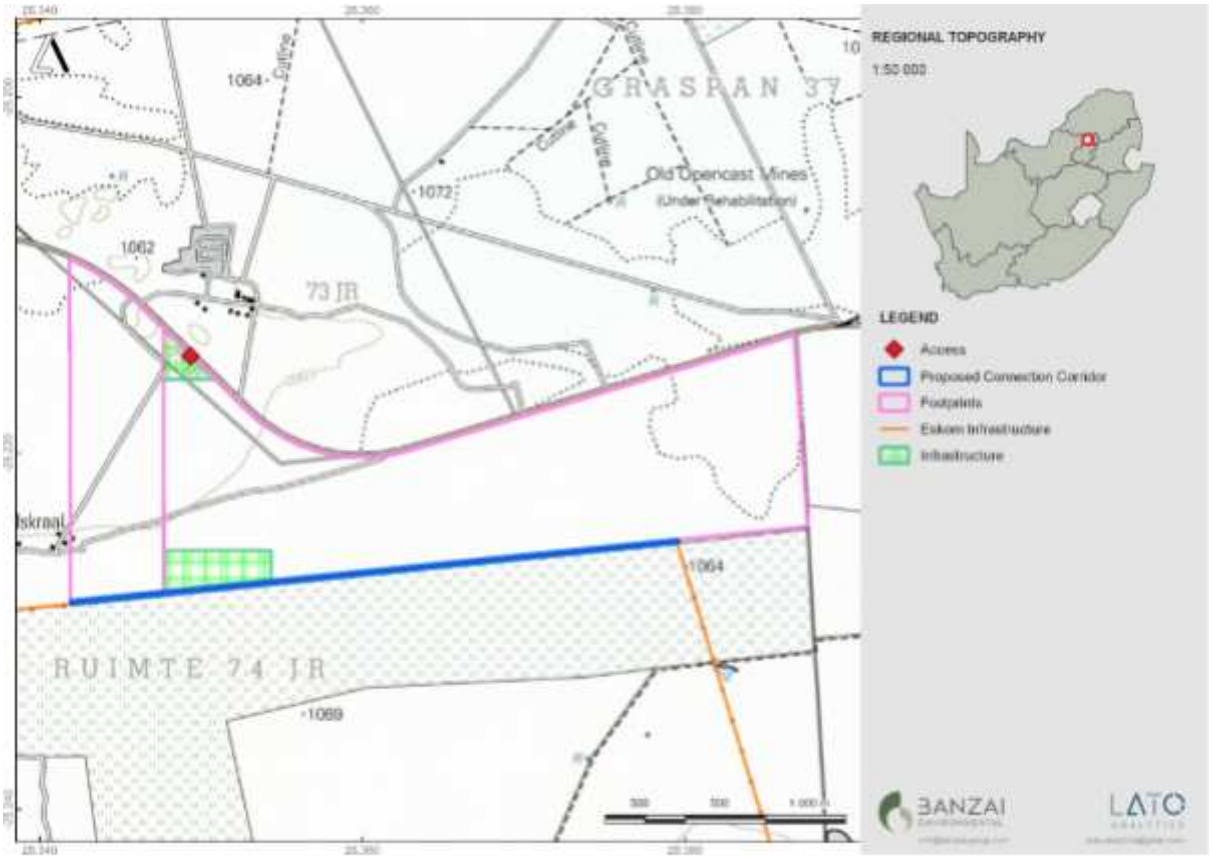



***Figure SEQ Figure * ARABIC 3**:Close-up view of the proposed Oribi Solar Power Plant near Pienaarsrivier in the Limpopo Province.*

***Table 2***:*General site information*

| | |
|---|---|
| Description of affected farm portion | Solar Power Plant:<br>Farm Rumite No. 720<br><br>Grid Connection:<br>Farm Ruimte No. 720 |
| Province | Limpopo |
| District Municipality | Waterberg District Municipality |
| Local Municipality | Bela-Bela Local Municipality |
| Ward numbers | 4 |
| Closest towns | Pienaarsriver is located approximately 1km east of the proposed development. |
| 21 Digit Surveyor General codes | Solar Power Plant:<br>Farm Rumite No. 720<br>T0JR00000000072000000<br><br>Grid Connection:<br>Farm Rumite No. 720<br>T0JR00000000072000000 |
| Type of technology | Photovoltaic solar facility |
| Structure Height | Panels ~ 6m;<br>Buildings ~ 6m;<br>Power line ~ 32m; and<br>Battery storage facility ~ 8m. |
| Battery storage | Within a 4-hectare area |
| Surface area to be covered (Development footprint) | 365 ha |
| Laydown area dimensions (EIA footprint) | Assessed 500 ha |
| Structure orientation | The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies |

| | |
|---|---|
| | according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is in order to capture the most sun. |
| Generation capacity | Up to 150MW |
| Description of affected farm portion | Solar Power Plant:<br>Farm Rumite No. 720<br><br>Grid Connection:<br>Farm Ruimte No. 720 |

### 1.1 Technical Details

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 150MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the Yield.

- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a

distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid via the proposed loop-in loop-out connection to the existing Pelly/SAR Pienaarsrivier 132 kV Overhead Line. The connection power line will be constructed within the limits of the grid connection corridor. The Project will inject up to 150MW into the National Grid. Refer to the figure below.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.
- Supporting Infrastructure – All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex which will include an on-site substation, Battery Energy Storage System, Operations and Maintenance buildings etc.
- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 $m^3$ of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via a public gravel road off of the D262 district road to the north of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

**Table 3**:Technical details for the proposed facility

| Component | Description / dimensions |
|---|---|
| **Height of PV panels** | 6 meters |
| **Area of PV Array** | 365 Hectares (Development footprint) |
| **Number of inverters required** | Minimum 50 |
| **Area occupied by inverter / transformer stations / substations / BESS** | Central inverters+ LV/MV trafo: 750 $m^2$<br>HV/MV substation with switching station: 3,35 ha<br>BESS: 5.5 ha (within the Infrastructure & Ancillary Complex) |
| **Capacity of on-site substation** | 132kV |
| **Capacity of the power line** | 132kV |
| **Area occupied by both permanent and construction laydown areas** | Permanent Laydown Area: 365 Hectares<br>Construction Laydown Area: ~5 ha |
| **Area occupied by buildings** | Infrastructure & Ancillary Complex: ~14.9 ha |
| **Battery storage facility** | Maximum height: 8m<br>Maximum volume: 1740 $m^3$<br>Capacity ~up to 150MWh |
| **Length of access roads** | 2.61 km |
| **Width of access roads** | 10 m |
| **Length of internal roads** | 12.8 km |
| **Width of internal roads** | 4 m – 6 m |
| **Length of perimeter roads** | 24.5 km |
| **Width of perimeter roads** | 4 m – 6 m |
| **Grid connection corridor width** | 200m up to 550m |
| **Grid connection corridor length** | ~ 2.8 km |
| **Power line servitude width** | 32m |
| **Height of fencing** | Approximately 2.5 meters |

## 1.2 Consideration of Alternatives

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of

alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

: No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

Location alternatives

No other possible sites were identified on the Farm Rumite No. 720. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

Generation from the facility will tie in with the existing existing Pelly/SAR Pienaarsrivier 132 kV Overhead Line by way of a Loop-In Loop-Out connection. The connection power line will be constructed within the limits of the grid connection corridor. The Project will inject up to 150MW into the National Grid.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume of 1,740m$^3$ of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to

enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

## 2. LEGAL MANDATE AND PURPOSE OF THE REPORT

The National Environmental Management Act identifies listed activities (in terms of Section 24) which are likely to have an impact on the environment. These activities cannot commence without obtaining an EA from the relevant competent authority. Sufficient information is required by the competent authority to make an informed decision and the project is therefore subject to an environmental assessment process which can be either a Basic Assessment Process or a full Scoping and Environmental Impact Assessment process.

The EIA Regulations No. 324, 325, and 327 outline the activities that may be triggered and therefore require EA. The following listed activities with special reference to the proposed development is triggered:

***Table 4**:Listed activities (SPPs)*

| **Relevant notice:** | **Activity No (s)** | **Description of each listed activity as per project description**: |
|---|---|---|
| GNR. 327 (as amended in 2017) | Activity 11(i) | • *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*<br>• Activity 11(i) is triggered as the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area. |
| GNR. 327 (as amended in 2017) | Activity 28(ii) | • *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*<br>• Activity 28(ii) is triggered as portions of the affected farm has been previously used for grazing and the property will be re-zoned to "special" use. |
| GNR. 327 (as amended in 2017) | Activity 24(ii) | • *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters;*<br>• Activity 24(ii) is triggered as the access road will be 8-10 meters in width. |
| GNR. 327 (as amended in 2017) | Activity 56 (ii): | • *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"*<br>• Activity 56 (ii) is triggered as the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres. |

| | | |
|---|---|---|
| GNR. 325 (as amended in 2017) | Activity 1 | • *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*<br>• Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 150 megawatts electricity through the use of a renewable resource. |
| GNR. 325 (as amended in 2017) | Activity 15 | • *"The clearance of an area of 20 hectares or more of indigenous vegetation."*<br>• More than 20 hectares of indigenous vegetation will be cleared. |

The activities triggered under Listing Notice 1 and 2 (Regulation 327 & 325) for the project implies that the development is considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation measures. The listed activities indicated above are subject to change with the input from specialists.

## 3. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She 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-eight 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.

## 4. LEGISLATION

### 4.1 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".

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the

South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and 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), an 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 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 $m^2$ in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 $m^2$ in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

## 5. 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 of 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).

## 6. GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Oribi Solar Power Plant near Pienaarsrivier in the Limpopo Province is depicted on the 1: 250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) (Figure 4, Table 5-6). The proposed Oribi SPP is located in the Springbokflats Basin and is largely underlain by the Letaba Formation (Lebombo Group, Karoo Igneous Province) with a small portion of Irrigasie Formation (P-Tri) (Undifferentiated Karoo) in the south west of the development footprint. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Karoo Igneous Province is Zero while that of

the Irrigasie Formation is Very High (Almond and Pether, 2009; Almond *et al*., 2013, Groenewald et al 2014) (**Figure 5**). Updated Geology (Council of Geosciences) indicates that the proposed development is mainly underlain by the Lahau Formation (Lebombo Group, Karoo-Ferrar igneous intrusions) and the Late Triassic Molteno Formation (Stormberg Group, Karoo Supergroup).

A large portion of the development footprint (**Figure 4**) is underlain by the Letaba Formation of the Karoo Igneous Province that is one of the world's classic continental basalt (CFB) provinces. This province consists of intrusive and extrusive rocks that occur over a large area (Duncan et al, 2006). Generally, the flood basalts do not contribute to prominent volcanic structures, but instead are formed by successive eruptions from a set of fissures that form sub-horizontal lava flows (sills and dykes) varying in thickness. This lava caps the landscape on which they erupted. As the Karoo is an old flood basalt province it is today preserved as erosional fragments of a more extensive lava cap that covered much of southern Africa in the geological past. It is estimated that the Karoo lava outcrop currently covered at least 140 000 $km^2$ while it was larger in the past [~2 000 000 $km^2$ (Cox 1970, 1972)].

The Karoo Igneous Province contains a large volume of flood basalts as well as silicic volcanic rocks. These units are comprised of rhyodacite and rhyolitic magma and crops out along the Lebombo monocline. Individual units span up to 60 km and sometimes show massive pyroclastic structures and are thus classified as rheoignimbrites. The basal lavas lie conformable on the Clarens Formation but in specific localities sandstone erosion occurred before the volcanic eruptions took place. Lock *et al* (1974) found evidence in the Eastern Cape that in the early stages of volcanism magma interacted with ground water to produce volcaniclastic deposits as well as phreatic and phreatomagmatic diatremes. Eales *et al* (1984) also found evidence of aqueous environments during early volcanism by the existence of pillow lavas and associated hyaloclastite breccias and thin lenses of fluviatile sandstones interbedded with the lowermost magmas. These basalts are igneous in origin and thus unfossiliferous.

The Irrigasie Formation comprise of brownish-red mudstone with green mottling. A change of color occurs towards the base when the sediments change to purple with a thin grey mudstone zone with shale directly above the Coal Zone. Sandston of up to 45m is generally present within the purple and grey mudrock. This unit includes sequences of conglomerate grade upwards into siltstone or erosive base fining upwards. Sediments of this Formation may reach a maximum thickness of approximately 200m (Johnson *et al*., 2006). Deposition occurred by sluggish, ephemeral suspension-load rivers in low-lying lakes or floodplains. Bioturbation is a common feature in this Formation. Dinosaur fossils have been uncovered and is possibly remains of "Euskelosaurus" while remains of the so-called *Gigantoscelus* have also been found. The latter is an intermediate sauropod that may come from the Clarens Formation. A very important fossil locality located at Hammanskraal on the Gauteng/Limpopo border have been described. During the deposition of this Formation the climate became drier and is indicated by the predominantly red

colour indicating oxidation conditions. Although a high Palaeontological Sensitivity has been allocated to the Irrigasie Formation in the Limpopo Province, outcrops are sporadic and generally associated with mining activities. Surface exposure is poor and generally data is acquired from borehole cores (Groenewald et al, 2014).

The Molteno Formation of the Stormberg Group is Late Triassic in age. In its most southern outcrop this formation is about 600m thick and can be divided into five members (Turner, 1975; Christie, 1981) namely [oldest (bottom) to youngest (top)] Bamboesberg, Indwe, Mayaputi, Qiba and Tsomo Members. This Formation becomes thinner and reaches 10m in the far north. The Molteno Formation consists of alternating coarse to medium grained sandstones and grey mudrocks. The characteristic "glittering" look of this Formation is caused by secondary quartz overgrowths. This Formation is known for well-preserved insect and plant fossils with coal seams in places. The Bamboesberg Member is the basal member in the south while the Indwe Sandstone Member, is the only representative in the north. These Members overlies the Beaufort Group unconformably (Turner, 1975). The Bamboesberg Member is about 130m thick and is a complex succession that becomes finer upwards in the succession and more erosively based. Medium to fine grained sandstone beds is present with thin, lenticular mudrock intercalations. The Indwe Sandstone Member is about 60m thick and consists of course (pebbly) to medium grained sandstones with an erosively based cobble and pebble bed at its base. The Mayaputi Member is thicker than 50 m and is mostly an argillaceous unit while the more than 60m thick Qiba Member consists of fine- to medium-grained sandstone beds associated with thin mudrock partings. The Tsomo Member is about 300m thick and comprise of a recurring pattern of erosively based, coarse-grained to pebbly sandstones (up to 25m thick) grading upwards into mudrock units (up to 60 m thick). The Molteno Formation is known from two sporadically developed coal seams present in the Tsomo Member comprising of thin, lenticular coal seams.

The Dicroidium Flora of Gondwana preserved in the Molteno Formation is known for the richest plant fossils in the world comprising of diverse vascular plant fossils (horsetails, ferns, gymnosperms include ginkgophytes, cycads, conifers, and seed ferns, silicified woods and palynomorphs) insect's groups as well as dinosaur trackways. Other fossils include bivalves, conchostracans, fish as well as invertebrate trace fossils. This Formation is not known to contain vertebrate fossils (Hancox et al 2020).

The proposed development is underlain by the Letaba Formation of the Karoo Igneous Province as well as the Irrigasie Formation of the Undifferentiated Karoo (Karoo Supergroup).

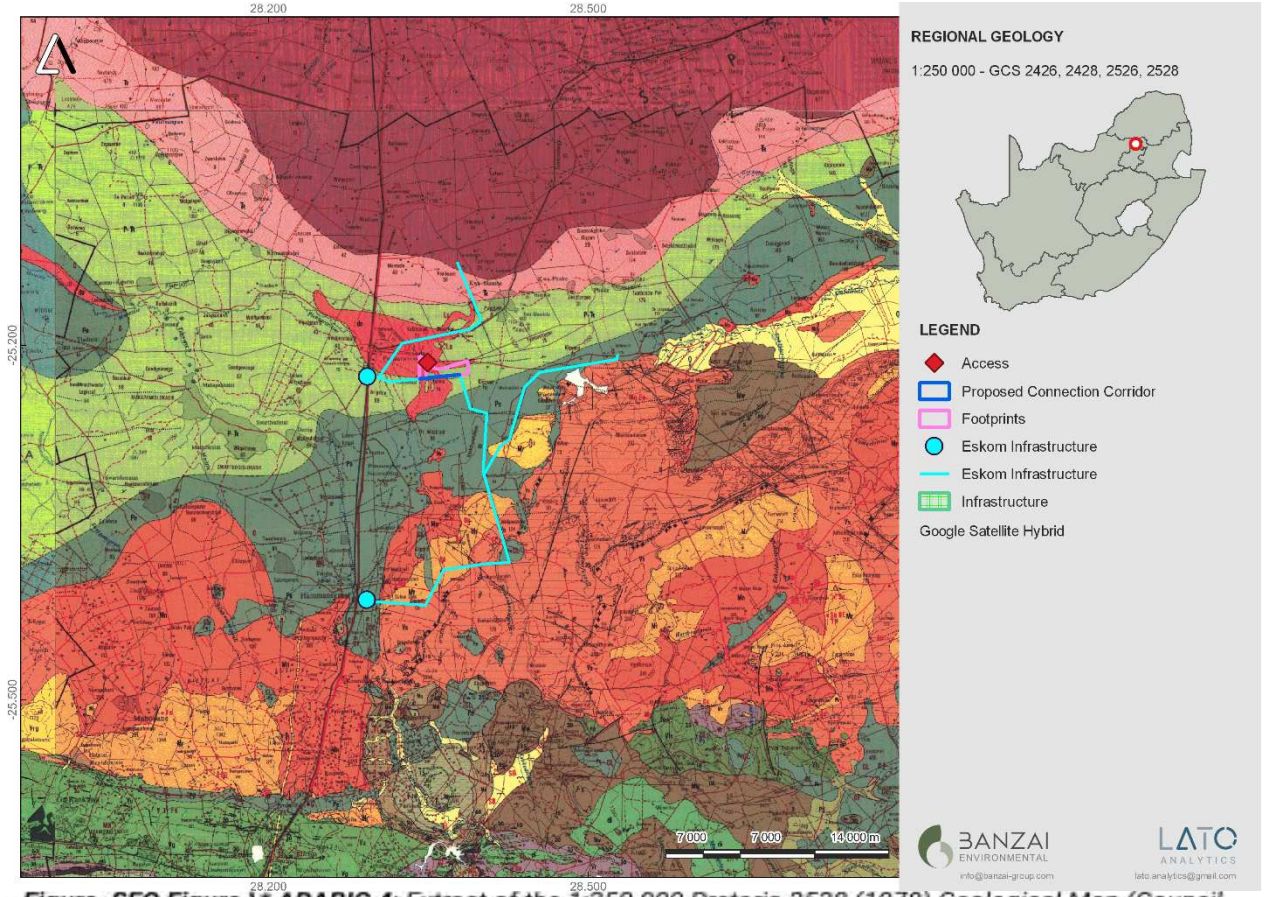
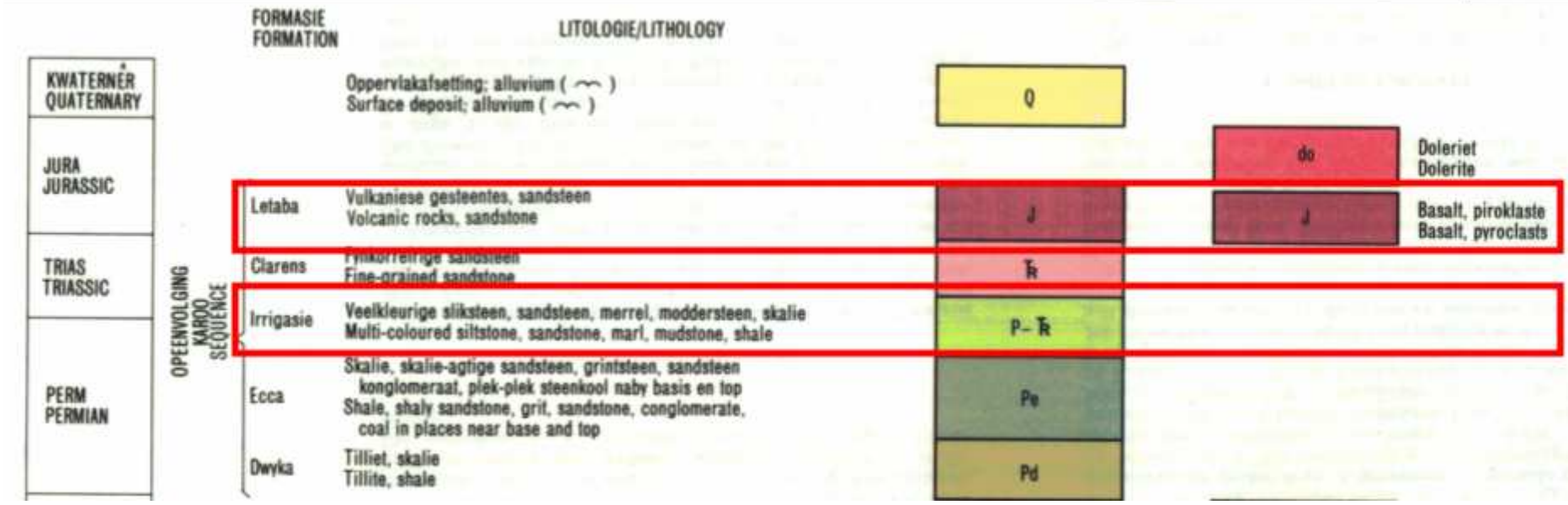



***Figure SEQ Figure * ARABIC 4**: Extract of the 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria) indicating the proposed Oribi SPP development near Pienaarsrivier in the Limpopo Province*

***Table SEQ Table * ARABIC 5**: Legend to the Pretoria 2528 (1978) Geological Map (Council for Geoscience, Pretoria).*

*Relevant sediments are indicated in a red square*



The Karoo Igneous Province can be divided into the Lebombo Group and the Drakensberg Group.

| **Table 6**: Formal stratigraphic units of the Karoo Igneous Province | | | |
|---|---|---|---|
| Karoo Igneous Province | | | |
| Drakensberg Group | | Lebombo Group | |
| Formation | Rock Type | Formation | Rock Type |
| | | Movene | Basalt |
| | | Mbuluzi | Rholite |
| | | Jozini | Rhyodacite |
| Lesotho | Basalt | Sabie River | Basalt |
| Barkley East | Basalt | Letaba | Picritic basalt |
| | | Mashikri | Nephelinite |

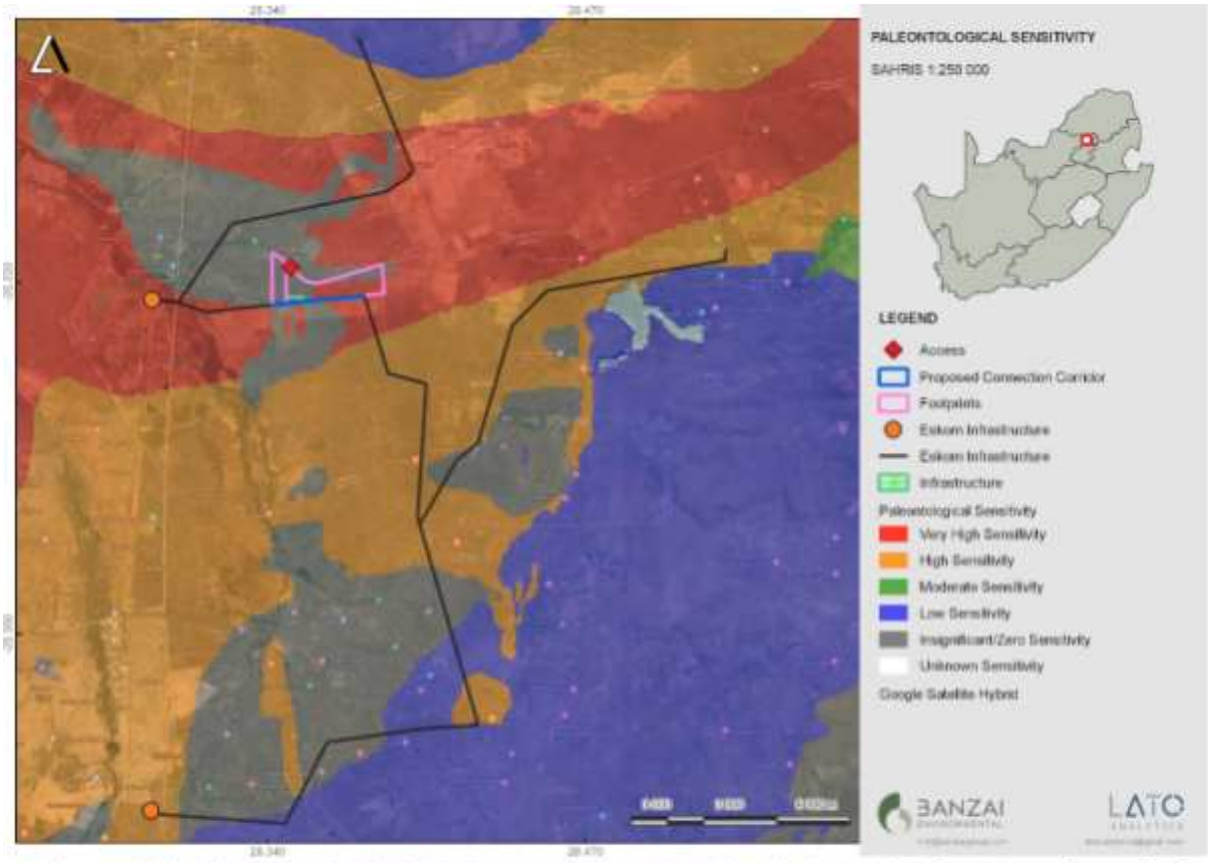



***Figure SEQ Figure * ARABIC 5**: Extract of the 1 in 250 000 SAHRIS PalaeoMap (Council of Geosciences) indicating the proposed Oribi SPP development near Pienaarsrivier in Limpopo.*

***Table 7:*** *Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).*

| 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. |

The SAHRIS Palaeosensitivity map (Figure 5) indicates that the proposed development is underlain by sediments with a Very High (red) and Zero (grey) Palaeontological Sensitivity.

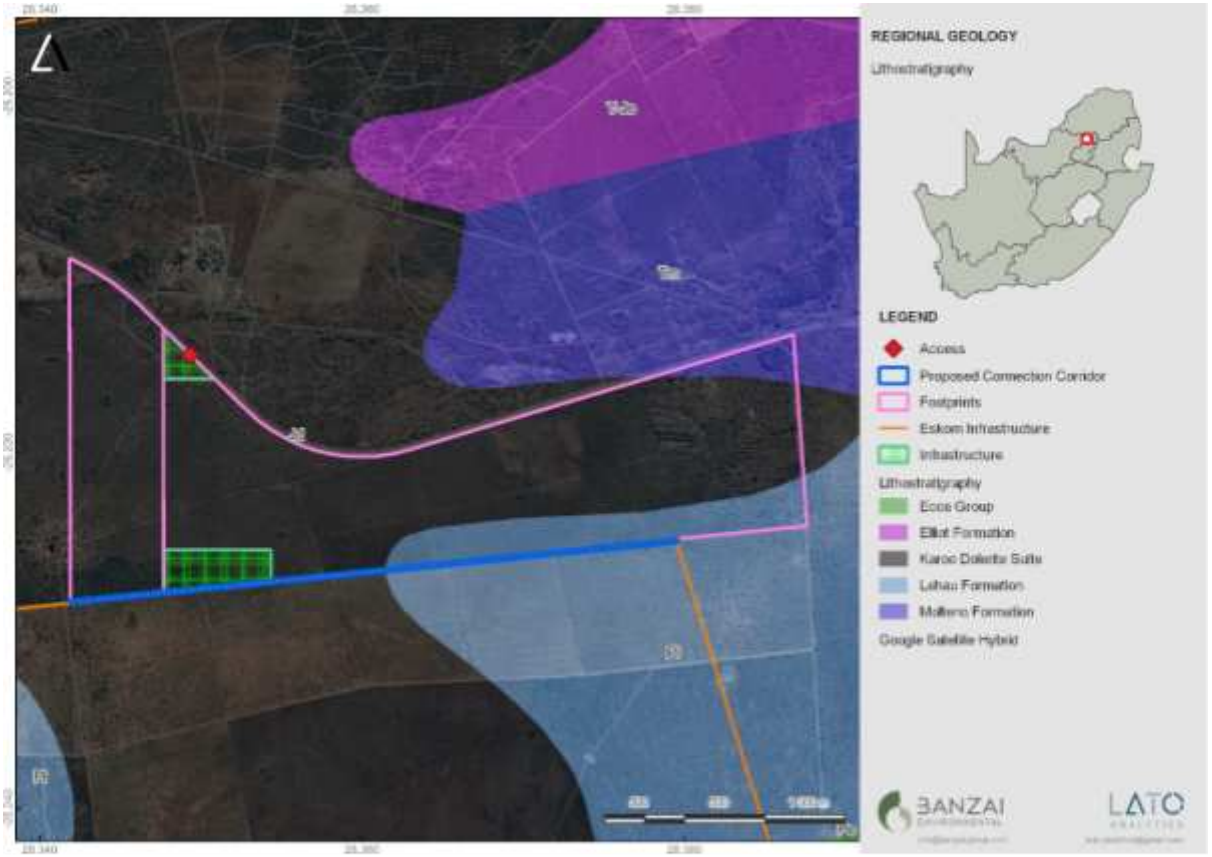



***Figure SEQ Figure * ARABIC 6:*** *Updated Geology (Council of Geosciences, Pretoria) of the proposed Oribi SPP development indicates that development is underlain by the Karoo Dolerite Suite as well as the Molteno Formation of the Stormberg Group.*

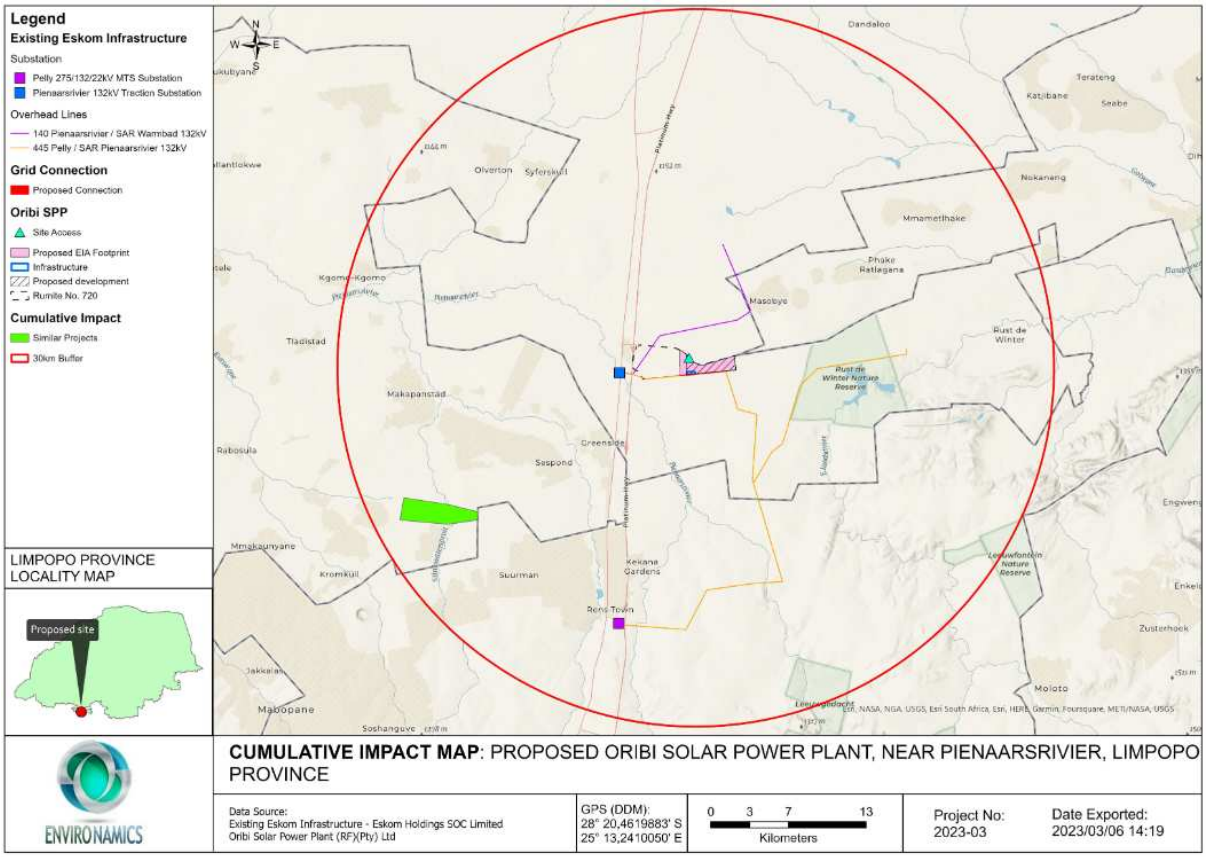



***Figure SEQ Figure * ARABIC 7**: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines for the Oribi SPP*

Solar Facilities to the west of the Oribi SPP will have a Zero to Very High Palaeontological Sensitivity. However, it is important to note that the quality of preservation of these different sites will most probably vary and it is thus difficult to allocate a Cumulative Sensitivity to the projects. If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will vary between Low and Medium.

***Table 8**: A summary of related facilities, that may have a cumulative impact, in a 30 km radius of the Oribi SPP*

| Site name | Distance from study area | Proposed generating capacity | DEFF reference | EIA process | Project status |
|---|---|---|---|---|---|
| Moretele Solar Power Plant | 21 km | 100 MW | 14/12/16/3/3/2/423 | Scoping and EIA | Approved |

It is unclear whether other projects not related to renewable energy is or has been constructed in this area, and whether other projects are proposed. In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm development may take place within the general area.

## 7. GEOGRAPHICAL LOCATION OF THE SITE

Pienaarsriver is located approximately 1km east of the proposed development (Figure 1-3).

## 8. METHODS

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

### 8.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps 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 also used to provide information on the existence of fossils in an area which has 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.

## 9. 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)
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website
- A Google Earth kmz files, background information as well as screening report of the proposed development was obtained from Environamics.
- Google Earth© satellite imagery.
- 1:250 000 Pretoria 2528 (1978) Geological Map (Council for Geosciences, Pretoria),
- Published geological and palaeontological literature as well as
- Relevant PIAs in the area that includes that of Almond 2013, Bamford 2021, Fourie
- A two day-comprehensive site-specific field survey of the development footprint for the combined projects was conducted on foot and motor vehicle in 11-12 March 2023.

## 10. SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 April 2023. No fossiliferous outcrops were identified during the site visit.

***Figure SEQ Figure * ARABIC 8**:Study area located on a very flat topography and is covered by lush vegetation.*

## 11. IMPACT ASSESSMENT METHODOLOGY

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 4.1.

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 total number of points scored for each impact indicates the level of significance of the impact.

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 project phases:

- planning
- construction
- operation
- 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 9**:The rating system*

| **NATURE** |
|---|
| Loss 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 + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

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 | | 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 effects. |

***Table 10**:Summary of Impacts*

| SPECIALIST STUDY | IMPACT | PRE-MITIGATION RATING | POST MITIGATION RATING | SUMMARY OF MITIGATION MEASURES |
|---|---|---|---|---|
| Palaeontological Impact Assessment | Disturbance, damage or destruction of legally protected fossil heritage within the development footprint during the construction phase | 48 | 16 | The ECO for this project must be informed that the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity.<br><br>If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources 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) so that mitigation (recording and collection) can be carried out.<br><br>Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012). |

| | | | | |
|---|---|---|---|---|
| | | | | These recommendations should be incorporated into the Environmental Management Plan for the Oribi Solar Power Plant. |

## 12. FINDINGS AND RECOMMENDATIONS

The proposed Oribi SPP is located in the Springbokflats Basin and is largely underlain by the Letaba Formation (Lebombo Group, Karoo Igneous Province) with a small portion of Irrigasie Formation (Undifferentiated Karoo) in the south west of the development footprint. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of Karoo Igneous Province is Zero while that of the Irrigasie Formation is Very High (Almond and Pether, 2009; Almond *et al*., 2013, Groenewald et al 2014). Updated Geology (Council of Geosciences) indicates that the proposed development is mainly underlain by the Lahau Formation (Lebombo Group, Karoo-Ferrar igneous intrusions) and the Late Triassic Molteno Formation (Stormberg Group, Karoo Supergroup). The potential fossiliferous sedimentary bedrocks have often been thermally metamorphized by overlying dolerite sills compromising their palaeontological sensitivity.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 April 2023. No fossiliferous outcrop was detected in the proposed development area. A medium Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a very low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

Recommendations:

- The ECO for this project must be informed that the Irrigasie Formation/ Late Triassic Molteno Formation (Karoo Supergroup) has a Very High Palaeontological Sensitivity.
- If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources 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) so that mitigation (recording and collection) can be carried out.

- Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
- These recommendations should be incorporated into the Environmental Management Plan for the Oribi Solar Power Plant.

## 13. CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

### Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the National Heritage Resources Act (Act No 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.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived 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.

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.

**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.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. 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 the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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# APPENDIX A

| | |
|---|---|
| PROFESSION: | Palaeontologist |
| YEARS' EXPERIENCE: | 30 years in Palaeontology |
| EDUCATION: | B.Sc Botany and Zoology, 1988<br>University of the Orange Free State |
| | B. Sc (Hons) Zoology, 1991<br>University of the Orange Free State |
| | Management Course, 1991<br>University of the Orange Free State |
| | M. Sc. *Cum laude* (Zoology), 2009<br>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<br>University of the Free State Zoology 1992 |
| Research Assistant | National Museum, Bloemfontein 1993 – 1997 |
| Principal Research Assistant<br>and Collection Manager | National Museum, Bloemfontein<br>1998–2022 |

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Butler. E. 2022. Palaeontological Impact Assessment for the proposed development of a 10 MW Solar Photovoltaic (PV) Plant and associated grid connection infrastructure on Portion 9 of the Farm Little Chelsea 10, Eastern Cape Province.

Butler. E. 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 1 Solar Park, located on the Remaining Extent of Portion 18 of Farm 425, near Klerksdorp within the North-West Province.

Butler. E., 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 2 Solar Park, located on the Remaining Extent of Portion 8 of Farm 425, near Klerksdorp within the North-West Province.

Butler. E., 2022.Palaeontological Desktop Assessment to assess the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Delta Solar Power Plant on the remaining extent of the farm Kareefontein No. 340, Dr Ruth Segomotsi Mompati District Municipality, Lekwa-Teemane Local Municipality near Bloemhof in the North West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Sonneblom Solar Power Plant (SPP) on Portion 1 of the farm Blydschap No. 504 within the Mangaung Metropolitan Municipality, southeast of Bloemfontein in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV One Project near Viljoenskroon in the Free State.

Butler. E., 2022.Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State.

Butler. E., 2022.Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State

Butler. E., 2022.Palaeontological Impact Assessment for the Ngwedi Solar Power near Viljoenskroon in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line near Orkney in the North West.

Butler. E., 2022. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment for the Thakadu Solar Plant which near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment of the Kentani, Braklaagte, Klipfontein, Klipfontein 2, Leliehoek and Sonoblomo PV Facilities located near Dealsville in the Free State Province

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Harvard 1 Solar Photovoltaic (PV) facility on Portion 5 of Farm Spes Bona no 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for proposed Harvard 2 Solar Photovoltaic (PV) facility on Portion 8 of Farm Spes Bona No 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Doornrivier Solar 1, southwest of Matjhabeng (formerly Virginia) in the Free State

Butler. E., 2022. Palaeontological Desktop Assessment for the proposed Leeuwbosch PV solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality in the North West Province.

## APPENDIX 3: Heritage Screening Assessment

CTS HERITAGE

# HERITAGE SCREENER

| | |
|---|---|
| CTS Reference Number: | **CTS23_037** |
| SAHRIS Ref | |
| Client: | **Environamics** |
| Date: | **March 2023** |
| Title: | **Proposed development of the Oribi PV Facility and Grid Connection near Pienaarsrivier, Limpopo Province** |

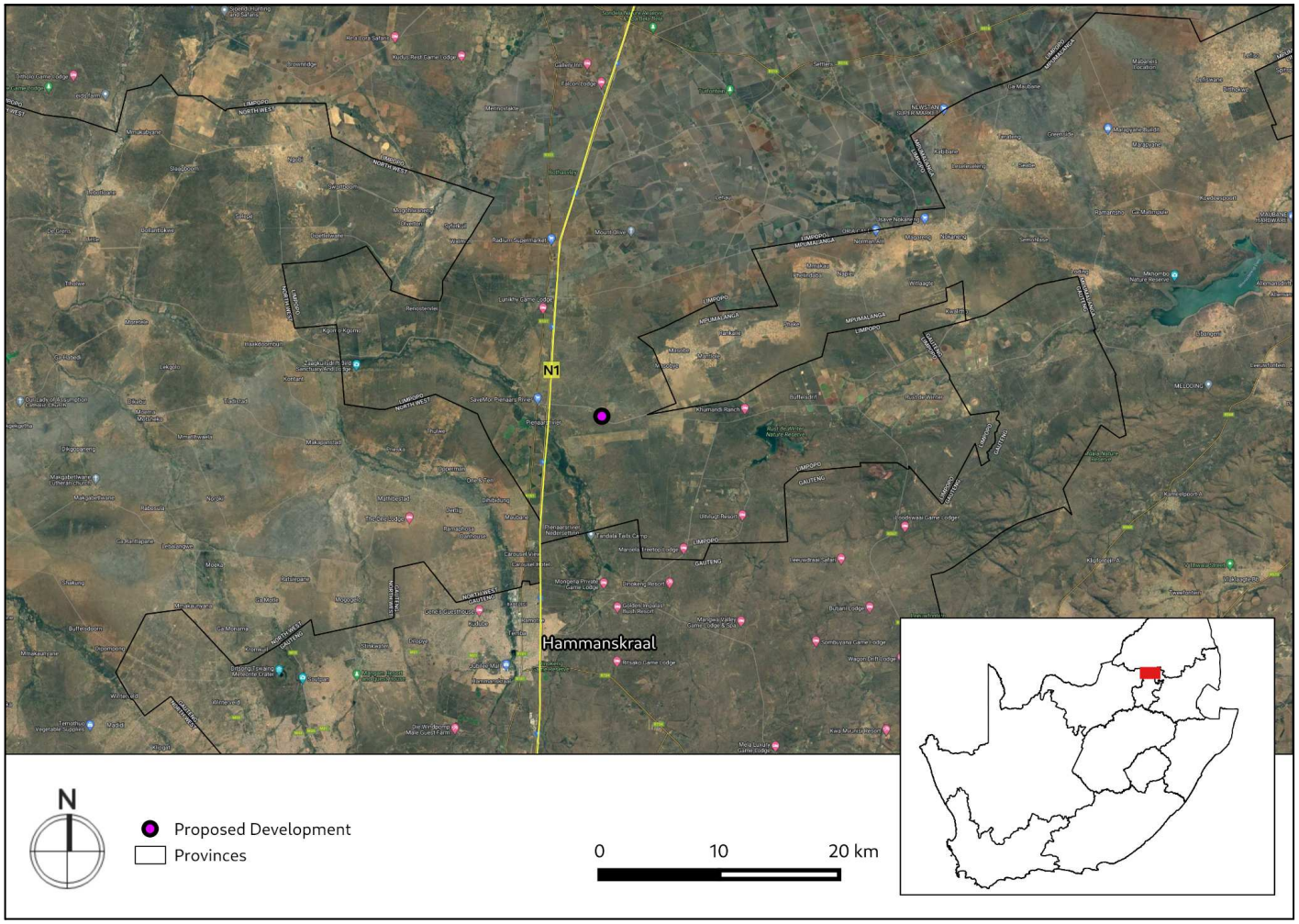


**Figure 1a**. Satellite map indicating the location of Oribi Solar PV Energy Facility in the Limpopo Province

| | |
|---|---|
| Recommendation: | **RECOMMENDATION**<br>**The area proposed for development is located in an area of high archaeological and cultural landscape sensitivity. It is recommended that a full HIA be undertaken to assess the impacts likely to result from the proposed development of the PV facility and associated grid connections. It is recommended that an alternative location is considered that is located more than 3km from this significant context.** |

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CTS HERITAGE

## 1. Proposed Development Summary

This report assesses the anticipated impacts to heritage resources that are likely to result from the development of the proposed Oribi SPP located near Hammanskraal.

## 2. Application References

| | |
|---|---|
| **Name of relevant heritage authority(s)** | SAHRA |
| **Name of decision making authority(s)** | Limpopo Department of Economic Development, Environment and Tourism (LDEDET) |

## 3. Property Information

| | |
|---|---|
| **Latitude / Longitude** | |
| **Erf number / Farm number** | |
| **Local Municipality** | |
| **District Municipality** | Waterberg |
| **Province** | Limpopo |
| **Current Use** | Agriculture |
| **Current Zoning** | Agriculture |

## 4. Nature of the Proposed Development

| | |
|---|---|
| **Total Surface Area** | TBA |
| **Depth of excavation (m)** | TBA |
| **Height of development (m)** | TBA |

## 5. Category of Development

| | |
|---|---|
| **x** | **Triggers: Section 38(8) of the National Heritage Resources Act** |
| | **Triggers: Section 38(1) of the National Heritage Resources Act** |
| | 1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length. |
| | 2. Construction of a bridge or similar structure exceeding 50m in length. |
| | 3. Any development or activity that will change the character of a site- |
| x | a) exceeding 5 000$m^2$ in extent |
| | b) involving three or more existing erven or subdivisions thereof |
| | c) involving three or more erven or divisions thereof which have been consolidated within the past five years |
| | 4. Rezoning of a site exceeding 10 000$m^2$ |
| | 5. Other (state): |

## 6. Additional Infrastructure Required for this Development

| |
|---|
| TBA |

## 7. Mapping (please see Appendix 3 and 4 for a full description of our methodology and map legends)

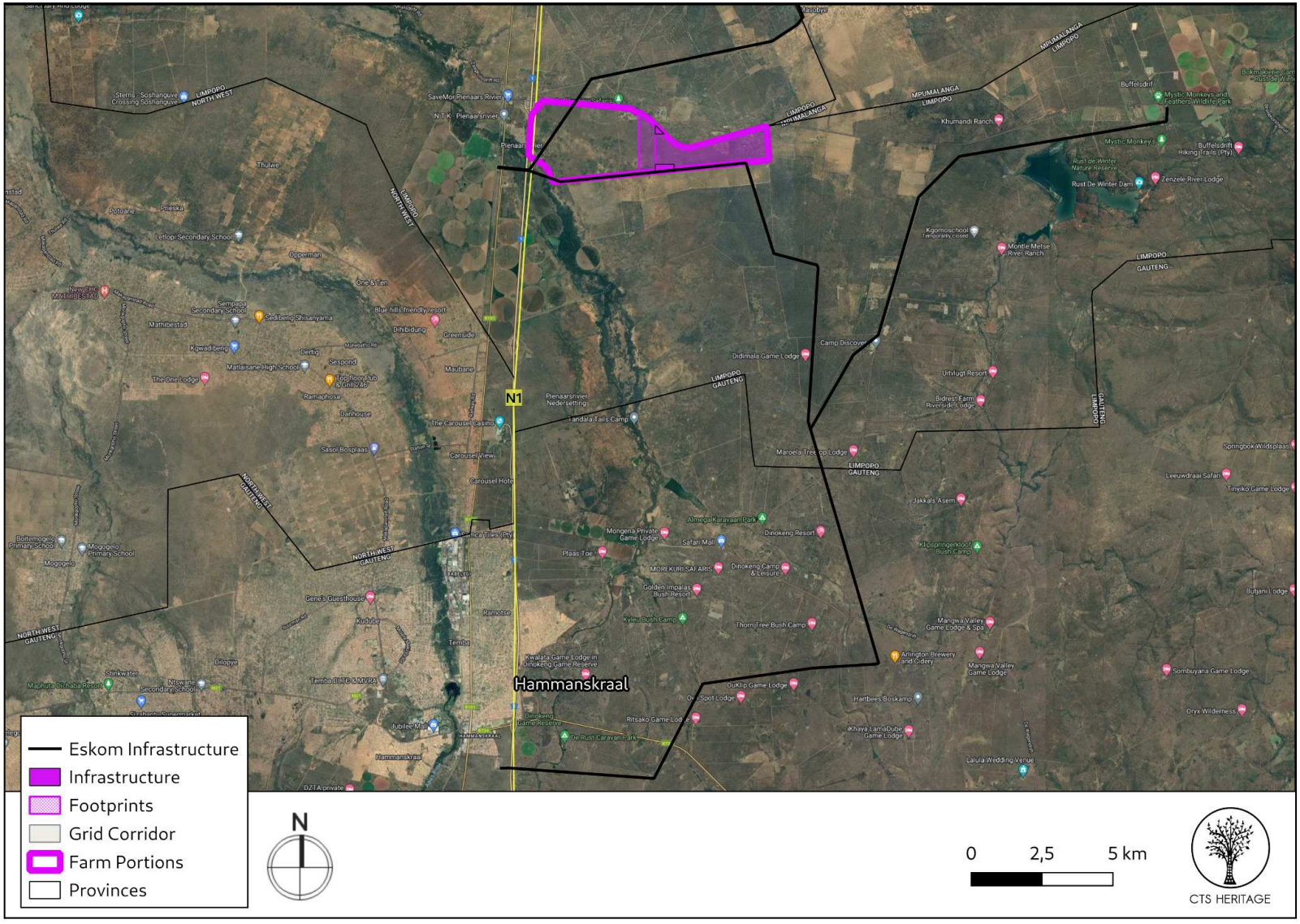


**Figure 1b Overview Map**. Satellite image (2022) indicating the proposed development area.

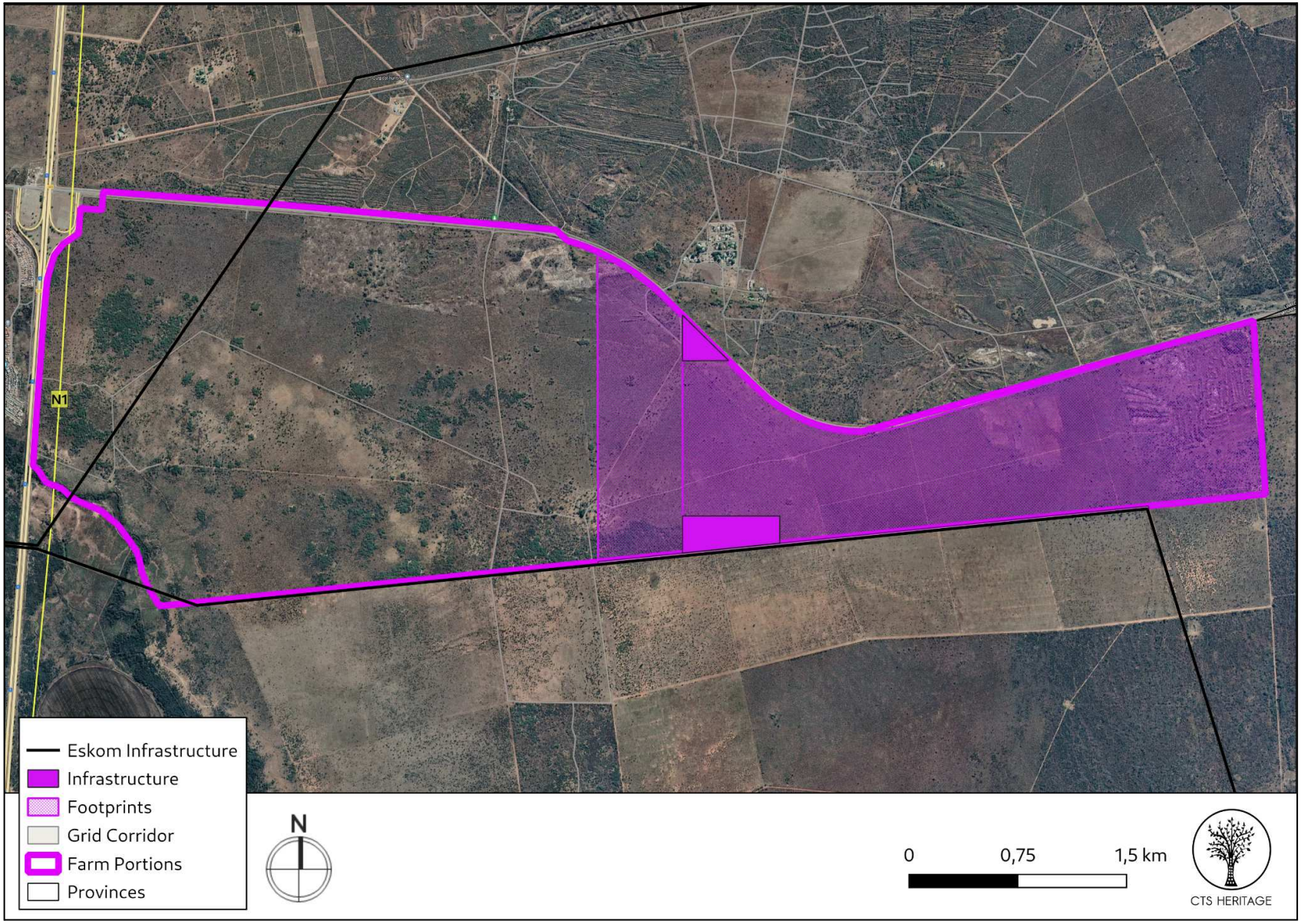


**Figure 1c Overview Map**. Satellite image (2022) indicating the proposed development area, close up.

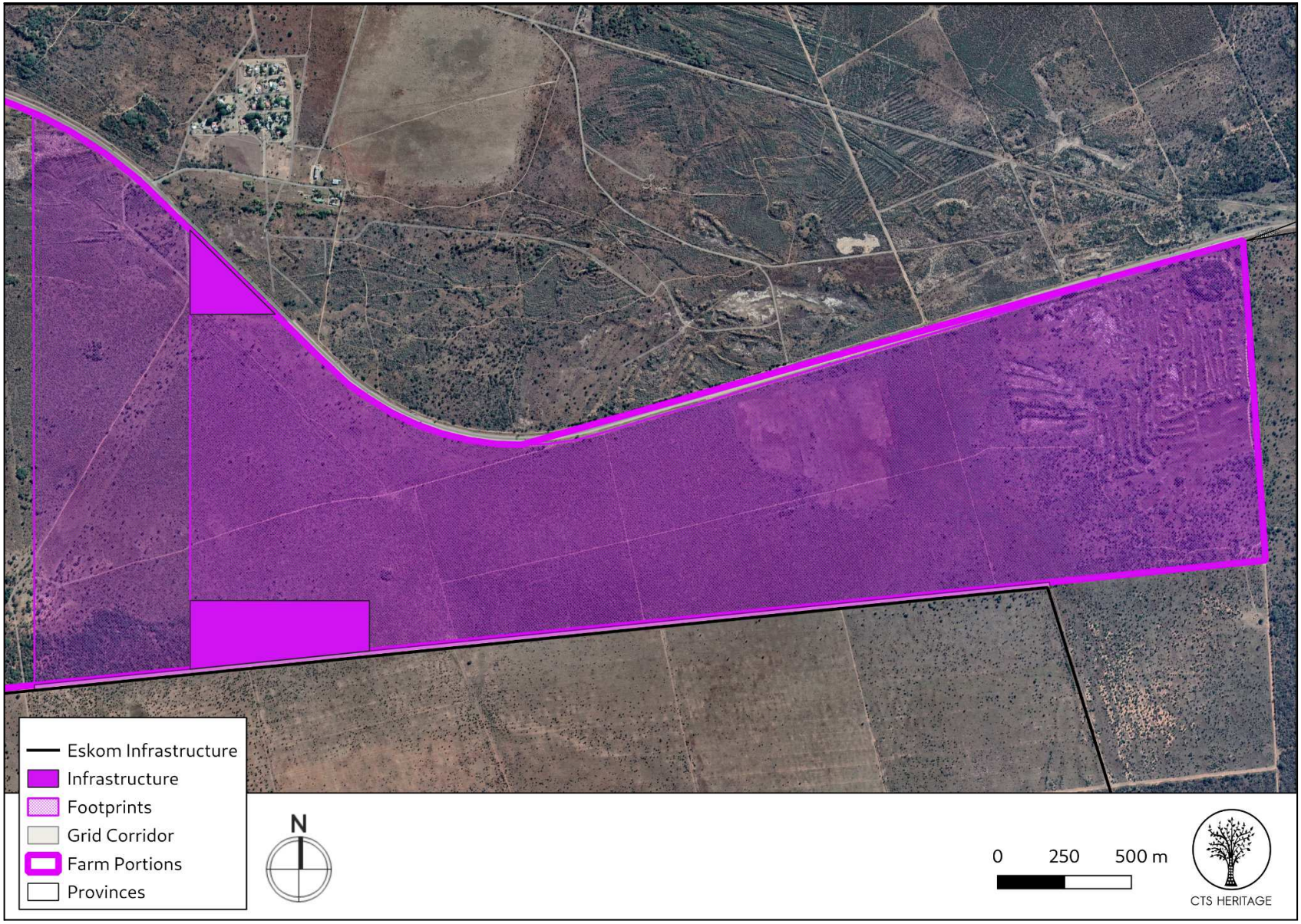


**Figure 1d Overview Map**. Satellite image (2022) indicating the proposed development area, close up.

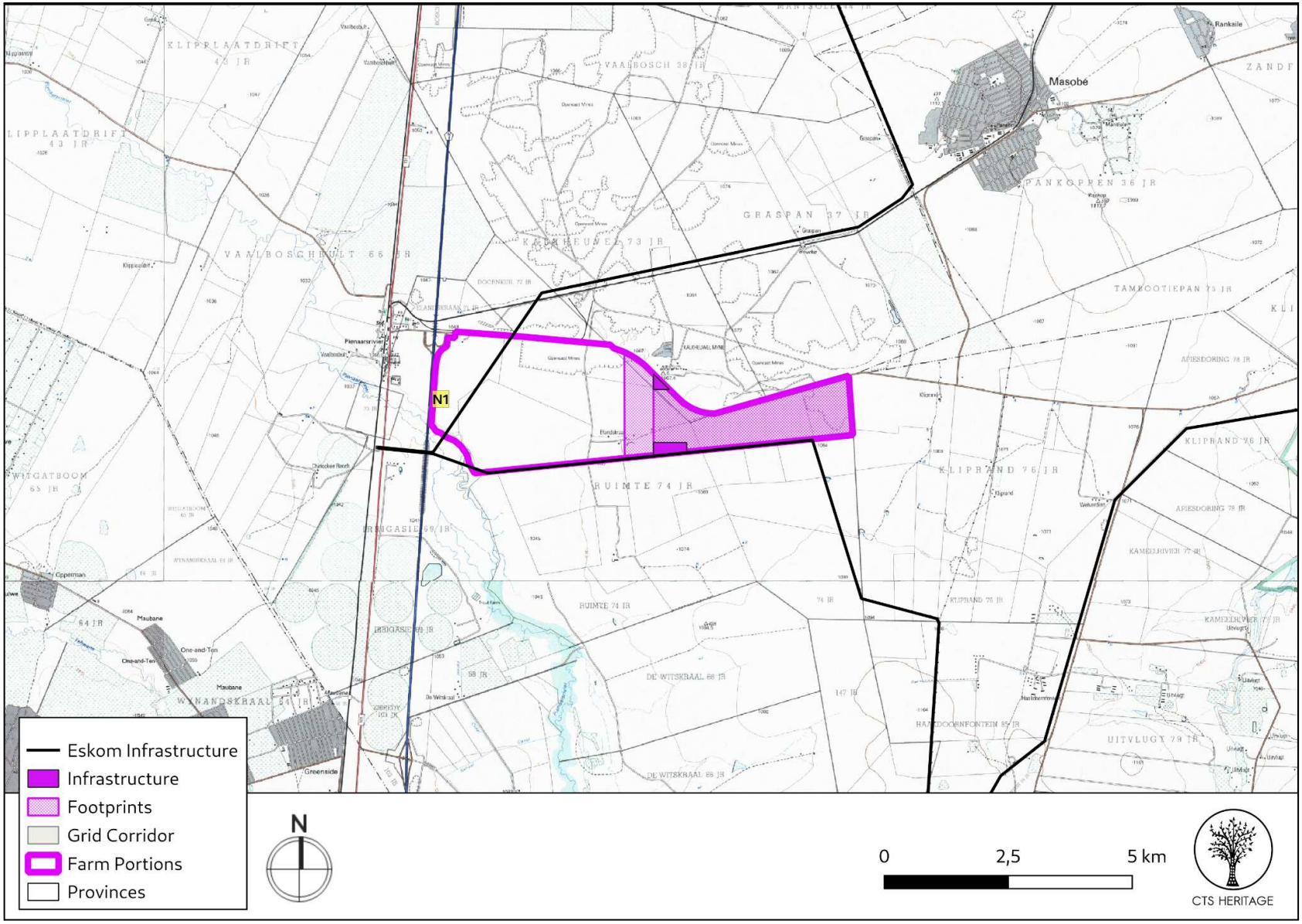


**Figure 1e Overview Map**. Extract from the 1:50 000 Topo map for the development area.

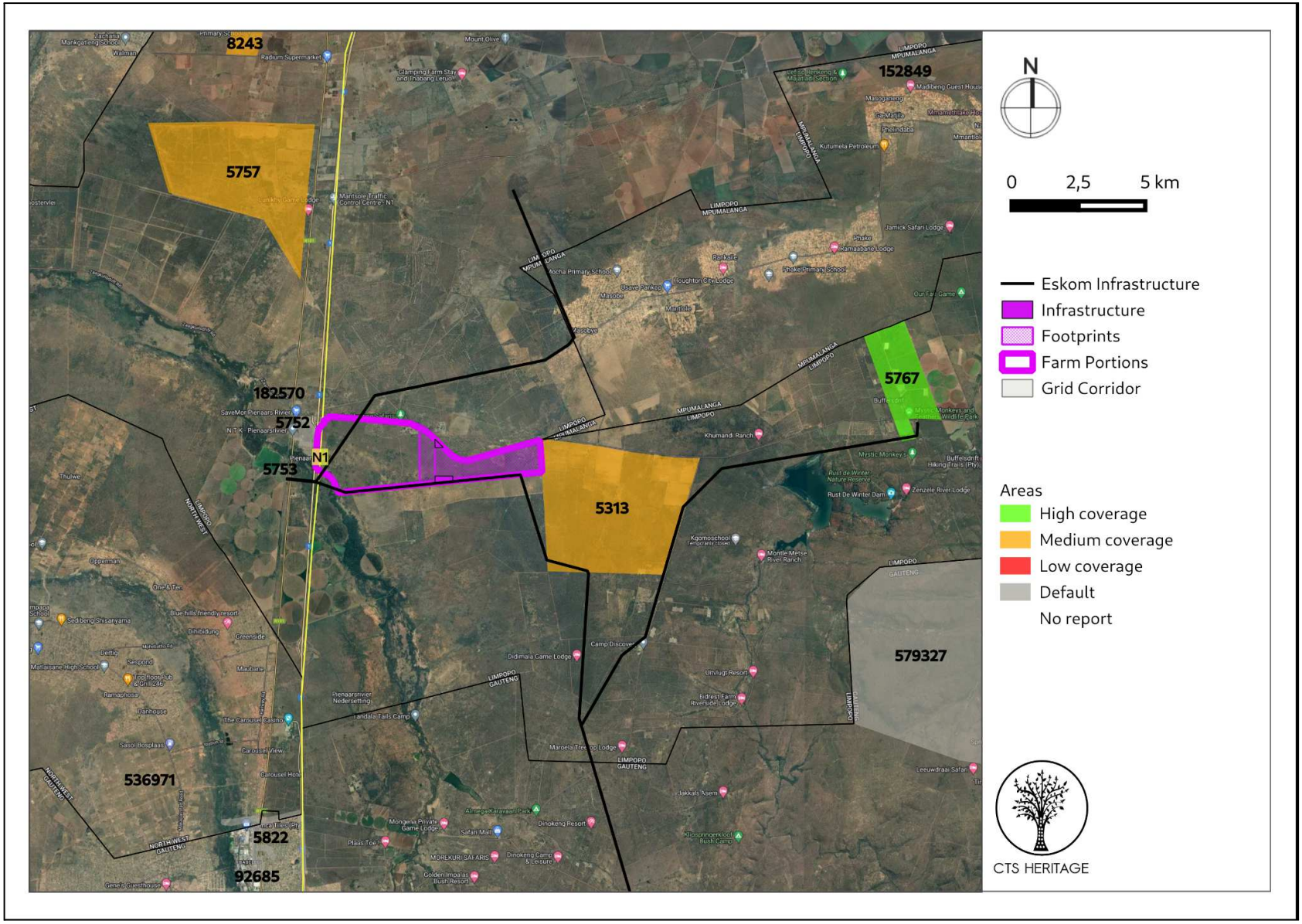


**Figure 2. Previous HIAs Map.** Previous Heritage Impact Assessments surrounding the proposed development area within 15km, with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

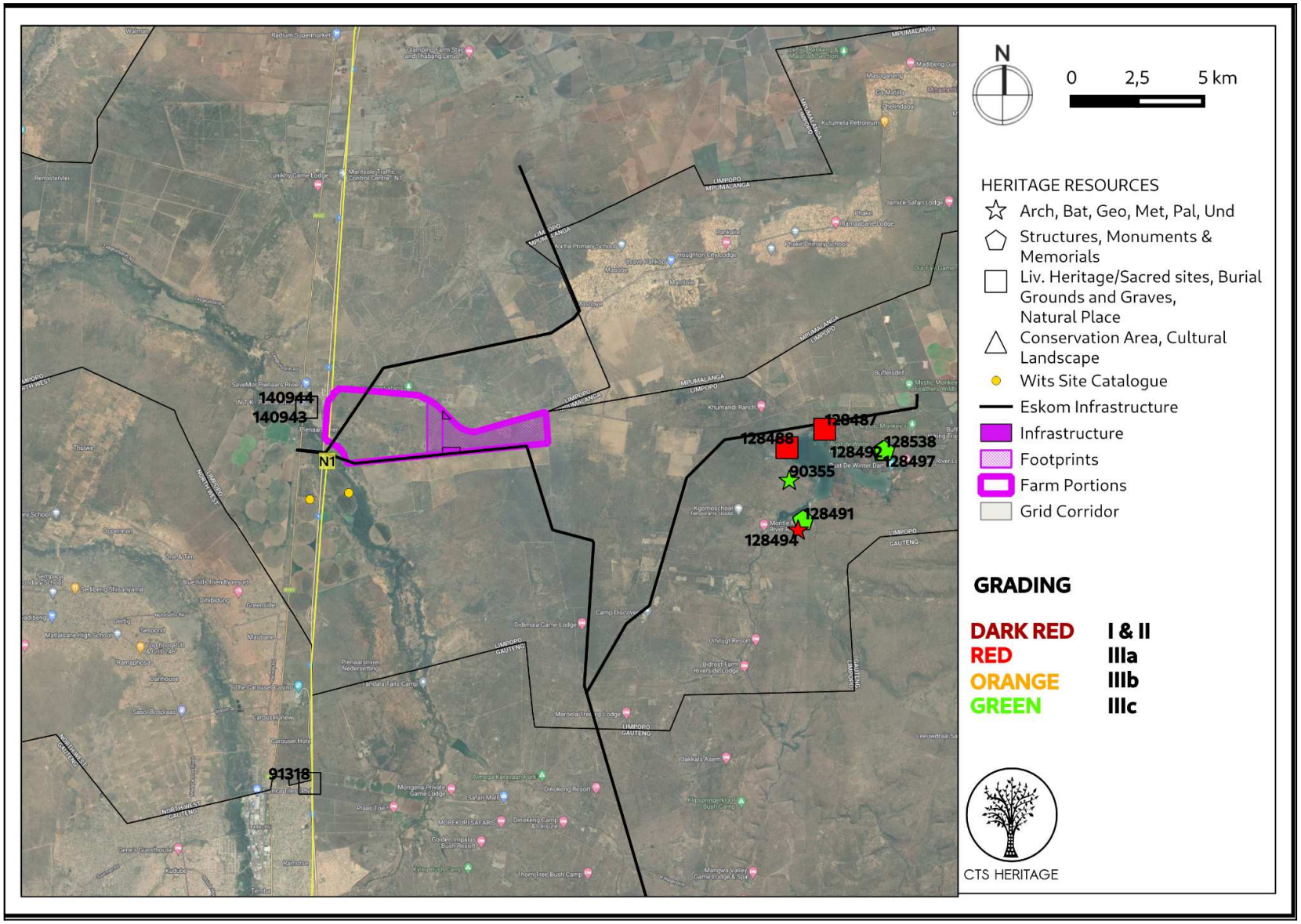


**Figure 3. Heritage Resources Map.** Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated within 10km. Please See Appendix 4 for full description of heritage resource types.

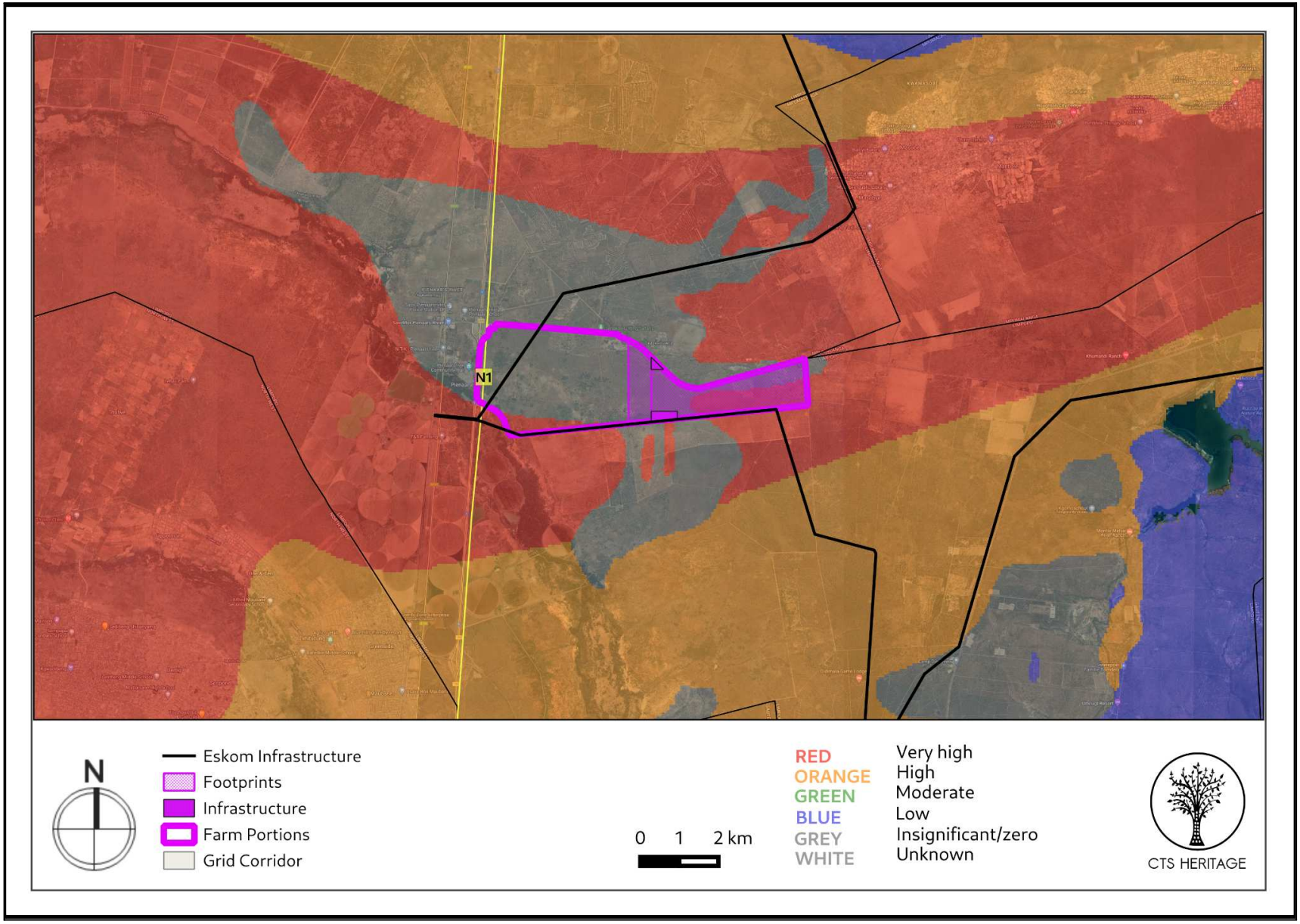


**Figure 4.1. Palaeosensitivity Map**. Indicating low fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

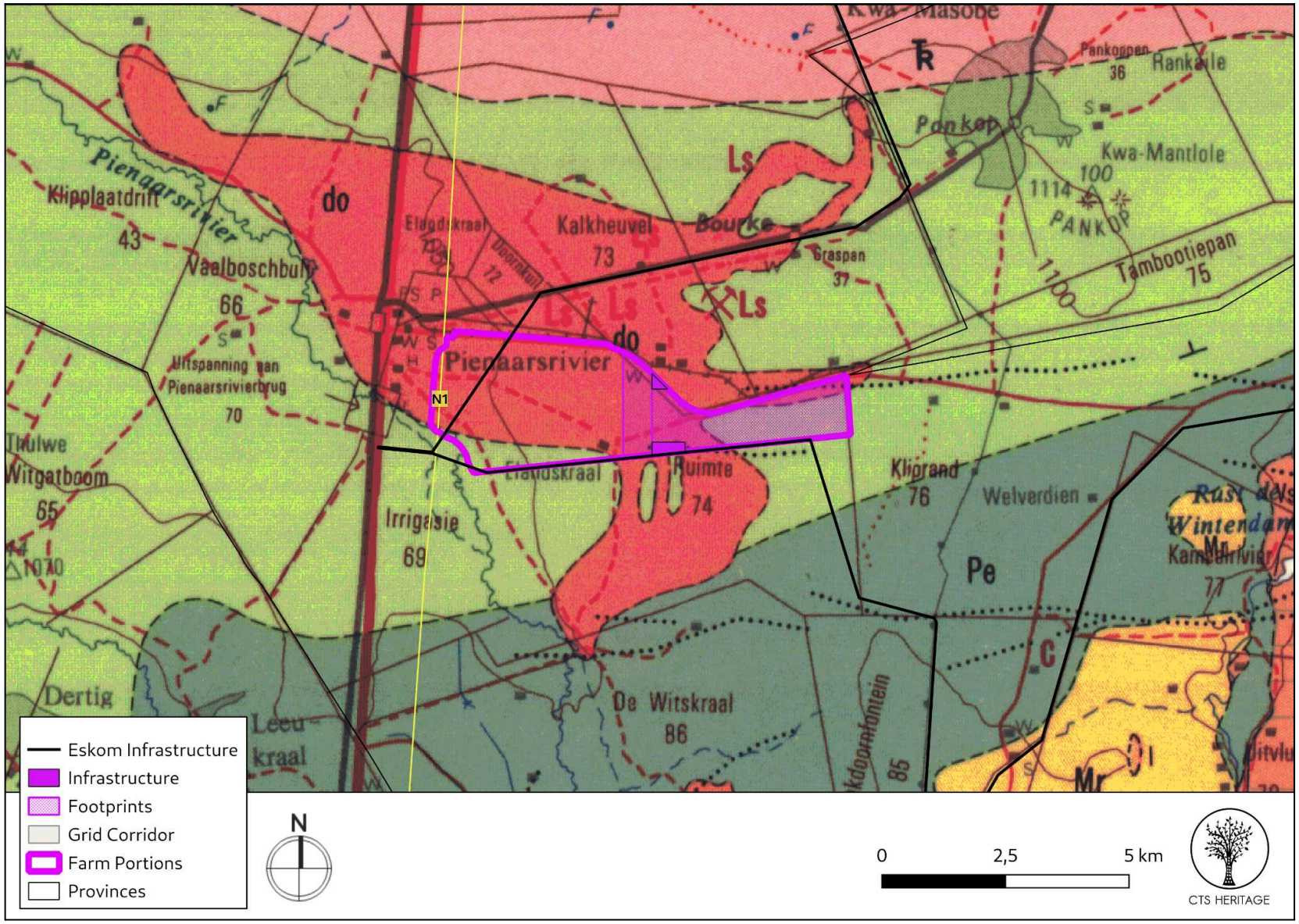


**Figure 4.2. Geology Map**. Extract from the CGS Map 2528 for Pretoria indicating that the development area is underlain by Karoo dolerite sediments and Irrigasie Formation sediments of the Karoo Sequence

# 8. Heritage Assessment

**Background**

The area proposed for development is located in between Bela-Bela, previously known as Warmbaths, in the Limpopo Province and Hammanskraal located north of Pretoria, to the east of the N1. When the Tswana tribes first moved into the region in about the 1800s, they discovered hot springs in the area. The Voortrekker Carl Van Heerden established the first farm in what is now Bela-Bela and called it *Het Bad*. In 1873, President Burgers' Transvaal government bought the land and established a resort called *Hartingsburg* after the prominent Dutch biologist Pieter Harting. The British occupied the town during the Anglo-Boer War, and renamed the post office *Warm Baths* in 1903, and proclaimed the boundaries of Warmbaths to be the entire farm of *Het Bad.* In 1920 Warmbaths was proclaimed a township.

**Cultural Landscape**

A broad history of the area is included in Murimbika (2010) and is referred to here. According to Murimbika (2010), the broader region has also yielded some significant Iron Age Sites such as the Mzonjani facies Broederstroom site (AD 430 to AD 780). According to Murimbika (2010), the broader region was subject to a number of instances of migration and settlement from 450 AD. Evidence indicates that Sotho-Tswana groups migrated in and out of the Magaliesberg region, and such groups are responsible for the many early stone-walled settlements in this region. One of the most documented migrations is the Mfecane (forced migration or scattering) which was a period of widespread chaos and warfare among indigenous ethnic communities in southern Africa during the period between 1815 and about 1840. During this time, the Ndebele under Mzilikazi reached the Magaliesberg region and are responsible for introducing the Doornspruit-type walled settlements that are known from this region (the Doornspruit River drains into the project area). According to Murimbika (2010) this type of stone-walled settlement represents “typical Nguni-Sotho-Tswana acculturation”. Murimbika (2010) further explains that one of the most acculturated groups in the region is known as the “Po”, whose Chief Mogale lends his name to the Magaliesberg Mountains and the Mogale City Municipality. By the mid-1800’s, Voortrekkers had begun to settle in the foothills of the Magaliesberg mountains and in so doing, clashed with Mzilikazi’s Ndebele in 1837. These early colonial battles forced the Ndebele north of the Limpopo River and effectively ended the independence of African Chiefdoms in the area. The Voortrekkers went on to establish the Republic of the Transvaal.

As part of the assessment completed by Van der Walt (2007), Birkholtz completed an historical and archival study of the Bela-Bela area. This detailed archival history is not repeated here, however some important notes from Birkholtz are reiterated below as they pertain to the cultural significance of the development area:

- The route between Great Zimbabwe, the copper mines at Messina and the tin mines at Rooiberg passed through the area
- The railway line and wagon road between Pretoria and then Pietersburg passed through this area. This meant that the region had immense strategic significance during the South African War (1899-1902). Pistorius (2013) notes that historical beacons in the area include a blockhouse which served in the line of blockhouses which stretched from Naauwpoort in the Magaliesberg to Pietersburg during the Anglo Transvaal War (1899-1902).
- A Voortrekker cemetery lies along the Thabazimbi road (Berg 1992, Erasmus 1995)

These points speak to the cultural value of the N1 heading north from Pretoria as a significant historic linking route. Cognisance of this significance must be taken.

**Archaeology**

Roodt (2008) remarks that “The Bela Bela region has a rich archaeological tradition, starting from the Stone Age period, right up to the Historical period. The following Iron Age material may occur in the region: According to the most recent archaeological cultural distribution sequences by Huffman (2007), this area falls within the distribution area of various cultural groupings originating out of both the Urewe Tradition (eastern stream of migration) and the Kalundu Tradition (western stream of migration).” Previous Heritage Impact Assessments conducted in the immediate vicinity of the proposed study area (Roodt, 2008, Van der Walt, 2007 and 2021 and Huffman, 2008) have identified a number of significant archaeological sites in the vicinity of the study area, dated to the Late Iron Age (Figure 3, 3a and 3b). Huffman (2008) in his assessment of a site located to the south of Bela-Bela, identified a few Middle Stone Age artefacts however he concluded that due to their context, these artefacts were likely bought into the area from somewhere else along with road ballast and therefore, these artefacts are not conservation-worthy.

Roodt (2008) noted that, 40km north of the area proposed for development, “Buyskop contains a stonewalled archaeological site... The observed ceramic shards are both decorated and undecorated. Thus it is possible to broadly assign the site to the Blackburn Branch of the Uruwe Tradition, probably Uitkomst facies (AD 1650 – 1820), but could also represent the related Rooiberg facies (AD 1650 – 1750). Cupules (also known as 'dolly holes'), used during rainmaking rituals, were noted in two places adjacent to the existing road, which has already damaged the site. Large ash areas were noted that could be attributed to middens and kraals.” The sites identified by Roodt 92008) are graded IIIB due to their moderate scientific value. Roodt (2008) concludes that “Buyskop (Buiskop) appears to have been occupied for an extensive period during the South African Iron Age. Based on ceramic analysis of decorated ceramic shards, occupation can be assigned to the period AD 1650 -1820. The ceramics are associated with the ceramic facies Uitkomst and Rooiberg, thus reflecting occupation by Sotho speaking peoples (Huffman 2007: 433). Rainmaking also occurred on the hill, archaeologically reflected by the presence of cupules.”

In his assessment completed for the property located immediately east of the development area, Van Vollenhoven and Strydom (2003) noted that although no Stone Age sites are known from the vicinity of the development, they identified two stone artefacts on the property that they assessed. These they ascribed to the Middle and Later Stone Age. These artefacts were determined to have no context and as such, were determined to be Not Conservation-Worthy. Van Vollenhoven and Strydom (2003) also note that a significant number of Late Iron Age sites are known south of the development area, the best known located at Wallmansthal and associated with the Ndebele occupation of the area. Several sites preserving Moloko pottery are also known from the broader area. However, Van Vollenhoven and Strydom (2003) did not identify any Iron Age sites in their assessment of the adjacent property. Pistorius (2013) concurs with the findings of Van Vollenhoven and Strydom (2003) and notes that the most common heritage resources which do occur in the broader area are stone walled sites which date from the Late Iron Age. These LIA sites are mostly found along the base lines of kopjes and randjes in the region.

According to Roodt (1999), archaeologists from the University of the Witwatersrand conducted excavations in the mid-1990’s at a site located on the Farm Irrigasie 69 JR located immediately south of the Farm Ruimte 74 JR on which this development is proposed. The location of the excavations is indicated in Figure 3 above. According to Roodt (1999), the excavations revealed a burial as well as some pottery and ostrich eggshell beads. In her assessment of a small area located on Farm Pienaarsrivierbrug 70 JR located adjacent to this development area, Roodt (1999) identified five sites of Middle and Later Stone Age artefacts. It is very likely that similar Middle and Later Stone Age artefacts will be present within the development area, as well as sites associated with the Late Iron Age occupation of the area. As such, further archaeological assessment of the development area is recommended.

**Palaeontology**

According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have Zero and Very High palaeontological sensitivity. The development area is underlain by the Irrigasie Formation of the Karoo Supergroup. This formation is known to preserve Extensive bioturbation by trace fossils as well as Dinosaur remains that include possible “*Euskelesaurus”* including so-called *Gigantoscelus*. An important plant fossil locality at Hammanskraal on the Limpopo / Gauteng border at which three insects from the Upper Permian were identified (Riek, 1976). Based on the very sensitive geology of the development area, further palaeontolological assessment is recommended.

**RECOMMENDATION**

**The area proposed for development is located in an area of high archaeological, palaeontological and cultural landscape sensitivity. It is recommended that a full HIA be undertaken to assess the impacts likely to result from the proposed development of the PV facility and associated grid connections.**

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## APPENDIX 1: List of heritage resources in proximity to the development area

| Site ID | Site no | Full Site Name | Site Type | Grading |
|---|---|---|---|---|
| 90355 | Kliprand76-001 | Kliprand 76 JR/ 001 | Stone walling | Grade IIIc |
| 128487 | LHMP.Rdw001 | Sebaka grave | Burial Grounds & Graves | Grade IIIa |
| 128488 | LHMP.Rdw002 | Stone cairn. Possible grave | Burial Grounds & Graves | Grade IIIa |
| 128491 | LHMP.Rdw006 | Ruined house dry pack walls | Structures | Grade IIIc |
| 128492 | LHMP.Rdw008 | Old house. Ruined | Structures | Grade IIIc |
| 128494 | LHMP.Rdw005 | Stone walled kraal. Possible initiation school lodge | Stone walling, Archaeological | Grade IIIa |
| 128497 | LHMP.Rdw007 | Old farm house ruin | Structures | Grade IIIc |
| 128538 | LHMP.Rdw010 | Concrete mud square structure | Structures | Grade IIIc |
| 140943 | ERF 607 | on Erf 607 In Pienaarsrivier Extension 1 Within Bela - Bela Local Municipality | Burial Grounds & Graves | Grade IIIa |
| 140944 | erf 607 | on Erf 607 In Pienaarsrivier Extension 1 Within Bela - Bela Local Municipality | Burial Grounds & Graves | Grade IIIa |

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# APPENDIX 2: Reference List

| Heritage Impact Assessments | | | | |
|---|---|---|---|---|
| **Nid** | **Report Type** | **Author/s** | **Date** | **Title** |
| 159050 | HIA Phase 1 | Udo Kusel | 06/02/2014 | CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT FOR PORTION R/17 OF THE FARM HAMANSKRAAL 112 JR IN HAMMANSKRAAL GAUTENG PROVINCE |
| 182570 | HIA Phase 1 | Julius CC Pistorius | 16/09/2013 | |
| 362741 | PIA Desktop | Marion Bamford | 11/09/2014 | Palaeontological Impact Assessment for the Proposed development of the Hammanskraal Business Process Outsourcing and Technology Park, Gauteng |
| 5313 | AIA Phase 1 | Anton van Vollenhoven, JA Strydom | 01/04/2003 | Report on a Cultural Resources Survey Done on Portion 8 of the Farm Kliprand 76 JR |
| 5752 | AIA Phase 1 | Hester Marie Roodt | 01/03/1999 | Phase 1 Archaeological Impact Assessment Ruimte 74 JR Pienaarsrivier |
| 5753 | AIA Phase 1 | Hester Marie Roodt | 01/04/1999 | Phase 1 Archaeological Impact Assessment Oxidation Dam Pienaarsriver, Pienaarsrivierbrug 70 JR |
| 5757 | AIA Phase 1 | Johnny Van Schalkwyk | 28/11/2006 | Heritage Impact Assessment: Kalkfontein 42 JR |
| 5767 | AIA Phase 1 | Johnny Van Schalkwyk | 01/12/2007 | Heritage Impact Survey of Portions of the Farm Buffelsdrift 179 JR, Warmbad Magisterial District, Limpopo Province |
| 5822 | AIA Phase 1 | Johnny Van Schalkwyk | 01/02/2008 | Heritage Impact Survey Report for the Proposed Development of a Storm Water Drainage Network, Ramotse Village, in the Moretele and Wonderboom Magisterial Districts |
| 7994 | AIA Phase 1 | Jaco van der Walt | 18/08/2008 | Archaeological Impact Assessment for the Proposed Stevebikoville School, Nokeng Township, Gauteng Province |
| 8243 | AIA Phase 1 | Hester Marie Roodt | 03/03/1999 | Phase 1 Archaeological Impact Assessment: Welgegund 17 JR, Radium, Northern Province |
| 92685 | AIA Desktop | Neels Kruger | 16/07/2012 | Recommended Exemption from Archaeological Impact Assessment Study: Babelegi Steel Recycling Facility |

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| | | | | |
|---|---|---|---|---|
| | | | | Project |

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# APPENDIX 3 - Keys/Guides

## Key/Guide to Acronyms

| | |
|---|---|
| **AIA** | Archaeological Impact Assessment |
| **DARD** | Department of Agriculture and Rural Development (KwaZulu-Natal) |
| **DEFF** | Department of Environment, Forest and Fisheries (National) |
| **DEADP** | Department of Environmental Affairs and Development Planning (Western Cape) |
| **DEDEAT** | Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape) |
| **DEDECT** | Department of Economic Development, Environment, Conservation and Tourism (North West) |
| **DEDT** | Department of Economic Development and Tourism (Mpumalanga) |
| **DEDTEA** | Department of economic Development, Tourism and Environmental Affairs (Free State) |
| **DENC** | Department of Environment and Nature Conservation (Northern Cape) |
| **DMR** | Department of Mineral Resources (National) |
| **GDARD** | Gauteng Department of Agriculture and Rural Development (Gauteng) |
| **HIA** | Heritage Impact Assessment |
| **LEDET** | Department of Economic Development, Environment and Tourism (Limpopo) |
| **MPRDA** | Mineral and Petroleum Resources Development Act, no 28 of 2002 |
| **NEMA** | National Environmental Management Act, no 107 of 1998 |
| **NHRA** | National Heritage Resources Act, no 25 of 1999 |
| **PIA** | Palaeontological Impact Assessment |
| **SAHRA** | South African Heritage Resources Agency |
| **SAHRIS** | South African Heritage Resources Information System |
| **VIA** | Visual Impact Assessment |

## Full guide to Palaeosensitivity Map legend

| | | |
|---|---|---|
| | **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/PURPLE**: | LOW - no palaeontological studies are required however a protocol for chance finds is required |
| | **GREY**: | INSIGNIFICANT/ZERO - no palaeontological studies are required |
| | **WHITE/CLEAR**: | UNKNOWN - these areas will require a minimum of a desktop study. |

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# APPENDIX 4 - Methodology

The Heritage Screener summarises the heritage impact assessments and studies previously undertaken within the area of the proposed development and its surroundings. Heritage resources identified in these reports are assessed by our team during the screening process.

The heritage resources will be described both in terms of **type**:

- Group 1: Archaeological, Underwater, Palaeontological and Geological sites, Meteorites, and Battlefields
- Group 2: Structures, Monuments and Memorials
- Group 3: Burial Grounds and Graves, Living Heritage, Sacred and Natural sites
- Group 4: Cultural Landscapes, Conservation Areas and Scenic routes

and **significance** (Grade I, II, IIIa, b or c, ungraded), as determined by the author of the original heritage impact assessment report or by formal grading and/or protection by the heritage authorities.

Sites identified and mapped during research projects will also be considered.

**DETERMINATION OF THE EXTENT OF THE INCLUSION ZONE TO BE TAKEN INTO CONSIDERATION**

The extent of the inclusion zone to be considered for the Heritage Screener will be determined by CTS based on:

- the size of the development,
- the number and outcome of previous surveys existing in the area
- the potential cumulative impact of the application.

The inclusion zone will be considered as the region within a maximum distance of 50 km from the boundary of the proposed development.

**DETERMINATION OF THE PALAEONTOLOGICAL SENSITIVITY**

The possible impact of the proposed development on palaeontological resources is gauged by:

- reviewing the fossil sensitivity maps available on the South African Heritage Resources Information System (SAHRIS)
- considering the nature of the proposed development
- when available, taking information provided by the applicant related to the geological background of the area into account

**DETERMINATION OF THE COVERAGE RATING ASCRIBED TO A REPORT POLYGON**

Each report assessed for the compilation of the Heritage Screener is colour-coded according to the level of coverage accomplished. The extent of the surveyed coverage is labeled in three categories, namely low, medium and high. In most instances the extent of the map corresponds to the extent of the development for which the specific report was undertaken.

**Low coverage** will be used for:

- desktop studies where no field assessment of the area was undertaken;
- reports where the sites are listed and described but no GPS coordinates were provided.
- older reports with GPS coordinates with low accuracy ratings;
- reports where the entire property was mapped, but only a small/limited area was surveyed.
- uploads on the National Inventory which are not properly mapped.

**Medium coverage** will be used for

- reports for which a field survey was undertaken but the area was not extensively covered. This may apply to instances where some impediments did not allow for full coverage such as thick vegetation, etc.
- reports for which the entire property was mapped, but only a specific area was surveyed thoroughly. This is differentiated from low ratings listed above when these surveys cover up to around 50% of the property.

**High coverage** will be used for

- reports where the area highlighted in the map was extensively surveyed as shown by the GPS track coordinates. This category will also apply to permit reports.

**RECOMMENDATION GUIDE**

The Heritage Screener includes a set of recommendations to the applicant based on whether an impact on heritage resources is anticipated. One of three possible recommendations is formulated:

**(1) The heritage resources in the area proposed for development are sufficiently recorded - The surveys undertaken in the area adequately captured the heritage resources. There are no known sites which require mitigation or management plans. No further heritage work is recommended for the proposed development.**

This recommendation is made when:

- enough work has been undertaken in the area
- it is the professional opinion of CTS that the area has already been assessed adequately from a heritage perspective for the type of development proposed

**(2) The heritage resources and the area proposed for development are only partially recorded - The surveys undertaken in the area have not adequately captured the heritage resources and/or there are sites which require mitigation or management plans. Further specific heritage work is recommended for the proposed development.**

This recommendation is made in instances in which there are already some studies undertaken in the area and/or in the adjacent area for the proposed development. Further studies in a limited HIA may include:

- improvement on some components of the heritage assessments already undertaken, for instance with a renewed field survey and/or with a specific specialist for the type of heritage resources expected in the area
- compilation of a report for a component of a heritage impact assessment not already undertaken in the area

- undertaking mitigation measures requested in previous assessments/records of decision.

**(3) The heritage resources within the area proposed for the development have not been adequately surveyed yet - Few or no surveys have been undertaken in the area proposed for development. A full Heritage Impact Assessment with a detailed field component is recommended for the proposed development.**

**Note:**
The responsibility for generating a response detailing the requirements for the development lies with the heritage authority. However, since the methodology utilised for the compilation of the Heritage Screeners is thorough and consistent, contradictory outcomes to the recommendations made by CTS should rarely occur. Should a discrepancy arise, CTS will immediately take up the matter with the heritage authority to clarify the dispute.

## APPENDIX 5 -Summary of Specialist Expertise

**Jenna Lavin**, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

Jenna is a member of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of the Association of Southern African Professional Archaeologists (ASAPA) since 2009. Recently, Jenna has been responsible for conducting training in how to write Wikipedia articles for the Africa Centre's WikiAfrica project.

Since 2016, Jenna has drafted over 70 Heritage Impact Assessments throughout South Africa.