HERITAGE IMPACT ASSESSMENT

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

PROPOSED DEVELOPMENT OF THE DICOMA PV FACILITY AND ASSOCIATED INFRASTRUCTURE NEAR LICHTENBURG, NORTH WEST PROVINCE

Prepared by Heritage CTS

CTS HERITAGE

For

Savannah Environmental

January 2022

CTS HERITAGE

EXECUTIVE SUMMARY

The Applicant, Dicoma PV (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Dicoma PV facility) located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area.

The findings of the archaeology assessment largely correlate with the findings of Van der Walt (2014) and a number of additional heritage resources were identified. The stone age archaeological resources identified were all *ex situ* and are of low heritage significance. These have been graded IIIC in the tables and maps provided and no additional mitigation is recommended for these sites. They have been sufficiently recorded in this report.

A stone structure was identified within the development area. It is likely that this is a burial site (LICBUR?1, LICBUR2, LI9). These sites are graded IIIA in the tables and maps provided and a no-development buffer of 10m is recommended around these sites. Furthermore, it is recommended that a management plan is developed to ensure the ongoing conservation of these sites for the duration of the lifespan of the development.

Based on the experience of the palaeontologist and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. No fossils were seen during the site survey and there were no rocky outcrops at all. There is a very small chance that stromatolites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) may occur below the ground surface and may be disturbed. Therefore, a Fossil Chance Find Protocol should be added to the EMPr or site management plan. If fossils are found by the developer, environmental officer or other designated person, once excavations for foundations, access and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

It should be noted that, although there were no other archaeological or heritage resources identified during the project survey; some archaeological material, including artefacts and graves can be buried underground and as such, may not have been identified during the initial survey and site visits. In the case where the proposed

development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately to determine a way forward.

There is no objection to the proposed development of the Dicoma PV facility on heritage grounds on condition that:

- A 10m no-go and no development buffer is implemented around the potential burial sites LICBUR?1, LICBUR2 and LI9
- A management plan is developed for the ongoing and long-term management of the burials within the development area.
- The attached Chance Fossil Finds Procedure must be implemented for the duration of the construction phase of the project

Should any buried archaeological resources 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.

CTS HERITAGE

CONTENTS

1. INTRODUCTION

1.1 Background Information on Project

The Applicant, Dicoma PV (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Dicoma PV facility) located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area.

The development area for the PV facility and associated infrastructure will be located on the following properties:

- Portion 1 of the Farm Houthaalboomen 31
- Portion 9 of the Farm Houthaalboomen 31
- Portion 10 of the Farm Houthaalboomen 31
- Portion 0 of Farm Talene 25
- Portion 7 of Farm Elandsfontein 34

Two additional 75MW PV facilities (Barleria PV and Setaria PV) are concurrently being considered on the project site (within Portion 1, Portion 9, and Portion 10 of the Farm Houthaalboomen 31) and are assessed through separate Environmental Impact Assessment (EIA) processes.

A facility development area (approximately 180ha) as well as two alternative grid connection solutions (within a 100m wide corridor) have been considered in the Scoping phase. The infrastructure associated with this 75MW PV facility includes:

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Temporary and permanent laydown area
- Grid connection solution (two alternative locations assessed) within a 100m wide corridor, including:
- 33kV cabling between the project components and the facility substation
- A 132kV facility substation

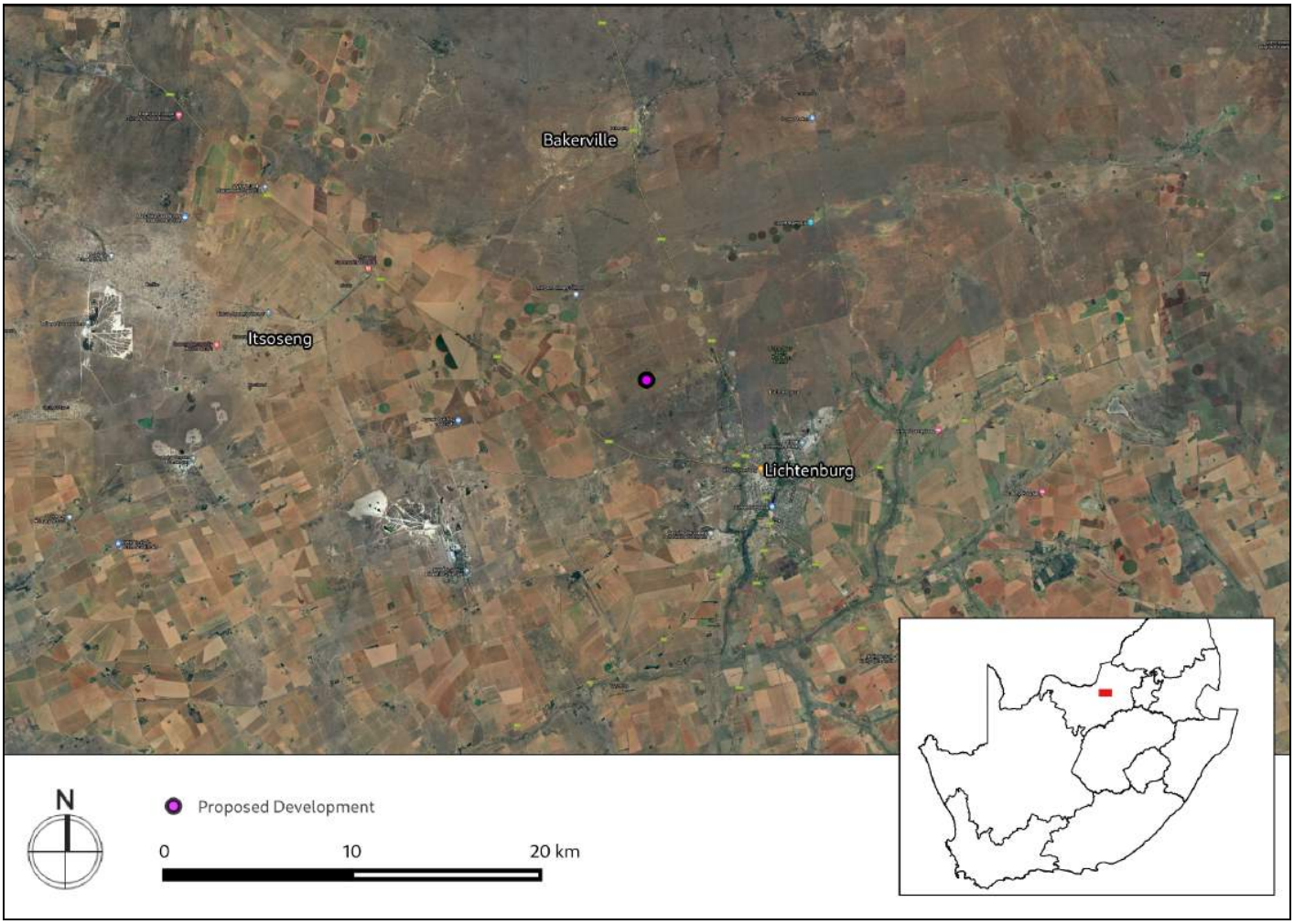
- A 132kV Eskom switching station
- A Loop-in-Loop out (LILO) overhead 132kV power line between the Eskom switching station and the existing Delareyville Munic–Watershed 1 88kV power line.[1]

The alternative grid connection configurations assessed include:

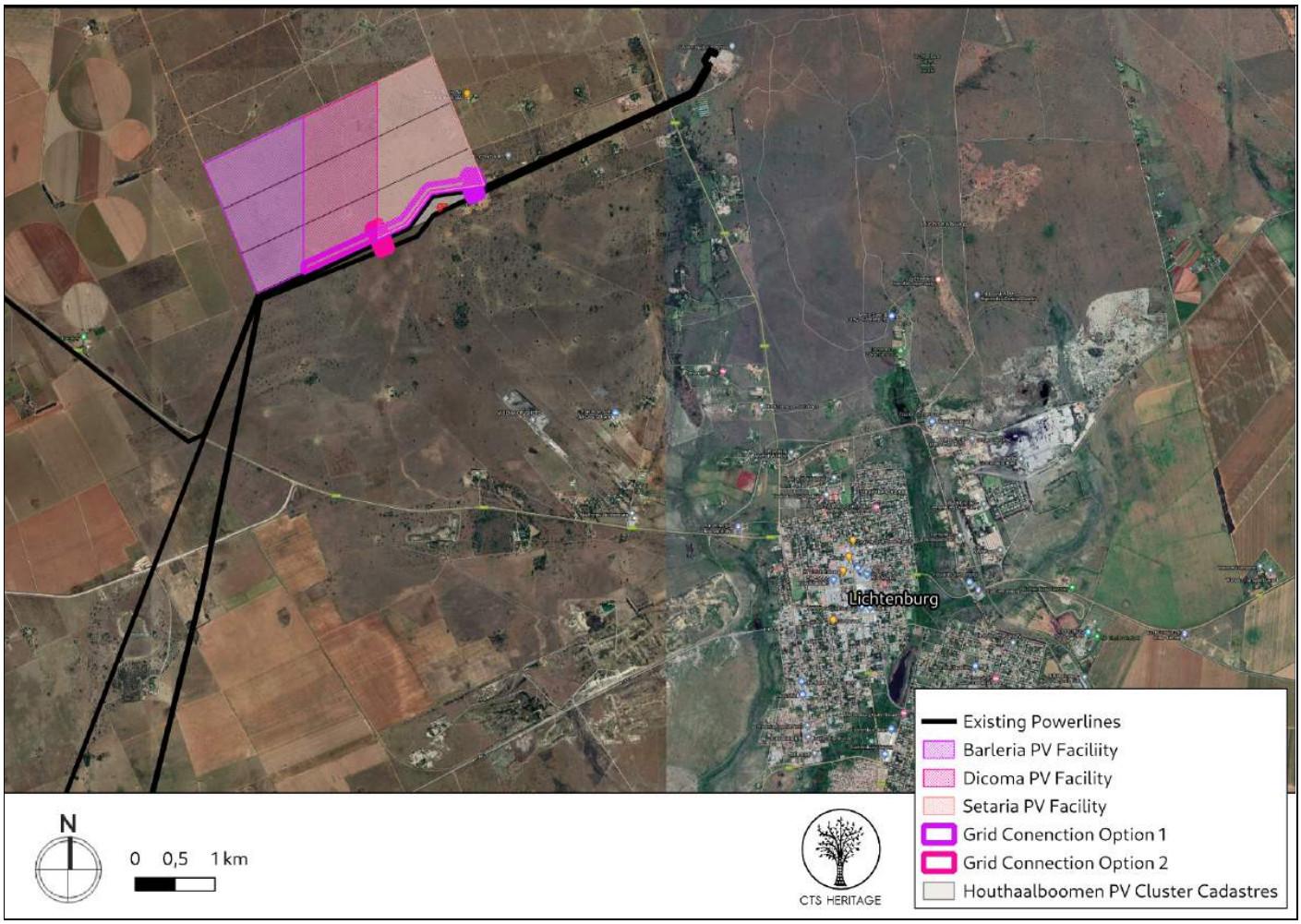
Grid Connection Alternative 1: 33kV MV cabling will connect the Dicoma PV solar array to the 132kV facility substation. The 132kV Eskom switching station is located directly adjacent to the development footprint of the facility substation. The facility substation and Eskom switching station are located approximately 1.3km east of the Dicoma PV facility on Portion 1 of the Farm Houthaalboomen 31. A 132kV Loop-in-Loop Out power line from the Eskom switching station will connect into the Delareyville Munic–Watershed 1 88kV.[2] The grid connection infrastructure is located within an assessment corridor of 100m wide.

Grid Connection Alternative 2: 33kV MV cabling will connect the Dicoma PV solar array to the 132kV facility substation. The 132kV Eskom switching station is located directly adjacent to the development footprint of the facility substation. The facility substation and Eskom switching station are located within the development footprint of the Dicoma PV facility on Portion 1 of the Farm Houthaalboomen 31. A 132kV Loop-in-Loop Out power line from the Eskom switching station will connect into the Delareyville Munic–Watershed 1 88kV.[2] The grid connection infrastructure is located within an assessment corridor of 100m wide.

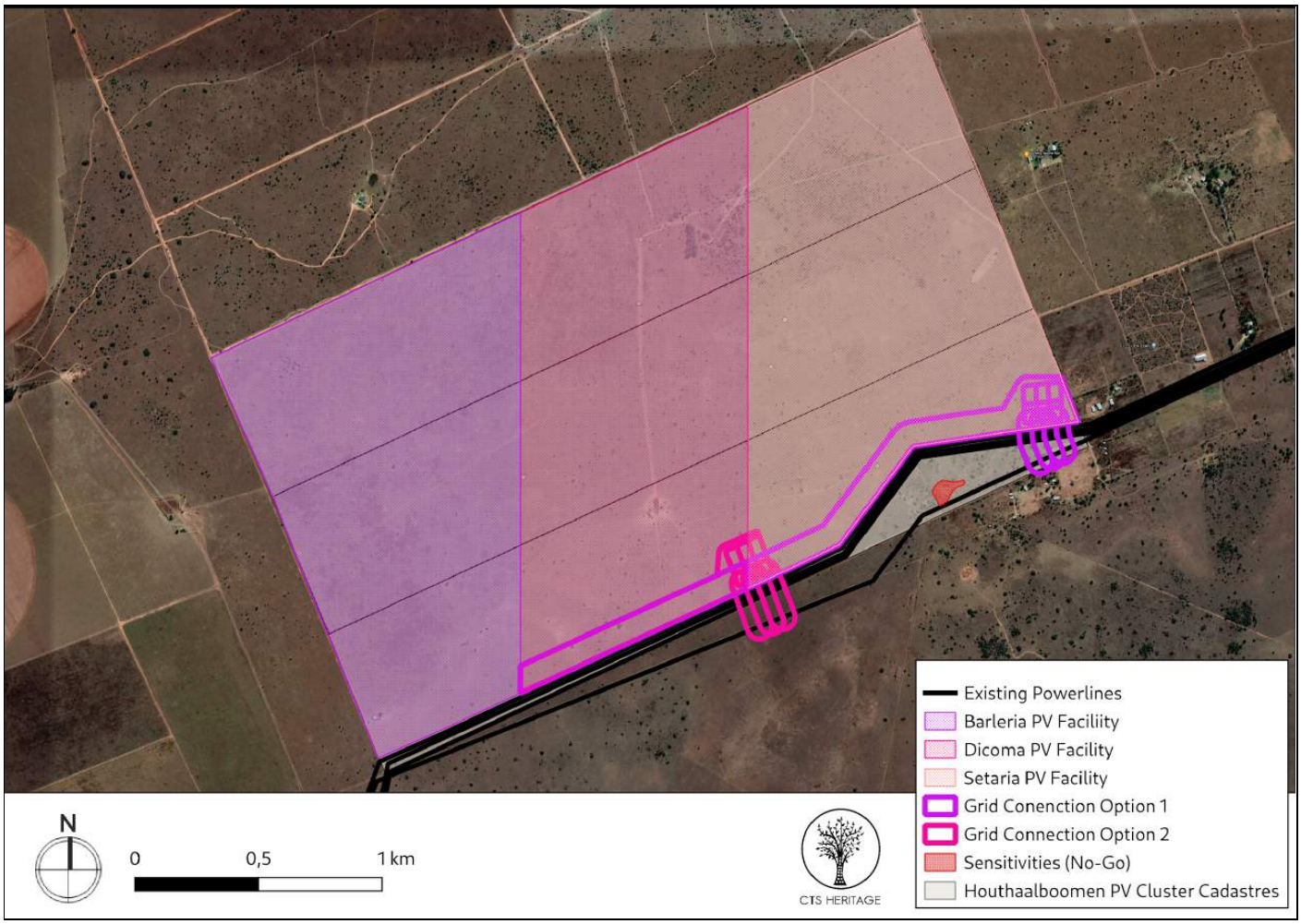
To avoid areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer will identify a suitable development footprint within which the infrastructure of Dicoma PV facility and its associated infrastructure is proposed to be located and fully assessed during the EIA Phase.



Map 1a: The proposed project area



Map 1b: The proposed development area



Map 1c: The proposed development area

Map 1d: The proposed development area

1.2 Description of Property and Affected Environment

The landscape falls within the semi-arid southern African Grassland Biome, and the vegetation across the project area is characterized largely by grassland (dense in several portions) and shrubland that is evident on undulating plains with chert bedrock outcropping in multiple locations (see Mucina et al., 2006), which served as a source of raw-material for Pleistocene and Holocene occupants of the area. Nodules were also used as demarcation/protection within potential grave structures documented within the project area (see below).

The topography of the project area is generally flat, with extensive disturbance in the form of clearing for crop farming and bioturbation in the form of rodent activity in the upper 0.5-2m of sandy topsoil. Indeed, much of the area has been affected by historical farming related activities, with prominent evidence in the form of extensive mounds of chert nodules that were recently cleared from the land surface by farmers and accumulated in

strategic locations within different grazing camps (Figure 5). The surface sediments are generally bioturbated sandy soils, which appear to be aeolian in terms of original deposition, with inclusions of primary nodules of chert (5-30cm in maximum diameter) deriving from the local bedrock.

The general land use in the footprint is predominantly stock farming, with evidence of smaller antelope (Bushbuck, Steenbok and Duiker) as well as bushpig in addition to burrowing rodents (molerats, hares and meerkats) within the project footprint.

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
- An archaeologist conducted a survey of archaeological resources likely to be disturbed by the proposed development. The site visit took place on 17 July 2021.
- A palaeontologist conducted a survey of a palaeontological resources likely to be disturbed by the proposed development. The site visits took place on 21 September 2021.
- The identified resources were assessed to evaluate their heritage significance
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner
- The results of the VIA were integrated into the HIA

2.3 Assumptions and uncertainties

- The *significance* of the sites and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.
- It should be noted that archaeological and palaeontological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.

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

2.4 Constraints & Limitations

The following constraints and limitations were experienced:

1. Dense grass and shrubs cover portions of the project area, and this inhibited the visibility of surface archaeology (Figure 4). This is not regarded as a substantial problem in relation to the Stone Age archaeological remains, which in most cases have generally limited scientific importance due to the disturbed contexts they occur in. It is clear that the Stone Age sensitivity and scientific potential of the project area has been comprehensively assessed. However the inability to assess some of the footprint area at ground surface level should be regarded as a constraint to the documentation of potential graves, given the identified presence of several characteristic structures.
2. Previous rock clearing activities by farmers may have affected surface archaeology including the possible above-surface presence of material evidence of graves.
3. Access was acquired to assess the eastern portion of the connection route area (Figure 5). However, when this portion was being assessed large numbers of cattle with calves were present on the property, with several bulls amongst them. When the cattle showed aggressive behaviour towards the consultants, this portion was abandoned. This section was subsequently reviewed from the neighbouring property and from the far eastern portion which was accessible from a separate property (Figure 5: see track). The latter portion of the project area is considered to have limited to no potential for *in situ* Stone Age archaeological remains.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Previous Heritage Impact Assessments

The area proposed for development was thoroughly assessed for impacts to heritage resources in an Archaeological Impact Assessment conducted by Van der Walt (2014, SAHRIS NID 123075). This report is referred to below in order to determine the likely heritage sensitivity of the area proposed for the development of the PV facility and grid connection.

The proposed PV development is located within an area that has already approved PV facilities within a belt of approved renewable energy facilities. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The construction of the proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact. Furthermore, Van der Walt (2014) notes that "Visual impacts to scenic routes and sense of place are not assessed to be high from a heritage perspective."

Lichtenburg town was established in 1873 and named "Town of Light". General Del la Rey was buried in Lichtenburg after a fatal shooting incident at Langlaagte. During the 1800's, more and more farmers settled in the area. During the Second Boer War, the strategically important town of Lichtenburg was occupied by both Boer and Briton for short spells. In November 1900, a large British force under Col. Robert Baden-Powell was transferred to Lichtenburg and secured the town, and much of the territory with it. In addition, the town is known from Rudyard Kipling's poem, Lichtenberg, which relays the story of a foreign combatant in the second South African War. In 1926, Lichtenburg experienced a gold rush that lasted approximately 10 years. Lichtenburg district is now mostly a farming area, combining cattle and crop-farming and large areas of former diamond mine diggings are now used as grazing.

According to van Schalkwyk et al (1995, SAHRIS NID 6237) in their report completed for the Bakerville Diamond Fields, "land use in the area goes back to the Early Stone Age, as can be determined by the number of stone artifacts found near the old mining commissioners office. This material seems to be disturbed from its primary context because of the mining activities. It is postulated that similar occurrences will be found in other parts of the diggings, but that this material would have been disturbed out of context." As a result of the dominant land use in the area, many of the heritage resources identified by van Schalkwyk et al (1995) are associated with past and present agriculture, and consist of farming implements (many of them found together with discarded mining equipment), a few windmills, and dipping-troughs. One such trough, located at Elandsputte on the farm

Uitgevonden 355JP, was the site where the first diamond was discovered. This structure is a proclaimed national monument (now Provincial Heritage Site). Van Schalkwyk et al (1995) identified a number of burial grounds within their surveyed area (Map 5 and 5a). Heritage resources known from this area include burial grounds and graves, archaeological artefacts and old structures, often associated with farming activities or diamond mining.

An archaeological field assessment was conducted for the Lichtenburg PV facilities located immediately adjacent to this proposed development (CTS Heritage, 2018). The field assessment noted that the area assessed had been disturbed and transformed by agricultural activities in a similar way to the area proposed for this development. Pre-existing agricultural plough fields, grazing areas and farm buildings were identified in the development area. Furthermore, throughout the farming areas several heaps of rocks that were removed from the agricultural fields were identified. During the field assessment of the site *no archaeological resources, graves or burial grounds were identified* in the project area assessed in CTS Heritage's report (2018).

The exact area proposed for development was previously assessed by Van der Walt (2014, SAHRIS NID 123075). Van der Walt (2014) notes that "The site lies on a featureless flat plain. The entire development footprint was extensively utilised for crop farming and ploughing through the years resulted in a lateral and downward migration of artefacts making it virtually impossible to identify knapping or manufacture sites and site extent of artefact concentrations. In some areas borrowing animals brought MSA artefacts to the surface where the sand cover is more than a meter and a half thick and the possibility of finding subsurface material cannot be excluded. Most of the Stone Age archaeology in the study area consists of low densities of scattered (and possibly mixed) MSA and LSA artefacts. These find spots are documented as "occurrences" and are of low significance but more substantial and higher density scatters of MSA material do occur, and were recorded as "sites"." The archaeological sites are described as "Medium density scatters of tools. Blades, flakes, cores. MSA mainly of chert." and are graded IIIC i.e. low local significance. Van der Walt (2014) also identified a single unmarked grave (approximately 27 years old) and farm labour housing dating to the 1990's. He further notes that "Cultural landscape elements were noted in the northern portion of the study area consisting of the mentioned farm labourer dwelling together with a windmill, stone walled cattle kraal and a recently constructed kraal." (Van der Walt, 2014).

During the desktop assessment phase, it was noted that the proposed development is located on geological deposits belonging to the Monte Christo Formation of the Chuniespoort Group. These deposits have a very high sensitivity for impacts to palaeontological resources (Map 2). This group is known to contain a Range of shallow marine to intertidal stromatolites (domes, columns *etc*) and organic-walled microfossils. In addition, it is within this

group that fossiliferous Late Cenozoic cave breccias have been identified such as within the Cradle of Humankind region. As such, a field assessment was undertaken to verify the sensitivity of these sediments for impacts to palaeontology.

Table 1: Known Heritage Resources located within the 10km inclusion zone (see Heritage Screening Assessment)

Site ID	Site no	Full Site Name	Site Type	Grading
130171	2626AA/ Solar/ Farm Zamenkomst 04/ Site 1	Old farm house	Structures, Structures	Grade IIIc
128694	ZKT1	Zamenkomst 1	Building	Grade IIIc
26803	9/2/235/0005	Nederduitse Gereformeerde Church, 27 Gerrit Maritz Street, Lichtenburg	Building	Grade II
51468	**WSF 01**	**Watershed Solar Facility 01**	**Artefacts**	**Grade IIIc**
51470	**WSF 02**	**Watershed Solar Facility 02**	**Artefacts**	**Grade IIIc**
51472	**WSF 03**	**Watershed Solar Facility 03**	**Burial Grounds & Graves**	**Grade IIIa**
128308	Grave of Vic Hamman	Grave of Vic Hamman	Burial Grounds & Graves	
138616	FHDN-001	FARM HOUTHAALDOORNS 2	Palaeontological	
138617	FHDN-002	FARM HOUTHAALDOORNS 2	Palaeontological	
138618	FHDN-003	FARM HOUTHAALDOORNS 2	Palaeontological	
138619	FHDN-004	FARM HOUTHAALDOORNS 2	Palaeontological	
138620	FHDN-005	FARM HOUTHAALDOORNS 2	Palaeontological	
138621	FHDN-006	FARM HOUTHAALDOORNS 2	Palaeontological	
138624	FHDN-009	FARM HOUTHAALDOORNS 2	Palaeontological	
138625	FHDN-010	FARM HOUTHAALDOORNS 2	Palaeontological	
138626	FHDN-011	FARM HOUTHAALDOORNS 2	Palaeontological	
138627	FHDN-012	FARM HOUTHAALDOORNS 2	Palaeontological	
138628	FHDN-013	FARM HOUTHAALDOORNS 2	Burial Grounds & Graves	Grade IIIa
137491	Gereformeerde kerk	Gereformeerde kerk Lichtenburg	Monuments & Memorials	

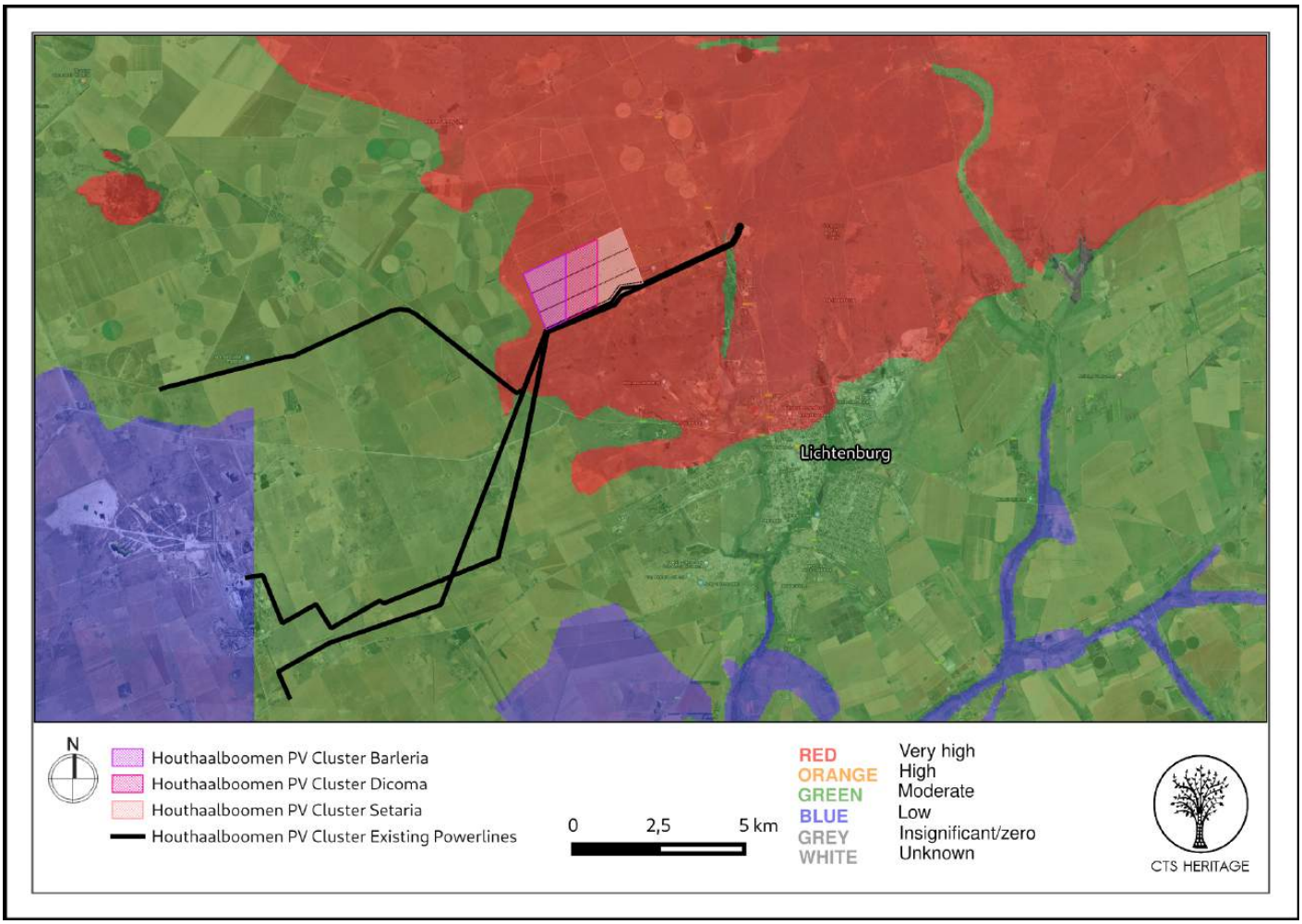
3.2 Geology and geomorphology, climate, vegetation

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

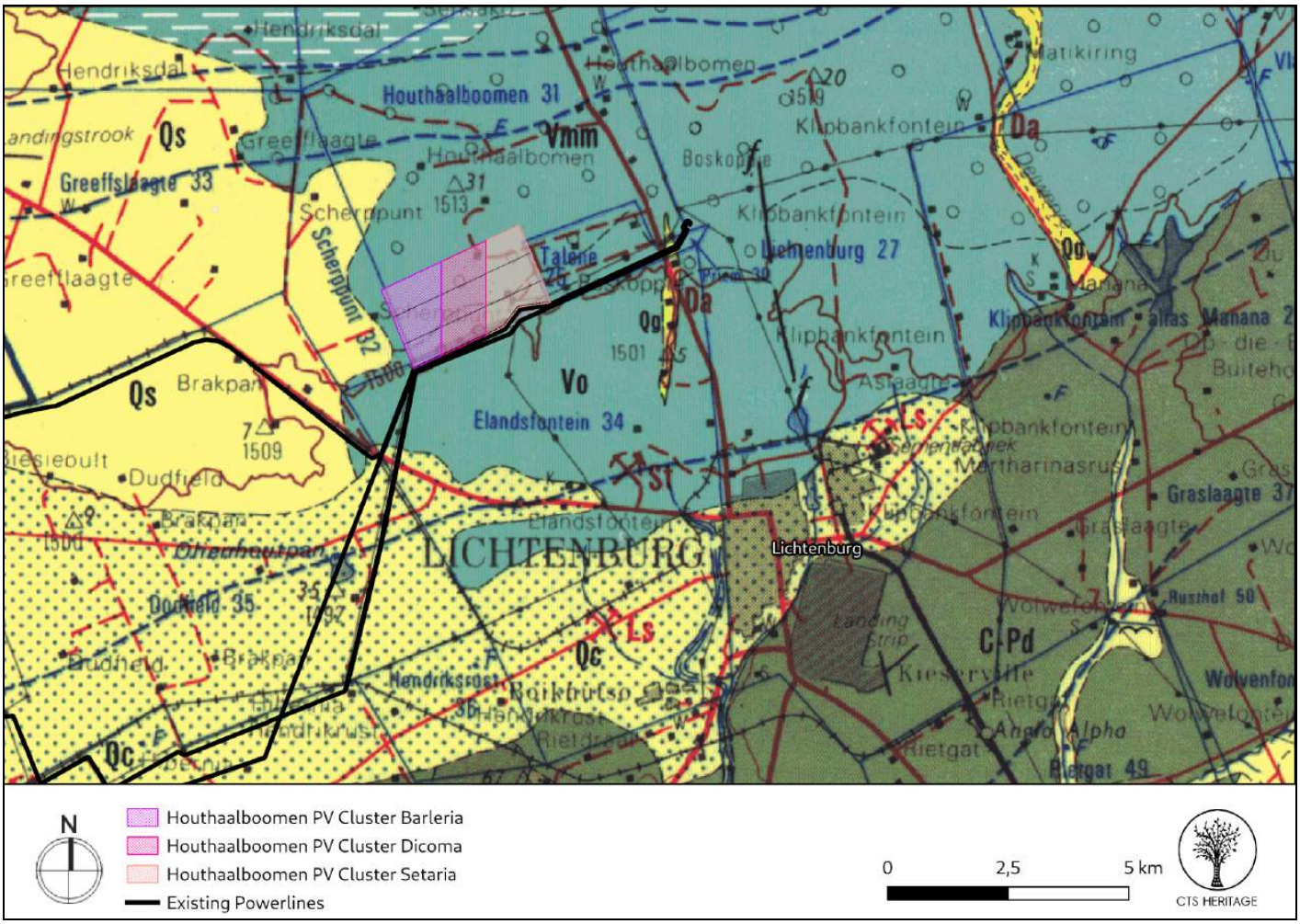
The Transvaal Supergroup comprises one of the world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

The Malmani Subgroup is up to 2000m thick and has been divided into five formations based on the composition of cherts, stromatolites, limestones and shales. At the base, overlying the Black Reef Formation, is the Oaktree Formation that represents a transition from siliciclastic sedimentation to platform carbonates (Eriksson et al., 2006). It is composed of carbonaceous shales, stromatolitic dolomites and locally developed quartzites. Next is the Monte Christo Formation that has an erosive breccia base and continues with stromatolitic and oolitic platformal dolomites. Above that is the Lyttleton Formation that is composed of shales, quartzites and stromatolitic dolomites. The overlying Eccles Formation includes a series of cherty dolomites and erosion breccias that locally contain gold deposits. This mineralisation has been attributed to hydrothermal remobilisation of fluids by the Bushveld complex (Eriksson et al., 2006). The topmost formation is the Frisco Formation that is composed mainly of stromatolitic dolomites but these become more shale rich towards the top of the sequence because of the deepening depositional environment.



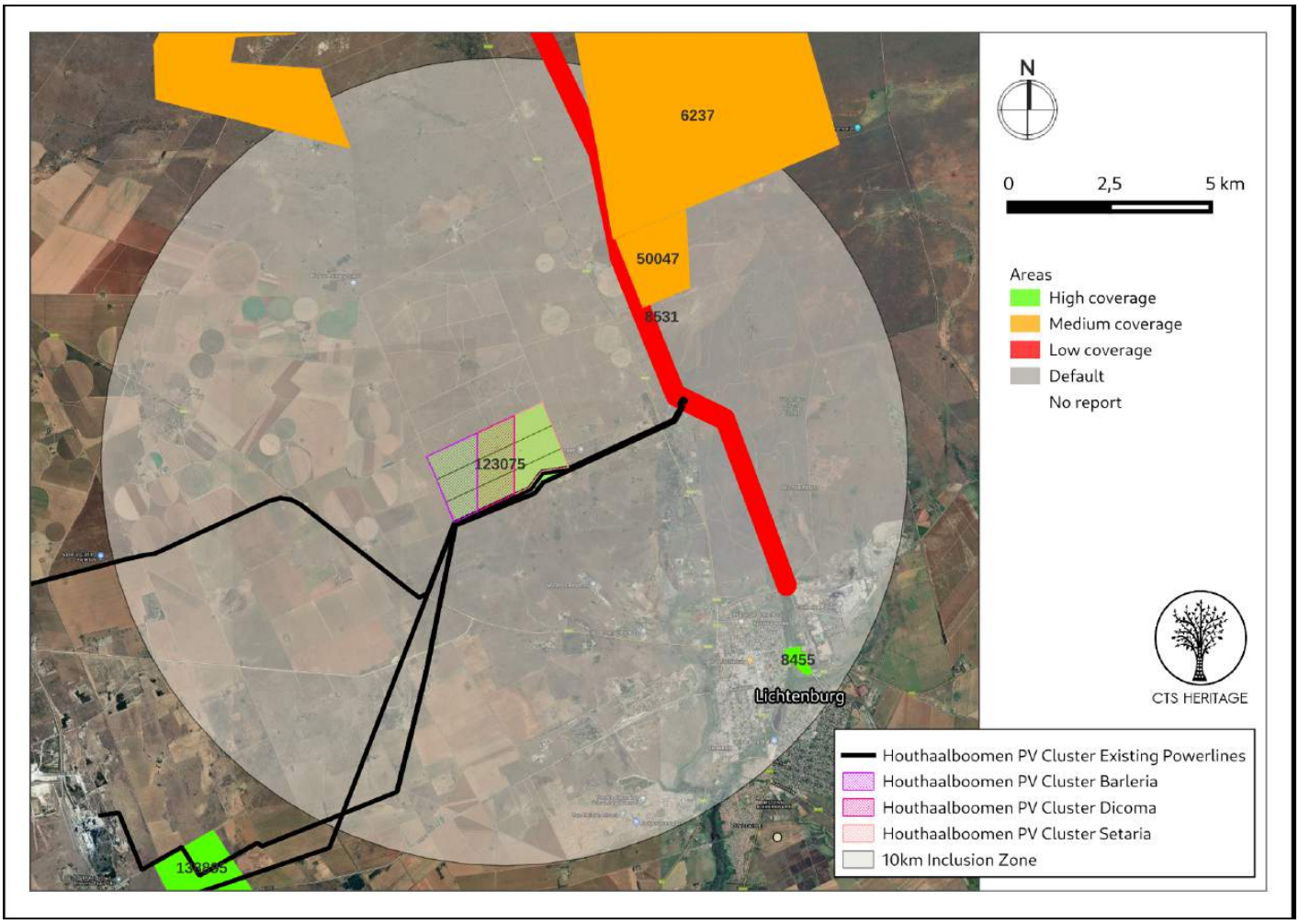
Map 2: Palaeontological sensitivity of the proposed development area



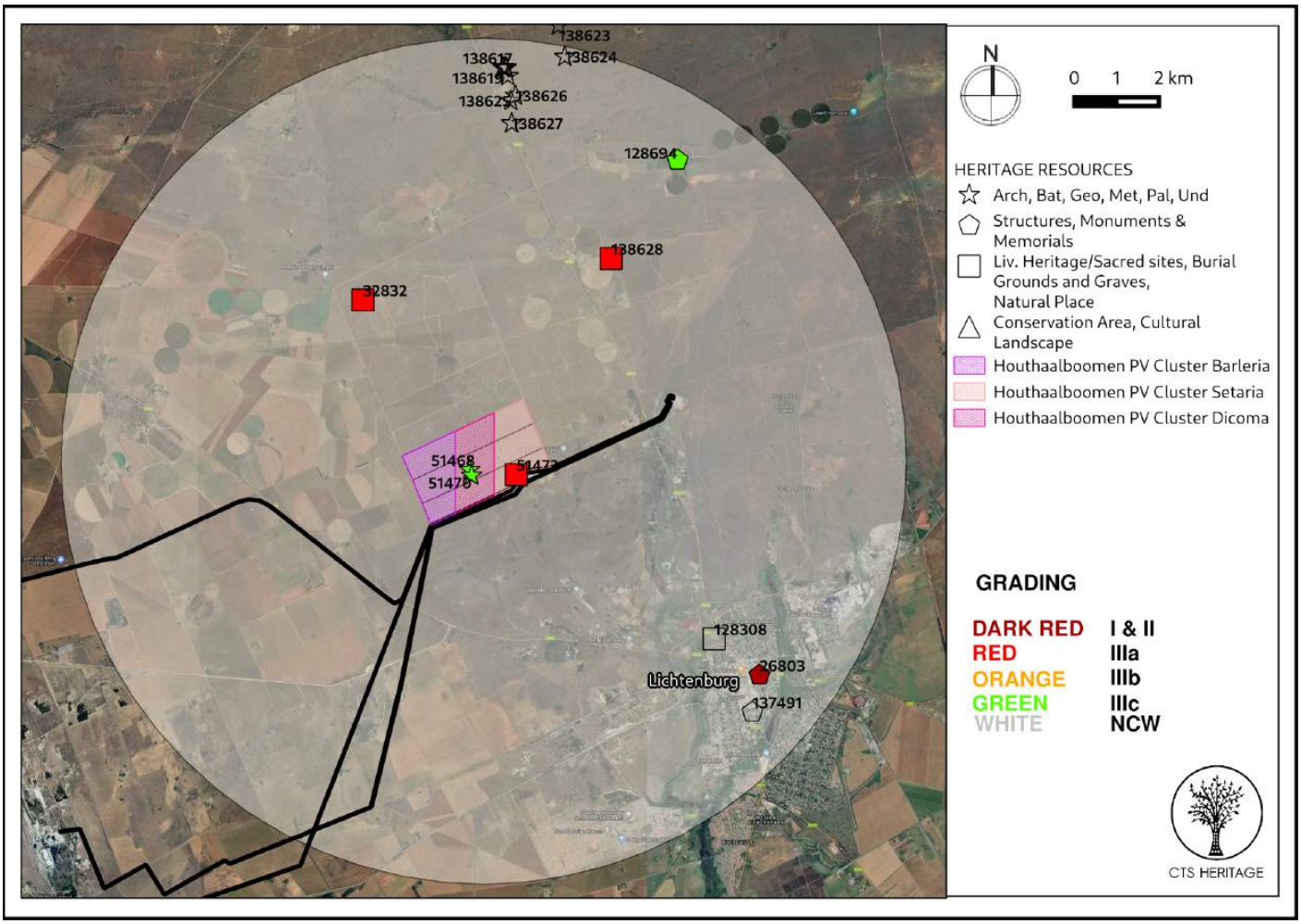
Map 3: Geology underlying the proposed project area extracted from the Council of Geoscience Map (1:250 000) 2626 West Rand

Table 2: Explanation of symbols for the geological map and approximate ages (Erikssen et al., 2006. Johnson et al., 2006; McCarthy et al., 2006; Robb et al., 2006; van der Westhuizen et al., 2006). SG = Supergroup; Fm = Formation.

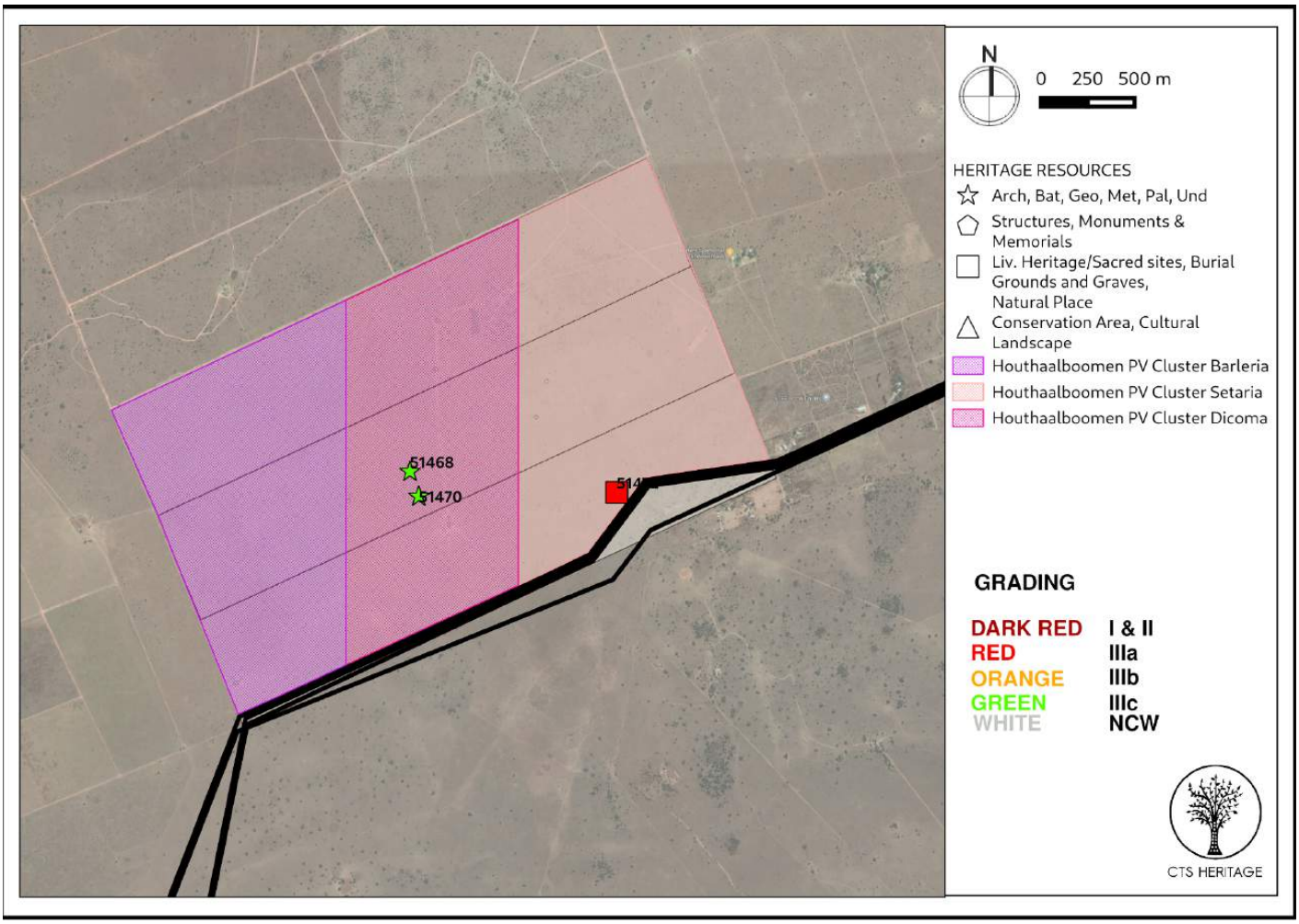
Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Qg			Neogene, ca 2.5 Ma to present
C-Pd	Dwyka Group	Diamictites, tillites, mudstones, shales,	Early Permian, Middle Ecca, ca 280-270 Ma
Vml	Littleton Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dark chert-poor dolomite	Ca 2585 – 2480 Ma
Vmm	Monte Christo Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Chert-rich dolomite; circles = oolitic	Ca 2585 – 2480 Ma
Vmo	Oaktree Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dark chert-free dolomite	Ca 2585 – 2480 Ma
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale	<2618 Ma



Map 4: Spatialisation of heritage assessments conducted in proximity to the proposed development



Map 5: Spatialisation of known heritage resources in proximity to the proposed development



Map 5a: Spatialisation of known heritage resources in proximity to the proposed development (inset)

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology (Appendix 1)

Stone Age Archaeology

Field assessment suggests that the area was occupied or traversed intermittently by Stone Age groups potentially through periods in both the Middle Stone Age (MSA – 300ka:~40ka) and the Later Stone Age (LSA: 40ka: ~2ka), although artefacts that could be clearly linked with chrono-cultural periods were scarce, which is likely a function of the proximity to primary sources of raw-material. The abundance of high-quality chert rocks in the project area was likely the resource that attracted groups there and resulted in them leaving behavioural traces in the form of stone artefacts.

Indeed the majority of the stone artefacts identified look to be the result of expedient 'testing' of rocks for quality, and the so-called products in many of the scatters were likely transported away. In this sense no evidence of substantial densities of finds or occupational debris were identified, and the stone artefacts present are evidenced to have been produced by mobile groups moving through the area. The raw-materials exploited for stone artefact manufacture were exclusively local cherts. The presence of primary and secondary sources of chert in association with stone artefacts, are suggestive of the landscape resources that probably drew Stone Age groups to the region over an extended expanse of human evolutionary history.

Stone Structures

The structures with spatial layouts of potential graves are ranked in terms of sensitivity below in Table 2. None have headstones or inscriptions, however due to their layout and orientation, it is likely that these structures represent burials.

The other structures (see table) are less typical for human graves and have a range of sizes and orientations. These structures were recorded due to their proximity to abandoned building remains and other human made structures, and are considered to be potentially sensitive due to their spatial association to historical human occupation and activity, rather than their morphology and orientation. In terms of material form, the latter cannot definitively be identified as graves.

Palaeontology (Appendix 2)

The palaeontological sensitivity of the area under consideration is presented in Figure 3, with the Monte Christo and Oaktree Formations of the Malmani Subgroup indicated as very highly sensitive (red) because of the potential of finding trace fossils, in particular stromatolites.

Stromatolites are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.

Visual Impacts (Appendix 5)

According to the VIA (2021) completed for this project, "Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), plays a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development represents existing visual disturbances.

The anticipated visual impact of the proposed PV facility on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development site."

4.2 Heritage Resources identified

Table 3: Heritage resources identified within the Baleria PV development area

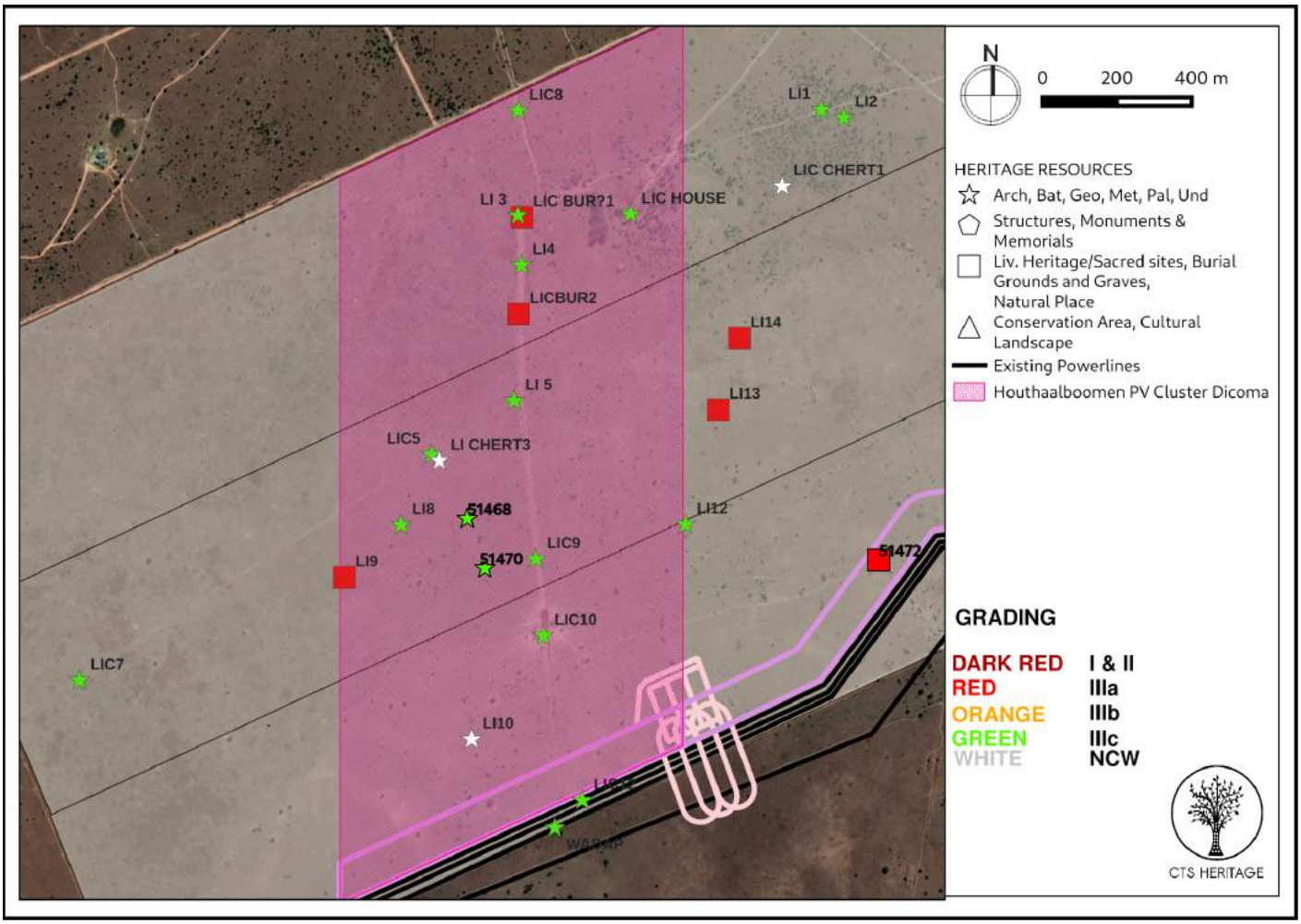
Site No.	Site Name	PV Area	Description	Co-ordinates		Grading	Mitigation
LCTB 002	LIC HOUSE	**Dicoma**	Historic house	26,099023	-26,098134	IIIC	None required
LCTB 003	**LIC BUR?1**	**Dicoma**	**Stone structure - likely burial. Occur within an existing Farm Road**	**26,096115**	**-26,098202**	**IIIA**	**10m no-development buffer**
LCTB 004	**LICBUR2**	**Dicoma**	**Stone structure - likely burial. Occur within an existing Farm Road**	**26,09602**	**-26,100536**	**IIIA**	**10m no-development buffer**
LCTB 005	LI 5	**Dicoma**	Flake with cortical platform and bi-directional core	26,095902	-26,102629	IIIC	None required
LCTB 006	LIC5	**Dicoma**	Bifacial point	26,093677	-26,103923	IIIC	None required
LCTB 007	LI CHERT3	**Dicoma**	Chert raw material source	26,09389	-26,104075	NCW	None required
LCTB 010	LIC9	**Dicoma**	Sparse stone artefact scatter	26,096485	-26,106449	IIIC	None required
LCTB 011	LIC10	**Dicoma**	Platform rejuvenation flake	26,096685	-26,108293	IIIC	None required
LCTB 012	LIC11	**Dicoma**	Sparse stone artefact scatter	26,096994	-26,11293	IIIC	None required
LCTB 014	LIC12	**Dicoma**	Sparse stone artefact scatter	26,097733	-26,112259	IIIC	None required
LCTB 019	LI 3	**Dicoma**	MSA and LSA retouched flakes	26,095999	-26,098162	IIIC	None required
LCTB 020	LI4	**Dicoma**	Hammerstone	26,096096	-26,09936	IIIC	None required
LCTB 021	LI8	**Dicoma**	MSA and LSA notched flakes, artefacts with evidence of post-depositional disturbance and Cores with ephemeral removals	26,092861	-26,10562	IIIC	None required

LCTB 022	**LI9**	**Dicoma**	**Stone structure - likely burial**	**26,091343**	**-26,106886**	**IIIA**	**10m no-development buffer**
LCTB 023	LIC8	**Dicoma**	Sparse stone artefact scatter	26,096008	-26,095638	IIIC	None required
LCTB 024	WADAP	**Dicoma**	Sparse stone artefact scatter	26,096995	-26,112918	IIIC	None required
LCTB 025	LI10	**Dicoma**	Chert raw material source	26,094757	-26,11079	NCW	None required

Palaeontology (Appendix 2)

No palaeontological resources of significance were identified within the development area.

4.3 Mapping and spatialisation of heritage resources



Map 6: Heritage Resources in the vicinity of the proposed development area

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

Archaeology

All Stone Age finds identified in the field assessment were documented in *ex-situ* contexts, which is further supported by the extensive evidence for rock clearing, and the palimpsests of artefacts documented in several places. The potential for finding a dateable *in-situ* archaeological horizon based on current surface observations appears to be low. The documented Stone Age archaeology is therefore classified as scientifically LOW-SIGNIFICANCE, or Grade IIIC.

As such, it is unlikely that the proposed development will negatively impact on significant stone age archaeological heritage. However, it is possible that significant *in situ* deposits may exist beneath the ground surface. A recommended protocol for such a scenario is included in the recommendations below.

A number of stone structures were identified within the study area. Some of these structures are likely to represent human burial (LICBUR?1, LICBUR2, LI9) and as such, these structures are conservatively graded IIIA (high local significance). It is recommended that a 10m no-development buffer zone around each structure or set of structures is implemented.

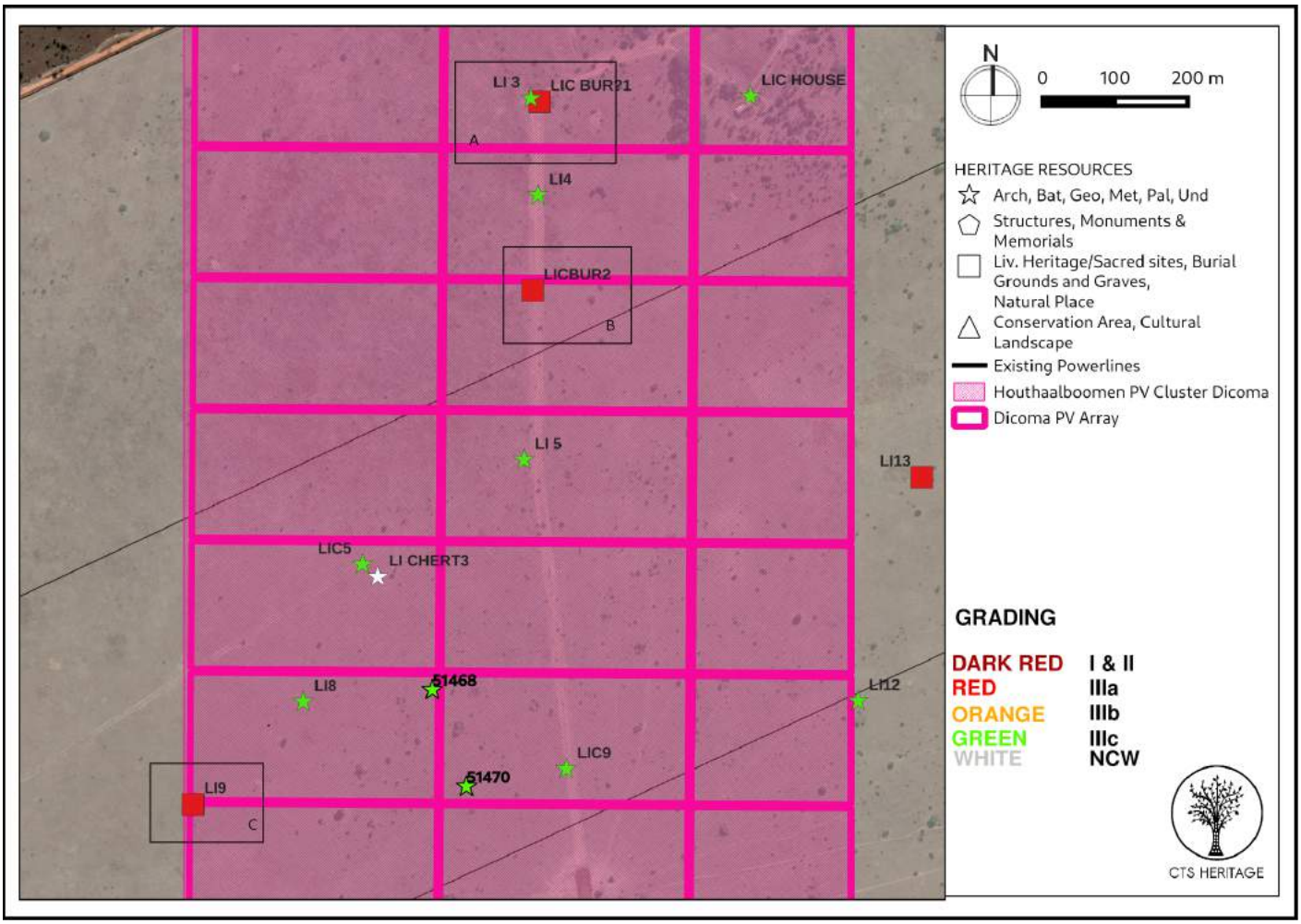
Not all the stone structures identified are likely human burials. Some of these less typical stone structures should be avoided where possible, and construction in the vicinity should proceed with caution. If human remains are exposed during construction, activities should cease immediately and the on-duty Environmental Control Officer should protect these (in the primary exposed context). A recommended protocol for such a scenario is included in the recommendations below

Palaeontology

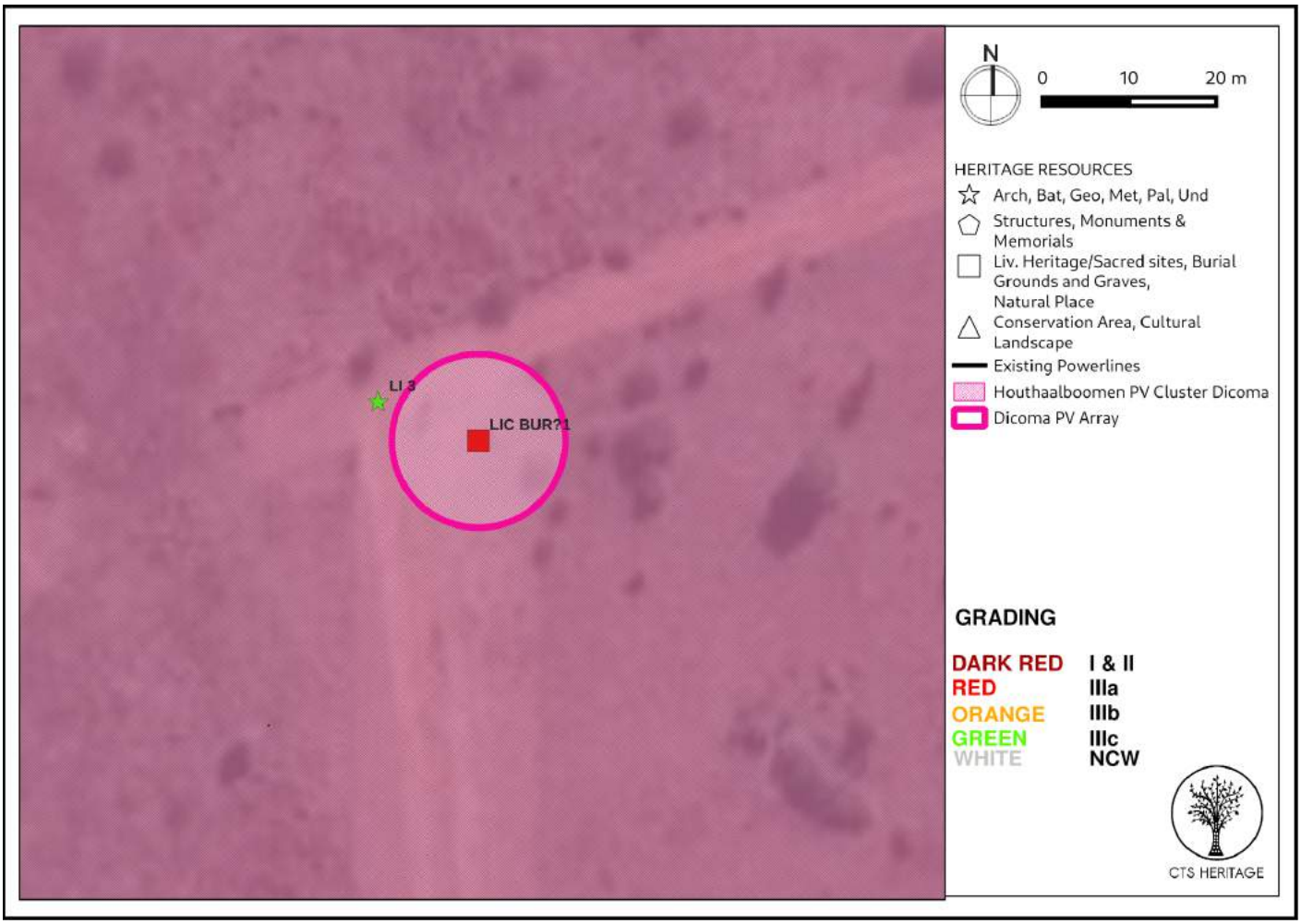
Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to contain trace fossils, namely stromatolites in the Malmani Subgroup. Furthermore, the material to be excavated is loose sand and this does not preserve fossils. Since there is an extremely small chance that trace fossils, stromatolites, from the Malmani Subgroup 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.

Table 4: Impacts to heritage resources

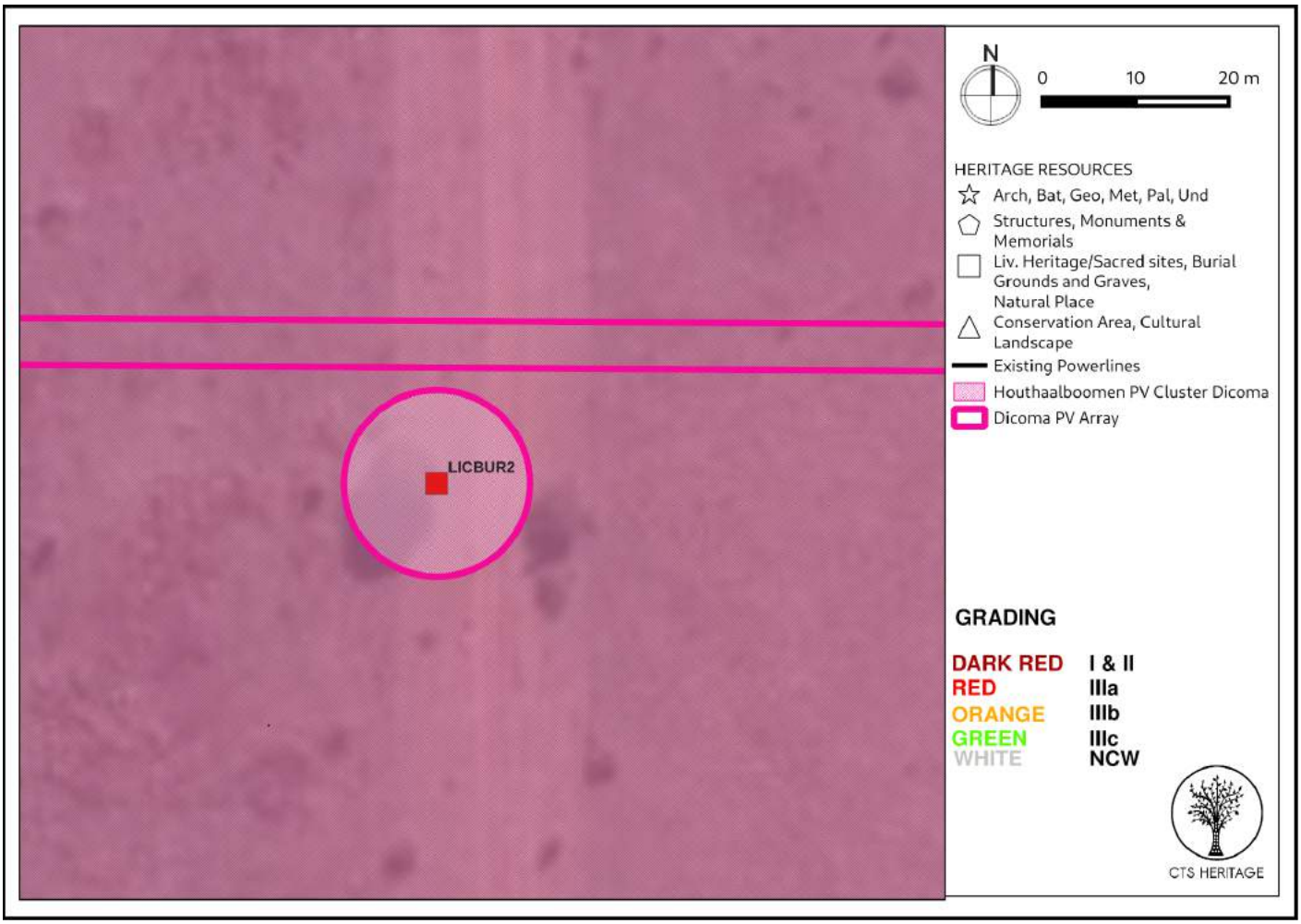
NATURE: The construction phase of the project will require excavation, which may impact on heritage resources if present.				
		Archaeology		**Palaeontology**
MAGNITUDE	**H (8)**	Low significance artefact scatters and three possible burials were identified within the development area	**L (2)**	Loose sands do not preserve plant fossils; stromatolites are common trace fossils and not considered palaeontologically important in this age deposit. They outcrop sporadically. The impact would be very unlikely.
DURATION	**H (5)**	Where an impact to a resources occurs, the impact will be permanent.	**H (5)**	Where an impact to resources occurs, the impact will be permanent.
EXTENT	**L (1)**	Localised within the site boundary	**L (1)**	Since only the possible fossils within the area would be microscopic blue-green algae in some stromatolites, the spatial scale will be localised within the site boundary.
PROBABILITY	**P (5)**	It is possible that significant burials will be impacted	**L (1)**	It is extremely unlikely that any fossils would be found in the stromatolites which are themselves common trace fossils.
SIGNIFICANCE	**L**	(8+5+1)x5=70	**L**	(2+5+1)x1=8
STATUS		Neutral		Neutral
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**	Possible	**L**	Unlikely
CAN IMPACTS BE MITIGATED		Yes		Yes
MITIGATED SIGNIFICANCE		(8+5+1)x1=14		(2+5+1)x1=8
MITIGATION: - A 10m no-go development area must be implemented around sites LICBUR?1, LICBUR2, LI9 - The attached Chance Fossil Finds Procedure must be implemented				
RESIDUAL RISK: Should any significant resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources.				



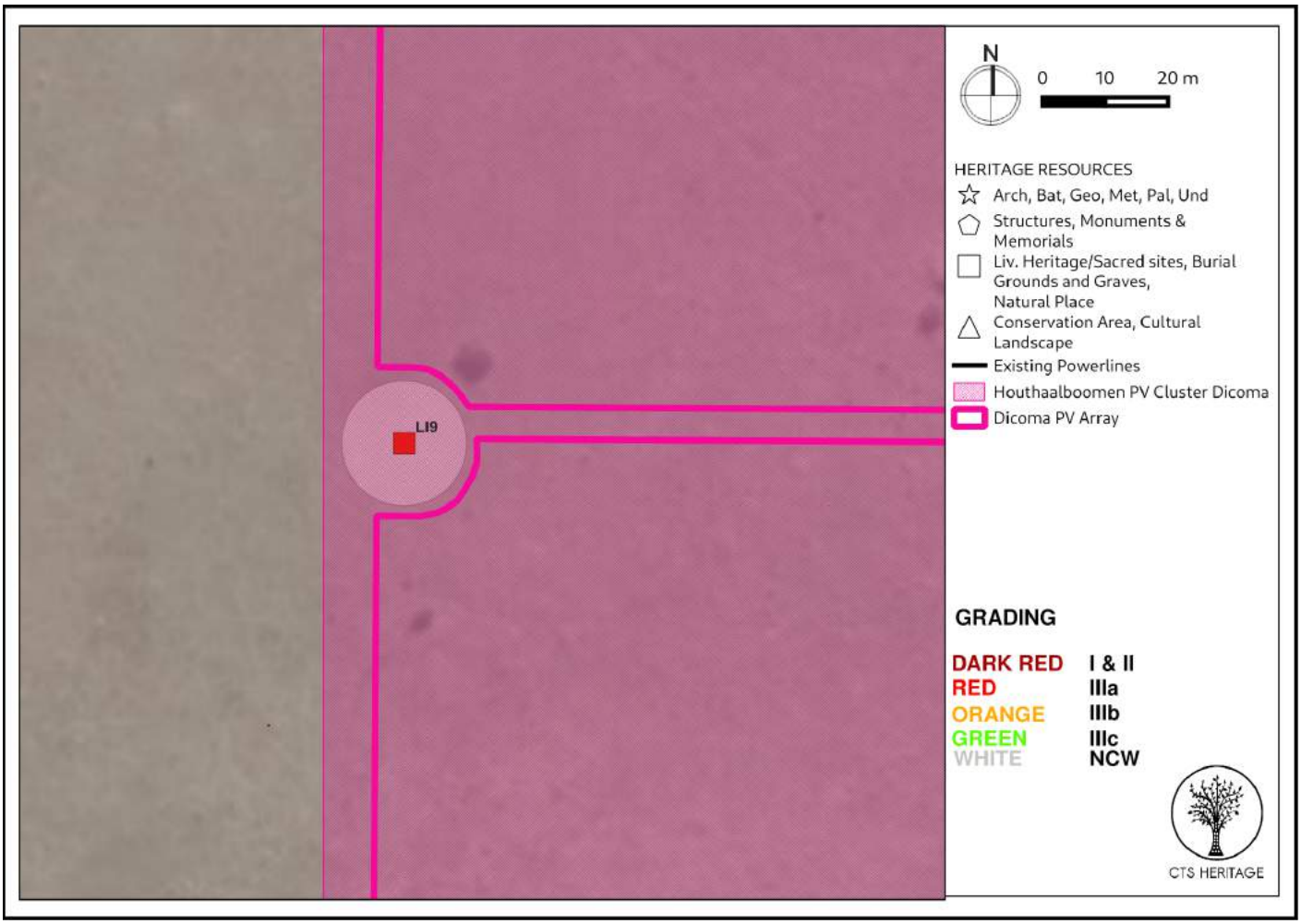
Map 7: Proposed Barleria Layout with sites indicated



Map 7a: Inset A indicating 10m buffer around sites as recommended in the preferred layout



Map 7b: Inset B indicating 10m buffer around sites as recommended in the preferred layout



Map 7c: Inset C indicating 10m buffer around sites as recommended in the preferred layout

5.2 Sustainable Social and Economic Benefit

According to the SIA (2021) completed for this project, "The majority of social impacts associated with the project are anticipated to occur during the construction phase of the development and are typical of the type of social impacts generally associated with construction activities. These impacts will be temporary and short-term (~18 months) but could have long-term effects on the surrounding social environment if not planned or managed appropriately." Potential positive socio-economic impacts primarily pertain to the creation of direct and indirect employment opportunities.

The SIA (2021) goes on to note that "It is anticipated that development of the PV Facility will result in the creation of approximately 50 full -time employment opportunities, comprising a mixture of skilled, semi-skilled and unskilled positions during the operational phase. Employment opportunities generated as a result of the project will be temporary in nature, and will last for the duration of the construction period (i.e. ~18 months). The general labour force will, as far as possible and where skills are available, be sourced from the local labour pool. Where relevant skills are unavailable from the local labour pool, these would need to be sought elsewhere. The injection of income into the area, albeit limited, in the form of wages will represent an opportunity for the local economy and businesses in the area.

Several indirect employment opportunities will also be created. Indirect employment opportunities will predominantly be created in the service industry, through the opportunity for the provision of secondary services to the construction team. Services may include, but are not limited to, accommodation, catering, and laundry services."

The other primary socio-economic benefit likely to result from this proposed development is the contribution to the infrastructure required for non-polluting renewable energy. According to the SIA (2021), "South Africa currently relies predominantly on coal-generated electricity to meet its energy needs. As a result, the country's carbon emissions are considerably higher than those of most developed countries partly because of the energy-intensive sectors which rely heavily on low quality coal, which is the main contributor to GHG emissions. The use of solar technology for power generation is considered a non-consumptive use of a natural resource which produces zero GHG emissions during its operation. The generation of RE utilising solar power will contribute positively to South Africa's electricity market. Given South Africa's reliance on Eskom as a power utility, the benefits associated with a REIPPP Programme are regarded as an important contribution, and the advancement of RE has been identified as a priority for South Africa.

Increasing the contribution of the RE sector to the local economy would contribute to the diversification of the local economy and provide greater economic stability. The growth in the RE sector as a whole could introduce new skills and development into the area. This is especially true with regards to solar power specifically considering the number of other solar power projects proposed within the broader area.

The development of RE projects have the potential to contribute to the stability of the economy, and could contribute to the local economy through employment generation (direct, indirect, and local service providers) and revenue generation for the LM. While the overall contribution of the project to South Africa's total energy requirements is small, the facility will also contribute towards offsetting the total carbon emissions associated with energy generation in South Africa. It should however be noted that such a benefit is associated with all RE projects and not only solar power projects in particular."

As such, the socio-economic benefits to be derived from the proposed development therefore outweigh the anticipated negative impacts to heritage resources identified in this assessment on condition that the recommendations made below are implemented.

5.3 Proposed development alternatives

Grid connection alternative 1 is 2.2km long, while the alternative 2 is less than 1km. The shorter of the two corridors is preferred due to the reduced length and reduced visual exposure. This alternative (2) will also remove the substation and switching station further away from the Elandsfontein small holdings and place it in closer proximity to the other PV facility infrastructure.

However, it must be noted that although Alternative 2 is preferred for the reasons given above, Alternative 1 is still acceptable from a heritage perspective.

5.4 Cumulative Impacts

As per Map 4 and Table 6, ten Heritage Impact Assessments have been conducted within a 30km inclusion zone of the proposed development area according to SAHRIS. Of these, 5 are for proposed solar parks or solar facilities, and one is for a proposed 88kv powerline.

In addition, the landscape surrounding Lichtenburg has not been identified as having any special tangible or intangible heritage significance. Therefore it is unlikely that the proposed development will result in unacceptable risk, unacceptable loss, wholesale changes to the sense of place or unacceptable increase in impact.

Table 5: Development projects within 30km of the proposed development area

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
6237	AIA	Johnny Van Schalkwyk, Robert de Jong, S Smith	01/08/1995	Reconnaissance of Remaining Cultural Resources in the Bakerville Diamond Fields
8330	AIA	Francois P Coetzee	01/03/2008	Cultural Heritage Survey of the PPC Slurry Operation, near Zeerust, North West Province
8455	HIA	Udo Kusel	25/07/2008	Cultural Heritage Resources Impact Assessment of Portion 151 of Lichtenburg Town and Townlands 27 IP (Lichtenburg Extension 10) North West Province
8531	HIA	Johnny Van Schalkwyk	01/11/2008	Heritage Impact Report for the Proposed 88 kV Power Line from Watershed Substation, Lichtenburg, to the Mmabatho Substation, North West Gauteng Province
50047	HIA	M Hutten	01/05/2012	Heritage Impact Assessment for the Proposed Lichtenburg Solar Park North of Lichtenburg, North West Province
50048	PIA	Bruce Rubidge	14/07/2012	Palaeontological Assessment - Lichtenburg Solar Park
110338	HIA	Julius CC Pistorius	01/06/2011	A PHASE I HERITAGE IMPACT ASSESSMENT (HIA) STUDY FOR THE PROPOSED MAFIKENG CEMENT PROJECT NEAR ITSOSENG IN THE NORTH-WEST PROVINCE OF SOUTH AFRICA
123075	HIA	Jaco van der Walt	12/11/2013	Archaeological Impact Assessment Report - Watershed Solar Facility
138895	AIA	Jaco van der Walt, John E Almond	14/10/2013	Archaeological Impact Assessment for the Proposed Hibernia Solar Project near the town of Lichtenburg in the North West Province of South Africa & Paleontological Report: Recommended Exemption From Further Palaeontological Studies: Proposed Hibernia Pv S
389424	HIA	Wouter Fourie	14/06/2016	HIA for the proposed 75MW SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY – TLISITSENG PV 1 PROJECT

Table 6: Cumulative Impact Table

NATURE: Cumulative Impact to the sense of place due to the development of the PV facility which will intensify industrial development within the area.				
		Overall impact of the proposed project considered in isolation		**Cumulative impact of the project and other projects in the area**
MAGNITUDE	**L (4)**	Low	**L (4)**	Low
DURATION	**M (3)**	Medium-term	**H (4)**	Long-term
EXTENT	**L (1)**	Low	**L (1)**	Low
PROBABILITY	**L (2)**	Improbable	**H (3)**	Probable
SIGNIFICANCE	**L**	(4+3+1)x2=16	**L**	(4+4+1)x3=27
STATUS		Neutral		Neutral
REVERSIBILITY	**H**	High	**L**	Low
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely	**L**	Unlikely
CAN IMPACTS BE MITIGATED		NA		NA
CONFIDENCE IN FINDINGS: High				
MITIGATION: No impacts are anticipated and as such, no mitigation is required				

Considering the assessment of cumulative impacts on heritage resources, as per Table 5 and 6 above, the development of the Setaria PV Facility and the other solar energy facilities in the area are considered to be acceptable as no cumulative impacts of a high significance are expected to occur.

6. RESULTS OF PUBLIC CONSULTATION

The public consultation process will be undertaken by the EAP during the EIA.

7. CONCLUSION

The findings of the archaeology assessment largely correlate with the findings of Van der Walt (2014) and a number of additional heritage resources were identified. The stone age archaeological resources identified were all *ex situ* and are of low heritage significance. These have been graded IIIC in the tables and maps provided and no additional mitigation is recommended for these sites. They have been sufficiently recorded in this report.

A stone structure was identified within the development area. It is likely that this is a burial site (LICBUR?1, LICBUR2, LI9). These sites are graded IIIA in the tables and maps provided and a no-development buffer of 10m is recommended around these sites. Furthermore, it is recommended that a management plan is developed to ensure the ongoing conservation of these sites for the duration of the lifespan of the development.

Based on the experience of the palaeontologist and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. No fossils were seen during the site survey and there were no rocky outcrops at all. There is a very small chance that stromatolites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) may occur below the ground surface and may be disturbed. Therefore, a Fossil Chance Find Protocol should be added to the EMPr or site management plan. If fossils are found by the developer, environmental officer or other designated person, once excavations for foundations, access and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

It should be noted that, although there were no other archaeological or heritage resources identified during the project survey; some archaeological material, including artefacts and graves can be buried underground and as such, may not have been identified during the initial survey and site visits. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately to determine a way forward.

8. RECOMMENDATIONS

There is no objection to the proposed development of the Dicoma PV facility on heritage grounds on condition that:

- A 10m no-go and no development buffer is implemented around the potential burial sites LICBUR?1, LICBUR2 and LI9
- A management plan is developed for the ongoing and long-term management of the burials within the development area.
- The attached Chance Fossil Finds Procedure must be implemented for the duration of the construction phase of the project
- Should any buried archaeological resources 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	**Report Type**	**Author/s**	**Date**	**Title**
6237	AIA Phase 1	Johnny Van Schalkwyk, Robert de Jong, S Smith	01/08/1995	Reconnaissance of Remaining Cultural Resources in the Bakerville Diamond Fields
8330	AIA Phase 1	Francois P Coetzee	01/03/2008	Cultural Heritage Survey of the PPC Slurry Operation, near Zeerust, North West Province
8455	HIA Phase 1	Udo Kusel	25/07/2008	Cultural Heritage Resources Impact Assessment of Portion 151 of Lichtenburg Town and Townlands 27 IP (Lichtenburg Extension 10) North West Province
8531	HIA Phase 1	Johnny Van Schalkwyk	01/11/2008	Heritage Impact Report for the Proposed 88 kV Power Line from Watershed Substation, Lichtenburg, to the Mmabatho Substation, North West Gauteng Province
50047	HIA Phase 1	M Hutten	01/05/2012	Heritage Impact Assessment for the Proposed Lichtenburg Solar Park North of Lichtenburg, North West Province
50048	PIA Phase 1	Bruce Rubidge	14/07/2012	Palaeontological Assessment - Lichtenburg Solar Park
110338	HIA Phase 1	Julius CC Pistorius	01/06/2011	A PHASE I HERITAGE IMPACT ASSESSMENT (HIA) STUDY FOR THE PROPOSED MAFIKENG CEMENT PROJECT NEAR ITSOSENG IN THE NORTH-WEST PROVINCE OF SOUTH AFRICA
123075	Heritage Scoping	Jaco van der Walt	12/11/2013	Archaeological Impact Assessment Report
138895		Jaco van der Walt, John E Almond	14/10/2013	Archaeological Impact Assessment for the Proposed Hibernia Solar Project near the town of Lichtenburg in the North West Province of South Africa & Paleontological Report: Recommended Exemption From Further Palaeontological Studies: Proposed Hibernia Pv S

Other References:

Lavin, Tomose, de Bruin et al. (September 2018). ARCHAEOLOGICAL SPECIALIST STUDY: In terms of Section 38(8) of the NHRA for a Development of the Lichtenburg 1, 2 and 3 PV Solar Energy Facility and associated infrastructure on a site near Lichtenburg, North West Province (Unpublished)

Bamford (September 2018). Palaeontological Impact Assessment for three proposed PV projects near Lichtenburg, Northwest Province. (Unpublished)

Lavin and Wiltshire. (June 2018). Heritage Screening Assessment for the proposed development of the Lichtenburg 2 PV Solar Energy Facility and associated infrastructure on a site near Lichtenburg, North West Province. (Unpublished).

Du Plessis (October 2018). Proposed Lichtenburg 2 Pv Solar Energy Facility, North West Province: Visual Impact Assessment. (Unpublished)

CTS HERITAGE

APPENDICES

CTS HERITAGE

APPENDIX 1: Archaeological Assessment (2021)

ARCHAEOLOGICAL SPECIALIST STUDY

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

THE PROPOSED DEVELOPMENT OF A PV CLUSTER NEAR LICHTENBURG, NORTH WEST PROVINCE

Prepared by

Dr Darya Presnyakova, Dr Will Archer

And

Jenna Lavin

CTS HERITAGE

In Association with

Savannah Environmental

September 2021

EXECUTIVE SUMMARY

The development of solar energy facilities is proposed on a site near Lichtenburg, in the North West Province. The development (and project area) will consist of three (3) PV facilities and associated infrastructure respectively. The proposed developments require Environmental Authorisation in terms of the National Environmental Management Act (Act 107 of 1998) from the Department of Forestry, Fisheries, and the Environment (DFFE). A full impact assessment will be required to be undertaken for each of the proposed projects.

The findings of this field assessment largely correlate with the findings of Van der Walt (2014) and a number of additional heritage resources were identified. The stone age archaeological resources identified were all *ex situ* and are of low heritage significance. These have been graded IIIC in the tables and maps provided and no additional mitigation is recommended for these sites. They have been sufficiently recorded in this report.

A number of stone structures were identified within the development area. It is likely that a number of these are burial sites (LICBUR?1, LICBUR2, LICBUR6, LICBUR10, LI9, LI13 and LI14). These have been graded IIIA in the tables and maps provided and a no-development buffer of 10m is recommended around these sites. Furthermore, it is recommended that a management plan is developed to ensure the ongoing conservation of these sites for the duration of the lifespan of the development.

Lastly, it is possible that archaeological resources may be located beneath the ground surface which may be impacted during the course of development. Recommendations in this regard are included below.

Recommendations

There is no objection to the proposed development of the PV cluster and associated grid connection in terms of impacts to archaeological heritage on condition that:

- A 10m no-go and no development buffer is implemented around the potential burial sites LICBUR?1, LICBUR2, LICBUR6, LICBUR10, LI9, LI13 and LI14.
- A management plan is developed for the ongoing and long-term management of the burials within the development area.
- Should any buried archaeological resources 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.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

CONTENTS

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

1. INTRODUCTION

1.1 Background Information on Project

Three 75MW PV facilities (Barleria PV, Dicoma PV and Setaria PV), collectively referred to as the PV Cluster, are concurrently being considered on the project site (within Portion 1, Portion 9, and Portion 10 of the Farm Houthaalboomen 31) and are assessed through separate Environmental Impact Assessment (EIA) processes and separate Heritage Impact Assessments (HIAs). These facilities are located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. Each solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area. Each facility development area (approximately 176ha) as well as two alternative grid connection solutions (within a 100m wide corridor) have been considered in the Scoping phase and now assessed in the EIA Phase.

1.2 Description of Property and Affected Environment

The footprint for each proposed PV facility and related grid connection infrastructure is located across several properties, approximately 5.5km North-West of the town of Lichtenburg, in the North West Province of South Africa. The landscape falls within the semi-arid southern African Grassland Biome, and the vegetation across the project area is characterised largely by grassland (dense in several portions) and shrubland that is evident on undulating plains with chert bedrock outcropping in multiple locations (see Mucina et al., 2006), which served as a source of raw-material for Pleistocene and Holocene occupants of the area. Nodules were also used as demarcation/protection within potential grave structures documented within the project area (see below).

The topography of the project area is generally flat, with extensive disturbance in the form of clearing for crop farming and bioturbation in the form of rodent activity in the upper 0.5-2m of sandy topsoil. Indeed, much of the area has been affected by historical farming related activities, with prominent evidence in the form of extensive mounds of chert nodules that were recently cleared from the land surface by farmers and accumulated in strategic locations within different grazing camps (Figure 5). The surface sediments are generally bioturbated sandy soils, which appear to be aeolian in terms of original deposition, with inclusions of primary nodules of chert (5-30cm in maximum diameter) deriving from the local bedrock.

The general land use within the combined project footprint is predominantly stock farming, with evidence of smaller antelope (Bushbuck, Steenbok and Duiker) as well as bushpig in addition to burrowing rodents (molerats, hares and meerkats) within the project footprint. The majority of identified archaeological Stone Age remains occur within these disturbed upper sandy soil contexts and therefore have limited potential for modern scientific analyses (due to the *ex situ* spatial contexts of the finds and limited possibility of radiometric dating). Where topsoil has been extensively removed through grazing and clearing, the stone artefacts are randomly oriented (multiple specimens on end),

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

indicating redeposited or reworked archaeological contexts (Figure 12).

Chert bedrock outcrops in several places across the combined project area including in the North-West, North-East and South-West regions of the combined project footprint (Figure 7). Stone Age exploitation traces in the form of simple cortical flakes and cores associated with the outcrops indicate these chert outcrops were sources of raw-material for Pleistocene hunter-gatherer populations, and the expedient nature of the technology (roughing out and primary flakes abundant) indicate that much of the archaeology was likely the result of Stone Age groups testing the available rock nodules for faults and incipient fractures within their mobility cycles, and then moving on. Limited evidence for occupational artefact scatters was identified.

The relatively intensive current and historical use of substantial portions of the landscape, and relatively abundant recently abandoned building structures (in the North-West and South West areas), in combination with the presence of a previously identified grave within the footprint raise the potential for historical graves and isolated burials, and several stone structures were documented within this survey that need to be avoided (see sensitivity ranking), or removed with caution (see below). However, the rock clearing activities and 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 affected by rock clearing). The recommendation is therefore to err on the side of caution and avoid elongated stone structures comparable to the entities identified within this report, if exposed in future development of the property.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

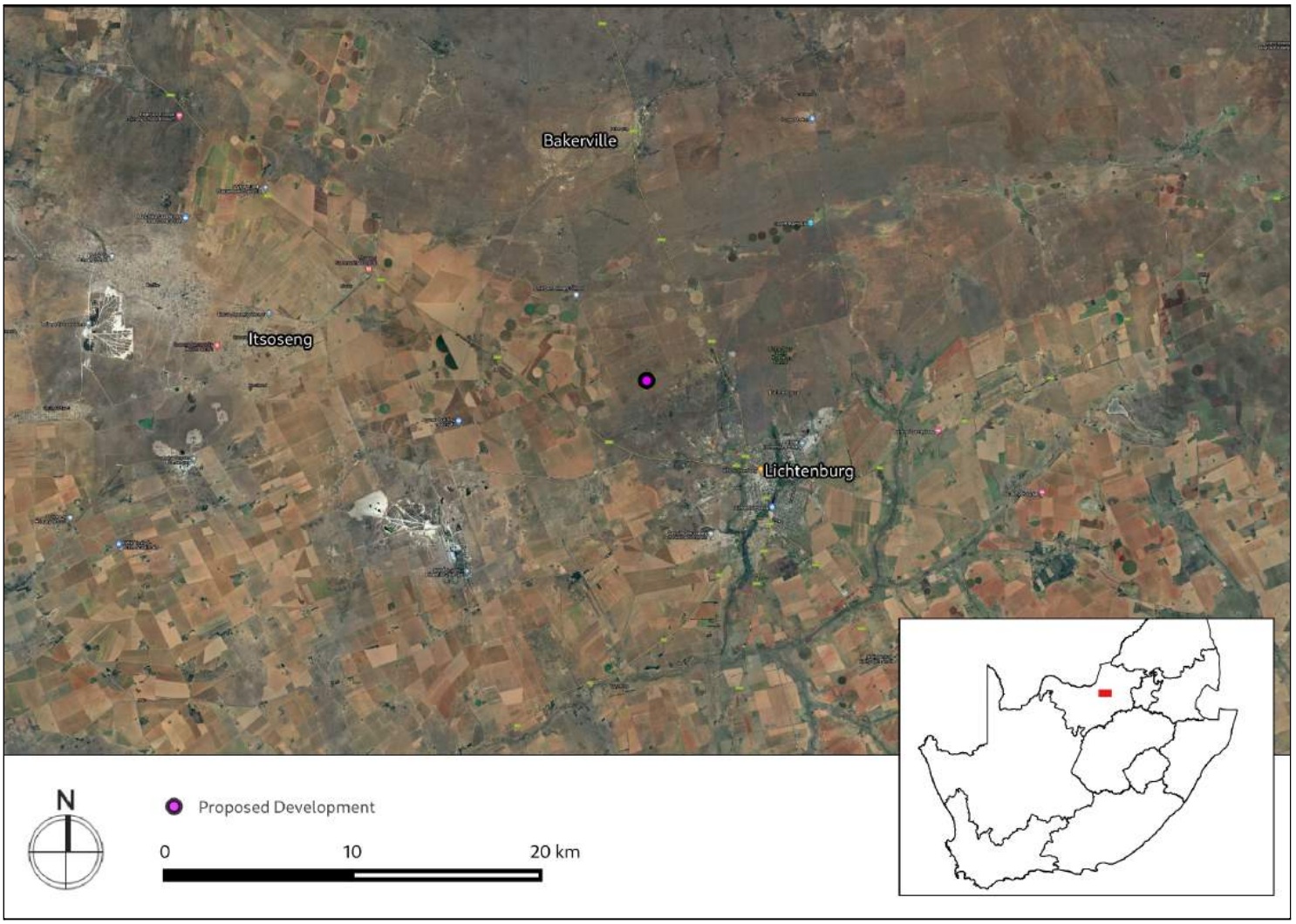


Figure 1.1: Close up satellite image indicating proposed location of study area

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

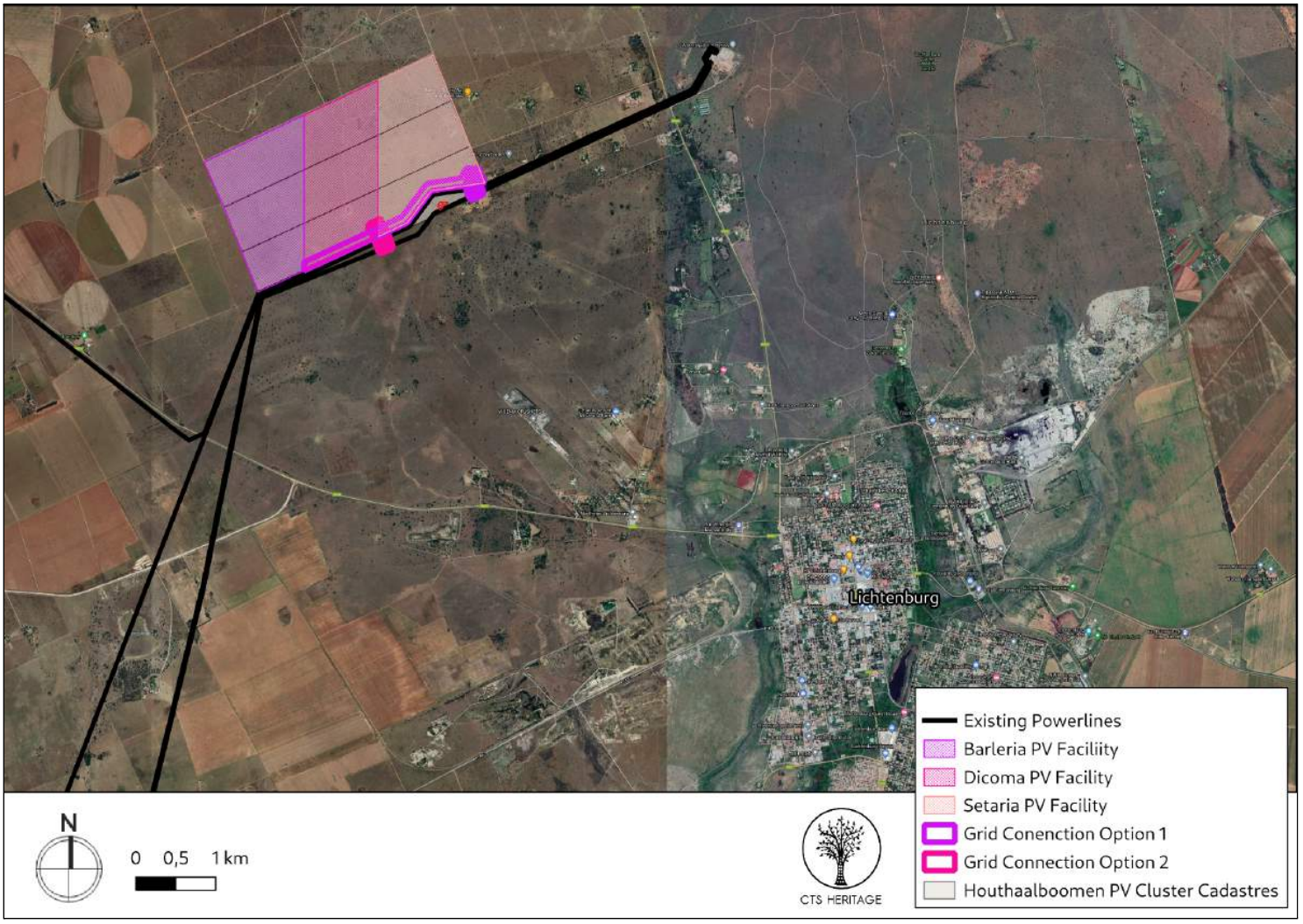


Figure 1.2: Study Area

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

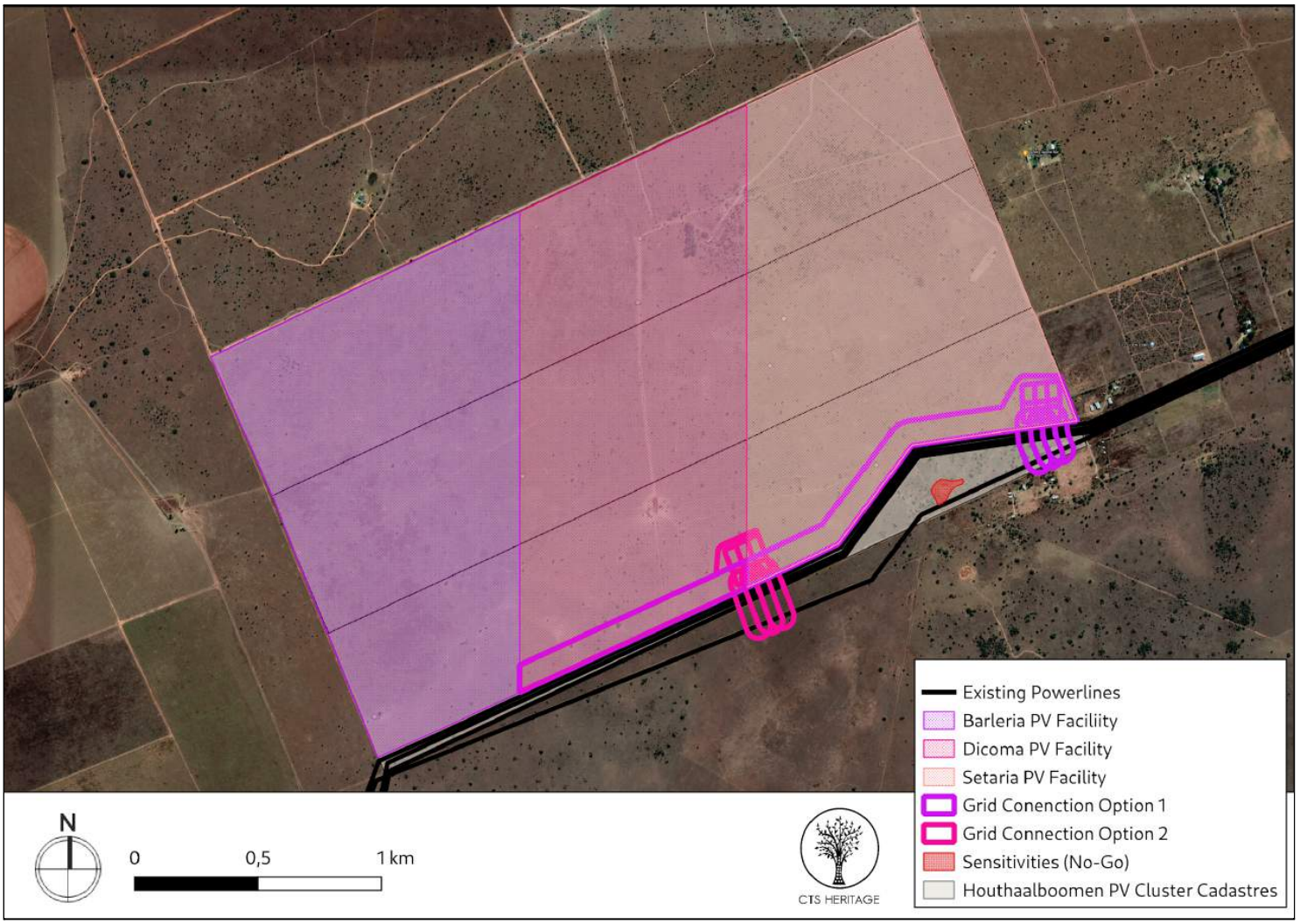


Figure 1.3: Study Area

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 17 July 2021 to determine what archaeological resources are likely to be impacted by the proposed development.
- The study area was assessed on foot in transects, photographs of the archaeological contexts and representative 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.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

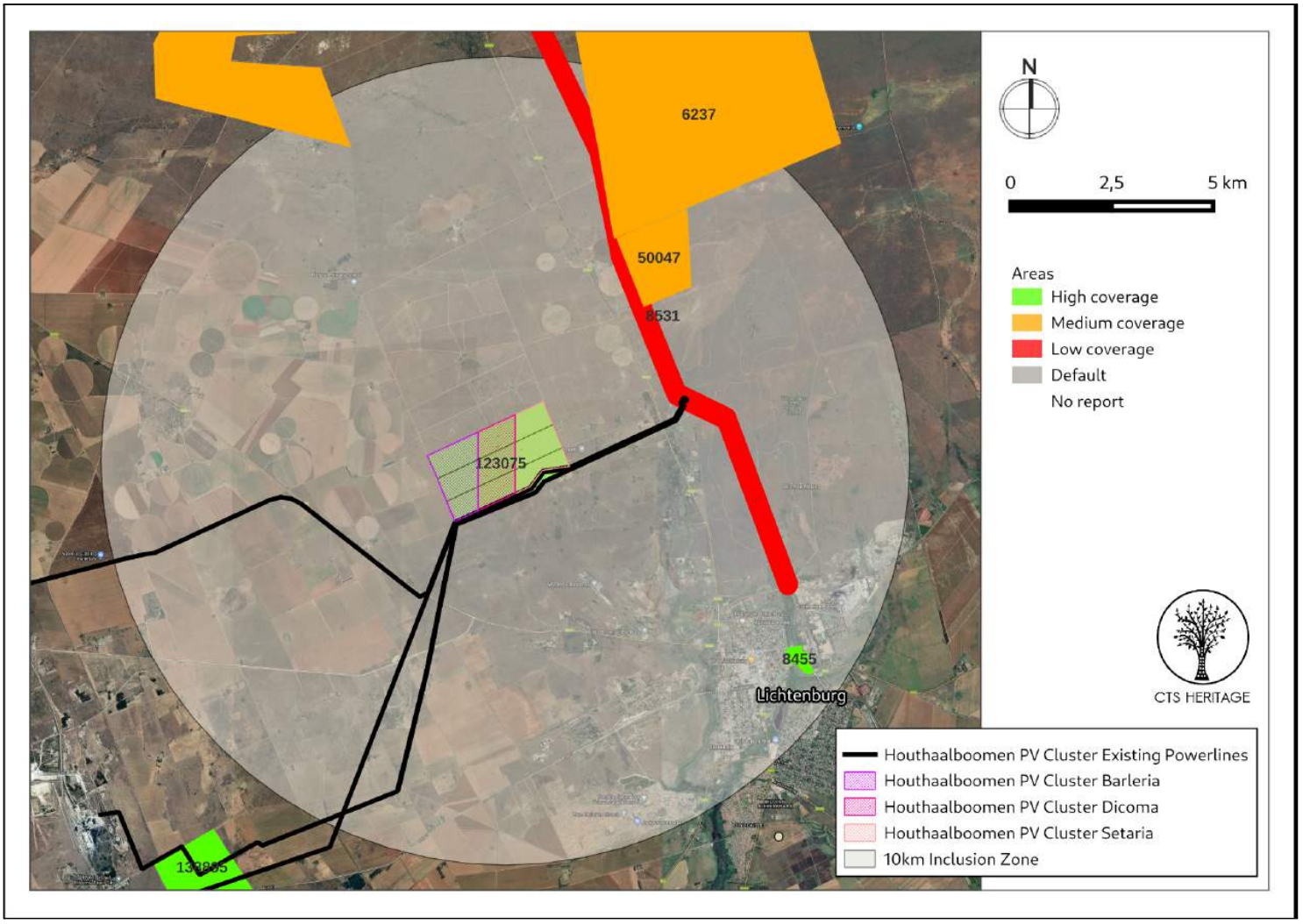


Figure 2: Close up satellite image indicating proposed location of the study area in relation to heritage studies previously conducted

2.3 Constraints & Limitations

The following constraints and limitations were experienced:

1. Dense grass and shrubs cover portions of the project area, and this inhibited the visibility of surface archaeology (Figure 4). This is not regarded as a substantial problem in relation to the Stone Age archaeological remains, which in most cases have generally limited scientific importance due to the disturbed contexts they occur in. It is clear that the Stone Age sensitivity and scientific potential of the project area has been comprehensively assessed. However the inability to assess some of the footprint area at ground surface level should be regarded as a constraint to the documentation of potential graves, given the identified presence of several characteristic structures.
2. Previous rock clearing activities by farmers may have affected surface archaeology including the possible above-surface presence of material evidence of graves.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

3. Access was acquired to assess the eastern portion of the connection route area (Figure 5). However, when this portion was being assessed large numbers of cattle with calves were present on the property, with several bulls amongst them. When the cattle showed aggressive behaviour towards the consultants, this portion was abandoned. This section was subsequently reviewed from the neighbouring property and from the far eastern portion which was accessible from a separate property (Figure 5: see track). The latter portion of the project area is considered to have limited to no potential for *in situ* Stone Age archaeological remains.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area proposed for development was thoroughly assessed for impacts to heritage resources in an Archaeological Impact Assessment conducted by Van der Walt (2014, SAHRIS NID 123075). This report is referred to below in order to determine the likely heritage sensitivity of the area proposed for the development of the PV cluster and grid connection alternatives.

The proposed PV cluster development is located within an area that has already approved PV facilities within a belt of approved renewable energy facilities. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The construction of the proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact. Furthermore, Van der Walt (2014) notes that "Visual impacts to scenic routes and sense of place are not assessed to be high from a heritage perspective."

Archaeology and Built Environment Heritage

Lichtenburg town was established in 1873 and named "Town of Light". General Del la Rey was buried in Lichtenburg after a fatal shooting incident at Langlaagte. During the 1800's, more and more farmers settled in the area. During the Second Boer War, the strategically important town of Lichtenburg was occupied by both Boer and Briton for short spells. In November 1900, a large British force under Col. Robert Baden-Powell was transferred to Lichtenburg and secured the town, and much of the territory with it. In addition, the town is known from Rudyard Kipling's poem, Lichtenberg, which relays the story of a foreign combatant in the second South African War. In 1926, Lichtenburg experienced a gold rush that lasted approximately 10 years. Lichtenburg district is now mostly a farming area, combining cattle and crop-farming and large areas of former diamond mine diggings are now used as grazing.

According to van Schalkwyk et al (1995, SAHRIS NID 6237) in their report completed for the Bakerville Diamond Fields, "land use in the area goes back to the Early Stone Age, as can be determined by the number of stone artifacts found near the old mining commissioners office. This material seems to be disturbed from its primary context because of the mining activities. It is postulated that similar occurrences will be found in other parts of the diggings, but that this material would have been disturbed out of context." As a result of the dominant land use in the area, many of the heritage resources identified by van Schalkwyk et al (1995) are associated with past and present agriculture, and

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

consist of farming implements, a few windmills, and dipping-troughs. One such trough, located at Elandsputte on the farm Uitgevonden 355JP, was the site where the first diamond was discovered. This structure is a proclaimed national monument (now Provincial Heritage Site). Van Schalkwyk et al (1995) identified a number of burial grounds within their surveyed area. Heritage resources known from this area include burial grounds and graves, archaeological artefacts and old structures, often associated with farming activities or diamond mining. An archaeological field assessment was conducted for the Lichtenburg PV facilities located immediately adjacent to this proposed development (CTS Heritage, 2018). The field assessment noted that the area assessed had been disturbed and transformed by agricultural activities in a similar way to the area proposed for this development. Pre-existing agricultural plough fields, grazing areas and farm buildings were identified in the development area. Furthermore, throughout the farming areas several heaps of rocks that were removed from the agricultural fields were identified. During the field assessment of the site *no archaeological resources, graves or burial grounds were identified* in the project area assessed in CTS Heritage's report (2018).

The exact area proposed for development was previously assessed by Van der Walt (2014, SAHRIS NID 123075). Van der Walt (2014) notes that "The site lies on a featureless flat plain. The entire development footprint was extensively utilised for crop farming and ploughing through the years resulted in a lateral and downward migration of artefacts making it virtually impossible to identify knapping or manufacture sites and site extent of artefact concentrations. In some areas borrowing animals brought MSA artefacts to the surface where the sand cover is more than a metre and a half thick and the possibility of finding subsurface material cannot be excluded. Most of the Stone Age archaeology in the study area consists of low densities of scattered (and possibly mixed) MSA and LSA artefacts. These find spots are documented as "occurrences" and are of low significance but more substantial and higher density scatters of MSA material do occur, and were recorded as "sites"." The archaeological sites are described as "Medium density scatters of tools. Blades, flakes, cores. MSA mainly of chert." and are graded IIIC i.e. low local significance. Van der Walt (2014) also identified a single unmarked grave (approximately 27 years old) and farm labour housing dating to the 1990's. He further notes that "Cultural landscape elements were noted in the northern portion of the study area consisting of the mentioned farm labourer dwelling together with a windmill, stone walled cattle kraal and a recently constructed kraal." (Van der Walt, 2014).

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Table 1: Sites previously identified in and near the proposed study area

SAHRIS ID	Site No.	Site Name	Site Type	Grading
130171	2626AA/ Solar/ Farm Zamenkomst 04/ Site 1	Old farm house	Structures, Structures	Grade IIIc
128694	ZKT1	Zamenkomst 1	Building	Grade IIIc
26803	9/2/235/0005	Nederduitse Gereformeerde Church, 27 Gerrit Maritz Street, Lichtenburg	Building	Grade II
51468	**WSF 01**	**Watershed Solar Facility 01**	**Artefacts**	**Grade IIIc**
51470	**WSF 02**	**Watershed Solar Facility 02**	**Artefacts**	**Grade IIIc**
51472	**WSF 03**	**Watershed Solar Facility 03**	**Burial Grounds & Graves**	**Grade IIIa**
128308	Grave of Vic Hamman	Grave of Vic Hamman	Burial Grounds & Graves	
138616	FHDN-001	FARM HOUTHAALDOORNS 2	Palaeontological	
138617	FHDN-002	FARM HOUTHAALDOORNS 2	Palaeontological	
138618	FHDN-003	FARM HOUTHAALDOORNS 2	Palaeontological	
138619	FHDN-004	FARM HOUTHAALDOORNS 2	Palaeontological	
138620	FHDN-005	FARM HOUTHAALDOORNS 2	Palaeontological	
138621	FHDN-006	FARM HOUTHAALDOORNS 2	Palaeontological	
138624	FHDN-009	FARM HOUTHAALDOORNS 2	Palaeontological	
138625	FHDN-010	FARM HOUTHAALDOORNS 2	Palaeontological	
138626	FHDN-011	FARM HOUTHAALDOORNS 2	Palaeontological	
138627	FHDN-012	FARM HOUTHAALDOORNS 2	Palaeontological	
138628	FHDN-013	FARM HOUTHAALDOORNS 2	Burial Grounds & Graves	Grade IIIa
137491	Gereformeerde kerk Lichtenburg	Gereformeerde kerk Lichtenburg	Monuments & Memorials	

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

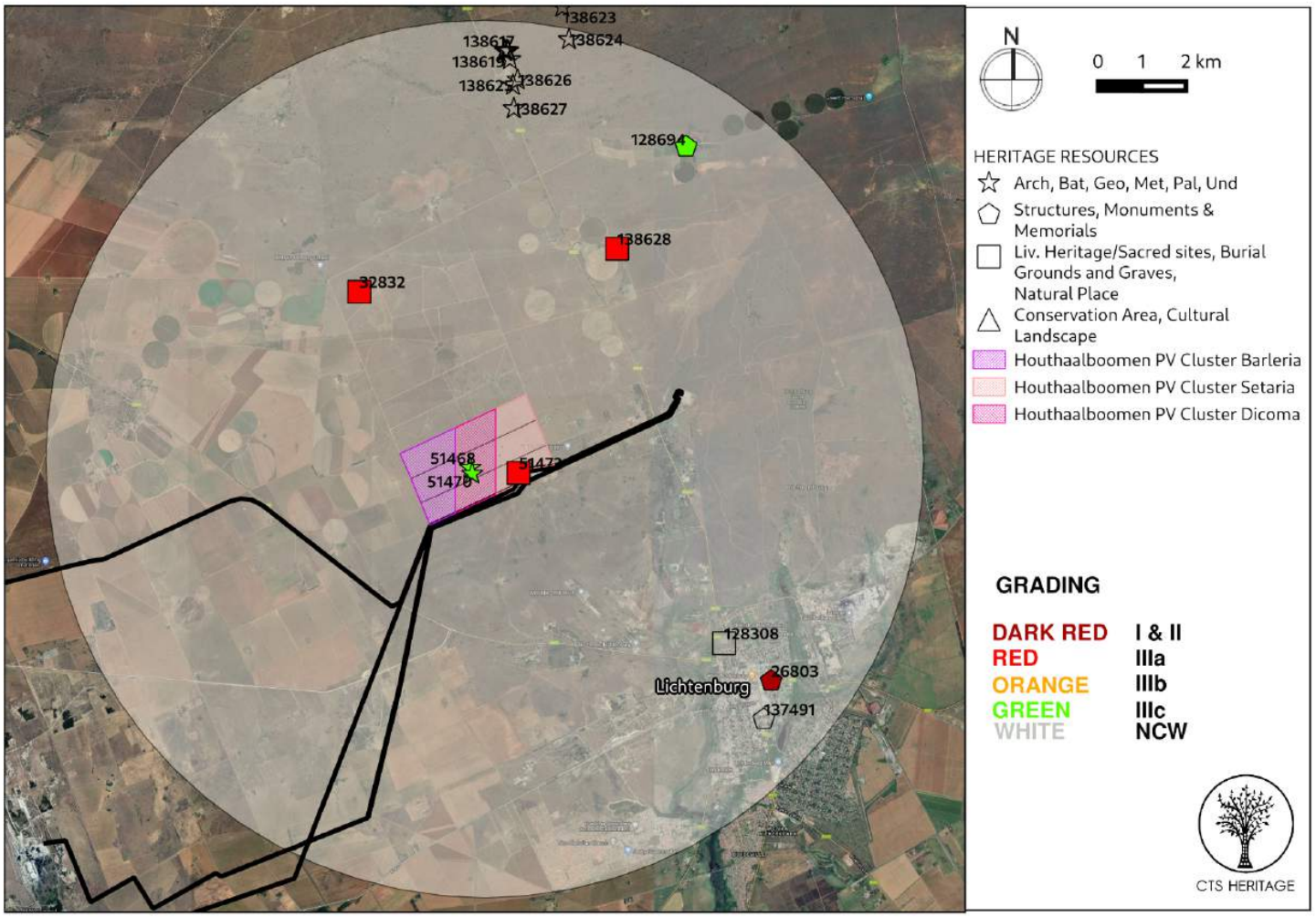


Figure 3.1. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated (see Heritage Screening Assessment for insets)

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

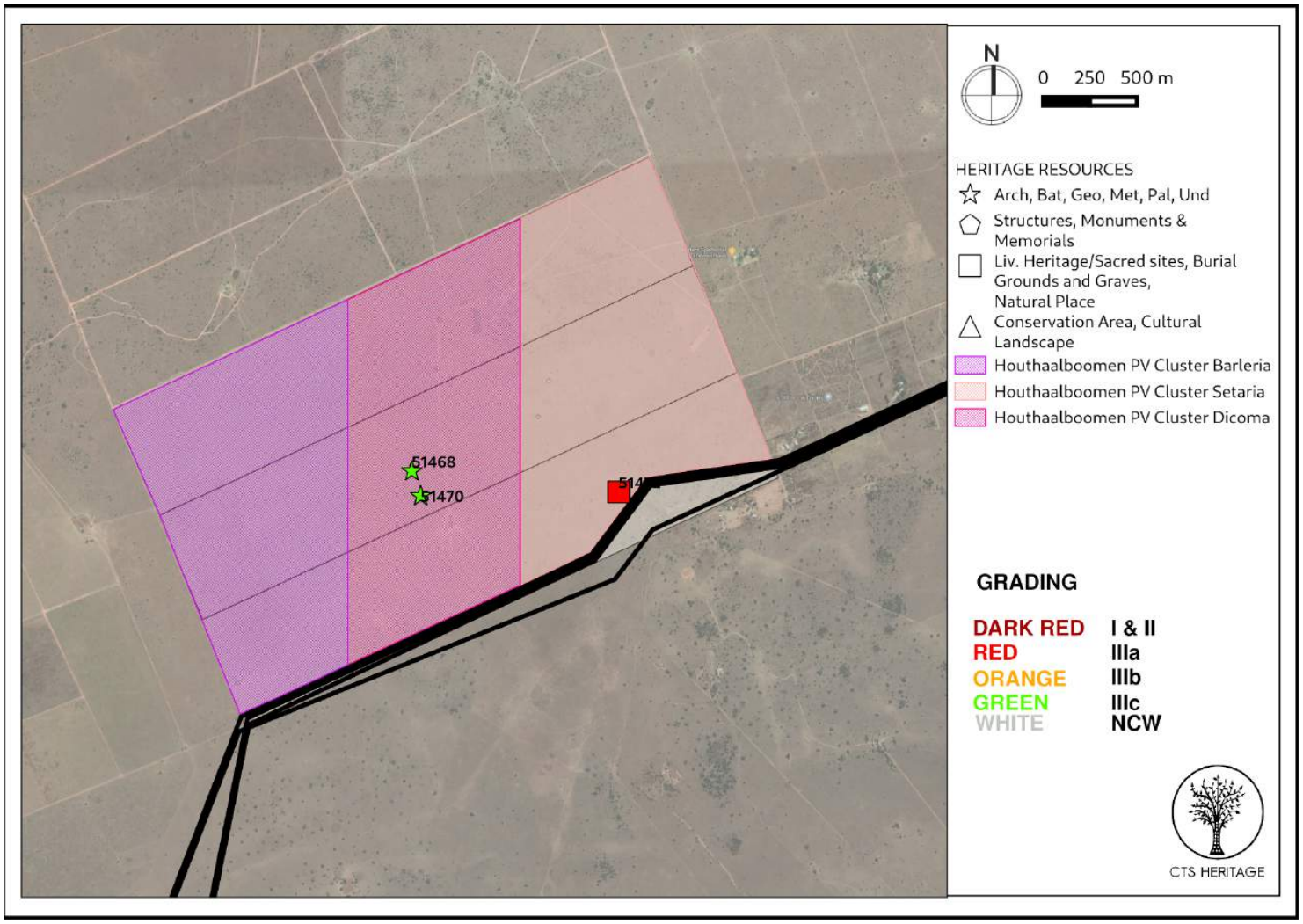


Figure 3.2. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated (see Heritage Screening Assessment for insets)

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

Stone Age Archaeology

Field assessment suggests that the area was occupied or traversed intermittently by Stone Age groups potentially through periods in both the Middle Stone Age (MSA – 300ka:~40ka) and the Later Stone Age (LSA: 40ka: ~2ka), although artefacts that could be clearly linked with chrono-cultural periods were scarce, which is likely a function of the proximity to primary sources of raw-material. The abundance of high-quality chert rocks in the project area was likely the resource that attracted groups there and resulted in them leaving behavioural traces in the form of stone artefacts.

Indeed the majority of the stone artefacts identified look to be the result of expedient 'testing' of rocks for quality, and the so-called products in many of the scatters were likely transported away. In this sense no evidence of substantial densities of finds or occupational debris were identified, and the stone artefacts present are evidenced to have been produced by mobile groups moving through the area. The raw-materials exploited for stone artefact manufacture were exclusively local cherts. The presence of primary and secondary sources of chert in association with stone artefacts, are suggestive of the landscape resources that probably drew Stone Age groups to the region over an extended expanse of human evolutionary history.

Stone Structures

The structures with spatial layouts of potential graves are ranked in terms of sensitivity below in Table 2. None have headstones or inscriptions, however due to their layout and orientation, it is likely that these structures represent burials.

The other structures (see table) are less typical for human graves and have a range of sizes and orientations. These structures were recorded due to their proximity to abandoned building remains and other human made structures, and are considered to be potentially sensitive due to their spatial association to historical human occupation and activity, rather than their morphology and orientation. In terms of material form, the latter cannot definitively be identified as graves.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 4: Images depicting the parameters affecting archaeological visibility and efficiency in the survey: (a-d) Dense grass cover; (c) Human for scale; (e-f) Examples of chert nodules accumulated through agricultural clearing and track construction.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

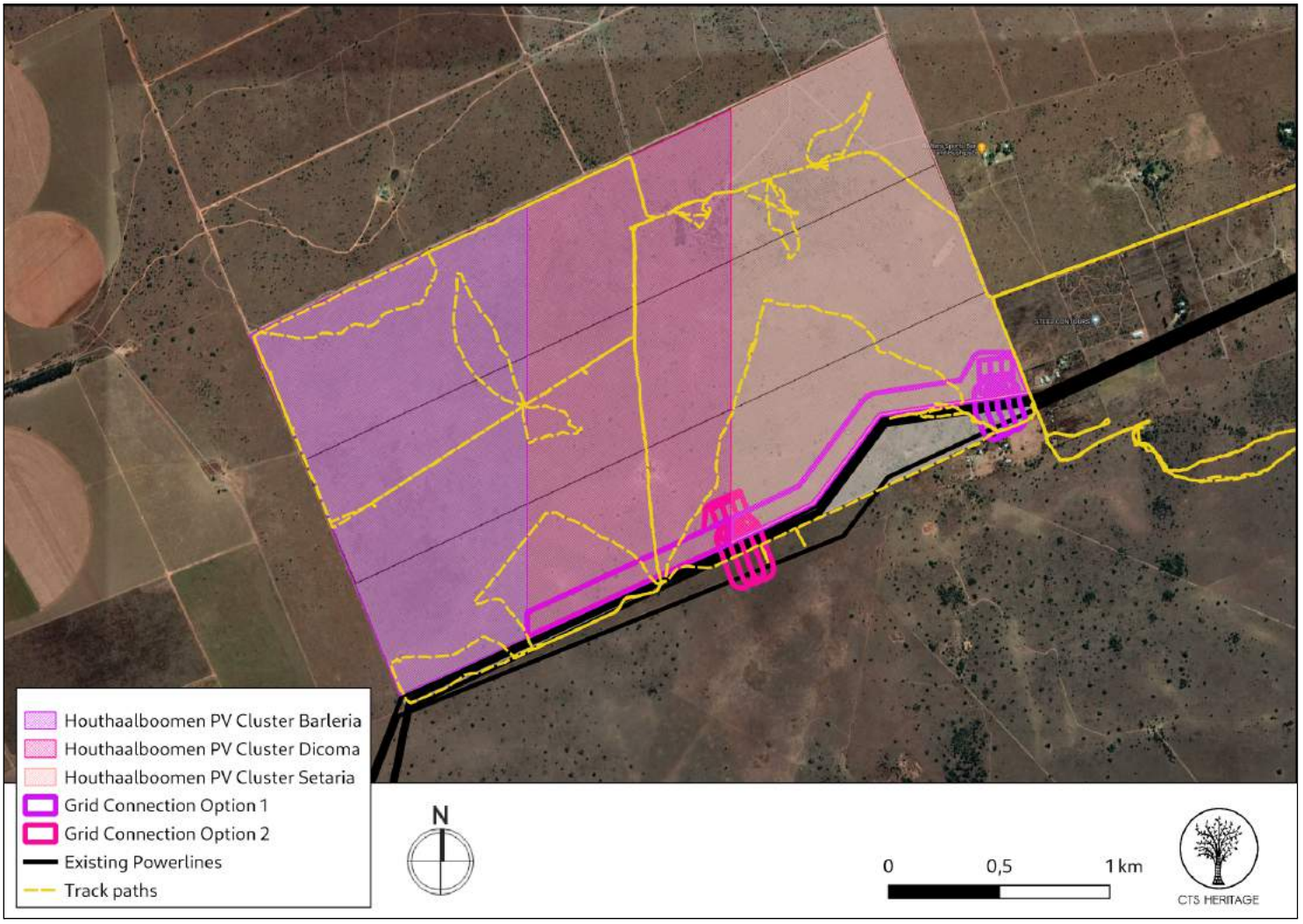


Figure 5: Overall track paths of foot survey

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4.2 Archaeological Resources identified

Table 2: Observations noted during the field assessment

Site No.	Site Name	PV Area	Description	Co-ordinates		Grading	Mitigation
LCTB 001	LIC CHERT1	**Setaria**	Chert raw material source	26,103104	-26,097456	NCW	None required
LCTB 002	LIC HOUSE	**Dicoma**	Historic house	26,099023	-26,098134	IIIC	None required
LCTB 003	**LIC BUR?1**	**Dicoma**	**Stone structure - likely burial**	**26,096115**	**-26,098202**	**IIIA**	**10m no-development buffer**
LCTB 004	**LICBUR2**	**Dicoma**	**Stone structure - likely burial**	**26,09602**	**-26,100536**	**IIIA**	**10m no-development buffer**
LCTB 005	LI 5	**Dicoma**	Flake with cortical platform and bi-directional core	26,095902	-26,102629	IIIC	None required
LCTB 006	LIC5	**Dicoma**	Bifacial point	26,093677	-26,103923	IIIC	None required
LCTB 007	LI CHERT3	**Dicoma**	Chert raw material source	26,09389	-26,104075	NCW	None required
LCTB 008	LIC7	**Barleria**	Sparse stone artefact scatter	26,084219	-26,109369	IIIC	None required
LCTB 009	LIC8	**Barleria**	Artefact scatter with unworked chert nodules exposed through top-soil removal	26,080669	-26,106448	IIIC	None required
LCTB 010	LIC9	**Dicoma**	Sparse stone artefact scatter	26,096485	-26,106449	IIIC	None required
LCTB 011	LIC10	**Dicoma**	Platform rejuvenation flake	26,096685	-26,108293	IIIC	None required
LCTB 012	LIC11	**Dicoma**	Sparse stone artefact scatter	26,096994	-26,11293	IIIC	None required
LCTB 013	**LICBUR6**	**Barleria**	**Stone structure - likely burial**	**26,085323**	**-26,115651**	**IIIA**	**10m no-development buffer**
LCTB 014	LIC12	**Dicoma**	Sparse stone artefact scatter	26,097733	-26,112259	IIIC	None required
LCTB 015	LIC13	**Setaria**	Sparse stone artefact scatter	26,109219	-26,107903	IIIC	None required
LCTB 016	**LICBUR10**	**Setaria**	**Stone structure - likely burial**	**26,109238**	**-26,105839**	**IIIA**	**10m no-development buffer**
LCTB 017	LI1	**Setaria**	Artefacts with evidence of post-depositional disturbance, and scraper on a flake with cortex including carinated blade core	26,104159	-26,095615	IIIC	None required
LCTB 018	LI2	**Setaria**	Cores with ephemeral removals	26,104759	-26,095804	IIIC	None required

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

LCTB 019	LI 3	**Dicoma**	MSA and LSA retouched flakes	26,095999	-26,098162	IIIC	None required
LCTB 020	LI4	**Dicoma**	Hammerstone	26,096096	-26,09936	IIIC	None required
LCTB 021	LI8	**Dicoma**	MSA and LSA notched flakes, artefacts with evidence of post-depositional disturbance and Cores with ephemeral removals	26,092861	-26,10562	IIIC	None required
LCTB 022	**LI9**	**Dicoma**	**Stone structure - likely burial**	**26,091343**	**-26,106886**	**IIIA**	**10m no-development buffer**
LCTB 023	LIC8	**Dicoma**	Sparse stone artefact scatter	26,096008	-26,095638	IIIC	None required
LCTB 024	WADAP	**Dicoma**	Sparse stone artefact scatter	26,096995	-26,112918	IIIC	None required
LCTB 025	LI10	**Dicoma**	Chert raw material source	26,094757	-26,11079	NCW	None required
LCTB 026	LI12	**Setaria**	Stone cores with ephemeral removals near raw-material source.	26,100504	-26,105609	IIIC	None required
LCTB 027	**LI13**	**Setaria**	**Stone structure - likely burial**	**26,101384**	**-26,102843**	**IIIA**	**10m no-development buffer**
LCTB 028	**LI14**	**Setaria**	**Stone structure - likely burial**	**26,10195**	**-26,101126**	**IIIA**	**10m no-development buffer**
LCTB 029	LI15	**Setaria**	Cores with ephemeral removals	26,108559	-26,103651	IIIC	None required

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

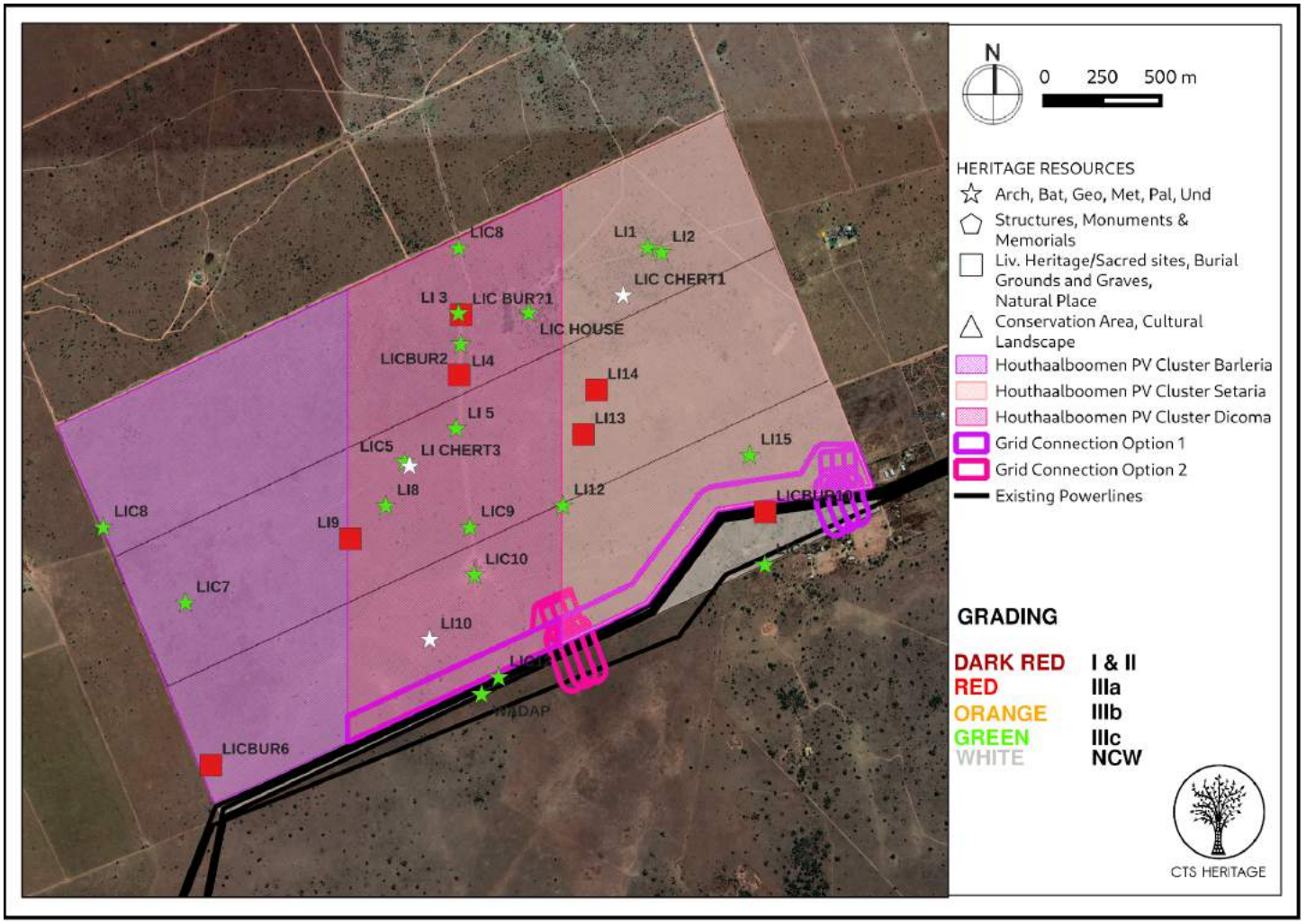


Figure 6: Map of field observations relative to the proposed development

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4.3 Selected photographic record

(a full photographic record is available upon request)

Figure 7: (a,b,e,f) Primary outcrops of chert with exploitation traces; (c-d) Secondary chert nodules accumulated through agricultural activities

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 8: Two elongated structures oriented NE-SW, likely to be adult graves.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

LIC_bur1_a

LIC_bur1_b

LIC_bur1_c

Figure 9: Human accumulations of stone near a historical building remnant

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 10: Artefact scatter with unworked chert nodules exposed through top-soil removal (LIC8).

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 11: Artefacts representing initial production stages (testing): (a) scraper on a flake with cortex (LI1); (b) flake with cortical platform (LI5); (c,d,f,g) Cores with ephemeral removals (LI2, LIC8, LI15) and (e) Hammerstone (LI4).

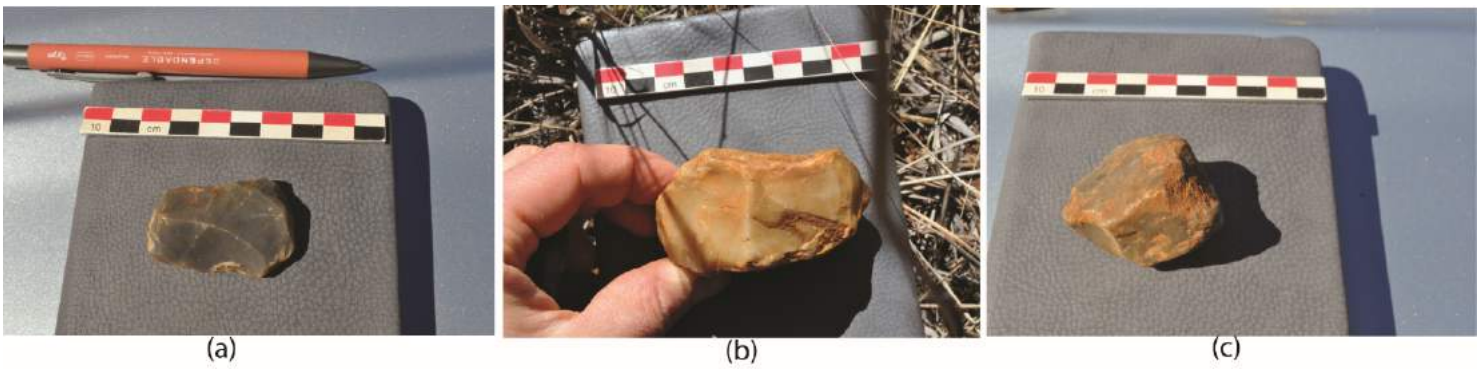


Figure 12: Artefacts with evidence of post-depositional disturbance (a, b: LI1) and (c: LI8)

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 13: MSA and LSA artefacts including (a) Notched flakes (LI8); (b) Retouched flake (LI3); (c) Bifacial point (LI5); (d) Carinated blade core (LI1).

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

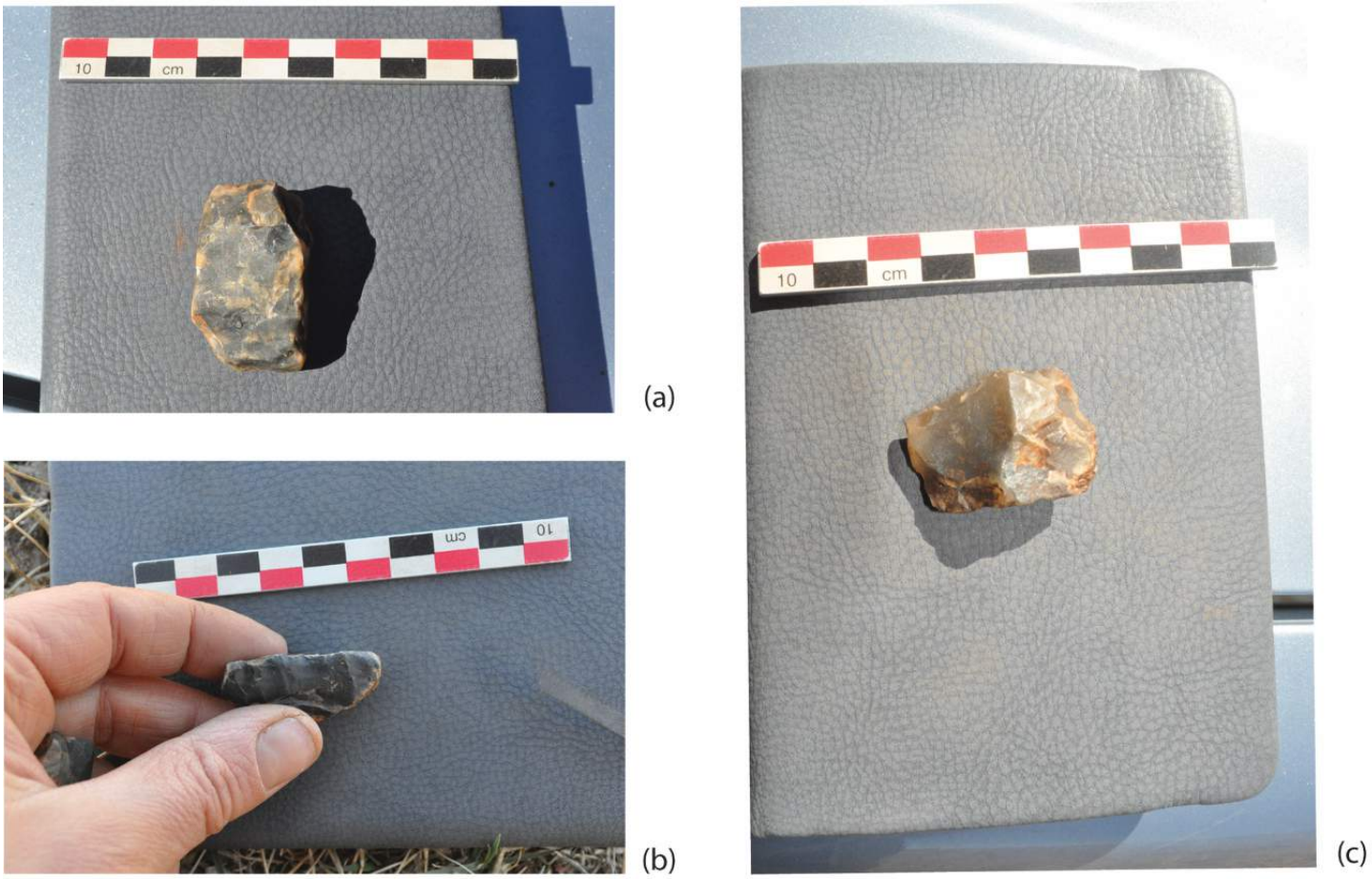


Figure 14: MSA and LSA artefacts including (a) Bipolar core (LI1); (b) Platform rejuvenation flake (LIC10); (c) Bi-directional core (LI5).

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 15: Additional images of stone structures

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 16: Additional images of stone structures (LI14 and LICBUR2)

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

All Stone Age finds identified in the field assessment were documented in *ex-situ* contexts, which is further supported by the extensive evidence for rock clearing, and the palimpsests of artefacts documented in several places. The potential for finding a dateable *in-situ* archaeological horizon based on current surface observations appears to be low. The documented Stone Age archaeology is therefore classified as scientifically LOW-SIGNIFICANCE, or Grade IIIC.

As such, it is unlikely that the proposed development will negatively impact on significant stone age archaeological heritage. However, it is possible that significant *in situ* deposits may exist beneath the ground surface. A recommended protocol for such a scenario is included in the recommendations below.

A number of stone structures were identified within the study area. Some of these structures are likely to represent human burial (LICBUR?1, LICBUR2, LICBUR6, LICBUR10, LI9, LI13 and LI14) and as such, these structures are conservatively graded IIIA (high local significance). It is recommended that a 10m no-development buffer zone around each structure or set of structures is implemented.

Not all the stone structures identified are likely human burials. Some of these less typical stone structures should be avoided where possible, and construction in the vicinity should proceed with caution. If human remains are exposed during construction, activities should cease immediately and the on-duty Environmental Control Officer should protect these (in the primary exposed context). A recommended protocol for such a scenario is included in the recommendations below

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

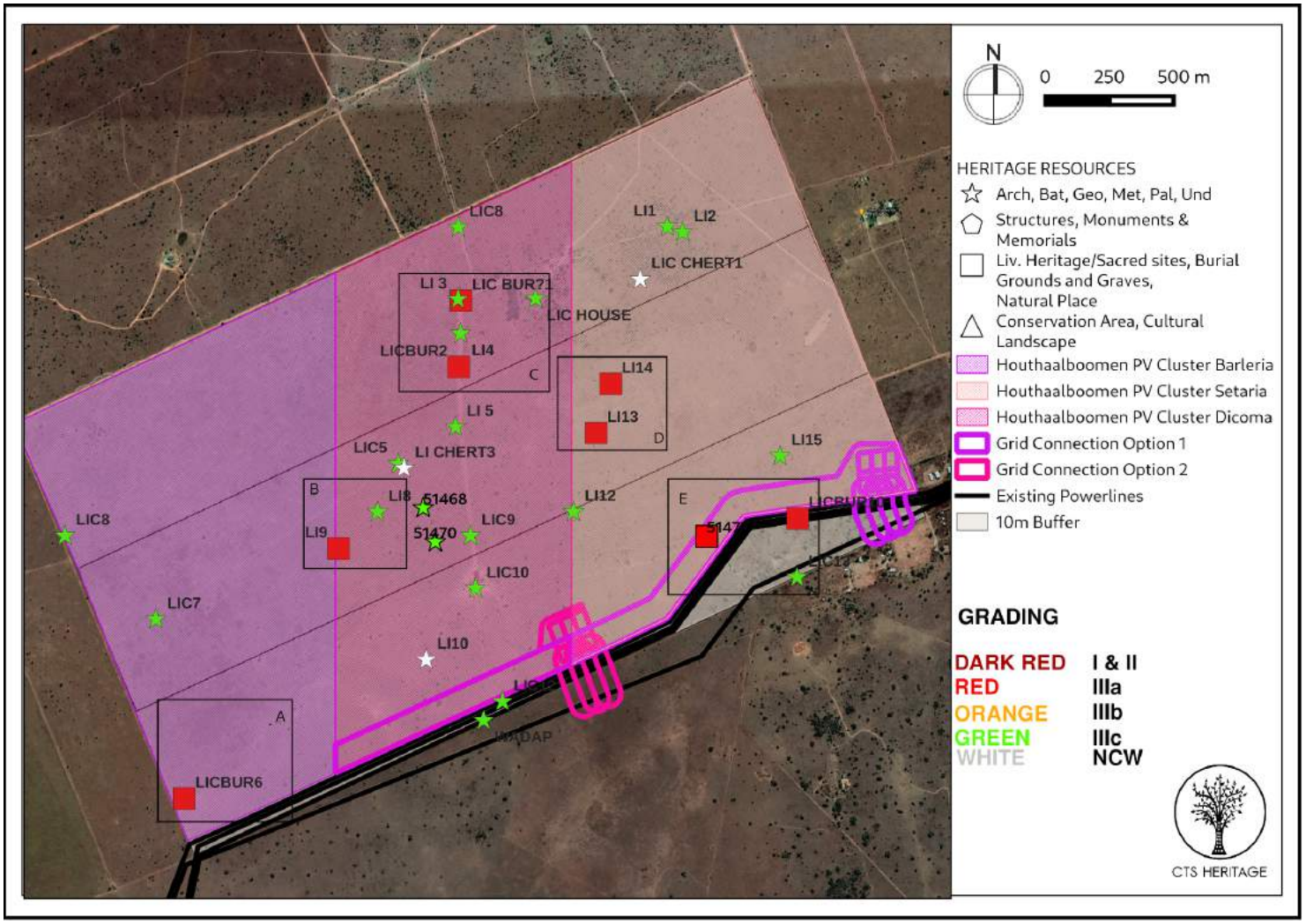


Figure 17.1: Map of heritage resources identified during the field assessment, relative to the study area and associated archaeological sensitivity

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 17.2: Inset A

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

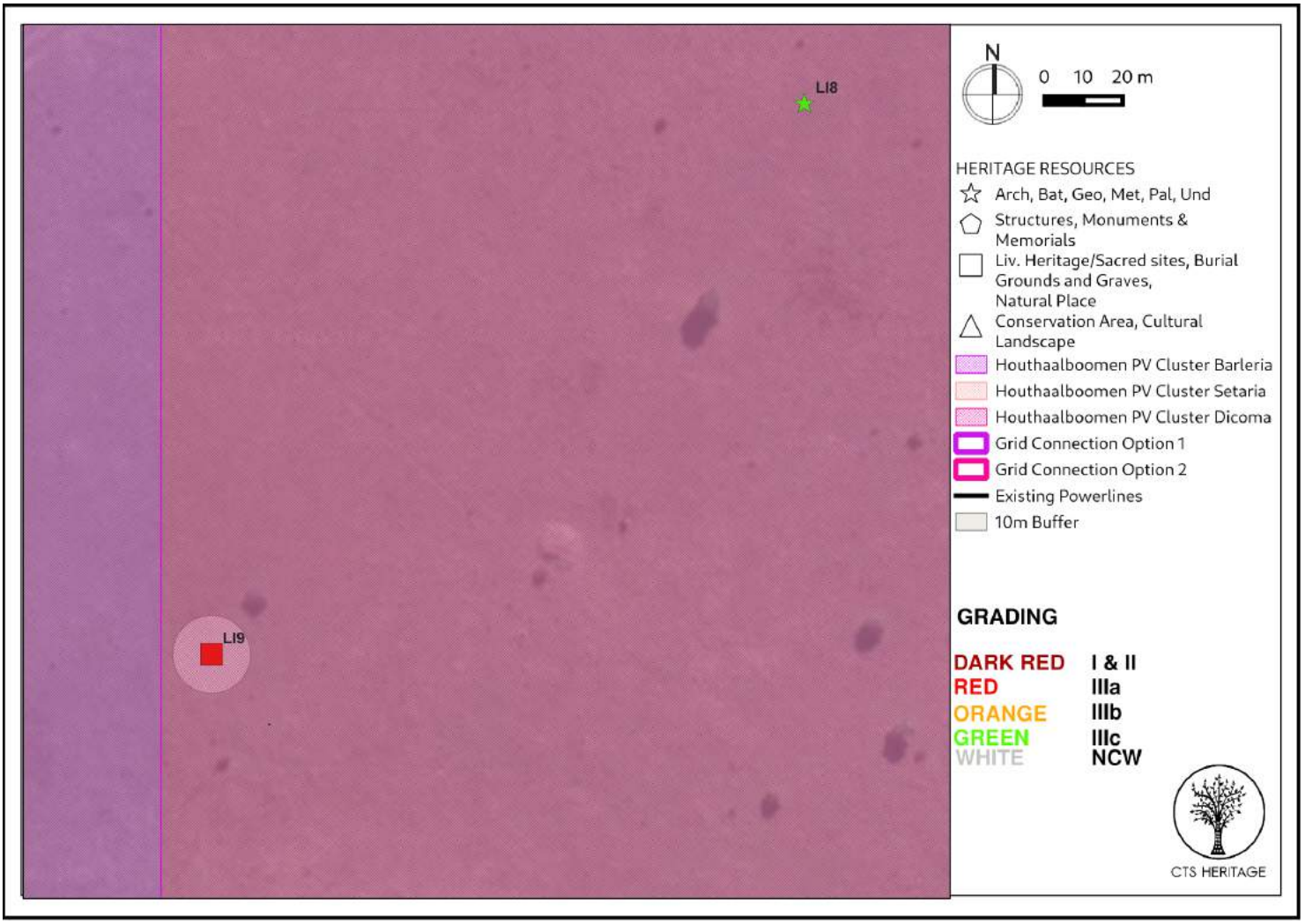


Figure 17.3: Inset B

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

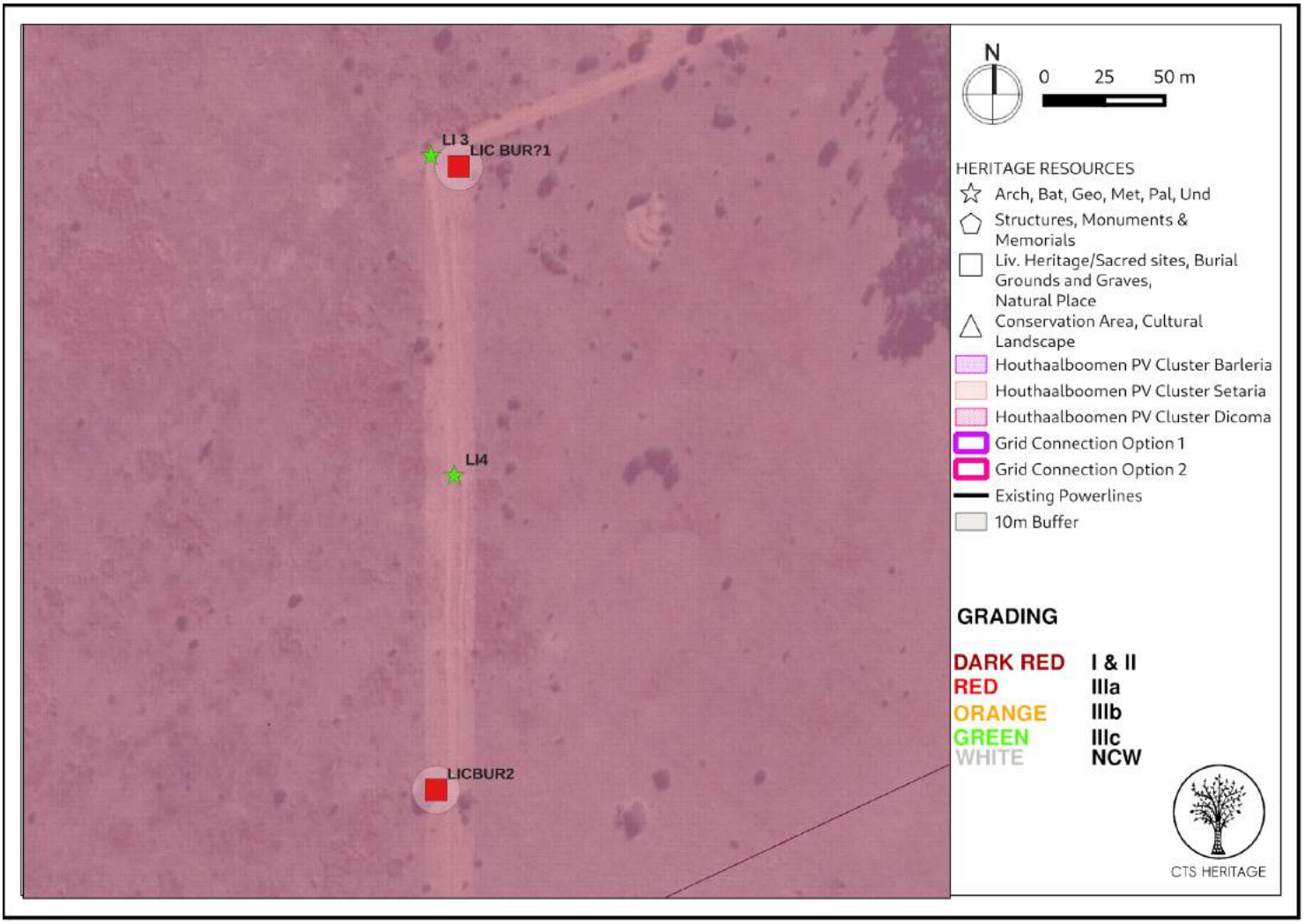


Figure 17.4: Inset C

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

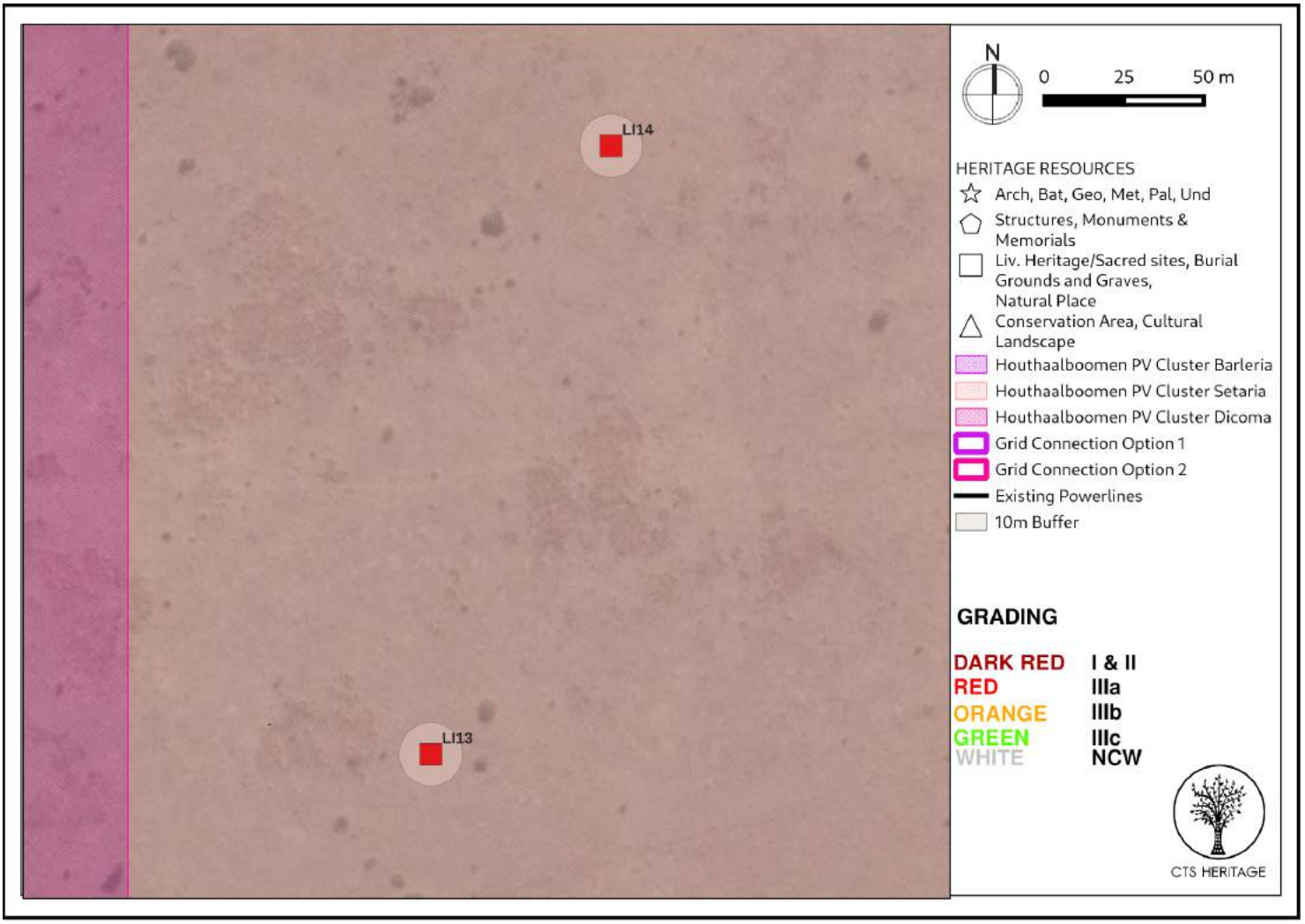


Figure 17.5: Inset D

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

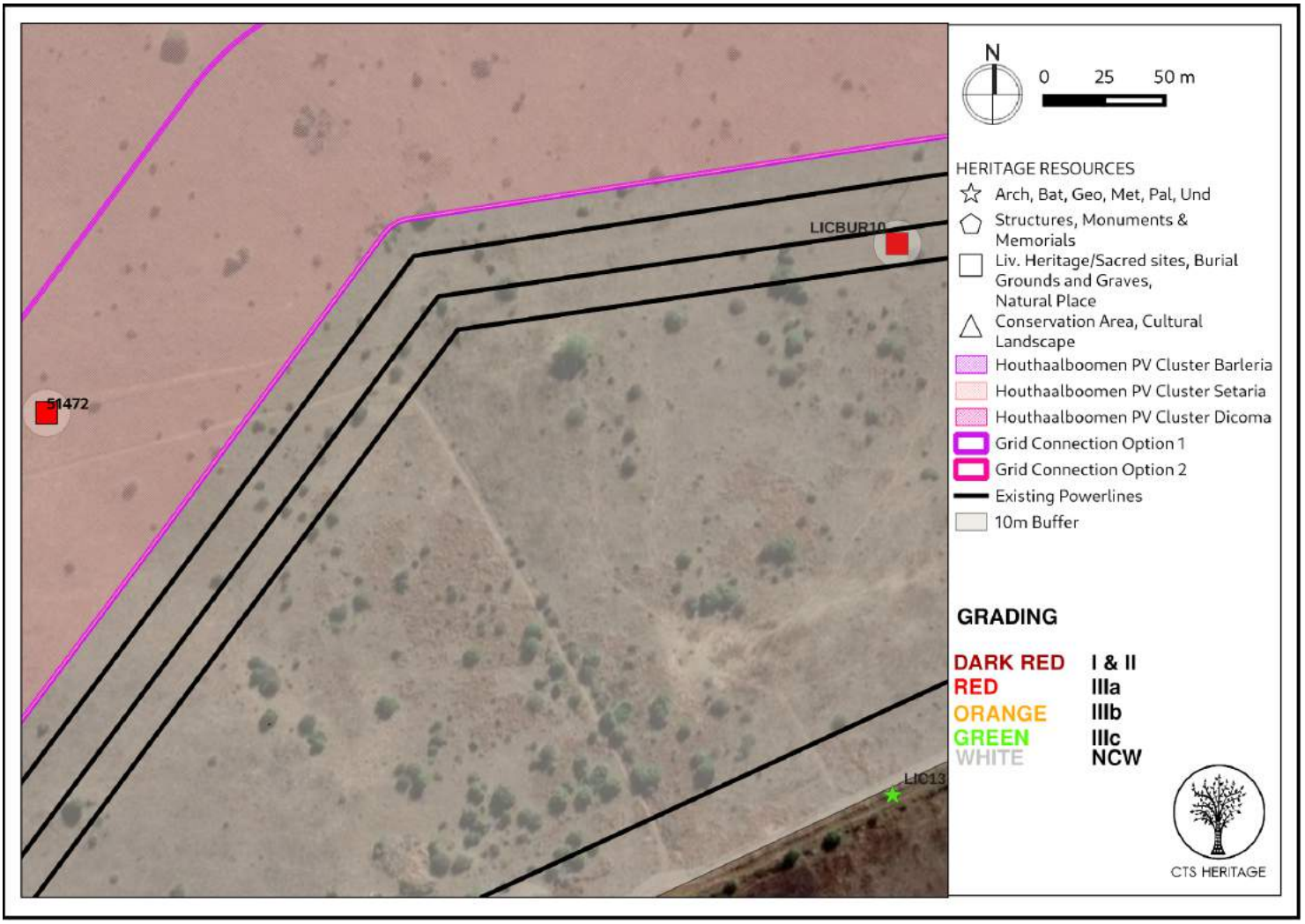


Figure 17.6: Inset E

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

6. CONCLUSION AND RECOMMENDATIONS

The findings of this field assessment largely correlate with the findings of Van der Walt (2014) and a number of additional heritage resources were identified. The stone age archaeological resources identified were all *ex situ* and are of low heritage significance. These have been graded IIIC in the tables and maps provided and no additional mitigation is recommended for these sites. They have been sufficiently recorded in this report.

A number of stone structures were identified within the development area. It is likely that a number of these are burial sites (LICBUR?1, LICBUR2, LICBUR6, LICBUR10, LI9, LI13 and LI14). These have been graded IIIA in the tables and maps provided and a no-development buffer of 10m is recommended around these sites. Furthermore, it is recommended that a management plan is developed to ensure the ongoing conservation of these sites for the duration of the lifespan of the development.

Lastly, it is possible that archaeological resources may be located beneath the ground surface which may be impacted during the course of development. Recommendations in this regard are included below.

Recommendations

There is no objection to the proposed development of the PV cluster and associated grid connection in terms of impacts to archaeological heritage on condition that:

- A 10m no-go and no development buffer is implemented around the potential burial sites LICBUR?1, LICBUR2, LICBUR6, LICBUR10, LI9, LI13 and LI14.
- A management plan is developed for the ongoing and long-term management of the burials within the development area.
- Should any buried archaeological resources 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.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
6237	AIA Phase 1	Johnny Van Schalkwyk, Robert de Jong, S Smith	01/08/1995	Reconnaissance of Remaining Cultural Resources in the Bakerville Diamond Fields
8330	AIA Phase 1	Francois P Coetzee	01/03/2008	Cultural Heritage Survey of the PPC Slurry Operation, near Zeerust, North West Province
8455	HIA Phase 1	Udo Kusel	25/07/2008	Cultural Heritage Resources Impact Assessment of Portion 151 of Lichtenburg Town and Townlands 27 IP (Lichtenburg Extension 10) North West Province
8531	HIA Phase 1	Johnny Van Schalkwyk	01/11/2008	Heritage Impact Report for the Proposed 88 kV Power Line from Watershed Substation, Lichtenburg, to the Mmabatho Substation, North West Gauteng Province
50047	HIA Phase 1	M Hutten	01/05/2012	Heritage Impact Assessment for the Proposed Lichtenburg Solar Park North of Lichtenburg, North West Province
50048	PIA Phase 1	Bruce Rubidge	14/07/2012	Palaeontological Assessment - Lichtenburg Solar Park
110338	HIA Phase 1	Julius CC Pistorius	01/06/2011	A PHASE I HERITAGE IMPACT ASSESSMENT (HIA) STUDY FOR THE PROPOSED MAFIKENG CEMENT PROJECT NEAR ITSOSENG IN THE NORTH-WEST PROVINCE OF SOUTH AFRICA
123075	Heritage Scoping	Jaco van der Walt	12/11/2013	Archaeological Impact Assessment Report
138895		Jaco van der Walt, John E Almond	14/10/2013	Archaeological Impact Assessment for the Proposed Hibernia Solar Project near the town of Lichtenburg in the North West Province of South Africa & Paleontological Report: Recommended Exemption From Further Palaeontological Studies: Proposed Hibernia Pv S

Additional Reports:

- Lavin, J. 2018. HERITAGE IMPACT ASSESSMENT In terms of Section 38(8) of the NHRA for the DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.
- Lavin, J. 2018. ARCHAEOLOGICAL IMPACT ASSESSMENT In terms of Section 38(8) of the NHRA for the DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.
- Bamford, M. 2018. Palaeontological Impact Assessment for the proposed DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.
- Mucina, L. and Rutherford, M.C., 2006. *The vegetation of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

APPENDIX 2: Palaeontological Assessment (2021)

Palaeontological Impact Assessment for the proposed Houthaalbomen PV Cluster near Lichtenburg, North West Province

CTS21_128

Site Visit (Phase 2) Report

For

CTS Heritage

30 September 2021

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by CTS Heritage, Cape Town, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the proposed Houthaalbomen PV Cluster near Lichtenburg (photo voltaic) facility just north west of Lichtenburg, North West Province, with a Loop-in-Loop-out link to an existing 88kV Eskom powerline that runs south of the site.

To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit and survey (phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development. The site visit was carried on 21st September by Rick Tolchard.

The proposed site lies on the potentially fossiliferous (stromatolites) rocks of the Oaktree and Monte Christo Formations of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup. No dolomites and no stromatolites were found during the site survey. There were no rocky outcrops. It is not known if stromatolites occur below the soils, therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found once excavations commence. As far as the palaeontology is concerned, the project should be authorised.

Table of Contents

i. Background

The development of solar energy facilities is proposed on a site near Lichtenburg, in the North West Province. The development (and project area) will consist of three PV (photo voltaic) facilities and associated infrastructure respectively (Figure 1). The energy generated will be fed into Watershed substation next to the Lichtenburg Game Breeding Centre. The proposed developments require Environmental Authorisation in terms of the National Environmental Management Act (Act 107 of 1998) from the Department of Forestry, Fisheries, and the Environment (DFFE). A full impact assessment will be required to be undertaken for each of the proposed projects. The project site is just north of the town of Lichtenburg, on Farm Houthaalbomen 31 and a part of Farm Elandsfontein 37, in the Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North West Province

A Palaeontological Impact Assessment is required for the proposed PV project because it lies on very highly sensitive rocks according to the SAHRIS palaeosensitivity map. In order to comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit and survey (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed project and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section i.
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Page 1
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A for fossils
e	A description of the methodology adopted in preparing the report or carrying out the	Section ii.

	specialised process	
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	Section 6
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Sections 1, 6
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section vii.
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section vi.
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	Section 8
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed PV development northwest of Lichtenburg town with the sections shown by the green outline and purple track.

ii. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (as reported herein, and collect or rescue fossils if required);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*as indicated in section 4 below)*; and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a just a representative sample collected and housed in a recognised repository.

iii. Geology and Palaeontology

iv. Project location and geological context

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

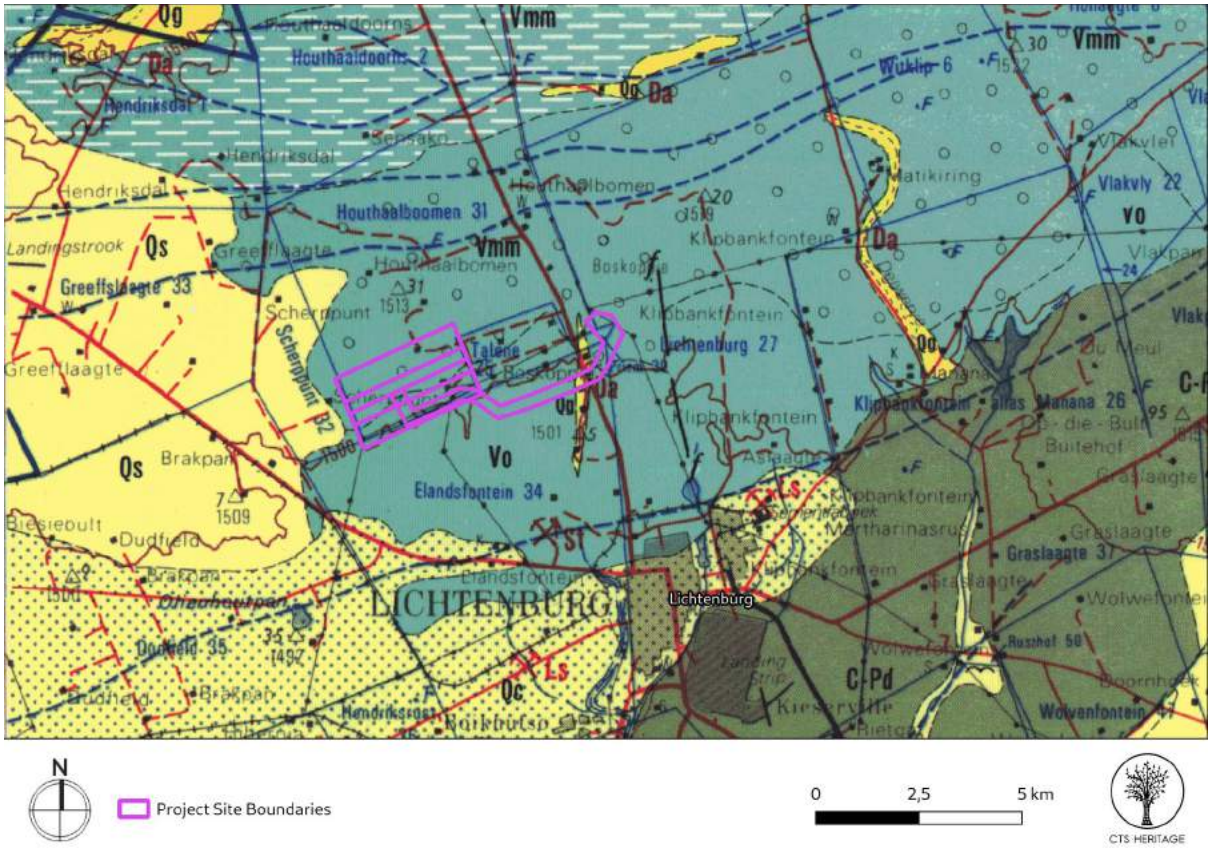


Figure 2: Geological map of the area around Lichtenburg with PV project as indicated by the purple outlines.. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Qg			Neogene, ca 2.5 Ma to present
C-Pd	Dwyka Group	Diamictites, tillites, mudstones, shales,	Early Permian, Middle Ecca, ca 280-270 Ma
Vml	Littleton Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dark chert-poor dolomite	Ca 2585 – 2480 Ma
Vmm	Monte Christo Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Chert-rich dolomite; circles = oolitic	Ca 2585 – 2480 Ma
Vmo	Oaktree Fm, Malmani Subgroup, Chuniespoort Group,	Dark chert-free dolomite	Ca 2585 – 2480 Ma

Symbol	Group/Formation	Lithology	Approximate Age
	Transvaal SG		
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale	<2618 Ma

The Malmani Subgroup is up to 2000m thick and has been divided into five formations based on the composition of cherts, stromatolites, limestones and shales. At the base, overlying the Black Reef Formation, is the base is the Oaktree Formation that represents a transition from siliciclastic sedimentation to platform carbonates (Eriksson et al., 2006). It is composed of carbonaceous shales, stromatolitic dolomites and locally developed quartzites. Next is the Monte Christo Formation that has an erosive breccia base and continues with stromatolitic and oolitic platformal dolomites. Above that is the Lyttleton Formation that is composed of shales, quartzites and stromatolitic dolomites. The overlying Eccles Formation includes a series of cherty dolomites and erosion breccias that locally contain gold deposits. This mineralisation has been attributed to hydrothermal remobilisation of fluids by the Bushveld complex (Eriksson et al., 2006). The topmost formation is the Frisco Formation that is composed mainly of stromatolitic dolomites but these become more shale rich towards the top of the sequence because of the deepening depositional environment.

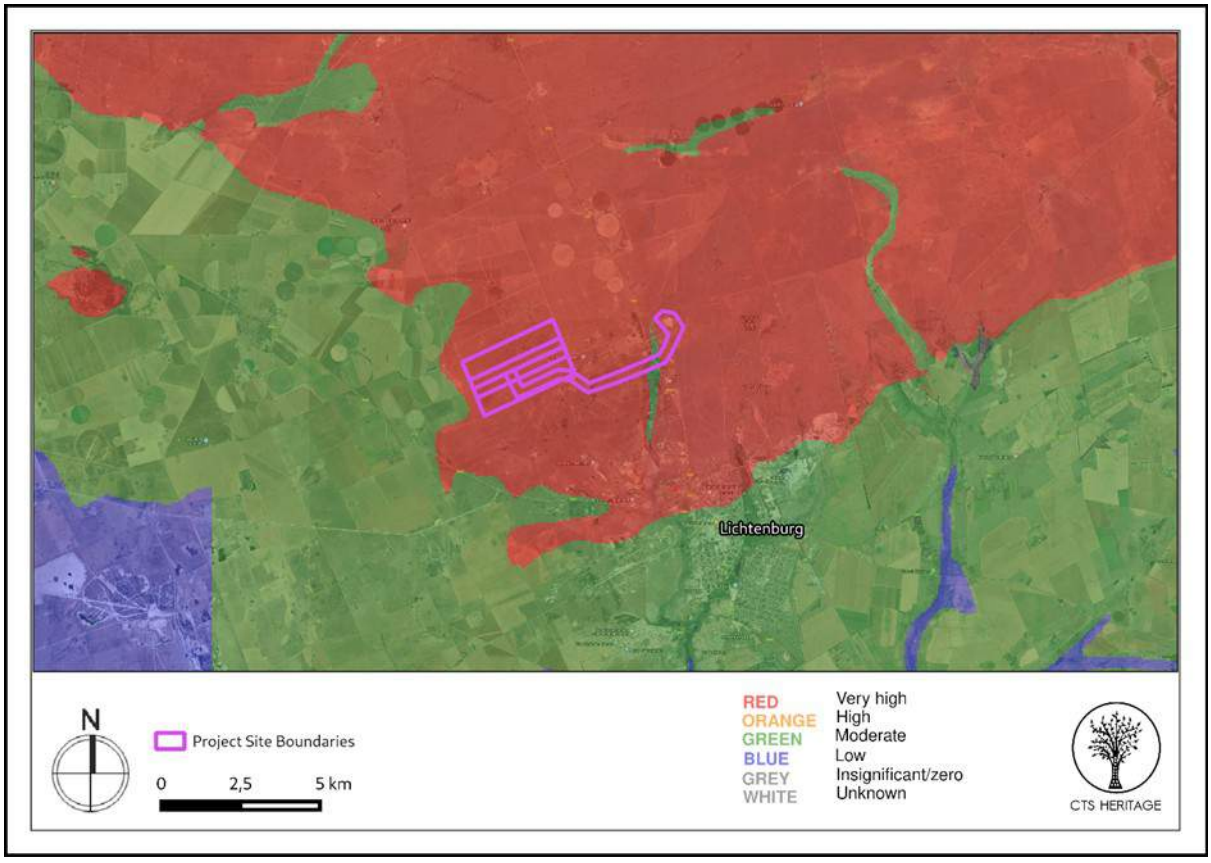


Figure 3: SAHRIS palaeosensitivity map for the site for the proposed Lichtenburg PV facility shown within the lilac rectangles. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

v. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3, with the Monte Christo and Oaktree Formations of the Malmani Subgroup indicated as very highly sensitive (red) because of the potential of finding trace fossils, in particular stromatolites.

Stromatolites are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.

Iii **Site visit observations**

A site visit and survey of the project area was completed on 21st September by Rick Tolchard. The whole area was walked through, but stops with GPS coordinates, photographs and observations were taken from nine points. This information is presented in Table 3, the map in Figure 4 and site photographs in Figures 5 – 8. All photographs were taken by Rick Tolchard.

Table 3: Site visit observations (refer to Figure 4) and relevant site photographs as indicated.

GPS coordinates	Observations	Figure
Pal 1 S26°06’03.35” E26°06’43.75”	Entrance gate to the property, along fence line to show short grass; close-up of grass showing no rocky outcrops and no fossils	5A, B
Pal 2 S26°05’55.69” E26°06’37.86”	Close to eastern margin of property, reddish sandy soils and no rocky outcrops. Grasses are very short at the end of winter so there is good visibility of the soils.	5C, D
Pal 3 S26°06’05.74” E26°05’38.54”	Very short grass and bare soils in all directions with no rocky and no rocky outcrops	
Pal 4 S26°06’12.77” E26°05’57.63”	Area with more bare ground or short grass cover. No rocky outcrops	6A, B
Pal 5 S26°06’25.99” E26°05’12.69”	Rare isolated rocks but these are not layered stromatolites, just quartzite; one of several examples of piles of small rocks from clearing of the field. All quartzite or chert.	6C, D
Pal 6 S26°06’35.26” E26°05’36.17”	More short grasses and no rocky outcrops	7A
Pal 7 S26°06’38.41” E26°05’59.97”	More short grasses; view across the field showing flat topography and no rocky outcrops	7B, C
Pal 8 S26°06’23.49” E26°07’35.23”	Red, sandy soils and sparse grass cover	7D
Pal 9 S26°06’07.73” E26°08’23.46”	Site adjacent to the main road where the powerline route will cross to join the substation farther to the north east; view along the dirt road and bare soils with small pebbles	8A, B

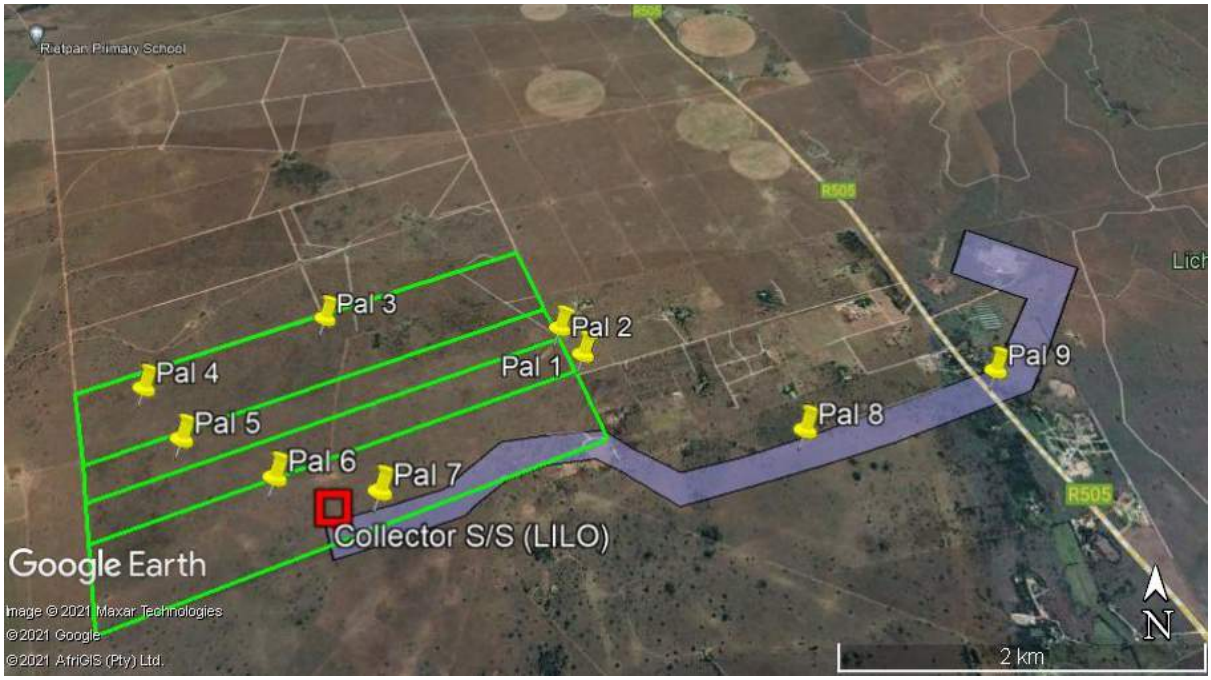


Figure 4: Google Earth map of the project area with the stops (observation points as described in Table 3.

Figure 5: Site photographs for the Lichtenberg PV project. A-B = GPS stop Pal 1; C-D = stop Pal 2.

Figure 6: Site photographs for the Lichtenburg PV project. A-B = stop Pal 4; C-D = stop Pal 5.

Figure 7: Site photographs for the Lichtenburg PV project. A = stop Pal 6; B-C = stop Pal 7; D = stop Pal 8.

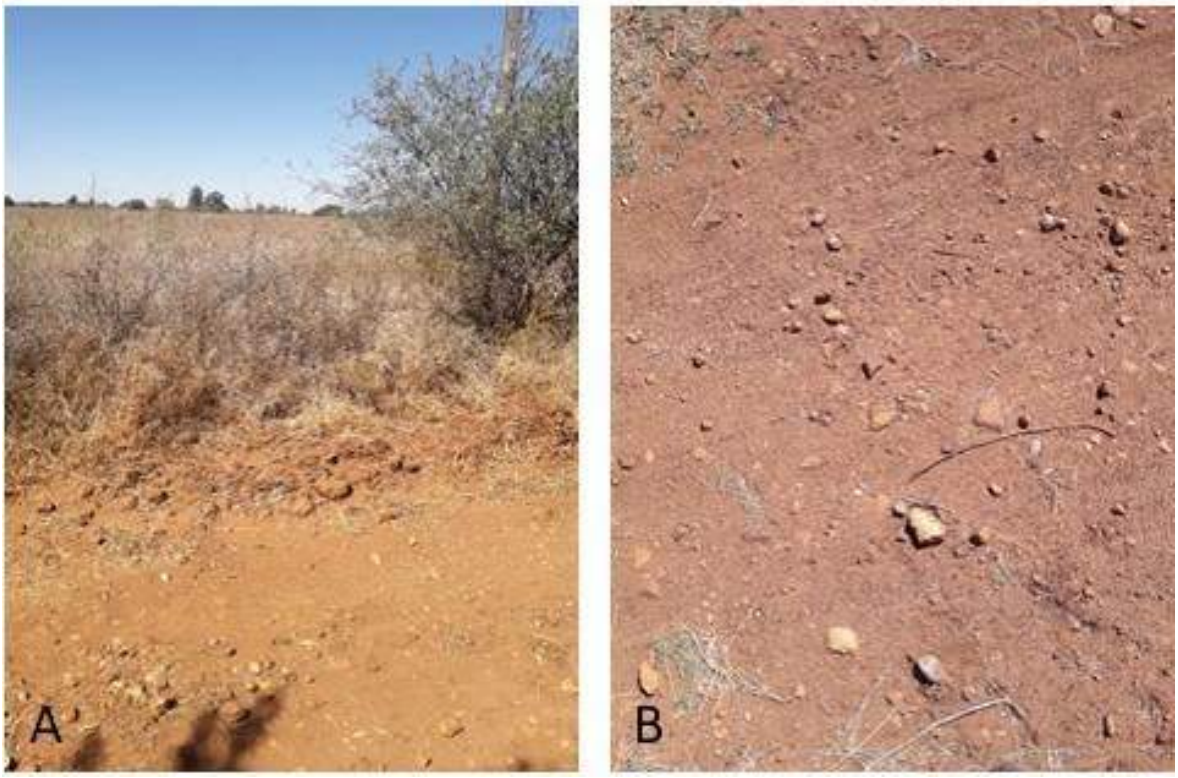


Figure 8: Site photographs for the Lichtenburg PV project. A-B = stop Pal 9.

In summary: the whole area is relatively flat and has been cleared for agriculture in the past. The few rocks present have been removed from the fields and piled up, however, none of them shows any indication of stromatolites. No fossils were seen on the site visit and survey.

vi. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 4:

TABLE 4A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.

Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 4B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Sands and soils do not preserve any fossils; so far there are no records from the Monte Christo Fm of stromatolites in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be trace fossils, i.e. stromatolites in the dolomites, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the loose sand and soils that will be excavated for foundations. Nonetheless, a Fossil Chance Find Protocol should be added to the eventual EMPr.

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 correct age and type to contain trace fossils, namely stromatolites in the Malmani Subgroup. Furthermore, the material to be excavated is loose sand and this does not preserve fossils. Since there is an extremely small chance that trace fossils, stromatolites, from the Malmani Subgroup 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.

vii. Assumptions and uncertainties

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, shales and sands are typical for the country and could contain stromatolites which are traces fossils. No dolomite, stromatolitic dolomite or stromatolites were seen during the site survey. It is not known, however, if such material occurs below the soil covering.

viii. Recommendation

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 loose sands of the Quaternary. No fossils were seen during the site survey and there were no rocky outcrops at all. There is a very small chance that stromatolites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) may occur below the ground surface and may be disturbed. Therefore, a Fossil Chance Find Protocol should be added to the EMPr or site management plan. If fossils are found by the developer, environmental officer or other designated person, once excavations for foundations, access and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

ix. References

Beukes, N.J., 1987. Facies relations, depositional environments and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbellrand Subgroup, Transvaal Supergroup, southern Africa. Sedimentary Geology 54, 1-46.

Eriksson, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

x. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (stromatolites) should be put aside in a suitably protected place. This way the construction activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 9). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Trace fossils, fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A: Examples from the Malmani Subgroup

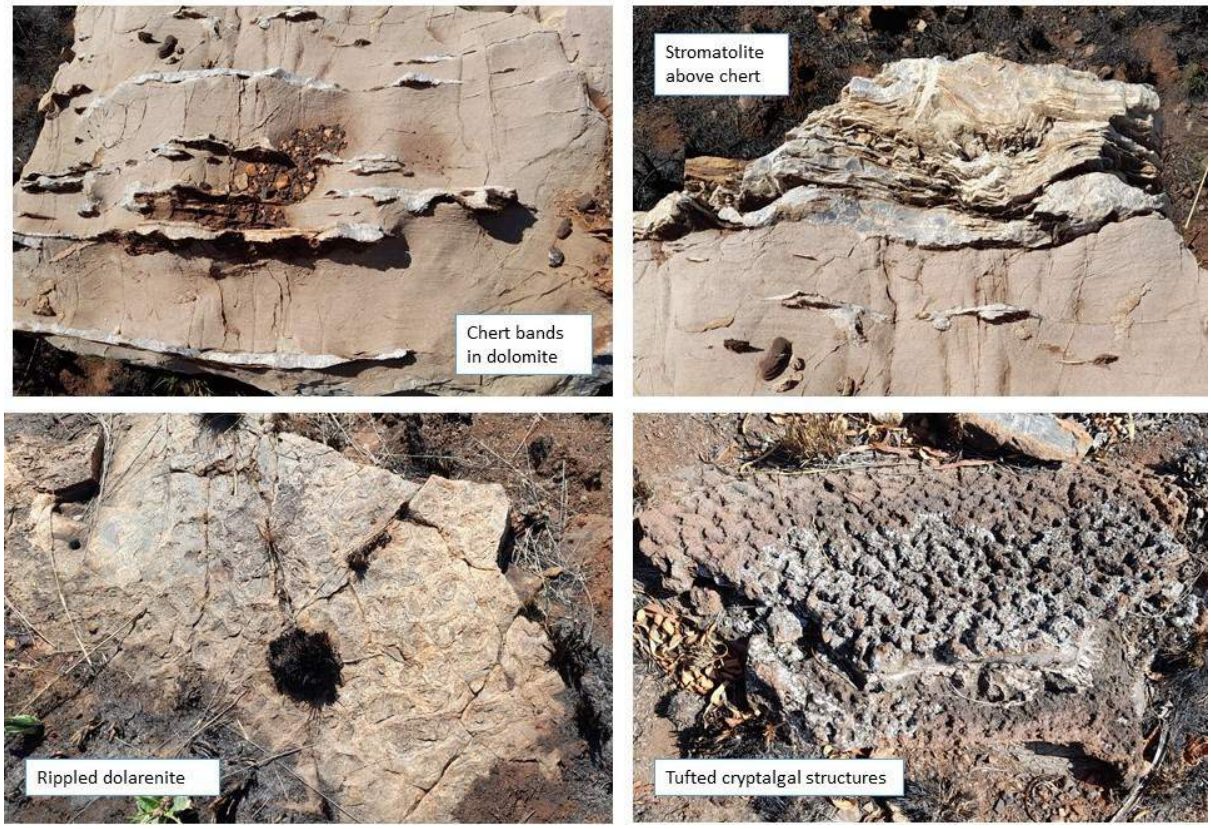


Figure 9: Photographs of stromatolites and dolomite.

Appendix B – Details of specialists

Curriculum vitae (short) - Marion Bamford PhD July 2021

I) Personal details

Surname : **Bamford**
First names : **Marion Kathleen**
Present employment : Professor; Director of the Evolutionary Studies Institute.
Member Management Committee of the NRF/DST Centre of
Excellence Palaeosciences, University of the Witwatersrand,
Johannesburg, South Africa-
Telephone : +27 11 717 6690
Fax : +27 11 717 6694
Cell : 082 555 6937
E-mail : marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications
Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications
Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations
Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/ completed	Current
Honours	11	2
Masters	10	5
PhD	11	4
Postdoctoral fellows	10	4

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 – Cretaceous Research: 2014 –
Journal of African Earth Sciences: 2020 –

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018

- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for Enviropro

xi) Research Output

Publications by M K Bamford up to July 2021 in peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 29; Google scholar h index = 36;
Conferences: numerous presentations at local and international conferences.

Mr Frederick Tolchard
Brief Curriculum Vitae – August 2021

Academic training

BA Archaeology – University of the Witwatersrand, graduated 2015
BSc (Honours) Palaeontology – University of the Witwatersrand, 2017 with distinction
MSc Palaeontology – University of the Witwatersrand, 2018 – 2019. Graduated 2020 with Distinction
PhD Palaeontology – Wits – 2020 - current

Field Experience

Honours Fieldtrip – Karoo biostratigraphy – April 2017
Research fieldwork – Elliot Formation with Prof Choiniere – April 2018, Nov 2018; April 2019; Sept 2021

Publications

Tolchard, F., Nesbitt, S.J., Desojo, J.B., Viglietti, P.A., Butler, R.J. and Choiniere, J.N., 2019. 'Rauisuchian' material from the lower Elliot Formation of South Africa: Implications for late Triassic biogeography and biostratigraphy. Journal of African Earth Sciences, 160, 103610.

Viglietti, P.A., McPhee, B.W., Bordy, E.M., Sciscio, L., Barrett, P.M., Benson, R.B.J., Wills, F., Tolchard, F., Choiniere, J.N., 2020. Biostratigraphy of the Scalenodontoides Assemblage Zone (Stormberg Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 239-248.

PIA fieldwork projects

2018 May – Williston area – SARAO project, Digby Wells
2018 September – Lichtenburg PVs – CTS Heritage
2018 November – Nomalanga farming – Digby Wells
2019 January – Thubelisha coal – Digby Wells
2019 March – Matla coal – Digby Wells
2019 March – Musina-Machado SEZ – Digby Wells
2019 June – Temo coal – Digby Wells
2019 September – Makapanstad Agripark – Plantago
2020 January – Hendrina, Kwazamakuhle – Kudzala
2020 February – Hartebeestpoort Dam - Prescali
2020 March – Twyfelaar Coal mine – Digby Wells
2020 March – Ceres Borrow Pits – ACO Associates
2020 March – Copper Sunset Sand – Digby Wells
2020 October – Belfast loop and Expansion – Nsovo
2020 October – VLNR lodge Mapungubwe – HCAC
2020 November – Delmore Park BWSS - HCAC
2020 December – Kromdraai commercial – HCAC
2021 January – Welgedacht Siding – Elemental Sustainability
2021 March – Shango Kroonstad – Digby Wells
2021 May – Copper Sunset sand mining – Digby Wells
2021 August – New Largo Pit – Golder
2021 August – Khutsong Ext 8 housing, Carletonville, for Afzelia

CTS HERITAGE

APPENDIX 3: Chance Fossil Finds Procedure

CTS HERITAGE

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.

CTS HERITAGE

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:		

CTS Heritage
34 Harries Street, Plumstead, Cape Town, 7800
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

APPENDIX 4: Heritage Screening Assessment

CTS HERITAGE

HERITAGE SCREENER

CTS Reference Number:	**CTS21_128**
SAHRIS Reference:	
Client:	**Savannah Environmental (Pty) Ltd**
Date:	**August 2021**
Title:	**HERITAGE SCREENING ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF A PV FACILITY NEAR LICHTENBURG, NORTH WEST PROVINCE**

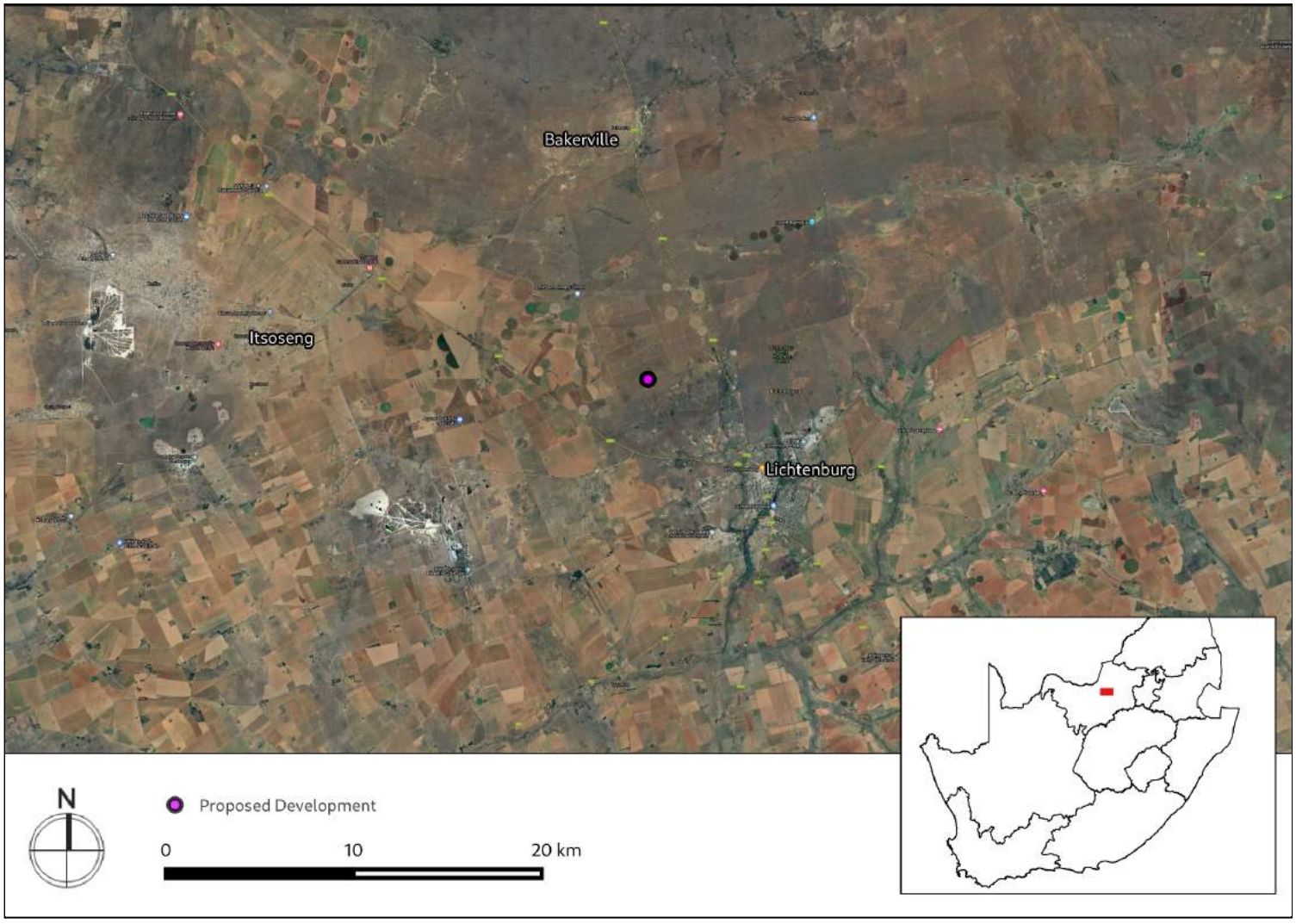


Figure 1a. Satellite map indicating the location of the proposed development in the North West Province

CTS Heritage
16 Edison Way, Century City, Cape Town
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

1. Proposed Development Summary

Three 75MW PV facilities (Barleria PV, Dicoma PV and Setaria PV) are concurrently being considered on the project site (within Portion 1, Portion 9, and Portion 10 of the Farm Houthaalboomen 31) and are assessed through separate Environmental Impact Assessment (EIA) processes. These facilities are located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area. A facility development area (approximately 176ha) as well as two alternative grid connection solutions (within a 100m wide corridor) have been considered in the Scoping phase.

2. Application References

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

3. Property Information

Latitude / Longitude	26° 6'17.76"S 26° 5'44.64"E
Erf number / Farm number	Portion 1 of the Farm Houthaalboomen 31, Portion 9 of the Farm Houthaalboomen 31, Portion 10 of the Farm Houthaalboomen 31, Portion 0 of Farm Talene 25, Portion 7 of Farm Elandsfontein 34
Local Municipality	Ditsobotla Local Municipality
District Municipality	Ngaka Modiri Molema District Municipality
Province	North West Province
Current Use	Agriculture with approved PV facility
Current Zoning	Agriculture

4. Nature of the Proposed Development

Total Area	176ha
Depth of excavation (m)	1.5m to 3m
Height of development (m)	Panel Heights: +- 5.5m. Grid Connection: 33 kV lines are either carried on small lattice steel pylons or on wood poles.

5. Category of Development

x	**Triggers: Section 38(8) of the National Heritage Resources Act**
	Triggers: Section 38(1) of the National Heritage Resources Act
	1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	2. Construction of a bridge or similar structure exceeding 50m in length.
	3. Any development or activity that will change the character of a site-
x	a) exceeding 5 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

NA

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

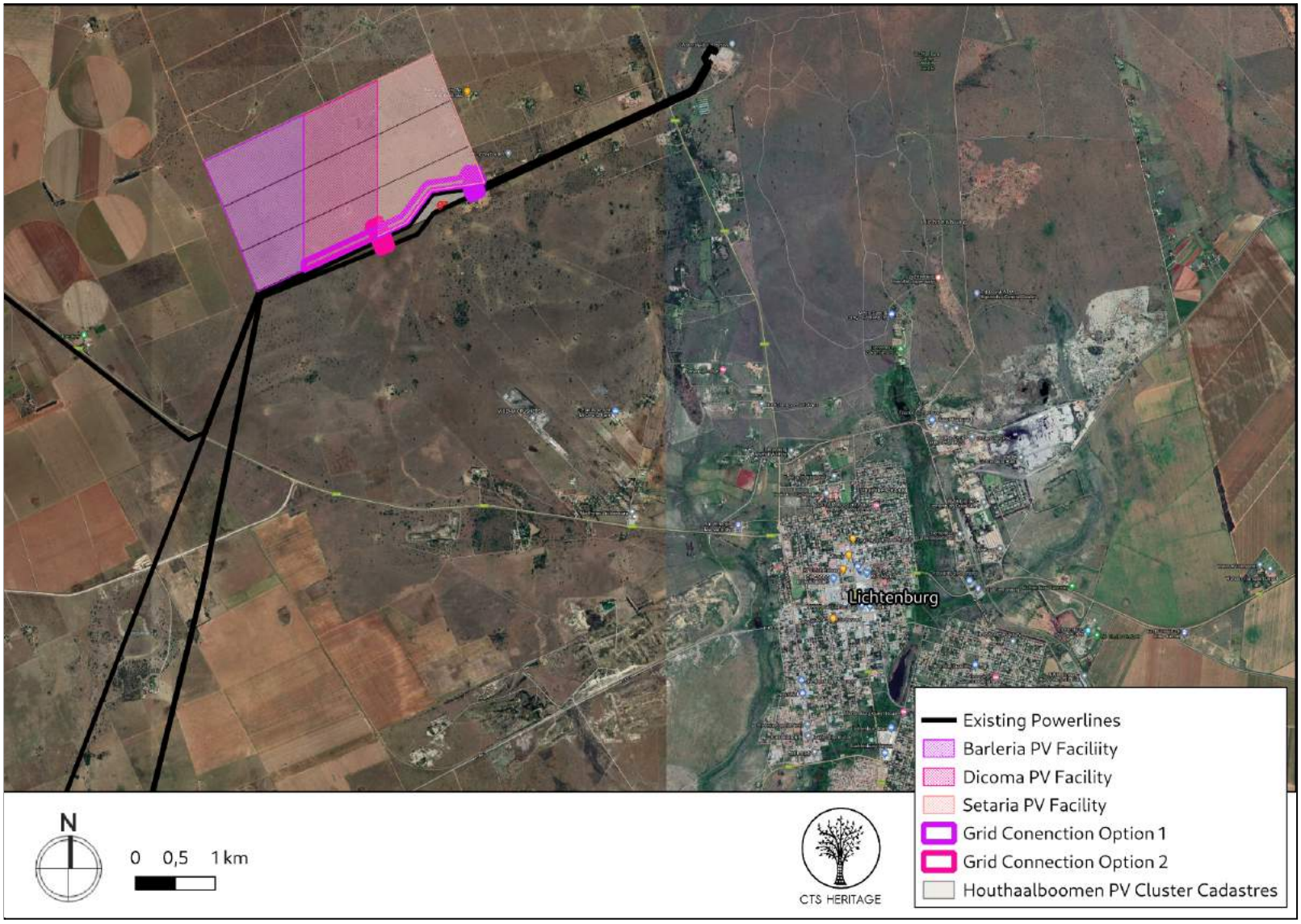


Figure 1b. Overview Map. Satellite image (2020) indicating the proposed development area relative to Lichtenburg

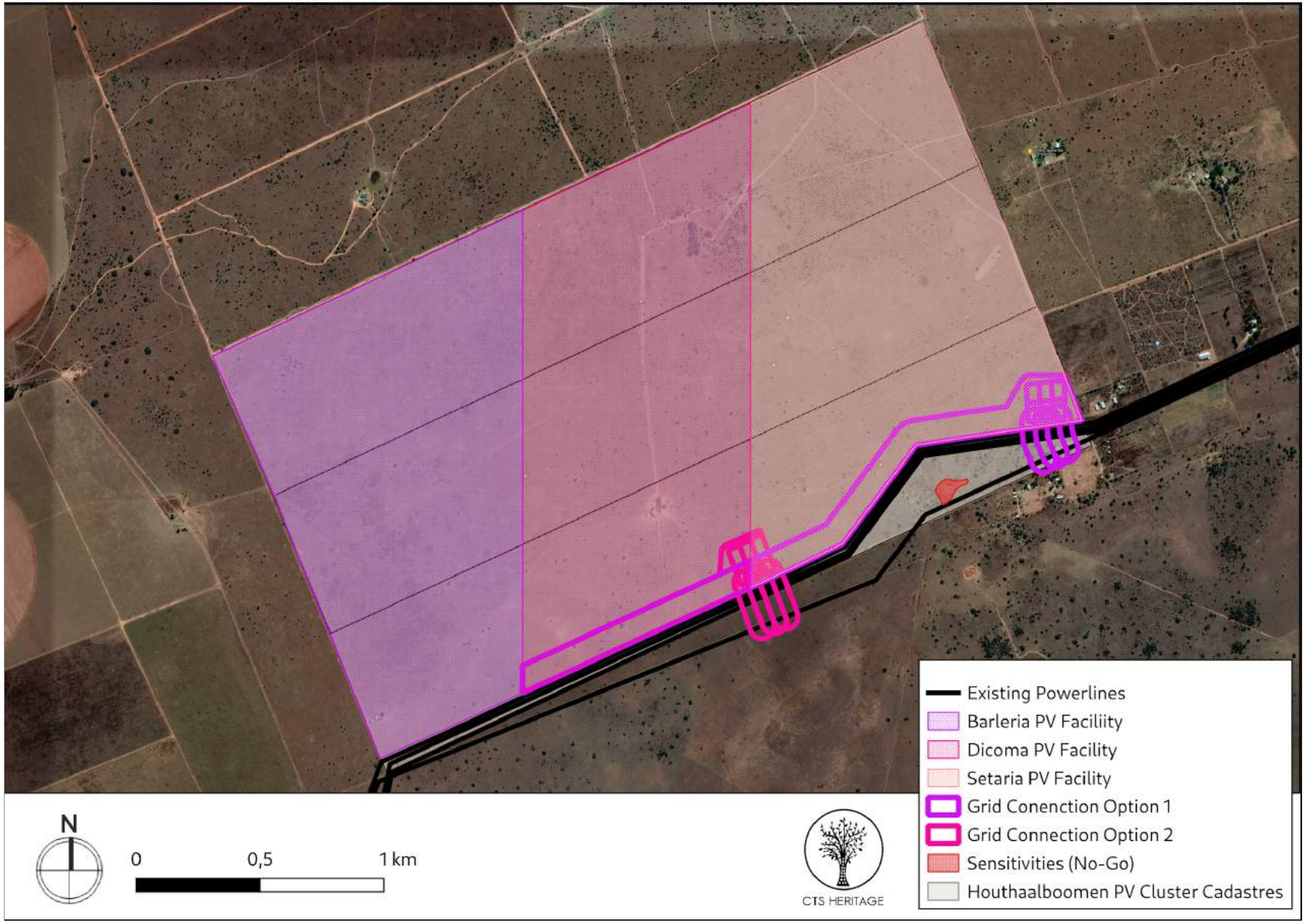


Figure 1c. Overview Map. Satellite image (2020) indicating the proposed development area

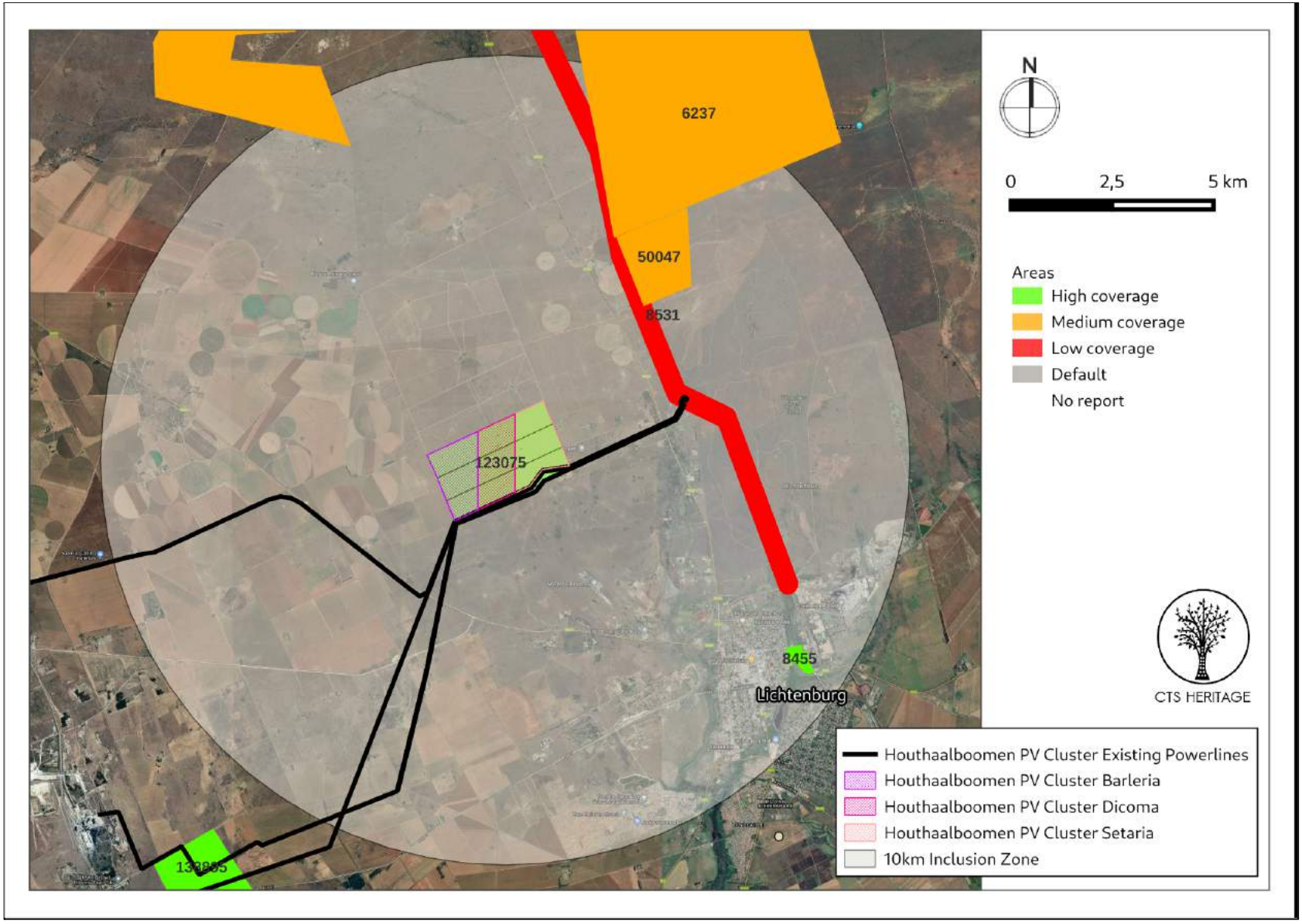


Figure 2. Previous HIAs Map. Previous Heritage Impact Assessments covering the proposed development area with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

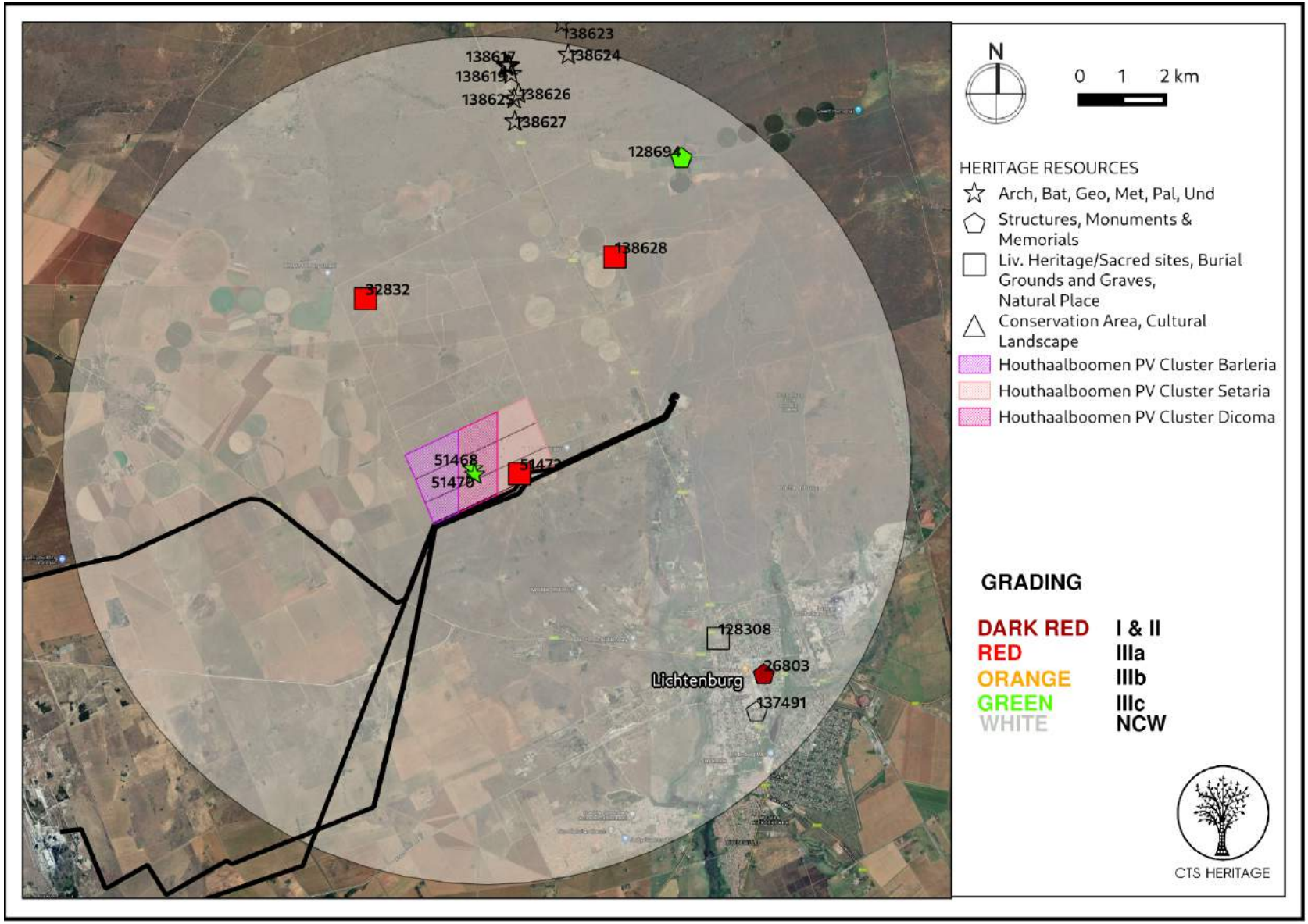


Figure 3. Heritage Resources Map. Heritage Resources previously identified within the study area, with SAHRIS Site IDs indicated in the insets below. Please See Appendix 4 for full description of heritage resource types.

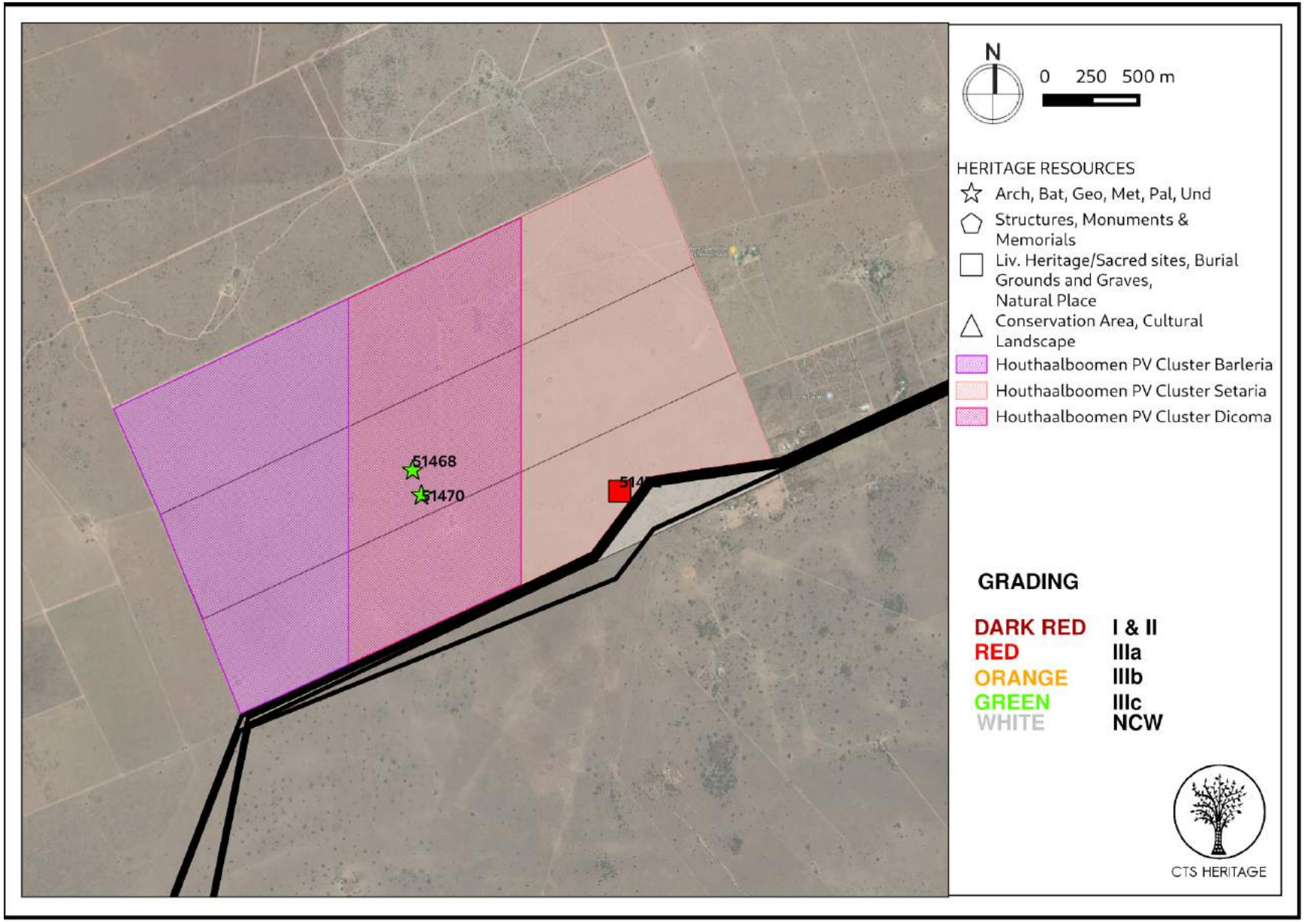


Figure 3a. Heritage Resources Map Inset A

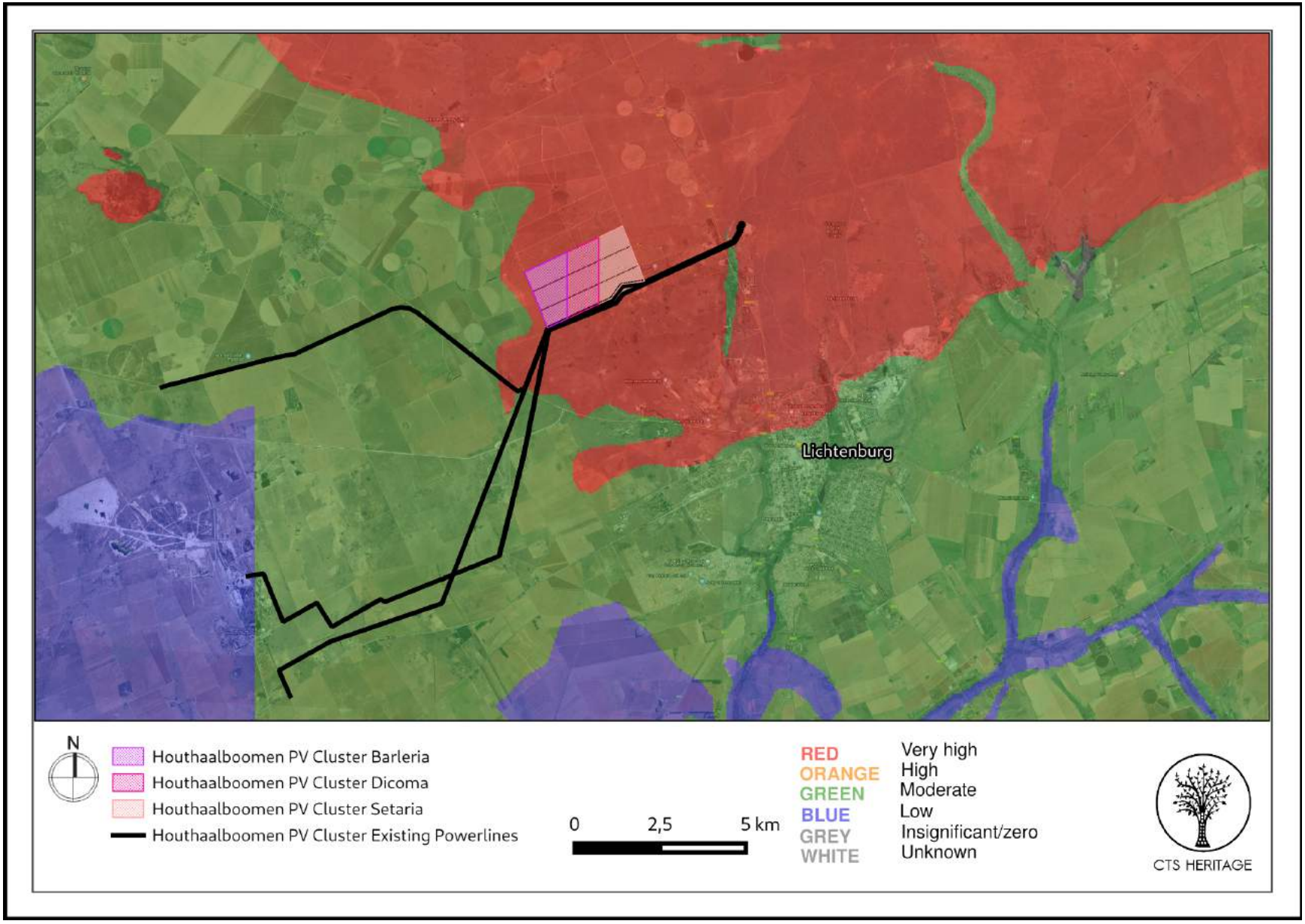


Figure 4a. Palaeosensitivity Map. Indicating fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

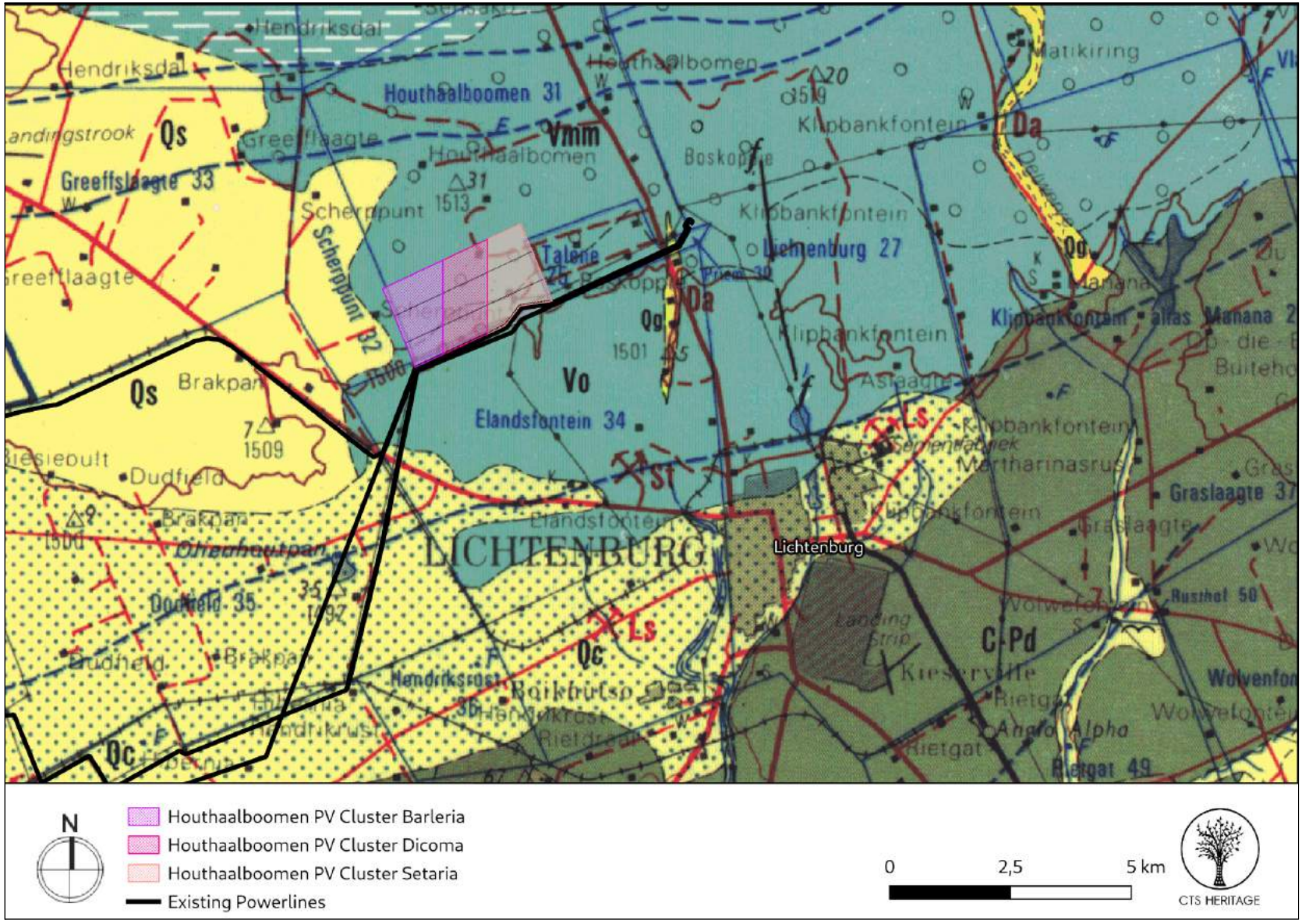


Figure 4b. Geology Map. Extract from the CGS 2626 West Rand Map indicating that the development area for the Lichtenburg PV Facility is underlain by sediments of the Monte Christo Formation assigned to the Chuniespoort group, within the Malmani Subgroup (Vmm).

8. Heritage Assessment

Introduction

Three 75MW PV facilities (Barleria PV, Dicoma PV and Setaria PV) are concurrently being considered on the project site and are assessed through separate Environmental Impact Assessment (EIA) processes. These facilities are located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area. A facility development area (approximately 176ha) as well as two alternative grid connection solutions (within a 100m wide corridor) have been considered in the Scoping phase.

Archaeology and Built Environment Heritage

Lichtenburg town was established in 1873 and named "Town of Light". General Del la Rey was buried in Lichtenburg after a fatal shooting incident at Langlaagte. During the 1800's, more and more farmers settled in the area. During the Second Boer War, the strategically important town of Lichtenburg was occupied by both Boer and Briton for short spells. In November 1900, a large British force under Col. Robert Baden-Powell was transferred to Lichtenburg and secured the town, and much of the territory with it. In addition, the town is known from Rudyard Kipling's poem, Lichtenberg, which relays the story of a foreign combatant in the second South African War. In 1926, Lichtenburg experienced a gold rush that lasted approximately 10 years. Lichtenburg district is now mostly a farming area, combining cattle and crop-farming and large areas of former diamond mine diggings are now used as grazing.

According to van Schalkwyk et al (1995, SAHRIS NID 6237) in their report completed for the Bakerville Diamond Fields, "land use in the area goes back to the Early Stone Age, as can be determined by the number of stone artifacts found near the old mining commissioners office. This material seems to be disturbed from its primary context because of the mining activities. It is postulated that similar occurrences will be found in other parts of the diggings, but that this material would have been disturbed out of context." As a result of the dominant land use in the area, many of the heritage resources identified by van Schalkwyk et al (1995) are associated with past and present agriculture, and consist of farming implements, a few windmills, and dipping-troughs. One such trough, located at Elandsputte on the farm Uitgevonden 355JP, was the site where the first diamond was discovered. This structure is a proclaimed national monument (now Provincial Heritage Site). Van Schalkwyk et al (1995) identified a number of burial grounds within their surveyed area. Heritage resources known from this area include burial grounds and graves, archaeological artefacts and old structures, often associated with farming activities or diamond mining. An archaeological field assessment was conducted for the Lichtenburg PV facilities located immediately adjacent to this proposed development (CTS Heritage, 2018). The field assessment noted that the area assessed had been disturbed and transformed by agricultural activities in a similar way to the area proposed for this development. Pre-existing agricultural plough fields, grazing areas and farm buildings were identified in the development area. Furthermore, throughout the farming areas several heaps of rocks that were removed from the agricultural fields were identified. During the field assessment of the site *no archaeological resources, graves or burial grounds were identified* in the project area assessed in CTS Heritage's report (2018).

The exact area proposed for development was previously assessed by Van der Walt (2014, SAHRIS NID 123075). Van der Walt (2014) notes that "The site lies on a featureless flat plain. The entire development footprint was extensively utilised for crop farming and ploughing through the years resulted in a lateral and downward migration of artefacts making it virtually impossible to identify knapping or manufacture sites and site extent of artefact concentrations. In some areas borrowing animals brought MSA artefacts to the surface where the sand cover is more than a meter and a half thick and the possibility of finding subsurface material cannot be excluded. Most of the Stone Age archaeology in the study area consists of low densities of scattered (and possibly mixed) MSA and LSA artefacts. These find spots are documented as "occurrences" and are of low significance but more substantial and higher density scatters of MSA material do occur, and were recorded as "sites"." The archaeological sites are described as "Medium density scatters of tools. Blades, flakes, cores. MSA mainly of chert." and are graded IIIC i.e. low local significance. Van der Walt (2014) also identified a single unmarked grave (approximately 27 years old) and farm labour housing

dating to the 1990's. He further notes that "Cultural landscape elements were noted in the northern portion of the study area consisting of the mentioned farm labourer dwelling together with a windmill, stone walled cattle kraal and a recently constructed kraal." (Van der Walt, 2014).

Palaeontology

According to the extract from the Council of GeoScience Map for the West Rand (Figure 4b), the proposed development is located on geological deposits belonging to the Monte Christo Formation of the Chuniespoort Group. The Monte Christo Formation is within the Malmani Subgroup. These deposits have a very high sensitivity for impacts to palaeontological resources. This group is known to contain a range of shallow marine to intertidal stromatolites (domes, columns *etc*) and organic-walled microfossils. In addition, it is within this group that fossiliferous Late Cenozoic cave breccias have been identified such as within the Cradle of Humankind region. The project area lies on rocks of the Malmani Subgroup, Chuniespoort Group. According to Bamford (2018), the Malmani Subgroup is up to 2000m thick and comprises five formations distinguished by the amount of chert, stromatolite morphology, intercalated shales and erosion surfaces (Eriksson et al., 2006). The basal Oaktree Formation overlies the Black Reef Formation, and is made up of carbonaceous shales, stromatolitic dolomites and locally developed quartzites. Above this is the Monte Christo Formation comprising erosive breccia, overlain by stromatolitic and oolitic platformal dolomites. Next is the Lyttleton Formation of shales quartzites and stromatolitic dolomites. The Eccles Formation comprises a series of erosional breccias and the overlying Frisco Formation is made up mostly of stromatolitic dolomites.

The palaeontological sensitivity of the area under consideration is presented in Figure 4a. Bamford (2018) notes that the site proposed for development is in the Malmani Subgroup which contains a number of stromatolitic dolomites. These were formed in warm shallow sea and are the accumulation of layer upon layer of minerals deposited by blue-green algae (also known as cyanobacteria) and rarely some filamentous algae. Minerals deposited by the algae include calcium carbonate, calcium sulphate and magnesium carbonate. Very rarely are the algal cells preserved in the stromatolites and these are microscopic. Stromatolites are essentially trace fossils and these ones are 2750 to 2650 million years old and very abundant. 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 much too old to contain fossils other than blue-green algae. Taking account of the defined criteria, the potential impact to fossil heritage resources is negligible to extremely low. As such, the proposed development is unlikely to negatively impact significant palaeontological heritage resources.

Cumulative Impacts

The proposed PV development is located within an area that has already approved PV facilities within a belt of approved renewable energy facilities. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The construction of the proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact. Furthermore, Van der Walt (2014) notes that "Visual impacts to scenic routes and sense of place are not assessed to be high from a heritage perspective."

Conclusion

The heritage assessments that have previously been conducted within the area proposed for development have identified a number of significant heritage resources that may be impacted by the proposed developments. Significant archaeological resources as well as a burial were identified by Van Der Walt (2014) within the development area. It is recommended that a 10m no-go buffer is implemented around the known sites with SAHRIS IDs 51468, 51470 and 51472.

Based on the known sensitivities of the broader area, it is recommended that a specialist archaeology assessment and specialist palaeontology assessment are completed for integration into the Heritage Impact Assessment. The area proposed for development has not been identified as part of a special or recognised cultural landscape and as such, no further assessment of impacts to the cultural landscape is recommended.

CTS HERITAGE

APPENDIX 1

List of heritage resources within close proximity to the development area

Site ID	Site no	Full Site Name	Site Type	Grading
32832	AEPC 3	Steenkoolspruit farm,Ogies Emalahleni Mpumalanga Province **MAPPED INCORRECTLY ON SAHRIS**	Burial Grounds & Graves	Grade IIIa
130171	2626AA/ Solar/ Farm Zamenkomst 04/ Site 1	Old farm house	Structures, Structures	Grade IIIc
128694	ZKT1	Zamenkomst 1	Building	Grade IIIc
26803	9/2/235/0005	Nerderduitse Gereformeerde Church, 27 Gerrit Maritz Street, Lichtenburg	Building	Grade II
51468	**WSF 01**	**Watershed Solar Facility 01**	**Artefacts**	**Grade IIIc**
51470	**WSF 02**	**Watershed Solar Facility 02**	**Artefacts**	**Grade IIIc**
51472	**WSF 03**	**Watershed Solar Facility 03**	**Burial Grounds & Graves**	**Grade IIIa**
128308	Grave of Vic Hamman	Grave of Vic Hamman	Burial Grounds & Graves	
138616	FHDN-001	FARM HOUTHAALDOORNS 2	Palaeontological	
138617	FHDN-002	FARM HOUTHAALDOORNS 2	Palaeontological	
138618	FHDN-003	FARM HOUTHAALDOORNS 2	Palaeontological	
138619	FHDN-004	FARM HOUTHAALDOORNS 2	Palaeontological	
138620	FHDN-005	FARM HOUTHAALDOORNS 2	Palaeontological	
138621	FHDN-006	FARM HOUTHAALDOORNS 2	Palaeontological	

138624	FHDN-009	FARM HOUTHAALDOORNS 2	Palaeontological	
138625	FHDN-010	FARM HOUTHAALDOORNS 2	Palaeontological	
138626	FHDN-011	FARM HOUTHAALDOORNS 2	Palaeontological	
138627	FHDN-012	FARM HOUTHAALDOORNS 2	Palaeontological	
138628	FHDN-013	FARM HOUTHAALDOORNS 2	Burial Grounds & Graves	Grade IIIa
137491	Gereformeerde kerk Lichtenburg	Gereformeerde kerk Lichtenburg	Monuments & Memorials	

CTS HERITAGE

APPENDIX 2

Reference List with relevant AIAs and PIAs

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
6237	AIA Phase 1	Johnny Van Schalkwyk, Robert de Jong, S Smith	01/08/1995	Reconnaissance of Remaining Cultural Resources in the Bakerville Diamond Fields
8330	AIA Phase 1	Francois P Coetzee	01/03/2008	Cultural Heritage Survey of the PPC Slurry Operation, near Zeerust, North West Province
8455	HIA Phase 1	Udo Kusel	25/07/2008	Cultural Heritage Resources Impact Assessment of Portion 151 of Lichtenburg Town and Townlands 27 IP (Lichtenburg Extension 10) North West Province
8531	HIA Phase 1	Johnny Van Schalkwyk	01/11/2008	Heritage Impact Report for the Proposed 88 kV Power Line from Watershed Substation, Lichtenburg, to the Mmabatho Substation, North West Gauteng Province
50047	HIA Phase 1	M Hutten	01/05/2012	Heritage Impact Assessment for the Proposed Lichtenburg Solar Park North of Lichtenburg, North West Province
50048	PIA Phase 1	Bruce Rubidge	14/07/2012	Palaeontological Assessment - Lichtenburg Solar Park
110338	HIA Phase 1	Julius CC Pistorius	01/06/2011	A PHASE I HERITAGE IMPACT ASSESSMENT (HIA) STUDY FOR THE PROPOSED MAFIKENG CEMENT PROJECT NEAR ITSOSENG IN THE NORTH-WEST PROVINCE OF SOUTH AFRICA
123075	Heritage Scoping	Jaco van der Walt	12/11/2013	Archaeological Impact Assessment Report
138895		Jaco van der Walt, John E Almond	14/10/2013	Archaeological Impact Assessment for the Proposed Hibernia Solar Project near the town of Lichtenburg in the North West Province of South Africa & Paleontological Report: Recommended Exemption From Further Palaeontological Studies: Proposed Hibernia Pv S

Additional Reports:

- Lavin, J. 2018. HERITAGE IMPACT ASSESSMENT In terms of Section 38(8) of the NHRA for the DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.
- Lavin, J. 2018. ARCHAEOLOGICAL IMPACT ASSESSMENT In terms of Section 38(8) of the NHRA for the DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.
- Bamford, M. 2018. Palaeontological Impact Assessment for the proposed DEVELOPMENT OF THE LICHTENBURG 1, 2 and 3 PV SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR LICHTENBURG, NORTH WEST PROVINCE. Unpublished Report.

CTS HERITAGE

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.

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

APPENDIX 5 -Summary of Specialist Expertise

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation since 2016, 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 100 Heritage Impact Assessments and Screening Assessments throughout South Africa.

CTS HERITAGE

APPENDIX 5: Visual Impact Assessment