

# HERITAGE IMPACT ASSESSMENT

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

## **Xhariep Export Programme (XEP) Agricultural Development and associated infrastructure near Luckhoff, Free State Province**

SAHRIS Ref:

**Prepared by CTS Heritage**



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**For  
Savannah Environmental**

**June 2022  
Updated August 2022**



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## EXECUTIVE SUMMARY

### 1. Site Name:

Farms Weltevreden 755, Lemoen-spruit 667, Diepdraai 754 and a portion of the Farm Grootpoort 168

### 2. Location:

10km south west of Luckhoff

### 3. Locality Plan:

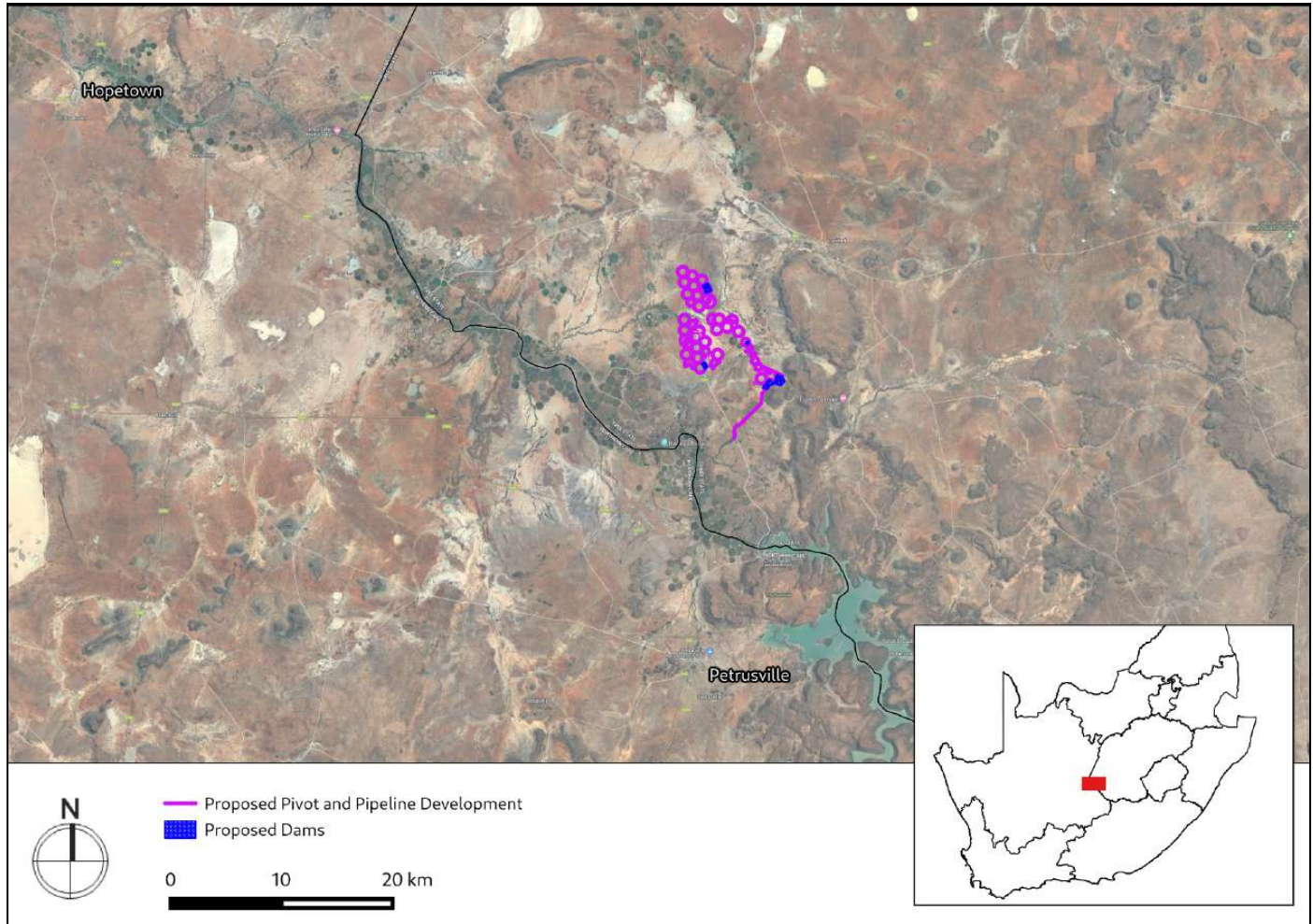


Figure 1: Location of the proposed study area

### 4. Description of Proposed Development:

JN Venter Beleggings Trust is proposing the development of an expansion of a centre pivot irrigation farm on a site located Southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667, Diepdraai 754 and a portion of the Farm Grootpoort 168. The total area on all three portions is 4800 ha,



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however only 2690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality. The agricultural development will entail the following at a minimum:

- Developmental of centre pivot areas (cultivation and irrigation) which is planned to take approximately 2154ha or more within the project site.
- Two irrigation water storage dams, with a combined surface area of 82ha in extent
- Establishment of an irrigation pipeline network from the irrigation dams to the centre pivot areas.
- A new pump station taking a total surface area of 549m<sup>2</sup>.
- A 5MW solar PV facility occupying an area of 9ha, and an associated overhead power line of ~6.9km in length.
- A Battery Energy Storage System covering a surface area of 0.36ha

The current proposed water pipeline crossing will be approximately 68m downstream and north west of an existing road bridge crossing. It is proposed that ~2690ha will be transformed across the property for the establishment of the agricultural development. The proposed development will require the following infrastructure:

Infrastructure	Purpose
<b>315 mm PVC pipeline</b>	Water for the pivots will be sourced from the Oranje Riet Water User Association's canal pumped 6km underground through 2 x 1.4m fibreglass pipes, which will be extended by further 500 m to reach the pivots
<b>Centre Pivot Irrigation System</b>	The underground PVC pipeline will provide water to a centre pivot irrigation system. A centre pivot irrigation system is a moveable pipe structure which usually spans the length of a field and rotates around a pivot in the centre of the field. As the irrigation system rotates around its central pivot, it supplies water to crops through sprinklers along its length.
<b>Two Water Storage Systems</b>	Two main storage dams are proposed for utilization on the agricultural development. This dam system will feed the planned additional expansion
<b>Pump station</b>	A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams
<b>Solar PV area and overhead power line</b>	Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams
<b>BESS</b>	A battery system will be used to collect any additional power generated by the PV facility for use as and when required.



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

Site No.	Site Name	Description	Density m2	Period	Co-ordinates		Grading	Mitigation
009	Diepdraai009	At least two clear marked graves, one in stones, the other with bricks and fencing. Bottles with flower dedications strewn around, labourers graves most likely, unnamed. Probably more graves x 2 due to bottles	n/a	Modern/historic	-29.82597	24.71001	IIIA	100m Buffer area around site
028	Diepdraai028	Havenga Bridge built in 1934. Scottish steel trusses. Plaque stolen and one beam bent. There's mention of additions made in 1990s, perhaps the overhead trusses but can't be sure without research. Spans the Orange/Gariep River.	n/a	Historic	-29.91090935	24.63635735	IIIA	Outside of development area - no impacts anticipated
041	Diepdraai041	Stone covered farm workers graves x 3 clear, apparently 7, graves in veld, green grass marks area near eskom 33kV poles	n/a	Historic	-29.79571	24.67954	IIIA	100m Buffer area around site

6. Anticipated Impacts on Heritage Resources:

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage. Two burial sites were identified within the development footprint (Observation 009 and 041), graded IIIA due to their high levels of social and spiritual significance. Both of these burial grounds are located within the boundaries of the proposed development footprint and if the development proceeds as intended, it is likely that these burial sites will be negatively impacted. As such, it is recommended that a no-impact buffer of 100m is implemented around each of these sites in order to ensure that the burials are not disturbed and to maintain a semblance of sense of place associated with the burial sites. In the maps below, there are recommended pivot exclusion areas indicated as well as the recommended buffers.

As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant.



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

#### 7. Recommendations:

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

- A no-impact buffer of 100m is implemented around Observations 009 and 041 as per Figures 4.2 and 4.3
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



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

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

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

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



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## 1. INTRODUCTION

### 1.1 Background Information on Project

JN Venter Beleggings Trust is proposing the development of an expansion of a centre pivot irrigation farm on a site located Southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667, Diepdraai 754 and a portion of the Farm Grootpoort 168. The total area on all three portions is 4800 ha, however only 2690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality. The agricultural development will entail the following at a minimum:

- Developmental of centre pivot areas (cultivation and irrigation) which is planned to take approximately 2154ha or more within the project site.
- Two irrigation water storage dams, with a combined surface area of 82ha in extent
- Establishment of an irrigation pipeline network from the irrigation dams to the centre pivot areas.
- A new pump station taking a total surface area of 549m<sup>2</sup>.
- A 5MW solar PV facility occupying an area of 9ha, and an associated overhead power line of ~6.9km in length.
- A Battery Energy Storage System covering a surface area of 0.36ha

The current proposed water pipeline crossing will be approximately 68m downstream and north west of an existing road bridge crossing. It is proposed that ~2690ha will be transformed across the property for the establishment of the agricultural development. The proposed development will require the following infrastructure:

Infrastructure	Purpose
<b>315 mm PVC pipeline</b>	Water for the pivots will be sourced from the Oranje Riet Water User Association’s canal pumped 6km underground through 2 x 1.4m fibreglass pipes, which will be extended by further 500 m to reach the pivots
<b>Centre Pivot Irrigation System</b>	The underground PVC pipeline will provide water to a centre pivot irrigation system. A centre pivot irrigation system is a moveable pipe structure which usually spans the length of a field and rotates around a pivot in the centre of the field. As the irrigation system rotates around its central pivot, it supplies water to crops through sprinklers along its length. (2154ha)
<b>Two Water Storage Systems</b>	Two main storage dams are proposed for utilisation on agricultural development. This dam system will feed the planned additional expansion





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<b>Pump station</b>	A new pump station will facilitate the required water from the Oranje Riet canal to the proposed storage dams - 549m <sup>2</sup>
<b>Solar PV area and overhead power line</b>	5MW Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams - 9ha for PV and a 6.9km OHL
<b>BESS</b>	A battery system will be used to collect any additional power generated by the PV facility for use as and when required - 0.36ha

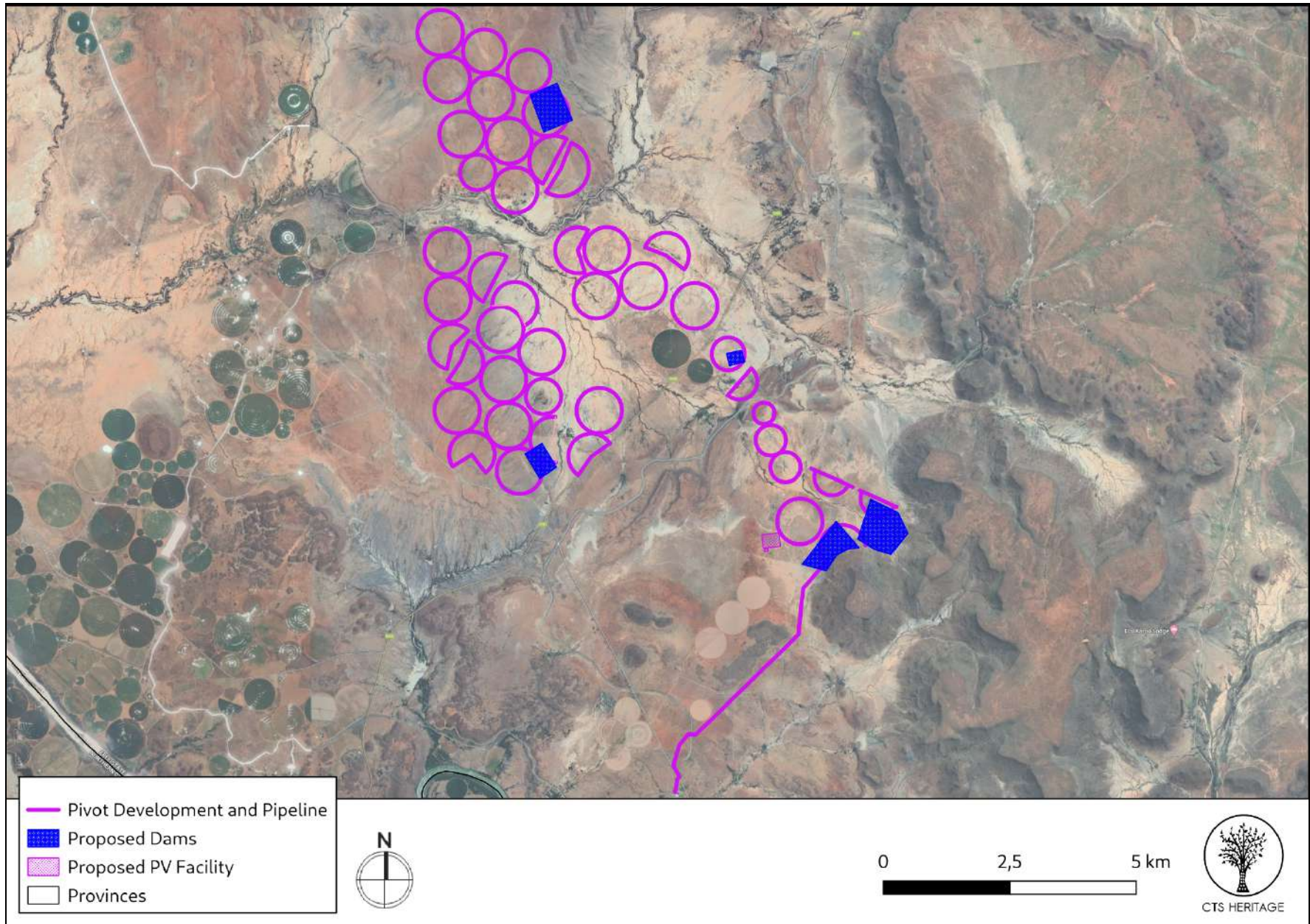
## 1.2 Description of Property and Affected Environment

The area assessed for proposed expansion of centre pivot irrigation farming lies 13km southwest of the town of Luckhoff in the Free State Province and 9km northeast of the Orange River. A number of farming activities have taken place on the properties earmarked for more intensive crop production such as grazing ground for cattle and sheep as well as smaller scale crop agriculture closer to the various farm homesteads. The proposed development includes the construction of farm dams and water pipelines to bring sufficient water up from the Orange River and the various canal systems traversing the area further south where highly intensive maize production dominates the landscape either side of the Orange River. This production area forms a long corridor of agricultural activity for hundreds of kilometres.

The ground is relatively level with gentle slopes forming over calcretes set against a backdrop of more rugged terrain to the south east towards the Vanderkloof Dam. Acacia thorn trees are densely packed into the streams and riverways while grassland and shrub vegetation cover the majority of the ground. The R48 road linking Luckhof to the Havenga Bridge, a former National Monument (now a Provincial Heritage Site) divides one third of the development area from the rest of the proposed agricultural fields to the west of the R48. An abandoned farm lies in the eastern segment while the western portions span a number of small stream systems and floodplains. Wild game farming has also taken place and high game fences surround these properties that offer hunting and sale of breeding stock of buck and other game.



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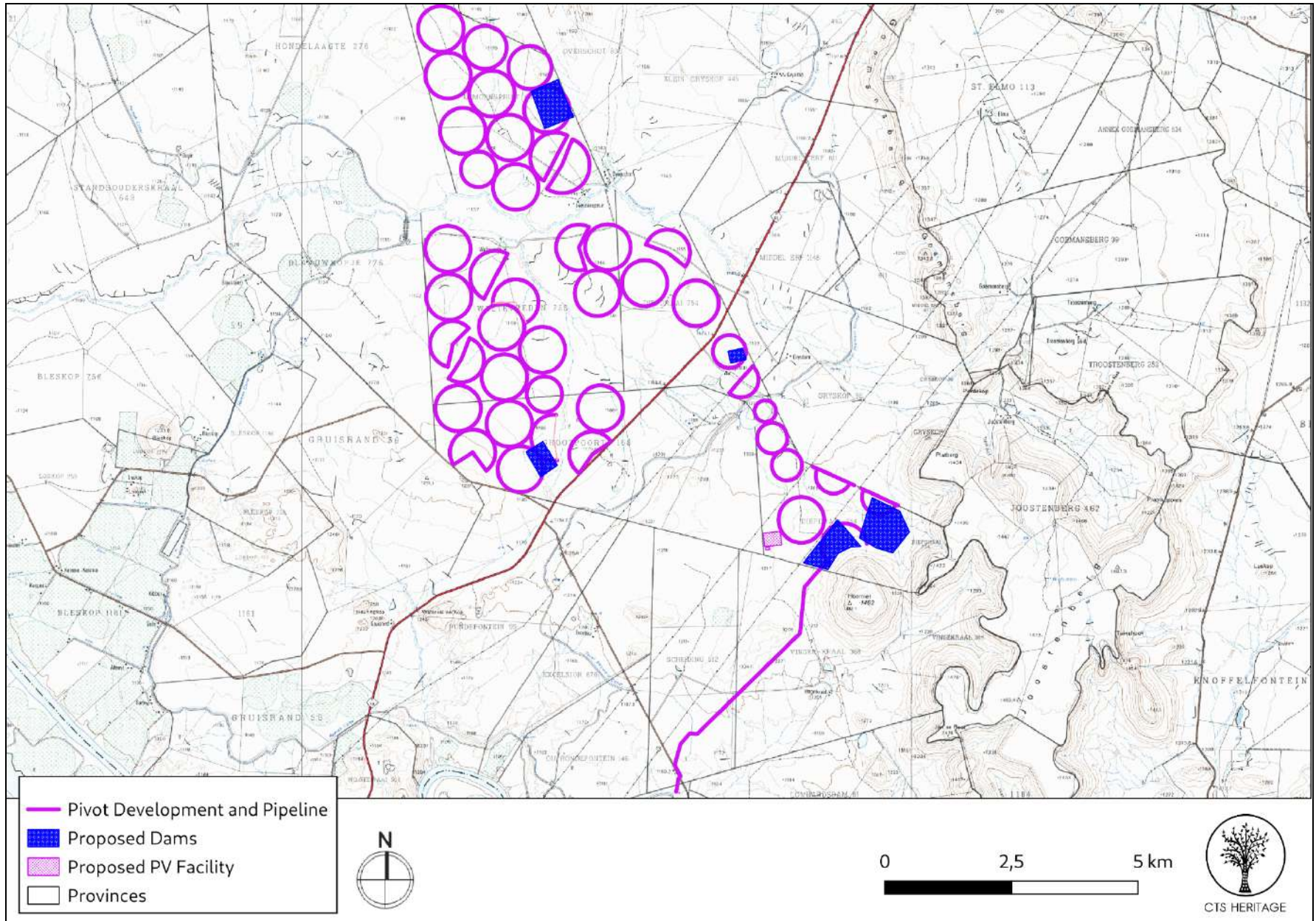


Map 1.1: The proposed development area

Cedar Tower Services (Pty) Ltd t/a CTS Heritage  
Bon Esperance, 238 Queens Road, Simons Town  
Email [info@ctsheritage.com](mailto:info@ctsheritage.com) Web <http://www.ctsheritage.com>



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Map 1.2: Study Area reflected on the 1:50 000 Topo Map



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## 2. METHODOLOGY

### 2.1 Purpose of HIA

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

### 2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used) (Appendix 1)
- An archaeologist conducted an assessment of the broader study area in order to determine the archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit on 16 to 18 March 2022 (Appendix 2)
- A Desktop Palaeontology Assessment was completed (30 May 2022, Appendix 3)
- The identified resources were assessed to evaluate their heritage significance and potential impacts to these resources were interrogated
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner

### 2.3 Assumptions and uncertainties

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

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

### 2.4 Constraints & Limitations

The survey took place in the summer rainfall season and dense reeds and grasses covered some areas that hold natural wetlands. However, much of the ground is not entirely covered in low shrubs and grassland and the archaeological visibility is relatively high. Much of the project area is relatively flat and easily traversed which enabled very high survey coverage to be achieved.



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## 2.5 Savannah Impact Assessment Methodology

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

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The duration, wherein it will be indicated whether:
  - The lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1.
  - The lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2.
  - Medium-term (5 – 15 years) – assigned a score of 3.
  - Long term (> 15 years) – assigned a score of 4.
  - Permanent – assigned a score of 5.
- The consequences (magnitude), quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 – 5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

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

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

S = Significance weighting

E = Extent

D = Duration



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M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

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



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

#### **3.1 Desktop Assessment**

##### **Background**

This application is for the proposed development of agricultural pivots, a dam and pipeline located in between Luckhoff and Vanderkloof Dam in the Free State. The area proposed for the development has been extensively transformed through agricultural activities. The nearest town to the proposed development is the town of Vanderkloof which has been established on the banks of the dam. The Vanderkloof dam was constructed in 1977. Neither the town nor the dam are anticipated to be negatively impacted by the proposed development, furthermore, the proposed development is largely agricultural in nature and as such, will contribute to the existing cultural landscape of the area.

##### **Archaeology and the Built Environment**

Very few Heritage Impact Assessments have been completed in the area according to the South African Heritage Resources Information System (SAHRIS, Figure 2) and very few heritage resources are known from the vicinity of the development (Figure 3). According to Morris (2008), “The Northern Cape has a wealth of archaeological sites (Beaumont & Morris 1990; Morris & Beaumont 2004), with locales along and adjacent to the major river systems being of particular significance. Stone Age material found in the broader region spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times. Late Holocene material with pottery is known to occur on the river banks, while rock engravings are richly distributed in the region (Wilman 1933; Fock & Fock 1989; Morris 1988). A particularly notable rock engraving is known from the farm Kraai Bosch, while others occur on the hills near Petrusville.”

In his assessment, Morris (2008) identified low significance Middle and Later Stone Age scatters of archaeological material. These finds correspond with the findings of Tusenius (2016) who noted that “Most of the archaeological remains recorded in the study area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA)/ Later Stone Age (LSA) artefacts, with the former being more common. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations, and are in a secondary context in areas affected by sheet erosion. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Kloofsig 1 development area is of low archaeological heritage sensitivity.” Three archaeological observations have been noted within the area proposed for pivot development - these are listed in Appendix 1. Two of these observations consist of very low density MSA archaeological scatters and the third reflects a corrugated iron shed.



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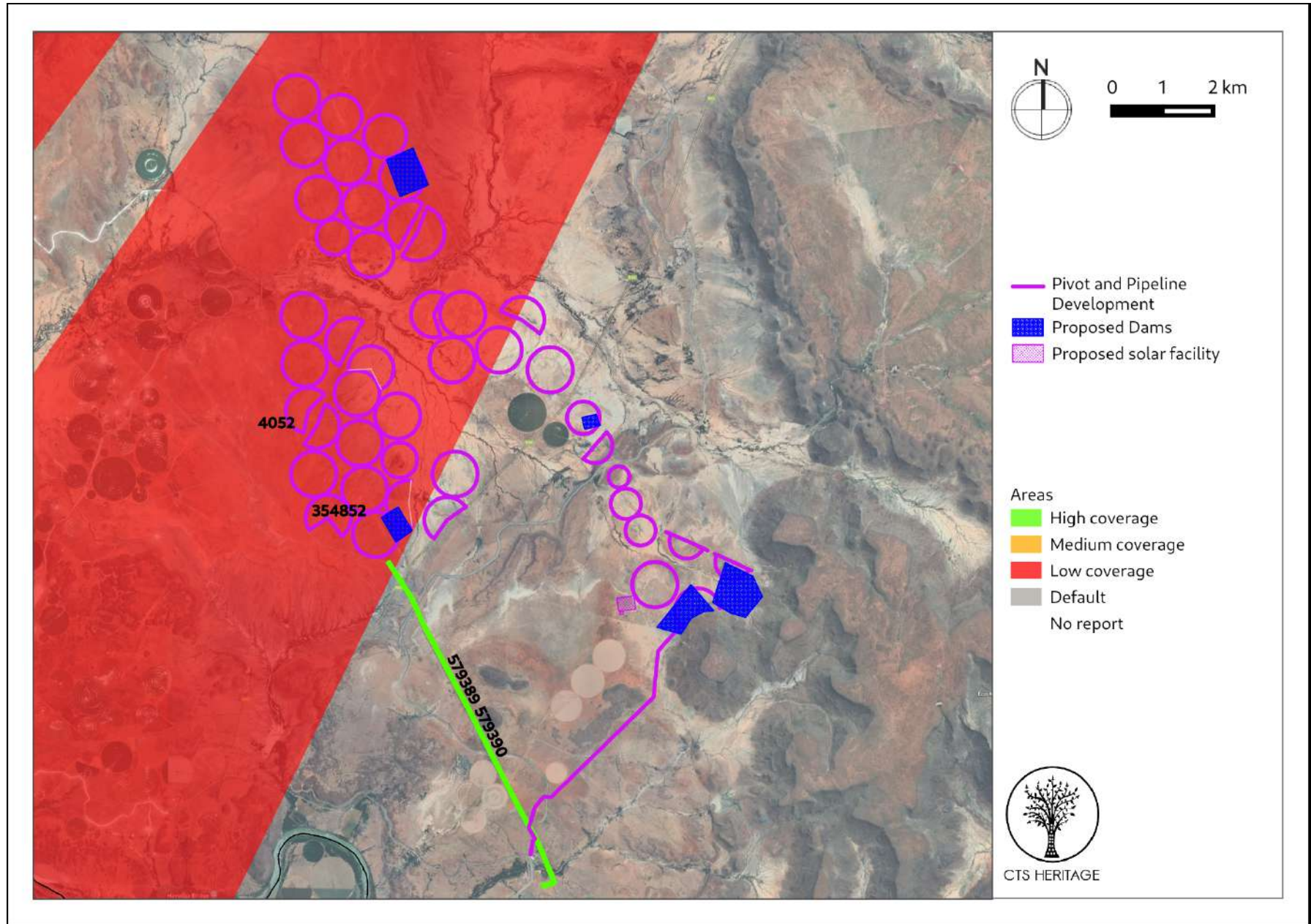
**Table 1: Heritage resources identified through previous assessments**

Site ID	Site no	Full Site Name	Description	Grading	Latitude	Longitude	Mitigation
139138	GTP-001	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite	Grade IIIc	29° 50' 3.336" S	24° 39' 40.032" E	NA
139139	GTP-002	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite.	Grade IIIC	29° 50' 42.288" S	24° 39' 28.476" E	NA
137035	ZTF-011	Zoutpansfontein	This shed has been refurbished with a new corrugated iron roof. It was the processing and dispatch centre of grapes produced at what was then the largest wine-fields in South Africa and in the southern hemisphere. Operations ceased in the 1990s	Grade IIIB	29° 50' 47.6988" S	24° 42' 39.3516" E	NA

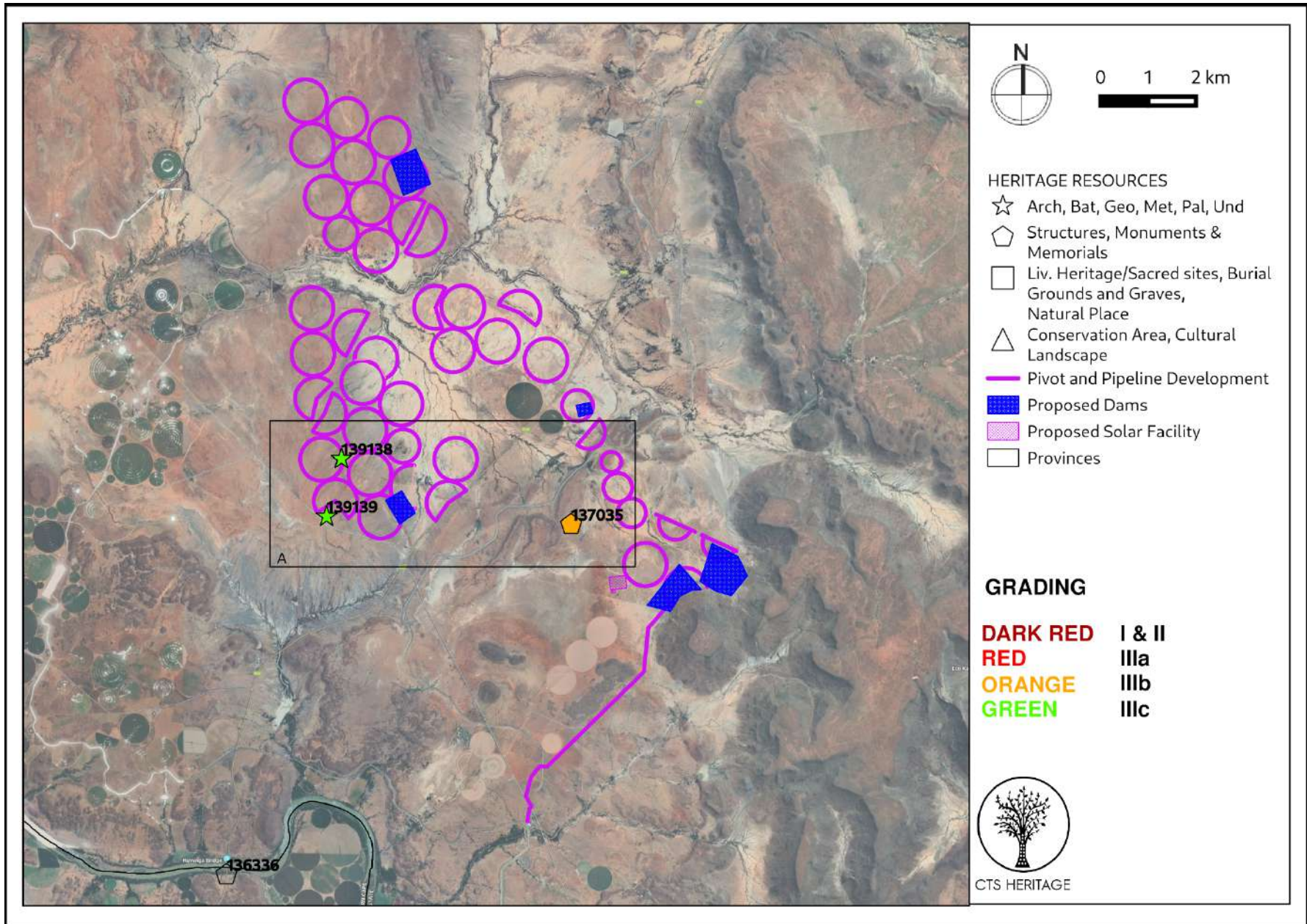




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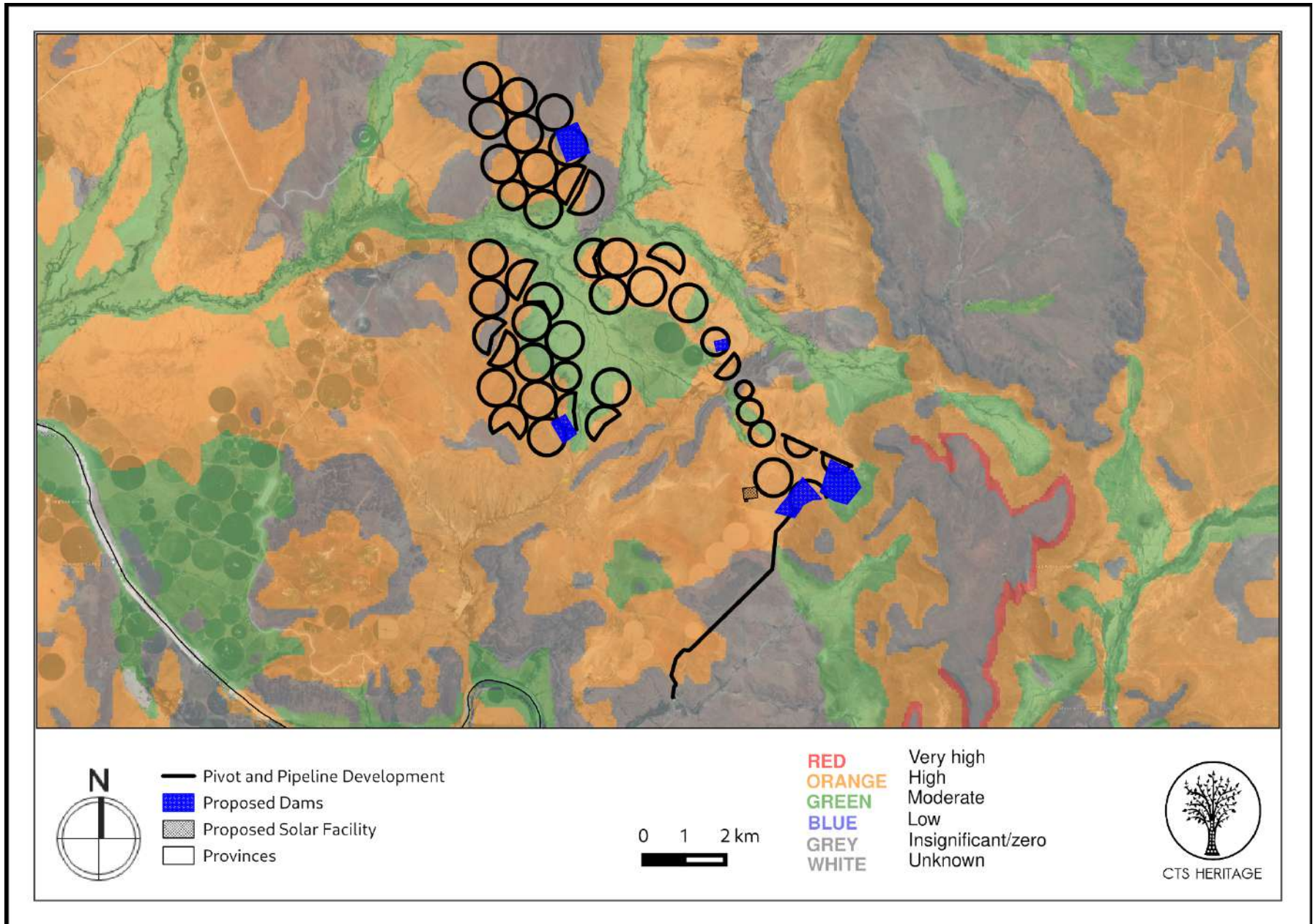
Map 2.1: Spatialisation of heritage assessments conducted in proximity to the broader study area



Map 2.1: Spatialisation of heritage resources known in proximity to the broader study area



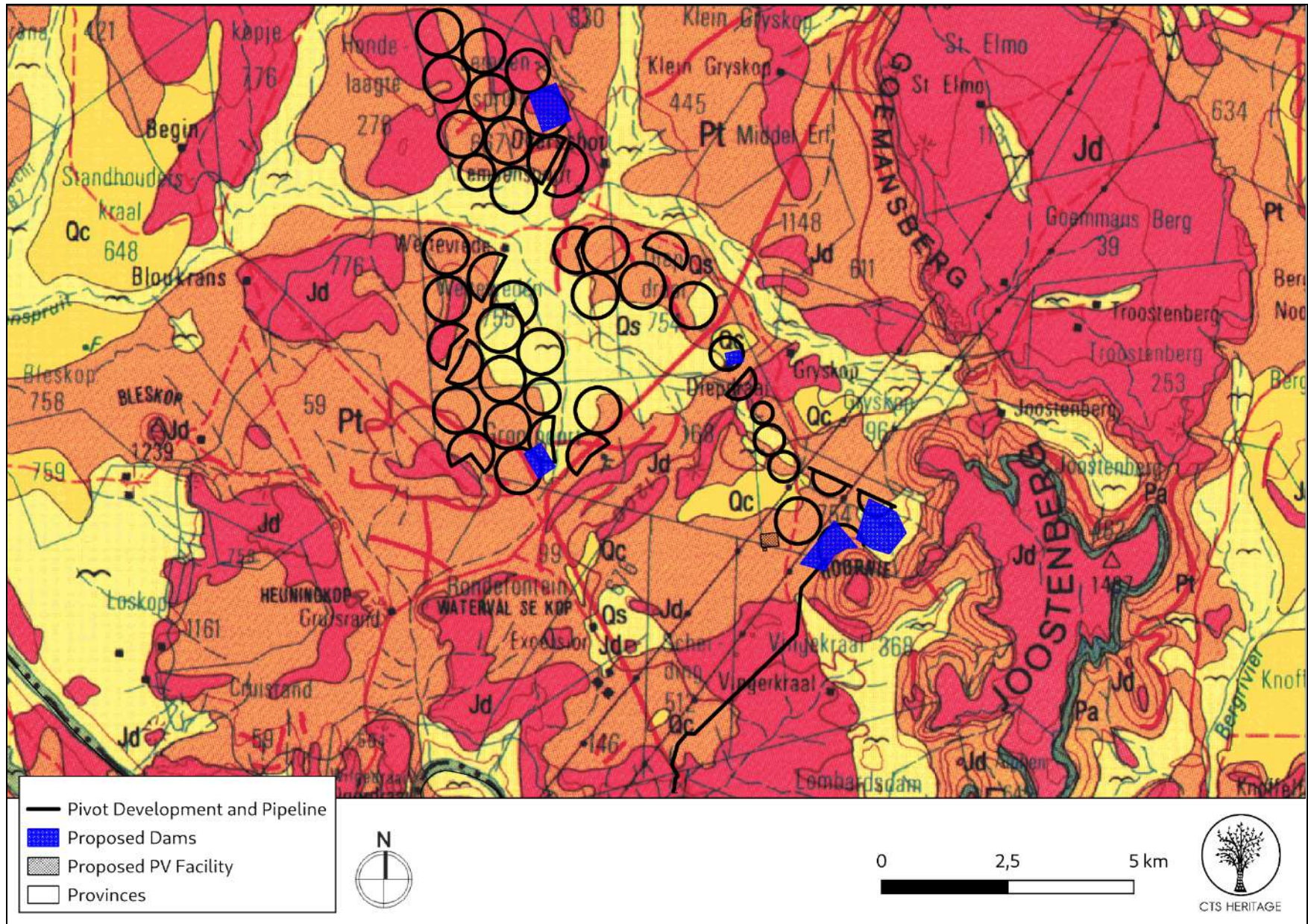
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Map 3.1: Palaeontological sensitivity of the area surrounding the broader study area



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**Map 3.2: Geology Map.** Extract from the CGS 2924 Koffiefontein Map indicating that the development area is underlain by sediments Qc and Qs - Quaternary Sands, Pt - Tierberg Formation of the Ecca Group and Jd - Jurassic Dolerite



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### 3.2 Palaeontology

According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments of low, moderate and high palaeontological sensitivity. According to the extract from the Council for GeoScience Map 2924 for Koffiefontein, the area is underlain by Jurassic Dolerite (zero paleontological sensitivity) and Quaternary Sands (moderate and high sensitivity). According to the Desktop Palaeontological Assessment completed by Bamford (2021) for a grid connection project located in the immediate vicinity of this development, the proposed development is positioned within “a mix of potentially fossiliferous (trace fossils) Tierberg Formation (Ecca Group, Karoo Supergroup), Jurassic dolerite and on the Quaternary aeolian sands and calcretes that are non-fossiliferous unless there are traps for fossils such as paleo-pans or palaeo-springs. No such feature is visible on the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMP. Based on this information it is recommended that no palaeontological site visit is required unless fossils are found when excavations for pole foundations commence.” This recommendation is also applicable to this proposed development.



#### 4. IDENTIFICATION OF HERITAGE RESOURCES

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

Most of the 70 observations made consisted of open air Middle Stone Age scatters of stone tools. Some Later Stone Age material was also observed along with historical/modern farm graves and ruined farm buildings. The stone tools are almost entirely made of locally sourced hornfels and siltstones which is typical of the area where these are highly abundant. Retouched blade forms and blade blanks were present across the study area as well as radial cores and various flakes with prepared platforms. The density and variety of Stone Age material definitely increased towards the banks and floodplain of the Lemoenspruit while much of the rest of the area held isolated and generally dispersed archaeological material. The Havenga Bridge spans the Orange/Gariep River and was built in 1934. The bridge features Scottish steel trusses and has been vandalised - the plaque has been stolen and one beam is bent.

The farm graves are not well marked and will require some careful planning in creating a site development plan which formalises the area around these locations. The ruined homestead at Diepdraai is already intersected by relatively clear farm roads and infrastructure and is unlikely to be negatively affected by the development of the agricultural fields.

The palaeontological sensitivity of the area under consideration is presented in Figure 3.1. The site for development is in the Tierberg Formation (orange) and the Quaternary calcretes (green). Vertebrate fossils are not present but the deep-water shales of the Tierberg Formation might preserve trace fossils of invertebrate trackways and burrows. These are deep water deposits so there would be no terrestrial plants either (Plumstead, 1969). The Quaternary calcretes might preserve fossils trapped in features such as palaeo-pans or palaeo-springs. There would be more robust but transported fossils such as bone fragments or silicified wood.

##### 4.2 Heritage Resources identified

Table 2: Heritage resources identified from fieldwork 2022

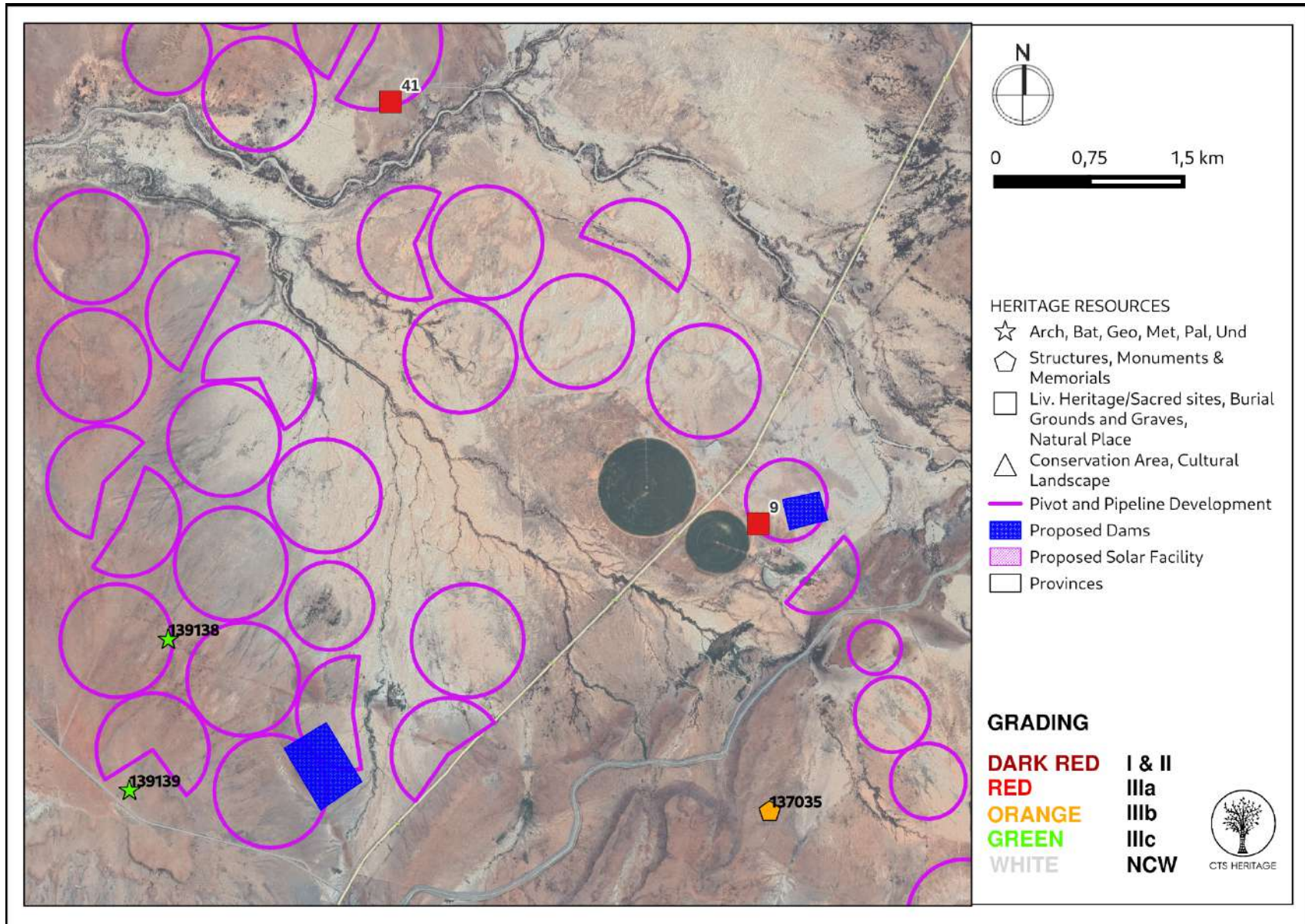
Site No.	Site Name	Description	Density m2	Period	Co-ordinates		Grading	Mitigation
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		sure without research. Spans the Orange/Gariep River.						
041	Diepdraai041	Stone covered farm workers graves x 3 clear, apparently 7, graves in veld, green grass marks area near eskom 33kV poles	n/a	Historic	-29.79571	24.67954	IIIA	100m Buffer area around site

### 4.3 Mapping and spatialisation of heritage resources



Map 4: Map of significant heritage resources identified during the field assessment, relative to the proposed development (see Table 1 and 2).



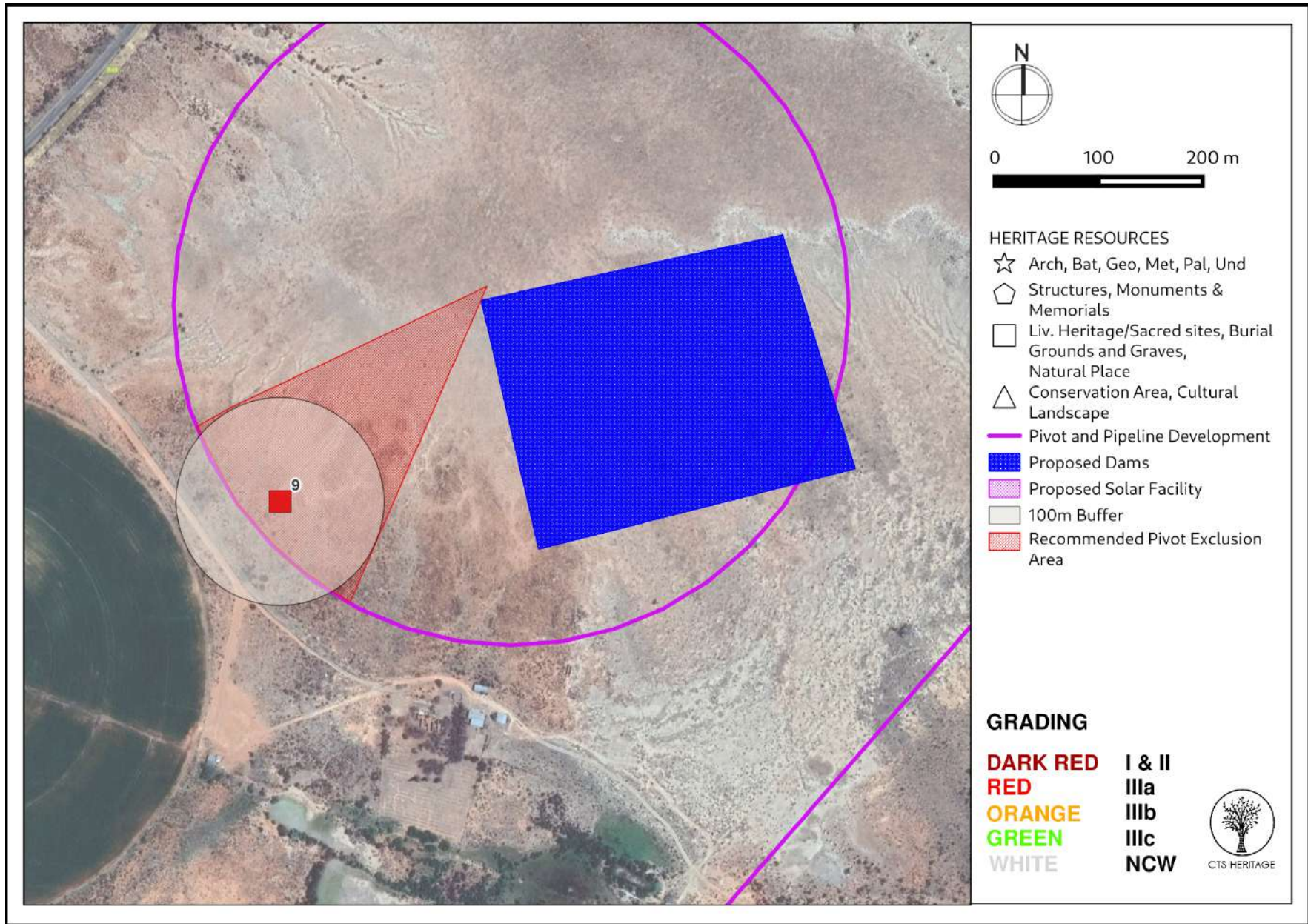


Figure 4.2: Map of significant sites relative to proposed development with recommended mitigation for Observation 09



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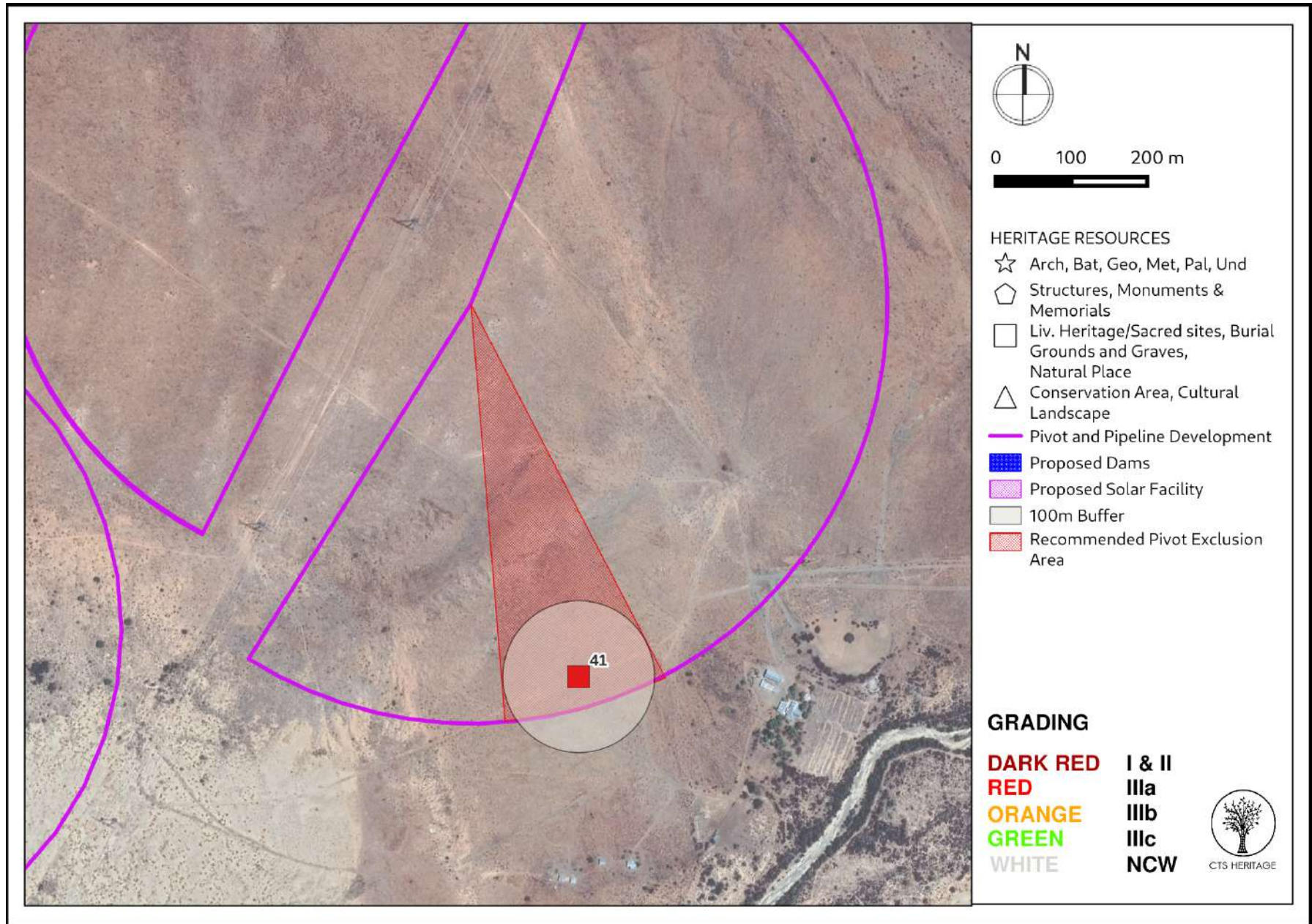


Figure 7.3: Map of significant sites relative to proposed development with recommended mitigation for Observation 041



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## 5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

### 5.1 Assessment of impact to Heritage Resources

#### *Archaeology*

Only one site of archaeological significance was identified within the proposed development area in a previous archaeological assessment conducted by Van Schalkwyk in 2015. SAHRIS Site 139138 is graded III C and is described as “Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m<sup>2</sup>. The material used for the tools are hardened shale and lideanite.” Van Schalkwyk (2015) goes on to conclude that “as the density of the scatter is very low, as well as the fact that it is surface material and therefore not in its original context any more, it is viewed to have a low significance and it is judged that the impact would be very low” and no recommendations for mitigation are provided.

As such, we reiterate the findings of Van Schalkwyk (2015) as they pertain to this site and as such, no mitigation measures are recommended in this report. There is no objection to the destruction of this site in terms of its archaeological significance.

In the field assessment conducted in 2022, all of the archaeological resources observed were determined to be low density surface scatters. As such, these sites have limited scientific value beyond their recording as per this report. To this end, these resources are determined to be Not Conservation-Worthy (NCW) and there is no objection to their impact as a result of this development.

Two burial sites were identified within the development footprint (Observation 009 and 041), graded III A due to their high levels of social and spiritual significance. Both of these burial grounds are located within the boundaries of the proposed development footprint and if the development proceeds as intended, it is likely that these burial sites will be negatively impacted. As such, it is recommended that a no-impact buffer of 100m is implemented around each of these sites in order to ensure that the burials are not disturbed and to maintain a semblance of sense of place associated with the burial sites. In the maps below, there are recommended pivot exclusion areas indicated as well as the recommended buffers.

The Havenga Bridge, originally constructed in 1934, was identified as a structure of high local significance for its architectural significance and as such, has been graded III A. This site is located well outside of the development area and no impact is anticipated.



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

<b>NATURE:</b> It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location				
		<b>Without Mitigation</b>		<b>With Mitigation</b>
<b>MAGNITUDE</b>	<b>H (8)</b>	No archaeological resources of significance were identified within the development area however two burial sites are located within the development area	<b>H (8)</b>	No archaeological resources of significance were identified within the development area however two burial sites are located within the development area
<b>DURATION</b>	<b>H (5)</b>	Where manifest, the impact will be permanent.	<b>H (5)</b>	Where manifest, the impact will be permanent.
<b>EXTENT</b>	<b>L (1)</b>	Limited to the development footprint	<b>L (1)</b>	Limited to the development footprint
<b>PROBABILITY</b>	<b>H (5)</b>	It is likely that burials will be impacted	<b>L (1)</b>	It is unlikely that burials will be impacted
<b>SIGNIFICANCE</b>	<b>L</b>	$(8+5+1) \times 5 = 70$	<b>L</b>	$(8+5+1) \times 1 = 14$
<b>STATUS</b>		Negative		Negative
<b>REVERSIBILITY</b>	<b>L</b>	Any impacts to heritage resources that do occur are irreversible	<b>L</b>	Any impacts to heritage resources that do occur are irreversible
<b>IRREPLACEABLE LOSS OF RESOURCES?</b>	<b>H</b>	Likely	<b>L</b>	Not Likely
<b>CAN IMPACTS BE MITIGATED</b>		Yes		
<b>MITIGATION:</b>				
<ul style="list-style-type: none"> <li>A no-impact buffer of 100m is implemented around Observations 009 and 041 as per Figures 4.2 and 4.3</li> <li>Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.</li> </ul>				
<b>RESIDUAL RISK:</b>				
None				

### **Palaeontology**

According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments of low, moderate and high palaeontological sensitivity. According to the extract from the Council for GeoScience Map 2924 for Koffiefontein, the area is underlain by Jurassic Dolerite (zero paleontological sensitivity) and Quaternary Sands (moderate and high sensitivity). According to the Desktop Palaeontological Assessment completed by Bamford (2021) for a grid connection project located in the immediate vicinity of this development, the proposed development is positioned within “a mix of potentially fossiliferous (trace fossils) Tierberg Formation (Ecca Group, Karoo Supergroup), Jurassic dolerite and on the Quaternary aeolian sands and calcretes that are non-fossiliferous unless there are traps for fossils such as paleo-pans or palaeo-springs. No such feature is visible on the satellite imagery.”

According to the desktop assessment completed by Bamford (2022), “Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. Furthermore, the material to be cultivated is soil and this does not preserve fossils. Since there is an extremely small chance that fossils from



the Tierberg Formation 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.”

Bamford (2022) concludes that “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 soils of the Quaternary. There is a very small chance that trace fossils may occur in the shales of the early Permian Tierberg Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations for pipes, dam walls and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low so as far as the palaeontology is concerned, the project should be authorised.”

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

<b>NATURE:</b> It is possible that buried palaeontological resources may be impacted by the proposed development in the preferred location				
		<b>Without Mitigation</b>		<b>With Mitigation</b>
<b>MAGNITUDE</b>	<b>L (1)</b>	According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have high palaeontological sensitivity.	<b>L (1)</b>	According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have high palaeontological sensitivity.
<b>DURATION</b>	<b>H (5)</b>	Where manifest, the impact will be permanent.	<b>H (5)</b>	Where manifest, the impact will be permanent.
<b>EXTENT</b>	<b>L (1)</b>	Limited to the development footprint	<b>L (1)</b>	Limited to the development footprint
<b>PROBABILITY</b>	<b>L (1)</b>	It is unlikely that significant fossils will be impacted	<b>L (1)</b>	It is unlikely that significant fossils will be impacted
<b>SIGNIFICANCE</b>	<b>L</b>	(1+5+1)x1=7	<b>L</b>	(1+5+1)x1=7
<b>STATUS</b>		Negative		Negative
<b>REVERSIBILITY</b>	<b>L</b>	Any impacts to heritage resources that do occur are irreversible	<b>L</b>	Any impacts to heritage resources that do occur are irreversible
<b>IRREPLACEABLE LOSS OF RESOURCES?</b>	<b>L</b>	Unlikely	<b>L</b>	Not Likely
<b>CAN IMPACTS BE MITIGATED</b>		Yes		
<b>MITIGATION:</b>				
<ul style="list-style-type: none"> <li>The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities</li> <li>Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.</li> </ul>				
<b>RESIDUAL RISK:</b>				
None				



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## 5.2 Sustainable Social and Economic Benefit

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the JN Venter Beleggings Trust Agricultural Development. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The recommendations proposed for the project are considered to be appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts.

The positive and negative social impacts identified and assessed for the **construction phase** includes:

- » Direct and indirect employment opportunities
- » Economic multiplier effects
- » Influx of jobseekers and change in population
- » Safety and security impacts
- » Impacts on daily living and movement patterns
- » Nuisance impacts, including noise and dust
- » Visual impacts and sense of place impacts

It is anticipated that the JN Venter Beleggings Trust Agricultural Development will operate for approximately 20 – 50 years, or as long as required by the development.

As such, the identified socio-economic benefits to be derived from this project outweigh the anticipated negative impacts to heritage resources identified in this report.

## 5.3 Proposed development alternatives

The JN Venter Beleggings Trust is considering agricultural development consisting of cultivation of various crops (maize, wheat, soya, and nuts), centre pivot irrigation system, dams for storage irrigation water, solar PV and battery storage to supply energy on the farm, and a pump house and related network of pipelines to supply water to the centre pivot. Only the proposed agricultural development and all the supporting infrastructures are considered in the ambit of this EIA. The project proposal is furthermore in line with surrounding land use, which comprises existing cultivated land and associated infrastructure.

No activity alternatives were investigated within the ambit of this EIA, as the applicant's purpose with the project is to expand the agricultural pivot areas and establish the supporting infrastructure for the success of the agricultural development. The project proposal is furthermore in line with surrounding land use, which consists of



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various agriculture and associated infrastructure. Therefore, no activity alternatives are considered within this Scoping Report.

### ***Technology Alternatives***

Only the use of a centre pivot irrigation system is considered due to how such a system efficiently spreads water onto growing crops. Centre pivots deliver water as close to the ground as possible and minimises the amount of water lost due to the wind and runoff. The centre pivot irrigation system is considered the most efficient technology given the magnitude of the proposed agricultural development proposed by the Applicant.

With the challenges associated with power supply in South Africa, the use of solar energy generated on site is considered to be the most suitable renewable energy technology for this proposed development, based on the site location, ambient conditions and renewable energy resource availability. The operating hours of the PV facility can be effectively extended through the inclusion of a Battery Energy Storage System (BESS).

Inclusion of the storage irrigation dams is very important for the agricultural development as it will enable availability of irrigation water on the times whereby the canal is closed for maintenance. The standard methodology for an off-stream balancing dam of the proposed sizes, is an earthfill structure established through cut and fill. Also, a fiberglass pipe is considered the best bulk water pipe to take water from the canal to the irrigation dams because of its corrosion resistant and that it has a longer lifespan as compared to other pipe alternatives such as steel and concrete.

No further technology alternatives are investigated.

### ***Amended Layout***

Subsequent to the completion of the HIA, an amended layout was provided for the project. This amended and updated layout has been mapped against the findings of this HIA in Figure 8.1 below. This amended layout will have the same anticipated impacts to heritage resources and the same recommendations therefore apply as per Figures 8.1 to 8.4.

## **5.4 Cumulative Impacts**

This application is for the proposed development of pivot irrigation as well as a small solar facility and associated grid connection and BESS. The majority of this development pertains to agricultural activities within a predominantly agricultural context and as such, no negative cumulative impact from the pivot development is anticipated. The proposed solar development is relatively small and as such, is not likely to have a significant negative cumulative impact.

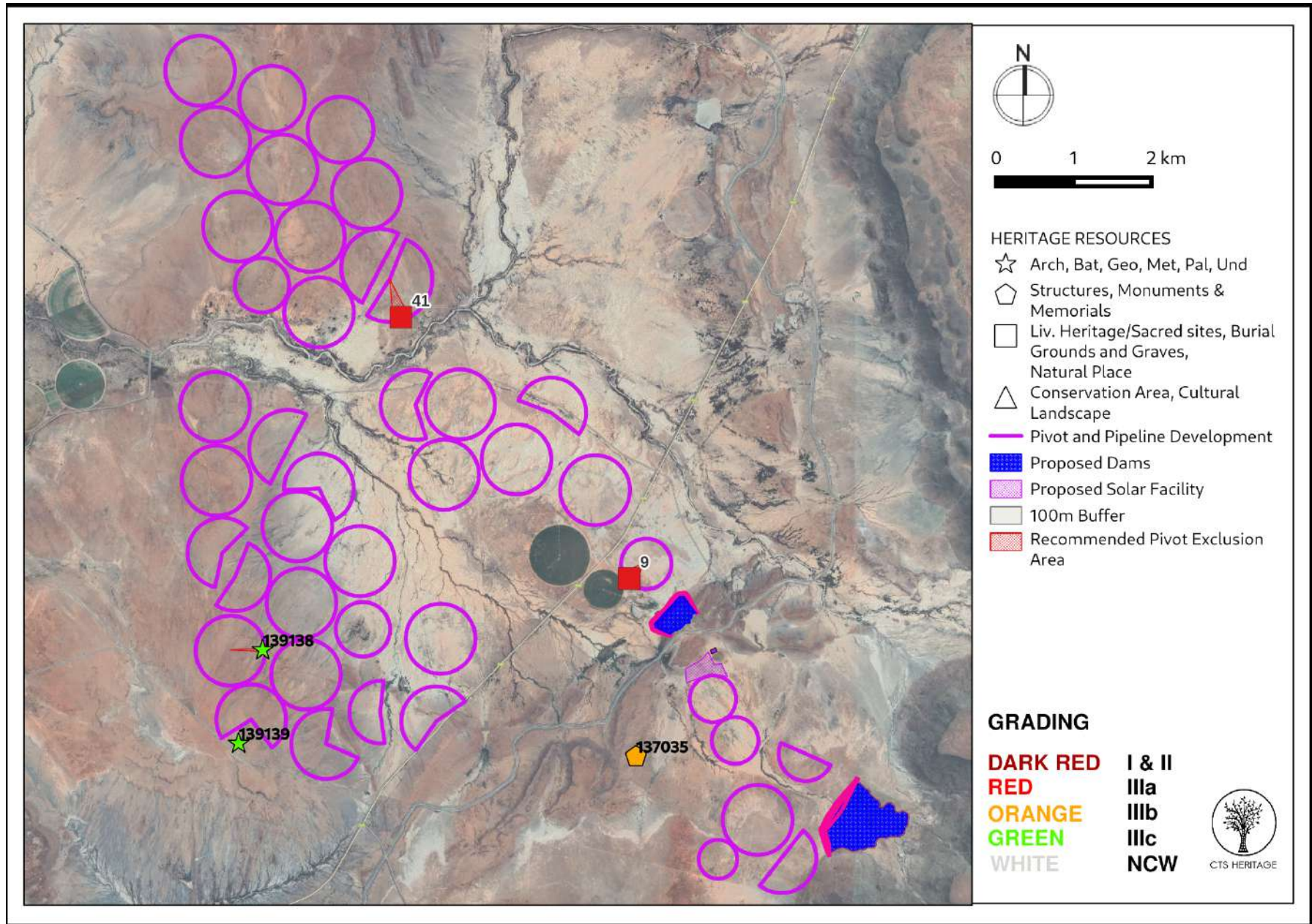


Figure 8.1: Map of amended layout (August 2022) relative to heritage findings



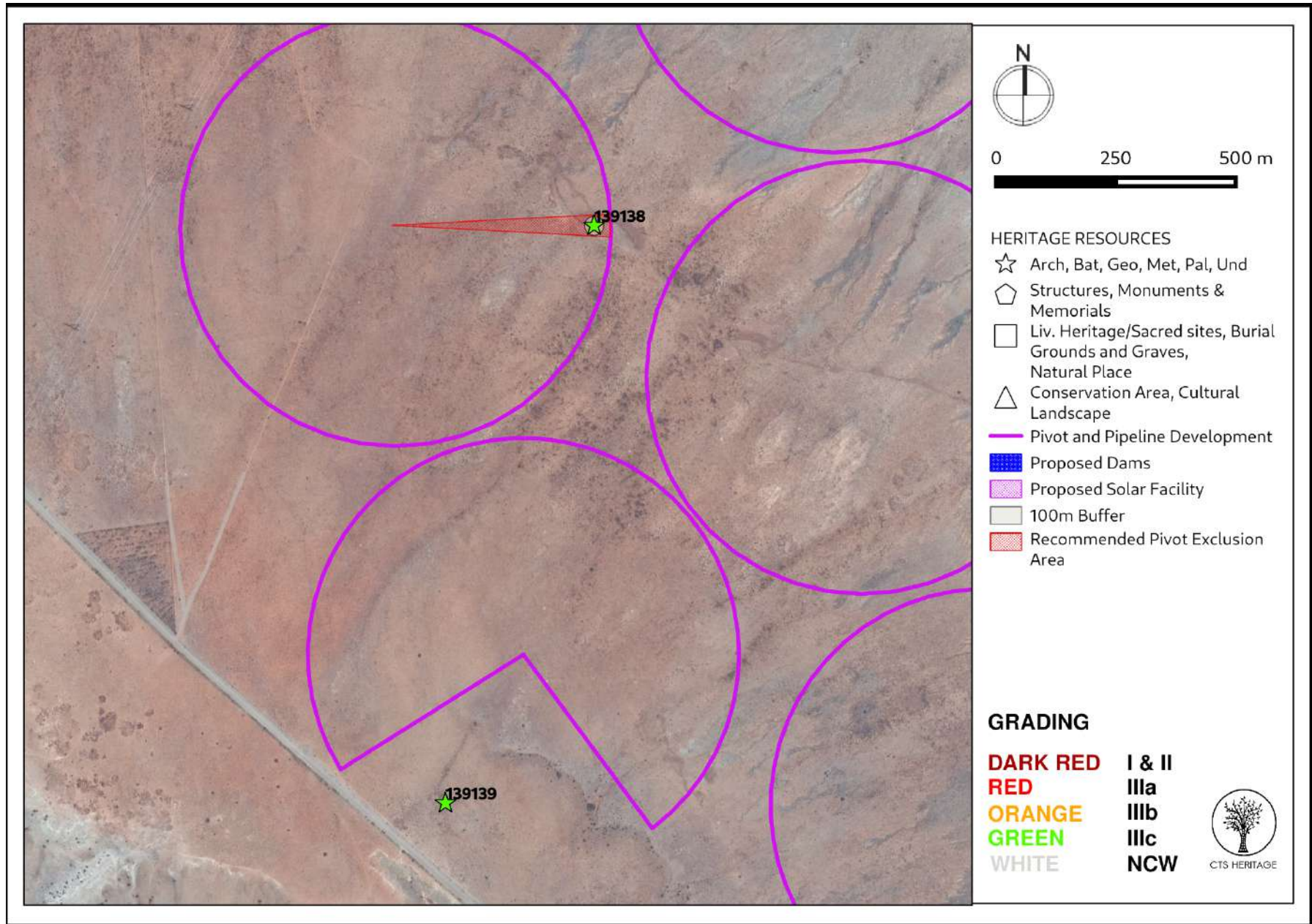


Figure 8.2 Map of amended layout (August 2022) relative to heritage findings

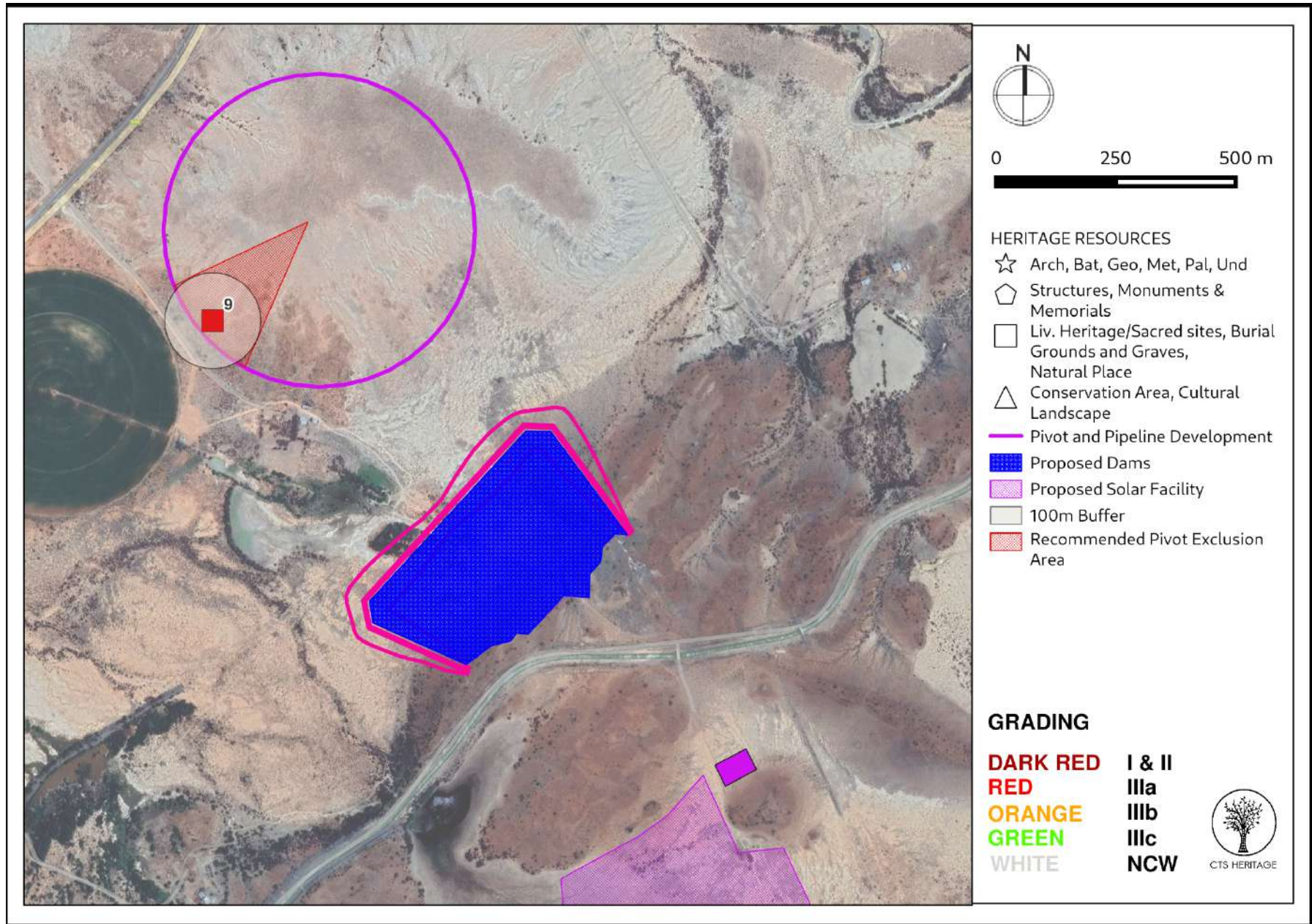


Figure 8.3: Map of amended layout (August 2022) relative to heritage findings

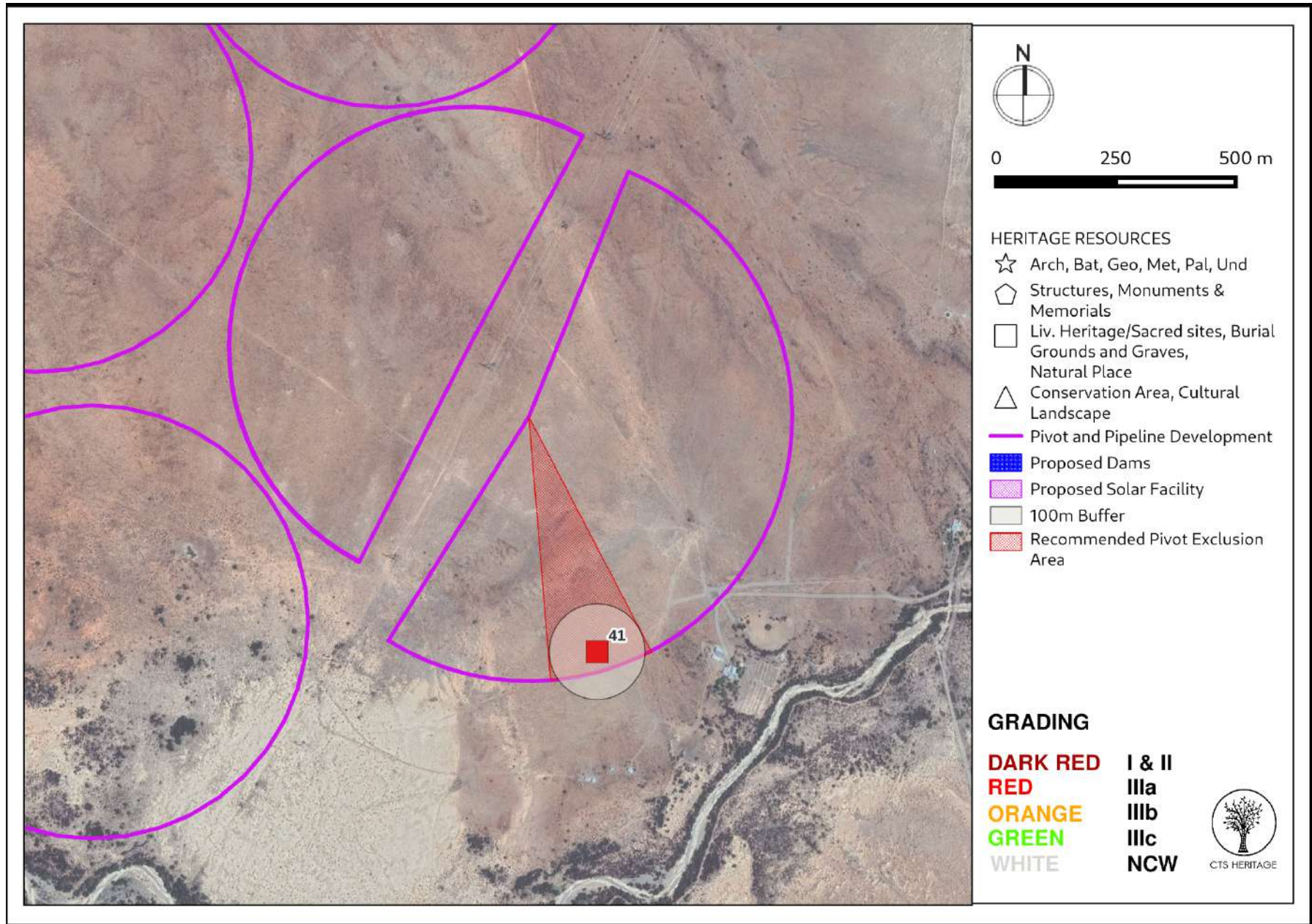


Figure 8.4: Map of amended layout (August 2022) relative to heritage findings



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## 6. RESULTS OF PUBLIC CONSULTATION

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

## 7. CONCLUSION

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage. Two burial sites were identified within the development footprint (Observation 009 and 041), graded IIIA due to their high levels of social and spiritual significance. Both of these burial grounds are located within the boundaries of the proposed development footprint and if the development proceeds as intended, it is likely that these burial sites will be negatively impacted. As such, it is recommended that a no-impact buffer of 100m is implemented around each of these sites in order to ensure that the burials are not disturbed and to maintain a semblance of sense of place associated with the burial sites. In the maps below, there are recommended pivot exclusion areas indicated as well as the recommended buffers.

As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant.

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

## 8. RECOMMENDATIONS

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

- A no-impact buffer of 100m is implemented around Observations 009 and 041 as per Figures 4.2 and 4.3
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



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**9. REFERENCES**

Heritage Impact Assessments				
NID	Author(s)	Date	Type	Title
354852	Heritage Impact Assessment Specialist Reports	Johnny Van Schalkwyk		Cultural Heritage Impact Assessment for the proposed Grootpoort Photovoltaic Solar Energy development Facility nearr Luckhoff, Letsemeng Local Municipality, Free State Province.
364728	PIA Desktop	John E. Almond	01/06/2016	PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY PROPOSED GROOTPOORT PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR LUCKHOFF, FREE STATE PROVINCE
4052	HIA Phase 1	Albert van Jaarsveld	01/03/2006	Hydra-Perseus and Beta-Perseus 765 kV Transmission Power Lines Environmental Impact Assessment. Impact on Cultural Heritage Resources
579389	Letter of Exemption	CTS Heritage	02/08/2021	Desktop Heritage Screening Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State
579390	PIA Desktop	Marion Bamford	29/07/2021	Desktop Palaeontology Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State



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## APPENDICES



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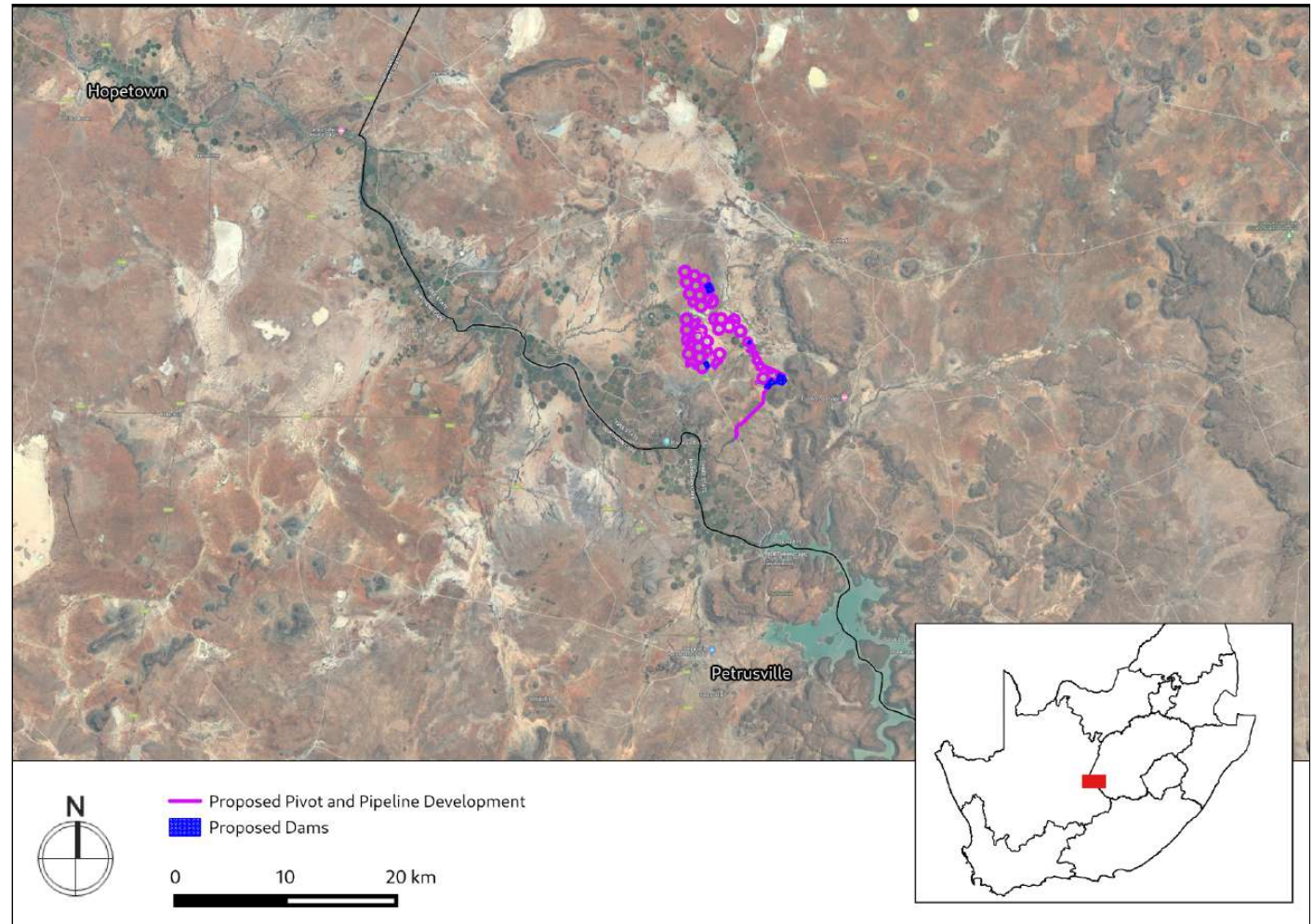
## APPENDIX 1: Heritage Screening Assessment (2021)



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## HERITAGE SCREENER

CTS Reference Number:	<b>CTS22_028</b>
SAHRIS Reference:	
Client:	<b>Savannah Environmental (Pty) Ltd</b>
Date:	<b>March 2022</b>
Title:	<b>Agricultural and Pivot Expansion near Luckhoff, Free State Province</b>



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

### **RECOMMENDATION**

**It is likely that the proposed development will impact significant archaeological and palaeontological heritage and as such, it is recommended that a heritage impact assessment be completed that assesses these impacts as per section 38(3) of the NHRA.**

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## 1. Proposed Development Summary

JN Venter Beleggings Trust is proposing the development of an expansion of a centre pivot irrigation farm on a site located Southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754. The total area on all three portions is 4800 ha, however only 2690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality. The agricultural development will entail the following at a minimum:

- Development of centre pivot areas (cultivation and irrigation)
- Construction of an abstraction pipeline from the existing irrigation canal
- Two water storage dams each with a proposed alternative
- A new pump stations
- A 9ha solar PV with alternatives and an 5MW overhead power line
- A Battery Energy Storage System

The current proposed water pipeline crossing will be approximately 68m downstream and north west of an existing road bridge crossing.

It is proposed that ~2690ha will be transformed across the property for the establishment of the agricultural development

The proposed development will require the following infrastructure:

<b>Infrastructure</b>	<b>Purpose</b>
<b>315 mm PVC pipeline</b>	Water for the pivots will be sourced from the Oranje Riet Water User Association's canal pumped 6km underground through 2 x 1.4m fibreglass pipes, which will be extended by further 500 m to reach the pivots
<b>Centre Pivot Irrigation System</b>	The underground PVC pipeline will provide water to a centre pivot irrigation system. A centre pivot irrigation system is a moveable pipe structure which usually spans the length of a field and rotates around a pivot in the centre of the field. As the irrigation system rotates around its central pivot, it supplies water to crops through sprinklers along its length.
<b>Two Water Storage Systems</b>	Two main storage dams are proposed for utilization on the agricultural development. This dam system will feed the planned additional expansion

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<b>Pump station</b>	A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams
<b>Solar PV area and overhead power line</b>	Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams
<b>BESS</b>	A battery system will be used to collect any additional power generated by the PV facility for use as and when required.

## 2. Application References

<b>Name of relevant heritage authority(s)</b>	SAHRA
<b>Name of decision making authority(s)</b>	TBA

## 3. Property Information

<b>Latitude / Longitude</b>	29°49'14.77"S 24°40'32.96"E
<b>Erf number / Farm number</b>	Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754
<b>Local Municipality</b>	Letsemeng
<b>District Municipality</b>	Xhariep
<b>Province</b>	Free State Province
<b>Current Use</b>	Agriculture
<b>Current Zoning</b>	Agriculture

## 4. Nature of the Proposed Development

<b>Total Length of pipeline</b>	TBA
<b>Depth of excavation (m)</b>	NA

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Height of development (m)

NA

## 5. Category of Development

x	<b>Triggers: Section 38(8) of the National Heritage Resources Act</b>
	<b>Triggers: Section 38(1) of the National Heritage Resources Act</b>
x	1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	2. Construction of a bridge or similar structure exceeding 50m in length.
	3. Any development or activity that will change the character of a site-
	a) exceeding 5 000m <sup>2</sup> 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 <sup>2</sup>
	5. Other (state):

## 6. Additional Infrastructure Required for this Development

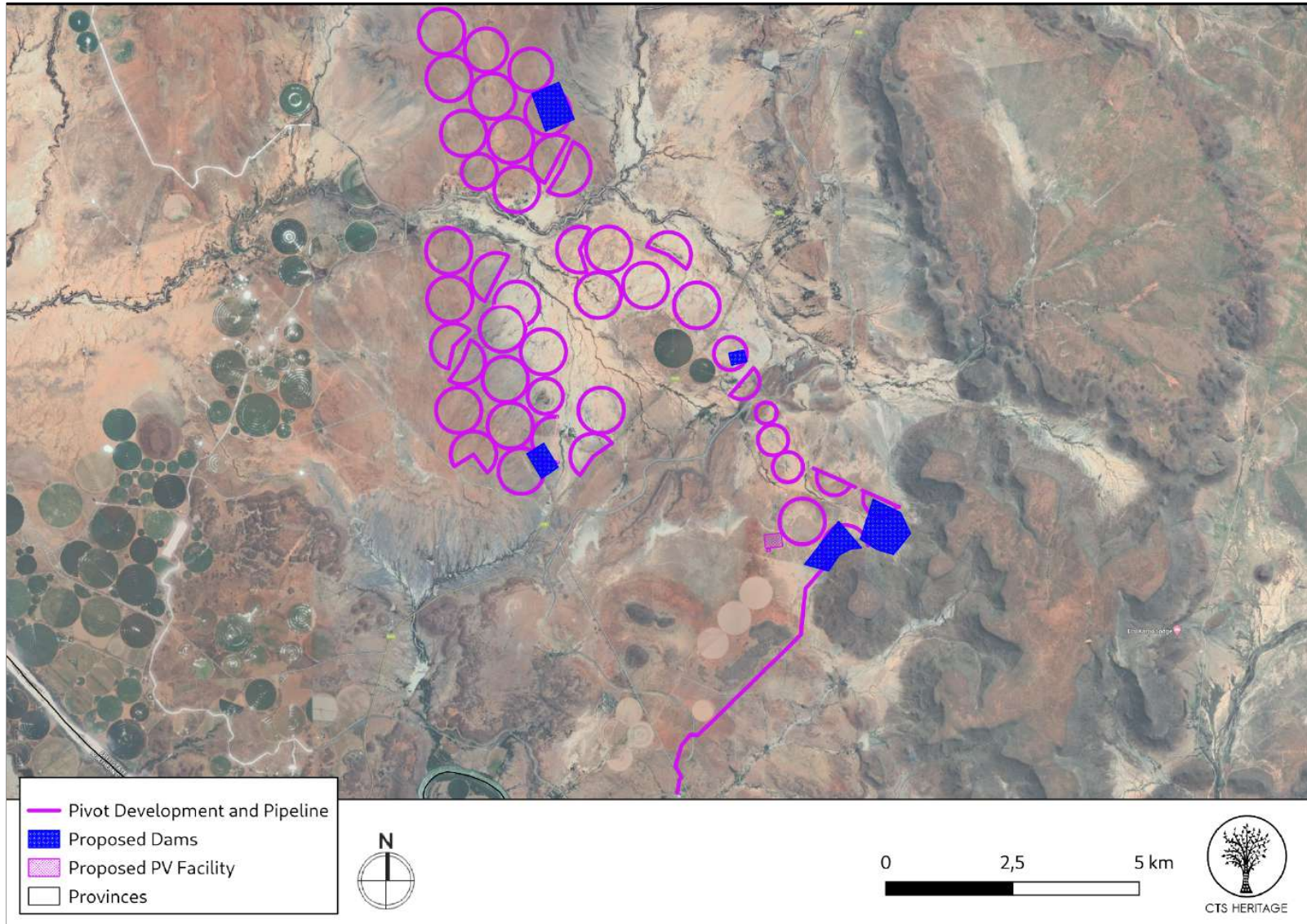
TBA

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## 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



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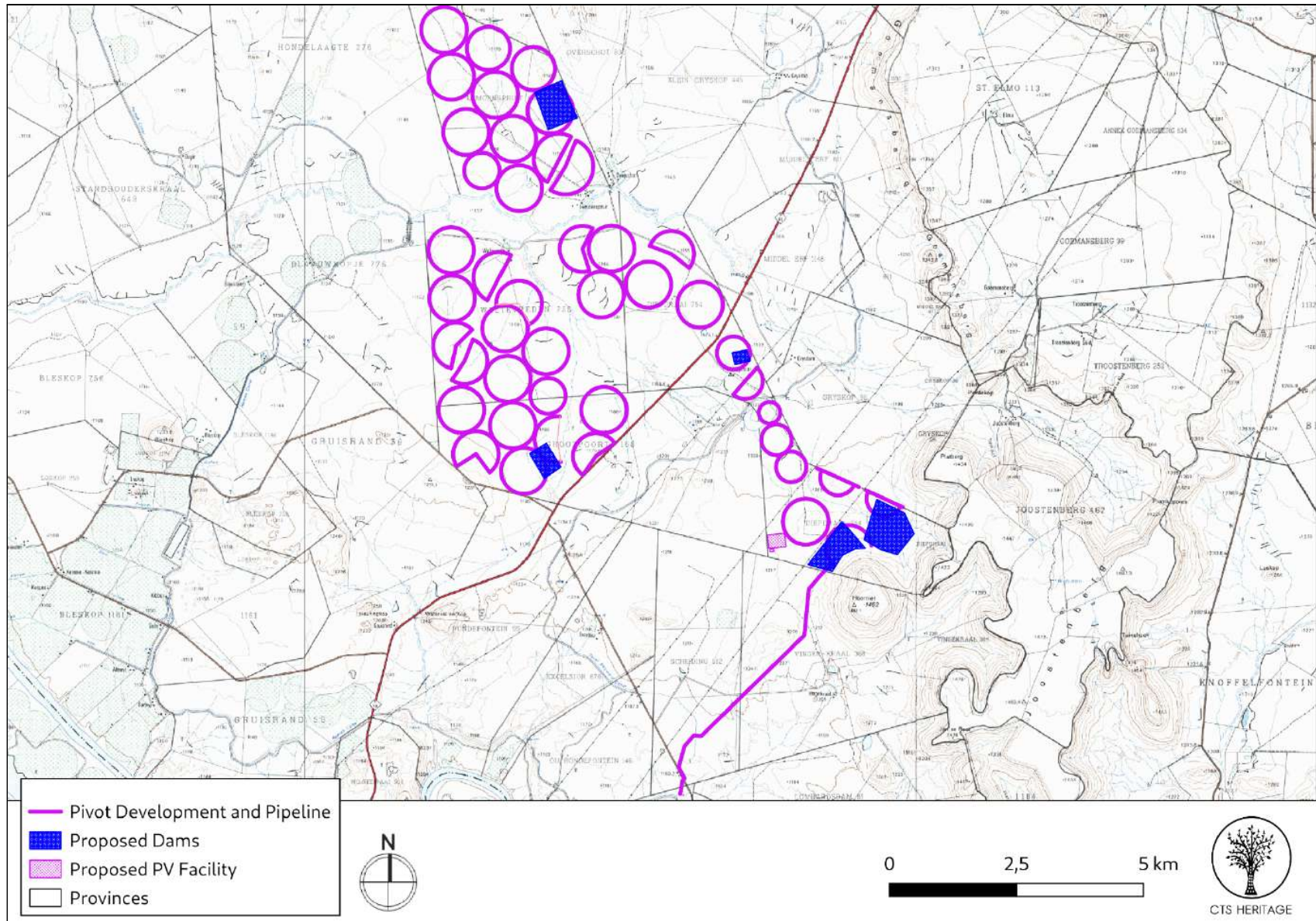
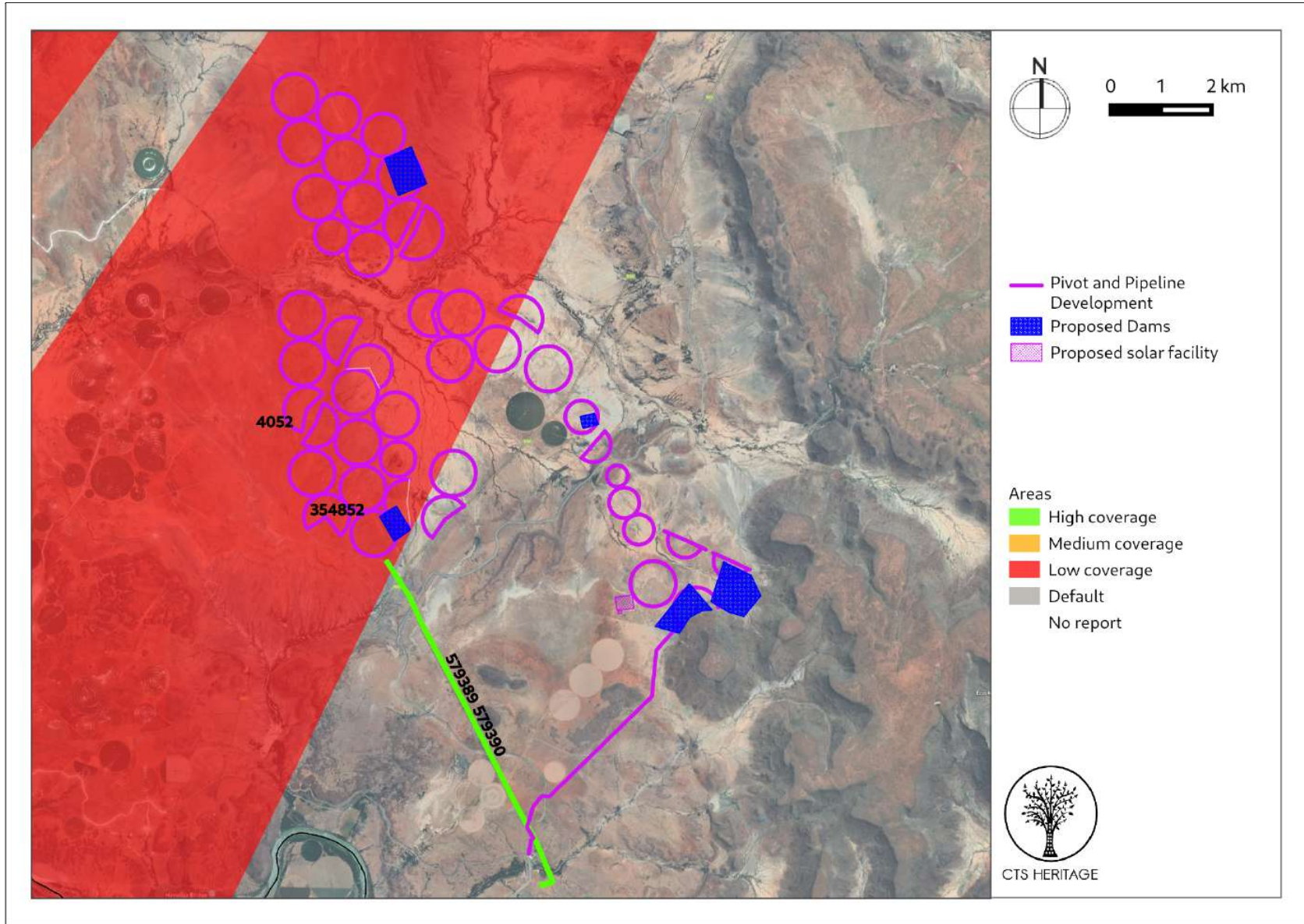


Figure 1c. Overview Map. Extract from 1:50 000 Topo

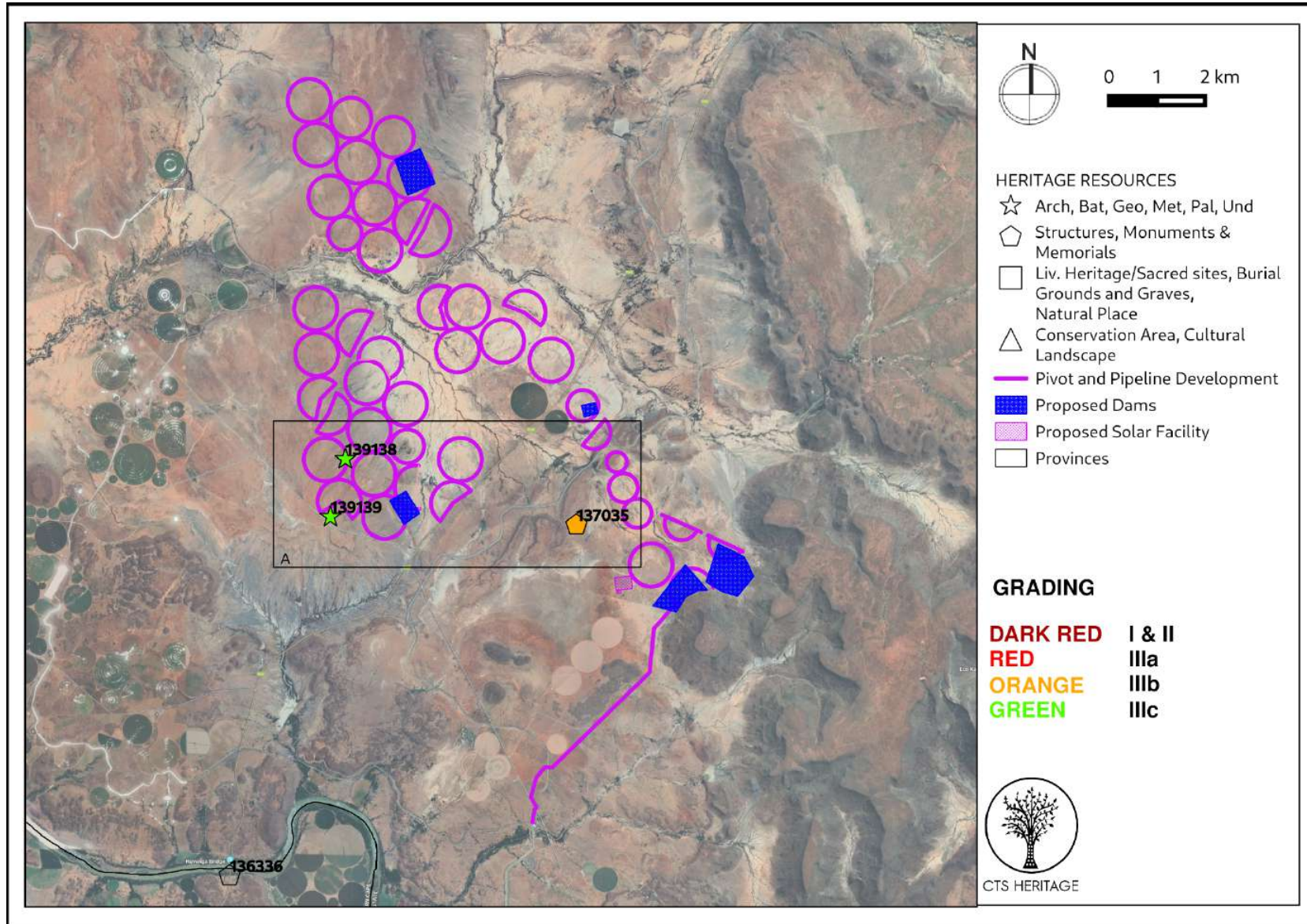
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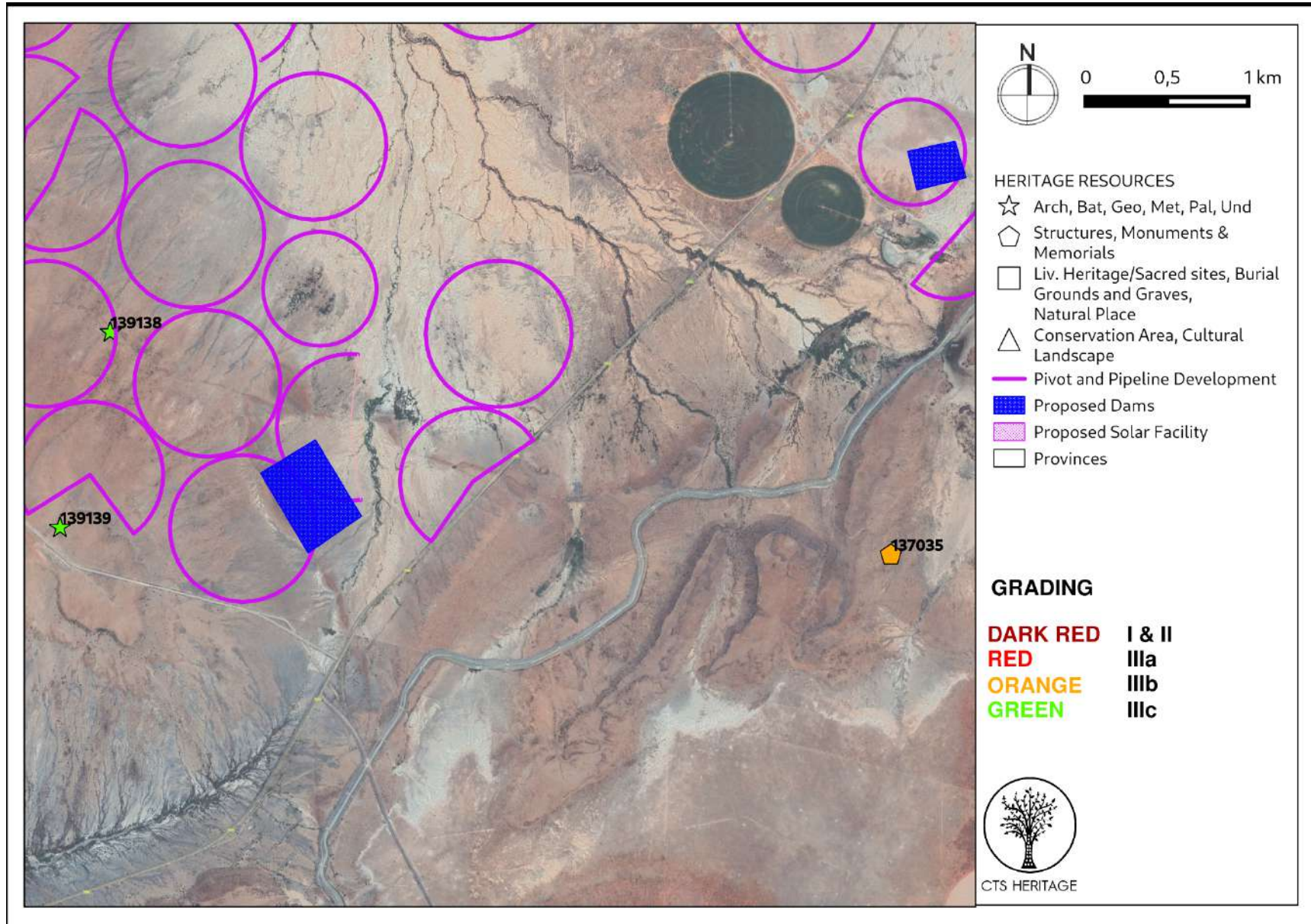
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**Figure 2. Previous HIAs Map.** Previous Heritage Impact Assessments covering the proposed development area with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.



**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.

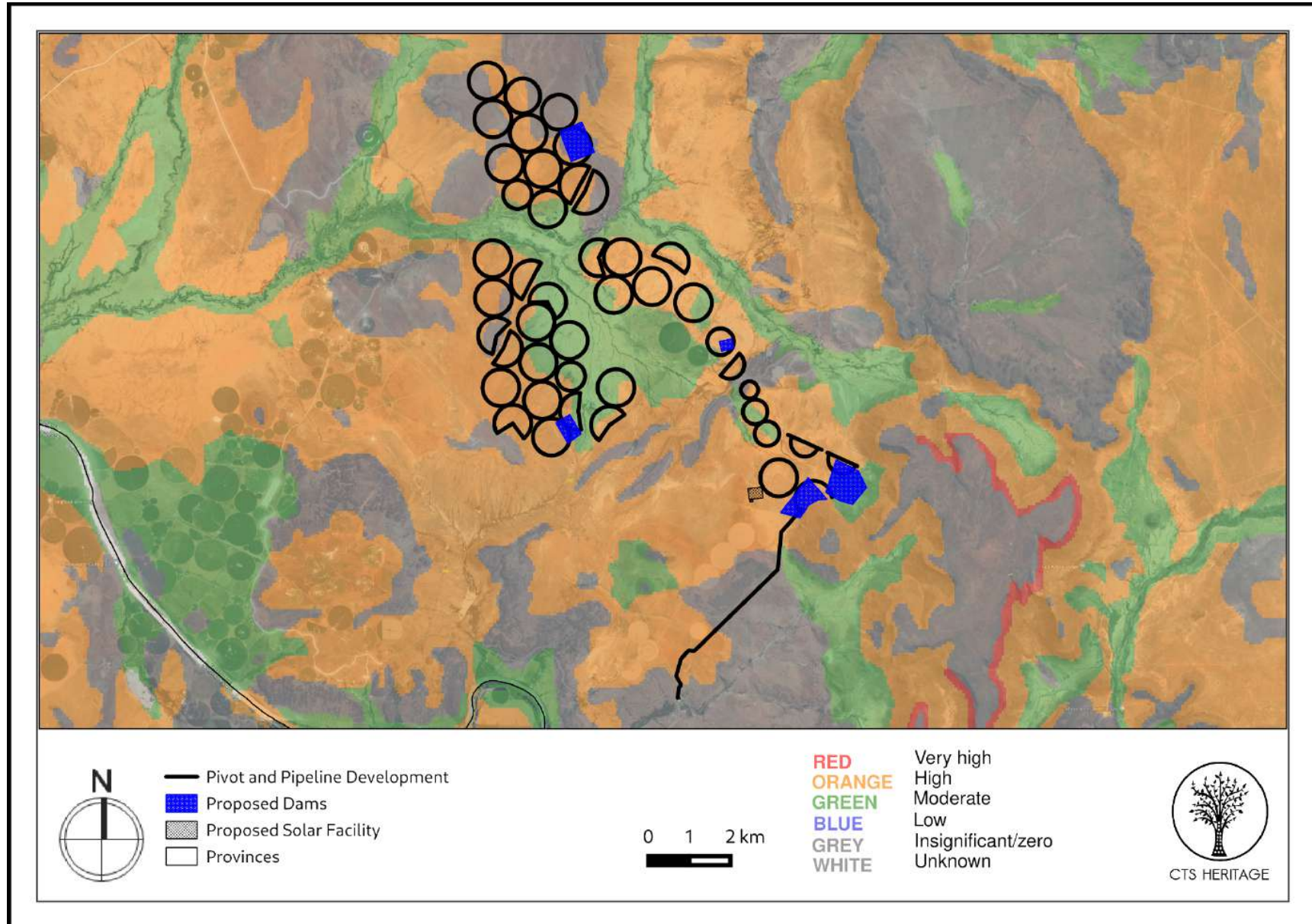


**Figure 3a. Heritage Resources Map** showing heritage resources near the proposed extension power line project.





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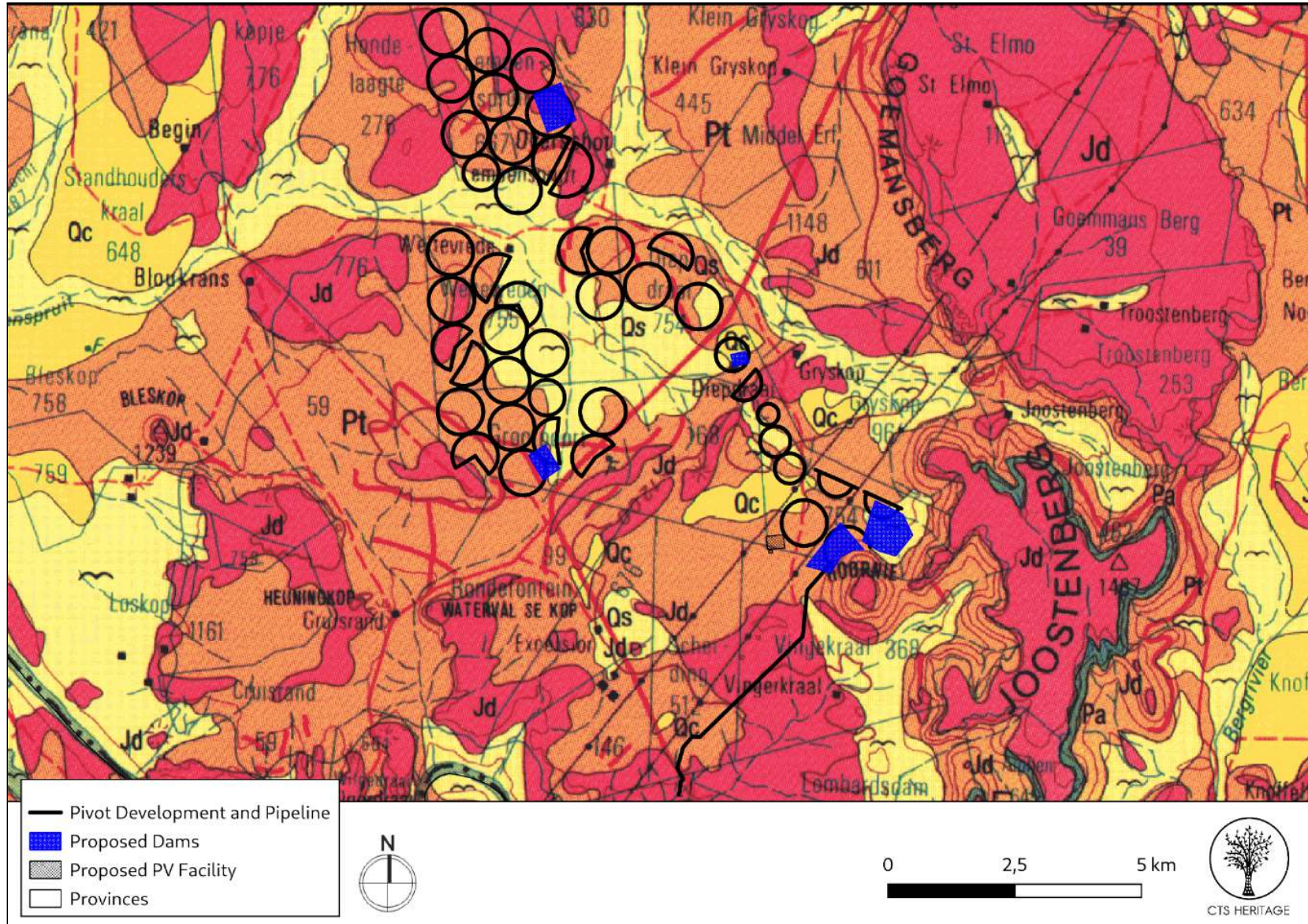


**Figure 4a. Palaeosensitivity Map.** Indicating fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

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**Figure 4b. Geology Map.** Extract from the CGS 2924 Koffiefontein Map indicating that the development area is underlain by sediments Qc and Qs - Quaternary Sands, Pt - Tierberg Formation of the Ecca Group and Jd - Jurassic Dolerite



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## 8. Heritage Assessment

### Background

This application is for the proposed development of agricultural pivots, a dam and pipeline located inbetween Luckhoff and Vanderkloof Dam in the Free State. The area proposed for the development has been extensively transformed through agricultural activities. The nearest town to the proposed development is the town of Vanderkloof which has been established on the banks of the dam. The Vanderkloof dam was constructed in 1977. Neither the town nor the dam are anticipated to be negatively impacted by the proposed development, furthermore, the proposed development is largely agricultural in nature and as such, will contribute to the existing cultural landscape of the area.

### Archaeology and the Built Environment

Very few Heritage Impact Assessments have been completed in the area according to the South African Heritage Resources Information System (SAHRIS, Figure 2) and very few heritage resources are known from the vicinity of the development (Figure 3). According to Morris (2008), “The Northern Cape has a wealth of archaeological sites (Beaumont & Morris 1990; Morris & Beaumont 2004), with locales along and adjacent to the major river systems being of particular significance. Stone Age material found in the broader region spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times. Late Holocene material with pottery is known to occur on the river banks, while rock engravings are richly distributed in the region (Wilman 1933; Fock & Fock 1989; Morris 1988). A particularly notable rock engraving is known from the farm Kraai Bosch, while others occur on the hills near Petrusville.”

In his assessment, Morris (2008) identified low significance Middle and Later Stone Age scatters of archaeological material. These finds correspond with the findings of Tusenius (2016) who noted that “Most of the archaeological remains recorded in the study area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA)/ Later Stone Age (LSA) artefacts, with the former being more common. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations, and are in a secondary context in areas affected by sheet erosion. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Kloofsig 1 development area is of low archaeological heritage sensitivity.” Three archaeological observations have been noted within the area proposed for pivot development - these are listed in Appendix 1. Two of these observations consist of very low density MSA archaeological scatters and the third reflects a corrugated iron shed.

Based on the known archaeological sensitivity of the broader area as noted in these assessments, as well as known heritage resources located within the development area, it is likely that significant archaeological heritage will be impacted by the proposed development and as such, a field assessment is recommended.

### Palaeontology

According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments of low, moderate and high palaeontological sensitivity. According to the extract from the Council for GeoScience Map 2924 for Koffiefontein, the area is underlain by Jurassic Dolerite (zero paleontological sensitivity) and Quaternary Sands (moderate and high sensitivity). According to the Desktop Palaeontological Assessment completed by Bamford (2021) for a grid connection project located in the immediate vicinity of this development, the proposed development is positioned within “a mix of potentially fossiliferous (trace fossils) Tierberg Formation (Ecca Group, Karoo Supergroup), Jurassic dolerite and on the Quaternary aeolian sands and calcretes that are non-fossiliferous unless there are traps for fossils such as paleo-pans or palaeo-springs. No such feature is visible on the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMP. Based on this information it is recommended that no palaeontological site visit is required unless fossils are found when excavations for pole foundations commence.” This recommendation is also applicable to this proposed development. It is further recommended that this be confirmed in an updated desktop palaeontological assessment.

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**RECOMMENDATION**

**It is likely that the proposed development will impact significant archaeological and palaeontological heritage and as such, it is recommended that a heritage impact assessment be completed that assesses these impacts as per section 38(3) of the NHRA.**

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## 9. Scoping Assessment Impact Table

### Impact

- Impact to archaeological resources
- Impact to palaeontological resources
- Impact to Cultural Landscape
- Cumulative Impact

### Desktop Sensitivity Analysis of the Site

- Impact to significant archaeological resources such as Stone Age artefact scatters, burial grounds and graves, historical artefacts, historical structures and rock art engravings through destruction during the development phase and disturbance during the operational phase is unlikely.
- Impacts to palaeontological resources are possible.
- Due to the nature of the development and its context, cumulative impact and negative impact to the cultural landscape is unlikely

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Impact to significant heritage resources through destruction during the development phase.	Destruction of significant heritage resources	Local scale with broader impacts to scientific knowledge	None known at present

### Gaps in knowledge & recommendations for further study

- It is likely that the proposed development will impact significant archaeological and palaeontological heritage and as such, it is recommended that a heritage impact assessment be completed that assesses these impacts as per section 38(3) of the NHRA.

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## APPENDIX 1

### List of heritage resources within the development area

Site ID	Site no	Full Site Name	Description	Site Type	Grading
139138	GTP-001	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite	Artefacts	Grade IIIc
139139	GTP-002	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite.	Artefacts	Grade IIIc
137035	ZTF-011	Zoutpansfontein	This shed has been refurbished with a new corrugated iron roof. It was the processing and dispatch centre of grapes produced at what was then the largest wine-fields in South Africa and in the southern hemisphere. Operations ceased in the 1990s	Building	Grade IIIb

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## APPENDIX 2

### Reference List with relevant AIAs and PIAs

Heritage Impact Assessments				
Nid	Report Type	Author/s	Date	Title
354852	Heritage Impact Assessment Specialist Reports	Johnny Van Schalkwyk		Cultural Heritage Impact Assessment for the proposed Grootpoort Photovoltaic Solar Energy development Facility near Luckhoff, Letsemeng Local Municipality, Free State Province.
364728	PIA Desktop	John E. Almond	01/06/2016	PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY PROPOSED GROOTPOORT PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR LUCKHOFF, FREE STATE PROVINCE
4052	HIA Phase 1	Albert van Jaarsveld	01/03/2006	Hydra-Perseus and Beta-Perseus 765 kV Transmission Power Lines Environmental Impact Assessment. Impact on Cultural Heritage Resources
579389	Letter of Exemption	CTS Heritage	02/08/2021	Desktop Heritage Screening Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State
579390	PIA Desktop	Marion Bamford	29/07/2021	Desktop Palaeontology Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State

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## APPENDIX 3 - Keys/Guides

### Key/Guide to Acronyms

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

### Full guide to Palaeosensitivity Map legend

	<b>RED:</b>	VERY HIGH - field assessment and protocol for finds is required
	<b>ORANGE/YELLOW:</b>	HIGH - desktop study is required and based on the outcome of the desktop study, a field assessment is likely
	<b>GREEN:</b>	MODERATE - desktop study is required
	<b>BLUE/PURPLE:</b>	LOW - no palaeontological studies are required however a protocol for chance finds is required
	<b>GREY:</b>	INSIGNIFICANT/ZERO - no palaeontological studies are required
	<b>WHITE/CLEAR:</b>	UNKNOWN - these areas will require a minimum of a desktop study.

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## APPENDIX 4 - Methodology

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

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

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

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

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

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

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

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

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

### DETERMINATION OF THE PALAEOLOGICAL 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.

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**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

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

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

**Note:**

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

## **APPENDIX 5 -Summary of Specialist Expertise**

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

Jenna is 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 50 Heritage Impact Assessments throughout South Africa.

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## APPENDIX 2: Archaeological Assessment (2021)

# ARCHAEOLOGICAL SPECIALIST STUDY

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

## **Agricultural and Pivot Expansion near Luckhoff, Free State Province**

Prepared by



CTS HERITAGE

In Association with  
**Savannah Environmental**

May 2022



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## 1. INTRODUCTION

### 1.1 Background Information on Project

JN Venter Beleggings Trust is proposing the development of an expansion of a centre pivot irrigation farm on a site located Southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754. The total area on all three portions is 4800 ha, however only 2690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality. The agricultural development will entail the following at a minimum:

- Development of centre pivot areas (cultivation and irrigation)
- Construction of an abstraction pipeline from the existing irrigation canal
- Two water storage dams each with a proposed alternative
- A new pump stations
- A 9ha solar PV with alternatives and an 5MW overhead power line
- A Battery Energy Storage System

The current proposed water pipeline crossing will be approximately 68m downstream and north west of an existing road bridge crossing. It is proposed that ~2690ha will be transformed across the property for the establishment of the agricultural development. The proposed development will require the following infrastructure:

<b>Infrastructure</b>	<b>Purpose</b>
<b>315 mm PVC pipeline</b>	Water for the pivots will be sourced from the Oranje Riet Water User Association's canal pumped 6km underground through 2 x 1.4m fibreglass pipes, which will be extended by further 500 m to reach the pivots
<b>Centre Pivot Irrigation System</b>	The underground PVC pipeline will provide water to a centre pivot irrigation system. A centre pivot irrigation system is a moveable pipe structure which usually spans the length of a field and rotates around a pivot in the centre of the field. As the irrigation system rotates around its central pivot, it supplies water to crops through sprinklers along its length.
<b>Two Water Storage Systems</b>	Two main storage dams are proposed for utilization on the agricultural development. This dam system will feed the planned additional expansion
<b>Pump station</b>	A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams
<b>Solar PV area and overhead power line</b>	Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams



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<b>BESS</b>	A battery system will be used to collect any additional power generated by the PV facility for use as and h required.
-------------	---

## 1.2 Description of Property and Affected Environment

The area assessed for proposed expansion of centre pivot irrigation farming lies 13km southwest of the town of Luckhoff in the Free State Province and 9km northeast of the Orange River. A number of farming activities have taken place on the properties earmarked for more intensive crop production such as grazing ground for cattle and sheep as well as smaller scale crop agriculture closer to the various farm homesteads. The proposed development includes the construction of farm dams and water pipelines to bring sufficient water up from the Orange River and the various canal systems traversing the area further south where highly intensive maize production dominates the landscape either side of the Orange River. This production area forms a long corridor of agricultural activity for hundreds of kilometres.

The ground is relatively level with gentle slopes forming over calcretes set against a backdrop of more rugged terrain to the south east towards the Vanderkloof Dam. Acacia thorn trees are densely packed into the streams and riverways while grassland and shrub vegetation cover the majority of the ground. The R48 road linking Luckhof to the Havenga Bridge, a former National Monument (now a Provincial Heritage Site) divides one third of the development area from the rest of the proposed agricultural fields to the west of the R48. An abandoned farm lies in the eastern segment while the western portions span a number of small stream systems and floodplains. Wild game farming has also taken place and high game fences surround these properties that offer hunting and sale of breeding stock of buck and other game.





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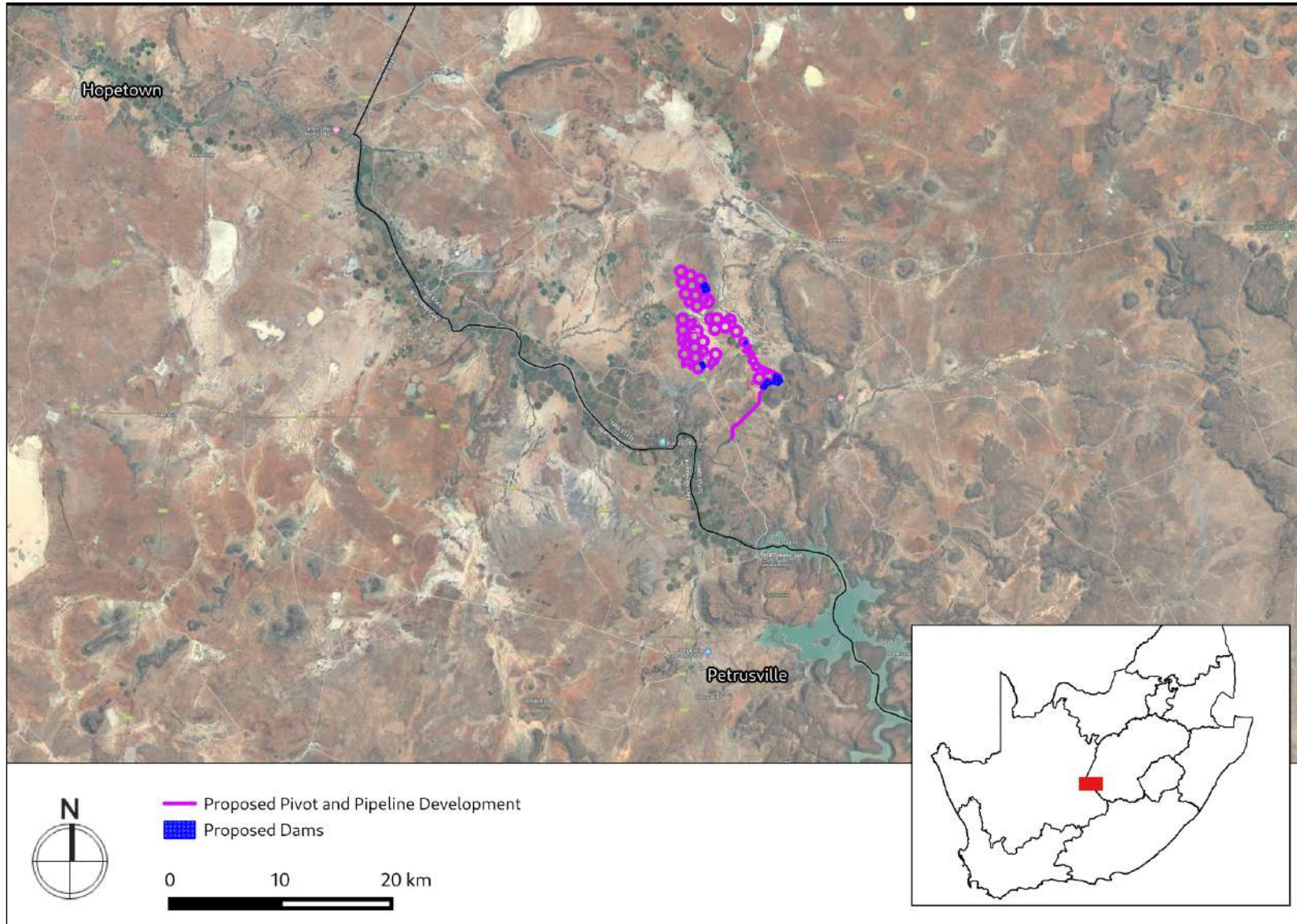


Figure 1.1: Close up satellite image indicating proposed location of study area



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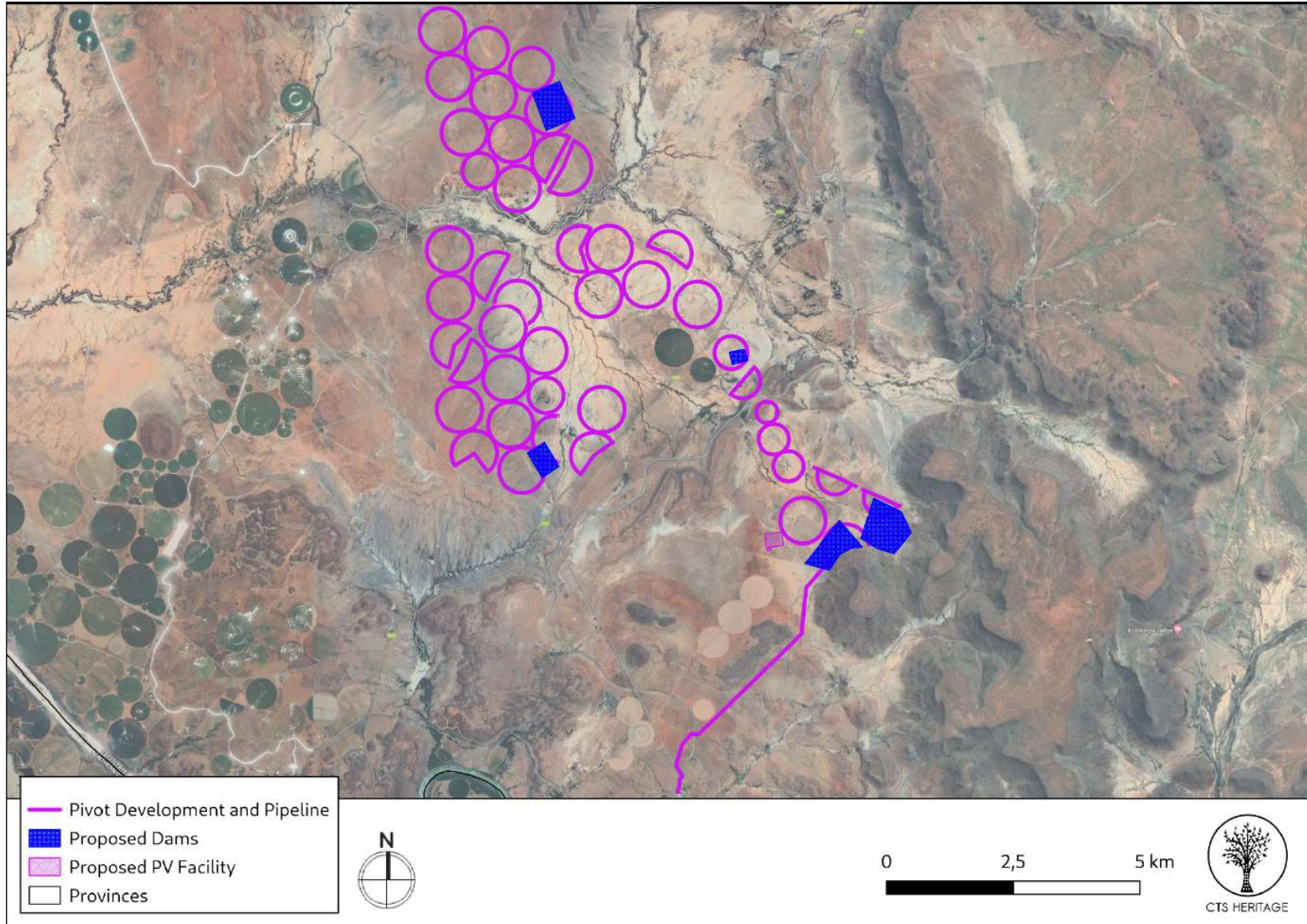


Figure 1.2: Study Area



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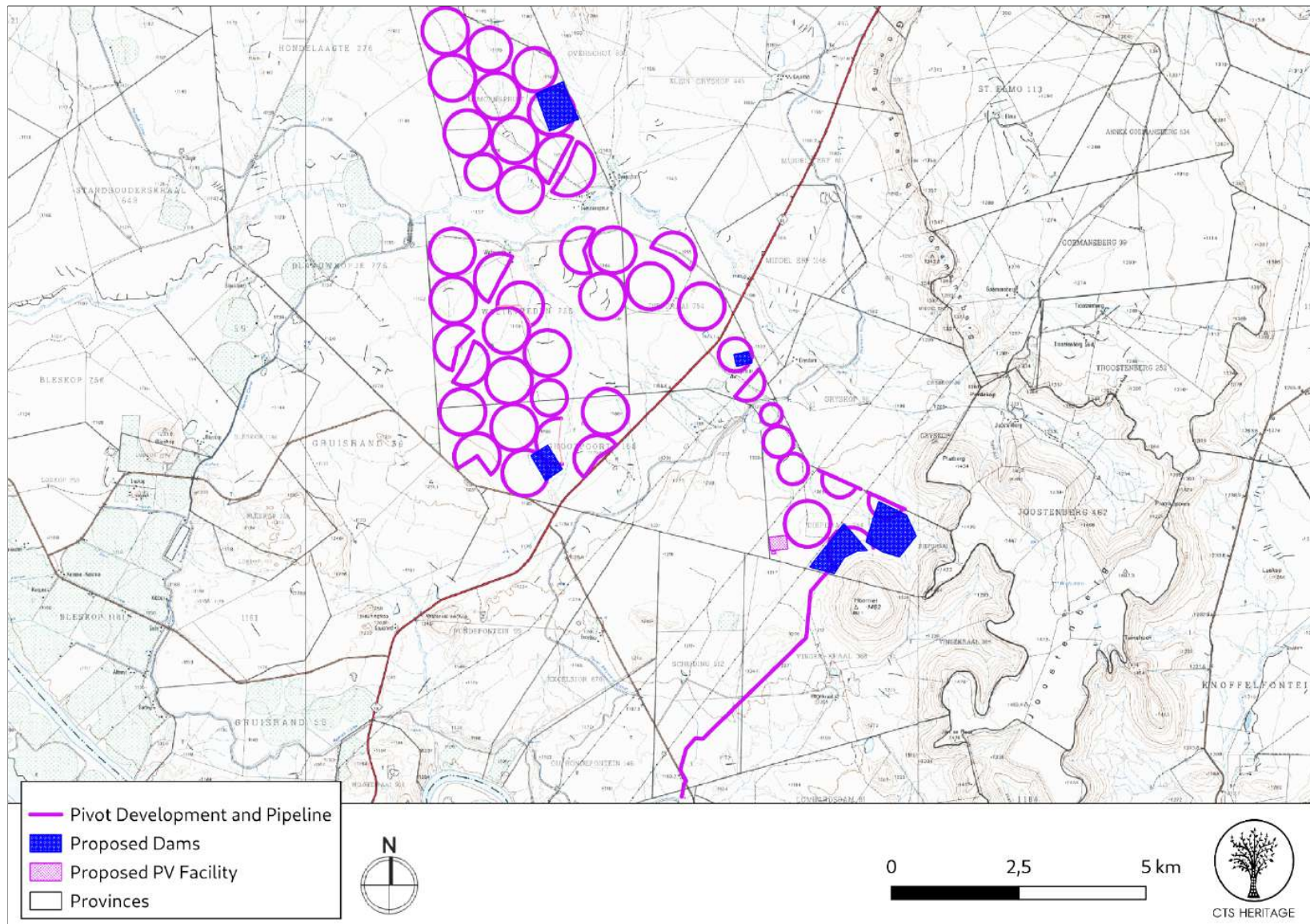


Figure 1.4: Study Area reflected on the 1:50 000 Topo Map



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## 2. METHODOLOGY

### 2.1 Purpose of Archaeological Study

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

### 2.2 Summary of steps followed

- An archaeologist conducted a survey of the site and its environs on 16-18 March 2022 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 context and finds were taken, and tracks were recorded using a GPS.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

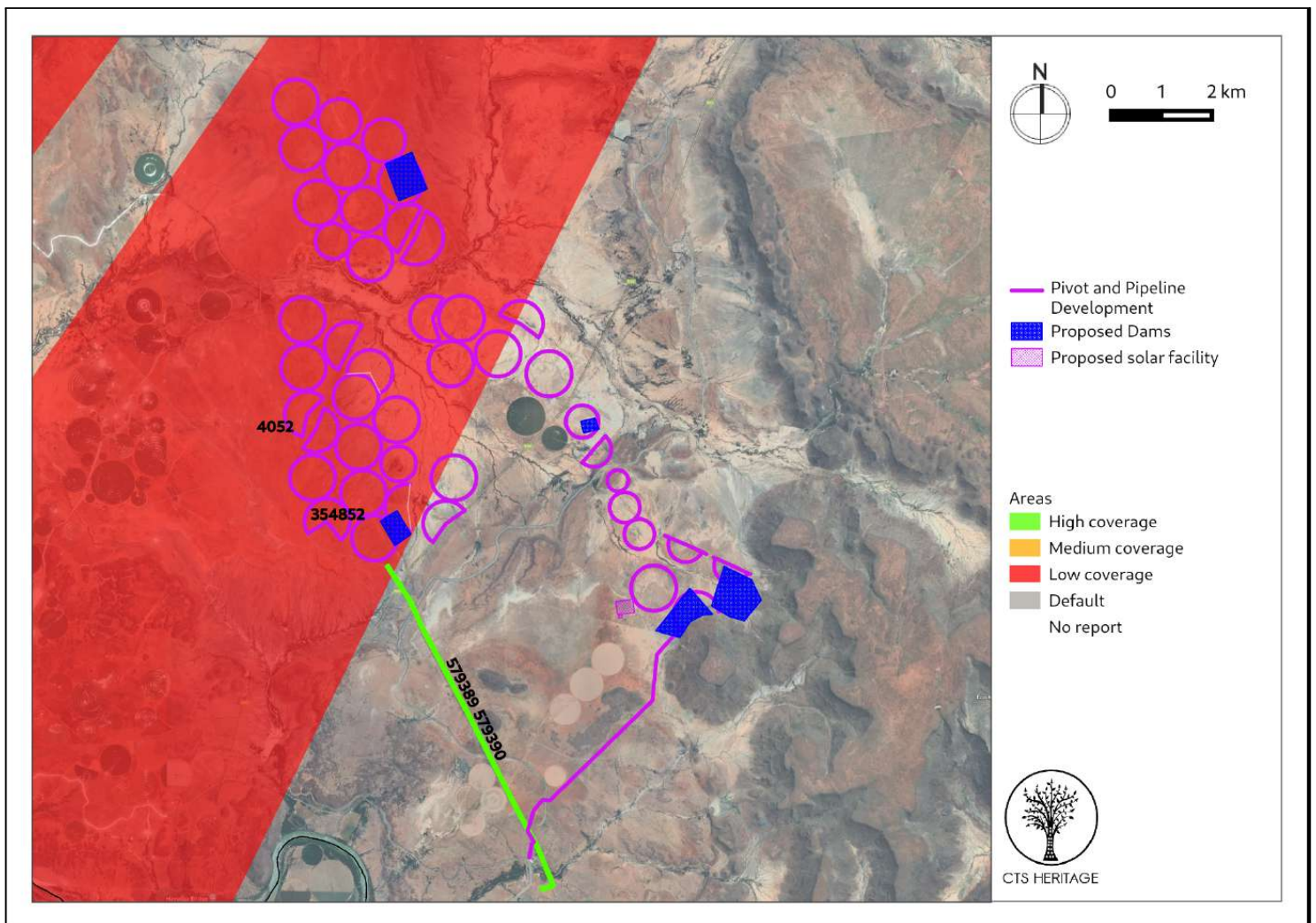


Figure 2: Close up satellite image indicating proposed location of the study area in relation to heritage studies previously conducted



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### 2.3 Constraints & Limitations

The survey took place in the summer rainfall season and dense reeds and grasses covered some areas that hold natural wetlands. However, much of the ground is not entirely covered in low shrubs and grassland and the archaeological visibility is relatively high. Much of the project area is relatively flat and easily traversed which enabled very high survey coverage to be achieved.

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

This application is for the proposed development of agricultural pivots, a dam and pipeline located in between Luckhoff and Vanderkloof Dam in the Free State. The area proposed for the development has been extensively transformed through agricultural activities. The nearest town to the proposed development is the town of Vanderkloof which has been established on the banks of the dam. The Vanderkloof dam was constructed in 1977. Neither the town nor the dam are anticipated to be negatively impacted by the proposed development, furthermore, the proposed development is largely agricultural in nature and as such, will contribute to the existing cultural landscape of the area.

#### Archaeology and the Built Environment

Very few Heritage Impact Assessments have been completed in the area according to the South African Heritage Resources Information System (SAHRIS, Figure 2) and very few heritage resources are known from the vicinity of the development (Figure 3). According to Morris (2008), “The Northern Cape has a wealth of archaeological sites (Beaumont & Morris 1990; Morris & Beaumont 2004), with locales along and adjacent to the major river systems being of particular significance. Stone Age material found in the broader region spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times. Late Holocene material with pottery is known to occur on the river banks, while rock engravings are richly distributed in the region (Wilman 1933; Fock & Fock 1989; Morris 1988). A particularly notable rock engraving is known from the farm Kraai Bosch, while others occur on the hills near Petrusville.”

In his assessment, Morris (2008) identified low significance Middle and Later Stone Age scatters of archaeological material. These finds correspond with the findings of Tusenius (2016) who noted that “Most of the archaeological remains recorded in the study area consist of a background scatter of weathered and patinated, typologically mixed Middle Stone Age (MSA)/ Later Stone Age (LSA) artefacts, with the former being more common. These artefacts occur dispersed within the surface gravels, rather than as discrete concentrations, and are in a secondary context in areas affected by sheet erosion. The fact that there appears to be no stratigraphic context and no organic remains are preserved would suggest that most of the proposed Kloofsig 1 development area is of low archaeological heritage sensitivity.” Three archaeological observations have been noted within the area proposed for pivot development - these are listed in Appendix 1. Two of these observations consist of very low density MSA archaeological scatters and the third reflects a corrugated iron shed.

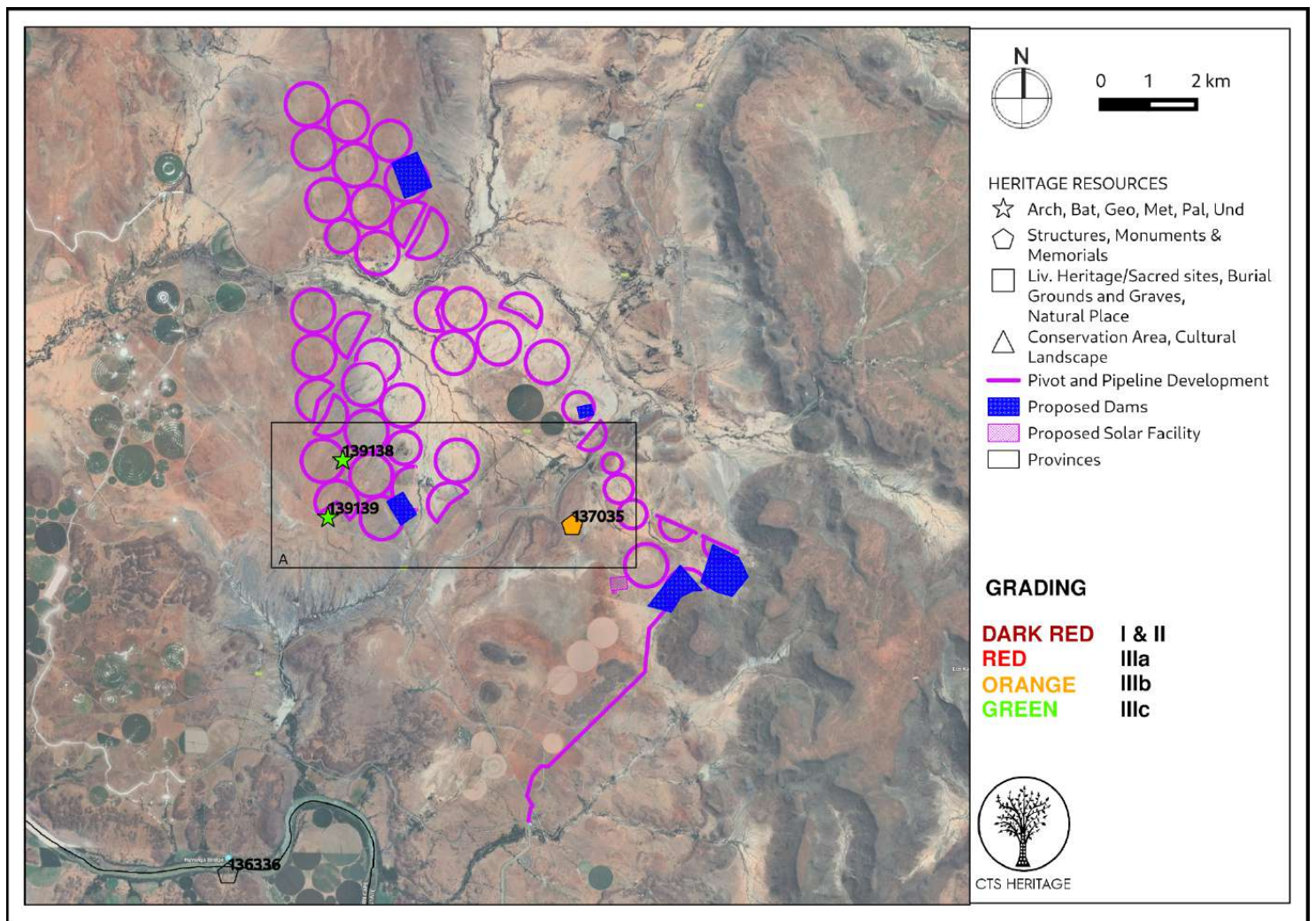
Based on the known archaeological sensitivity of the broader area as noted in these assessments, as well as known heritage resources located within the development area, it is likely that significant archaeological heritage will be impacted by the proposed development and as such, a field assessment is recommended.



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**Table 1: Heritage Resources located within the development area**

Site ID	Site no	Full Site Name	Description	Site Type	Grading
139138	GTP-001	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite	Artefacts	Grade IIIc
139139	GTP-002	Grootpoort	Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m <sup>2</sup> . The material used for the tools are hardened shale and lideanite.	Artefacts	Grade IIIc
137035	ZTF-011	Zoutpansfontein	This shed has been refurbished with a new corrugated iron roof. It was the processing and dispatch centre of grapes produced at what was then the largest wine-fields in South Africa and in the southern hemisphere. Operations ceased in the 1990s	Building	Grade IIIb



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



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## 4. IDENTIFICATION OF HERITAGE RESOURCES

### 4.1 Field Assessment

Most of the 70 observations made consisted of open air Middle Stone Age scatters of stone tools. Some Later Stone Age material was also observed along with historical/modern farm graves and ruined farm buildings. The stone tools are almost entirely made of locally sourced hornfels and siltstones which is typical of the area where these are highly abundant. Retouched blade forms and blade blanks were present across the study area as well as radial cores and various flakes with prepared platforms. The density and variety of Stone Age material definitely increased towards the banks and floodplain of the Lemoenspruit while much of the rest of the area held isolated and generally dispersed archaeological material. The Havenga Bridge spans the Orange/Gariep River and was built in 1934. The bridge features Scottish steel trusses and has been vandalised - the plaque has been stolen and one beam is bent.

The farm graves are not well marked and will require some careful planning in creating a site development plan which formalises the area around these locations. The ruined homestead at Diepdraai is already intersected by relatively clear farm roads and infrastructure and is unlikely to be negatively affected by the development of the agricultural fields.



Figure 4.1: Contextual Images



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Figure 4.2: Contextual Images



Figure 4.3: Contextual Images





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Figure 4.4: Contextual Images



Figure 4.5: Contextual Images



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Figure 4.6: Contextual Images



Figure 4.7: Contextual Images



Figure 4.8: Contextual Images



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Figure 4.9: Contextual Images



Figure 4.10: Contextual Images



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Figure 4.11: Contextual Images



Figure 4.12: Contextual Images



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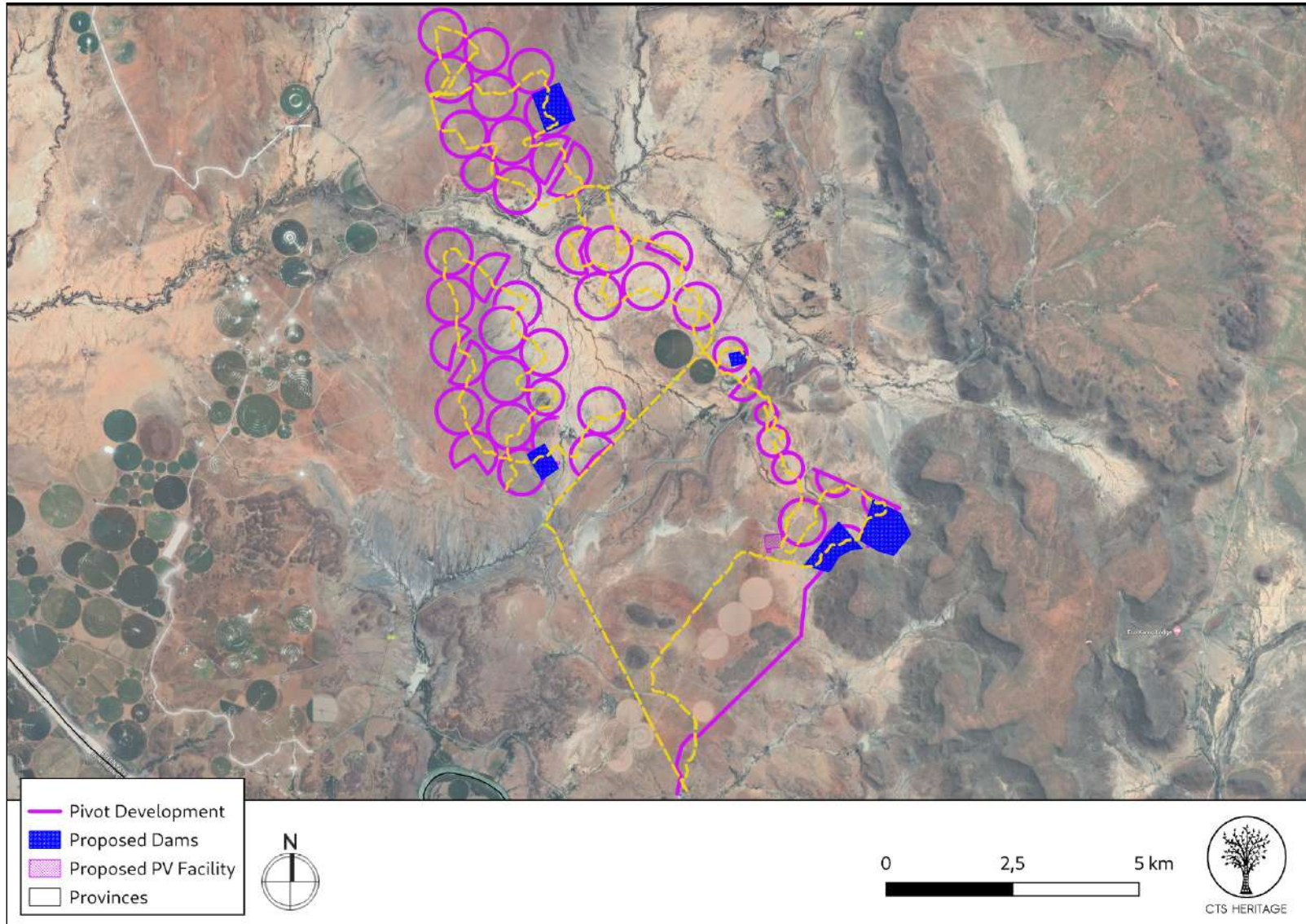


Figure 5.1: Overall track paths of foot survey



## 4.2 Archaeological Resources identified

Table 2: Observations noted during the field assessment

Site No.	Site Name	Description	Density m2	Period	Co-ordinates		Grading	Mitigation
001	Diepdraai001	Hornfels cores and flakes on side of the road	5 to 10	LSA, MSA	-29.899978	24.702612	NCW	NA
002	Diepdraai002	Lots of hornfels flakes and cores eroding out of banks	10 to 30	LSA, MSA	-29.898195	24.703325	NCW	NA
003	Diepdraai003	More hornfels flakes out of context next to canal	0 to 5	MSA	-29.896489	24.70356	NCW	NA
004	Diepdraai004	More hornfels flakes out of context next to canal, cores	0 to 5	MSA	-29.894174	24.705007	NCW	NA
005	Diepdraai005	Hornfels flakes out of context	0 to 5	MSA	-29.889546	24.705129	NCW	NA
006	Diepdraai006	Patinated hornfels flakes	0 to 5	MSA	-29.87876056	24.69706588	NCW	NA
007	Diepdraai007	Hornfels core flake	0 to 5	MSA	-29.86833993	24.70662262	NCW	NA
008	Diepdraai008	Hornfels flake and broken core	0 to 5	MSA	-29.86088891	24.72163265	NCW	NA
<b>009</b>	<b>Diepdraai009</b>	<b>At least two clear marked graves, one in stones, the other with bricks and fencing. Bottles with flower dedications strewn around, labourers graves most likely, unnamed. Probably more graves x 2 due to bottles</b>	<b>n/a</b>	<b>Modern/historic</b>	<b>-29.82597</b>	<b>24.71001</b>	<b>IIIA</b>	<b>100m Buffer area around site</b>
010	Diepdraai010	Hornfels flakes, prominent bulbs of percussion	5 to 10	MSA	-29.82529	24.71005	NCW	NA
011	Diepdraai011	Dilapidated farmhouse complex	n/a	Modern	-29.82784441	24.71196623	NCW	NA
012	Diepdraai012	Hornfels flakes, debitage	0 to 5	MSA	-29.82379	24.7103	NCW	NA
013	Diepdraai013	Hornfels flake patinated	0 to 5	MSA	-29.82329	24.71391	NCW	NA
014	Diepdraai014	Various patinated hornfels flakes	5 to 10	MSA	-29.8273	24.71571	NCW	NA
015	Diepdraai015	Exposed sandy grazed area with hornfels flakes, retouched	10 to 30	MSA	-29.82916	24.71553	NCW	NA
016	Diepdraai016	Hornfels core	0 to 5	MSA	-29.83319	24.71972	NCW	NA
017	Diepdraai017	Patinated hornfels flake	0 to 5	MSA	-29.8356	24.72002	NCW	NA
018	Diepdraai018	Patinated hornfels flake with edge retouch	0 to 5	MSA	-29.84150546	24.72147067	NCW	NA
019	Diepdraai019	Hornfels core and patinated flake	0 to 5	MSA	-29.84533895	24.72438629	NCW	NA
020	Diepdraai020	Hornfels flake with prominent bulb of percussion, dorsal scars	0 to 5	MSA	-29.85430178	24.72373837	NCW	NA
021	Diepdraai021	Hornfels core and large unifacial point	0 to 5	MSA	-29.85949859	24.72464275	NCW	NA
022	Diepdraai022	Hornfels flake, weathered	0 to 5	MSA	-29.85820276	24.73332211	NCW	NA



023	Diepdraai023	Dark hornfels, fine grained, blade and edge scraper	0 to 5	MSA	-29.85204757	24.74393172	NCW	NA
024	Diepdraai024	Hornfels flake with dorsal scars	0 to 5	MSA	-29.84986086	24.74053017	NCW	NA
025	Diepdraai025	Silcrete core, hornfels core and weathered hornfels flake	0 to 5	MSA, LSA	-29.84791711	24.73510388	NCW	NA
026	Diepdraai026	Sharp hornfels point with some retouch	0 to 5	LSA	-29.83908927	24.72295547	NCW	NA
027	Diepdraai027	Siltstone core and hornfels flake	0 to 5	MSA	-29.83062	24.71739	NCW	NA
<b>028</b>	<b>Diepdraai028</b>	<b>Havenga Bridge built in 1934. Scottish steel trusses. Plaque stolen and one beam bent. There's mention of additions made in 1990s, perhaps the overhead trusses but can't be sure without research. Spans the Orange/Gariep River.</b>	<b>n/a</b>	<b>Historic</b>	<b>-29.91090935</b>	<b>24.63635735</b>	<b>IIIA</b>	<b>Outside of development area - no impacts anticipated</b>
029	Diepdraai029	Hornfels flakes and core	0 to 5	MSA	-29.81953	24.70469	NCW	NA
030	Diepdraai030	Various patinated hornfels flakes, early MSA	0 to 5	MSA	-29.81768	24.70591	NCW	NA
031	Diepdraai031	Another hard pan area with deflated, patinated hornfels flakes	10 to 30	MSA	-29.81442	24.70624	NCW	NA
032	Diepdraai032	Hornfels point flake and retouched flake	0 to 5	MSA	-29.80965	24.70231	NCW	NA
033	Diepdraai033	Hornfels cores	0 to 5	LSA	-29.80498	24.69952	NCW	NA
034	Diepdraai034	Patinated hornfels flake	0 to 5	MSA	-29.80632	24.6898	NCW	NA
035	Diepdraai035	Hornfels flakes, previous scars visible	0 to 5	MSA	-29.80401	24.67913	NCW	NA
036	Diepdraai036	Patinated hornfels flake	0 to 5	MSA	-29.8085	24.68077	NCW	NA
037	Diepdraai037	Hornfels flakes	0 to 5	MSA	-29.81423	24.68691	NCW	NA
038	Diepdraai038	Thinly struck prepared platform flakes, hornfels	0 to 5	MSA	-29.81305	24.69367	NCW	NA
039	Diepdraai039	Hornfels blade	0 to 5	MSA	-29.79467	24.682	NCW	NA
040	Diepdraai040	Farmhouse complex, heavily altered	n/a	Historic/modern	-29.79587	24.68222	NCW	NA
<b>041</b>	<b>Diepdraai041</b>	<b>Stone covered farm workers graves x 3 clear, apparently 7, graves in veld, green grass marks area near eskom 33kV poles</b>	<b>n/a</b>	<b>Historic</b>	<b>-29.79571</b>	<b>24.67954</b>	<b>IIIA</b>	<b>100m Buffer area around site</b>
042	Diepdraai042	Kraal, jojo	n/a	Modern	-29.79399	24.67081	NCW	NA
043	Diepdraai043	Thinly struck hornfels blade flake	0 to 5	MSA	-29.79227	24.66346	NCW	NA
044	Diepdraai044	Long hornfels blade flake	0 to 5	MSA	-29.78866	24.66403	NCW	NA
045	Diepdraai045	Hornfels flakes prepared platform	0 to 5	MSA	-29.78721	24.66152	NCW	NA
046	Diepdraai046	Hornfels point edge retouch	0 to 5	MSA	-29.77742	24.65296	NCW	NA
047	Diepdraai047	hornfels patinated triangular	0 to 5	MSA	-29.77166	24.6529	NCW	NA



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		flake						
048	Diepdraai048	Ccs core	0 to 5	LSA	-29.7662	24.65252	NCW	NA
049	Diepdraai049	Patinated hornfels flake	0 to 5	MSA	-29.76767	24.65778	NCW	NA
050	Diepdraai050	Patinated hornfels flake microlith	0 to 5	MSA	-29.77798	24.65383	NCW	NA
051	Diepdraai051	Hornfels flake	0 to 5	MSA	-29.77722	24.65865	NCW	NA
052	Diepdraai052	Hornfels core	0 to 5	LSA	-29.7781	24.66614	NCW	NA
053	Diepdraai053	Patinated hornfels flakes	0 to 5	MSA	-29.77417	24.67383	NCW	NA
054	Diepdraai054	Hornfels cores	0 to 5	LSA	-29.78011	24.67409	NCW	NA
055	Diepdraai055	Large hornfels flake retouched	0 to 5	MSA	-29.78716	24.67674	NCW	NA
056	Diepdraai056	Hornfels pointed flake	0 to 5	LSA	-29.83529922	24.68844504	NCW	NA
057	Diepdraai057	Hornfels core and long flake blade	0 to 5	MSA	-29.84098853	24.68112005	NCW	NA
058	Diepdraai058	Chalky hornfels unifacial point	0 to 5	MSA	-29.84222121	24.67495663	NCW	NA
059	Diepdraai059	Early MSA patinated hornfels flake with retouch and secondary scarring on one end	0 to 5	MSA	-29.84335907	24.67223051	NCW	NA
060	Diepdraai060	Array of patinated hornfels flakes and cores	5 to 10	MSA	-29.83937655	24.6596192	NCW	NA
061	Diepdraai061	Hornfels flake blank and flake with ventral surface worked	0 to 5	MSA	-29.83378207	24.65724866	NCW	NA
062	Diepdraai062	Flake blades and blanks, hornfels, weathered, edge retouch	0 to 5	MSA	-29.82098112	24.65630044	NCW	NA
063	Diepdraai063	Hornfels point	0 to 5	MSA	-29.81605038	24.65639526	NCW	NA
064	Diepdraai064	Hornfels core and flake, some edge retouch	0 to 5	MSA	-29.81102483	24.66293797	NCW	NA
065	Diepdraai065	Hornfels flake, possibly earlier radial core re-used	0 to 5	MSA	-29.81842093	24.6678687	NCW	NA
066	Diepdraai066	Triangular hornfels flake and siltstone flake	0 to 5	MSA	-29.82335166	24.67279944	NCW	NA
067	Diepdraai067	Patinated hornfels flake	0 to 5	MSA	-29.82970473	24.66853246	NCW	NA
068	Diepdraai068	Hornfels flake with curved dorsal spine	0 to 5	MSA	-29.83055812	24.67583374	NCW	NA
069	Diepdraai069	Hornfels flakes, triangular with edge retouch	0 to 5	MSA	-29.83672154	24.67071336	NCW	NA
070	Diepdraai070	Hornfels flake	0 to 5	MSA	-29.84710453	24.66663602	NCW	NA





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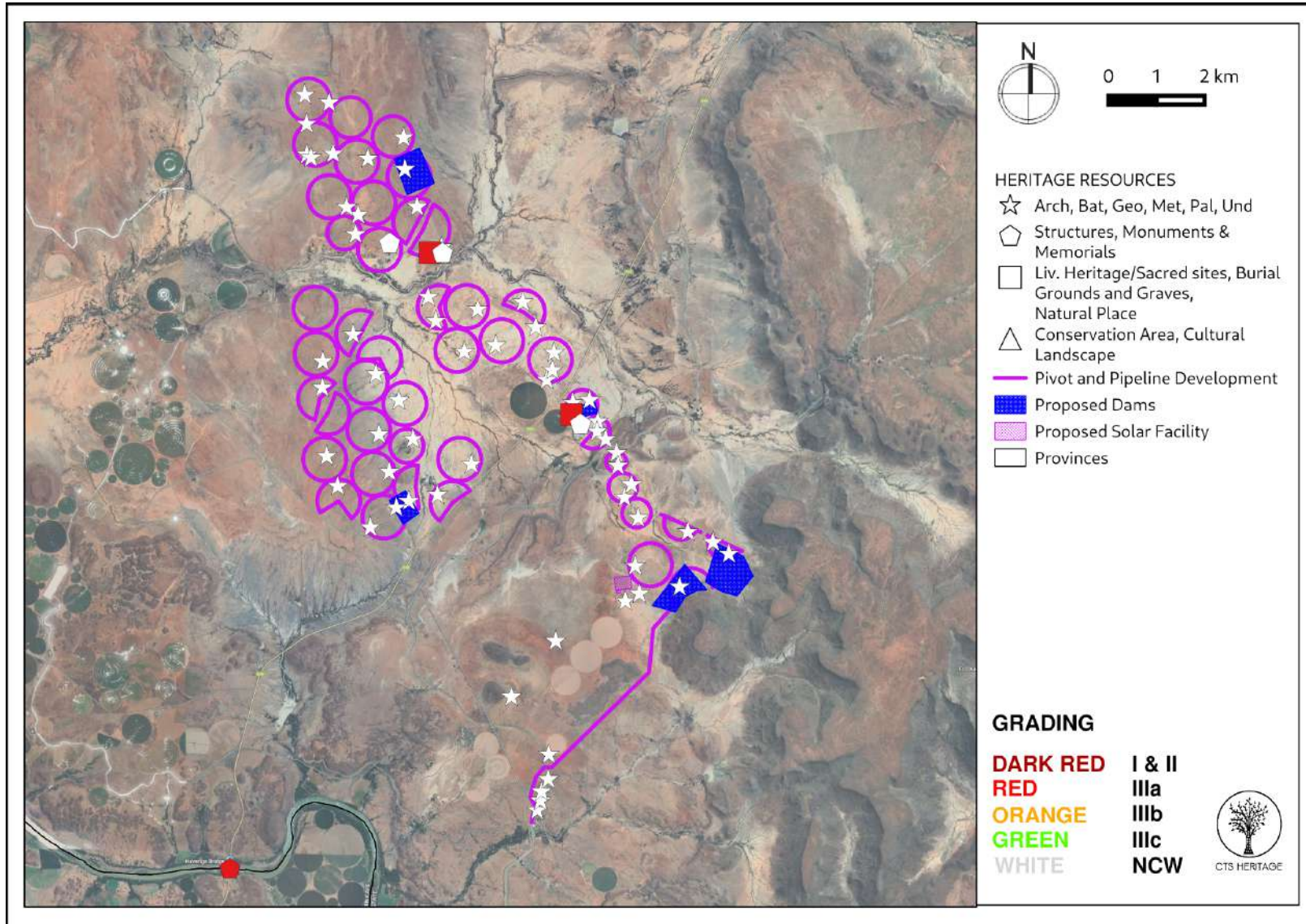


Figure 6.1: Map of field observations relative to the proposed development



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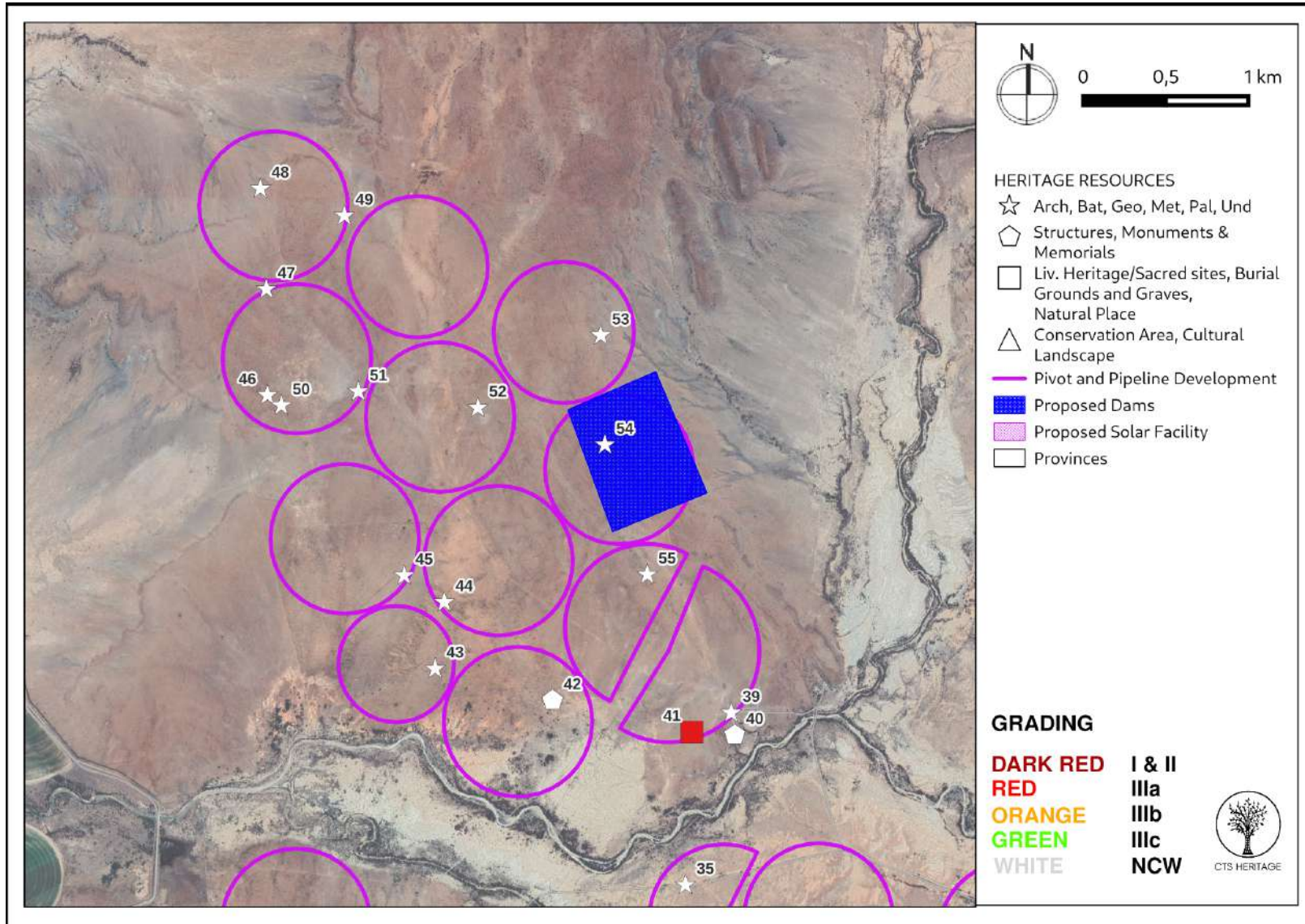


Figure 6.2: Map of field observations relative to the proposed development



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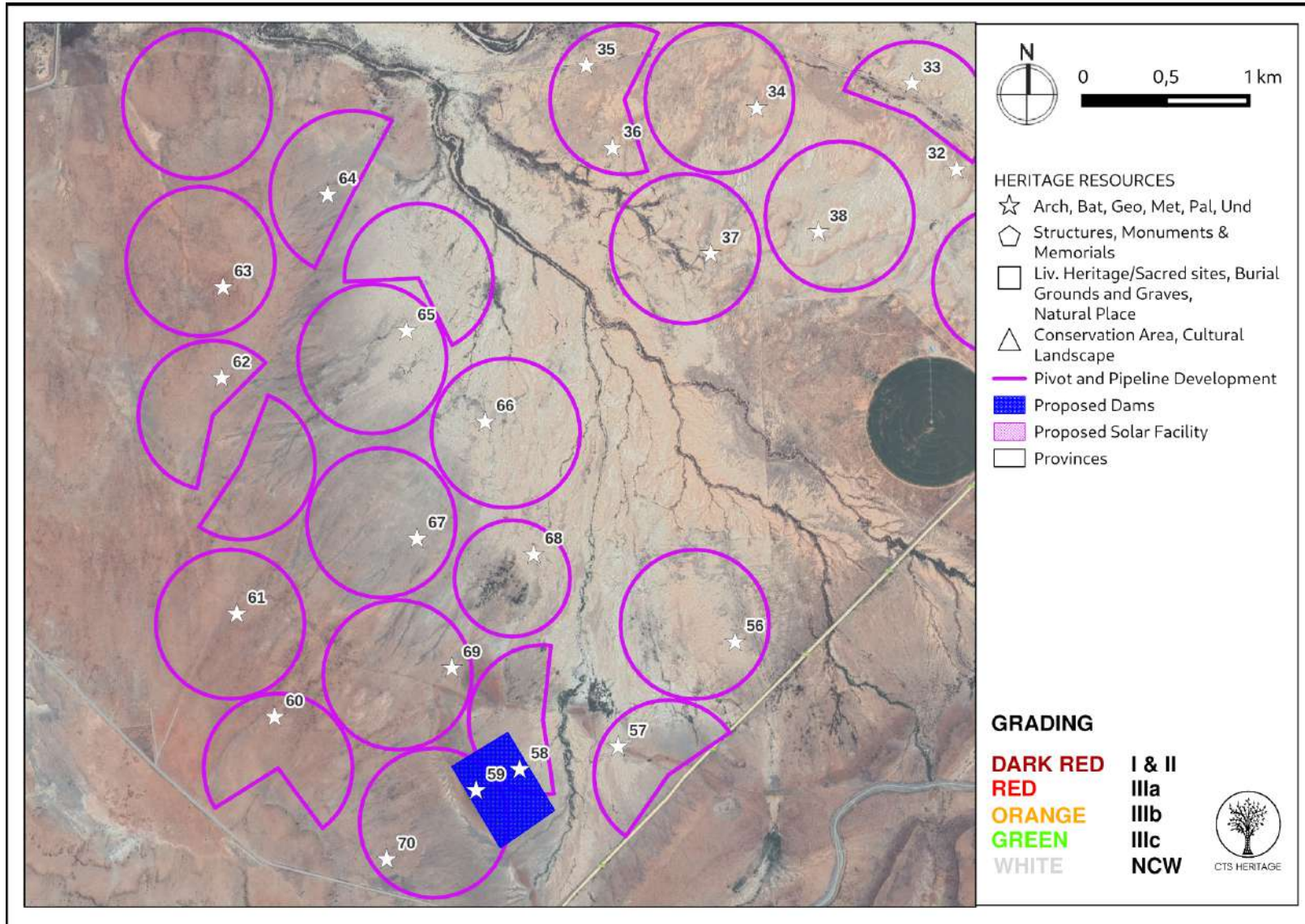


Figure 6.3: Map of field observations relative to the proposed development



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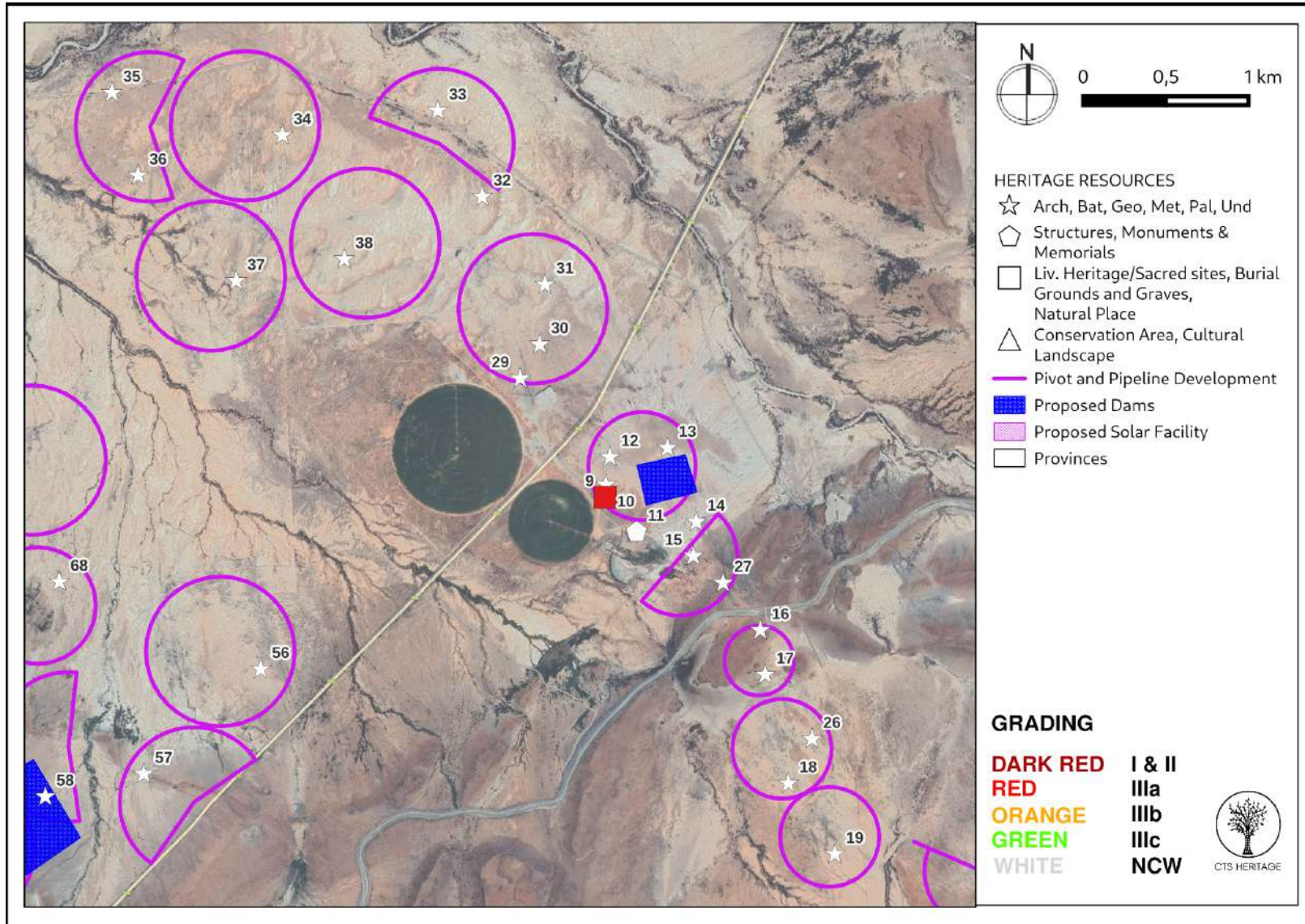


Figure 6.4: Map of field observations relative to the proposed development



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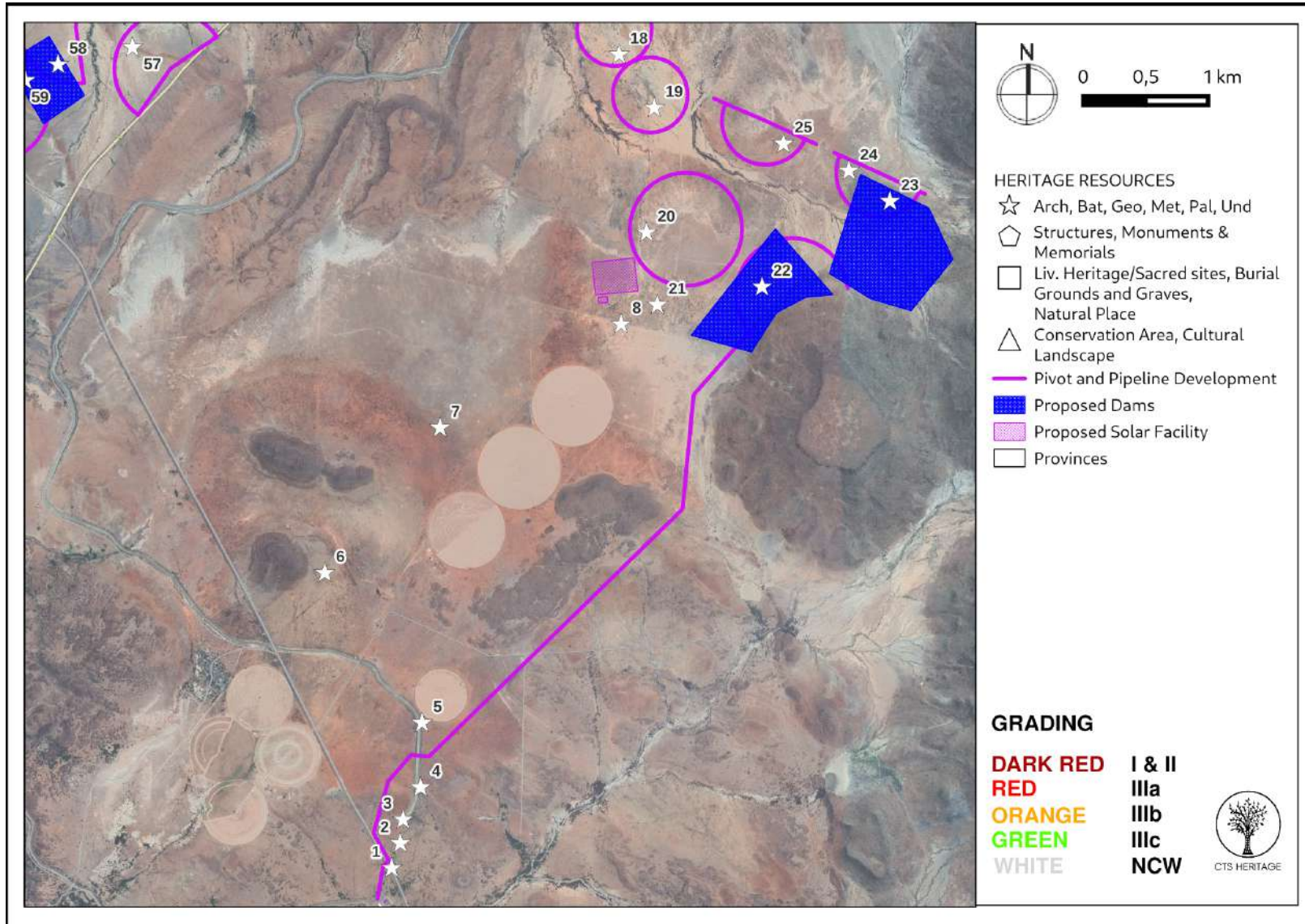


Figure 6.5: Map of field observations relative to the proposed development



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### 4.3 Selected photographic record

(a full photographic record is available upon request)



Figure 7.1: Observation 002



Figure 7.2: Observation 009



Figure 7.3: Observation 014



Figure 7.4: Observation 020



Figure 7.5: Observation 025



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Figure 7.6: Observation 028



Figure 7.7: Observation 035 and 036



Figure 7.8: Observation 041





Figure 7.9: Observation 050



Figure 7.10: Observation 060 and 062



Figure 7.11: Observation 070



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## **5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT**

### **5.1 Assessment of impact to Archaeological Resources**

Only one site of archaeological significance was identified within the proposed development area in a previous archaeological assessment conducted by Van Schalkwyk in 2015. SAHRIS Site 139138 is graded IIIC and is described as “Two localised areas, associated with small outcrops, where thin scatters of MSA tools and flakes were identified. The density of the material is approximately 1 artefact/flake per 10m<sup>2</sup>. The material used for the tools are hardened shale and lideanite.” Van Schalkwyk (2015) goes on to conclude that “as the density of the scatter is very low, as well as the fact that it is surface material and therefore not in its original context any more, it is viewed to have a low significance and it is judged that the impact would be very low” and no recommendations for mitigation are provided.

As such, we reiterate the findings of Van Schalkwyk (2015) as they pertain to this site and as such, no mitigation measures are recommended in this report. There is no objection to the destruction of this site in terms of its archaeological significance.

In the field assessment conducted in 2022, all of the archaeological resources observed were determined to be low density surface scatters. As such, these sites have limited scientific value beyond their recording as per this report. To this end, these resources are determined to be Not Conservation-Worthy (NCW) and there is no objection to their impact as a result of this development.

Two burial sites were identified within the development footprint (Observation 009 and 041), graded IIIA due to their high levels of social and spiritual significance. Both of these burial grounds are located within the boundaries of the proposed development footprint and if the development proceeds as intended, it is likely that these burial sites will be negatively impacted. As such, it is recommended that a no-impact buffer of 100m is implemented around each of these sites in order to ensure that the burials are not disturbed and to maintain a semblance of sense of place associated with the burial sites. In the maps below, there are recommended pivot exclusion areas indicated as well as the recommended buffers.

The Havenga Bridge, originally constructed in 1934, was identified as a structure of high local significance for its architectural significance and as such, has been graded IIIA. This site is located well outside of the development area and no impact is anticipated.



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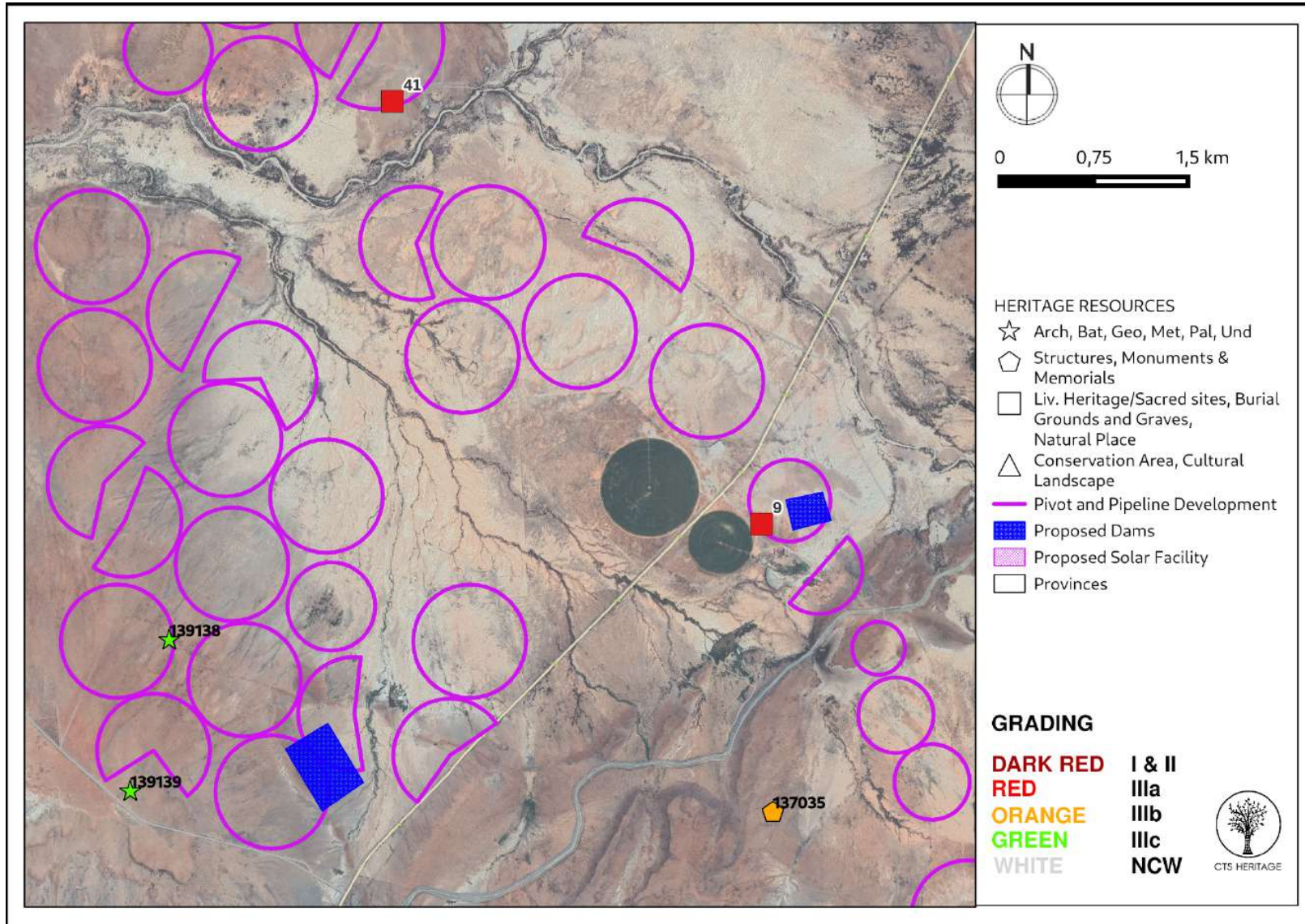


Figure 71: Map of significant sites relative to proposed development



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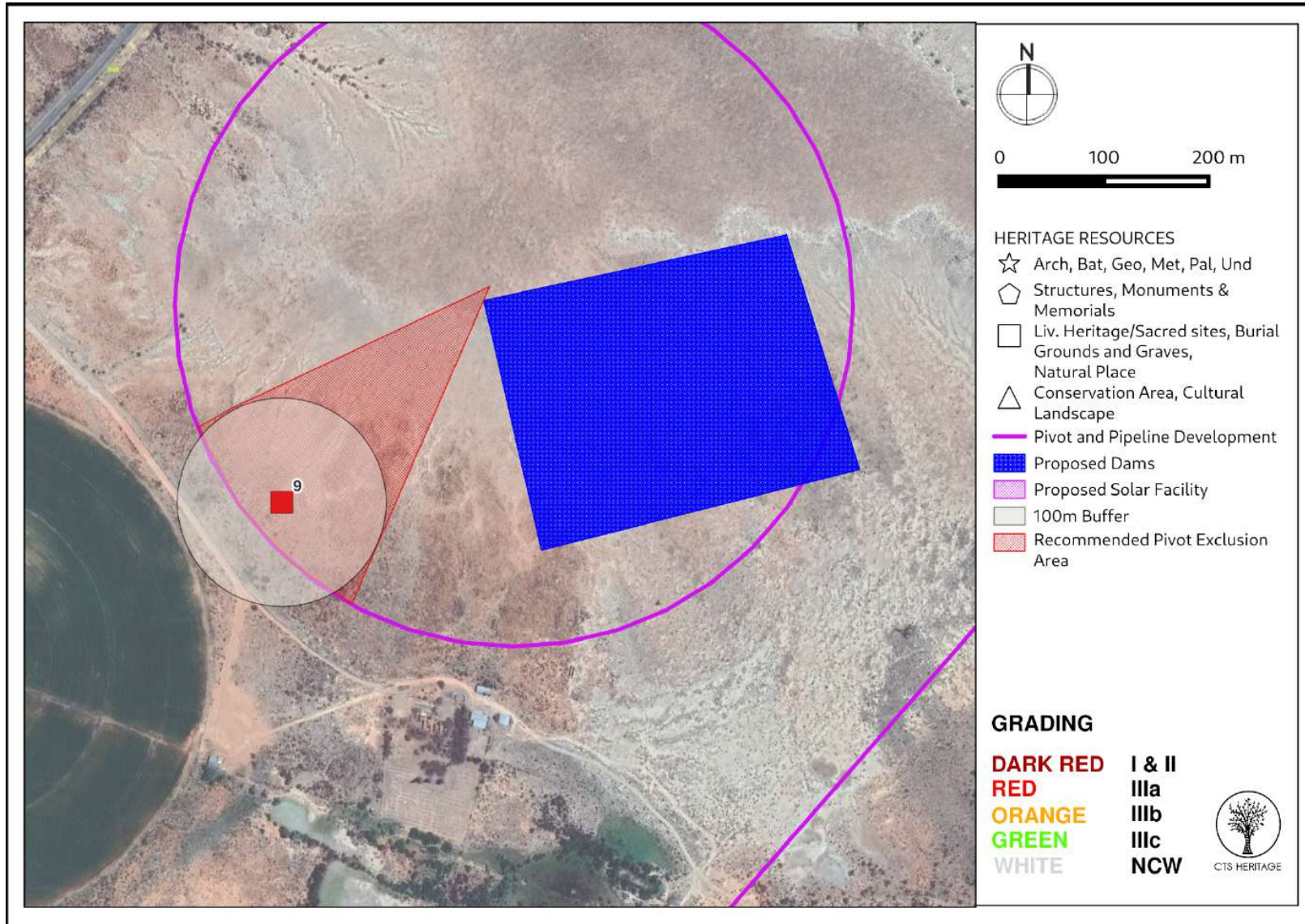


Figure 7.2: Map of significant sites relative to proposed development with recommended mitigation for Observation 09



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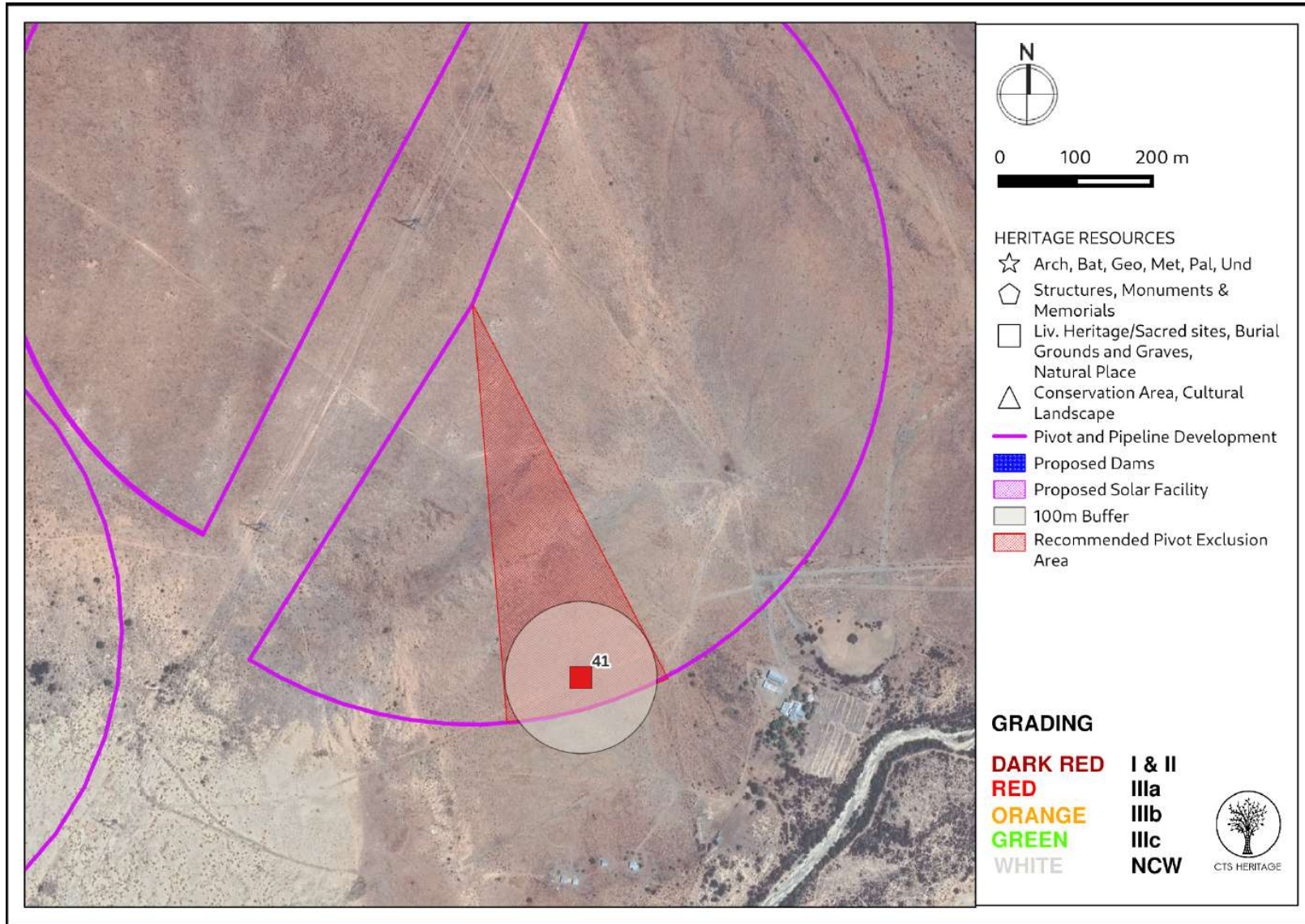


Figure 7.3: Map of significant sites relative to proposed development with recommended mitigation for Observation 041



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## 6. CONCLUSION AND RECOMMENDATIONS

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage.

As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant.

### ***Recommendations***

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

- A no-impact buffer of 100m is implemented around Observations 009 and 041 as per Figures 7.2 and 7.3
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



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## 7. REFERENCES

Heritage Impact Assessments				
Nid	Report Type	Author/s	Date	Title
354852	Heritage Impact Assessment Specialist Reports	Johnny Van Schalkwyk		Cultural Heritage Impact Assessment for the proposed Grootpoort Photovoltaic Solar Energy development Facility nearr Luckhoff, Letsemeng Local Municipality, Free State Province.
364728	PIA Desktop	John E. Almond	01/06/2016	PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY PROPOSED GROOTPOORT PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR LUCKHOFF, FREE STATE PROVINCE
4052	HIA Phase 1	Albert van Jaarsveld	01/03/2006	Hydra-Perseus and Beta-Perseus 765 kV Transmission Power Lines Environmental Impact Assessment. Impact on Cultural Heritage Resources
579389	Letter of Exemption	CTS Heritage	02/08/2021	Desktop Heritage Screening Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State
579390	PIA Desktop	Marion Bamford	29/07/2021	Desktop Palaeontology Assessment: Proposed development of the Grootpoort OHL near Luckhoff in the Free State



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### APPENDIX 3: Palaeontological Assessment (2016)



**Palaeontological Impact Assessment for  
the proposed Agricultural and Pivot  
Expansion near Luckhoff, Free State  
Province**

**CTS22\_028**

**Desktop Study (Phase 1)**

**For**

**CTS Heritage**

**31 May 2022**

**Prof Marion Bamford**

Palaeobotanist

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## **Expertise of Specialist**

The Palaeontologist Consultant: Prof Marion Bamford  
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf  
Experience: 33 years research and lecturing in Palaeontology  
25 years PIA studies and over 300 projects completed

## **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 agricultural and pivot irrigation expansion on three farms to the southwest of Luckhoff, western Free State Province. The farms are Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754.

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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the non-fossiliferous Jurassic dolerite, moderately fossiliferous Quaternary calcrete and potentially fossiliferous Tierberg Formation (Ecca Group, Karoo Supergroup) that might have traces fossils of invertebrates. 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 by the contractor, environmental officer or other designated responsible person once excavations have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

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## i. Background

JN Venter Beleggings Trust is proposing the expansion of a centre pivot irrigation farm on a site located southwest of Luckhoff and Koffiesfontein in the Free State Province. The proposed area of development is accessible via the R48. This expansion will be developed on farms Weltevreden 755, Lemoen-spruit 667 and Diepdraai 754. The total area on all three portions is 4800 ha, however only 2690 ha is proposed for development. The study area falls within the Letsemeng Local Municipality within the Xhariep District Municipality. The agricultural development will entail the following at a minimum:

- Development of centre pivot areas (cultivation and irrigation)
- Construction of an abstraction pipeline from the existing irrigation canal
- Two water storage dams each with a proposed alternative
- A new pump station
- A 9ha solar PV with alternatives and an 5MW overhead power line
- A Battery Energy Storage System

The current proposed water pipeline crossing will be approximately 68m downstream and northwest of an existing road bridge crossing. It is proposed that ~2690ha will be transformed across the property for the establishment of the agricultural development.

The proposed development will require the following infrastructure:

**315 mm PVC pipeline** - Water for the pivots will be sourced from the Oranje Riet Water User Association's canal pumped 6km underground through 2 x 1.4m fibreglass pipes, which will be extended by further 500 m to reach the pivots

**Centre Pivot Irrigation System** - The underground PVC pipeline will provide water to a centre pivot irrigation system. A centre pivot irrigation system is a moveable pipe structure which usually spans the length of a field and rotates around a pivot in the centre of the field. As the irrigation system rotates around its central pivot, it supplies water to crops through sprinklers along its length.

**Two Water Storage Systems** - Two main storage dams are proposed for utilization on the agricultural development. This dam system will feed the planned additional expansion.

**Pump station** - A new pumpstation will facilitate the required water from the Oranje Riet canal to the proposed storage dams

**Solar PV area and overhead power line** - Solar PV is proposed as the main energy source for the pump and pipeline system which will irrigate the entire development area as well as the dams

**BESS** - A battery system will be used to collect any additional power generated by the PV facility for use as and when required.

A Palaeontological Impact Assessment was requested for the proposed pivot irrigation expansion project. 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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6).

	<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:</b>	<b>Relevant section in report</b>
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	Yes
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
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section ii.
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	N/A
h	A map superimposing the activity including the associated structures and	N/A

	<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:</b>	<b>Relevant section in report</b>
	infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	
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	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
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	Sections 6, 8
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 of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A



**Figure 1: Google Earth map of the general area to show the relative land marks. The project area is shown within the yellow polygon.**





**Figure 2: Google Earth Map of the proposed expansion of the pivot irrigation and dams within the yellow polygon but see Figure 3 for detail.**

## ii. Methods and Terms of Reference

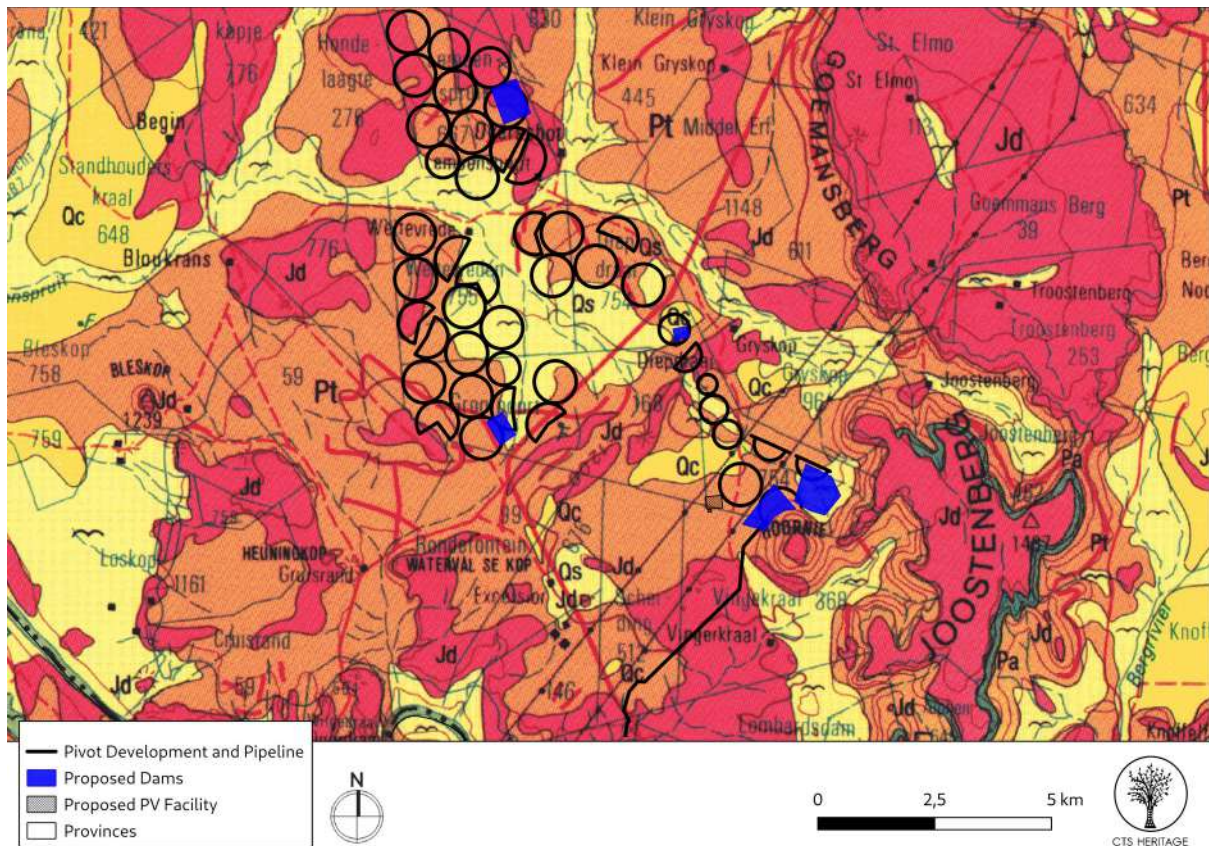
The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

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 (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

## iii. Geology and Palaeontology

### iv. Project location and geological context



**Figure 3: Geological map of the area for the pivot irrigation expansion with the features as in the legend. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2924 Koffiefontein.**

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

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Quaternary ca 1 Ma to present
Qc	Quaternary calcrete	Sand, calcrete	Quaternary ca 1 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pt	Tierberg Fm, Ecca Group, Karoo SG		Early Permian ca 270 Ma

The project lies in the western part of the main Karoo Basin where the older rocks of the Karoo sequence are exposed. Much younger sands and calcrete of the Quaternary unconformably overlie the Tierberg shales.

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa (Visser, 1986, 1989; Isbell et al., 2012). Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the Dwyka Group (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the west and central part are the following formations, from base upwards: Prince Albert Formation, Whitehill Formation, Collingham Formation, Laingsburg / Ripon Formations, Tierberg / Fort Brown Formations, and Waterford Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

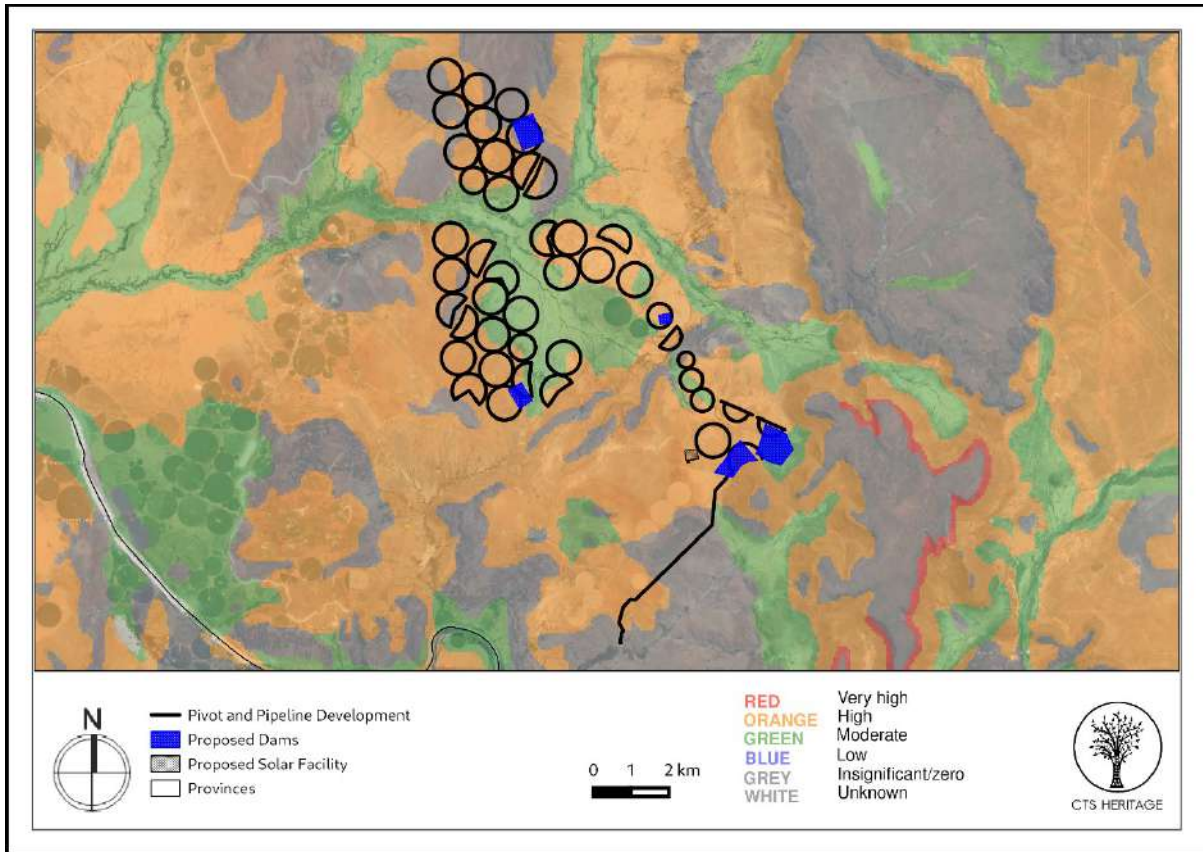
Large exposures of Jurassic dolerite dykes occur throughout the area. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption.

The Quaternary Kalahari sands form an extensive cover of much younger deposits over much of the Northern Cape Province and Botswana and part of the Free State. Uplift during the Pliocene caused erosion of the sand that was then reworked and redeposited by aeolian processes during drier periods, resulting in the extensive dune fields that are preserved today. There are numerous pans in the Kalahari, generally 3–4 km in diameter (Haddon and McCarthy, 2005). According to Goudie and Wells (1995) there are two conditions required for the formation of pans. Firstly, the fluvial processes must not be integrated, and second, there must be no accumulation of aeolian material that would fill the irregularities or depressions in the land surface. Favoured materials or substrates for the formation of pans in South Africa are Dwyka and Ecca shales and sandstones (ibid).

Overlying many of these rocks are loose sands and sand dunes of the Gordonia Formation, Kalahari Group of Neogene Age. The Gordonia Formation is the youngest of six formations and is the most extensive, stretching from the northern Karoo, Botswana, Namibia to the Congo River (Partridge et al., 2006). It is considered to be the biggest palaeo-erg in the world (ibid). The sands have been derived from local sources with some additional material transported into the basin (Partridge et al., 2006). Much of the Gordonia Formation comprises linear dunes that were reworked a number of times before being stabilised by vegetation (ibid).

#### v. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Tierberg Formation (orange) and the Quaternary calcretes (green). Vertebrate fossils are not present but the deep-water shales of the Tierberg Formation might preserve trace fossils of invertebrate trackways and burrows. These are deep water deposits so there would be no terrestrial plants either (Plumstead, 1969). The Quaternary calcretes might preserve fossils trapped in features such as palaeo-pans or palaeo-springs. There would be more robust but transported fossils such as bone fragments or silicified wood.



**Figure 4: SAHRIS palaeosensitivity map for the site for the proposed pivot irrigation expansion and dams on farms near Luckhoff as indicated. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.**

vi. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

**Table 3a: Criteria for assessing impacts**

<b>PART A: DEFINITION AND CRITERIA</b>		
<b>Criteria for ranking of the SEVERITY/NATURE of environmental impacts</b>	<b>H</b>	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	<b>M</b>	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	<b>L</b>	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.

	<b>L+</b>	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	<b>M+</b>	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	<b>H+</b>	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
<b>Criteria for ranking the DURATION of impacts</b>	<b>L</b>	Quickly reversible. Less than the project life. Short term
	<b>M</b>	Reversible over time. Life of the project. Medium term
	<b>H</b>	Permanent. Beyond closure. Long term.
<b>Criteria for ranking the SPATIAL SCALE of impacts</b>	<b>L</b>	Localised - Within the site boundary.
	<b>M</b>	Fairly widespread - Beyond the site boundary. Local
	<b>H</b>	Widespread - Far beyond site boundary. Regional/ national
<b>PROBABILITY (of exposure to impacts)</b>	<b>H</b>	Definite/ Continuous
	<b>M</b>	Possible/ frequent
	<b>L</b>	Unlikely/ seldom

**Table 3b: Impact Assessment**

<b>PART B: Assessment</b>		
<b>SEVERITY/ NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	Soils and sands do not preserve fossils; so far there are no records from the Tierberg Fm of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be negligible
	<b>L+</b>	-
	<b>M+</b>	-
	<b>H+</b>	-
	<b>DURATION</b>	<b>L</b>
<b>M</b>		-
<b>H</b>		Where manifest, the impact will be permanent.
<b>SPATIAL SCALE</b>	<b>L</b>	Since the only possible fossils within the area would be trace fossils in the shales of the Tierberg Fm, or fragments in the Quaternary calcrete, the spatial scale will be localised within the site boundary.
	<b>M</b>	-
	<b>H</b>	-

<b>PART B: Assessment</b>		
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	It is extremely unlikely that any fossils would be found in the loose soils and sands that cover the area or in the deepwater shales of the Tierberg Fm that will be cultivated. 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. Furthermore, the material to be cultivated is soil and this does not preserve fossils. Since there is an extremely small chance that fossils from the Tierberg Formation 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 mostly do not contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

#### 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 soils of the Quaternary. There is a very small chance that trace fossils may occur in the shales of the early Permian Tierberg Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations for pipes, dam walls and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low so as far as the palaeontology is concerned, the project should be authorised.

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## x. Chance Find Protocol

**Monitoring Programme for Palaeontology - to commence once the excavations begin.**



1. The following procedure is only required if fossils are seen on the surface and when drilling/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 (plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figures 5, 6). 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. 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.

xi. Appendix A – Examples of fossils from the Eccca Group and Quaternary sites.



**Figure 5: Photographs of trace fossils from the Eccca Group.**



A – leaf impression in sandstone; B – silicified wood fragments in a stream bed; C – fossil bone fragments in the shales.

**Figure 6: Photographs of transported and fragmentary fossils from Quaternary deposits.**

xii. Appendix B – Details of specialist

**Curriculum vitae (short) - Marion Bamford  
PhD**

**January 2022**

**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  
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[marionbamford12@gmail.com](mailto: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.  
NRF Rating: C-2 (1999-2004); B-3 (2005-2015); B-2 (2016-2020); B-1  
(2021-2026)

**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	13	0
Masters	11	3
PhD	11	6
Postdoctoral fellows	15	1

#### **viii) Undergraduate teaching**

Geology II - Palaeobotany GEOL2008 - average 65 students per year  
Biology III - Palaeobotany APES3029 - average 45 students per year  
Honours - Evolution of Terrestrial Ecosystems; African Plio-Pleistocene  
Palaeoecology; Micropalaeontology - average 12-20 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 -  
Associate Editor Open Science UK: 2021 -  
Review of manuscripts for ISI-listed journals: 30 local and international journals  
Reviewing of funding applications for NRF, PAST, NWO, SIDA, National Geographic, Leakey Foundation

#### **x) Palaeontological Impact Assessments**

Selected from the past five years only - list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klippoortjie 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
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

#### **xi) Research Output**

Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 160 articles published; 5 submitted/in press; 10 book chapters.

Scopus h-index = 30; Google scholar h-index = 35; -i10-index = 92

Conferences: numerous presentations at local and international conferences.



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## APPENDIX 4: Chance Fossil Finds Procedure



## **CHANCE FINDS OF PALAEOLOGICAL 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.





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

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

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FOSSIL DISCOVERIES: PRELIMINARY RECORDING FORM		
Name of project:		
Name of fossil location:		
Date of discovery:		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	<i>Lat:</i>	<i>Long:</i>
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)	<i>Digital image of vertical section (side)</i>	
	<i>Fossil from different angles</i>	
	<i>Wider context of the find</i>	
Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil Name:		
Contact:		
Recorder Name:		
Contact:		
Photographer Name:		
Contact:		

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