

# HERITAGE IMPACT ASSESSMENT

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

## **Proposed development of the 100MW Harmony Moab Khotsong Solar PV Facility, Vierfontein, Free State Province**

SAHRIS Ref:

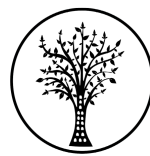
**Prepared by CTS Heritage**



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**For  
Savannah Environmental**

**July 2022**



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## EXECUTIVE SUMMARY

1. Site Name:

100MW Harmony Moab Khotsong Solar PV Facility, Vierfontein, Free State Province

2. Location:

10km southeast of Orkney

3. Locality Plan:

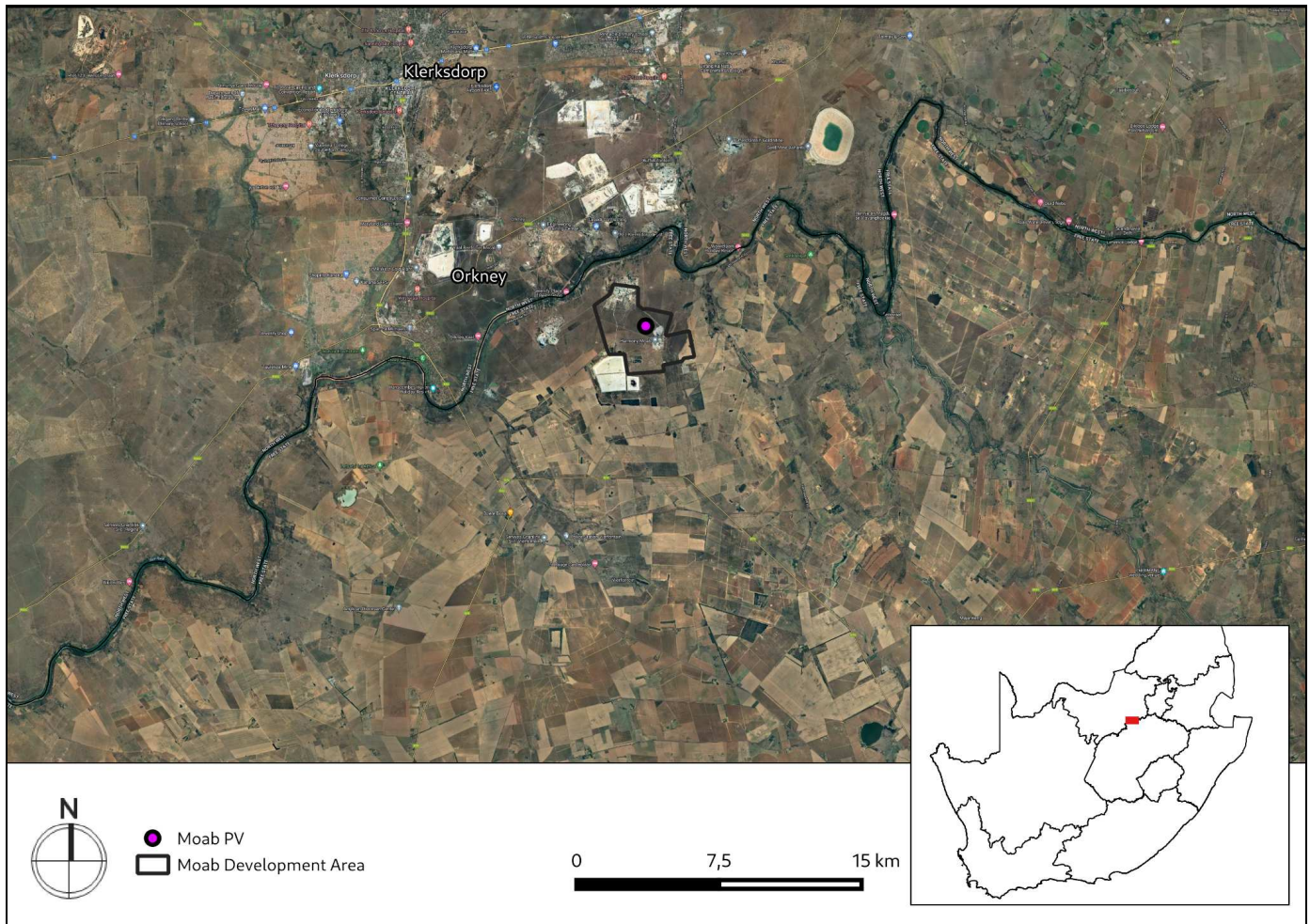
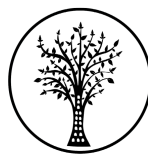


Figure 1: Location of the proposed study area

4. Description of Proposed Development:

The development of a renewable energy facility, overhead powerline and associated infrastructure is proposed by HARMONY MOAB KHOTSONG OPERATIONS PTY (LTD). The project entails the development of three (3) separate solar PV facilities with a combined contracted capacity of up to 100MW over 280 ha of land and will be



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known as Harmony Moab Khotsong Solar PV Facility, each facility will include a grid connection and other associated infrastructure.

The Solar PV facilities are based near Harmony Moab mining operations and fall within the Klerksdorp Renewable Energy Development Zone (REDZ) located ~10km North of the town of Vierfontein within the **Moghaka** Local Municipality respectively, and within the Fezile Dabi District Municipality, Free State Province.

5. Heritage Resources Identified in and near the study area:

Site No.	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
CM1	Moab 1	Isolated artefacts on sub-volcanic rock: Levallois core; Bladelet core and several flakes	MSA/LSA	-26.98790498	26.80750899	IIIC	30m Buffer
CM2	Moab 2	Chert outcrop with evidence of hominin exploitation	Stone Age	-26.98115604	26.77801601	NCW	NA
CM3	Moab 3	Isolated chert artefacts: several flakes	LSA	-26.97650903	26.78688196	NCW	NA

6. Anticipated Impacts on Heritage Resources:

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. As such, it is not surprising that the results of the survey only identified one site of scientific cultural value - CM1 within the Alternative Area proposed for the Noab PV development graded IIIC.

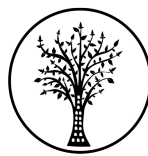
The identified site of archaeological significance has the potential to provide scientific insight into the past and as such, it is recommended that this area is not impacted by the proposed development. It is therefore recommended that no-go development buffers as per the recommendations below are implemented. Further, it is recommended that these sites are mapped on all relevant SDPs and that on-going conservation measures are put in place in the EMPs for the developments.

Furthermore, no impacts to significant palaeontological heritage is anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

7. Recommendations:

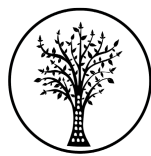
There is no objection to the proposed development in terms of impacts to heritage resources on condition that:

- The 30m buffer area recommended around site CM1 is implemented
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities



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- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



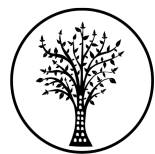
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### **Details of Specialist who prepared the HIA**

**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.

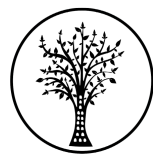
Jenna is a member of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of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

Since 2016, Jenna has drafted over 100 Heritage Impact Assessments throughout South Africa.



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## 1. INTRODUCTION

### 1.1 Background Information on Project

The development of a renewable energy facility, overhead powerline and associated infrastructure is proposed by HARMONY MOAB KHOTSONG OPERATIONS PTY (LTD). The project entails the development of three (3) separate solar PV facilities with a combined contracted capacity of up to 100MW over 280 ha of land and will be known as Harmony Moab Khotsong Solar PV Facility, each facility will include a grid connection and other associated infrastructure.

The Solar PV facilities are based near Harmony Moab mining operations and fall within the Klerksdorp Renewable Energy Development Zone (REDZ) located ~10km North of the town of Vierfontein within the **Moqhaka** Local Municipality respectively, and within the Fezile Dabi District Municipality, Free State Province.

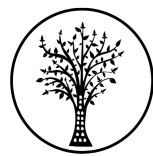
The details on the PV Facilities and grid connection infrastructure are listed below:

#### PV facilities:

Farm Name	Portion Number
ANGLO 593	593
HOEKPLAATS 598	598
MISPAH 274	274
MOAB 279	279
ZAAIPLAATS 2/190	2/190
ZAAIPLAATS 1/190	1/190
DOORNKOM WES 446	RE/446
CHRYSTALKOP 69	69
ZUIPING 394	4/394
ZUIPING 394	3/394
ZUIPING 394	5/394
ZUIPING 394	RE/394
ZUIPING 394	1/394

#### Grid connection infrastructure

The projects will tie-in to the Vaalreefs 11 , Southvaal Plant , Southvaal (6.6/132 kV) substations respectively Connection line A and C will have a connection capacity of up to 132kV, and Connection line B a connection capacity of up to 132kV. The lines connecting the PV facility to the respective substation will be up to 44kV.



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## 1.2 Description of Property and Affected Environment

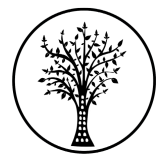
The potentially affected area related to the proposed PV facility is located across the Moab mining area and some privately owned agricultural camps in the east, approximately 12 km south-east of the town of Orkney. Although Orkney is located in the North-West province, the PV footprint is located across the southern bank of the Vaal River, on the northern border of the Free State province of South Africa.

Much of the footprint has been affected by sporadic surface disturbance and modern excavation likely associated with historical agricultural activities (and modern ploughed fields to the east of the Moab boundary included in the affected footprint) (CMB3), with mining prospection and the development of mining related infrastructure (CMB26). Where the natural vegetation is retained, it comprises grassland typical of the southern African Grassland Biome in the summer-rainfall region interspersed with acacia, and in some areas, such as the south-west, dense invasive forest comprising eucalyptus plantation and occasional black Wattle (CMB10). Chert bedrock outcrops in multiple locations (CMB4) in the north-west and in the south-east (some with clear prehistoric exploitation traces) (CM2). Where indigenous grassland is retained, evidence of smaller antelope (such as Duiker and Steenbok), abundant Vervet monkeys, indigenous fowl including francolin, spurfowl and guineafowl, as well as traces of burrowing rodents (molerats, hares and meerkats) were observed within the affected area.

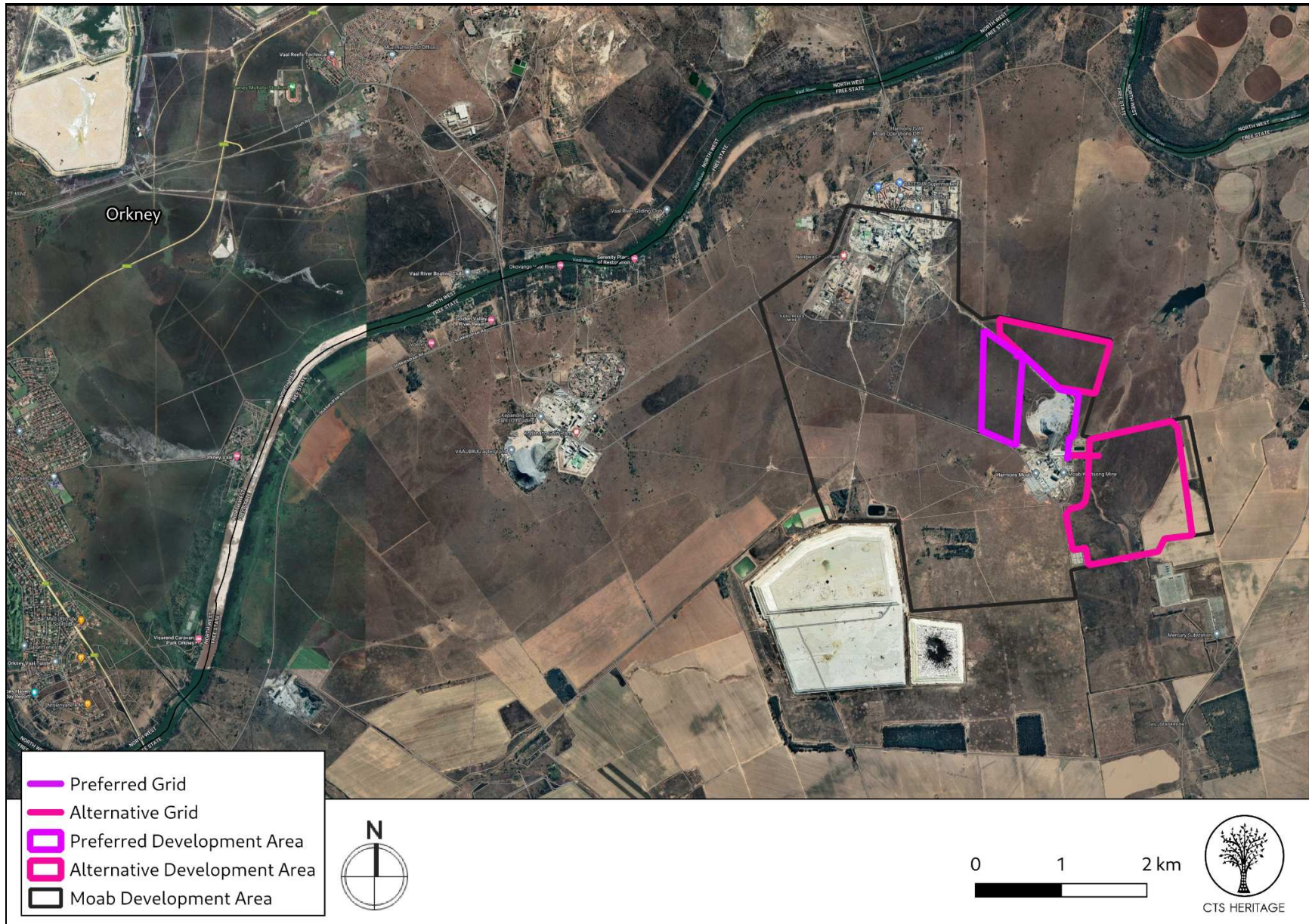
The topography of the project area is generally flat. It declines, however, gradually in the south-east where a drainage channel is located associated with Middle and Later Stone Age materials. There is extensive disturbance in the form of recent and historical clearing associated with probable mining-related activities. Bioturbation in the form of rodent activity is evident in the upper ~0.4-1m of sandy topsoil, as well as evidence for past stock rotation farming in the southern portion (probably prior to the land being owned by the mining company), and modern stock farming and bean plantation in the most easterly portion (on what looks to be privately owned/leased land).

The sandy upper sediments look to be fluvially deposited across much of the area, with very few lithic inclusions (some marginally rounded), indicating low-energy deposition in the north-western portions probably related to the Vaal river system, and with primary nodules of chert (5-10cm in maximum diameter) deriving from the local bedrock.



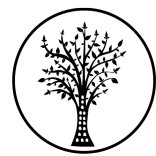


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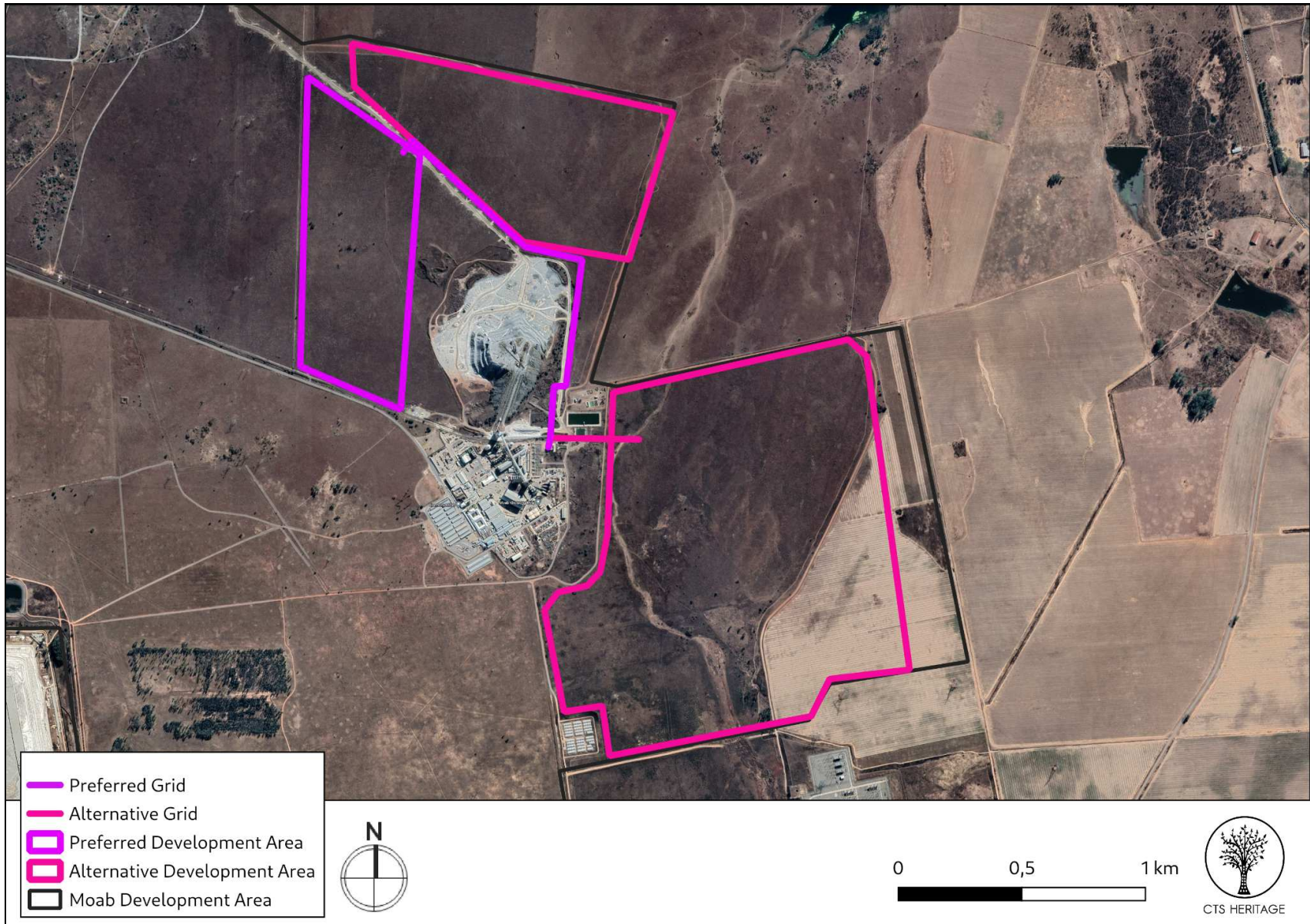


Map 11: The proposed development area

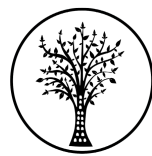
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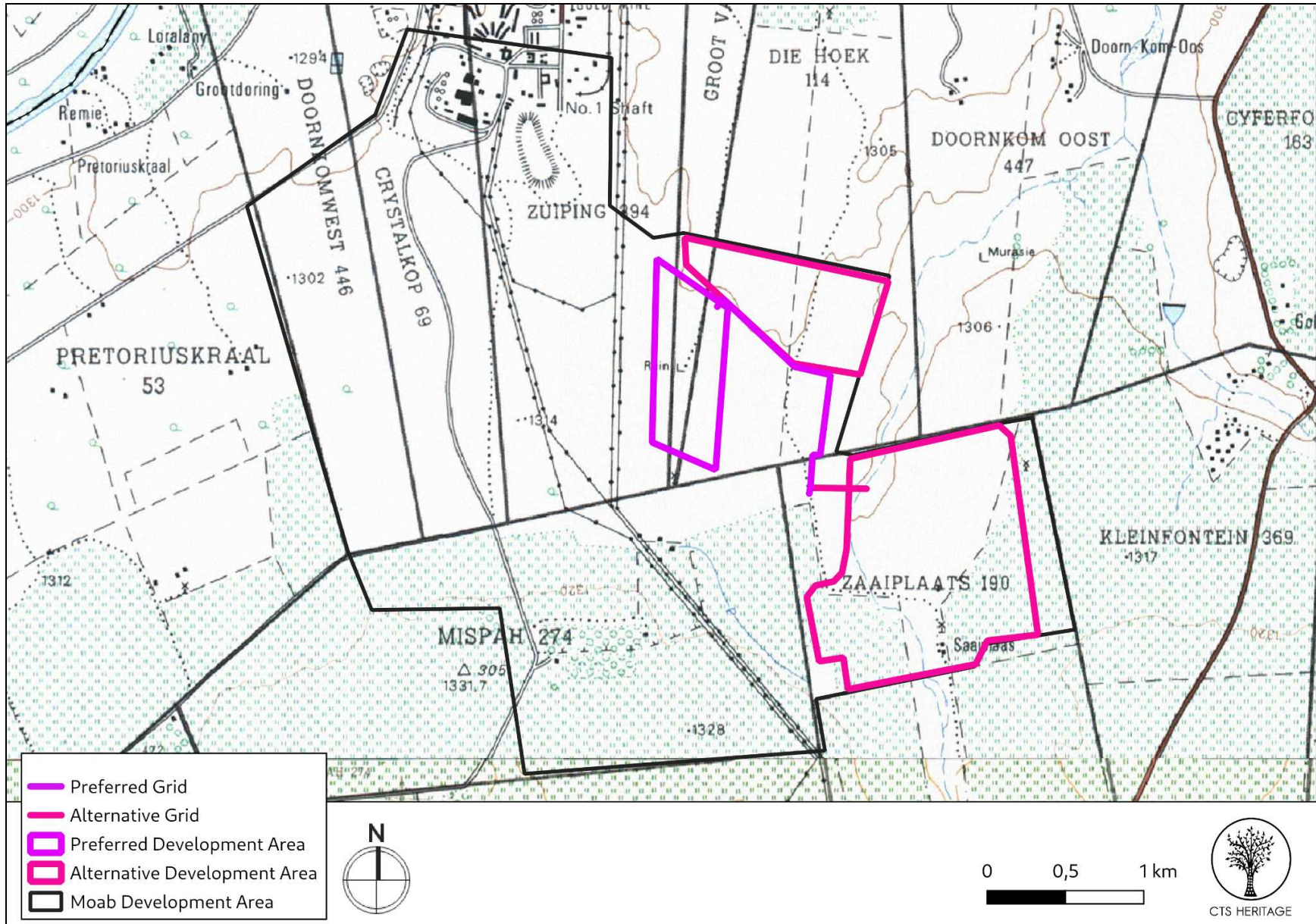
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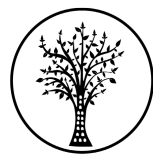
Map 1.2: The proposed development area



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Map 1.3: Study Area reflected on the 1:50 000 Topo Map



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## 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) (Appendix 1)
- An archaeologist conducted an assessment of the broader study area in order to determine the archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted her site visit on 8 and 9 June 2022 (Appendix 2)
- A Desktop Palaeontology Assessment was completed 6 July 2022, Appendix 3)
- The identified resources were assessed to evaluate their heritage significance and potential impacts to these resources were interrogated
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner

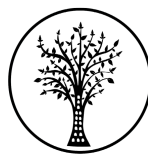
### 2.3 Assumptions and uncertainties

- 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

Dense grasses and occasional shrubland cover portions of the project area. This coverage significantly inhibited the visibility of surface archaeology. However, this is not regarded as a substantial problem in relation to the Stone Age archaeological remains, which in most cases look to have generally limited scientific importance due to the disturbed and deflated contexts they occur in. Additionally, even in the places that had optimal visibility,



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evidence of archaeology was extremely sparse. It is clear that the Stone Age sensitivity and scientific potential of the project area has been comprehensively assessed.

The inability to assess some of the footprint area at ground surface level in some portions (due to modern vegetation cover), should be regarded as a constraint to the documentation of potential graves.

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

Upper sediments are substantially disturbed in the eastern portion where crops are actively growing and cattle grazing is evident (in the area that appears to be private property).

Access was inhibited in areas actively mined; however, any archaeology occurring in these areas would likely be *ex situ* in any case, and of limited scientific importance.

The team is confident that, despite these challenges, the work completed has provided a sufficient assessment of the heritage sensitivity of the area proposed for development.

## 2.5 Savannah Impact Assessment Methodology

Direct, indirect and cumulative impacts of the issues identified through the Basic Assessment process were assessed in terms of the following criteria:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The duration, wherein it will be indicated whether:
  - The lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1.
  - The lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2.
  - Medium-term (5 – 15 years) – assigned a score of 3.
  - Long term (> 15 years) – assigned a score of 4.
  - Permanent – assigned a score of 5.
- The consequences (magnitude), quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high



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(processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 – 5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The significance is calculated by combining the criteria in the following formula:

$$S = (E + D + M) \times P$$

S = Significance weighting

E = Extent

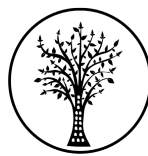
D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area).
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated).
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).



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

#### **3.1 Desktop Assessment**

##### **Background**

The assessment area for the proposed PV Solar farms and grid connections is situated north and south of the R76 close to the town of Viljoenskroon in the Free State Province. It falls within the jurisdiction of the Moqhaka Local Municipality in the Fezile Dabi District Municipality and is located within the existing Harmony Mine.

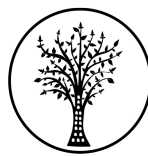
##### **Built Environment & Cultural Landscapes**

The development areas are located in peri-urban farms just outside the towns of Orkney (North West) and Viljoenskroon (Free State). The town of Orkney was established in 1940 at the junction of the various railway lines. It was named after the old gold mine opened by Thomas Leask, who came from the Orkney Islands, in 1880 (SESA 1973 in Van Schalkwyk 2021). Viljoenskroon is a maize and cattle farming town located in the Free State province of South Africa. It was named after the original farm owner J. J. Viljoen and his horse Kroon. The town was laid out in 1921 on the farm "Mahemskuil" and became a municipality in 1925. A number of large gold and diamond mines are also located in between the three solar PV sites, namely Taulekoa Mine next to Goedgenoeg 433, Kopanong Gold Mine next to Pretorius Kraal 53 and Great Nologwa Mine next to Groot Vaders Bosch 592. Ruins of or intact avenues of trees, historical farmsteads and farm labourer's cottages may potentially be found within the proposed development areas. The cultural landscape is characterised by a agriculture with abrupt transitions into extremely heavy industrial areas in and around the mining compounds. The installation of solar PV plants is therefore unlikely to have any impacts on the landscape character of the area.

##### **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. In Dreyer (2005) and Van der Walt's (2007) heritage impact assessments of the nearby Pretorius Kraal 53, various modern buildings were recorded that are located near the banks of the Vaal River that were deemed as not conservation worthy. Van der Walt identified some Middle to Later Stone Age artefacts scattered across the farm but did not map them. In Van Schalkwyk's (2021) impact assessment of the Siyanda Solar farm on Grootdraai 468 (which lies on the western border of Pretorius Kraal 53), visibility issues were a major problem,

*"Due to the very dense vegetation cover that occur in the project area, natural as well as agricultural fields, it was impossible to obtain any ground visibility. The strategy was therefore to examine natural and man-made features that are usually associated with human habitation and activities such as clumps of trees and rock outcrops. The proposed power line corridor connecting the Solar Power Plant to the the existing Vaal Reef Substation was not surveyed as access to the relevant properties (Pretoriuskraal 53) was not possible. It is proposed that once the power line route has been confirmed within the 100m corridor a heritage walk-through needs to be undertaken."*



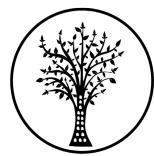
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Two burial sites were recorded during this survey despite the lack of Stone Age sites with the help of a local informant who had been working on the property for a number of years.

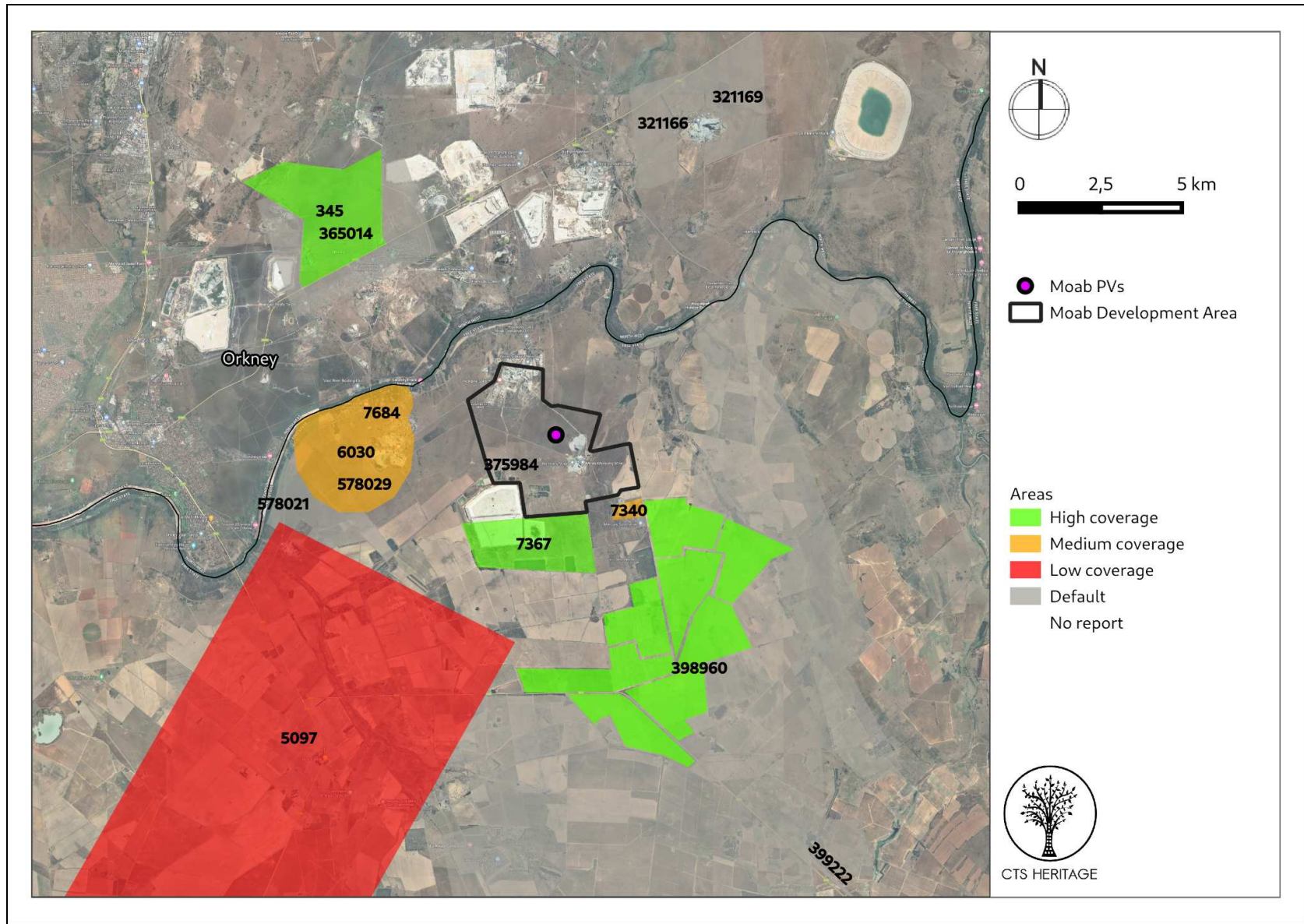
In his assessment of an area immediately adjacent to the project area, Huffman (2005, SAHRIS ID 7367) identified no sites of archaeological interest. In their assessment of an area located immediately adjacent to the areas proposed for development, Henderson and Koortzen (2007, SAHRIS ID 7340) noted that while no sites were found in the area surveyed, a number of previously excavated inspection pits yielded archaeological material in the form of stone artefacts. Henderson and Koortzen (2007, SAHRIS ID 7340) note that “These artefacts had been brought up from an unknown depth (probably no more than a metre or two), and were mostly undiagnostic flakes with one blade-like flake which could be Middle Stone Age. Raw material included cryptocrystalline, chert and quartz.”

In an assessment completed by CTS Heritage for a proposed PV facility located nearby, a single site and very few isolated individual artefacts were documented. Cumulatively these findings indicate cultural evidence for MSA and LSA occupations of the area. It was noted that the majority of finds were identified in disturbed surface contexts, and could not be tied chrono-culturally to a particular prehistoric period, however one site (VK4) was relatively less affected by post-depositional processes, and may have been exposed relatively recently. Apart from this one site, the potential for finding a dateable *in-situ* archaeological horizon based on current surface observations appears to be low. The documented archaeology is therefore classified as scientifically LOW-SIGNIFICANCE. It is therefore highly likely that further burials may be located on the proposed solar PV areas as well as Stone Age material similar to the artefacts recorded but not mapped by Van der Walt. An archaeological field survey is therefore recommended.

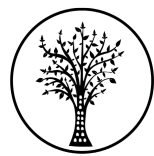




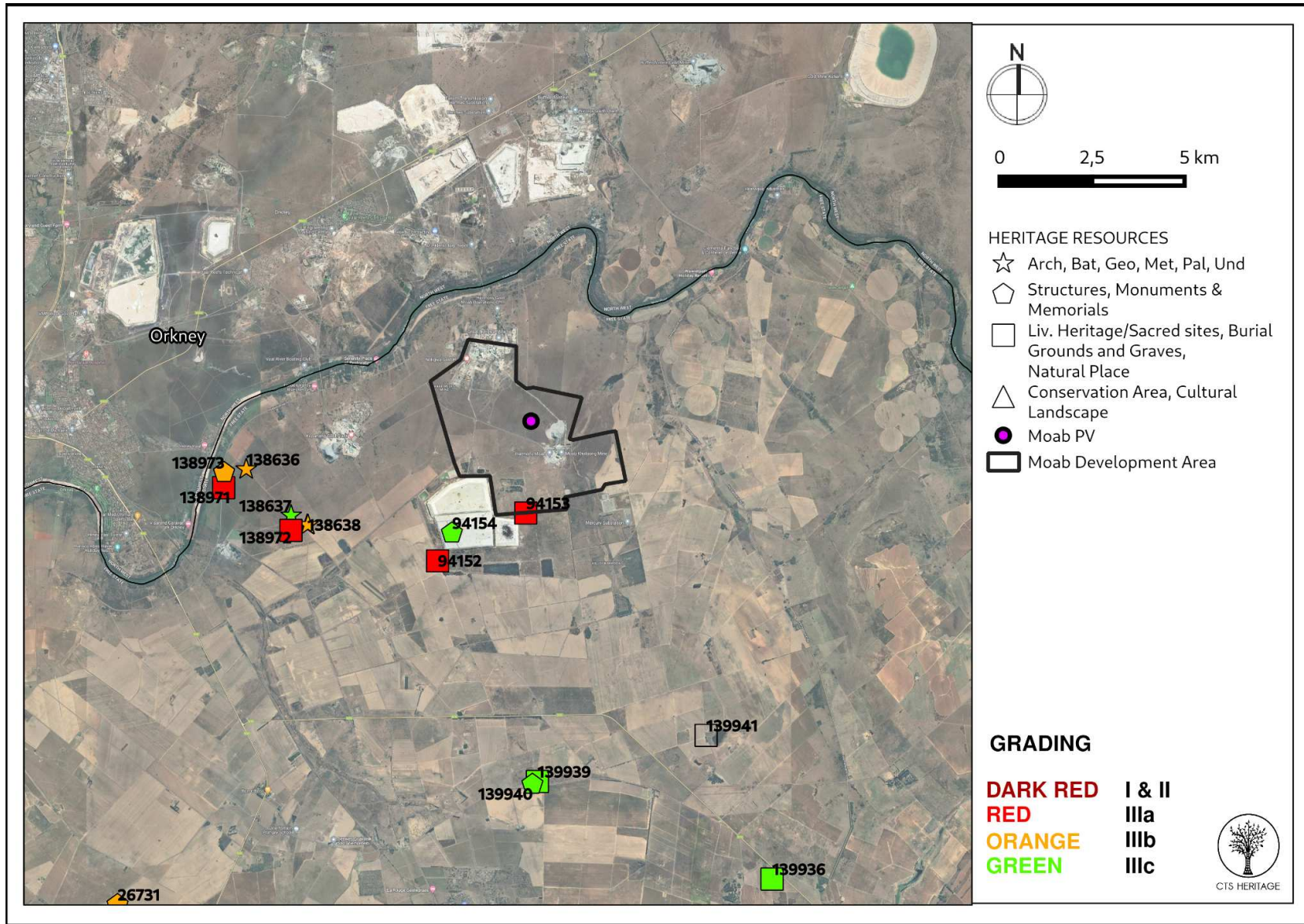
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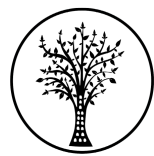
Map 2.1: Spatialisation of heritage assessments conducted in proximity to the broader study area



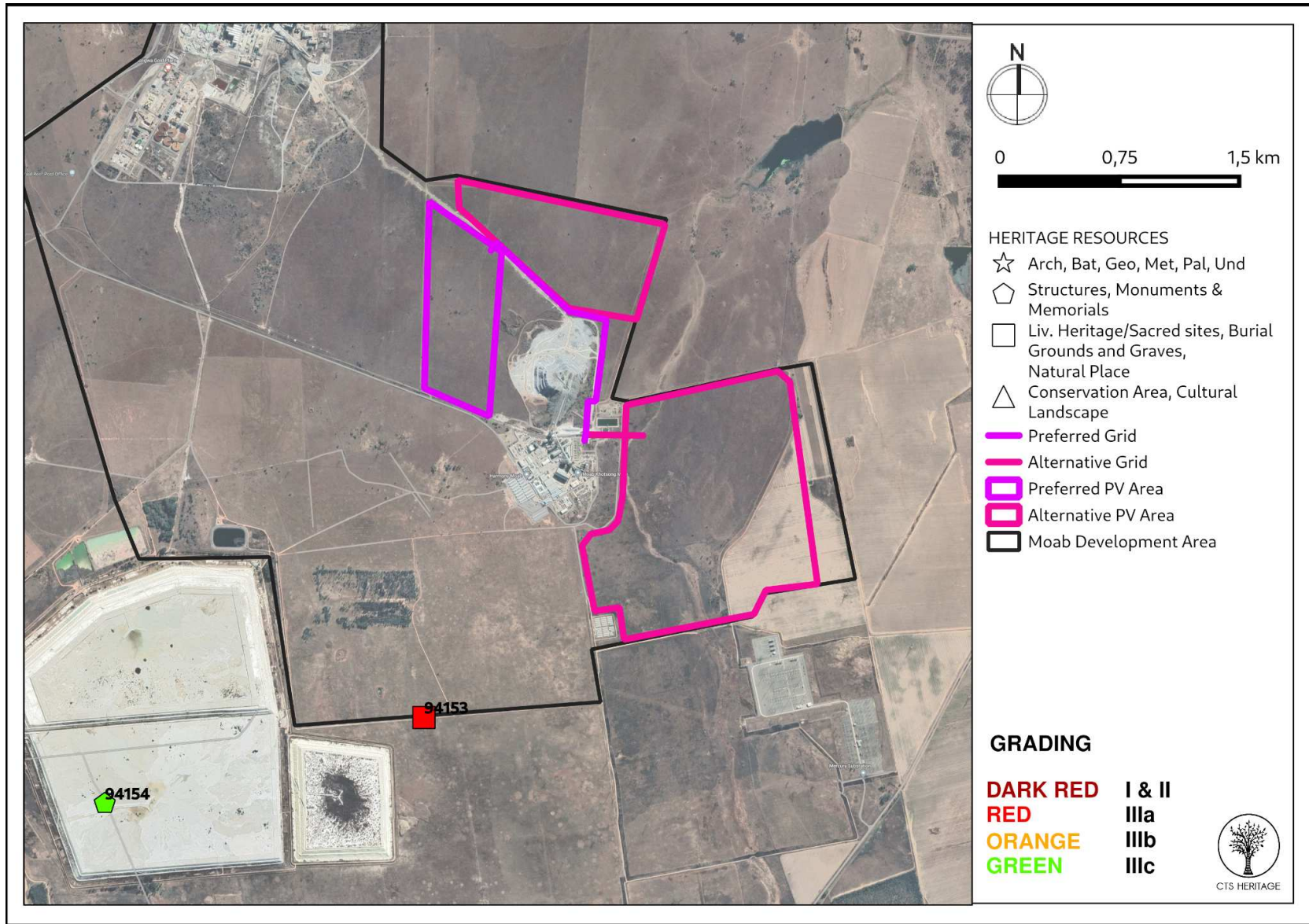
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Map 2.2: Spatialisation of heritage resources known in proximity to the broader study area



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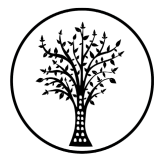


Map 2.3: Spatialisation of heritage resources known in proximity to the broader study area

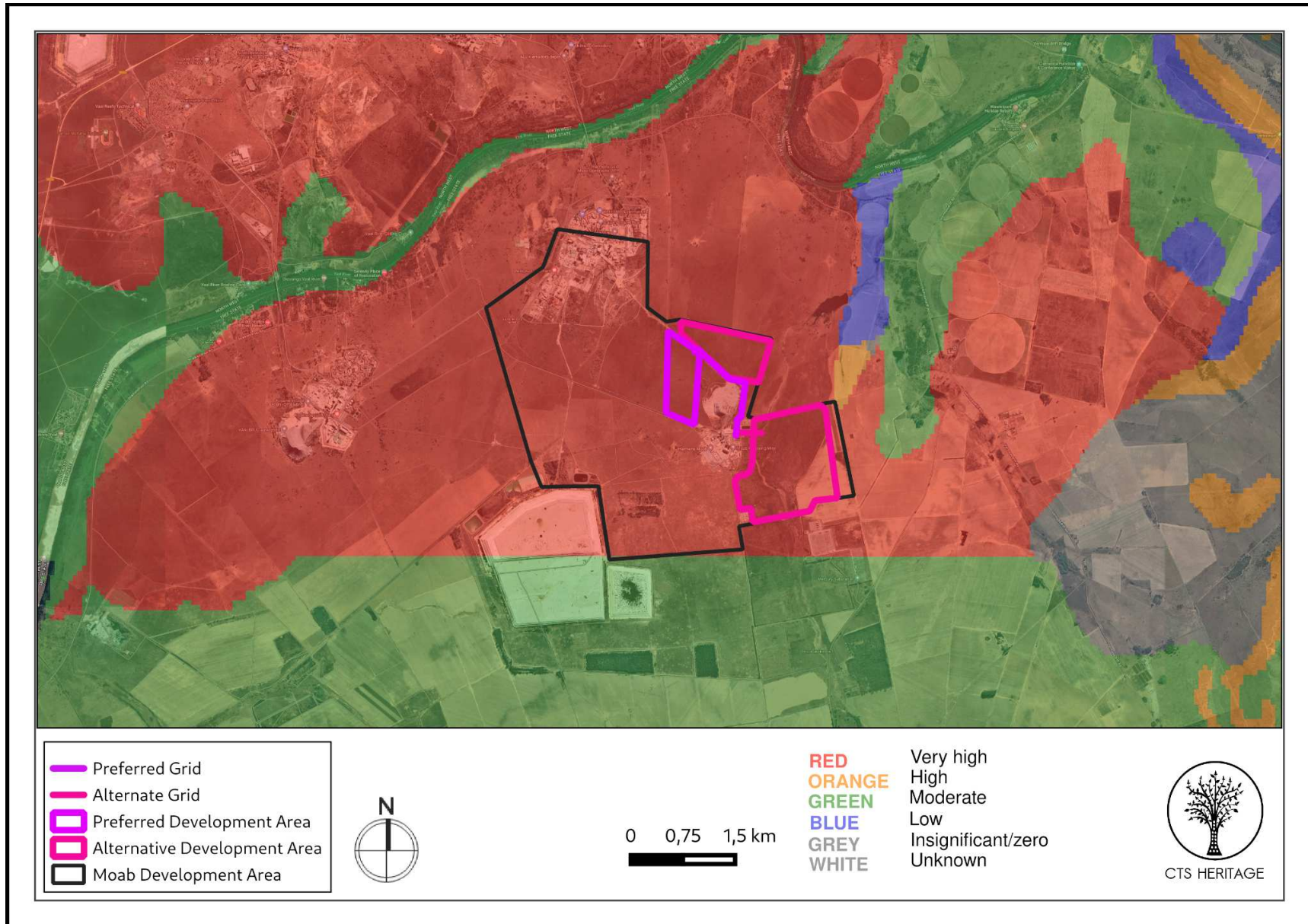
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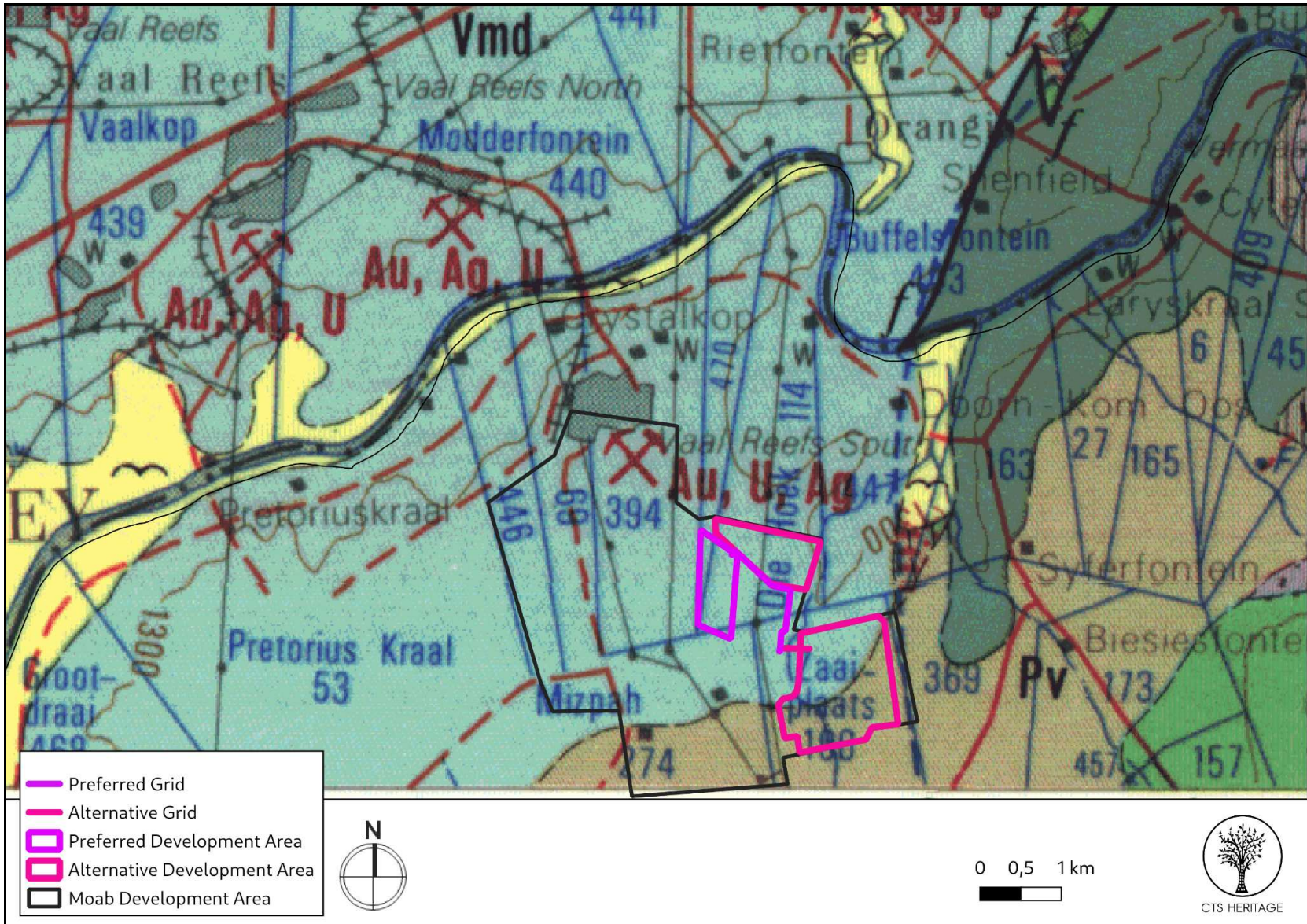
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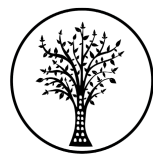
Map 3.1: Palaeontological sensitivity of the area surrounding the broader study area



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Map 3.2: Geology Map. Extract from the CGS 2626 West Rand Geology Map indicating that the development area is underlain by sediments of the (Pv) Vryheid Formation and (Vmd) Malmani Subgroup.



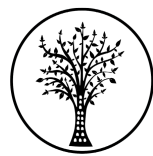
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### 3.2 Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of Low to Very High fossil sensitivity (Figure 4a). The solar PV sites are underlain by sediments of the Malmani subgroup (Vmd) and the Vryheid Formation (Figure 4b). In his assessment of the Siyanda Solar Plant, Almond (2021) found “*several large float blocks on either side of farm track comprising pale grey to yellowish-weathering chert within mm-scale fine internal lamination, locally convolute or with zones of regular, stromatolite-like, upward-convex stacked laminae. These might be pseudostromatolites - i.e. abiogenic sedimentary structures formed by isopachous cement growth - rather than true microbially-bound stromatolites.*”

In a PIA completed by Bamford (2022) for an adjacent PV development, it was noted that “The proposed site lies on the moderately sensitive Quaternary sands and alluvium which might have trapped transported and fragmentary fossils if there are such features as palaeo-pan and palaeo-springs. The land has been cultivated or grazed for decades and no such feature is visible in the satellite imagery. Due to inconsistency in the geological maps it appears that (the development is located) on very highly sensitive rocks of the Vryheid Formation that are most likely covered by Quaternary sands and alluvium.” Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, mudstones, shales and sands are typical for the country and might contain fossil plant, insect, invertebrate and vertebrate material. The sands and soils of the Quaternary period would not preserve fossils.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age and type to contain fossils but the area is covered in deep cultivated soils. Since there is an extremely small chance that fossils from the Vryheid Formation may occur below ground and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.



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## **4. IDENTIFICATION OF HERITAGE RESOURCES**

### **4.1 Summary of findings of Specialist Reports**

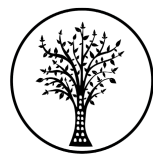
#### ***4.1.1 Archaeology***

The survey was conducted primarily on foot but also involved driving between key targeted areas, and sought to assess the presence and significance of archaeological occurrences within the project area. Overall field assessment documented a sparse number of isolated stone artefacts in secondary and surface contexts and one denser occupational context in a potentially dateable context, suggesting the area may have been traversed intermittently by Stone Age groups through periods in both the Middle Stone Age (MSA – ~300ka:~40ka), the Later Stone Age (LSA: ~40ka: ~2ka) in addition to individual bifacial tools potentially associated with the later ESA (~400--200ka), although artefacts that could be clearly linked with chrono-cultural periods were scarce.

The presence of small nodules of artefact-quality chert rocks, homogenous quartzites as well as high-quality riverine Hornfels and Quartz in the project areas in addition to relatively abundant standing water, were likely the resources that attracted groups to the broader region, and resulted in them leaving behavioural traces in the form of stone artefacts and traces of lithic exploitation on primary sources of raw-material (the latter exclusively at Moab). Indeed the majority of the stone artefacts identified look to be the result of expedient ‘testing’ of rocks for quality, although several cores and tools associated with more extensive investment in production were identified. In this sense no evidence of substantial densities of finds or occupational debris were identified, and the stone artefacts present look to have been produced by mobile forager groups moving through the area.

Artefact quality raw-material in the form of primary local cherts is available within the footprint, with several outcrops associated with sparse archaeological evidence. Some ephemeral Stone Age exploitation evidence in the form of simple cortical flakes, flake removal traces on outcrops and cores were identified as well as some systematic Levallois and bladelet production in the eastern portion. No identified sites represent archaeological remains in dateable contexts that need to be avoided (see sensitivity ranking), and all are of low scientific significance.

Importantly, no graves were identified within the survey, and there would not be evidence of graves within the extensively disturbed areas of the footprint. In addition, there was no evidence for historical dwelling structures apart from the non-domestic dilapidated Vaal Reef Shooting Club. Relevantly though, the dense grass cover was a pertinent constraint to documenting potential graves in the areas that were not disturbed. Extensive grass cover made potential grave locations impossible to exhaustively assess across the project area (particularly in cases where above surface material indicators may have been removed through modern disturbance or through trampling related to historical stock farming activities.



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#### **4.1.2 Palaeontology**

The site for development is on the Adelaide Subgroup with the margins on the Quaternary Kalahari Group sands. The Adelaide Subgroup can be divided into four vertebrate assemblage zones if there are fossils present but this has not been indicated in the geological map. Extrapolating from the recently updated biostratigraphy (Smith et al., 2020), the site is probably in the Balfour Formation and so is represented by the *Daptocephalus* Assemblage Zone

The *Daptocephalus* Assemblage Zone is recognised by the co-occurrence of the dicynodontoid *Daptocephalus leoniceps*, the therocephalian *Theriongnathus microps*, and the cynodont *Procynosuchus delaharpeae* (Viglietti, 2020). This has been further divided into two subzones, the lower *Dicynodon -Theriongnathus* Subzone (in co-occurrence with *Daptocephalus*), and the upper *Lystrosaurus maccaigi - Moschorhinus kitchingi* Subzone (ibid). Other taxa include fish, amphibians, parareptiles, eureptiles, biarmosuchians, anomodontians, gorgonopsians, therocephaleans, cynodonts and molluscs. The flora is more diverse than the older Assemblage Zones and comprises glossopterids, mosses, ferns, sphenophytes, lycopods, cordaitaleans and gymnosperm woods (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

Six formations are recognised in the Kalahari Group but they are not often indicated on the geological maps. A more recent review by Botha (2021) attempts to correlate the Quaternary sediments but they are difficult to date or to determine their source. In this part of the Free State the Hoopstad Aeolian sands are present. According to Harmse (1963, in Botha, 2021) this extensive red and grey sandy soil cover is associated with three generations of aeolian sand sheets. Moreover, these generations of aeolian sand form the soil substrate in the heart of the nation's maize cultivation region, yet their geological origin and age remains understudied (Botha, 2021, p. 825).

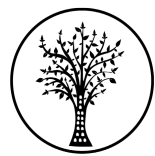
Quaternary sands and alluvium do not preserve fossils because they are transported and porous. For preservation of fossils, a low energy deposit with sedimentation of fine grained silts or muds that exclude decomposing organisms such as bacteria, fungi and invertebrates is required to maintain a highly reducing environment (Cowan, 1995). Only if there are traps such as palaeo-pans or palaeo-springs that provide traps for water and fine sediments, would plants or bones be preserved and fossilised. No such features are visible in the satellite imagery in the project footprint.





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**Figure 4:** Dense grasses and occasional shrubs cover portions of the project area, inhibiting the visibility of surface archaeology at Moab: CMB1; CMB3; CMB5; CMB8; CMB9; CMB10; CMB16; CMB22; CMB25; CMB27.

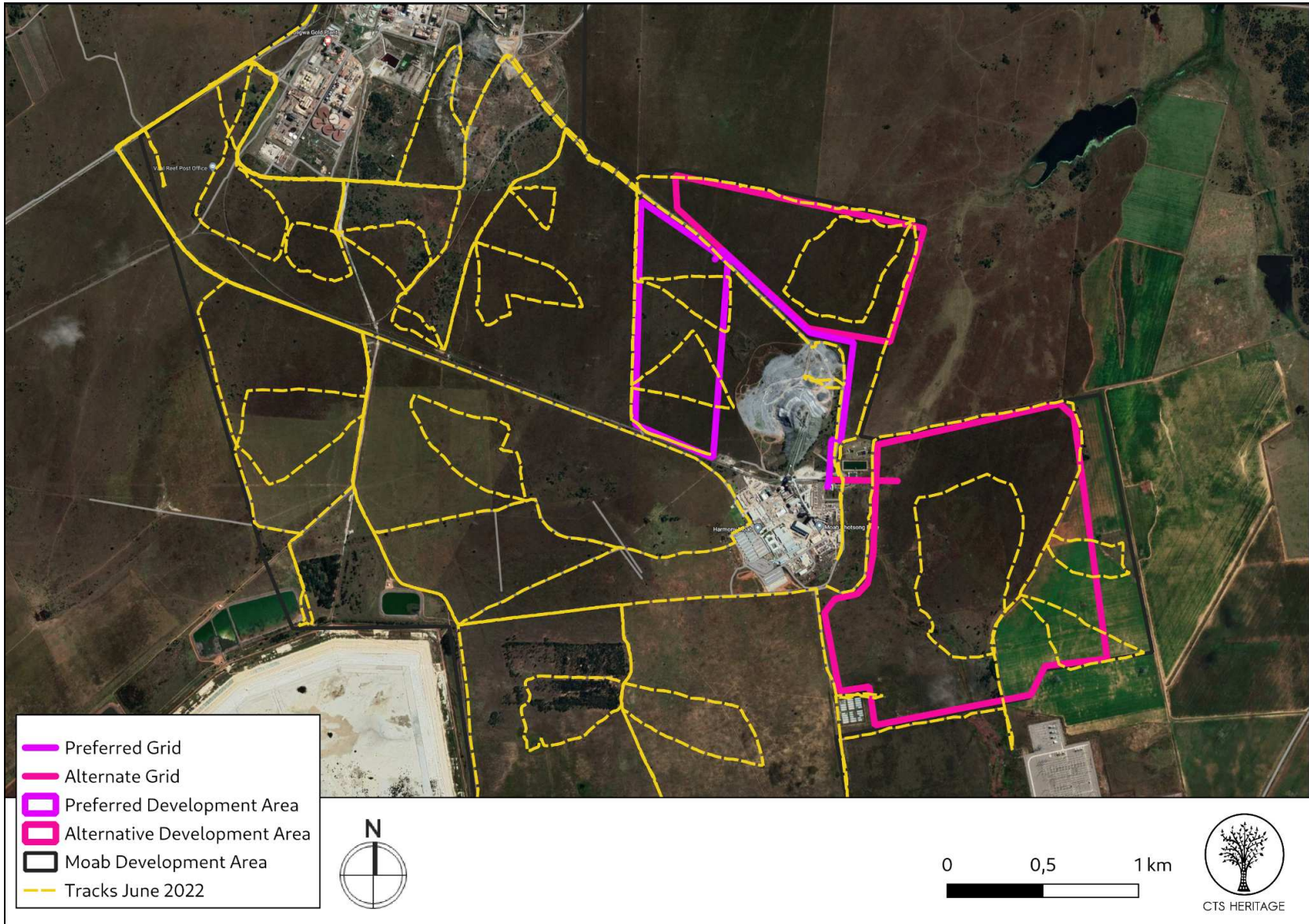


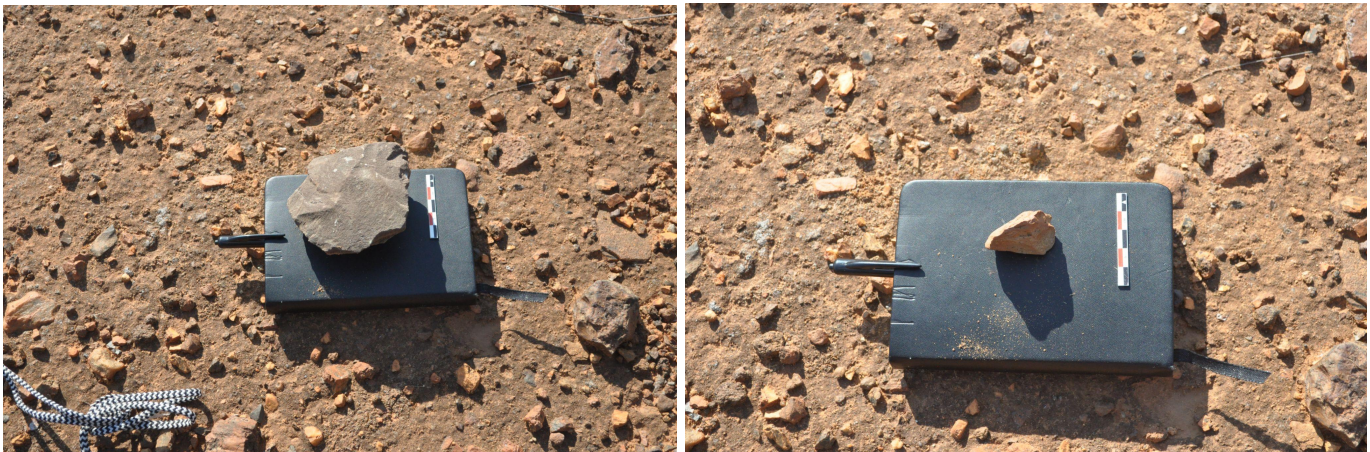
Figure 5.: Overall track paths of foot survey - Moab PV Facility

## 4.2 Heritage Resources identified

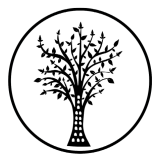
The survey at Moab documented several isolated finds, and a sparse stone artefact scatter in a secondary context. The site at CM1 has a concentration of artefacts that look to be eroding from an encompassing sedimentary context, although the sediments in the close vicinity have been affected by recent land use activities. If this site could be avoided with the guidance of a 30m buffer zone for development that would be optimal. At CM3 several isolated chert artefacts were present on a deflated land surface. The small size of the flakes in addition to the platform morphology and dorsal removal patterns on one specimen may be indicative of bladelet production, thus indicating a likely terminal Pleistocene or Holocene age for these artefacts. Primary sources of chert were documented at several locations within the footprint (e.g. CM2), and several negative flake removals indicating Stone Age exploitation were identified on these outcrops.

**Table 2: Heritage resources identified from fieldwork 2022**

Site No.	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
CM1	Moab 1	Isolated artefacts on sub-volcanic rock: Levallois core; Bladelet core and several flakes	MSA/LSA	-26.98790498	26.80750899	IIC	30m Buffer
CM2	Moab 2	Chert outcrop with evidence of hominin exploitation	Stone Age	-26.98115604	26.77801601	NCW	NA
CM3	Moab 3	Isolated chert artefacts: several flakes	LSA	-26.97650903	26.78688196	NCW	NA



**Figure 6.1: Deflated concentration of archaeological remains at Moab CM1: Levallois core and Bladelet core**



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Figure 6.2. Ex situ archaeological remains at Moab: CM2-Chert outcrop with evidence of hominin exploitation, CM3-flakes

### 4.3 Mapping and spatialisation of heritage resources

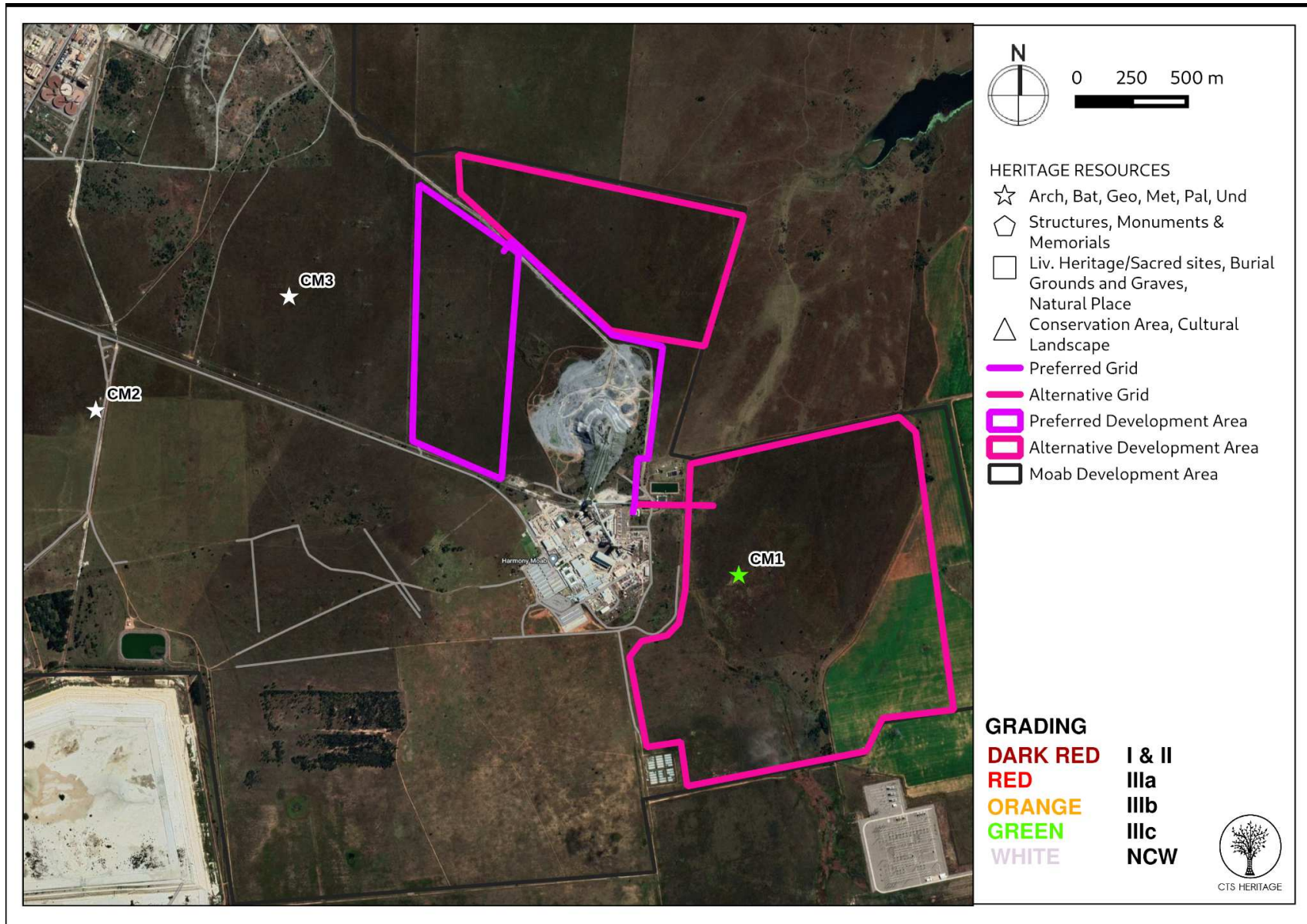
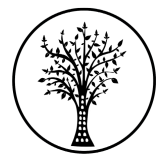


Figure 7.1: Map of significant heritage resources identified during the field assessment, relative to the proposed development



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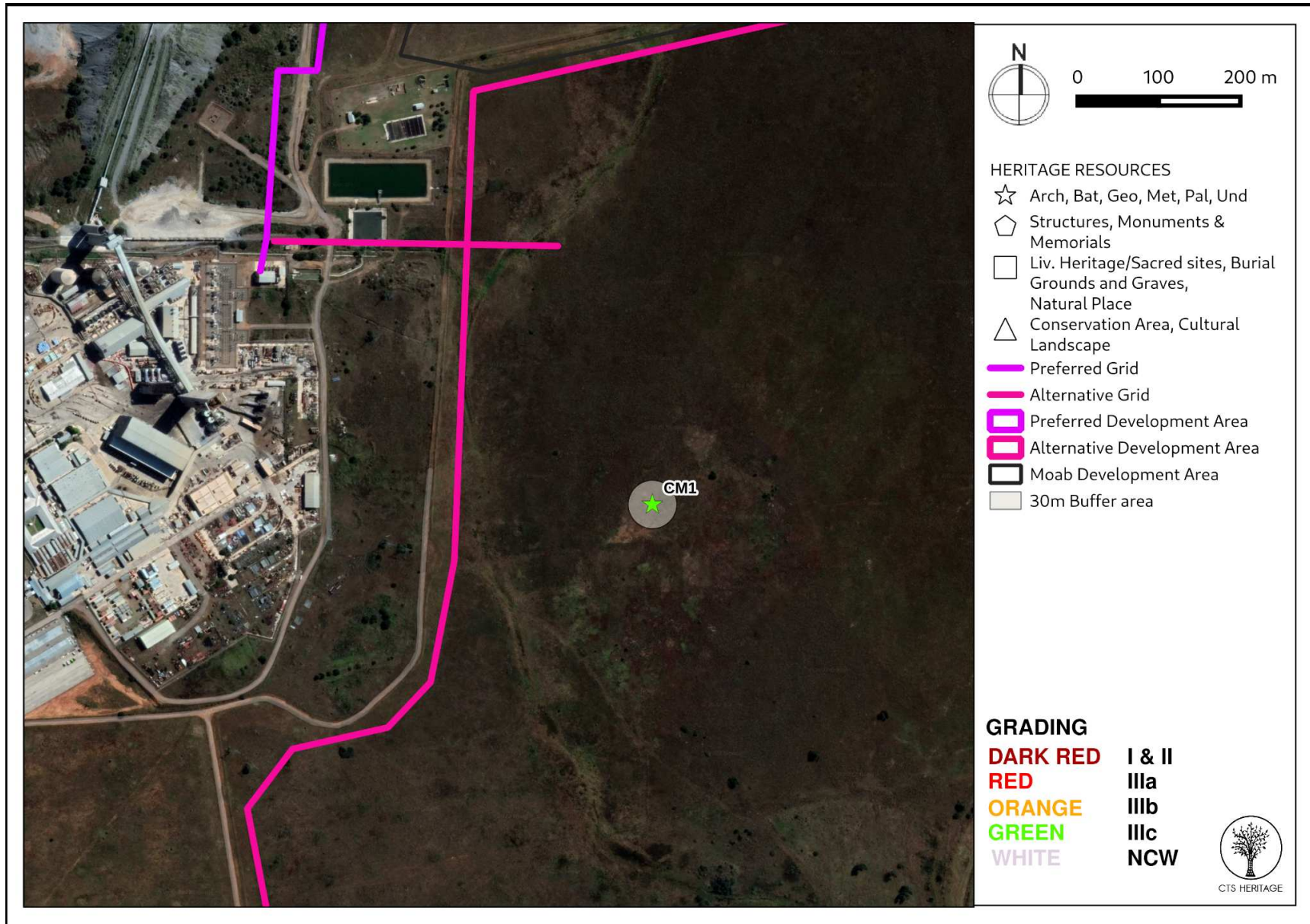
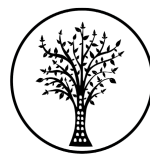


Figure 7.2: Map of significant sites relative to proposed development with recommended mitigation for CM1

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## 5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

### 5.1 Assessment of impact to Heritage Resources

#### 5.1.1 Archaeology

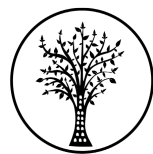
The potential for finding a dateable *in-situ* archaeological horizon based on current surface observations outlined above appears to be low. The documented archaeology at Moab is therefore classified as scientifically LOW SIGNIFICANCE.

Concerning the archaeology observed during the extensive survey of the potentially affected area at Moab, there are no objections to the authorization of the proposed development, provided that if any evidence of buried human remains are exposed during excavation, that development activities cease in the area of the identified remains.

**Table 4.1: Impacts of the proposed development on archaeological resources**

NATURE: It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		With Mitigation
MAGNITUDE	M (6)	One archaeological resource of significance was identified within the development area	M (6)	One archaeological resource of significance was identified within the development area
DURATION	H (5)	Where manifest, the impact will be permanent.	H (5)	Where manifest, the impact will be permanent.
EXTENT	L (1)	Limited to the development footprint	L (1)	Limited to the development footprint
PROBABILITY	H (5)	It is likely that significant will be impacted	L (1)	It is unlikely that significant resources will be impacted
SIGNIFICANCE	L	$(6+5+1) \times 5 = 60$	L	$(6+5+1) \times 1 = 12$
STATUS		Negative		Negative
REVERSIBILITY	L	Any impacts to heritage resources that do occur are irreversible	L	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	H	Likely	L	Not Likely
CAN IMPACTS BE MITIGATED		Yes		
<b>MITIGATION:</b> <ul style="list-style-type: none"> <li>A no-impact buffer of 30m is implemented around Site CM1 as per Figure 7.2</li> <li>Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.</li> </ul>				
<b>RESIDUAL RISK:</b> None				





### 5.1.2 Palaeontology

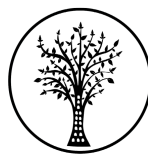
According to the Desktop Palaeontology Assessment, “Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sandstones, shales and sands are typical for the country and might contain trapped fossils. The sands of the Quaternary period would not preserve fossils. The area has been disturbed from farming and mining so no fossils would be present on the surface. No vertebrates or plants have been recorded so the lithology and assemblage zone can only be extrapolated..”

“Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age to contain fossils but are covered by soils. Furthermore, the material to be excavated are soils and this does not preserve fossils. Since there is a small chance that vertebrate fossils typical of the *Daptocephalus* Assemblage Zone or plant or bone fragments were trapped in pans that might occur below the soils and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low.”

“Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying sands and soils of the Quaternary. There is a very small chance that fossils may occur in pans or springs but no such feature is visible in the satellite imagery. Vertebrate fossils may occur but there is no outcrop. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr.”

**Table 4.2: Impacts of the proposed development to palaeontological resources**

NATURE: It is possible that buried palaeontological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		With Mitigation
MAGNITUDE	H (8)	According to the SAHRIS Palaeosensitivity Map (Figure 3.1), the area proposed for development of the PV facilities is underlain by sediments that have very high palaeontological sensitivity.	H (8)	According to the SAHRIS Palaeosensitivity Map (Figure 3.1), the area proposed for development of the PV facilities is underlain by sediments that have very high palaeontological sensitivity.
DURATION	H (5)	Where manifest, the impact will be permanent.	H (5)	Where manifest, the impact will be permanent.
EXTENT	L (1)	Limited to the development footprint	L (1)	Limited to the development footprint
PROBABILITY	L (1)	It is unlikely that significant fossils will be impacted	L (1)	It is unlikely that significant fossils will be impacted
SIGNIFICANCE	L	(8+5+1)x1=14	L	(8+5+1)x1=14
STATUS		Negative		Negative
REVERSIBILITY	L	Any impacts to heritage resources that do occur are irreversible	L	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	L	Unlikely	L	Not Likely
CAN IMPACTS BE MITIGATED		Yes		



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**MITIGATION:**

- The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

**RESIDUAL RISK:**

None

## 5.2 Sustainable Social and Economic Benefit

TBA

## 5.3 Proposed development alternatives

The alternatives assessed as part of this project have been mapped throughout the HIA. Based on the outcomes of this analysis, the preferred development alternative is also preferred from a heritage perspective as no impacts to significant heritage resources are anticipated. However, impacts to CM1 are anticipated should the Alternative layout be implemented. As such, the Alternative layout is NOT preferred from a heritage perspective.

## 5.4 Cumulative Impacts

This application is for the proposed development of a solar energy facility and associated grid connection to facilitate activities at the Central Harmony Mine. The location of the proposed PV facility within an area with existing mining activities may lend itself to cumulative impacts. However, in terms of cumulative impacts to heritage resources, it is preferable that industrial-type infrastructure is clustered within an area in order to prevent the sprawl of industrial development across otherwise sensitive cultural landscapes.

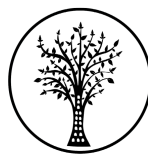
As such, it is not anticipated that the proposed development will have a negative cumulative impact on significant heritage resources.

## 6. RESULTS OF PUBLIC CONSULTATION

The public consultation process will be undertaken by the EAP during the EIA. No heritage-related comments have been received to-date. SAHRA is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation.

## 7. CONCLUSION

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. As such, it is not surprising that the results of the survey only identified one site of scientific cultural value - CM1 within the Alternative Area proposed for the Noab PV development graded IIIC.



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The identified site of archaeological significance has the potential to provide scientific insight into the past and as such, it is recommended that this area is not impacted by the proposed development. It is therefore recommended that no-go development buffers as per the recommendations below are implemented. Further, it is recommended that these sites are mapped on all relevant SDPs and that on-going conservation measures are put in place in the EMPs for the developments.

Furthermore, no impacts to significant palaeontological heritage is anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

## **8. RECOMMENDATIONS**

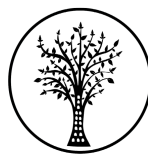
There is no objection to the proposed development in terms of impacts to heritage resources on condition that:

- The 30m buffer area recommended around site CM1 is implemented
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



**9. REFERENCES**

Heritage Impact Assessments				
NID	Author(s)	Date	Type	Title
321166	Archaeological Specialist Reports	Jaco van der Walt	17/06/2015	Archaeological Scoping Report for the Proposed Buffels Solar 1 SEF, Klerksdorp, North West Province
321168	PIA Desktop	Barry Millstead	21/06/2015	Palaeontological Heritage Impact Assessment Report on the Site of a Proposed Solar Power Production Facility known as the Buffels Solar 1 PV Energy Facility to be located approximately 20 km north East of Orkney, NW Province
321169	PIA Desktop	Barry Millstead	21/06/2015	Palaeontological Heritage Impact Assessment Report on the Site of a Proposed Solar Power Production Facility known as the Buffels Solar 2 PV Energy Facility to be located approximately 20 km north East of Orkney, NW Province
321170	Archaeological Specialist Reports		17/06/2015	Archaeological Scoping Report for the Proposed Buffels Solar 2 SEF, Klerksdorp, North West Province
345	PIA Phase 1	Marion Bamford	18/05/2012	Palaeontological Impact Assessment for Kabi Vaalkop Solar PV Facility
365014	HIA Phase 1	Sidney Miller	02/03/2015	Cultural Heritage Impact Assessment for Shafts #1 to #7, Orkney, Northwest Province, South Africa, for CAPM Gold.
369846		Jaco van der Walt	31/08/2016	
5097	AIA Phase 1	Johnny Van Schalkwyk	07/03/2003	Mercury-Perseus 400 kV Transmission Line, Cultural Heritage Resources
6030	AIA Phase 1	Cobus Dreyer	20/06/2005	Archaeological and Historical Investigation of the Proposed Residential Developments on Subdivision 13 of the Farm Pretoriuskraal 53, Viljoenskroon, Free State
7340	AIA Phase 1	Zoe Henderson, C Koortzen	19/06/2007	Heritage Assessment Report Mercury Substation Expansion, Zaaiplaats 190/3, Fezile Dabi (DC20) District, Free State, South Africa
7367	AIA Phase 1	Thomas Huffman	01/03/2005	Archaeological Assessment of the Mispah Tailings Dam Extension
7684	AIA Phase 1	Jaco van der Walt	25/09/2007	Archaeological Impact Assessment. Township Development and Sub Division of AH18, Pretoriuskraal, Orkney, North West Province
7685	AIA Phase 1	Jaco van der Walt	25/09/2007	Archaeological Impact Assessment. Township Development on Sub Division of AH19, Pretoriuskraal, Orkney, North West Province



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9124	Heritage Study	Francois P Coetzee	01/04/2012	Cultural Heritage Survey of the Proposed Kabi Vaalkop PV Facility near Orkney, Dr Kenneth Kaunda District, North West Province
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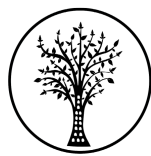
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## APPENDICES

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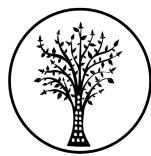
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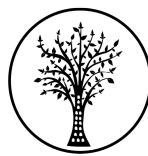
## APPENDIX 1: Heritage Screening Assessment (2022)



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## APPENDIX 2: Archaeological Assessment (2022)





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### APPENDIX 3: Palaeontological Assessment (2022)



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## APPENDIX 4: Chance Fossil Finds Procedure