HERITAGE IMPACT ASSESSMENT

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

Proposed Henneman Solar Energy Facility development near Henneman in the Free State

Prepared by CTS Heritage

CTS HERITAGE

Jenna Lavin

For

EnviroNamics

June 2022

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EXECUTIVE SUMMARY

1. Site Name:

Henneman PV Facility

2. Location:

RE Farm Vogels Rand 373

3. Locality Plan:

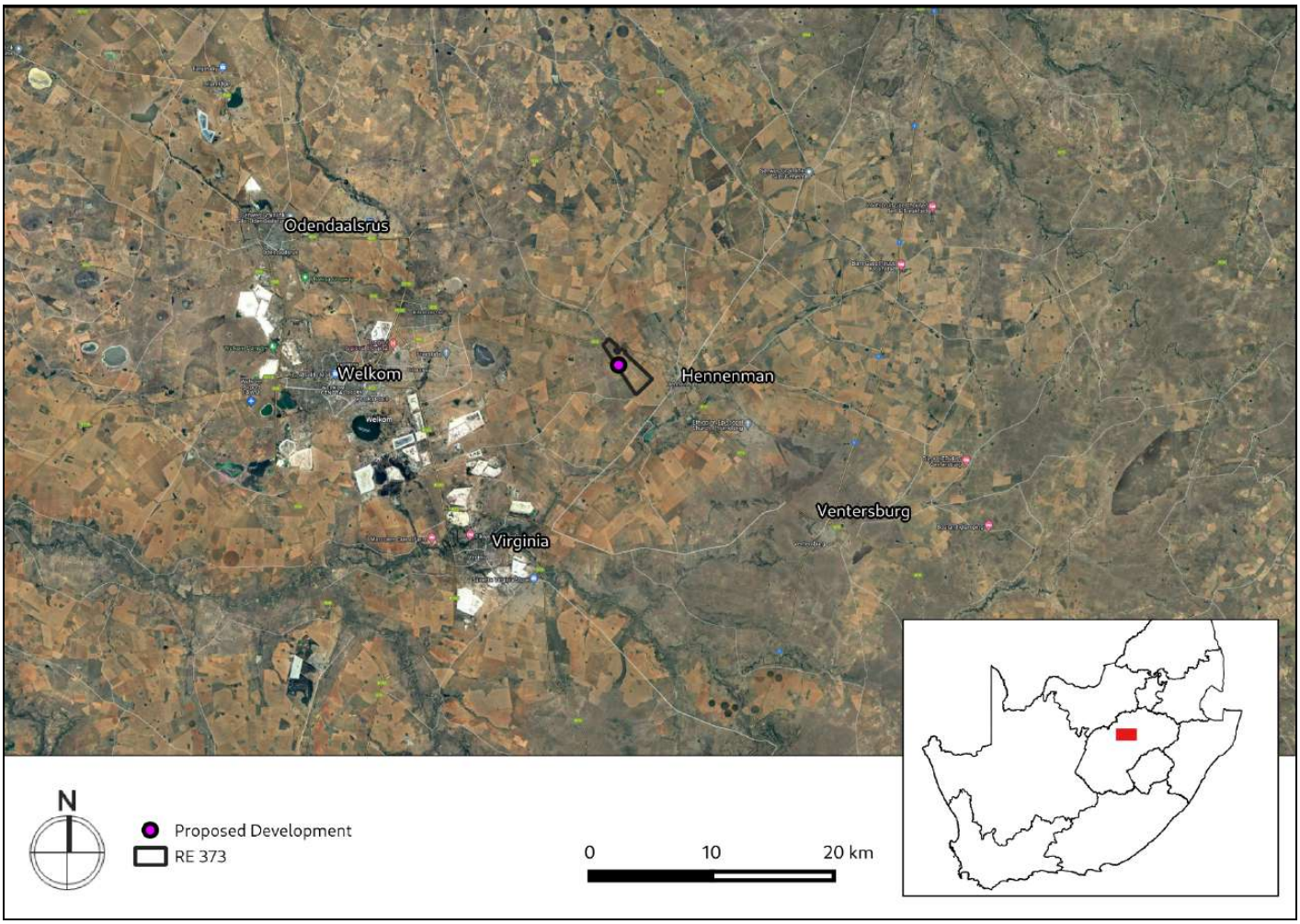

Figure A: Location of the proposed development area

4. Description of Proposed Development:

The activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the

proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

5. Heritage Resources Identified:
No heritage resources were identified during the field assessment

Although the presence of Adelaide Subgroup would normally require a field scoping study be conducted before excavation takes place, the entire footprint of the proposed development has been modified for agricultural purposes and is covered by dense grasses. This makes it unlikely that a field scoping study would provide any more information on the likelihood of the project resulting in irreversible loss of the palaeontological heritage.

Based on this, along with the presence of Quaternary superficial deposits covering half of the fossiliferous sediments (Beaufort Group), and the lack of fossils finds in the SAHRIS list of heritage resources within close proximity to the development area, it is anticipated that the impact of the development will mainly be **LOW to MODERATE.**

6. Anticipated Impacts on Heritage Resources:
The survey proceeded with two minor constraints and limitations, yet the project area was comprehensively surveyed for heritage resources, and no archaeological material remains were documented.

Should significant archaeological materials – such as well-preserved subsurface artefacts or fossils – be exposed during construction, the on-duty Environmental Control Officer should protect these (preferably in primary exposed context), and should immediately consult a professional archaeologist. In this circumstance, the South African Heritage Resources Authority should be immediately alerted so that appropriate mitigation measures by a professional archaeologist can be implemented, at the expense of the developer. In such a scenario, mitigation measures would normally involve the application for an excavation permit and the digital documentation of the occurrences with modern archaeological recording standards, as well as the collection of a reflective sample of material to be deposited in a local approved curation facility.

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subgroup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 2).

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 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 SAHRA must be alerted immediately to determine an appropriate way forward.

8. Author/s and Date:

Jenna Lavin

June 2022

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

The activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

The activities entail the development of a photovoltaic solar facility and associated infrastructure. The key component of the proposed project is described below:

- PV Panel Array - To produce up to 20MW, the proposed facilities 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 mounted to a single access tracking frame system
- 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 800V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 800V 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 132kV power line. It is expected that generation from the facility will connect to the national grid via a loop-in loop-out connection into the existing Kroonstad-Everest 132kV Power Line. The proposed connection point into the national grid is located within the remaining extent of Farm Vogelsrand No. 373.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on the sites:
    - Office / Control Room (~300m2);
    - 22kV Switch gear and relay room (~200m2);
    - 22kV/132KV Outdoor Switchyard (5000m2);
    - Security control (~60m2)

- Battery storage – A Battery Storage Facility with BESS Containerized solution and associated operational, safety and control infrastructure will be required.\
- Roads – Access will be obtained via the R70 regional 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.

1.2 Description of Property and Affected Environment

The footprint of the proposed PV facility as well as associated grid infrastructure is located across several agricultural camps, approximately 4.5 km West-North-West of the town of Henneman, in the Lejweleputswa district of the Free State province of South Africa.

The entirety of the footprint has been affected by recent, and likely also historical, agricultural activities focused on stock farming. However, across the north-west border where the original landscape can be observed, the natural vegetation comprises grassland typical of the southern African Grassland Biome in the summer-rainfall region, underlain by shales and sub-volcanic igneous outcrops in some places across the landscape. The affected property is interspersed with vehicle tracks where grass has been recently trimmed, probably to facilitate vehicle manoeuvrability between watering infrastructure present in several places, for the abundant cattle across several camps on the property. No primary or secondary sources of artefact quality stone were documented on the affected property, and no anthropogenic stone was documented in the vicinity of the affected property. Indigenous fowl including francolin and guineafowl were observed on the affected property, in addition to abundant traces of burrowing rodents (molerats, hares and meerkats), which may well affect any potential sub-surface archaeology (though none was documented).

The topography of the project area is generally flat, but undulates gradually from North-West to South-East, with more standing water sources in the North (all observed standing water sources were captured through modern anthropogenic activity). There is extensive modern disturbance across the footprint in the form of evidence of recent clearing for grazing and bioturbation in the form of rodent activity in the upper 0.25-0.5m of loamy topsoil (in the few places where partial topsoil profiles were exposed). In locations where historical grazing pressure has been more severe and soils have been excavated for watering purposes, secondary colluvial nodules (<5cm) of eroded shales were documented in amongst the sediment. The upper sediments look to have been fluvially deposited across much of the area, with characteristic moderately sub-angular rounding evident on some of the inclusions. There has clearly been cattle and potentially other stock rotation across all of the four camps that were surveyed. Indeed, the entirety of the area has been affected by historical farming related activities, with abundant cattle herds actively grazing in 3 of the 4 camps surveyed.

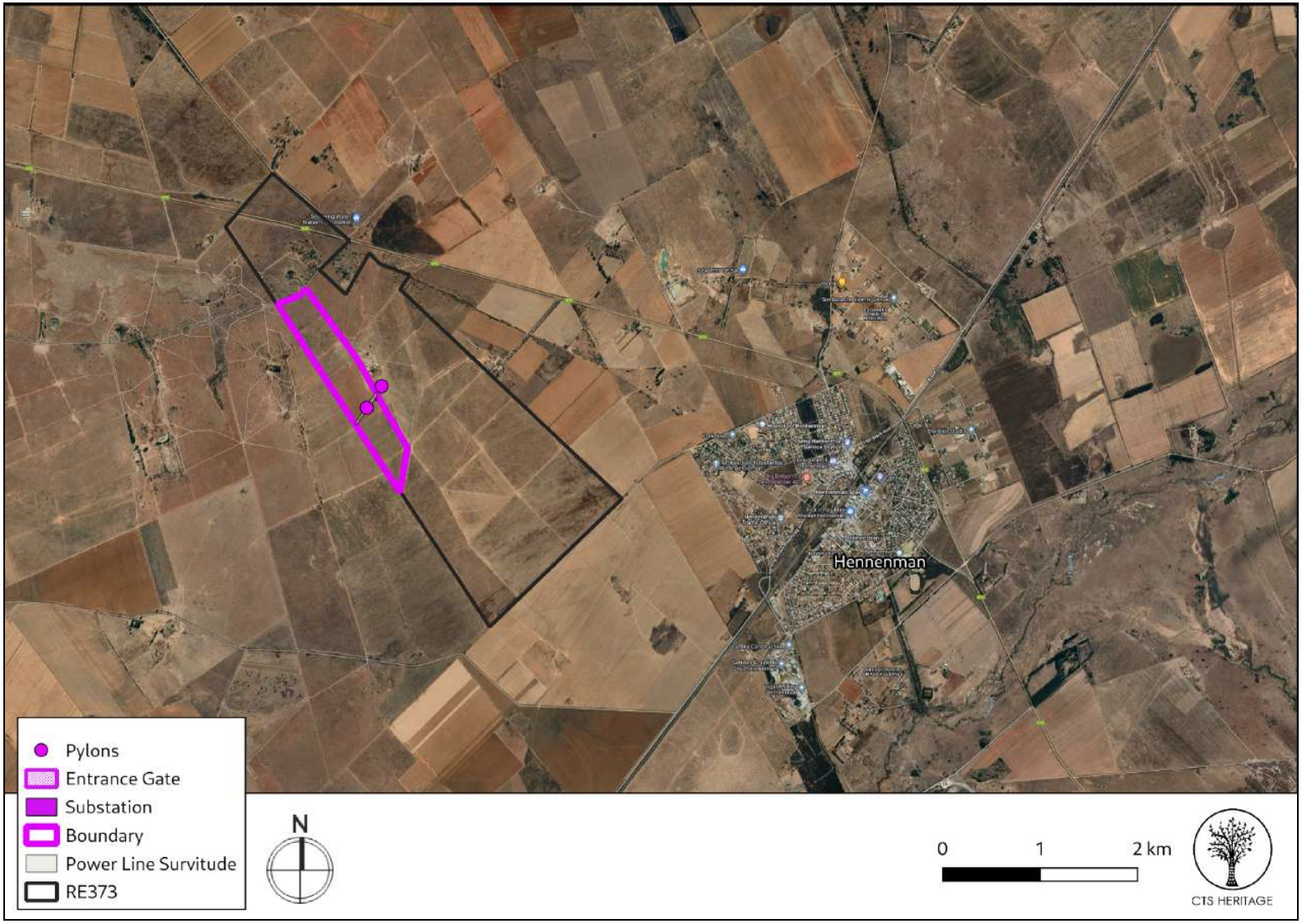

Figure 1.1: Proposed development relative to Henneman

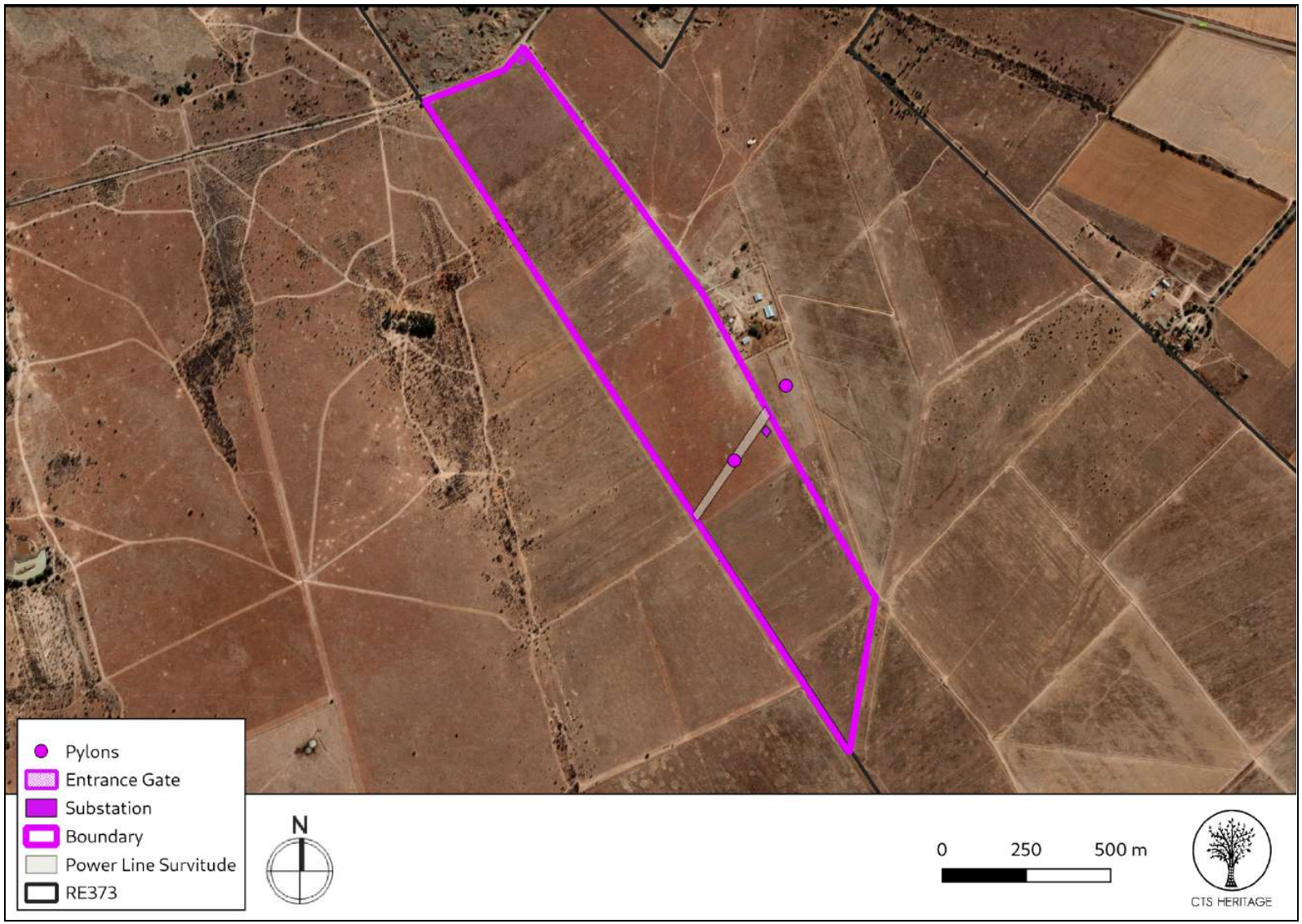

Figure 1.2: The proposed development layout

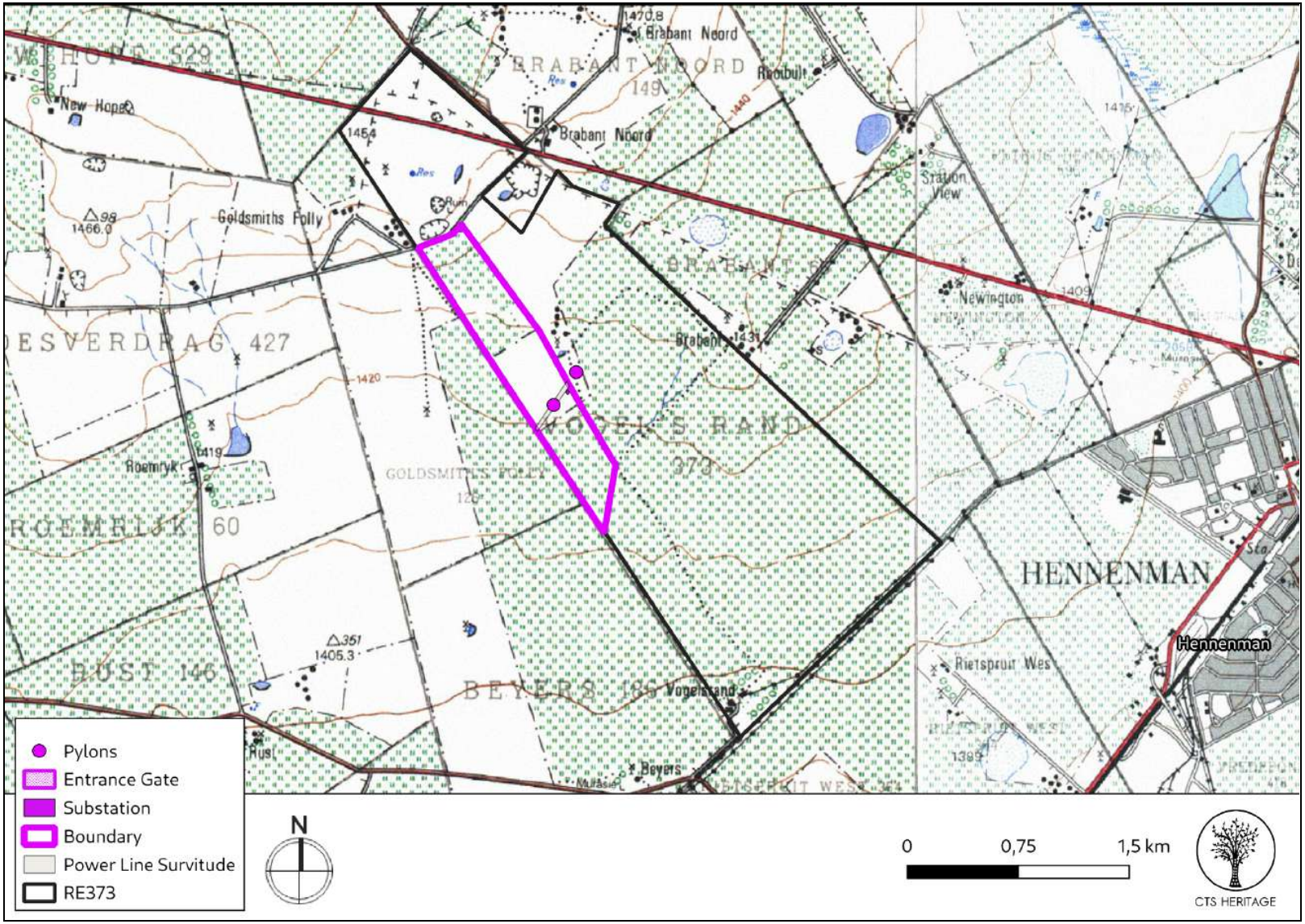

Figure 1.3: The proposed development layout on an extract of the 1:50 000 Topo Map

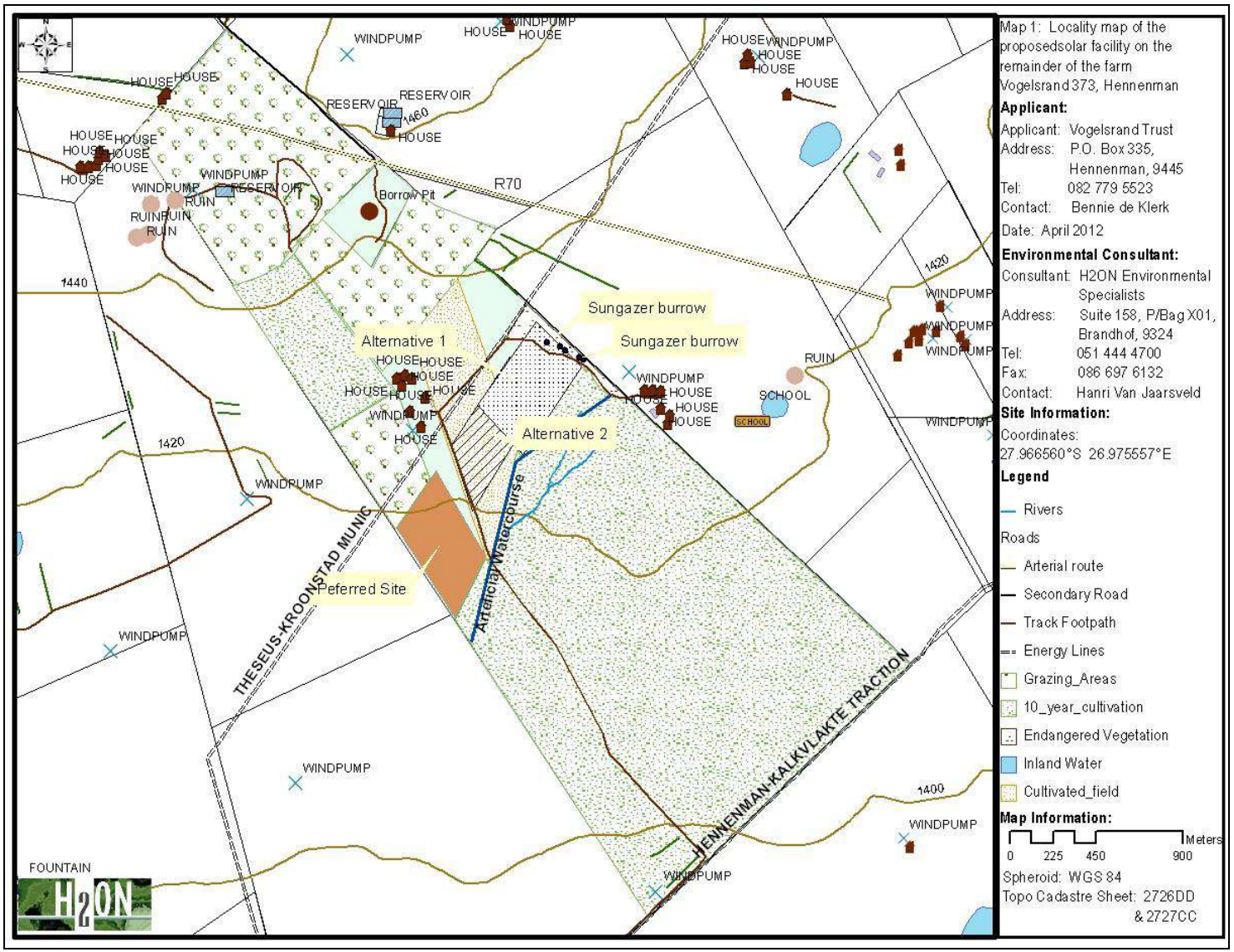

Figure 1.4. Development Map. From client

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 an assessment of archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted her site visit on 9 April 2022
- A palaeontologist conducted a desktop assessment of palaeontological resources likely to be disturbed by the proposed development.
- 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

1. The survey was conducted on the 9th of April, 2022 at the very end of the summer rainfall season. This is the time of year when one expects the densest grass cover in the region, although the evident intensive grazing would have contributed to mitigating the effects on visibility of grass cover to some degree.

Dense grass and associated recent soil formation cover the majority of the project area. This coverage significantly inhibited the visibility of surface archaeology.

Importantly, even in the few places that had better visibility, evidence of archaeology was non-existent. It is clear that the Stone Age sensitivity and scientific potential of the project area has been comprehensively assessed, regardless of the abundant grass cover.

2. Previous vegetation clearing activities by farmers may have affected surface archaeology including the possible above-surface presence of material evidence of graves (i.e. the removal of surface stone structures).

The experience of the heritage practitioner, and observations made during the study, allow us to predict with some accuracy the archaeological sensitivity of the receiving environment.

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 1: 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 Desktop Assessment

Background:

This application is for the proposed development of a PV facility and associated grid infrastructure located approximately 5km west of the town of Henneman in the Free State Province. *Hennenman*, which was built as a single railway station, was formerly denoted as *Ventersburg Road*. In 1927, it was renamed after local Afrikaner P.F. Hennenman, from Swartpan Farm. In 1944, black South Africans were confined to a segregated enclave in southern Hennenman. During apartheid, this area was cleared by order of the government and nearly all then-residents relocated to a new township some fifteen kilometres away, *Vergenoeg* (Afrikaans for "Far enough", now *Phomolong*). An area located immediately adjacent to the PV development was previously assessed by Van der Walt (2013) as part of a different development application. Van der walt (2013) describes the development area as "extremely flat and is utilized for extensive agricultural purposes (crop farming). The entire study area used to be cultivated land. No structures or farming infrastructure occur within the development footprint. The study area falls within the bioregion described by Mucina et al (2006) as the Dry Highveld Grassland Bioregion with the vegetation described as Vaal-Vet Sandy Grassland within a Grassland Biome. Land use in the general area is characterized by mining and agriculture, dominated by crops and cattle farming. The study area is characterised by deep sandy to loamy soils based on the extensive agricultural activities."

Archaeology

Archaeological sites spanning the Earlier, Middle and Later Stone Age have been found in the region despite the extensive agricultural transformation of the area. However, despite this, no heritage resources of significance were identified by Van der Walt (2013) in his assessment of the adjacent farm. Additionally, no significant archaeological sites have been recorded in the vicinity of the project area on SAHRIS. Van der Walt (2013) notes that "some MSA finds might be possible around pans on the farm. It is important to note that the lack of sites can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools. No Sites dating to the Early or Middle Iron Age have been recorded or is expected for the study area. The same goes for the Later Iron Age period where the study area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State. However to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986). Similarly to the east Makgwareng ceramics belonging to the Blackburn Branch of the Urewe tradition was recorded (Dreyer 1992 and Maggs 1976). There is however a low likelihood of finding sites dating to this period in the study area." As such, it is recommended that an archaeological field assessment be undertaken in order to assess such impacts.

Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and Very High fossil sensitivity (Figure 4). The Adelaide Formation of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2726 Kroonstad Geology Map (Figure 5). A desktop Palaeontological assessment (2013) was completed by Millsteed for an adjacent development which is of relevance here. Millsteed (2013) notes that "The Cainozoic regolith and the Adelaide Subgroup are both potentially fossiliferous and their stratigraphic equivalents are known to contain scientifically important fossil assemblages elsewhere in South Africa. Accordingly, it may be reasonably expected that significant fossils may be present within the project area." He goes on to note that "Thus, the historical farming processes have probably destroyed any fossil materials that may have been present at surface in these areas. Similarly, where present the regolith cover would hide any fossils contained within the underlying Adelaide Subgroup from discovery. The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. Any fossil materials that may have been present at/or near the surface in the cultivated regolith will have been historically destroyed and the likelihood of any negative impact is categorised as negligible. The possibility of a negative impact on the depth interval between the maximum depth of ploughing and the maximum depth of excavations within the regolith is categorised as low (due to the scarcity of fossils in general)." Millsteed (2013) recommends that a palaeontological assessment be conducted to assess possible impacts to significant fossil heritage.

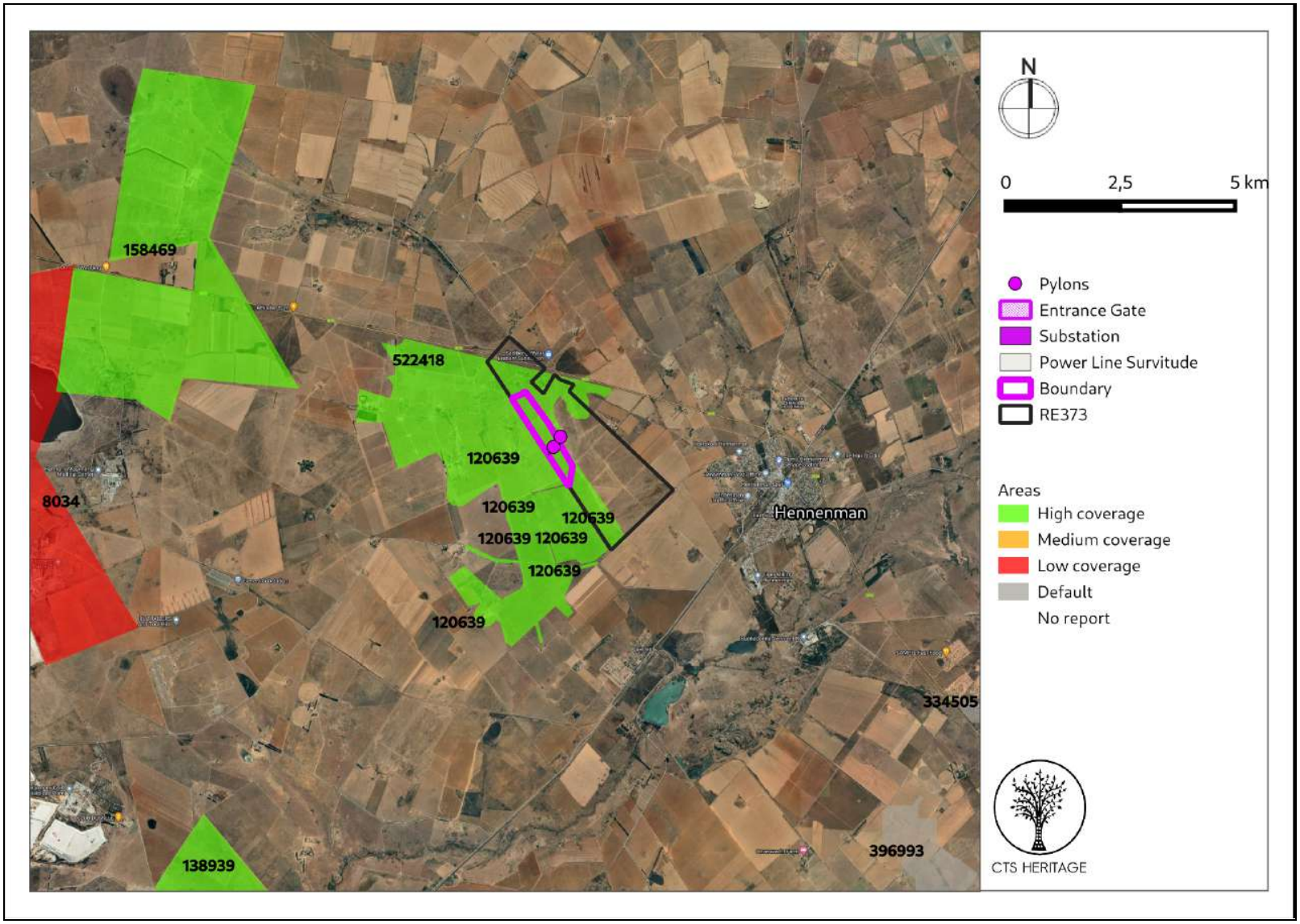

Figure 2: Spatialisation of heritage assessments conducted in proximity to the proposed development

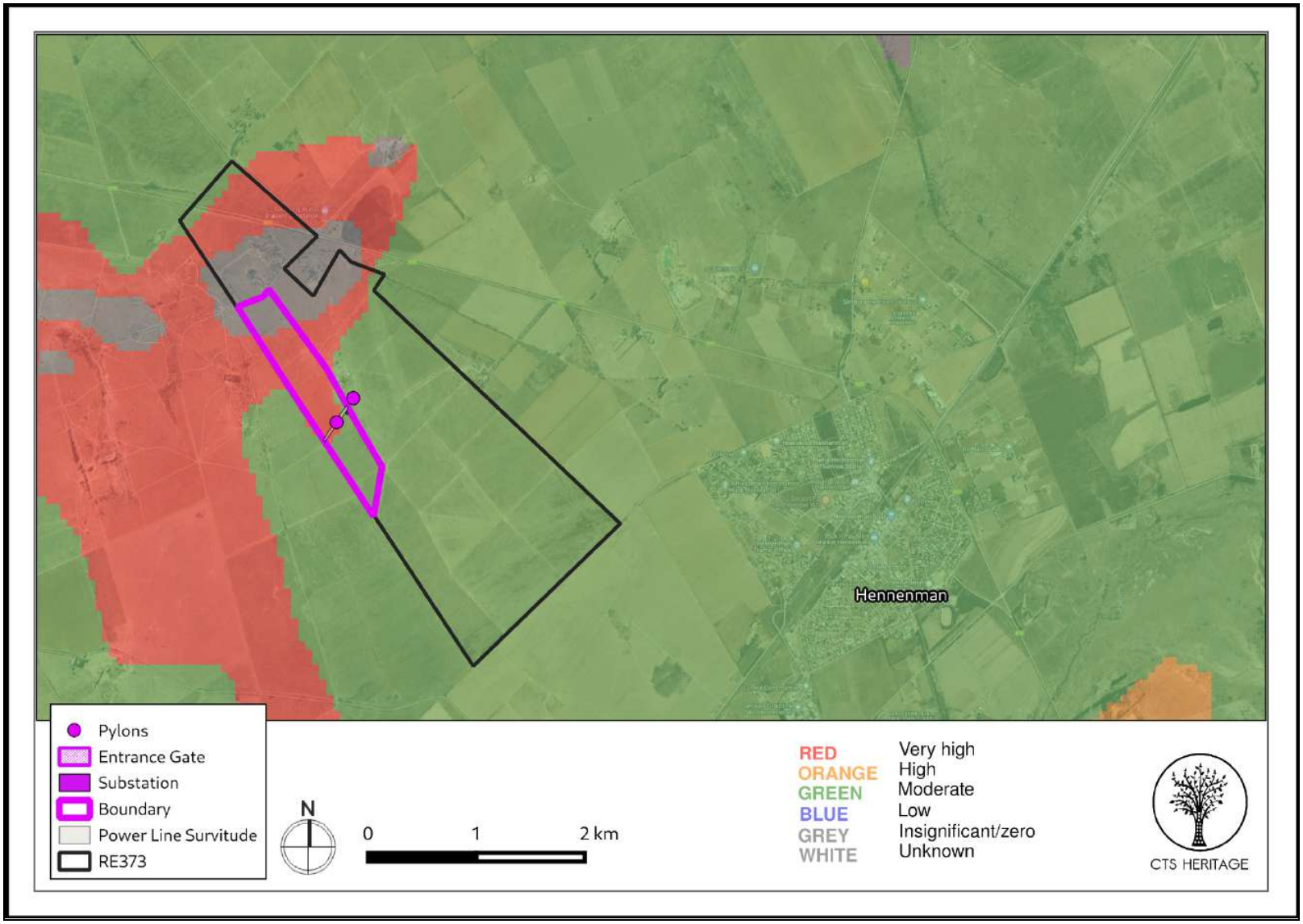

Figure 3.1: Palaeontological sensitivity of the proposed development area

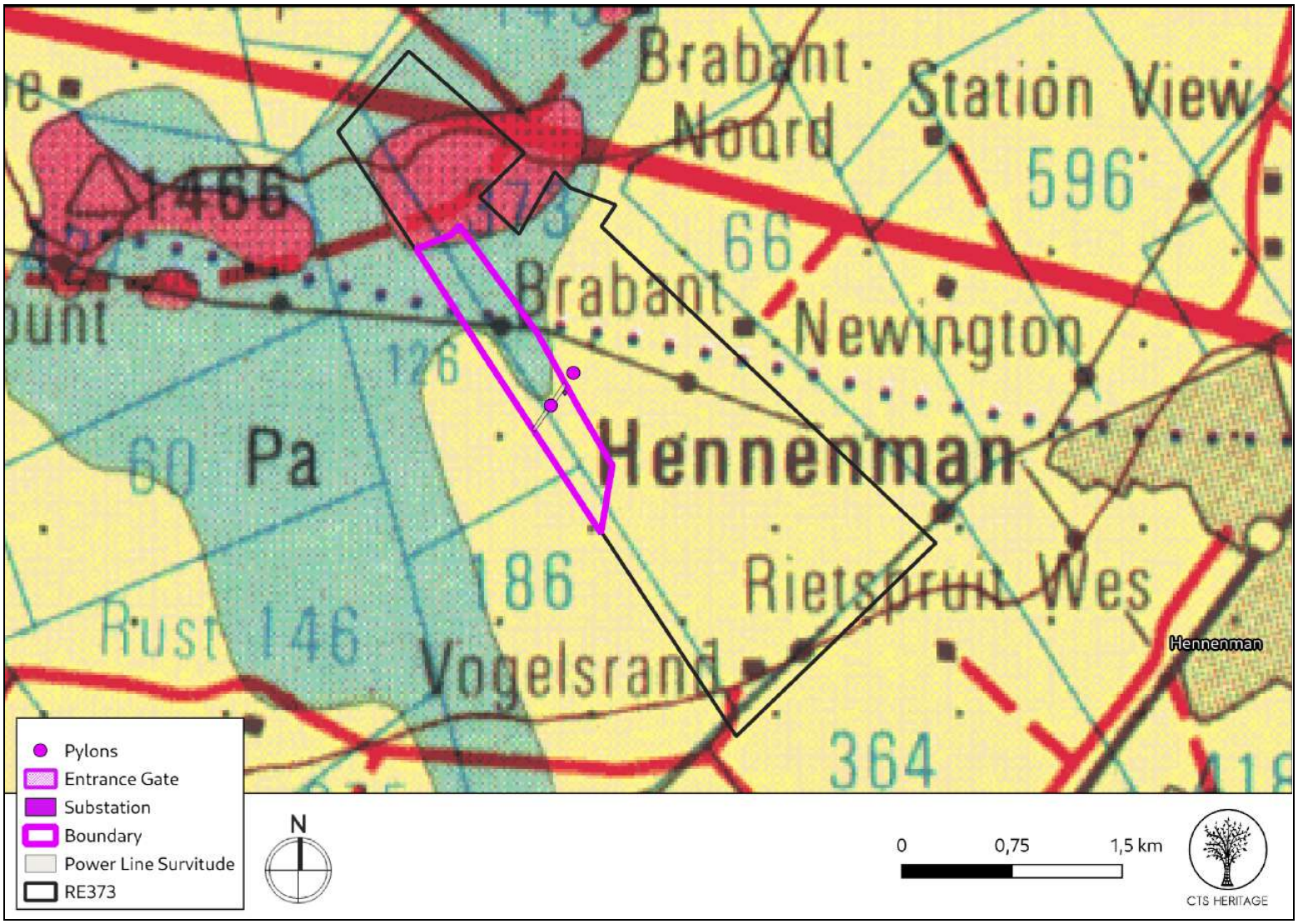

Figure 3.2: Geology Map. Extract from the CGS 2726 Kroonstad Geology Map indicating that the development area is underlain by sediments of the Adelaide Subgroup of the Beaufort Group (Pa), Jurassic dolerite (Jd) and Quaternary Sands

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology (Appendix 1)

The survey was conducted on foot, and sought to assess the presence and significance of archaeological occurrences within the project area. There was no evidence of Stone or Iron Age archaeology within the footprint. No graves were identified within the survey and visibility was reasonably good for stone structures, so the latter finding could be considered comprehensive. However, the substantial grass cover and soil formation across the entire footprint was a pertinent constraint to documenting stone artefacts and other smaller potential surface remains such as ceramics.

Field assessment did not document any archaeological remains.

Palaeontology (Appendix 2)

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and Very High fossil sensitivity (Figure 4). The Adelaide Formation of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2726 Kroonstad Geology Map (Figure 5).

4.2 Heritage Resources identified

No archaeological resources were identified during the field assessment.

In terms of palaeontology;

- The Palaeontological Sensitivity of the **Adelaide Subgroup** is classified as **Very High Risk** by SAHRIS (figure 2). The unit contains a highly diverse tetrapod assemblage and three Assemblage Zones: the *Tapinocephalus*, *Endothiodon*, and *Cistecephalus* Assemblage Zones (Day & Rubidge, 2020; Day & Smith, 2020; Rubidge & Day, 2020). These have yielded amphibian fossils (including temnospondyls like *Rhinesuchus*), Pan-testudines (e.e. *Eunotososaurus*), therapsids (including biarmosuchians, anomodonts, gorgonopsians and therocephalians) as well as fish (e.g. *Namaichthys*). Plant fossils (including petrified wood, plant remains, leaf & stem impressions), non-marine molluscs, and trace fossils (trackways, invertebrate burrows, coprolites) have also been recovered in the Adelaide Subgroup (Johnson, Anhauesser & Thomas, 2006; Bordy & Prevec, 2008; Bordy, Linkermann & Prevec, 2011; Bamford, Cairncross & Lombard, 2020; Almond, 2021). It is unclear which formation of the Adelaide the proposed Henneman Solar Energy Facility development area is situated in and therefore which Assemblage Zone is represented and what fossils can be expected. According to the SAHRIS list of heritage resources within close proximity to the development area (see Environamics Henneman PV Screener completed by CTS Heritage), no fossils were recovered nearby.

- The Palaeontological Sensitivity of the **Jurassic Dolerite** is classified as **Insignificant/Zero** by SAHRIS (figure 2). The igneous intrusive origin of the Jurassic dolerite dykes makes it unlikely that they contain fossils.
- The Palaeontological Sensitivity of the **Quaternary deposits** is classified as **Moderate** by SAHRIS (figure 2). Although present, the fossil record of the Quaternary Sands is sporadic and not very diverse. Aeolian dunes are not likely to preserve fossil material, however, calcretisation of burrows (including termites) and root casts (rhizoliths) can occur. Fossils that have been recorded include ostrich egg shells (*Struthio*), shells of land snails (e.g. *Trigonephrus*), bivalves and gastropods (e.g. *Corbula*, *Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones). Quaternary calcretes have also yielded calcretised burrows (including termites), root casts (rhizoliths) as well as mammalian ichnofossils (Malherbe, 1984; Almond & Pether, 2008). It is worth noting that the Quaternary deposits may contain stone tools from various lithic industries and these should be the subject of further specialist assessment. There is an increased probability of uncovering fossil bones and archaeological remains near pans (Pether, Nat & Thukgwi, 2018). Pan deposits have been found to be important palaeo-environmental indicators that record past conditions through the sediments and fossils (including micro-organisms, invertebrates, plants, small vertebrates and the remains of animals that succumbed to drought and predators) (Pether, Nat & Thukgwi, 2018). Although pans are abundant in the nearby area, these are not indicated on the Google Earth map of the proposed development area, which shows that the land has been modified by agricultural practices. The surficial sediments are therefore unlikely to be *in situ*. It is possible that the underlying Adelaide Subgroup will be exposed during construction, however this depends on the depth of the excavations necessary for the proposed project.

4.3 Mapping and spatialisation of heritage resources

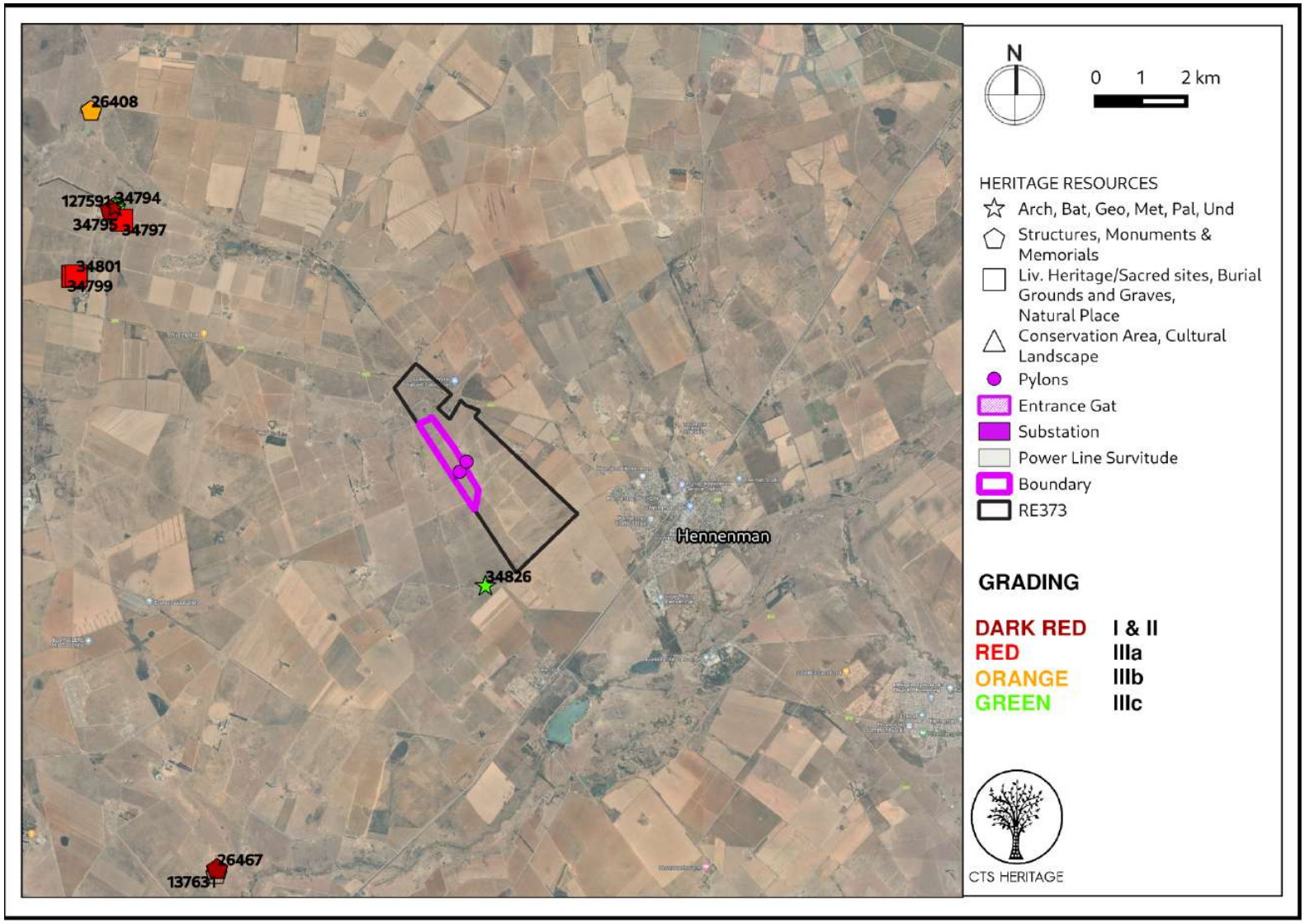

Figure 6.1: Map of known heritage resources relative to the proposed development area

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.

No archaeology was documented within the footprint. There are no objections to the authorization of the proposed development.

Although the presence of Adelaide Subgroup would normally require a field scoping study be conducted before excavation takes place, the entire footprint of the proposed development has been modified for agricultural purposes and is covered by dense grasses. This makes it unlikely that a field scoping study would provide any more information on the likelihood of the project resulting in irreversible loss of the palaeontological heritage.

Based on this, along with the presence of Quaternary superficial deposits covering half of the fossiliferous sediments (Beaufort Group), and the lack of fossils finds in the SAHRIS list of heritage resources within close proximity to the development area, it is anticipated that the impact of the development will mainly be **LOW to MODERATE.**

Table 2: 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. 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

According to the information provided, the development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during the operation phase. The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area,

and because of the project's location within an area which is characterised by high levels of solar irradiation and which is therefore well suited to the development of commercial solar energy facilities.

The proposed development also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society. It should be noted that the perceived benefits associated with the project, which include RE generation and local economic and social development, outweigh the perceived impacts associated with the project.

Based on the available information, the anticipated socio-economic benefits to be derived from the development outweigh the impacts to heritage resources identified in this report.

5.3 Proposed development alternatives

The following alternatives were considered in relation to the proposed activity:

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural 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 Remaining Extent of the Farm Vogelsrand No. 373. 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 process.

Technical alternatives: Powerlines

Connecting the array to the electrical grid requires transformation of the voltage from 800V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 800V 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 132kV power line. It is expected that generation from the facility will connect to the national grid via a loop-in loop-out connection into the existing Kroonstad-Everest 132kV Power Line. The proposed connection point into the national grid is located within the Remaining Extent of Farm Vogelsrand No. 373.

No alternative grid connection options are being considered.

Battery storage facility

A Battery Storage Facility with a BESS Containerized solution and associated operational, safety and control infrastructure will be required. 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. As it is not anticipated that any heritage resources will be impacted by the proposed development, there is no preferred alternative from a heritage perspective.

5.4 Cumulative Impacts

At this stage, there is the potential for the cumulative impact of proposed renewable energy facilities to negatively impact the cultural landscape due to a change in the landscape character from natural wilderness to semi-industrial. Although this project falls outside of a REDZ area, it is noted that it is preferable to have renewable energy facility development clustered in an area such as a REDZ.

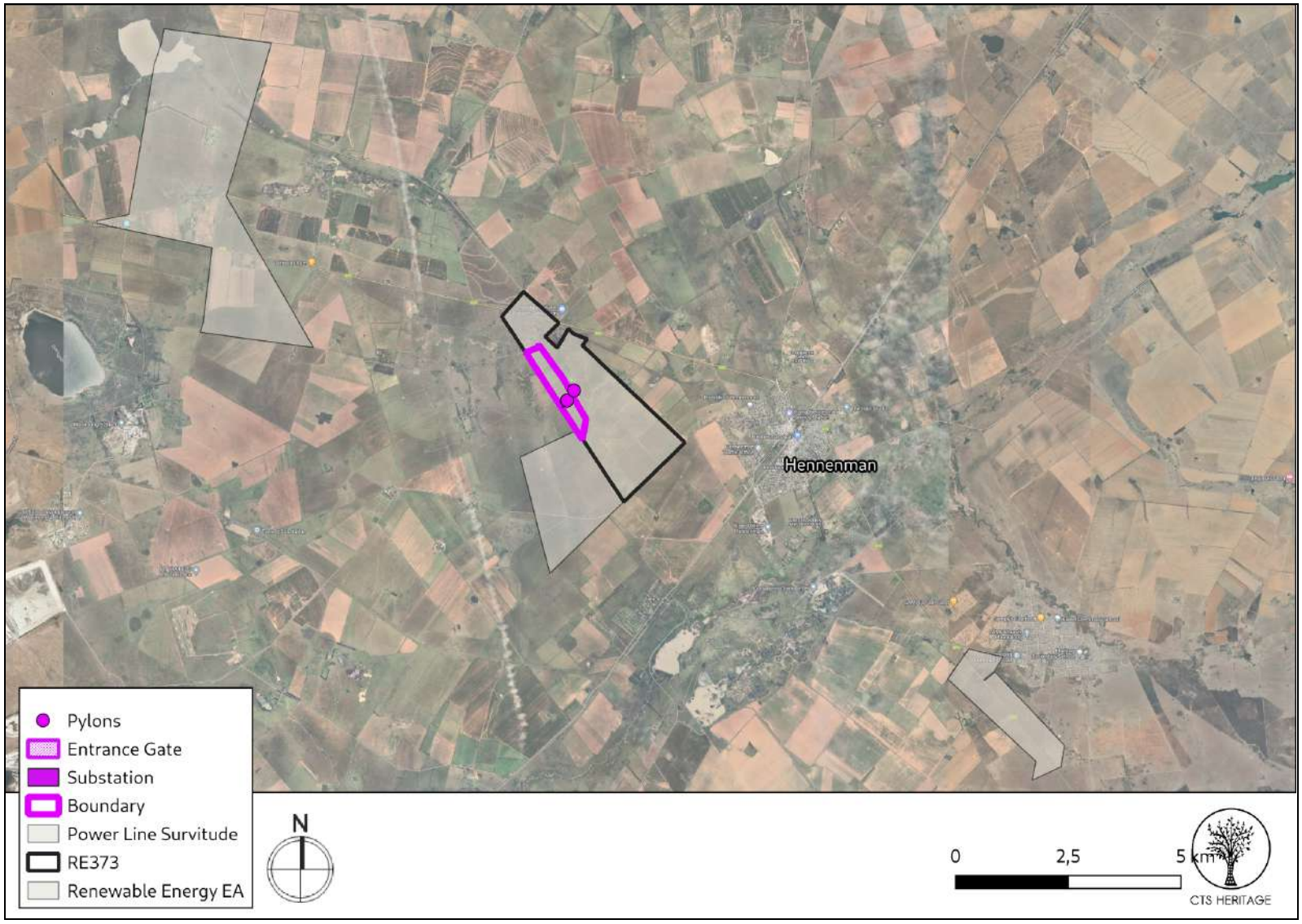

Figure 8: Approved REF projects within 50km of the proposed development area

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 two minor constraints and limitations, yet the project area was comprehensively surveyed for heritage resources, and no archaeological material remains were documented.

Should significant archaeological materials – such as well-preserved subsurface artefacts or fossils – be exposed during construction, the on-duty Environmental Control Officer should protect these (preferably in primary exposed context), and should immediately consult a professional archaeologist. In this circumstance, the South African Heritage Resources Authority should be immediately alerted so that appropriate mitigation measures by a professional archaeologist can be implemented, at the expense of the developer. In such a scenario, mitigation measures would normally involve the application for an excavation permit and the digital documentation of the occurrences with modern archaeological recording standards, as well as the collection of a reflective sample of material to be deposited in a local approved curation facility.

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subgroup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 2).

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 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**
120639	Jaco van der Walt	30/08/2013	Archaeological Specialist Reports	Archaeological Impact Assessment report for the Proposed Everest Solar Energy Facility
158469	Karen Van Ryneveld	19/10/2013	Heritage Impact Assessment Specialist Reports	PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT. THE THABONG SOLAR FARM, UITKYK 509, WELKOM, FREE STATE, SOUTH AFRICA
169703	Lloyd Rossouw		HIA	Thabong Homestead Phase 1 HIA
186709	Gideon Groenewald	14/10/2013	PIA Desktop	PALAEONTOLOGICAL ASSESSMENT OF THE PROPOSED DEVELOPMENT OF A 75MW PHOTOVOLTAIC SOLAR FARM, ON THE FARM UITKYK 509, WELKOM, FREE STATE PROVINCE.
8034	Cobus Dreyer	05/03/2004	AIA Phase 1	Archaeological and Historical Investigation of the Graves at the Proposed Housing Developments near Thabong, Welkom, Free State

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APPENDICES

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APPENDIX 1: Archaeological Assessment (2022)

ARCHAEOLOGICAL SPECIALIST STUDY

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

Proposed Henneman Solar Energy Facility development near Henneman in the Free State

Prepared by

CTS HERITAGE

Jenna Lavin
And Dr Darya Presnyakova

In Association with

EnviroNamics

May 2022

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EXECUTIVE SUMMARY

The activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

The survey was conducted on foot, and sought to assess the presence and significance of archaeological occurrences within the project area. There was no evidence of Stone or Iron Age archaeology within the footprint. No graves were identified within the survey and visibility was reasonably good for stone structures, so the latter finding could be considered comprehensive. However, the substantial grass cover and soil formation across the entire footprint was a pertinent constraint to documenting stone artefacts and other smaller potential surface remains such as ceramics.

Field assessment did not document any archaeological remains.

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

The activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

The activities entail the development of a photovoltaic solar facility and associated infrastructure. The key component of the proposed project is described below:

- PV Panel Array - To produce up to 20MW, the proposed facilities 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 mounted to a single access tracking frame system
- 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 800V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 800V 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 132kV power line. It is expected that generation from the facility will connect to the national grid via a loop-in loop-out connection into the existing Kroonstad-Everest 132kV Power Line. The proposed connection point into the national grid is located within the remaining extent of Farm Vogelsrand No. 373.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on the sites:
    - Office / Control Room (~300m2);
    - 22kV Switch gear and relay room (~200m2);
    - 22kV/132KV Outdoor Switchyard (5000m2);
    - Security control (~60m2)
- Battery storage – A Battery Storage Facility with BESS Containerized solution and associated operational, safety and control infrastructure will be required.\
- Roads – Access will be obtained via the R70 regional 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

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surrounding farm. Fencing with a height of 2.5 meters will be used.

1.2 Description of Property and Affected Environment

The footprint of the proposed PV facility as well as associated grid infrastructure is located across several agricultural camps, approximately 4.5 km West-North-West of the town of Henneman, in the Lejweleputswa district of the Free State province of South Africa.

The entirety of the footprint has been affected by recent, and likely also historical, agricultural activities focused on stock farming. However, across the north-west border where the original landscape can be observed, the natural vegetation comprises grassland typical of the southern African Grassland Biome in the summer-rainfall region, underlain by shales and sub-volcanic igneous outcrops in some places across the landscape. The affected property is interspersed with vehicle tracks where grass has been recently trimmed, probably to facilitate vehicle manoeuvrability between watering infrastructure present in several places, for the abundant cattle across several camps on the property. No primary or secondary sources of artefact quality stone were documented on the affected property, and no anthropogenic stone was documented in the vicinity of the affected property. Indigenous fowl including francolin and guineafowl were observed on the affected property, in addition to abundant traces of burrowing rodents (molerats, hares and meerkats), which may well affect any potential sub-surface archaeology (though none was documented).

The topography of the project area is generally flat, but undulates gradually from North-West to South-East, with more standing water sources in the North (all observed standing water sources were captured through modern anthropogenic activity). There is extensive modern disturbance across the footprint in the form of evidence of recent clearing for grazing and bioturbation in the form of rodent activity in the upper 0.25-0.5m of loamy topsoil (in the few places where partial topsoil profiles were exposed). In locations where historical grazing pressure has been more severe and soils have been excavated for watering purposes, secondary colluvial nodules (<5cm) of eroded shales were documented in amongst the sediment. The upper sediments look to have been fluvially deposited across much of the area, with characteristic moderately sub-angular rounding evident on some of the inclusions. There has clearly been cattle and potentially other stock rotation across all of the four camps that were surveyed. Indeed, the entirety of the area has been affected by historical farming related activities, with abundant cattle herds actively grazing in 3 of the 4 camps surveyed.

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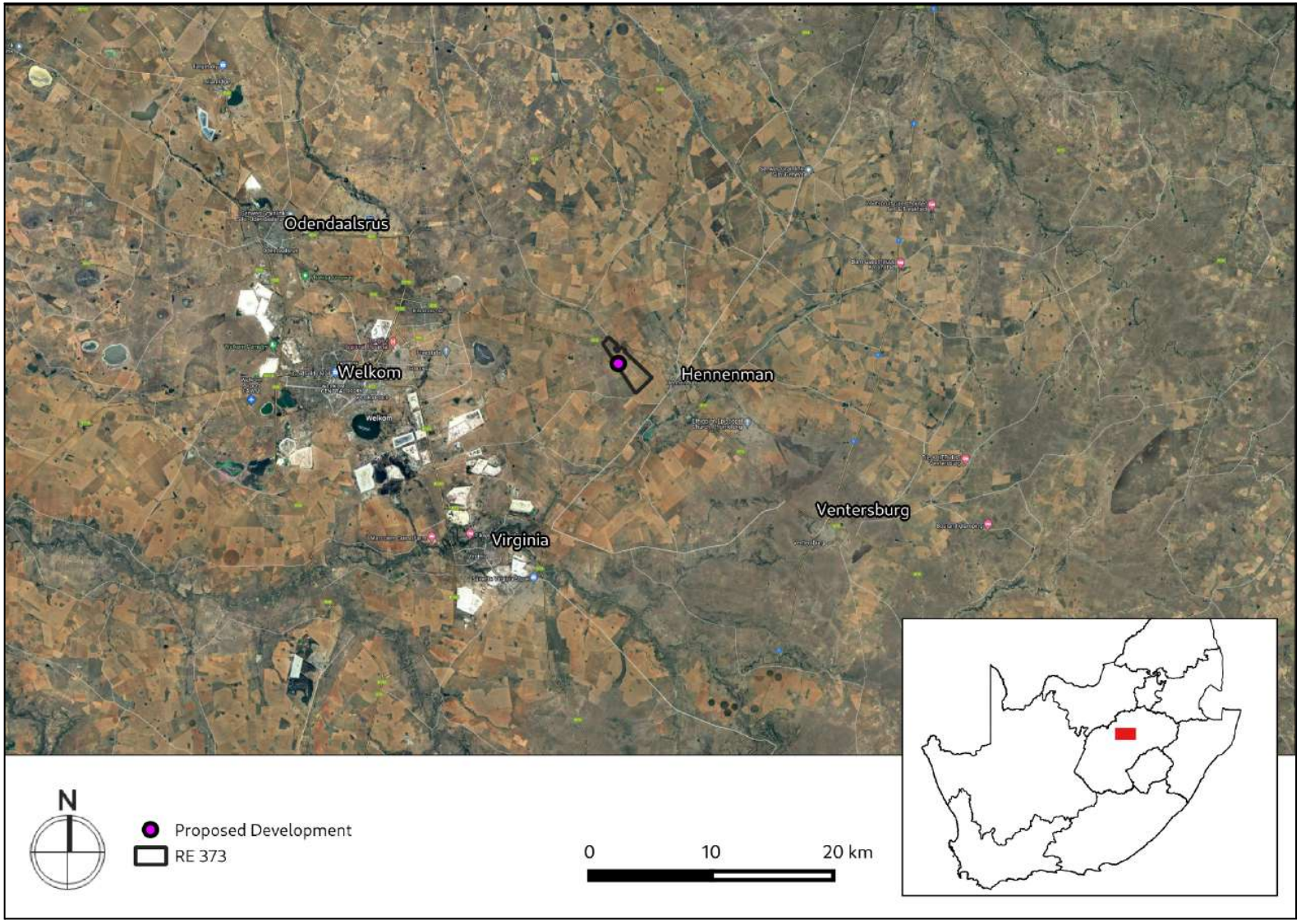

Figure 1.1: Satellite image indicating proposed location of development

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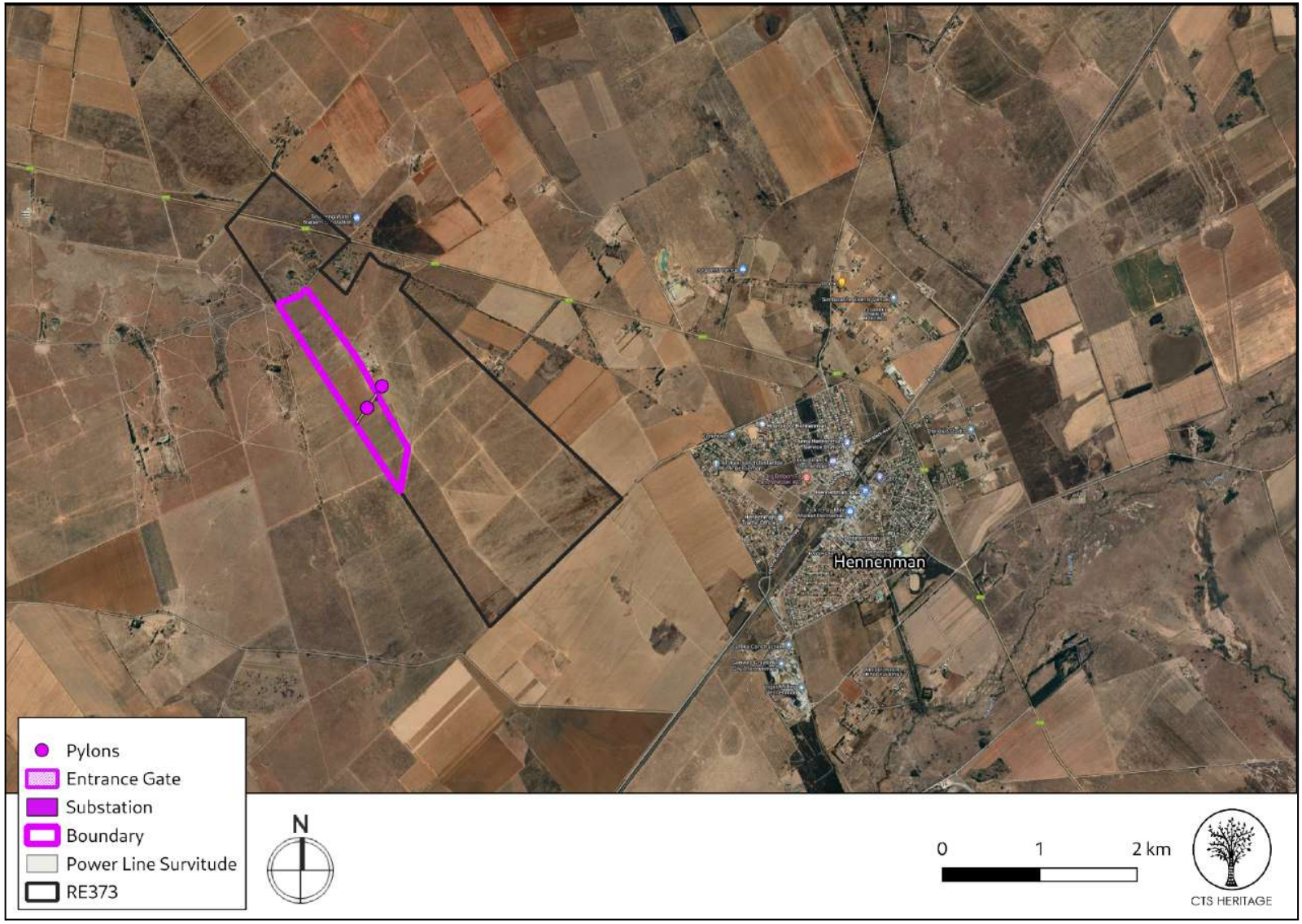

Figure 1.2: Proposed project boundary

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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 on 9 April 2022 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

1. The survey was conducted on the 9th of April, 2022 at the very end of the summer rainfall season. This is the time of year when one expects the densest grass cover in the region, although the evident intensive grazing would have contributed to mitigating the effects on visibility of grass cover to some degree. Dense grass and associated recent soil formation cover the majority of the project area. This coverage significantly inhibited the visibility of surface archaeology.

   Importantly, even in the few places that had better visibility, evidence of archaeology was non-existent. It is clear that the Stone Age sensitivity and scientific potential of the project area has been comprehensively assessed, regardless of the abundant grass cover.
2. Previous vegetation clearing activities by farmers may have affected surface archaeology including the possible above-surface presence of material evidence of graves (i.e. the removal of surface stone structures).

The experience of the heritage practitioner, and observations made during the study, allow us to predict with some accuracy the archaeological sensitivity of the receiving environment.

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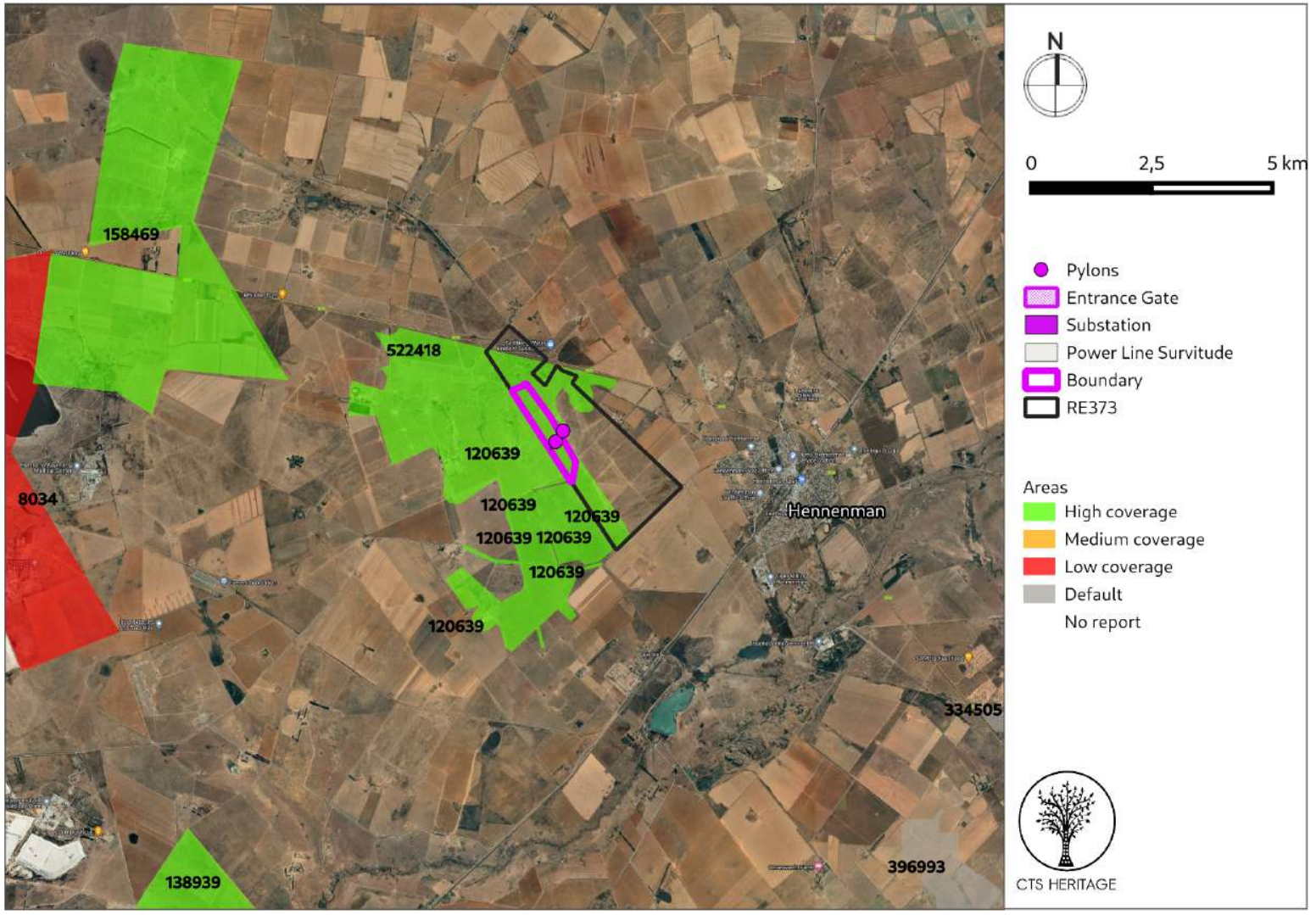

Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted

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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

Background:

This application is for the proposed development of a PV facility and associated grid infrastructure located approximately 5km west of the town of Henneman in the Free State Province. *Hennenman*, which was built as a single railway station, was formerly denoted as *Ventersburg Road*. In 1927, it was renamed after local Afrikaner P.F. Hennenman, from Swartpan Farm. In 1944, black South Africans were confined to a segregated enclave in southern Hennenman. During apartheid, this area was cleared by order of the government and nearly all then-residents relocated to a new township some fifteen kilometres away, *Vergenoeg* (Afrikaans for "Far enough", now *Phomolong*). An area located immediately adjacent to the PV development was previously assessed by Van der Walt (2013) as part of a different development application. Van der walt (2013) describes the development area as "extremely flat and is utilized for extensive agricultural purposes (crop farming). The entire study area used to be cultivated land. No structures or farming infrastructure occur within the development footprint. The study area falls within the bioregion described by Mucina et al (2006) as the Dry Highveld Grassland Bioregion with the vegetation described as Vaal-Vet Sandy Grassland within a Grassland Biome. Land use in the general area is characterized by mining and agriculture, dominated by crops and cattle farming. The study area is characterised by deep sandy to loamy soils based on the extensive agricultural activities."

Archaeology

Archaeological sites spanning the Earlier, Middle and Later Stone Age have been found in the region despite the extensive agricultural transformation of the area. However, despite this, no heritage resources of significance were identified by Van der Walt (2013) in his assessment of the adjacent farm. Additionally, no significant archaeological sites have been recorded in the vicinity of the project area on SAHRIS. Van der Walt (2013) notes that "some MSA finds might be possible around pans on the farm. It is important to note that the lack of sites can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools. No Sites dating to the Early or Middle Iron Age have been recorded or is expected for the study area. The same goes for the Later Iron Age period where the study area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State. However to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986). Similarly to the east Makgwareng ceramics belonging to the Blackburn Branch of the Urewe tradition was recorded (Dreyer 1992 and Maggs 1976). There is however a low likelihood of finding sites dating to this period in the study area."

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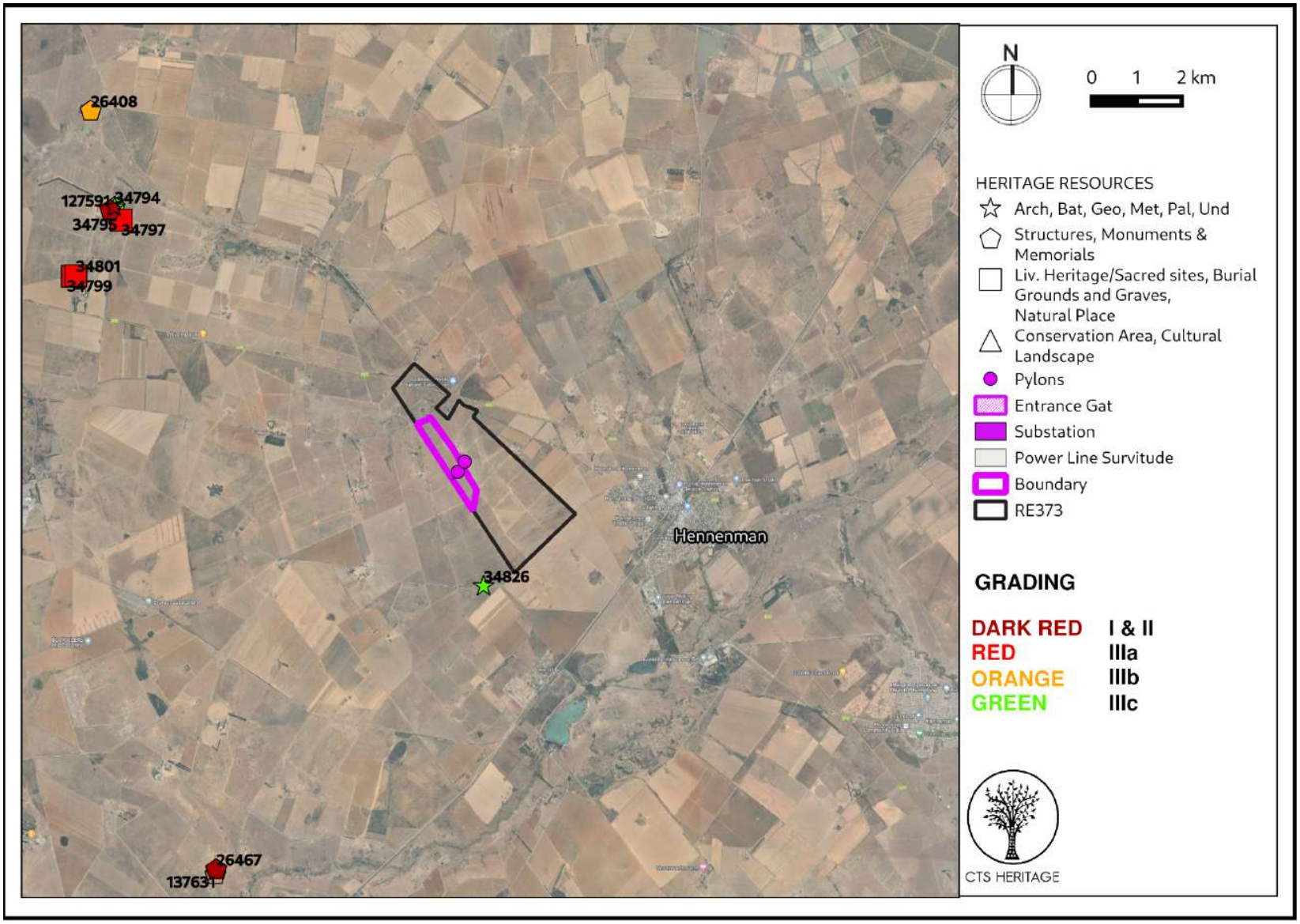

Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated

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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

The survey was conducted on foot, and sought to assess the presence and significance of archaeological occurrences within the project area. There was no evidence of Stone or Iron Age archaeology within the footprint. No graves were identified within the survey and visibility was reasonably good for stone structures, so the latter finding could be considered comprehensive. However, the substantial grass cover and soil formation across the entire footprint was a pertinent constraint to documenting stone artefacts and other smaller potential surface remains such as ceramics.

Field assessment did not document any archaeological remains.

Figure 4.1: Extensive grass coverage limited visibility during the survey

Figure 4.2: Extensive grass coverage limited visibility during the survey

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Figure 4.3: Extensive grass coverage limited visibility during the survey

Figure 4.4: Extensive grass coverage limited visibility during the survey

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Figure 4.5: Context CHN08 borders the area proposed for development. Outside the footprint, across the northwest border (the top photograph), lays an area that has not been affected by extensive agricultural activity, and the original landscape with natural vegetation and geology can be observed.

Figure 4.6: Context CHN_7 exposes the soil formation process that takes place in the whole area proposed for development.

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Figure 4.7: The areas with reasonably good visibility (here contexts CHN_01 and CHN_05) have been extensively examined during the survey and no stone artefacts or pottery have been observed.

Figure 4.8: Extensive grass coverage limited visibility during the survey

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Figure 4.9: Extensive grass coverage limited visibility during the survey

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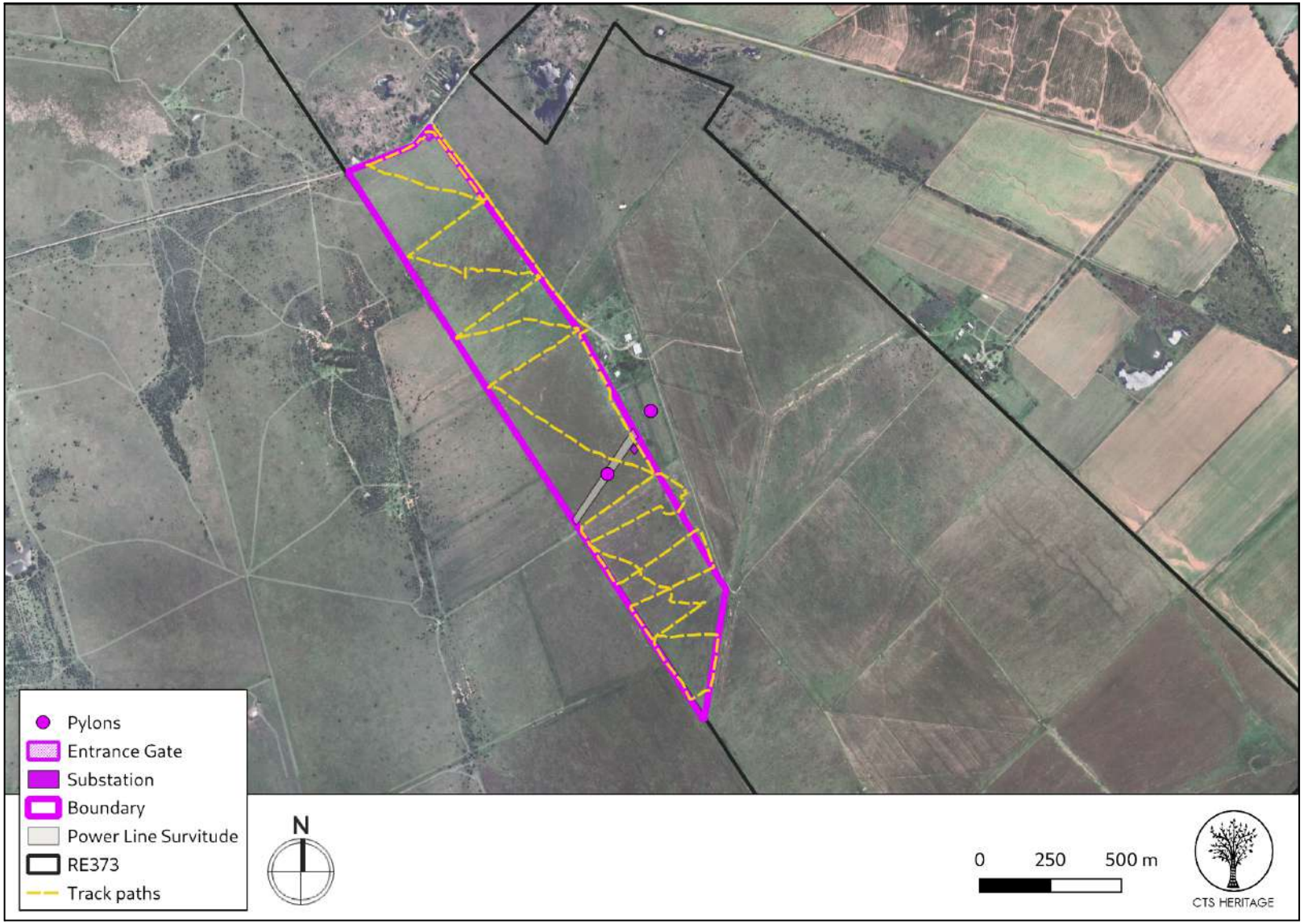

Figure 5.1: Overall track paths of foot survey for development

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4.2 Archaeological Resources identified

No archaeological resources were identified during the field assessment

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

No archaeology was documented within the footprint. There are no objections to the authorization of the proposed development.

6. CONCLUSION AND RECOMMENDATIONS

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

Should significant archaeological materials – such as well-preserved subsurface artefacts or fossils – be exposed during construction, the on-duty Environmental Control Officer should protect these (preferably in primary exposed context), and should immediately consult a professional archaeologist. In this circumstance, the South African Heritage Resources Authority should be immediately alerted so that appropriate mitigation measures by a professional archaeologist can be implemented, at the expense of the developer. In such a scenario, mitigation measures would normally involve the application for an excavation permit and the digital documentation of the occurrences with modern archaeological recording standards, as well as the collection of a reflective sample of material to be deposited in a local approved curation facility.

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**
120639	Jaco van der Walt	30/08/2013	Archaeological Specialist Reports	Archaeological Impact Assessment report for the Proposed Everest Solar Energy Facility
158469	Karen Van Ryneveld	19/10/2013	Heritage Impact Assessment Specialist Reports	PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT. THE THABONG SOLAR FARM, UITKYK 509, WELKOM, FREE STATE, SOUTH AFRICA
169703	Lloyd Rossouw		HIA	Thabong Homestead Phase 1 HIA
186709	Gideon Groenewald	14/10/2013	PIA Desktop	PALAEONTOLOGICAL ASSESSMENT OF THE PROPOSED DEVELOPMENT OF A 75MW PHOTOVOLTAIC SOLAR FARM, ON THE FARM UITKYK 509, WELKOM, FREE STATE PROVINCE.
8034	Cobus Dreyer	05/03/2004	AIA Phase 1	Archaeological and Historical Investigation of the Graves at the Proposed Housing Developments near Thabong, Welkom, Free State

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APPENDIX 2: Palaeontological Assessment (2022)

PALAEONTOLOGICAL SPECIALIST STUDY

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

Proposed Henneman Solar Energy Facility development near Henneman in the Free State

Prepared by

CTS HERITAGE

And Dr Kimberley Chapelle

In Association with

Environamics

June 2022

CTS HERITAGE

EXECUTIVE SUMMARY

The proposed activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

Although the presence of Adelaide Subgroup would normally require a field scoping study be conducted before excavation takes place, the entire footprint of the proposed development has been modified for agricultural purposes and is covered by dense grasses. This makes it unlikely that a field scoping study would provide any more information on the likelihood of the project resulting in irreversible loss of the palaeontological heritage.

Based on this, along with the presence of Quaternary superficial deposits covering half of the fossiliferous sediments (Beaufort Group), and the lack of fossils finds in the SAHRIS list of heritage resources within close proximity to the development area, it is anticipated that the impact of the development will mainly be **LOW to MODERATE.**

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subrgoup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 1).

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1. INTRODUCTION

1.1 Background Information on Project

The proposed activities entail the development of a photovoltaic solar facility and associated infrastructure on the remaining extent of Farm Vogelsrand No. 373, Registration Division Ventersburg, situated within the Mathjhabeng Local Municipality area of jurisdiction. The town of Hennenman is located approximately 4km southeast of the proposed development. The project entails the generation of up to 20MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 53 hectares (including supporting infrastructure on site) that is located within the larger affected property. The property on which the facility is to be constructed will be leased by DPT Henneman (Pty) Ltd from the property owner, for the lifespan of the project (minimum of 20 years). The electricity generated by the facility will be wheeled into the grid for offtake by third parties.

The activities entail the development of a photovoltaic solar facility and associated infrastructure. The key component of the proposed project is described below:

- PV Panel Array - To produce up to 20MW, the proposed facilities 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 mounted to a single access tracking frame system
- 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 800V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 800V 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 132kV power line. It is expected that generation from the facility will connect to the national grid via a loop-in loop-out connection into the existing Kroonstad-Everest 132kV Power Line. The proposed connection point into the national grid is located within the remaining extent of Farm Vogelsrand No. 373.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on the sites:
    - Office / Control Room (~300m2);
    - 22kV Switch gear and relay room (~200m2);
    - 22kV/132KV Outdoor Switchyard (5000m2);
    - Security control (~60m2)
- Battery storage – A Battery Storage Facility with BESS Containerized solution and associated operational, safety and control infrastructure will be required.\
- Roads – Access will be obtained via the R70 regional 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

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surrounding farm. Fencing with a height of 2.5 meters will be used.

1.2 Description of Property and Affected Environment

The footprint of the proposed PV facility as well as associated grid infrastructure is located across several agricultural camps, approximately 4.5 km West-North-West of the town of Henneman, in the Lejweleputswa district of the Free State province of South Africa.

The entirety of the footprint has been affected by recent, and likely also historical, agricultural activities focused on stock farming. However, across the north-west border where the original landscape can be observed, the natural vegetation comprises grassland typical of the southern African Grassland Biome in the summer-rainfall region, underlain by shales and sub-volcanic igneous outcrops in some places across the landscape. The affected property is interspersed with vehicle tracks where grass has been recently trimmed, probably to facilitate vehicle manoeuvrability between watering infrastructure present in several places, for the abundant cattle across several camps on the property. No primary or secondary sources of artefact quality stone were documented on the affected property, and no anthropogenic stone was documented in the vicinity of the affected property. Indigenous fowl including francolin and guineafowl were observed on the affected property, in addition to abundant traces of burrowing rodents (molerats, hares and meerkats), which may well affect any potential sub-surface archaeology (though none was documented).

The topography of the project area is generally flat, but undulates gradually from North-West to South-East, with more standing water sources in the North (all observed standing water sources were captured through modern anthropogenic activity). There is extensive modern disturbance across the footprint in the form of evidence of recent clearing for grazing and bioturbation in the form of rodent activity in the upper 0.25-0.5m of loamy topsoil (in the few places where partial topsoil profiles were exposed). In locations where historical grazing pressure has been more severe and soils have been excavated for watering purposes, secondary colluvial nodules (<5cm) of eroded shales were documented in amongst the sediment. The upper sediments look to have been fluvially deposited across much of the area, with characteristic moderately sub-angular rounding evident on some of the inclusions. There has clearly been cattle and potentially other stock rotation across all of the four camps that were surveyed. Indeed, the entirety of the area has been affected by historical farming related activities, with abundant cattle herds actively grazing in 3 of the 4 camps surveyed.

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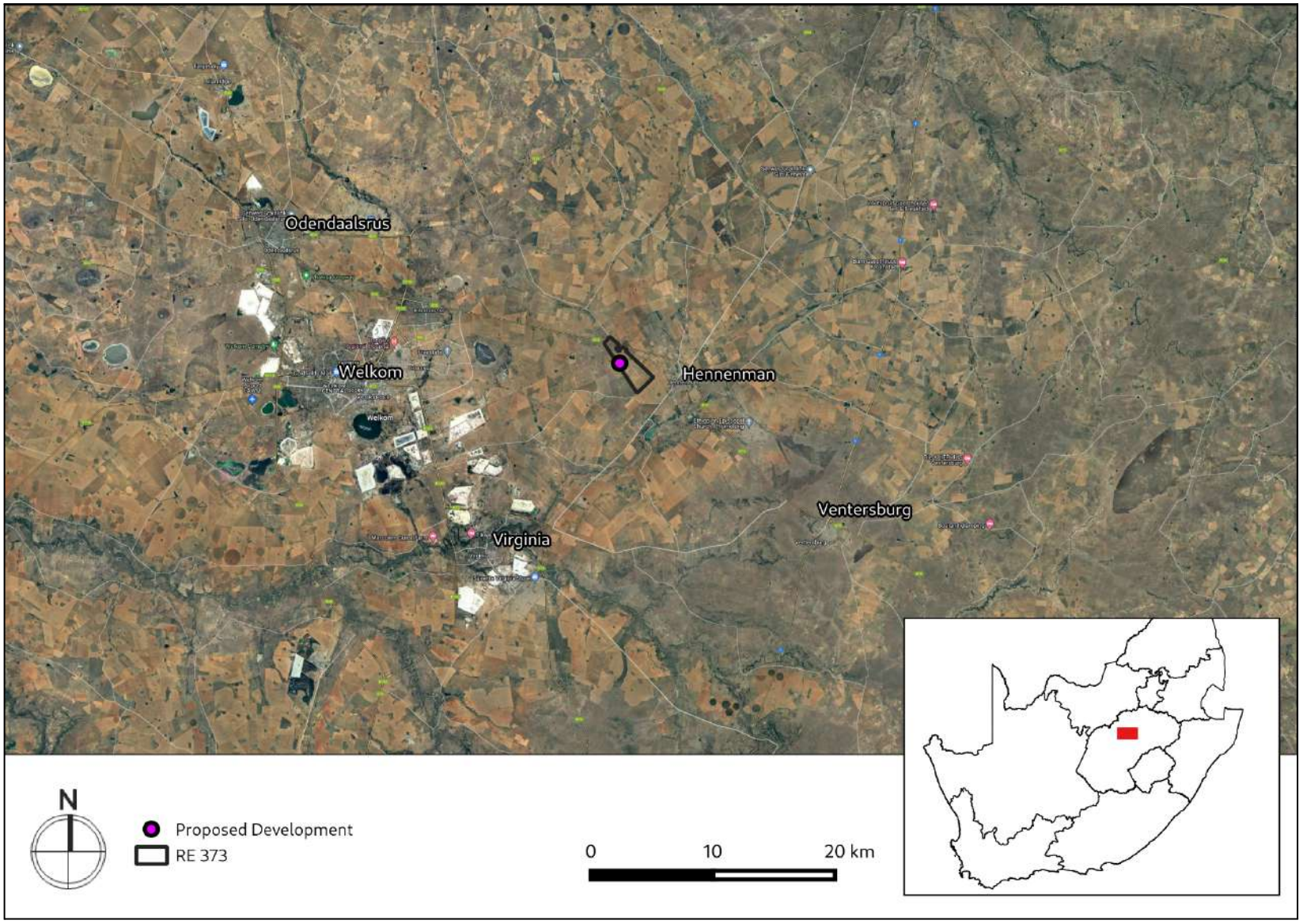

Figure 1.1: Close up satellite image indicating proposed location of study area

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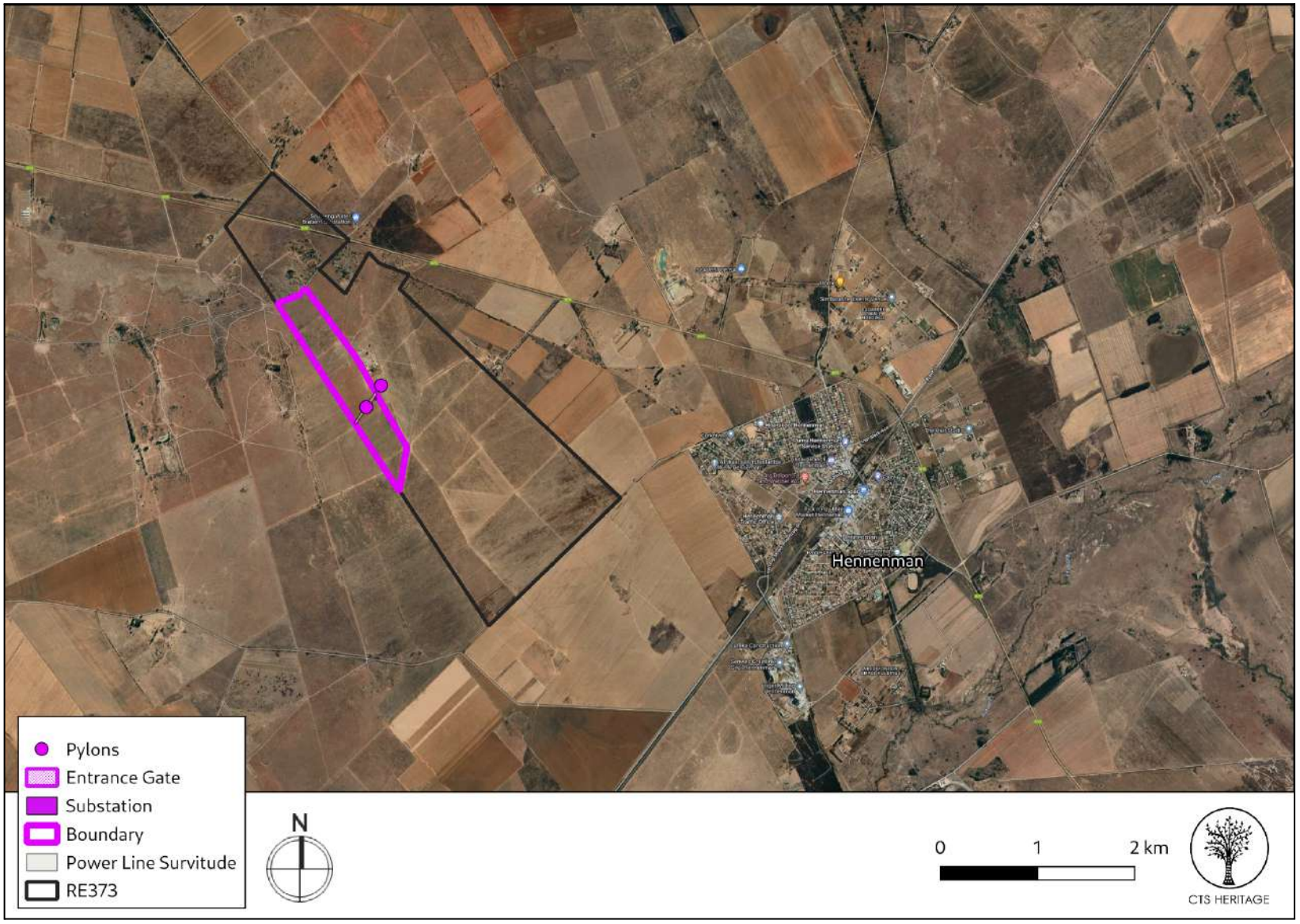

Figure 1.2: Study Area

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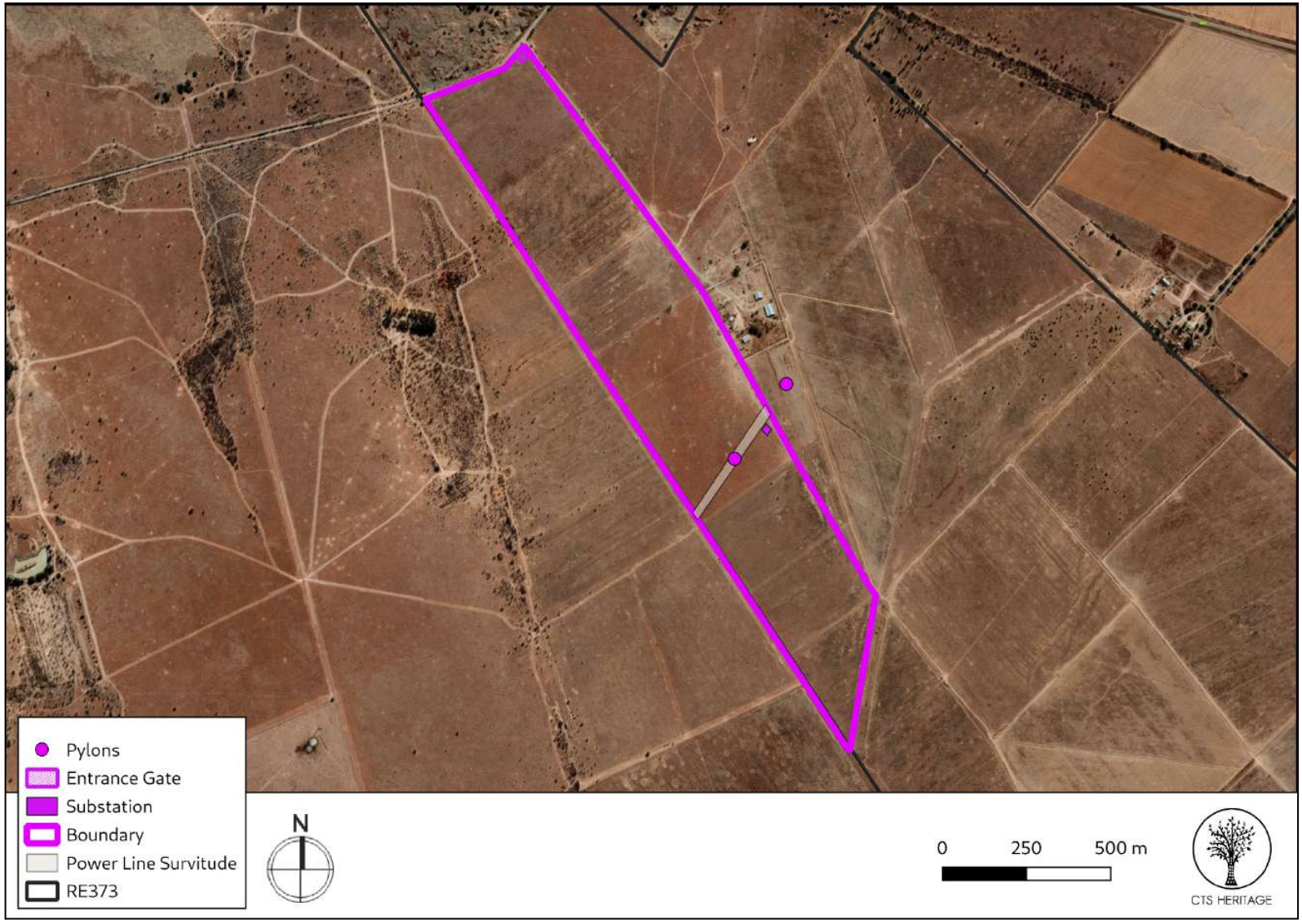

Figure 1.3: Study Area

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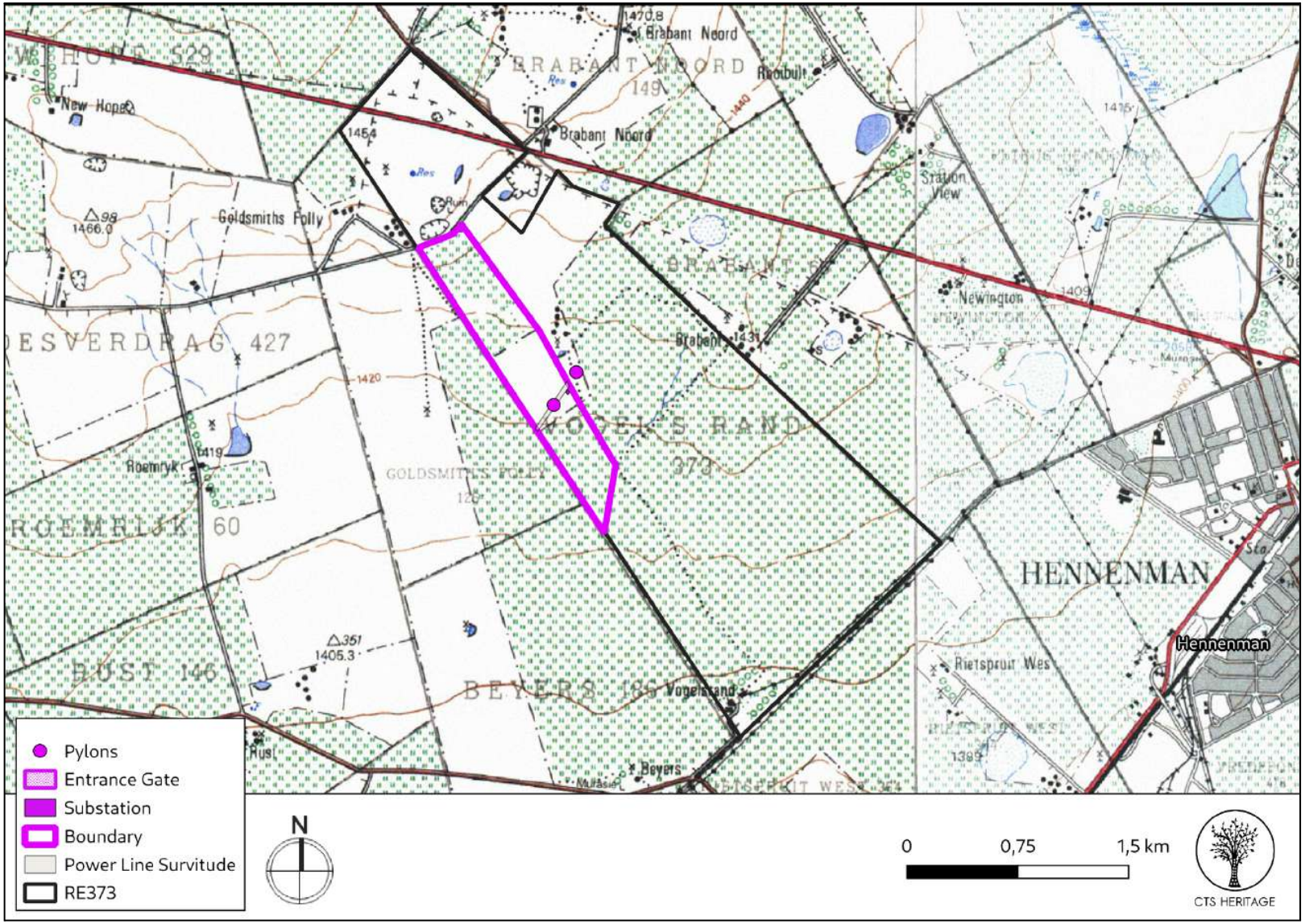

Figure 1.4: Study Area reflected on the 1:50 000 Topo Map

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2. METHODOLOGY

2.1 Purpose of Palaeontological Study

According to the SAHRIS Palaeosensitivity Map (Figure 4a), the area proposed for development is underlain by sediments of moderate and very high paleontological sensitivity. The purpose of this desktop palaeontological 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

- Primary research literature was consulted for detailed accounts of the geology and palaeontological representation across the study area. References of these primary research articles are provided.
- Geological maps (provided at various scales by CTS heritage and the South African Council for Geosciences) were consulted to identify represented geological contexts within the study area.
- Where possible, other Palaeontological Impact Assessments were consulted to provide additional information on local geomorphological, geological and palaeontological contexts. These often provide valuable additional information to primary research publications and formal geological maps, which can lack resolution at a local scale and it is important that discussions regarding alternative stratigraphic attributions of exposed rocks are noted and considered.
- The Archaeological Specialist Study report for the Proposed Henneman Solar Energy Facility (provided by CTS Heritage) was consulted to assess the landscape and geological exposures.

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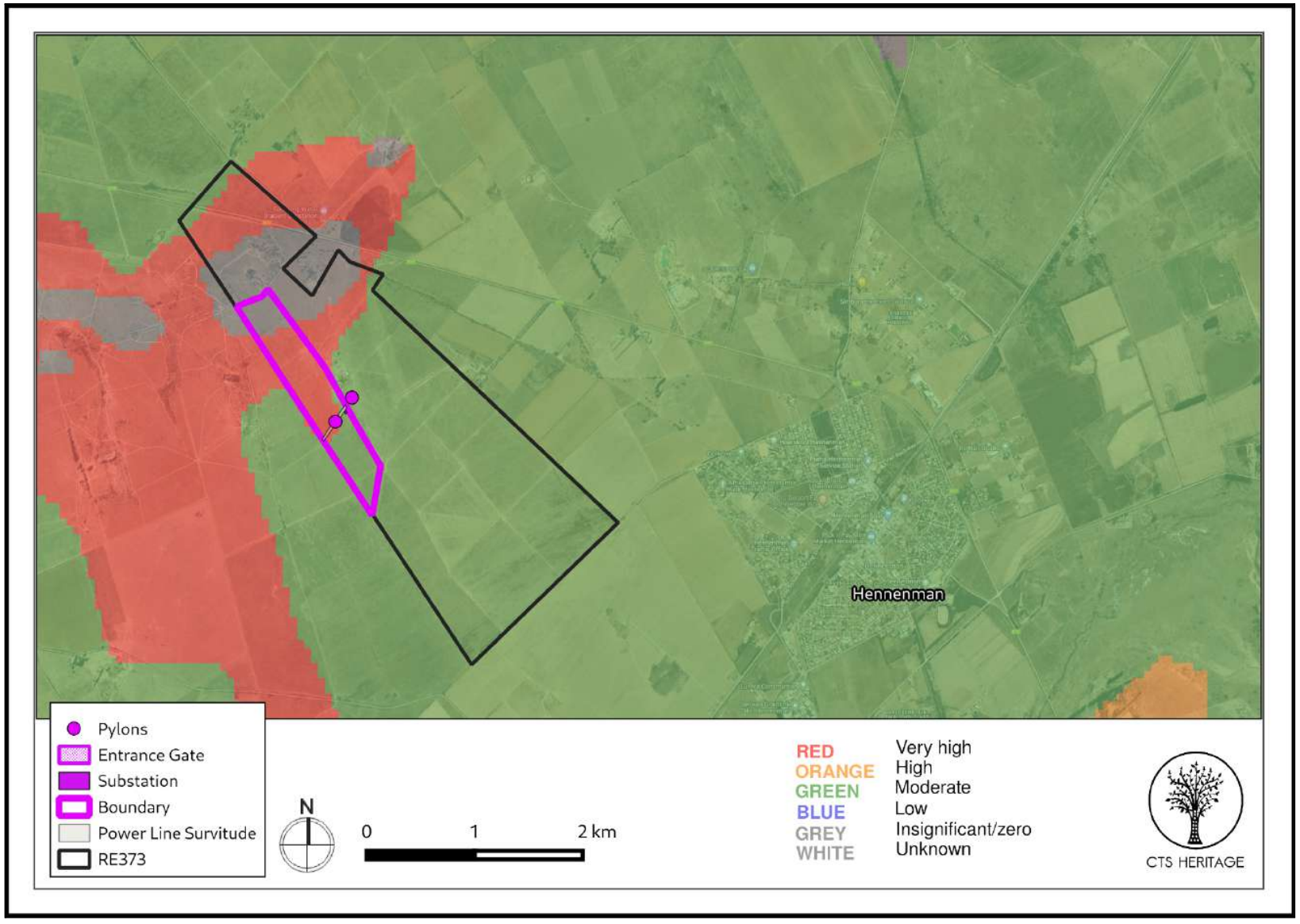

Figure 2: Palaeontological sensitivity of the development area from the SAHRIS PalaeoMap

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3. SITE SENSITIVITY

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and Very High fossil sensitivity (Figure 4). The Adelaide Formation of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2726 Kroonstad Geology Map (Figure 5).

A desktop Palaeontological assessment (2013) was completed by Millsteed for an adjacent development which is of relevance here. Millsteed (2013) notes that "The Cainozoic regolith and the Adelaide Subgroup are both potentially fossiliferous and their stratigraphic equivalents are known to contain scientifically important fossil assemblages elsewhere in South Africa. Accordingly, it may be reasonably expected that significant fossils may be present within the project area." He goes on to note that "Thus, the historical farming processes have probably destroyed any fossil materials that may have been present at surface in these areas. Similarly, where present the regolith cover would hide any fossils contained within the underlying Adelaide Subgroup from discovery. The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. Any fossil materials that may have been present at/or near the surface in the cultivated regolith will have been historically destroyed and the likelihood of any negative impact is categorised as negligible. The possibility of a negative impact on the depth interval between the maximum depth of ploughing and the maximum depth of excavations within the regolith is categorised as low (due to the scarcity of fossils in general)." Millsteed (2013) recommends that a palaeontological assessment be conducted to assess possible impacts to significant fossil heritage.

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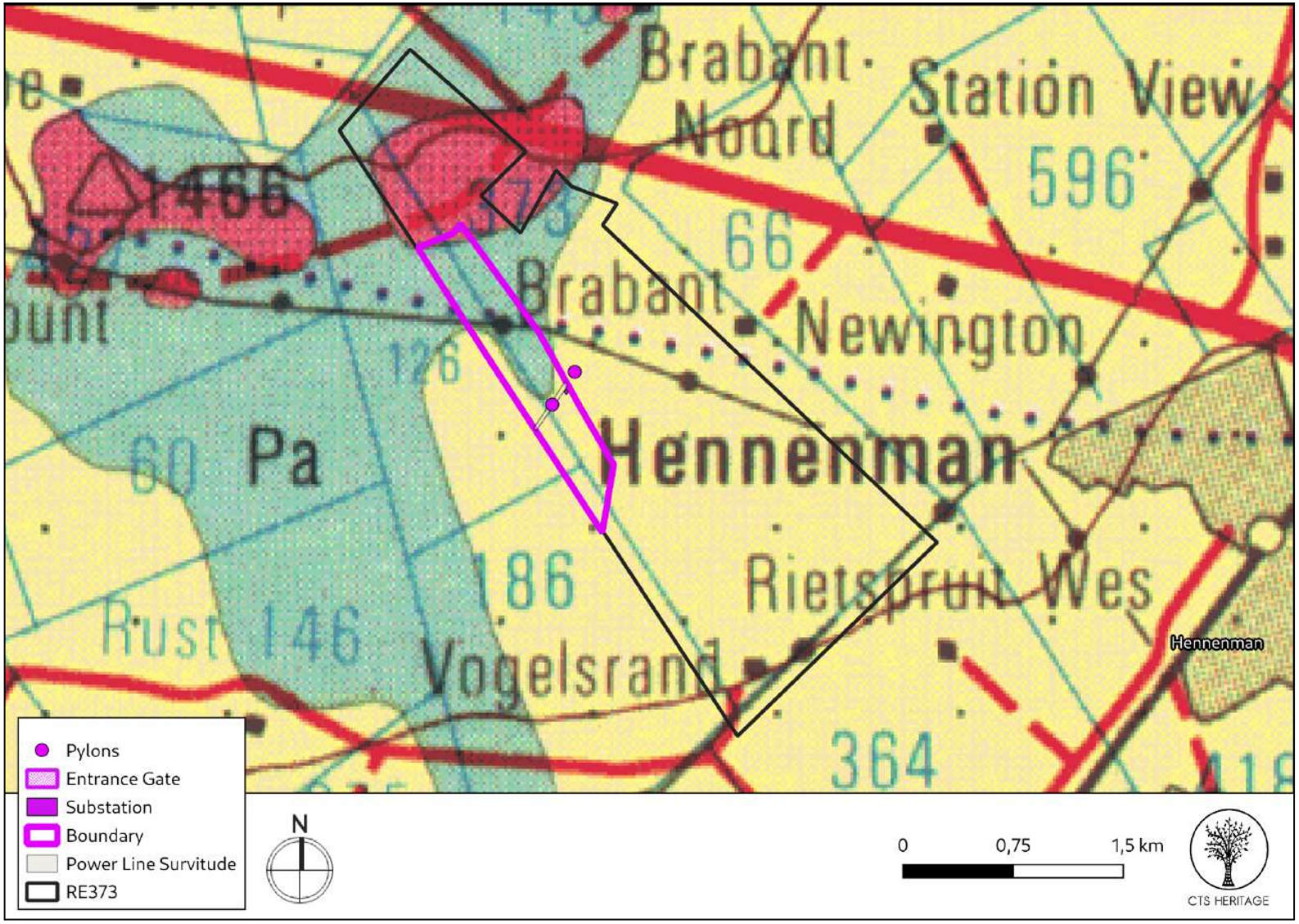

Figure 3. Geology Map. Extract from the CGS 2726 Kroonstad Geology Map indicating that the development area is underlain by sediments of the Adelaide Subgroup of the Beaufort Group (Pa), Jurassic dolerite (Jd) and Quaternary Sands

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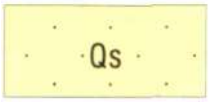
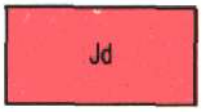
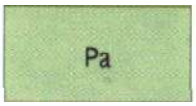
Table 1: Geological Summary Table

Geological unit	Age	Lithology	Symbol on figure 3	Fossil heritage	Palaeontological sensitivity (Almond and Pether, 2008)	Recommended mitigation
Quaternary	2.58 mya to 0 mya	Aeolian sand		Calcretised insect burrows (including termites) and root casts (rhizoliths), ostrich egg shells (S*truthio*), shells of land snails (e.g. *Trigonephrus*), bivalves and gastropods (e.g. *Corbula*, *unio*) and ostracods (seed shrimps), charophytes (stonewort algae), diatoms, stromatolites, mammalian ichnofossils	Moderate	Any fossil finds to be reported by developer
Jurassic dolerite	200 mya	Intrusive dolerite		None	Insignificant/Zero	No action required
Adelaide Subgroup - Beaufort Group - Karoo Supergroup	262 mya to 251 mya	Blue-grey silty mudstone, subordinate brownish-red mudstone; sandstone		Rich fossil tetrapod assemblage (including amphibians, pan-testudines, therapsids, pisces); fossil plants (including *Glossopteris,* lycopods, sphenophytes, ferns, silicified wood)	Very High	Field scoping study recommended before excavation takes place

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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Underlying geology of development area

The geological context of the proposed development area is characterised by Quaternary sands, Jurassic Dolerite (Jd), and the Permian Adelaide Subgroup (Pa) of the Beaufort Group, Karoo Supergroup (see Table 1 for summary).

- The northern half of the Proposed Henneman Solar Energy Facility development area is geologically represented by the **Adelaide Subgroup** (Beaufort Group, Karoo Supergroup). This unit was deposited in the middle to upper Permian (approximately 262 to 251 mya) (Groenewald *et al.*, 2022). The Adelaide Subgroup can be subdivided into several formations which vary depending on the latitude. This subdivision is currently being revised by the South African Committee for Stratigraphy (Groenewald *et al.*, 2022). Currently, the Adelaide is subdivided into the Abrahamskraal and Teekloof formations in the South-West part of the Karoo basin (west of 24° E), and the Abrahamskraal, Middleton and Balfour formations in the South-East part of the basin (east of 24° E) (Johnson *et al.*, 1996). In the eastern Free State and KwaZulu-Natal provinces, only the Normandien Formation has been defined, although it has been proposed that the lower part of the latter be placed in the Ecca Group and that the remainder of the Normandien be replaced by the Balfour Formation (Groenewald, 1990; Groenewald *et al.*, 2022). Finally, in the southern and central Free State, no subdivision is currently recognised, and only the Adelaide is mapped (Groenewald *et al.*, 2022). The proposed Henneman Solar Energy Facility is situated 4 km North-West of the town of Henneman, in the central/North-East part of the Free State. The CGS 2726 Kroonstad Geology Map (figure 3) indicates no subdivision of the Adelaide Subgroup in this area. The Beaufort Group reflects a shift from subaqueous conditions to subaerial fluvial environments (Groenewald *et al.*, 2022), in which the Adelaide Subgroup was formed through fluvial processes relating to large-scale meandering river systems (Johnson, Anhauesser & Thomas, 2006; Almond, 2021). The sediments of the Adelaide Subgroup comprise fine-grained bluish-grey, greenish-grey or greyish-red overbank mudrocks and grey fine- to medium-grained subordinate lenticular channel sandstones (Johnson, Anhauesser & Thomas, 2006; Almond, 2013; Millsteed, 2013; Millsteed, 2018; Almond, 2021). Sandstones can form 10% to 60% of the sequence, although usually average 20-30% (Millsteed, 2013; Millsteed, 2018).
- The North-East corner of the proposed project area is intruded by igneous **Jurassic Dolerite** sills and dykes (part of the Karoo Igneous Province of Southern Africa). These were formed through crustal doming and stretching during the break-up of Gondwana, (Johnson, Anhauesser & Thomas, 2006; Almond, 2013).
- The southern half of the Proposed Henneman Solar Energy Facility development area is covered in **Quaternary (<2.5 mya) to Recent aeolian** unconsolidated sand deposits (Holmes & Barker, 2006). The sands being aeolian indicate that they are not in primary context. These sands overlie the Adelaide Subgroup however it is not known how thick the sand deposits are in the proposed development area. The proposed Henneman Solar Energy Facility development area is geographically located in or near an area of South Africa with abundant pans (Holmes *et al.*, 2008). Pans are characterised by endoreic, flat and unvegetated basins in dryland areas. These get periodically inundated (Holmes *et al.*, 2008). The highest density of pans in southern Africa can be found in the western Free State (Holmes *et al.*, 2008).

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4.2 Palaeontological Sensitivity of the Development Area

- The Palaeontological Sensitivity of the **Adelaide Subgroup** is classified as **Very High Risk** by SAHRIS (figure 2). The unit contains a highly diverse tetrapod assemblage and three Assemblage Zones: the *Tapinocephalus*, *Endothiodon*, and *Cistecephalus* Assemblage Zones (Day & Rubidge, 2020; Day & Smith, 2020; Rubidge & Day, 2020). These have yielded amphibian fossils (including temnospondyls like *Rhinesuchus*), Pan-testudines (e.e. *Eunotososaurus*), therapsids (including biarmosuchians, anomodonts, gorgonopsians and therocephalians) as well as fish (e.g. *Namaichthys*). Plant fossils (including petrified wood, plant remains, leaf & stem impressions), non-marine molluscs, and trace fossils (trackways, invertebrate burrows, coprolites) have also been recovered in the Adelaide Subgroup (Johnson, Anhauesser & Thomas, 2006; Bordy & Prevec, 2008; Bordy, Linkermann & Prevec, 2011; Bamford, Cairncross & Lombard, 2020; Almond, 2021). It is unclear which formation of the Adelaide the proposed Henneman Solar Energy Facility development area is situated in and therefore which Assemblage Zone is represented and what fossils can be expected. According to the SAHRIS list of heritage resources within close proximity to the development area (see Environamics Henneman PV Screener completed by CTS Heritage), no fossils were recovered nearby.
- The Palaeontological Sensitivity of the **Jurassic Dolerite** is classified as **Insignificant/Zero** by SAHRIS (figure 2). The igneous intrusive origin of the Jurassic dolerite dykes makes it unlikely that they contain fossils.
- The Palaeontological Sensitivity of the **Quaternary deposits** is classified as **Moderate** by SAHRIS (figure 2). Although present, the fossil record of the Quaternary Sands is sporadic and not very diverse. Aeolian dunes are not likely to preserve fossil material, however, calcretisation of burrows (including termites) and root casts (rhizoliths) can occur. Fossils that have been recorded include ostrich egg shells (*Struthio*), shells of land snails (e.g. *Trigonephrus*), bivalves and gastropods (e.g. *Corbula*, *Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones). Quaternary calcretes have also yielded calcretised burrows (including termites), root casts (rhizoliths) as well as mammalian ichnofossils (Malherbe, 1984; Almond & Pether, 2008). It is worth noting that the Quaternary deposits may contain stone tools from various lithic industries and these should be the subject of further specialist assessment. There is an increased probability of uncovering fossil bones and archaeological remains near pans (Pether, Nat & Thukgwi, 2018). Pan deposits have been found to be important palaeo-environmental indicators that record past conditions through the sediments and fossils (including micro-organisms, invertebrates, plants, small vertebrates and the remains of animals that succumbed to drought and predators) (Pether, Nat & Thukgwi, 2018). Although pans are abundant in the nearby area, these are not indicated on the Google Earth map of the proposed development area, which shows that the land has been modified by agricultural practices. The surficial sediments are therefore unlikely to be *in situ*. It is possible that the underlying Adelaide Subgroup will be exposed during construction, however this depends on the depth of the excavations necessary for the proposed project.

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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Palaeontological Resources

Although the presence of Adelaide Subgroup would normally require a field scoping study be conducted before excavation takes place, the entire footprint of the proposed development has been modified for agricultural purposes and is covered by dense grasses. This makes it unlikely that a field scoping study would provide any more information on the likelihood of the project resulting in irreversible loss of the palaeontological heritage.

Based on this, along with the presence of Quaternary superficial deposits covering half of the fossiliferous sediments (Beaufort Group), and the lack of fossils finds in the SAHRIS list of heritage resources within close proximity to the development area, it is anticipated that the impact of the development will mainly be **LOW to MODERATE.**

6. CONCLUSION AND RECOMMENDATIONS

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subgroup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 1).

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7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
186709	Gideon Groenewald	14/10/2013	PIA Desktop	PALAEONTOLOGICAL ASSESSMENT OF THE PROPOSED DEVELOPMENT OF A 75MW PHOTOVOLTAIC SOLAR FARM, ON THE FARM UITKYK 509, WELKOM, FREE STATE PROVINCE.

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APPENDIX 1: CHANCE FOSSIL FINDS PROCEDURE

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CHANCE FINDS OF PALAEONTOLOGICAL MATERIAL

(Adopted from the HWC Chance Fossils Finds Procedure: June 2016)

Introduction

This document is aimed to inform workmen and foremen working on a construction and/or mining site. It describes the procedure to follow in instances of accidental discovery of palaeontological material (please see attached poster with descriptions of palaeontological material) during construction/mining activities. This protocol does not apply to resources already identified under an assessment undertaken under s. 38 of the National Heritage Resources Act (no 25 of 1999).

Fossils are rare and irreplaceable. Fossils tell us about the environmental conditions that existed in a specific geographical area millions of years ago. As heritage resources that inform us of the history of a place, fossils are public property that the State is required to manage and conserve on behalf of all the citizens of South Africa. Fossils are therefore protected by the National Heritage Resources Act and are the property of the State. Ideally, a qualified person should be responsible for the recovery of fossils noticed during construction/mining to ensure that all relevant contextual information is recorded.

Heritage Authorities often rely on workmen and foremen to report finds, and thereby contribute to our knowledge of South Africa's past and contribute to its conservation for future generations.

Training

Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.

Actions to be taken

One person in the staff must be identified and appointed as responsible for the implementation of the attached protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material.

Once a workman notices possible fossil material, he/she should report this to the ECO or site agent.Procedure to follow if it is likely that the material identified is a fossil:

- The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found;
- The ECO or site agent must inform SAHRA of the find immediately. This information must include photographs of the findings and GPS co-ordinates;
- The ECO or site agent must compile a Preliminary Report and fill in the attached Fossil Discoveries: Preliminary Record Form within 24 hours without removing the fossil from its original position. The Preliminary Report records basic information about the find including:
    - The date
    - A description of the discovery
    - A description of the fossil and its context (e.g. position and depth of find)
    - Where and how the find has been stored
    - Photographs to accompany the preliminary report (the more the better):
        - A scale must be used
        - Photos of location from several angles
        - Photos of vertical section should be provided
        - Digital images of hole showing vertical section (side);
        - Digital images of fossil or fossils.

Upon receipt of this Preliminary Report, SAHRA will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

- Exposed finds must be stabilised where they are unstable and the site capped, e.g. with a plastic sheet or sand bags. This protection should allow for the later excavation of the finds with due scientific care and diligence. SAHRA can advise on the most appropriate method for stabilisation.
- If the find cannot be stabilised, the fossil may be collect with extreme care by the ECO or the site agent and put aside and protected until SAHRA advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all fossil material and any breakage of fossil material must be avoided at all costs.

No work may continue in the vicinity of the find until SAHRA has indicated, in writing, that it is appropriate to proceed.

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FOSSIL DISCOVERIES: PRELIMINARY RECORDING FORM		
Name of project:		
Name of fossil location:		
Date of discovery:		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	*Lat:*	*Long:*
If no co-ordinates available then please describe the location:		
Time of discovery:		
Depth of find in hole		
Photographs (tick as appropriate and indicate number of the photograph)	*Digital image of vertical section (side)*	
	Fossil from different angles	
	Wider context of the find	
Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil Name:		
Contact:		
Recorder Name:		
Contact:		
Photographer Name:		
Contact:		

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APPENDIX 3: Heritage Screening Assessments

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HERITAGE SCREENER

CTS Reference Number:	**CTS22_009**
SAHRIS CaseID:	
Client:	**Environamics**
Date:	**March 2022**
Title:	**Henneman Solar PV**

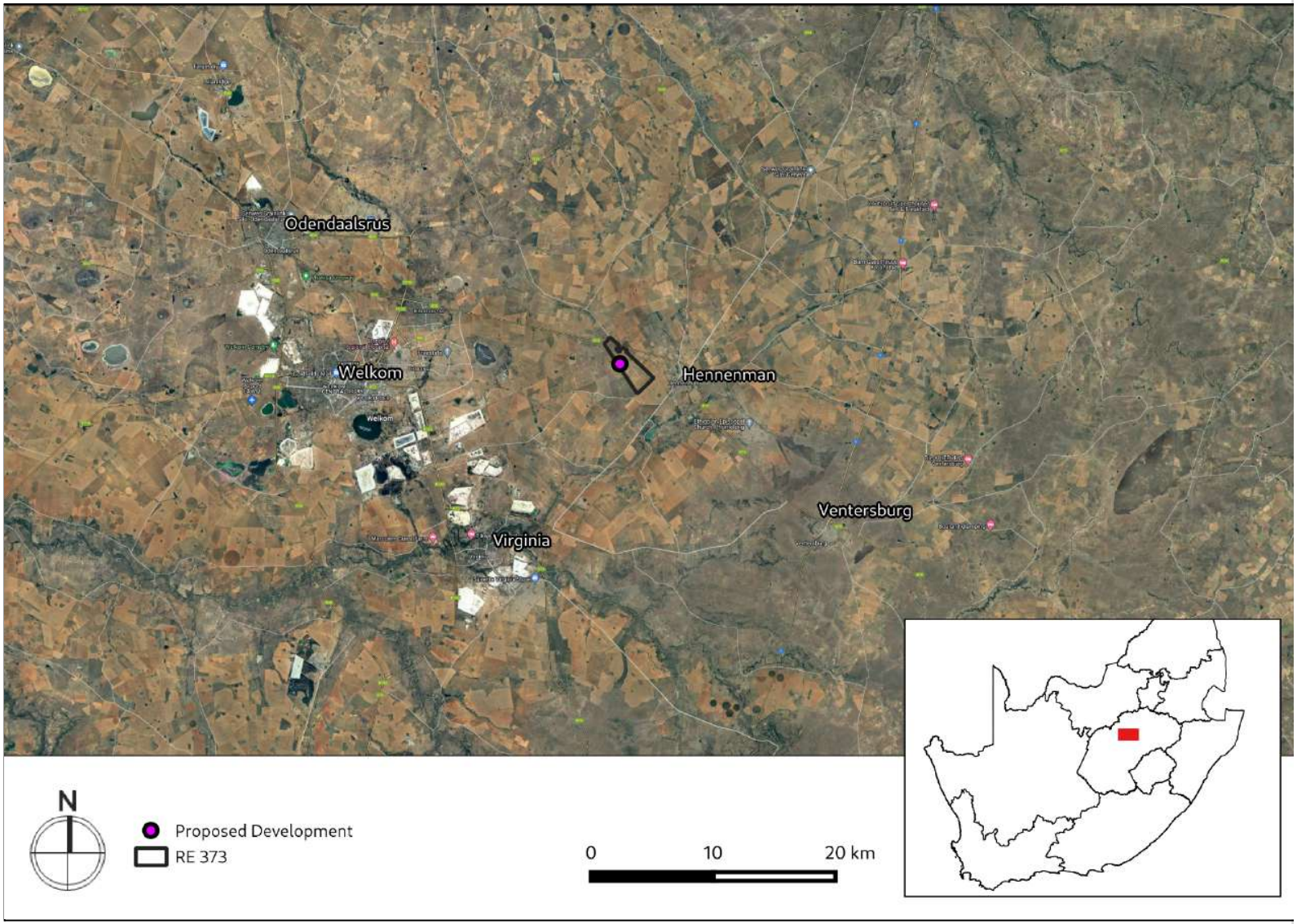

Figure 1a. Satellite map indicating the location of the proposed development in the Free State Province.

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1. Proposed Development Summary

TBA

2. Application References

Name of relevant heritage authority(s)	SAHRA
Name of decision making authority(s)	DFFE

3. Property Information

Latitude / Longitude	27°57'56.61"S 26°58'50.77"E
Erf number / Farm number	RE Farm Vogels Rand 373
Local Municipality	Matjhabeng
District Municipality	Lejweleputswa
Province	Free State
Current Use	Agriculture
Current Zoning	Agriculture

4. Nature of the Proposed Development

Total Surface Area of development	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
X	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 000m^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 000m^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)

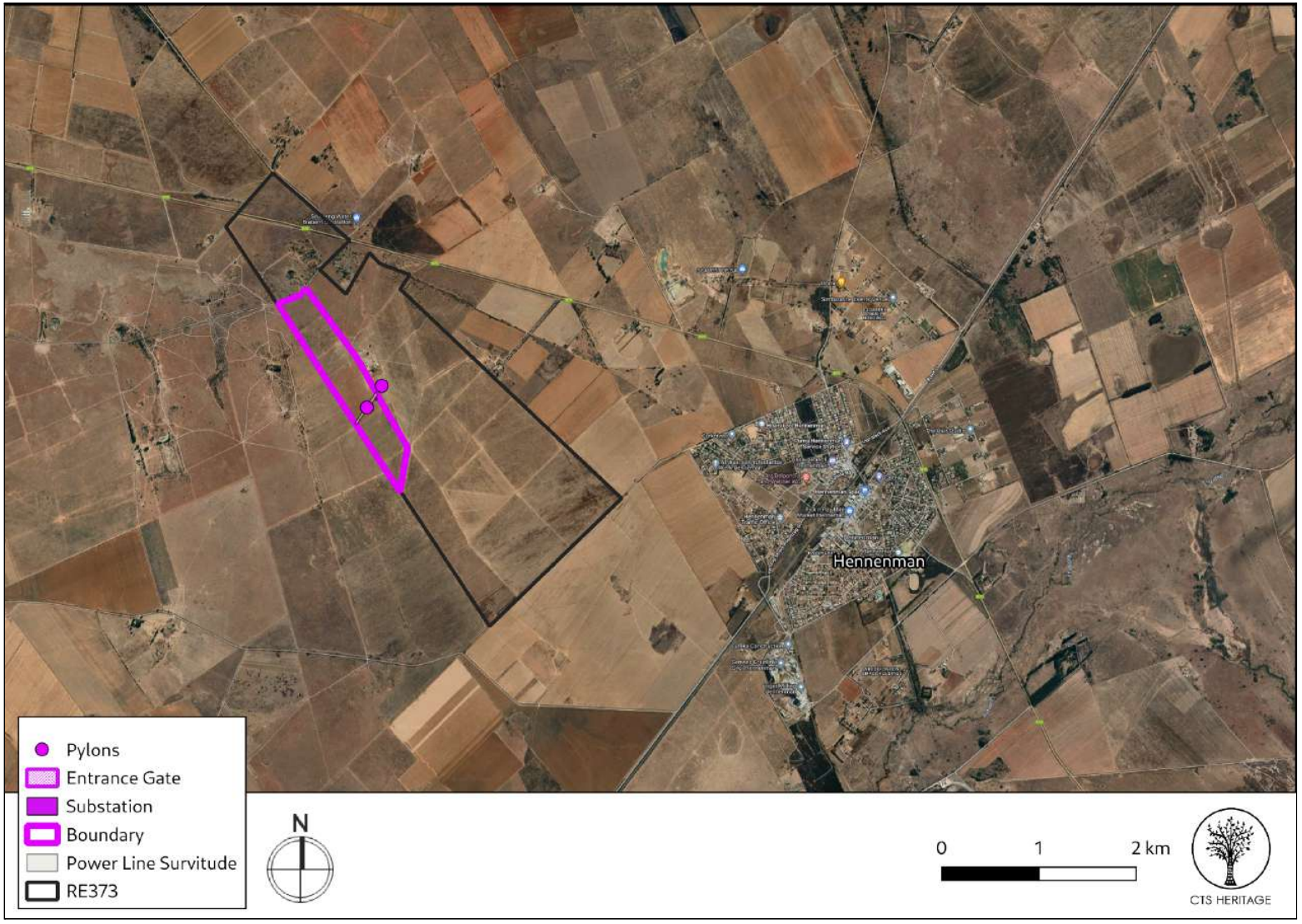

Figure 1b Overview Map. Satellite image (2019) indicating the proposed development area at closer range relative to Henneman PV

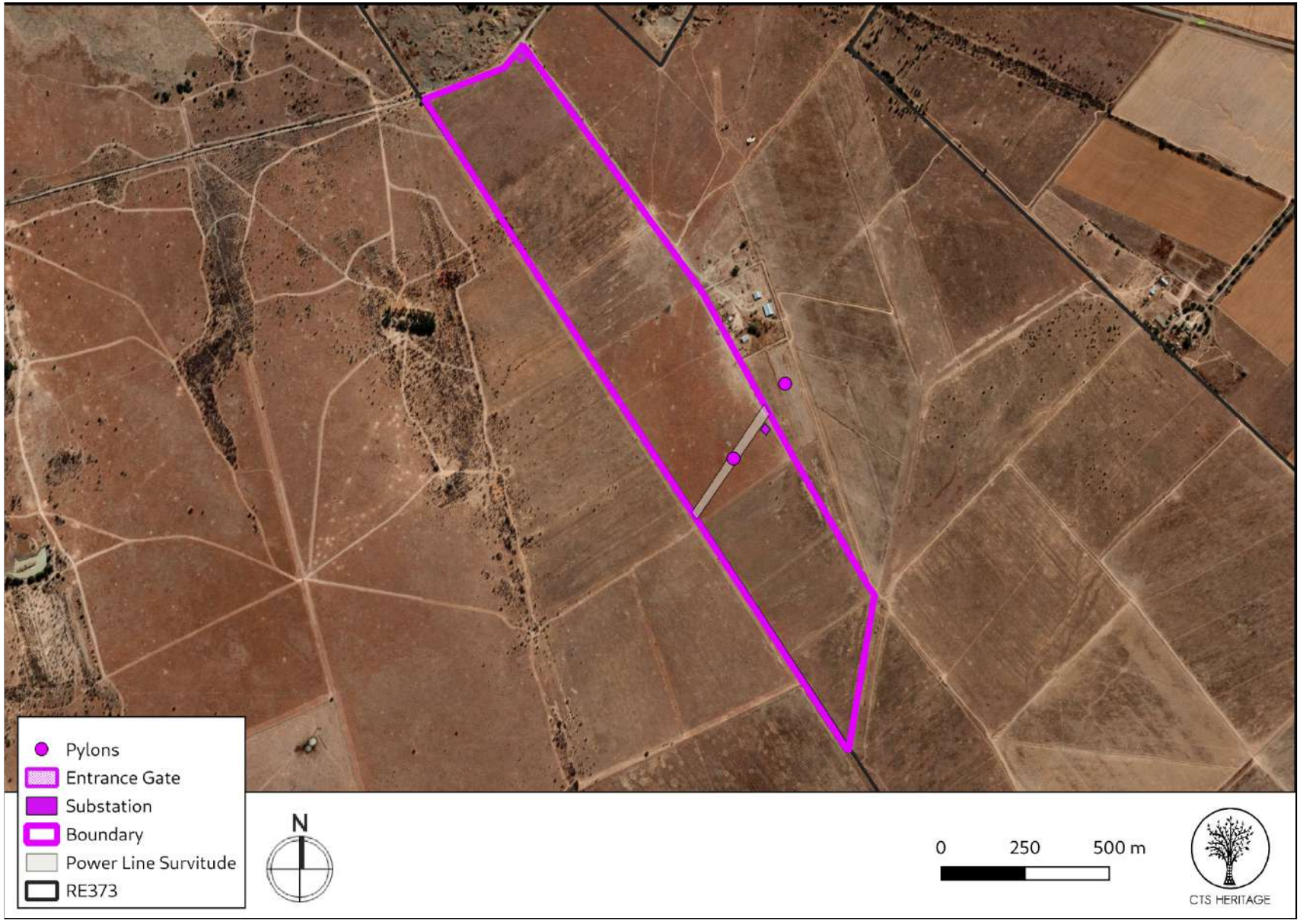

Figure 1c. Overview Map. Satellite image (2019) indicating the proposed development on RE Farm Vogels Rand 373, Free State Province, at closer range.

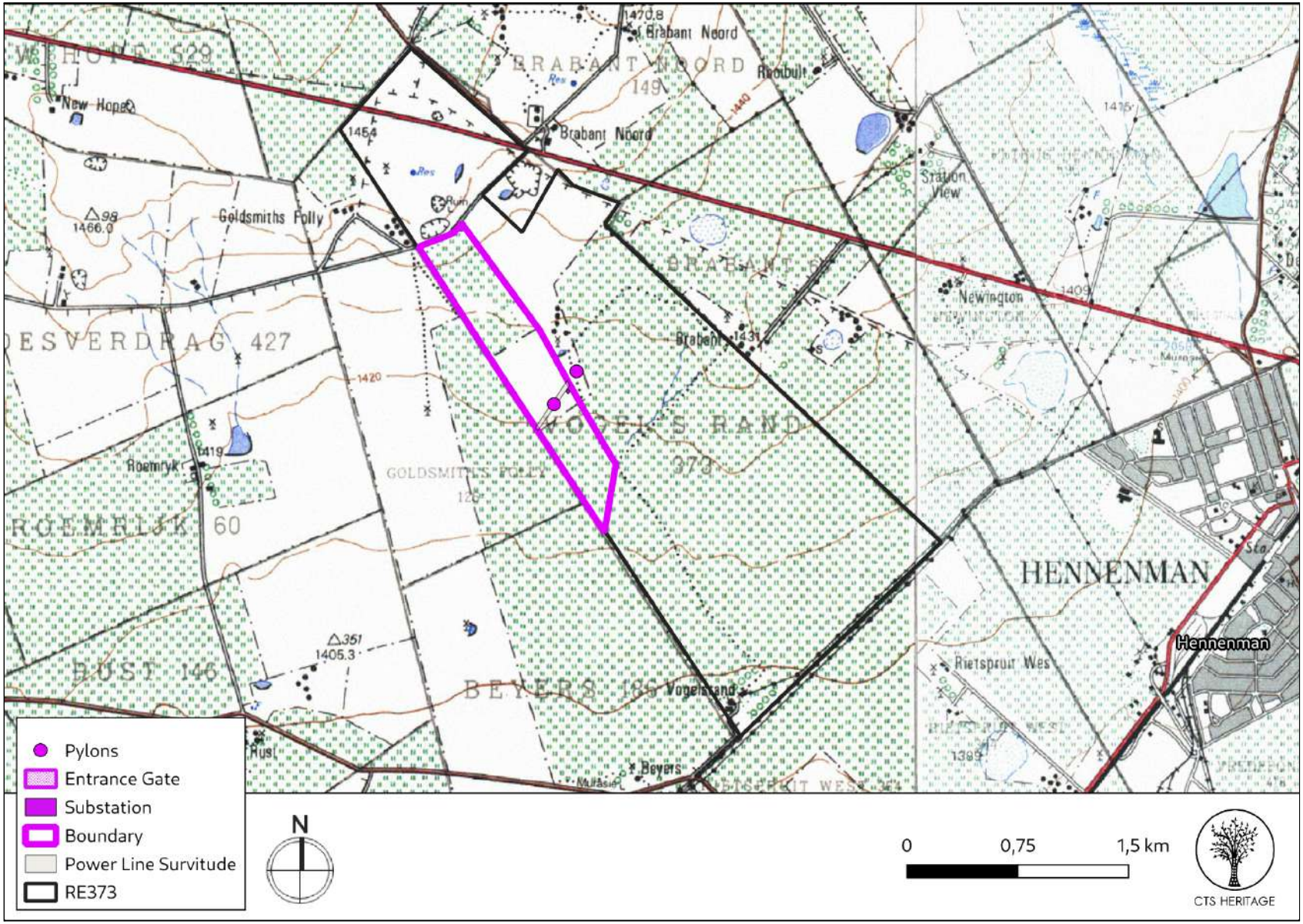

Figure 1d. Overview Map. 1:50 000 Topo Map for the development area

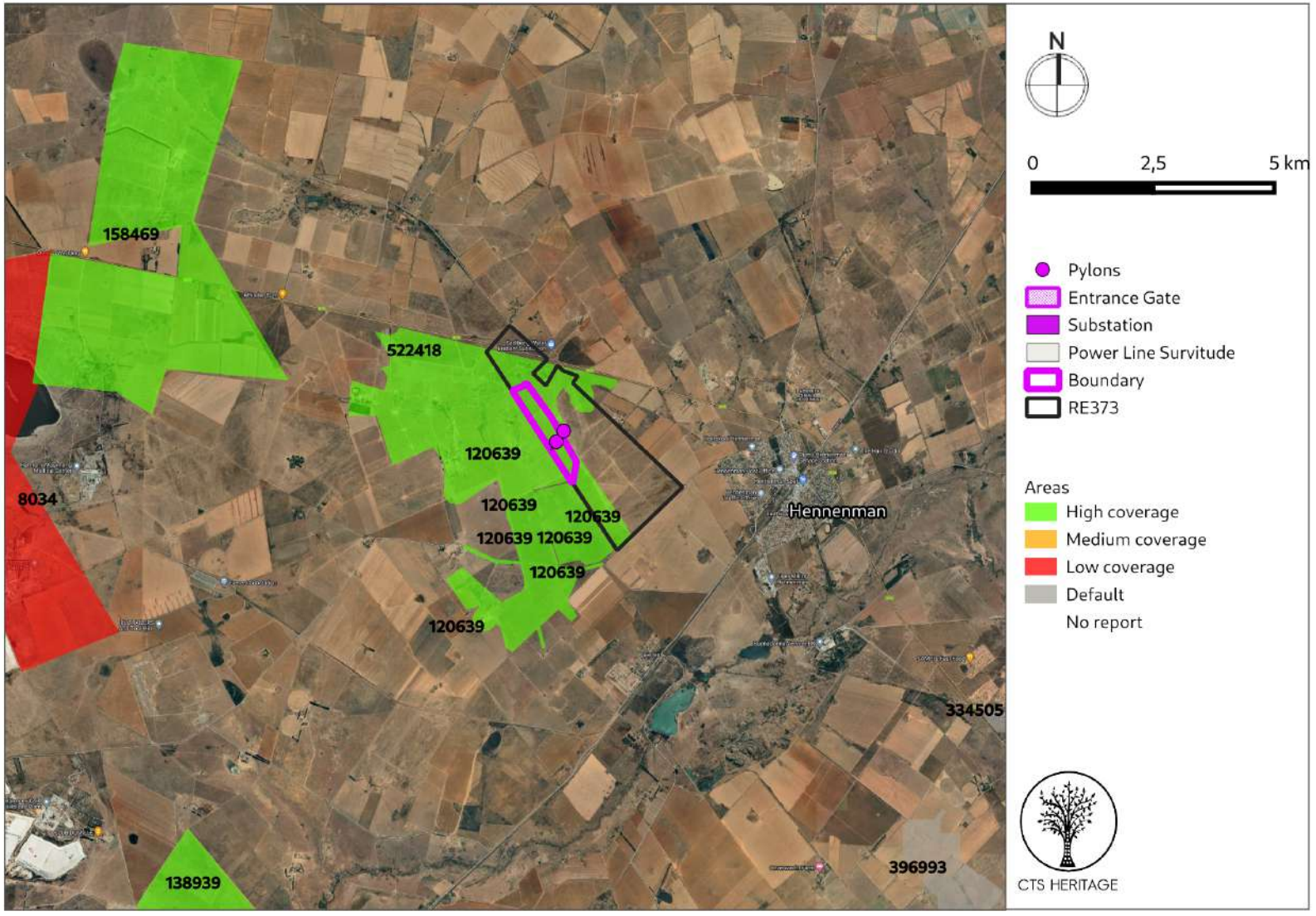

Figure 2. Previous HIAs Map. Previous Heritage Impact Assessments surrounding the proposed development area, with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

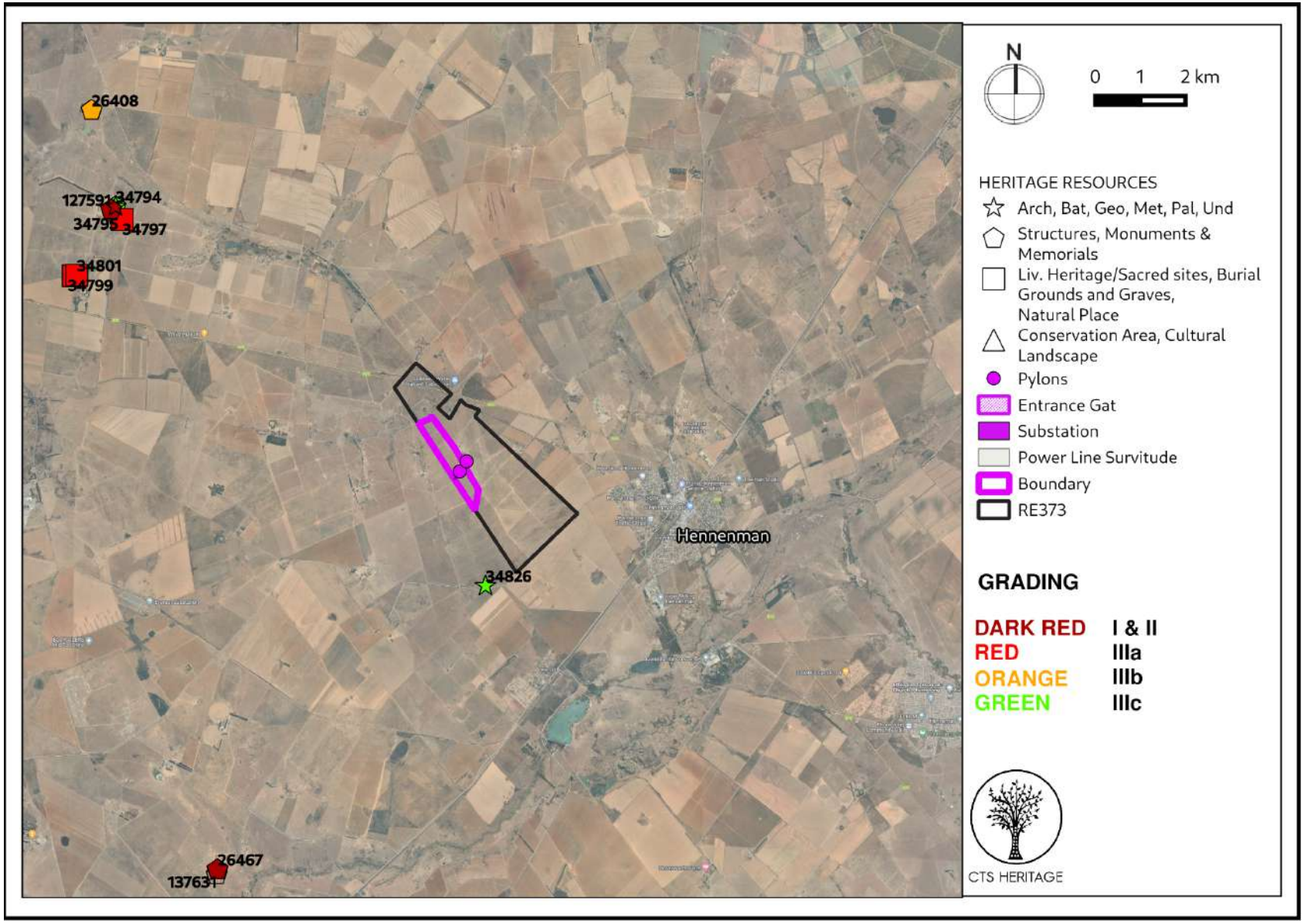

Figure 3a. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated. Please See Appendix 4 for a full description of heritage resource types.

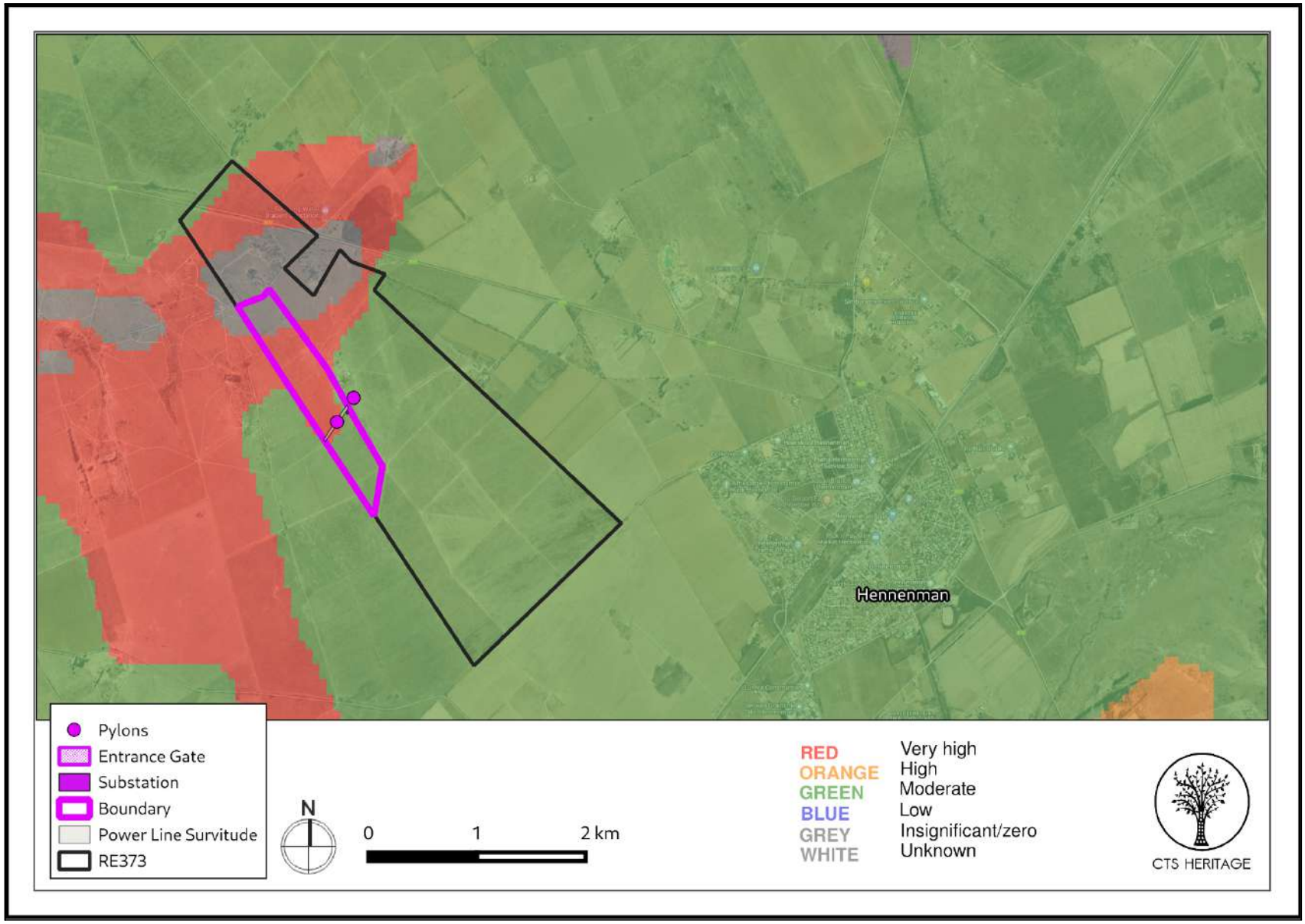

Figure 4. Palaeosensitivity Map. Indicating Low to Very High fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

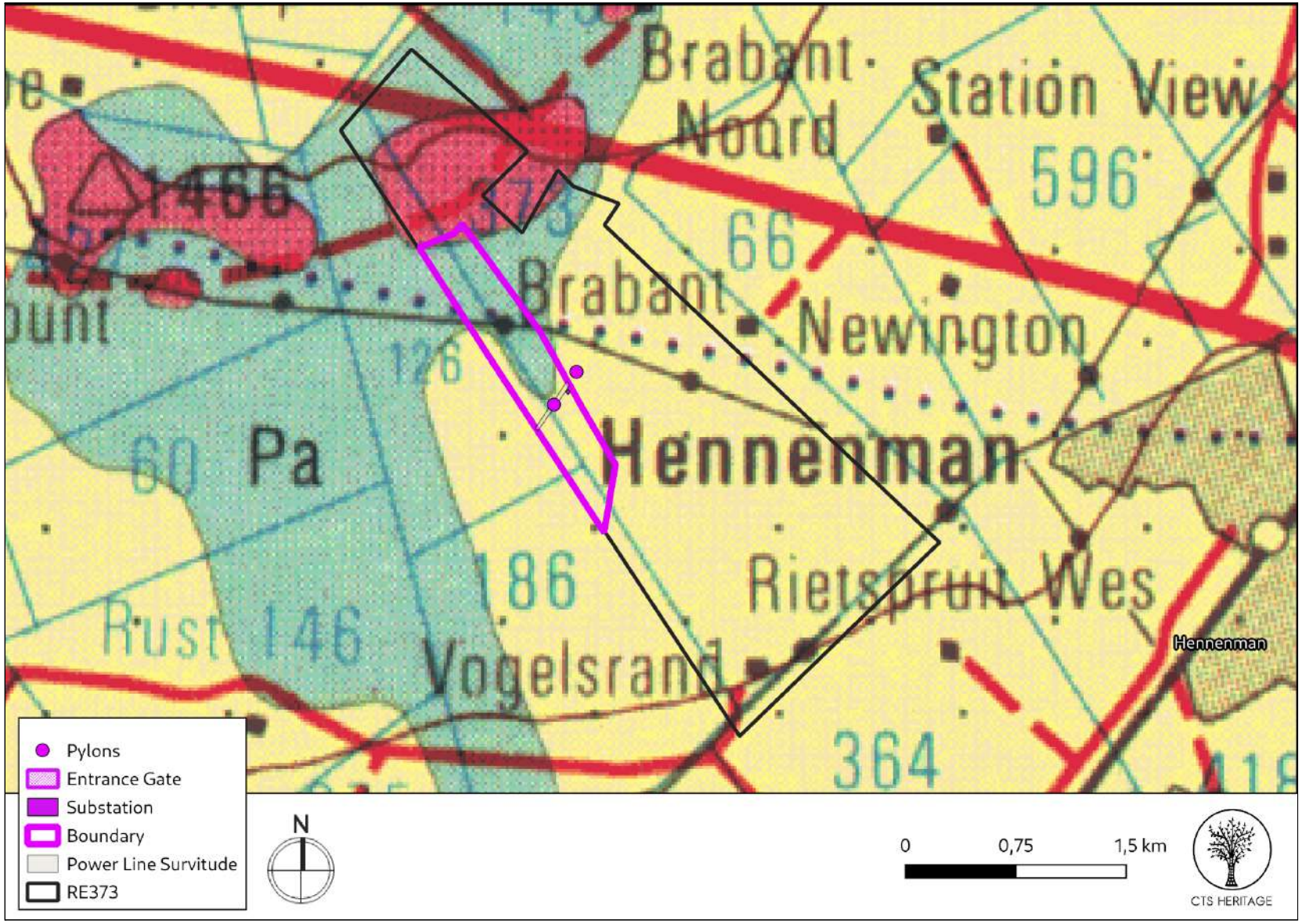

Figure 5. Geology Map. Extract from the CGS 2726 Kroonstad Geology Map indicating that the development area is underlain by sediments of the Adelaide Subgroup of the Beaufort Group (Pa), Jurassic dolerite (Jd) and Quaternary Sands

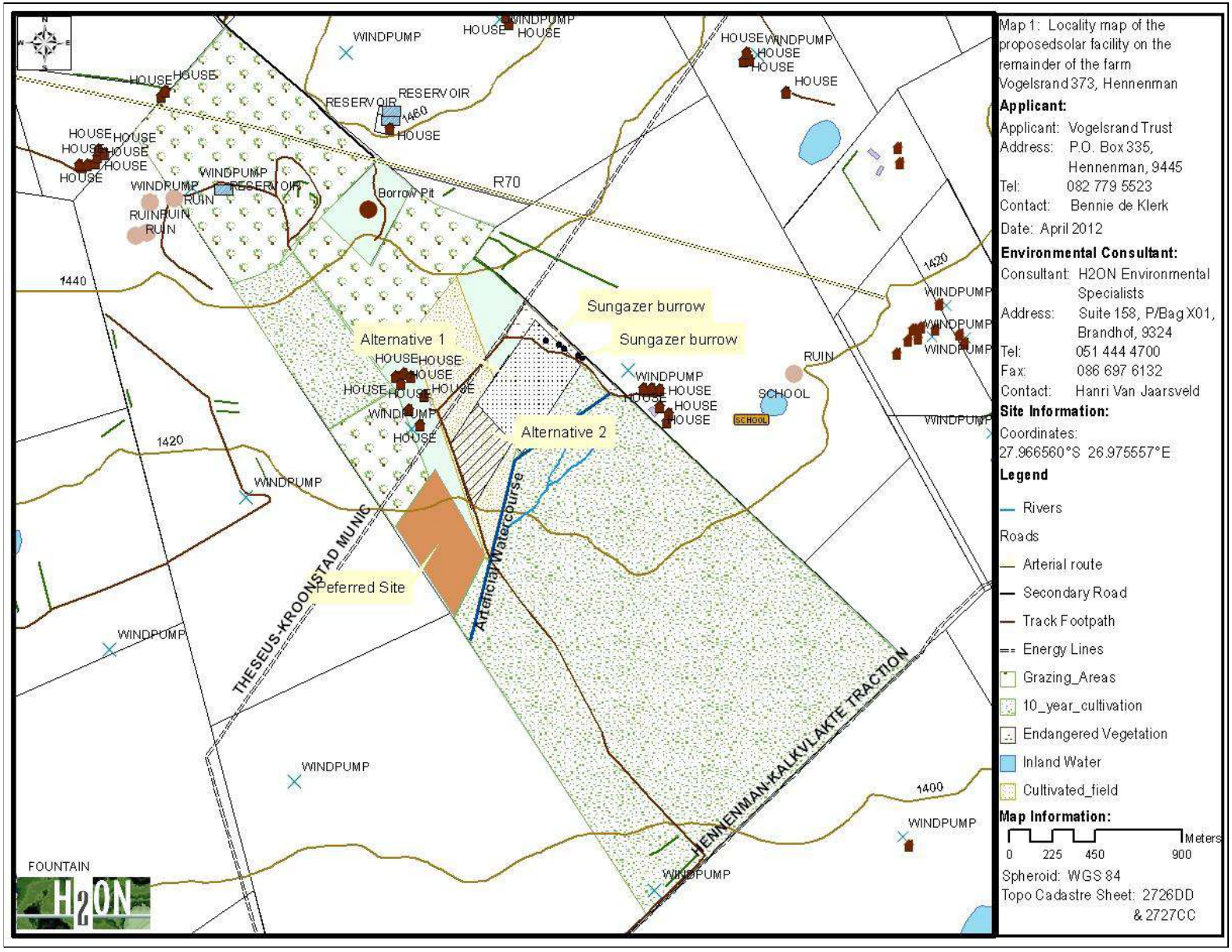

Figure 6. Development Map. From client

8. Heritage statement and character of the area

Background

This application is for the proposed development of a PV facility and associated grid infrastructure located approximately 5km west of the town of Henneman in the Free State Province. *Hennenman*, which was built as a single railway station, was formerly denoted as *Ventersburg Road*. In 1927, it was renamed after local Afrikaner P.F. Hennenman, from Swartpan Farm. In 1944, black South Africans were confined to a segregated enclave in southern Hennenman. During apartheid, this area was cleared by order of the government and nearly all then-residents relocated to a new township some fifteen kilometres away, *Vergenoeg* (Afrikaans for "Far enough", now *Phomolong*). An area located immediately adjacent to the PV development was previously assessed by Van der Walt (2013) as part of a different development application. Van der walt (2013) describes the development area as “extremely flat and is utilized for extensive agricultural purposes (crop farming). The entire study area used to be cultivated land. No structures or farming infrastructure occur within the development footprint. The study area falls within the bioregion described by Mucina et al (2006) as the Dry Highveld Grassland Bioregion with the vegetation described as Vaal-Vet Sandy Grassland within a Grassland Biome. Land use in the general area is characterized by mining and agriculture, dominated by crops and cattle farming. The study area is characterised by deep sandy to loamy soils based on the extensive agricultural activities.”

Archaeology

Archaeological sites spanning the Earlier, Middle and Later Stone Age have been found in the region despite the extensive agricultural transformation of the area. However, despite this, no heritage resources of significance were identified by Van der Walt (2013) in his assessment of the adjacent farm. Additionally, no significant archaeological sites have been recorded in the vicinity of the project area on SAHRIS. Van der Walt (2013) notes that “some MSA finds might be possible around pans on the farm. It is important to note that the lack of sites can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools. No Sites dating to the Early or Middle Iron Age have been recorded or is expected for the study area. The same goes for the Later Iron Age period where the study area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State. However to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986). Similarly to the east Makgwareng ceramics belonging to the Blackburn Branch of the Urewe tradition was recorded (Dreyer 1992 and Maggs 1976). There is however a low likelihood of finding sites dating to this period in the study area.” As such, it is recommended that an archaeological field assessment be undertaken in order to assess such impacts.

Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and Very High fossil sensitivity (Figure 4). The Adelaide Formation of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2726 Kroonstad Geology Map (Figure 5). A desktop Palaeontological assessment (2013) was completed by Millsteed for an adjacent development which is of relevance here. Millsteed (2013) notes that “The Cainozoic regolith and the Adelaide Subgroup are both potentially fossiliferous and their stratigraphic equivalents are known to contain scientifically important fossil assemblages elsewhere in South Africa. Accordingly, it may be reasonably expected that significant fossils may be present within the project area.” He goes on to note that “Thus, the historical farming processes have probably destroyed any fossil materials that may have been present at surface in these areas. Similarly, where present the regolith cover would hide any fossils contained within the underlying Adelaide Subgroup from discovery. The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. Any fossil materials that may have been present at/or near the surface in the cultivated regolith will have been historically destroyed and the likelihood of any negative impact is categorised as negligible. The possibility of a negative impact on the depth interval between the maximum depth of ploughing and the maximum depth of excavations within the regolith is categorised as low (due to the scarcity of fossils in general).” Millsteed (2013) recommends that a palaeontological field assessment be conducted to assess possible impacts to significant fossil heritage.

RECOMMENDATIONS

As it is likely that significant heritage resources will be impacted by the proposed development, it is recommended that a Heritage Impact Assessment is completed that satisfies section 38(3) of the NHRA and assesses likely impacts to archaeological and palaeontological heritage.

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APPENDIX 1

List of heritage resources within close proximity to the development area from SAHRIS

Site ID	Site no	Full Site Name	Site Type	Grading
26467	9/2/318/0001	Farmhouse, Ferreirasrust, Hennenman District	Building	Grade II
26408	9/2/335/0002	Farm school, Taaiboschspruit, Sasolburg District	Building	Grade IIIb
34793	UTK001	UITKYK 001	Building	Grade II
34794	UTK002	UITKYK 002	Structures	Grade IIIc
34795	UTK003	UITKYK 003	Building, Artefacts	Grade IIIb
34826	BEY001	Beyers 001	Artefacts, Ruin >100 years, Deposit	Grade IIIc
34797	UTK004	UITKYK 004	Burial Grounds & Graves	Grade IIIa
34799	UTK005	UITKYK 005	Burial Grounds & Graves	Grade IIIa
34801	UTK006	UITKYK 006	Burial Grounds & Graves	Grade IIIa
127591	TSF-S1	Thabong Solar Farm Site 1	Building	Grade II
127592	TSF-S2	Thabong Solar Farm site 2	Stone walling	Grade IV
137631	Ferreirasrust Farm	Ferreirasrust Farm	Monuments & Memorials	

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APPENDIX 2

Reference List from SAHRIS

NID	Author(s)	Date	Type	Title
120639	Jaco van der Walt	30/08/2013	Archaeological Specialist Reports	Archaeological Impact Assessment report for the Proposed Everest Solar Energy Facility
158469	Karen Van Ryneveld	19/10/2013	Heritage Impact Assessment Specialist Reports	PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT. THE THABONG SOLAR FARM, UITKYK 509, WELKOM, FREE STATE, SOUTH AFRICA
169703	Lloyd Rossouw		HIA	Thabong Homestead Phase 1 HIA
186709	Gideon Groenewald	14/10/2013	PIA Desktop	PALAEONTOLOGICAL ASSESSMENT OF THE PROPOSED DEVELOPMENT OF A 75MW PHOTOVOLTAIC SOLAR FARM, ON THE FARM UITKYK 509, WELKOM, FREE STATE PROVINCE.
8034	Cobus Dreyer	05/03/2004	AIA Phase 1	Archaeological and Historical Investigation of the Graves at the Proposed Housing Developments near Thabong, Welkom, Free State

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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)
DEA	Department of Environmental Affairs (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.

CTS HERITAGE

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.