

HERITAGE WALKDOWN REPORT

for the approved Iziduli Emoyeni Wind Energy Facility and associated
infrastructure in the Eastern Cape

Prepared by



CTS HERITAGE

In Association with

Nala Environmental Consulting

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EXECUTIVE SUMMARY

The authorised Iziduli Emoyeni wind energy facility (WEF) is located approximately 20km south of the town of Bedford in the Eastern Cape Province. The area proposed for development is located east and west of the R350 Main Road between Grahamstown and Bedford. According to Binneman (2014), the landscape comprises gentle undulating hills, lowlands and non-perennial, open valley drainage systems. The area is dominated by commercial stock farming.

The area under assessment in this application has been previously assessed by the ACO (Halkett et al.) as part of an extensive heritage assessment for a larger area proposed for the Amakhala Emoyeni WEF (2010, SAHRIS NID 8376). In addition, the area under assessment has also been surveyed by Binneman for the first phase of the Amakhala Emoyeni WEF (2012) and for the proposed substation, switching station and grid connection for the Iziduli Emoyeni WEF (2014, SAHRIS NID 250695).

In the HIA completed for the Amakhala Emoyeni WEF, Halkett (2010) recommended that “A “walkdown” of final cable routes, and power lines and access roads will be required to be conducted by a certified professional archaeologist/heritage consultant prior to construction commencing.” This requirement was reiterated by SAHRA in their correspondence dated 8 June 2011. The layout for the Amakhala Emoyeni WEF was subject to a walkdown completed by Binneman in 2012 as per SAHRA’s requirements and the recommendations of the HIA (Halkett, 2010). Since the Binneman (2014) walkdown, the layout has been subject to a number of changes and as such, a further walkdown was recommended for the Iziduli Emoyeni WEF.

Furthermore, in terms of the EA for the project, “If there are any changes to the layout, then additional survey work will be required in order to ensure that no sites are directly impacted and/or to identify the need for an excavation permit.” This report fulfils this requirement.

No archaeological resources of significance were identified within the area proposed for development during this field assessment although one site of heritage value was previously identified within the 300m grid corridor or the proposed substation footprint and assessment area. No impacts to significant archaeological heritage resources are anticipated from the proposed development on the condition that the recommended mitigation measures are implemented.

No observations of palaeontological significance were noted within the area proposed for development. However, the geology underlying the development area remains sensitive for impacts to significant palaeontological heritage. Based on the findings of the palaeontology walkdown report, the proposed layout should be approved as there is no infrastructure proposed within areas that can impact the site’s palaeontological significance on condition that the Fossil Chance Find Protocol is implemented for the duration of all construction activities.



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Recommendations

This report satisfies the requirements of SAHRA and condition 10.10.1 in the EA. There is no objection to the proposed final layout of the Iziduli Emoyeni WEF as provided and mapped in this report from a heritage perspective on condition that:

- A no development buffer of 30m is recommended around palaeontological site 40762 located along the existing road
- A no-development buffer of 50m is recommended around Observation 012. This site is located more than 200m from any proposed infrastructure and so no impact is anticipated.
- As per SAHRA's requirements, all stone structures, stone kraals and enclosures within 200m from the construction area must be protected through temporary fencing. The only site located within 200m of proposed construction is Observation 009. No impact to this site is anticipated.
- The attached Chance Fossil Finds Procedure (Appendix 2) is implemented for the duration of construction activities for this project.



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CONTENTS

1. INTRODUCTION	4
1.1 Background Information on Project	4
1.2 Description of Property and Affected Environment	6
2. METHODOLOGY	11
2.1 Purpose of Walkdown	11
2.2 Summary of steps followed	11
2.3 Constraints & Limitations	11
3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT	13
4. IDENTIFICATION OF HERITAGE RESOURCES	20
4.1 Findings of previous assessments	20
4.2 Heritage Resources identified in the Walkdown	30
4.3 Selected photographic record	32
5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT	37
5.1 Assessment of impact to Archaeological Resources	37
6. FINAL LAYOUT	41
7. CONCLUSION AND RECOMMENDATIONS	41
8. REFERENCES	44

Appendices

Appendix 1	Palaeontology Walkdown Report 2022
Appendix 2	Chance Fossil Finds Procedure



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1. INTRODUCTION

1.1 Background Information on Project

The authorised Iziduli Emoyeni wind energy facility (WEF) is located approximately 20km south of the town of Bedford in the Eastern Cape Province. The area proposed for development is located east and west of the R350 Main Road between Grahamstown and Bedford. According to Binneman (2014), the landscape comprises gentle undulating hills, lowlands and non-perennial, open valley drainage systems. The area is dominated by commercial stock farming.

The area under assessment in this application has been previously assessed by the ACO (Halkett et al.) as part of an extensive heritage assessment for a larger area proposed for the Amakhala Emoyeni WEF (2010, SAHRIS NID 8376). In addition, the area under assessment has also been surveyed by Binneman for the fourth phase of the Amakhala Emoyeni WEF (2012) and for the proposed substation, switching station and grid connection for the Iziduli Emoyeni WEF (2014, SAHRIS NID 250695).

SAHRA Comments

The application for the Amakhala Emoyeni Wind Energy Facility was first submitted to SAHRA on 8 June 2011 (SAHRIS Case ID 1331). In their Final Comment, dated 8 June 2011, made in response to the specialist studies submitted, SAHRA recommended that they have no objection to the proposed development on condition that:

- The final position of turbines and related infrastructures, including access roads, must be decided in consultation with an archaeologist and palaeontologist. If deemed necessary, a micro-siting survey of the footprint of turbines and related infrastructure must be undertaken. After this survey a report must be sent to SAHRA for comments.
- Site 457 (OWE/23-27A) should not be impacted upon, for this reason a well demarcated temporary fence should be built around it during construction and its presence should be made clear on maps for future reference. If the site cannot be avoided and it is deemed necessary for the development to impact on this site, a Phase 2 Archaeological Impact Assessment in the form of excavation is required by SAHRA. The specialist will require a mitigation permit from SAHRA. On receipt of a satisfactory mitigation (Phase 2) permit report from the archaeologist, SAHRA will make further recommendations in terms of the site. Very often permission is given for the destruction of the remainder of the archaeological or palaeontological sites. If a site has high heritage significance, the authority may request that it be conserved and that mini-site management plans, interpretive material and possibly protective infrastructure be established.
- The developer must apply for a destruction permit for any archaeological site to be impacted. An exception is made for site identified as one or very few flakes and one historical artefact, such as a bottle (an exemption from a destruction permit is therefore given for sites 427, 428, B353, B367, B368, B369, B370, 414, 418, 419, 421, B354, B355, B356, B358, 508, B377, 492, B374, B372, 552, 407, 408, 409, B351, B352, B375, B376, B363, B364, 423, 424, 425, 353, 376, 378, 386, 387). The developer, or the archaeologist on his/her behalf, may apply for a combined destruction permit for all these sites.
- The graves should be restored where these are dilapidated, protected and conserved. For this purpose, a proper fence must be built around them (if not already existing) including entry gates to allow visits from



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- relatives and family friends. The fence must be placed 2 metres away from the perimeter of the graves. No development or construction area is allowed within 30 metres from the fence line surrounding the graves.
- Alternatively, if the area where the burials are located fall within the development footprint, then provisions stipulated in section 36 of the National Heritage Resources Act (Act No. 25 of 1999) are applicable, and relocation of these might proceed provided that a public consultation process is followed (see Appendix 1 and SAHRA Regulations). Decisions in terms of section 36 of the NHRA are responsibility of the SAHRA's Burial Grounds and Graves (BGG) Unit (Ms Jennifer Kitto, email: jkitto@sat.sahra.org.za and Mr. T. Phili, email: tphili@sat.sahra.org.za).
 - All stone structures, stone kraals and enclosures within 200m from the construction area must be protected through temporary fencing. If this is deemed impossible, and construction will have to impact on any stone structures of medium and high significance, a Phase 2 in the form of recording and/or excavation, is required. For sites of low significance a destruction permit must be applied for with SAHRA.
 - Destruction of any of the seven palaeontological sites identified during the survey must be avoided, if this is not possible, a mitigation permit must be applied for.
 - An ECO must be trained by a professional palaeontologist on identifying fossil material. The possibility of encountering fossils during deep excavations and trenching is defined as low by the palaeontologist, but a trained ECO should be on site in the event that palaeontological resources are identified.
 - It is important that the position of all sites is recorded on construction maps so that accidental destruction of a site is avoided as much as possible and kept at its minimum.
 - Considering the high number of built environment structures identified on the properties, older than 60 and 100 years, it is requested that consultation with a conservation architect is undertaken in order to identify and specify conservation measures for these structures. This is required before micro-siting for turbine position may proceed.

No subsequent comments that pertain to this development have been submitted by SAHRA and as such, these comments stand as SAHRA's response to the development. No comments have been forthcoming from ECPHRA.

Environmental Authorisations (EA)

Initial EA was granted for the Amakhala Emoyeni Phase 4 WEF on 28 August 2012. With regard to heritage management, the following EA conditions are of relevance:

Condition 6.4 The applicant must submit a Final Layout plan for the entire WEF for approval to the department. The layout should indicate the Heritage Sites that will be affected by the turbines and associated infrastructure

Condition 10.10.1 If there are any changes to the layout, then additional survey work will be required in order to ensure that no sites are directly impacted and/or to identify the need for an excavation permit.

Condition 10.10.2 Should any graves be found, all construction activities must be suspended and an archaeologist be contacted immediately. The discovered graves must be cordoned off.

Condition 10.13.1 A walkthrough survey of the final survey powerline corridor must be undertaken by a heritage specialist to identify areas where mitigation may be required.



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Various subsequent amendments to the initial EA were authorised, however no changes to any heritage-related conditions were included in the amended EAs. This report is submitted in order to satisfy the requirements of the above conditions.

1.2 Description of Property and Affected Environment

As per Binneman (2014), the proposed development is “located within the 1:50 000 topographic reference maps 3225DD Golden Valley and 3226CC Herbert’s Hope (Map 1). The developments fall within the Blue Crane Route Local Municipality in the Eastern Cape Province. It is situated approximately 16 kilometres south of Bedford (nearest point) and west of the R350 main road connecting Grahamstown with Bedford. The Poseidon Substation is situated approximately 18 kilometres north-west of the development.”

Binneman (2014) goes on to note that “The general landscape comprises a gentle undulating hill landscape, lowlands and non- perennial open valley drainage systems/lines (Figure 1). No perennial rivers traverse the study area. The major rivers occurs many kilometres to the north, east (Great Fish River) and west (Sunday’s River). The dominant natural vegetation is grassland, small, low shrubs in places and patches of *Acacia karroo* in the drainage valleys. The main activity in the study area is commercial stock farming and the land is used for grazing of livestock. Apart from the usual small scale disturbances due to farming activities such as fences, tracks, dams, soil erosion and power lines which crosses through the area, the hill tops shows little disturbances. Most development and disturbance, such as homesteads, and associated infrastructure occur mainly along and adjacent to the network of gravel roads which traverse the study area, or in valleys areas close to drainage lines.”

In 2022, the ground survey found the area much in the same state as described by Binneman in 2014 with the notable exception that the Amakhala Emoyeni wind farm has been built with 56 2.4MW turbines. Around 7-9km of the north west end and the south east section run over ground which has been transformed by ploughing and levelling of ground for grazing sheep and cattle while the middle segment of approximately 5km is less transformed over a hilly section which gently slopes down into one of the non-perennial floodplains noted by Binneman. Most of the archaeological observations were made in this area.



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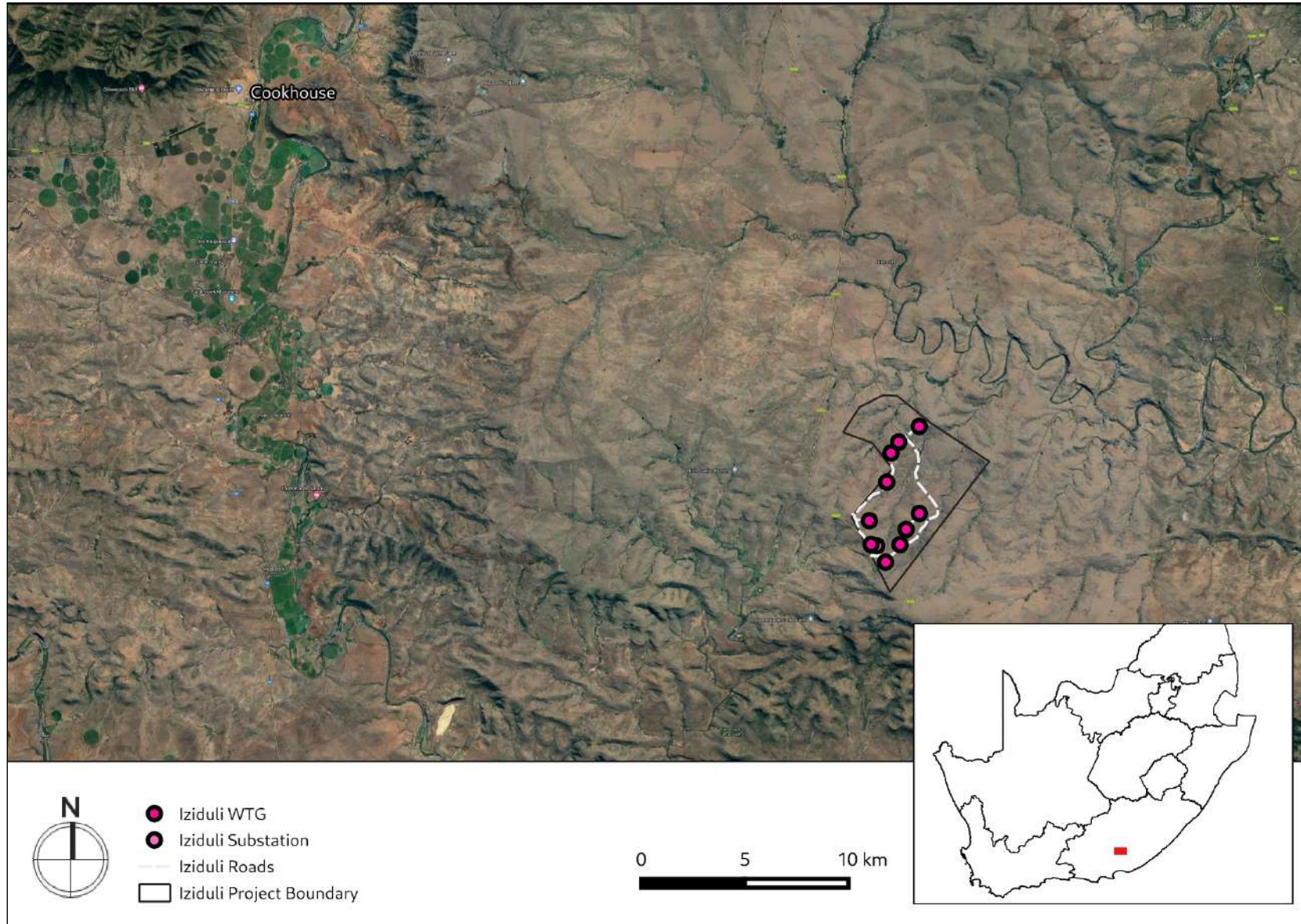


Figure 1.1: Close up satellite image indicating proposed location of the Iziduli Emoyeni WEF development



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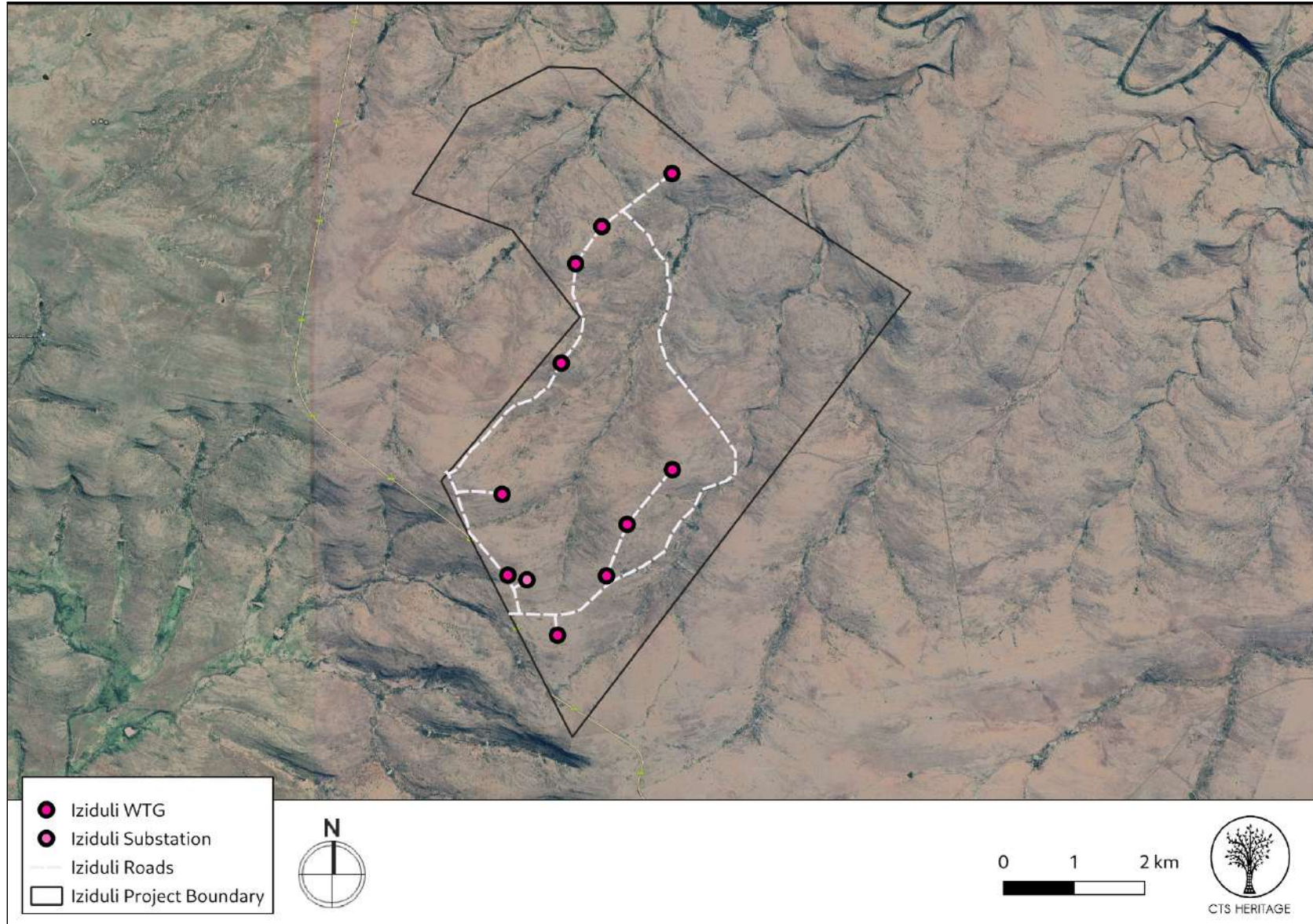


Figure 1.2: Final proposed layout for the Iziduli Emoyeni WEF development



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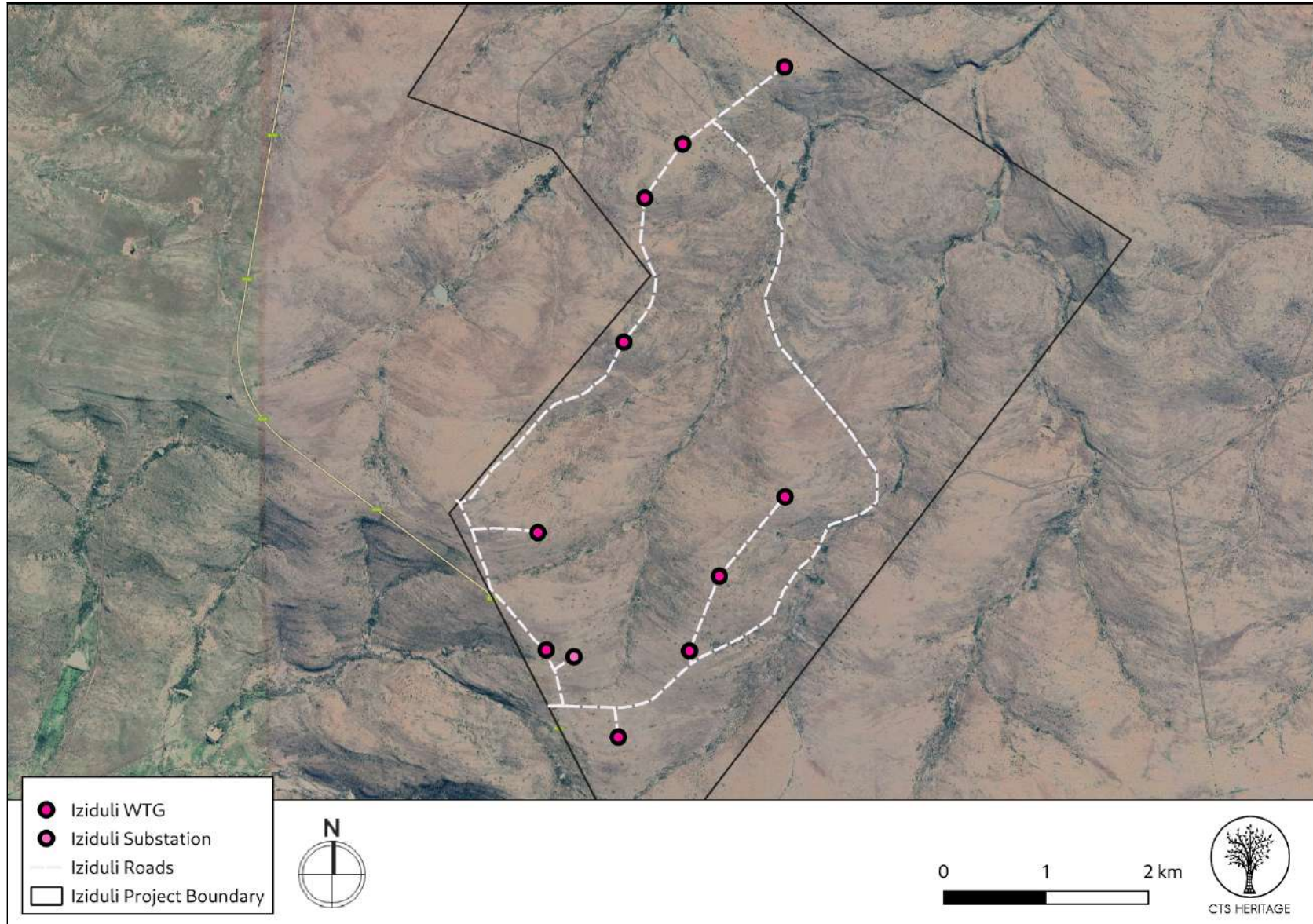


Figure 1.3: Final proposed layout for the Iziduli Emoyeni WEF development



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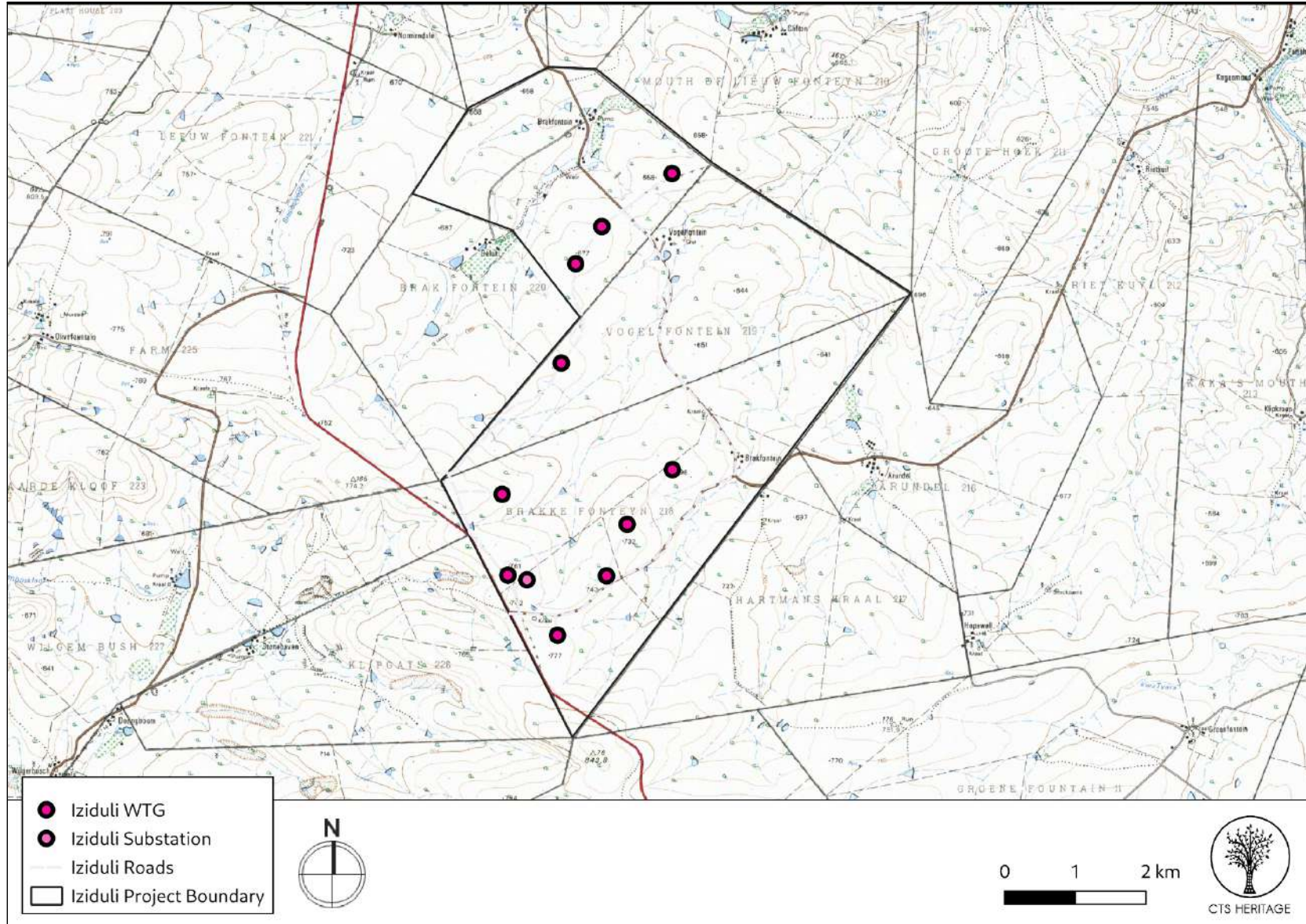


Figure 1.4: Final proposed layout for the Iziduli Emoyeni WEF development overlaying an extract from the 1:50 000 Topo Map



2. METHODOLOGY

2.1 Purpose of Walkdown

In the HIA completed for the Amakhala Emoyeni WEF, Halkett (2010) recommended that “A “walkdown” of final cable routes, and power lines and access roads will be required to be conducted by a certified professional archaeologist/heritage consultant prior to construction commencing.” This requirement was reiterated by SAHRA in their correspondence dated 8 June 2011. The layout for the Amakhala Emoyeni WEF was subject to a walkdown completed by Binneman in 2012 as per SAHRA’s requirements and the recommendations of the HIA (Halkett, 2010). Since the Binneman (2014) walkdown, the layout has been subject to a number of changes and as such, a further walkdown was recommended for the Iziduli Emoyeni WEF.

Furthermore, in terms of the EA for the project, “If there are any changes to the layout, then additional survey work will be required in order to ensure that no sites are directly impacted and/or to identify the need for an excavation permit.” This report fulfils this requirement.

2.2 Summary of steps followed

- An archaeologist conducted a full detailed walkdown and micro-siting of the Final development footprint for the Castle WEF and grid connection development footprint between 10 to 14 April 2022 and again on 17 May 2022 to determine what archaeological resources are likely to be impacted by the proposed development.
- The area proposed for development was assessed on foot, mountain bike and by 4x4 vehicle, photographs of the context and finds were taken, and tracks were recorded (at 20m intervals) using a GPS.
- A palaeontologist conducted an assessment of palaeontological resources likely to be disturbed by the proposed development. The palaeontologist conducted her site visit from 27 to 28 April 2022
- 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).

The development assessed includes:

- Roads & MV cables: 150m either side of centreline
- Substation: 300m radius
- WTGs: 200m radius around turbine base

2.3 Constraints & Limitations

It should be noted that access to some of the farms was prohibited for the palaeontologist because they are hunting farms and too dangerous to visit during the hunting season, which overlapped with the scheduled walkdowns. From the public roads the higher ridges were viewed, as well as the exposed rock in the road cuttings. The latter were ideal for determining the richness (or not) of the fossils because the area is covered in soils and thin to thick vegetation.

The experience of the archaeology, palaeontology and heritage practitioners, and observations made during the field study, allow us to predict with some accuracy the heritage sensitivity of the receiving environment, and identify the specific heritage resources to be impacted by the final layout of the development.



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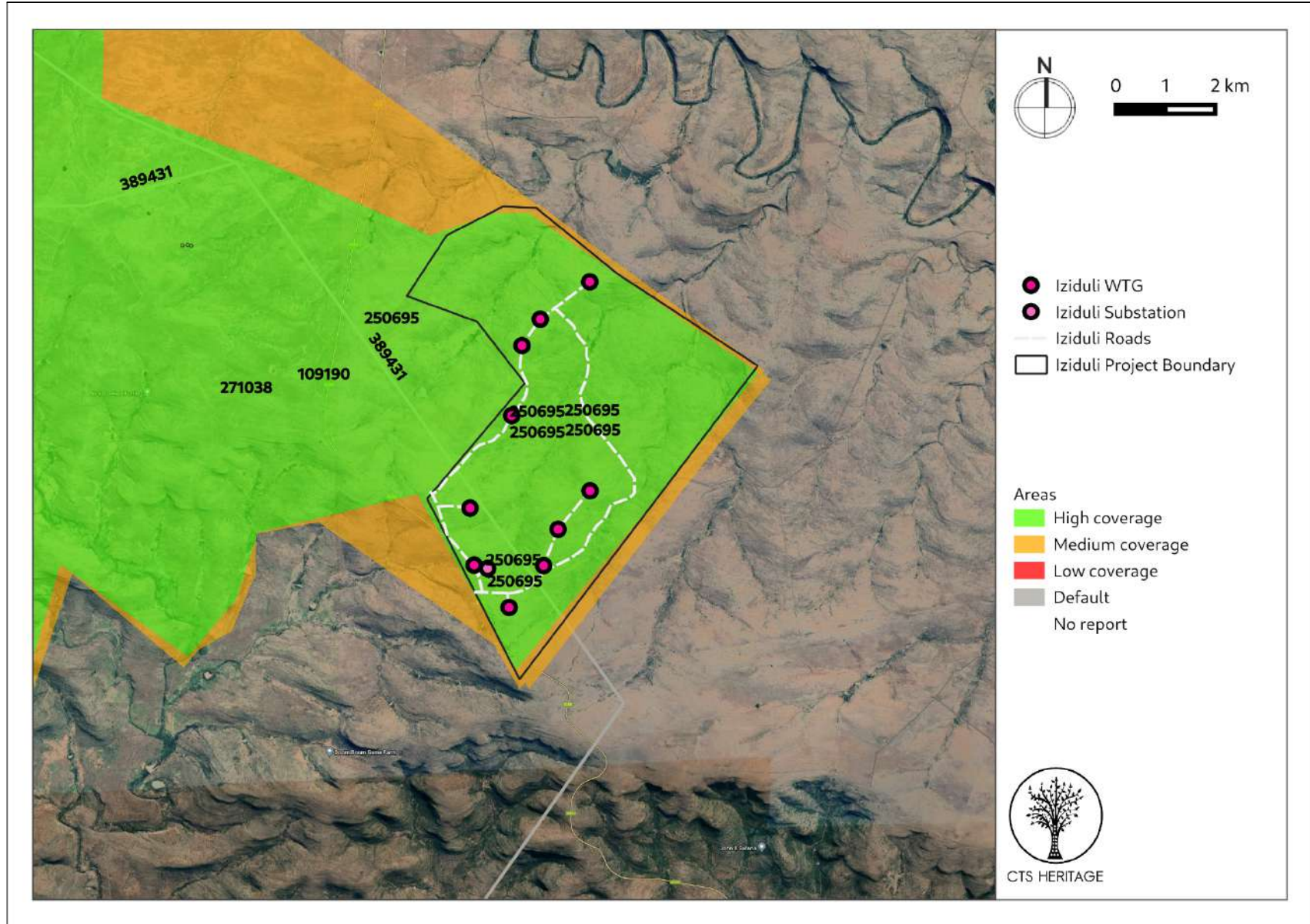


Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted



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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area under assessment in this application has been previously assessed by the ACO (Halkett et al.) as part of an extensive heritage assessment for a larger area proposed for the Amakhala Emoyeni WEF (2010, SAHRIS NID 8376). In addition, the area under assessment has also been surveyed by Binneman for the fourth phase of the Amakhala Emoyeni WEF (2012) and for the Iziduli Emoyeni WEF (2014, SAHRIS NID 250695). These reports are used to provide insight into the heritage sensitivities of the area. In general, it is known that the area was likely occupied by Early, Middle and Later Stone Age people. According to Halkett et al. (2010), “Before colonisation of the Eastern Cape by the British in the early 19th century, Khoer herders formed powerful transhumant communities herding cattle and sheep throughout the coastal plain... They enjoyed dominance as far as the Great Fish River, where they shared a loose border with Xhosa farming communities to the east.” Halkett et al. (2010) go on to note that “The arrival of the “Trekboer” farmers in the mid-18th century started what has become known as the “Bushman War” which continued for almost 60 years. Eventually, the kommandos that were dispatched from regional centres prevailed and the “wild bushmen” of the Karoo were subjugated by the early 19th century.”

In their field survey, Halkett et al. (2010) identified diffuse and isolated scatters of Early and Middle Stone Age artefacts. They note that these artefacts are often located along the margins of small depressions in the bedrock where rain water has collected. Some were also located along rocky ridges and in areas where the ground has been scarred by erosion. They further note that while these findings have limited heritage significance, they do seem to have some level of spatial integrity. Halkett et al. also identified a number of Later Stone Age sites, some with pottery. These sites tend to be located closer to “rivers”, particularly in sandy areas. Additional heritage resources identified in the broader area include various historic farmhouses dated to the early and mid-19th century as well as a number of abandoned/ruinous structures and colonial period artefacts. The field survey also identified a number of “stone features consisting of loose aggregations of boulders which could represent the remains of early settlements or possibly graves”, as well as formal cemeteries and informal groupings of graves. The findings of the survey conducted by Binneman (2014) corroborate the results of the assessment by Halkett et al (2010).

All heritage resources identified in these assessments have been mapped relative to the proposed development in Figures 3.1, 3.2 and 3.3. All known heritage resources located within the areas previously assessed occur more than 100m from the proposed OHL and substation. Three known sites fall within the 300m buffer zone around the OHL. All of these sites are stone walling sites (SAHRIS ID 36117, 36167 and 36284). AMA144 (SAHRIS ID 36167) is described as a “Stone kraal near modern house along main road.” graded IIIC. AMA036 (SAHRIS ID 36117) is described as “Stone alignment? along footpath, probably marking a subsurface pipe.”, graded IIIB and AMA202 (SAHRIS ID 36284) is described as “Large Stone Wall”, graded IIIA. Based on the assessments that have been completed in the area, it is clear that most of the archaeological heritage resources previously identified are found within river valleys.

Palaeontology

The area proposed for development is underlain by sediments that have very high palaeontological sensitivity according to the SAHRIS Fossil Sensitivity Map (Figure 4.1). The geology map of the area (Council of GeoScience Map 3226, King Williams Town, Figure 4.2) indicates that the area is underlain by sediments of the Karoo Supergroup



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assigned to the Beaufort group, within the Middleton Formation of the Adelaide Subgroup. According to the SAHRIS Fossil Heritage Browser which is based on Palaeotechnical Assessments completed for SAHRA, the Beaufort Group is known for “Diverse terrestrial and freshwater tetrapods of *Tapinocephalus* to *Lystrosaurus* Biozones (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways) and sparse vascular plants (*Glossopteris* Flora, including petrified wood)”.

De Klerk (2010) conducted a detailed palaeontological assessment for the proposed development and concluded that “Because fossils are rare in this part of the Lower Beaufort Group sediments, it is difficult to find them, even in ideal outcrop conditions. Because of the low relief topography in a great part of the footprint area, and the consequent deeper soil profile reducing the availability of bedrock outcrop, there is a very low likelihood of finding well-preserved fossils. There is, however, a reasonably good chance that fossils may be exposed in areas that are excavated for foundations, roads or trenches.”



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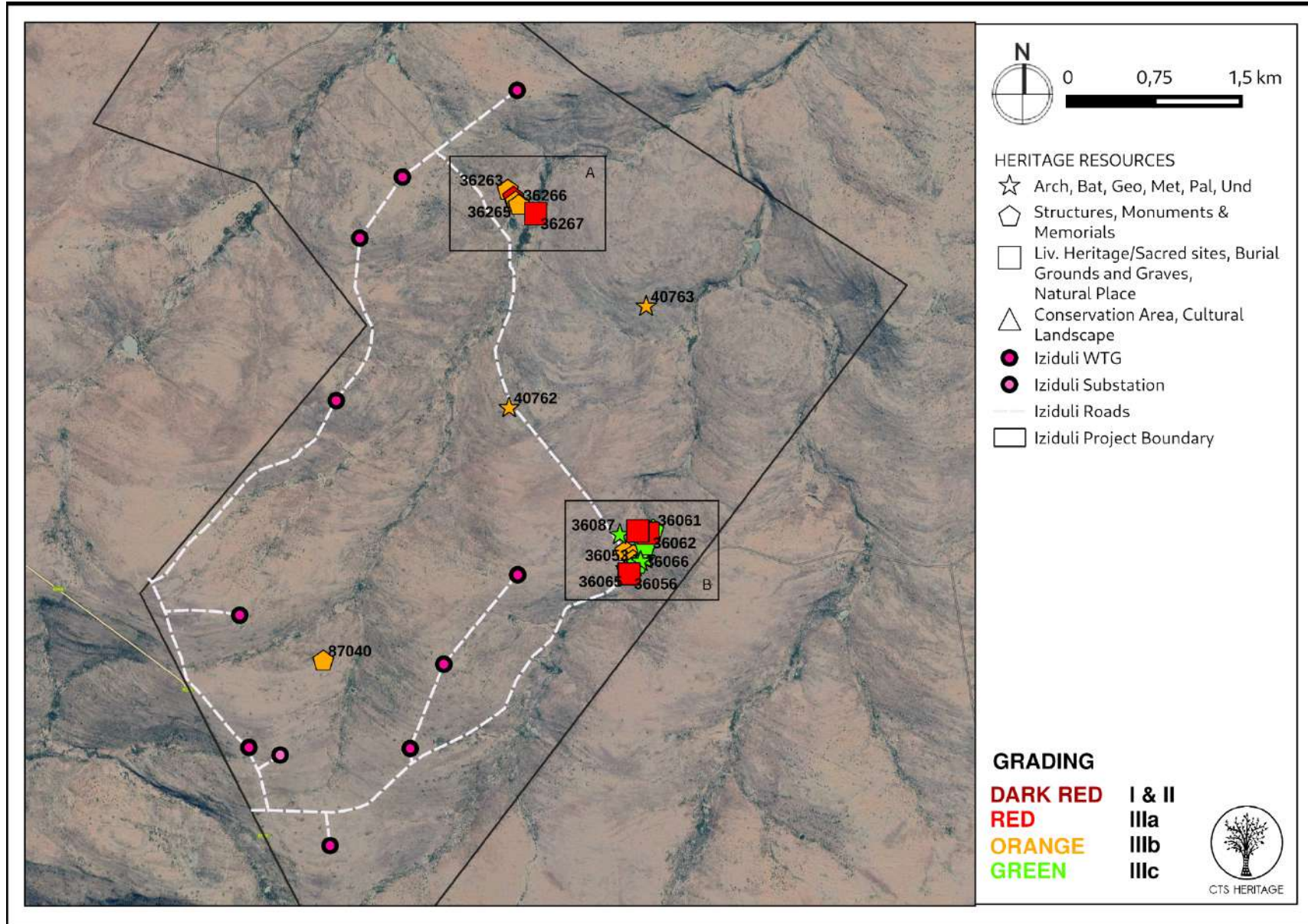


Figure 3.1. Heritage Resources Map. Heritage Resources previously identified in and near the study area from SAHRIS



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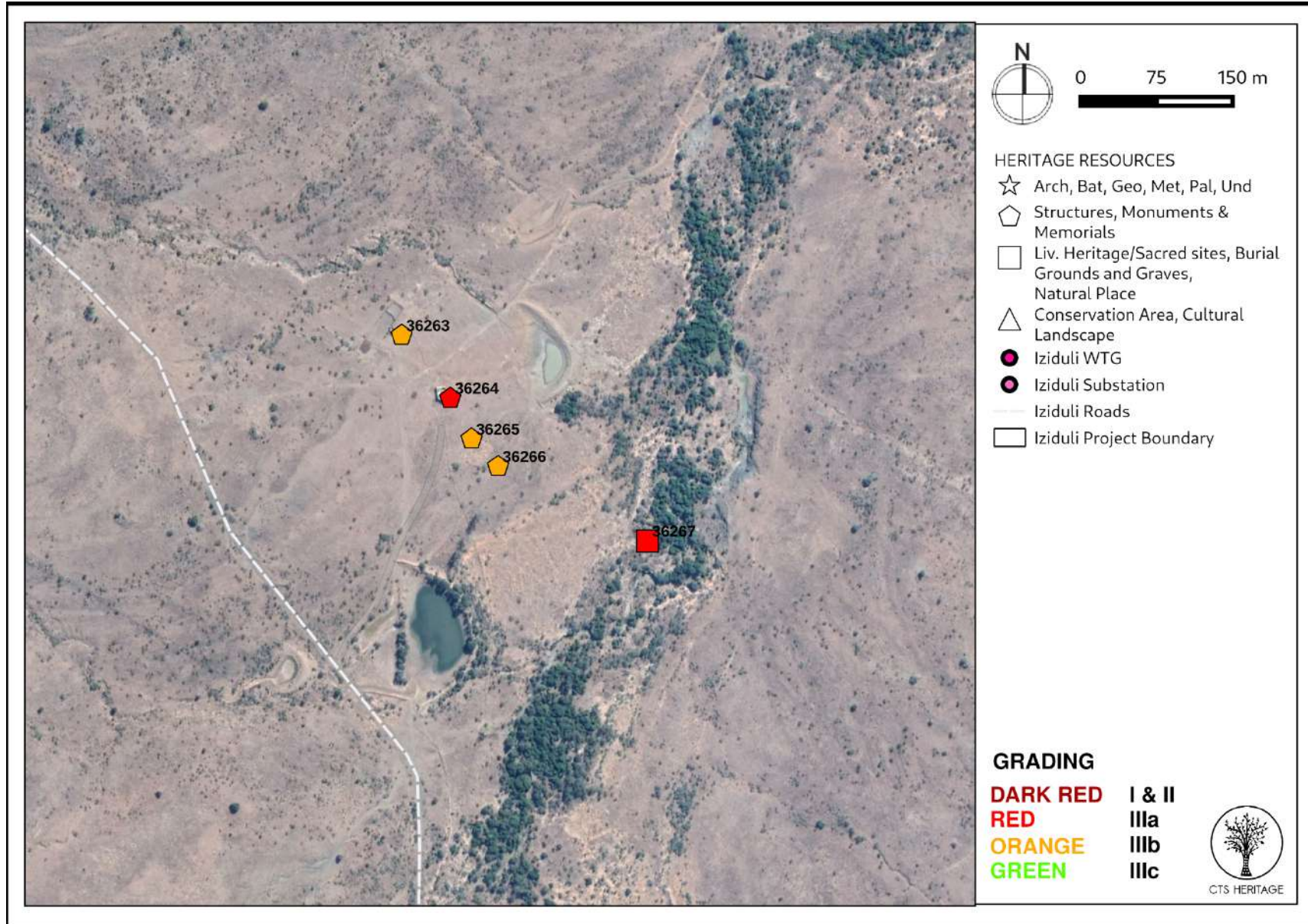


Figure 3.2. Heritage Resources Map. Inset A

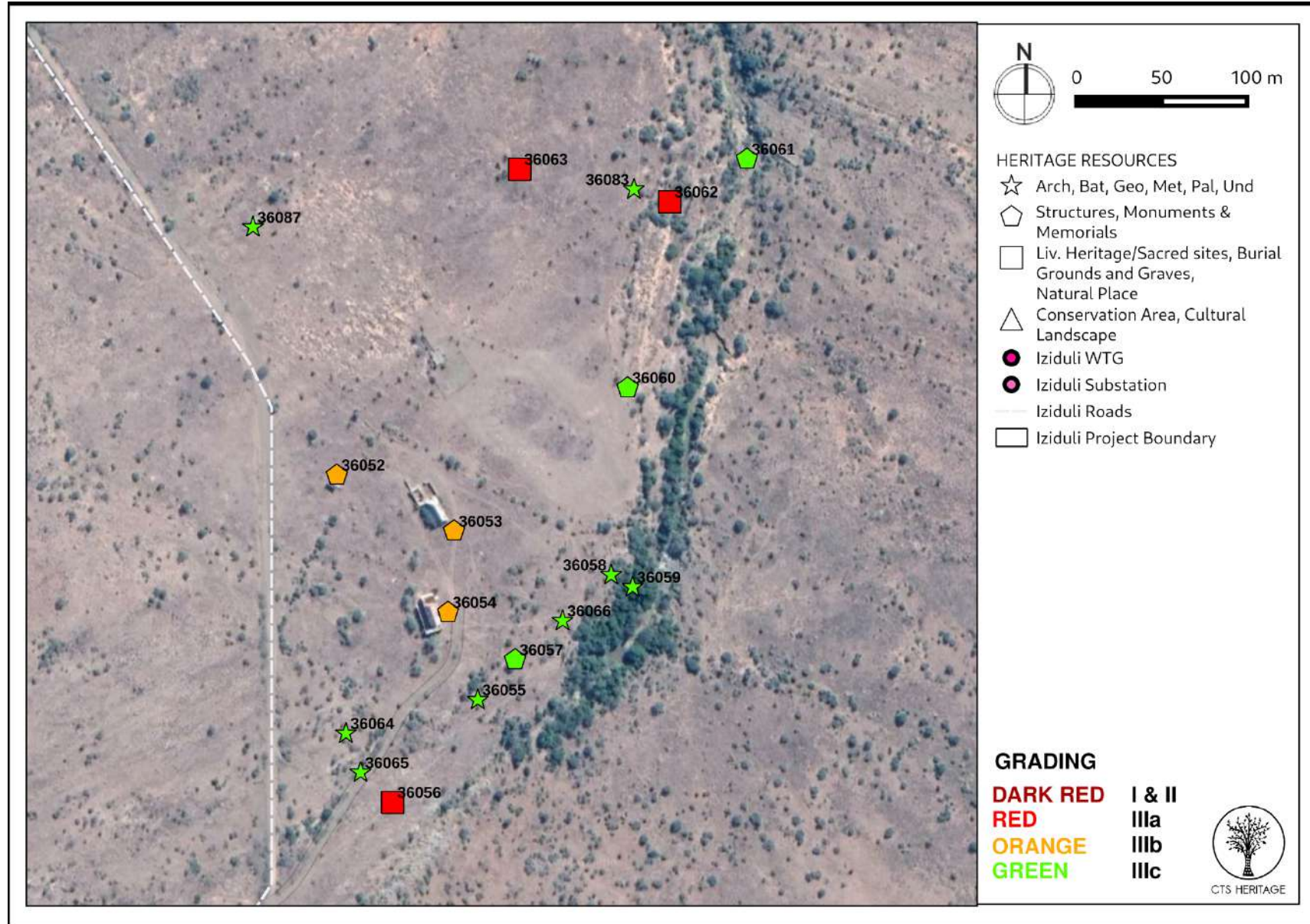


Figure 3.3. Heritage Resources Map. Inset B



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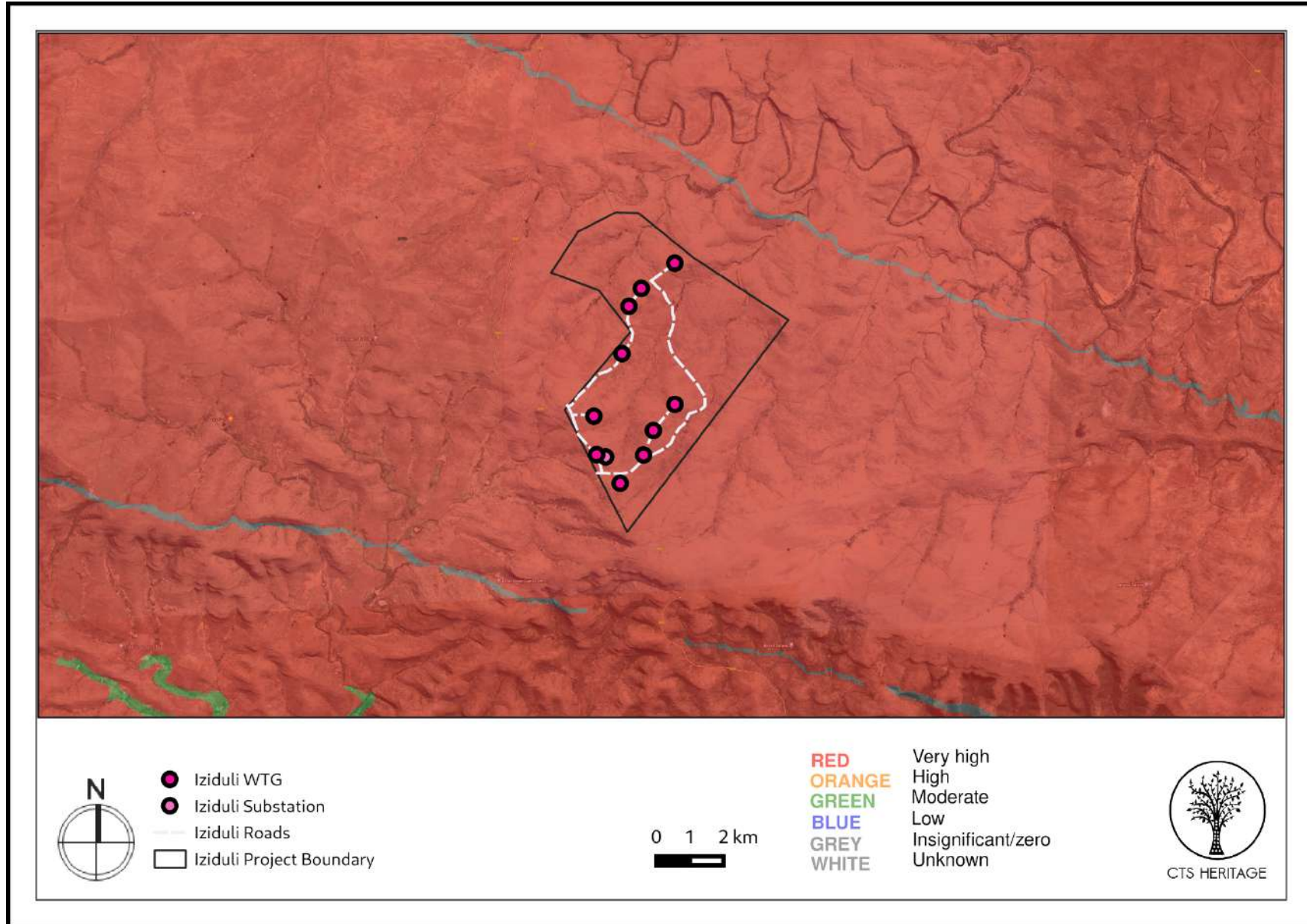


Figure 4.1. Palaeo Sensitivity map of the area from SAHRIS



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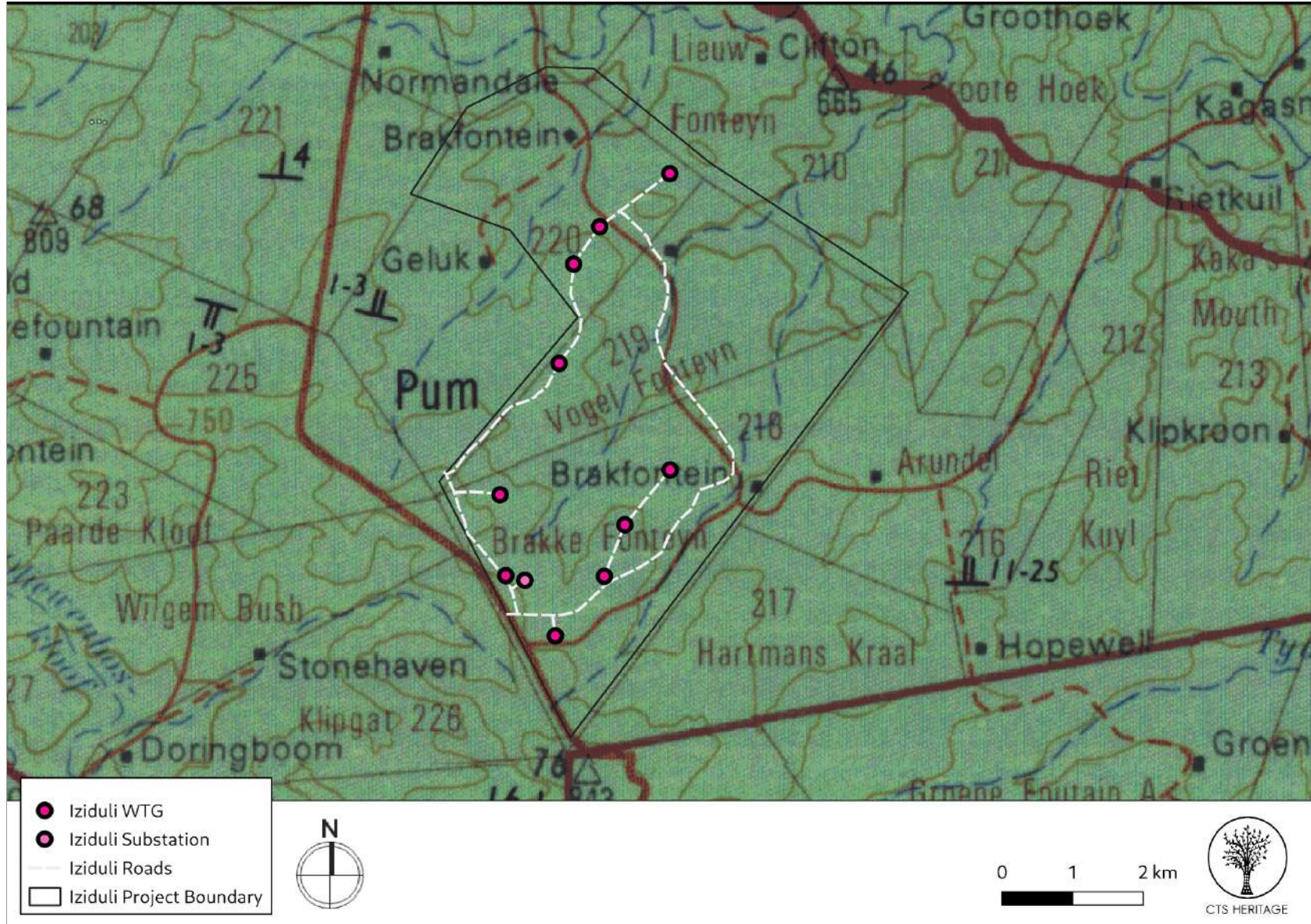


Figure 4.2: Geology Map. Extract from the CGS 3226 King Williams Town Map indicating that the development area is underlain by sediments of the Beaufort group, within the Middleton Formation of the Adelaide Subgroup (Pum).



4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Findings of previous assessments

Archaeology

Halkett (2010, SAHRIS NID 8376) conducted a field assessment of the area proposed for development in 2010. Halkett (2010) identified four single graves, twenty cemeteries with a number of burials between two and thirty, and five graveyards with more than thirty burials, with the most populated one counting about 76 burials. About 90 sites ranging between Stone Age scatters and open-air sites were also recorded: most of them seem to be dating to the Early (32) and Middle Stone Age, with some Later Stone Age sites also identified. In terms of structures, eighty-nine of them were recorded in the entire project area. Most of these are older than 60 years and therefore protected by the NHRA. Amongst these, there are also a high number of stone features, such as historic boundary stones, stone walls and kraals.

The findings of Halkett (2010) were corroborated in Binneman's walkdown of the adjacent Msenge Emoyeni WEF and his archaeological impact assessment report for the proposed substation, switching station and grid connection for the Iziduli Emoyeni WEF (2014, SAHRIS NID 250695) completed in 2014. The findings of both Halkett (2010) and Binneman (2014) are mapped relative to the amended layout for the Iziduli Emoyeni WEF layout in Figure 3.1, 3.2 and 3.3. Only one significant heritage resource is located in close proximity to the existing road - SAHRIS Site 40762. While no impact is anticipated as the site is located along an existing road, it is recommended that a 30m no development area be implemented around this site.

Table 1: Sites identified by Halkett (2010) and Binneman (2014) that are located in close proximity to the final layout

Site ID	Site No.	Site Type	Description	Co-ordinates		Grading
87040	IZI002	Building	Two of the dwellings, one square and the other round, were built from local flat stones and the walls were plastered with clay/ mud and must be older than 60 years.	-32,932583	26,132583	Grade IIIb
36263	AMA190	Structures	Stone kraal.	-32,895897	26,149714	Grade IIIb
36264	AMA191	Structures	Ruined stone cottage	-32,896455	26,150228	Grade IIIa
36265	AMA192	Structures	Brick and stone shed with recent changes.	-32,896816	26,150452	Grade IIIb
36266	AMA193	Structures	Stone road markers and tree line running NE-SW.	-32,89706	26,150732	Grade IIIb
36052	AMA001	Structures	One room cottage with internal corner fireplace.	-32,924061	26,160638	Grade IIIb
36053	AMA002	Structures	Stone and mud shed with later plaster and additions.	-32,924355	26,161374	Grade IIIb
36054	AMA003	Structures	Brick longhouse with additions. Windows and doors in back of main house bricked up as lean-to addition is in ruin. Arched doorway at back. Porch seems Victorian but is probably older. Ash dump out the back. House still occupied.	-32,924784	26,161336	Grade IIIb
36055	AMA004	Artefacts	2nd ash dump. Glass and ceramics of various	-32,925245	26,161523	Grade IIIc



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			ages are widely broadcast in this area.			
36057	AMA006	Structures	Stone foundation of a rectangular enclosure. A few bricks lying around as well.	-32,925033	26,161757	Grade IIIc
36058	AMA007	Artefacts	Pile of slag. Age unknown but probably historical.	-32,924587	26,16236	Grade IIIc
36059	AMA008	Stone walling	Stone feature/paved embankment, ?dam. Totally overgrown so cannot tell.	-32,924651	26,162495	Grade IIIc
36060	AMA009	Structures	Stone-lined furrow alongside what was probably an agricultural field.	-32,923601	26,162463	Grade IIIc
36061	AMA010	Structures	Stone enclosure above river.	-32,922396	26,163212	Grade IIIc
36064	AMA013	Artefacts	ESA flake.	-32,925422	26,160695	Grade IIIc
36065	AMA014	Artefacts	ESA flake.	-32,925628	26,160787	Grade IIIc
36066	AMA015	Artefacts	Hornfels core and quartzite flake.	-32,924829	26,162055	Grade IIIc
36083	AMA016	Artefacts	Hornfels scraper.	-32,922556	26,162503	Grade IIIc
36087	AMA017	Stone walling	Stone kraal is poorly preserved.	-32,922755	26,160112	Grade IIIc
40762	COOK-BE D003	Palaeontological	An occurrence of sphenophyte (horsetail) impressions in grey shales.	-32,912867	26,149833	Grade IIIb
40763	COOK-BE D002	Palaeontological	An occurrence of sphenophyte (horsetail) impressions in purple and grey-green shales.	-32,904956	26,162567	Grade IIIb
36267	AMA194	Burial Grounds & Graves	Graveyard with 2 formal graves. Fenced with a small, ornate gate.	-32,897721	26,15231	Grade IIIa
36056	AMA005	Burial Grounds & Graves	Graves. 4 or 5 piles of stone, 2 with bricks.	-32,925785	26,160989	Grade IIIa
36062	AMA011	Burial Grounds & Graves	Small fenced graveyard with 8 graves. Enclosure is diamond-shaped, not square. 6 are neatly stone-packed, 2 have cement surrounds.	-32,922621	26,162728	Grade IIIa
36063	AMA012	Burial Grounds & Graves	Small graveyard ?6/7 graves, some in very poor shape. 4 formal and mostly aligned E-W.	-32,92245	26,161786	Grade IIIa

Binneman (2014) concludes his report by noting that:

“Due to the dense tall, dry grass and little sheet erosion on the high ground the archaeological visibility was poor and made it difficult to locate pre-colonial archaeological sites and materials throughout the study area. Only a few isolated weathered stone tools were observed and it would appear unlikely that any significant *in situ* sites/material will be exposed during the development. However, it is possible that sites/materials are covered by soil and vegetation. Two historical sites were observed close to the proposed northern power line route. Both are typical examples of the architectural ‘style’ of the region and of high significance. These must be protected against possible damage/vandalism during the construction phase.”

Palaeontology

De Klerk (2010, SAHRIS ID 109187) completed his palaeontology assessment for the original environmental authorisation for Amakhala Emoyeni WEF. De Klerk (2010) found that:

“Because fossils are rare in this part of the Lower Beaufort Group sediments it is difficult to find them even in ideal outcrop conditions. Because of the low relief topography in the great part of the footprint area and the consequent deeper soil profile, reducing the availability of bedrock outcrop, there is a low likelihood of finding well-preserved fossils. There is however a reasonably good chance that fossils may be exposed in areas that are excavated for foundations, roads or trenches. It is recommended that development may take place but if at any stage during the construction phase of the wind turbines and the associated infrastructure like roads and trenching for cables, any semblance of a fossil were to be observed, it would be vital to stop the work and report this occurrence to the geological staff at either the Albany Museum or Rhodes University in Grahamstown. Reliance would be placed on the ECO to monitor this. The footprint site is within easy travelling distance and it can be investigated speedily. Generally, fossils can be removed quickly and would therefore not delay or hinder construction operations.”





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Figure 5.1: Contextual Image of development area



Figure 5.2: Contextual Image of development area



Figure 5.3: Contextual Image of development area indicating the low topography





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Figure 5.4: Contextual Images of Development Area indicating the low topography



Figure 5.5: Contextual Images of Development Area indicating existing tracks





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Figure 5.6: Contextual Images of Development Area



Figure 5.7: Contextual Images of Landscape



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Figure 5.8: Contextual Images of Development Area



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Figure 5.9: Contextual Images of Development Area



Figure 5.10: Contextual Images of Development Area



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Figure 5.11: Contextual Images of Development Area



Figure 5.12: Contextual Images of Development Area indicating

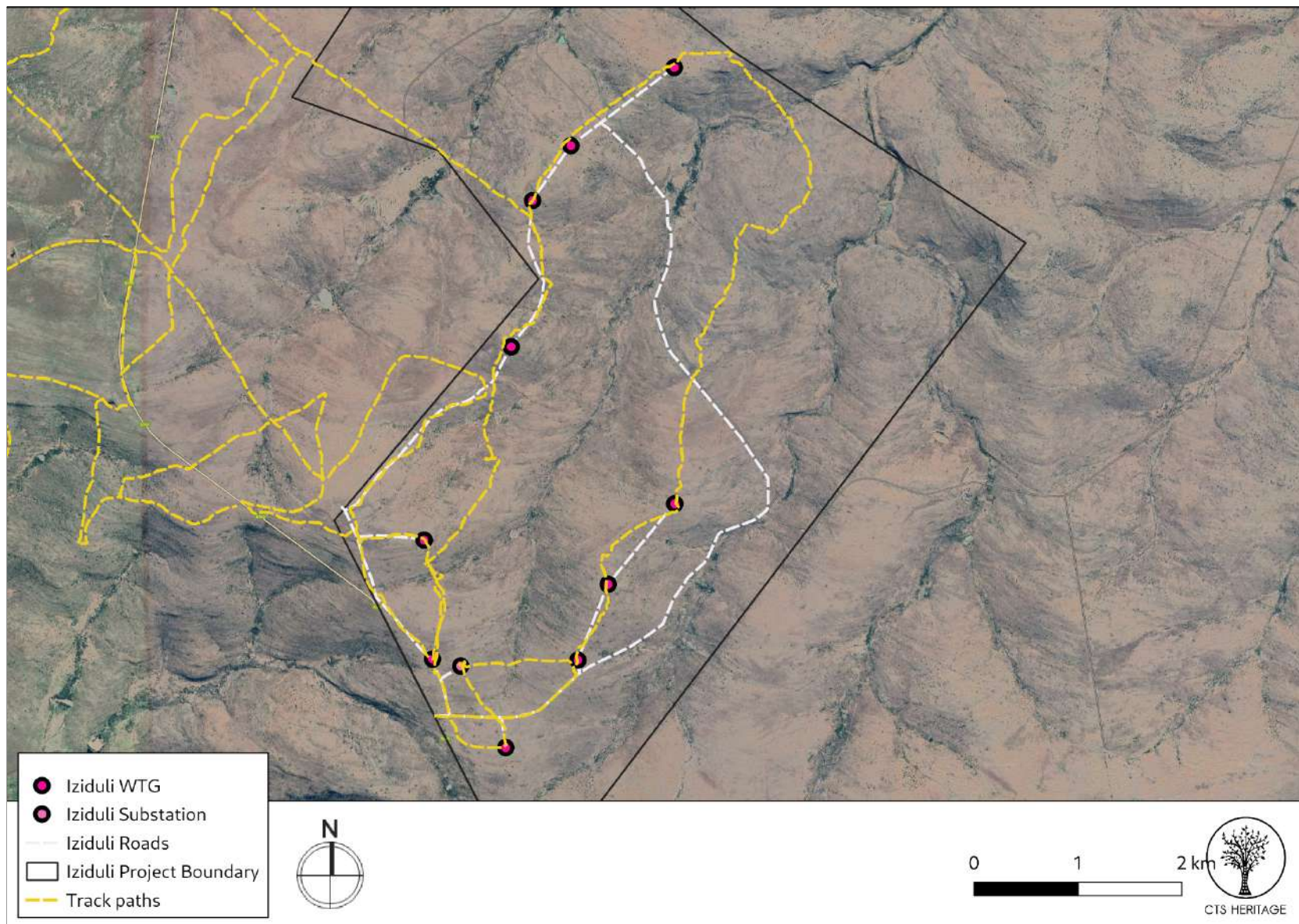


Figure 6.1: Overall track paths of foot survey (the road marked above that was not walked is along an existing road)



4.2 Heritage Resources identified in the Walkdown

The survey was conducted on foot with the aid of a mountain bike where feasible. Notably, the relative absence of archaeological material on the high ground observed when surveying the neighbouring turbine locations continued with stone artefacts concentrated along the floodplains of the non-perennial systems. There was also material lining the lower slopes of the rocky hill ridge. There are no rock shelters or large boulders holding potential engravings in this area and the main river system (Great Fish River) runs further to the west and north west.

Around 20 observations were made primarily of weathered Middle Stone Age flakes and radial cores. The raw materials were locally sourced quartzites and siltstones which displayed very little evidence of large transport distances as access to the bedrock and river cobbles is readily available. Later Stone Age evidence was also present and higher grade hornfels cores and flakes were found that were most likely brought into the area from a number of possible karoo sources. All of the archaeological resources identified were low density, single incidence *ex situ* artefacts that have been determined to be Not Conservation-Worthy. One structure, a stone walled ruin (Observation 012), was identified within the area proposed for the Iziduli Emoyeni WEF development area. This site has been Graded IIIB and while no impact to this site is anticipated from the layout provided, it is recommended that a no-development buffer of 50m is implemented around this site.

Table 1: Archaeological, palaeontological and built environment observations noted during both walk downs for the WEF and associated infrastructure

Obs #	Description	Type	Period	Density	Co-ordinates		Grading
001	Quartzite unifacial core flake	Artefacts	MSA	0 to 5	-32.93551	26.1432	NCW
002	Quartzite flake with lateral retouch	Artefacts	MSA	0 to 5	-32.92724	26.14857	NCW
003	Siltstone flake unworked	Artefacts	MSA	0 to 5	-32.91422	26.15327	NCW
004	Broken quartzite upper grindstone	Artefacts	LSA	0 to 5	-32.906	26.15671	NCW
005	Quartzite, hornfels, siltstone flakes, cores	Artefacts	MSA, LSA	5 to 10	-32.90286	26.157	NCW
006	Quartzite core and flake	Artefacts	MSA	0 to 5	-32.90209	26.16	NCW
007	Circular kraal 2x2m	Structure	Historical	n/a	-32.902	26.1615	NCW
008	Circular kraal 4x4m	Structure	Historical	n/a	-32.89281	26.14167	NCW
009	Circular kraal 4x4m	Structure	Historical	n/a	-32.8999	26.13561	NCW
010	Oval kraal 4x3m	Structure	Historical	n/a	-32.9023	26.13621	NCW
011	Siltstone flake and core	Artefacts	MSA	0 to 5	-32.90585	26.13706	NCW
012	Stone walled ruin and kraal near dam	Structure	Historical	n/a	-32.91788	26.13168	IIIB
013	Siltstone flake	Artefacts	MSA	0 to 5	-32.91899	26.13102	NCW
014	Termite mound packed worth stones, possible beehive	Structure	Historical	n/a	-32.9363	26.12645	NCW
015	Siltstone core and flake edge retouched	Artefacts	MSA	0 to 5	-32.94063	26.12632	NCW
016	Siltstone flake	Artefacts	MSA	0 to 5	-32.92597	26.10709	NCW
017	Single siltstone flake, blady, edge retouched, thicker side	Artefacts	MSA	0 to 5	-32.91268	26.09631	NCW
018	Quartzite flake early MSA	Artefacts	MSA	0 to 5	-32.89802	26.1027	NCW
019	Siltstone core radial both ends	Artefacts	MSA	0 to 5	-32.89334	26.10634	NCW
020	Siltstone flake, early MSA	Artefacts	MSA	0 to 5	-32.89205	26.10784	NCW
021	Siltstone blade flake	Artefacts	MSA	0 to 5	-32.88098	26.10519	NCW



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022	Siltstone flake, early MSA	Artefacts	MSA	0 to 5	-32.87855	26.10268	NCW
023	Siltstone early Msa flake, bifacially worked	Artefacts	MSA	0 to 5	-32.90982	26.06829	NCW
024	Siltstone point finely made	Artefacts	MSA	0 to 5	-32.90178	26.06333	NCW
025	Quartzite flakes and core, early MSA	Artefacts	MSA	0 to 5	-32.89438	26.05735	NCW
026	Quartzite core	Artefacts	MSA	0 to 5	-32.88438	26.05409	NCW
027	Quartzite biface early MSA	Artefacts	MSA	0 to 5	-32.87564	26.0677	NCW
028	Fine grained quartzite blade	Artefacts	MSA	0 to 5	-32.87233	26.07015	NCW
029	Brick water tank	Structure	Modern	n/a	-32.87218	26.04892	NCW
030	Early Msa quartzite flake in eroded jeep track	Artefacts	MSA	0 to 5	-32.79101	25.97021	NCW
031	Quartzite flake, early MSA	Artefacts	MSA	0 to 5	-32.79308	25.97158	NCW
032	Silcrete radial core, flake, quartzite flakes, siltstone flake, hornfels core	Artefacts	MSA, LSA	10 to 30	-32.80312	25.97532	NCW
033	Quartzite flake	Artefacts	MSA	0 to 5	-32.80566	25.98105	NCW
034	Siltstone bifacially worked flake	Artefacts	MSA	0 to 5	-32.80756	25.98438	NCW
035	Hornfels core	Artefacts	LSA	0 to 5	-32.81356	25.99092	NCW
036	Silcrete point on top of sand Bank of dam wall	Artefacts	MSA	0 to 5	-32.81892	25.99685	NCW
037	Quartzite flake early MSA	Artefacts	MSA	0 to 5	-32.82573	26.00442	NCW
038	Quartzite blade flake	Artefacts	MSA	0 to 5	-32.83107	26.01001	NCW
039	Hornfels and quartzite flakes in eroded warthog den	Artefacts	MSA, LSA	5 to 10	-32.84437	26.02901	NCW
040	Siltstone flake	Artefacts	MSA	0 to 5	-32.84965	26.03786	NCW
041	Siltstone flake	Artefacts	MSA	0 to 5	-32.894623	26.087614	NCW
042	Siltstone core and flake	Artefacts	MSA, LSA	0 to 5	-32.913522	26.105142	NCW
043	Siltstone flake	Artefacts	MSA	0 to 5	-32.92227	26.121494	NCW

Palaeontology

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 some do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on 25 and 26 April 2022 by Bamford and Matias confirmed that there are NO FOSSILS visible on the surface and there are no visible rocky outcrops that potentially could have vertebrate fossils. A representative section of the ridges was surveyed but not the entire area because of no access, but as far as we could see, and according to the geological map and satellite imagery, there did not appear to be any anomalous areas. It is not known what lies below the soils.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were NO FOSSILS in the project footprint. Since there is a small chance that fossils from the *Cistecephalus* Assemblage Zone (AZ) might occur below the surface and soils and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

4.3 Selected photographic record

(a full photographic record is available upon request)



Figure 7.1: Observation 001



Figure 7.2: Observation 002



Figure 7.3: Observation 003



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Figure 7.4: Observation 008



Figure 7.5 Observation 009



Figure 7.6 Observation 010



Figure 7.7 Observation 011



Figure 7.8 Observation 012



Figure 7.10 Observation 012



Figure 7.11 Observation 013



Figure 7.12 Observation 014



Figure 7.13 Observation 015



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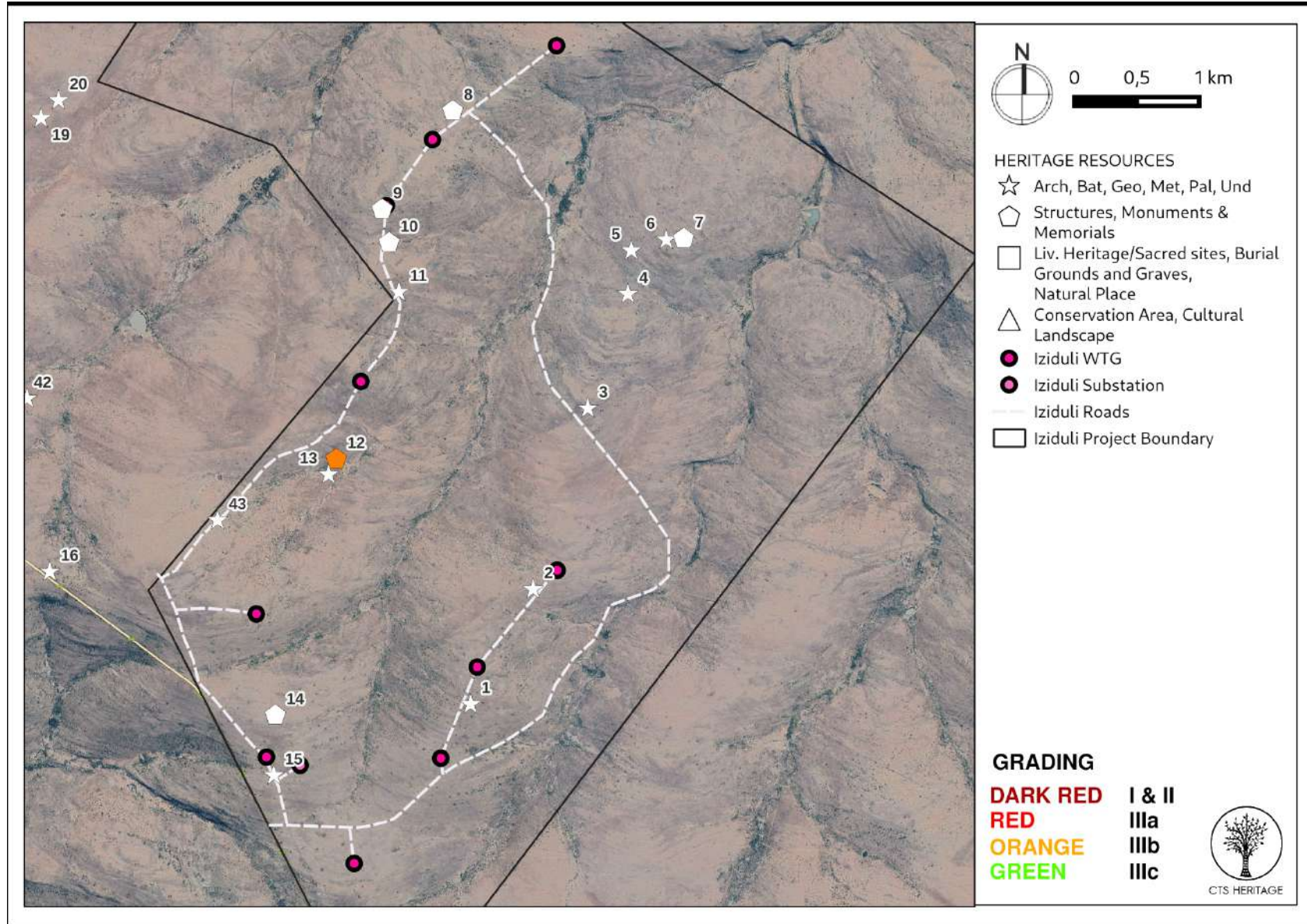


Figure 8.1: Map of heritage resources identified during the field assessment (2022) relative to the final proposed development footprint

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

Based on the field assessment completed, the overall archaeological sensitivity of the development area is low. As per the findings of Binneman (2014) and Halkett (2010), this field assessment identified that stone artefacts seem to be concentrated along the floodplains of the non-perennial river systems.

None of the archaeological observations noted in this field assessment were determined to have sufficient scientific significance to be conservation-worthy and their recording in this report is considered sufficient. No archaeological resources of significance will be impacted by the proposed turbines in their current locations.

One structure, a stone walled ruin (Observation 012), was identified within the area proposed for the Iziduli Emoyeni WEF development area. This site has been Graded IIIB and while no impact to this site is anticipated from the layout provided, it is recommended that a no-development buffer of 50m is implemented around this site.

In their original response to the Amakhala Emoyeni WEF, SAHRA required that “All stone structures, stone kraals and enclosures within 200m from the construction area must be protected through temporary fencing.” It must be noted that no impact to heritage resources are anticipated from the final layout provided, however a round stone kraal (Observation 009) is located within 200m of a proposed turbine and as such, as per SAHRA’s requirements, it is recommended that this site be fenced off.

Based on this field assessment and on the findings of previous assessments in the area, it is not anticipated that the proposed WEF development layout will negatively impact on significant archaeological heritage on condition that the recommendations articulated below are implemented.

Palaeontology

Based on the fossil record but confirmed by the site visit and walk through there are no visible rocky outcrops and NO FOSSILS on the land surface of the *Cistecephalus* Assemblage Zone (upper Middleton Formation, Adelaide Subgroup, Karoo Supergroup) even though fossils have been recorded from rocks of a similar age and type in South Africa. Only one significant heritage resource is located in close proximity to the existing road - SAHRIS Site 40762. This site is described as “An occurrence of sphenophyte (horsetail) impressions in grey shales”. While no impact is anticipated as the site is located along an existing road, it is recommended that a 30m no development area be implemented around this site.

It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the mudstones of the Middleton Formation, so a Fossil Chance Find Protocol should be added to the EMPr.



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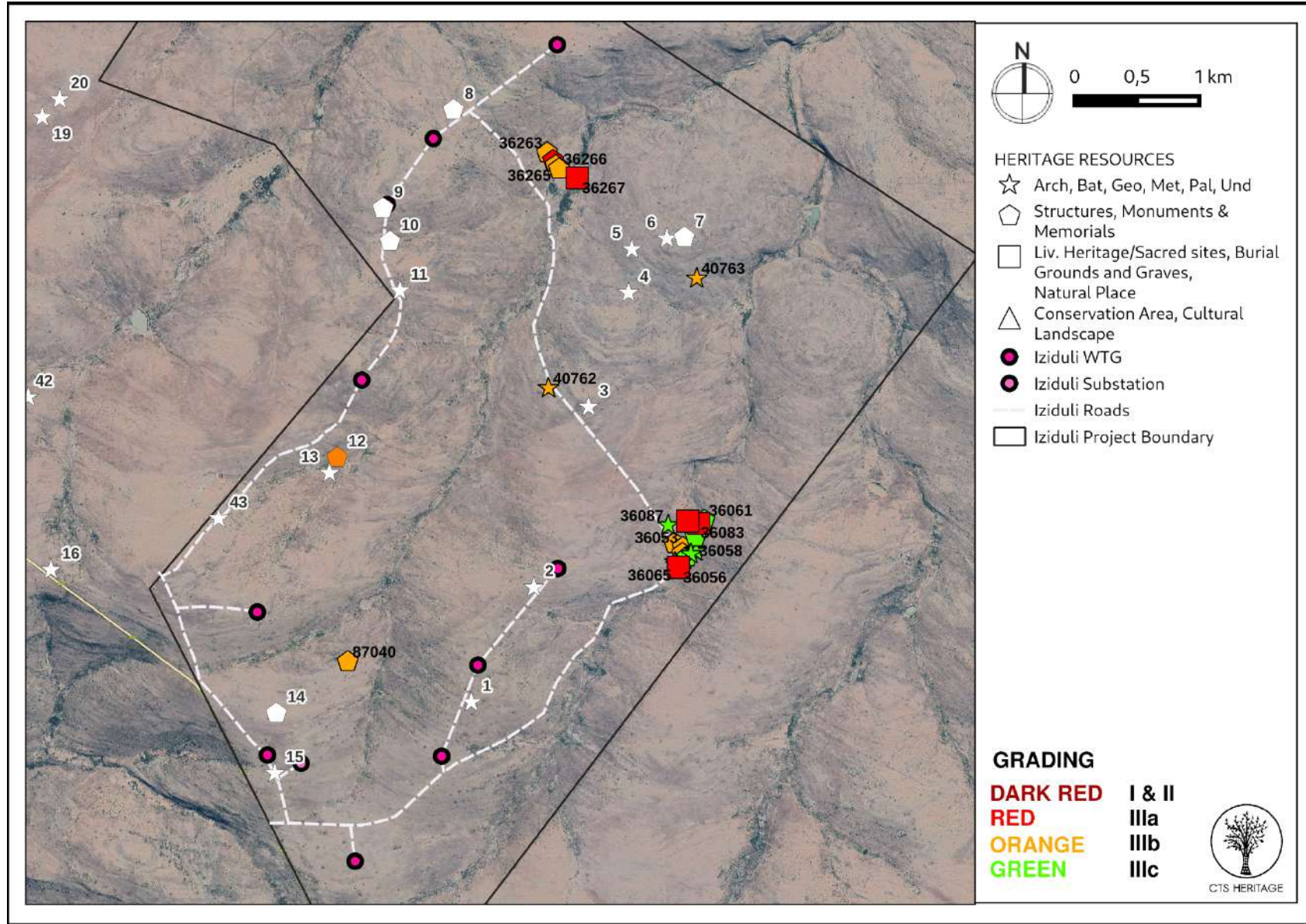


Figure 9.1: Map of all known significant heritage resources relative to the final proposed development footprint



Figure 9.2: Map of all known significant heritage resources relative to the final proposed development footprint with recommended buffer - no impact anticipated



Figure 9.3: Map of all known significant heritage resources relative to the final proposed development footprint with recommended buffers - no impact anticipated



6. FINAL LAYOUT

Subsequent to the walkdown results, the Final Layout was determined based on inputs from all of the specialists. Updated layouts and the consolidated sensitivity files from all specialists were provided in order to see how turbines and access roads have been micro-sited taking all considerations into account and if they could not be micro-sited comments as to why this was not feasible.

The Final Layout is mapped against the layout that was subjected to a walkdown in Figure 10. The differences in layout are minor from a heritage perspective and as such, the final layout is acceptable from a heritage perspective and it complies with all of the heritage recommendations put forward for this project.

7. CONCLUSION AND RECOMMENDATIONS

No archaeological resources of significance were identified within the area proposed for development during this field assessment although one site of heritage value was previously identified within the 300m grid corridor or the proposed substation footprint and assessment area. No impacts to significant archaeological heritage resources are anticipated from the proposed development on the condition that the recommended mitigation measures are implemented.

No observations of palaeontological significance were noted within the area proposed for development. However, the geology underlying the development area remains sensitive for impacts to significant palaeontological heritage. Based on the findings of the palaeontology walkdown report, the proposed layout should be approved as there is no infrastructure proposed within areas that can impact the site's palaeontological significance on condition that the Fossil Chance Find Protocol is implemented for the duration of all construction activities.

Recommendations

This report satisfies the requirements of SAHRA and condition 10.10.1 in the EA. There is no objection to the proposed final layout of the Msenge Emoyeni WEF as provided and mapped in this report from a heritage perspective on condition that:

- A no development buffer of 30m is recommended around palaeontological site 40762 located along the existing road
- A no-development buffer of 50m is recommended around Observation 012. This site is located more than 200m from any proposed infrastructure and so no impact is anticipated.
- As per SAHRA's requirements, all stone structures, stone kraals and enclosures within 200m from the construction area must be protected through temporary fencing. The only site located within 200m of proposed construction is Observation 009. No impact to this site is anticipated.
- The attached Chance Fossil Finds Procedure (Appendix 2) is implemented for the duration of construction activities for this project.



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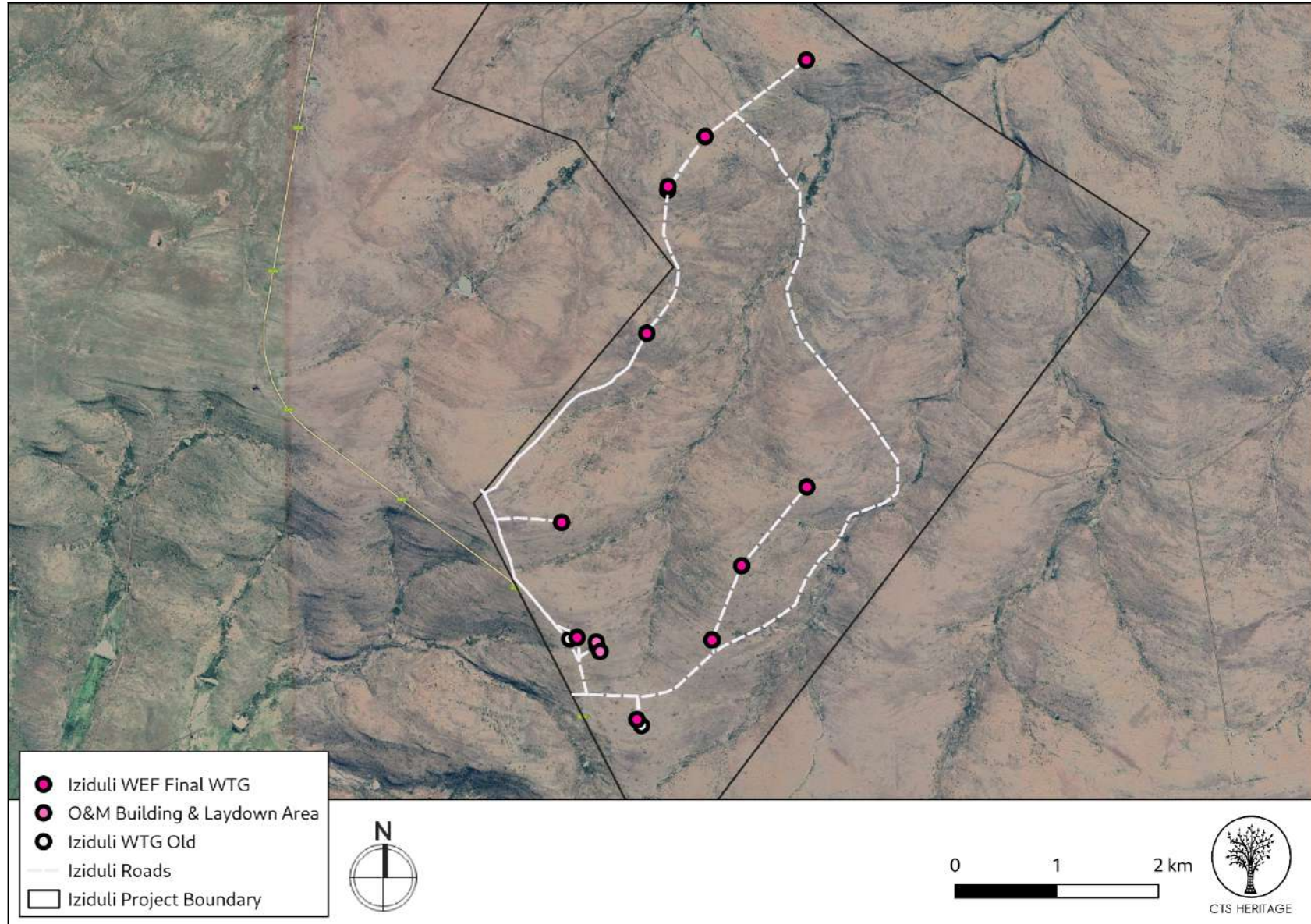


Figure 10.1: Final Layout of WEF mapped relative to layout that was walked



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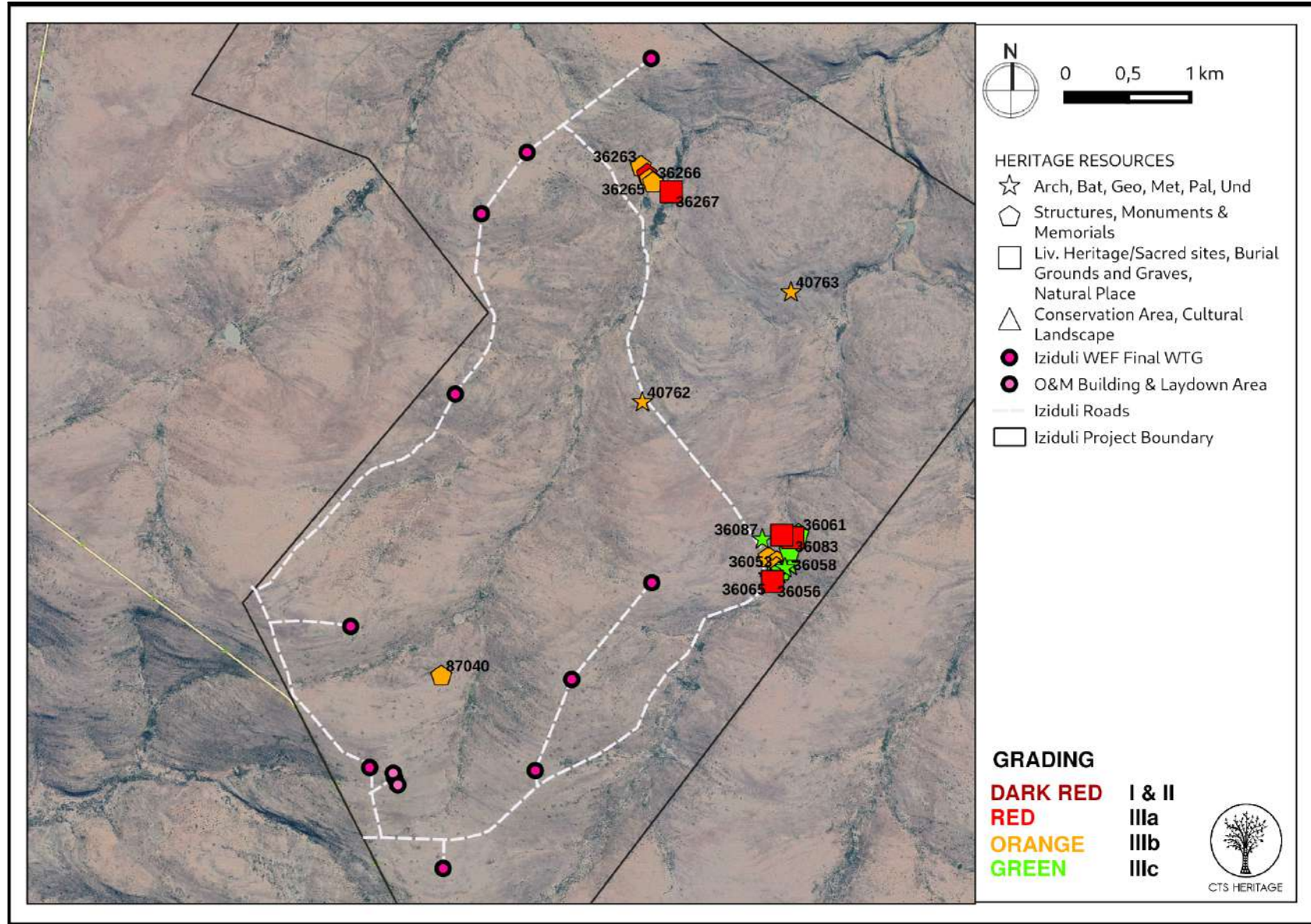


Figure 10.2: Final Layout of WEF mapped relative to known sites



8. REFERENCES

Heritage Impact Assessments				
Nid	Report Type	Author/s	Date	Title
6193	AIA Phase 1	Dave Halkett, Lita Webley	28/03/2010	Heritage Scoping Assessment of a Proposed Wind Energy Facility to be situated on farms in the Cookhouse District, Eastern Cape.
7945	AIA Desktop	Frans Prins	05/02/2011	DRAFT Technical Report in support of the EMP for the South Western Karoo Basin Gas Exploration Application Project: CULTURAL HERITAGE: EASTERN PRECINCT
8376	HIA Phase 1	Dave Halkett, Lita Webley, Jayson Orton, Hugo Pinto	17/10/2010	Heritage Impact Assessment of the proposed Amakhala-Emoyeni Wind Energy Facility, Cookhouse District, Eastern Cape
109187	PIA Phase 1	Billy De Klerk	01/09/2010	Palaeontological Impact Assessment of a proposed wind energy facility to be situated on a site south-east of Cookhouse and asouth of Bedford in the Eastern Cape province. The Amakhala-Emoyeni Wind Energy Facility
109190	AIA Phase 1B	Johan Binneman	01/08/2013	An archaeological walkthrough survey of the turbine footprint for the proposed Phase 1 Amakhala Emoyeni Wind Energy Facility, Cookhouse District, Blue Crane Route Municipality, Eastern Cape Province
250695	AIA Phase 1	Johan Binneman	31/07/2014	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENTS OF THE PROPOSED SUBSTATION, SWITCHING STATION AND POWER LINE GRID CONNECTION FOR THE IZIDULI EMOYENI WIND FARM, BLUE CRANE ROUTE LOCAL MUNICIPALITY, SARAH BAARTMAN DISTRICT, EASTERN CAPE
271038	Archaeologic al Specialist Reports	Johan Binneman	24/03/2014	An Archaeological Walk through Survey if the proposed turbine footprint and infrastructure for the Msenge Emoyeni Wind Energy Facility, Bedford District, Blue Crane Route Municipality, Eastern Cape Province



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APPENDIX 1: Palaeontology Walkdown Report (Bamford, 2022)

Palaeontological Impact Assessment for the proposed Iziduli WEF, south of Bedford and Adelaide, Eastern Cape Province

Site Visit Report (Phase 2)

For

CTS Heritage

01 May 2022 (Rev 17 May)

Prof Marion Bamford
Palaeobotanist
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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 33 years research; 25 years PIA studies

Declaration of Independence

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

Specialist: Prof Marion Bamford

A handwritten signature in blue ink, appearing to read 'M Bamford', with a horizontal line underneath.

Signature:

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed Iziduli WEF, south of Bedford and Adelaide, Eastern Cape Province.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the potentially very highly fossiliferous rocks of the Middleton Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup). These mudstones and sandstones could preserve vertebrate fossils of the *Cistecephalus* Assemblage Zone. The site visit on 24-25 April confirmed that there were NO FOSSILS visible on the lands surface. The road cuttings through the rocks also were barren of vertebrate and plant fossils. It is not known what lies beneath the soil cover, although fossils are not numerous in this part of the Karoo Basin. 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, developer, environmental officer or other designated responsible person once excavations or drilling activities for turbine foundations, pipes, powerlines and infrastructure have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

Expertise of Specialist.....	1
Declaration of Independence.....	1
1. Background.....	4
2. Methods and Terms of Reference.....	7
3. Geology and Palaeontology.....	8
i. Project location and geological context.....	8
ii. Palaeontological context.....	10
iii. Site visit observations	11
4. Impact assessment.....	18
5. Assumptions and uncertainties.....	19
6. Recommendation.....	19
7. References.....	20
8. Chance Find Protocol.....	21
9. Appendix A - Examples of fossils	22
10. Appendix B - Details of specialist.....	23
Figure 1: Google Earth map of the project area	8
Figures 4-5: Geological maps of the area around the project site.....	9
Figure 6: SAHRIS palaeosensitivity map for the site for the project	
Figure 7: Site visit map and coordinates	11
Figures 8-12: Site visit photographs	13-17

i. Background

The proposed Iziduli Wind Energy Facility (WEF) with 10 turbines, access roads, and power lines and an on-site substation is planned for construction on four land parcels that lie to the west and east of the R350 road between Bedford and Grahamstown, but closer to Bedford and Adelaide, Eastern Cape Province.

The land parcels in this project are from north to south, Farm Geluk RE220, Farm Vogelfontein 219 and Farm Brakfontein portions 2/218, 1/218 and RE218 (Figures 1, 2). The latter farm will also have an on-site substation. There are numerous turbines to the northwest of this cluster along the prominent ridges and they feed into the Poseidon Substation that in the direction of Cookhouse (Figure 1), as will this cluster.

The whole area is on potentially very highly fossiliferous rocks of the Middleton Formation so a site visit palaeontological assessment is required.

A Palaeontological Impact Assessment was requested for the Iziduli WEF 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 site visit and walkthrough (Phase 2) Palaeontological Impact Assessment (PIA) was completed on 25-26 April by palaeontologist Marion Bamford and assistant student Roxane Matias for the proposed development and is reported herein.

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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section i.
ci	An indication of the quality and age of the base data used for the	Yes

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
	specialist report: SAHRIS palaeosensitivity map accessed – date of this report	
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 infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section viii.
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 vii.
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 if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

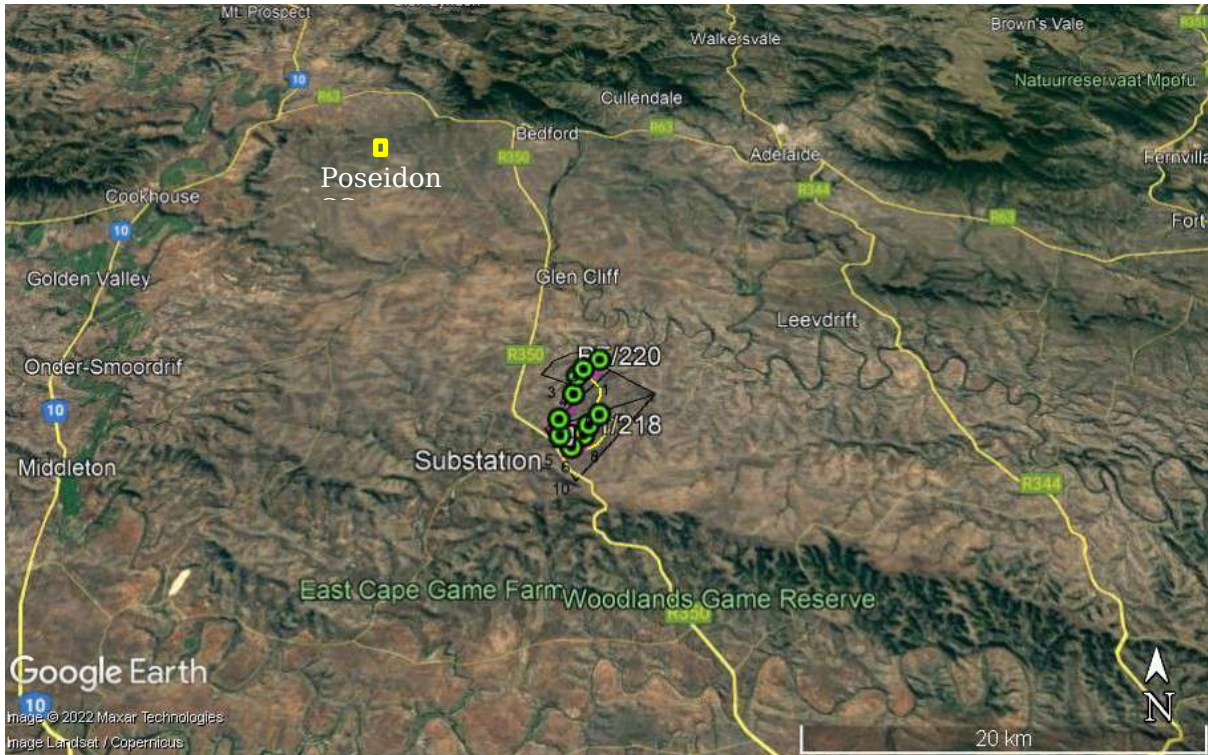


Figure 1: Google Earth map of the proposed development showing the relevant land marks. Turbines - Green, proposed road - pink and existing road - yellow

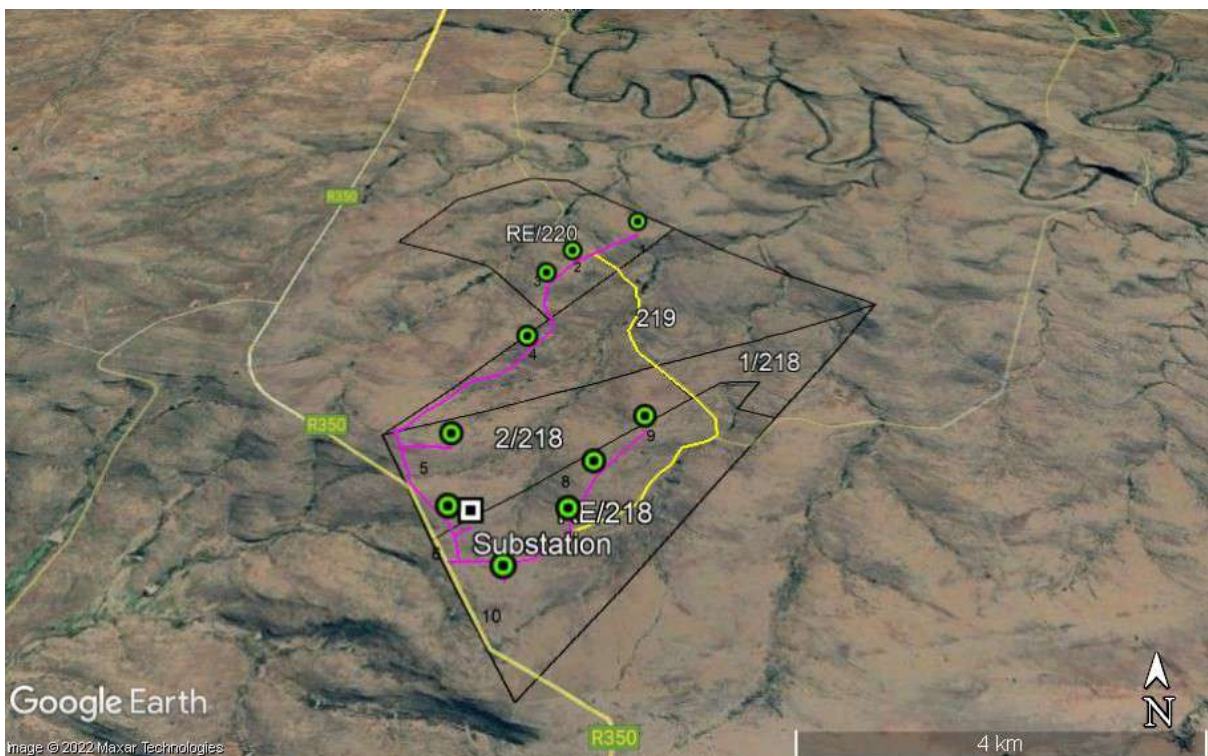


Figure 2: Google Earth map of the proposed Iziduli WEF turbines and connections. Turbines - Green, proposed road - pink and existing road - yellow

ii. Methods and Terms of Reference

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

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance, as is the case here;
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

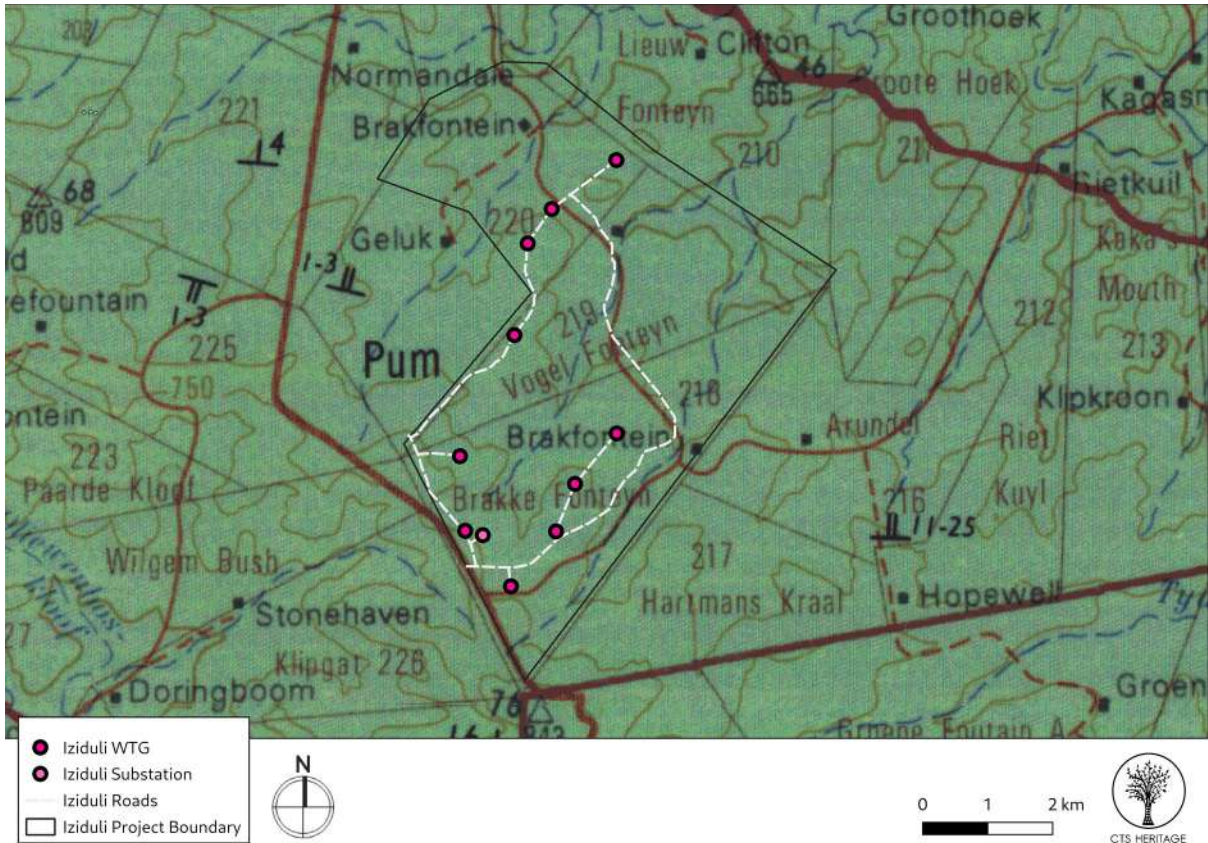


Figure 4: Geological map of the area around the Iziduli WEF south of Bedford indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 3226 King Williamstown.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006; Smith et al., 2020). 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	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pm	Middleton Fm, Adelaide Subgroup, Beaufort Group, Karoo SG	Grey and red mudstones, sandstone,	Late Permian,

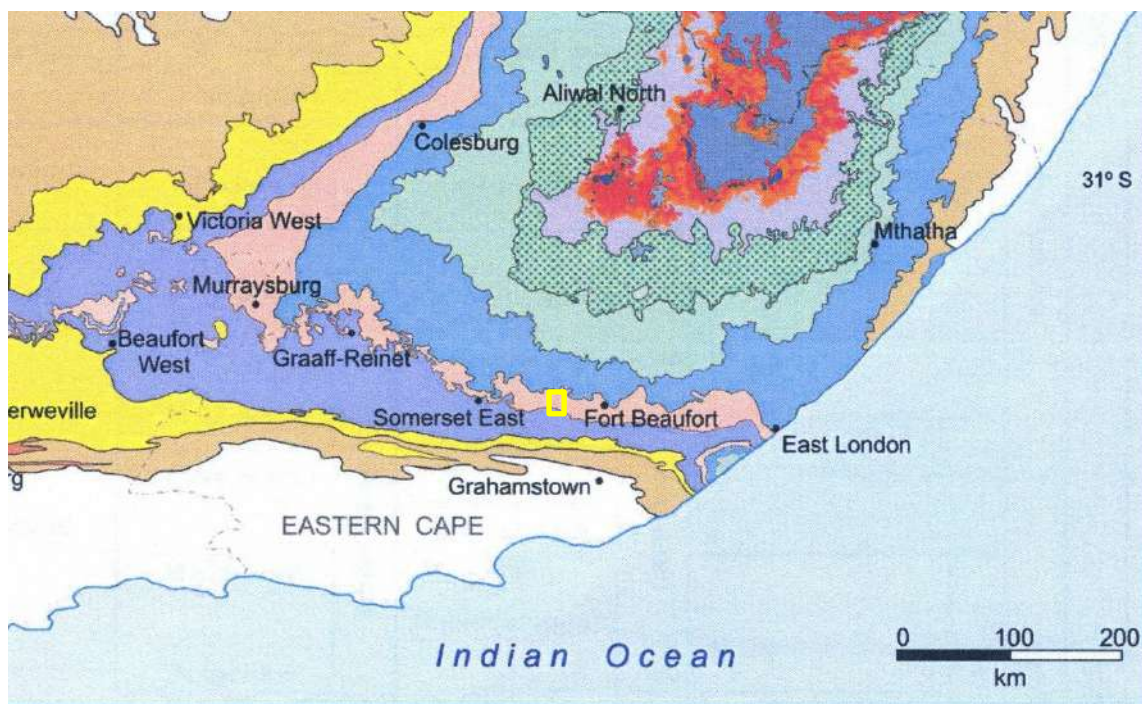


Figure 5: Karoo biostratigraphy map to show the vertebrate assemblage zones. Iziduli (yellow rectangle between Somerset East and fort Beaufort) is in the pink band - *Cistecephalus* Assemblage Zone (map from Smith et al., 2020, fig.1).

The site lies in the southern margin of the Main Karoo Basin where the rocks of the Middleton Formation are exposed (Figure 4).

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.

Overlying the Eccia Group are the rocks of the Beaufort Group that has been divided into the lower Adelaide Subgroup for the Upper Permian strata, and the Tarkastad Subgroup for the Early to Middle Triassic strata. As with the older Karoo sediments, the formations vary across the Karoo Basin. In this part of the basin, east of 24°E, three formations are recognised in the Adelaide Subgroup, the basal Koonap Formation, **Middleton Formation** and thick upper Balfour Formation. The latter has been divided into five members, the lower four from the base up are the Oudeberg, Daggaboersnek, Ripplemead and Elandsberg Members. The topmost member, the Palingkloof Member, is in the earliest Triassic (Smith et al., 2020).

Overlying the Beaufort Group are the three formations of the Stormberg Group. They are absent from the western part of the basin but are more uniform across the eastern part of the basin. Capping the Stormberg Group are the Drakensberg Group basalts and dykes that signalled the end of deposition in the Karoo basin. The Stormberg Group formations are the lower Molteno Formation shales, the Elliot Formation that recently has been divided into the lower and upper Elliot Formation, and the upper Clarens Formation.

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

v. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 6. The site for development is in the very highly sensitive Middleton Formation (red).

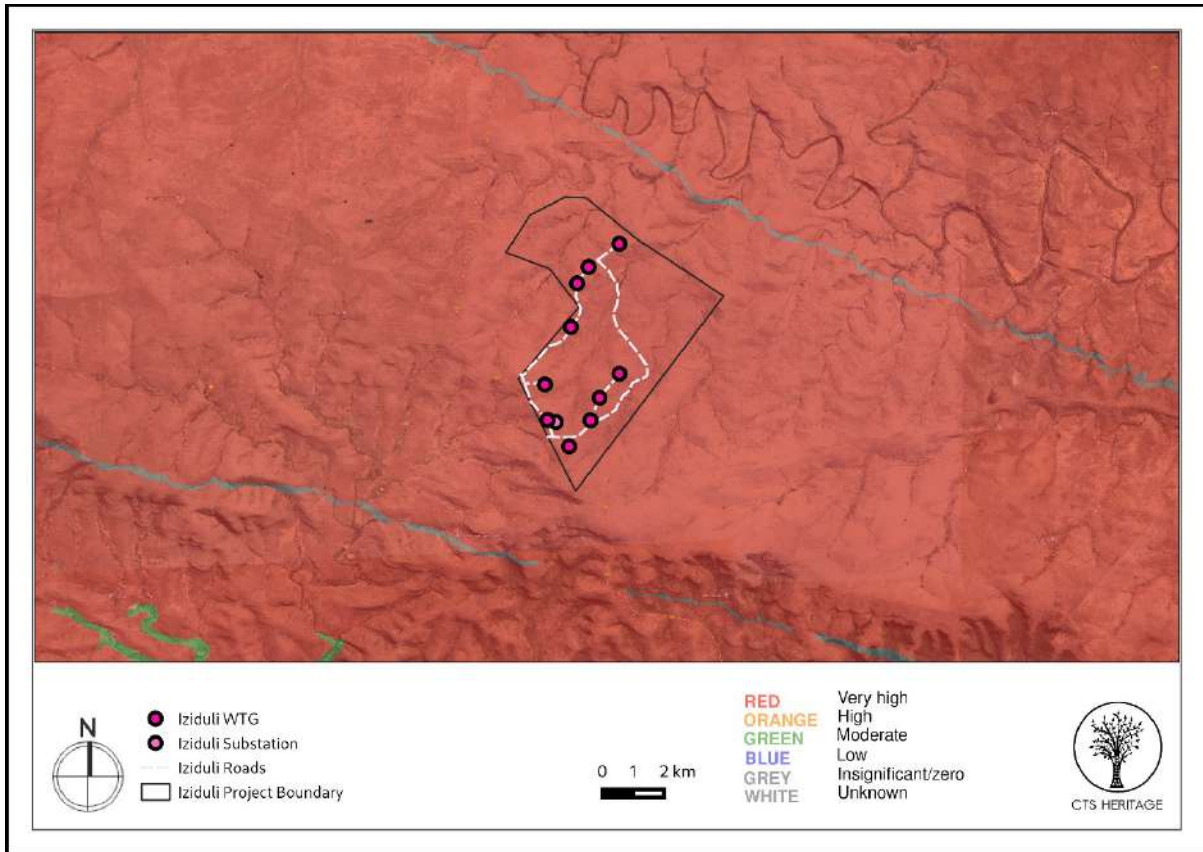


Figure 6: SAHRIS palaeosensitivity map for the site for the proposed Iziduli WEFs south of Bedford. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The Late Permian Middleton Formation preserves only a small selection of fossil plants of the *Glossopteris* flora but a variety of vertebrate fossils have been found in the Karoo exposures. These include Pisces, Amphibia, Parareptilia, Eureptilia, Biarmosuchia, Anomodontia, Gorgonopsia and Theriocephalia (see list of genera in Appendix A). Based on these fossils at other exposures in the Karoo, the upper Middleton Formation preserves the *Cistecephalus* Assemblage Zone (Rubidge et al., 1995; Smith et al., 2020). A site visit or Phase 2 Palaeontological Impact Assessment is therefore required.

vi. Site visit observations

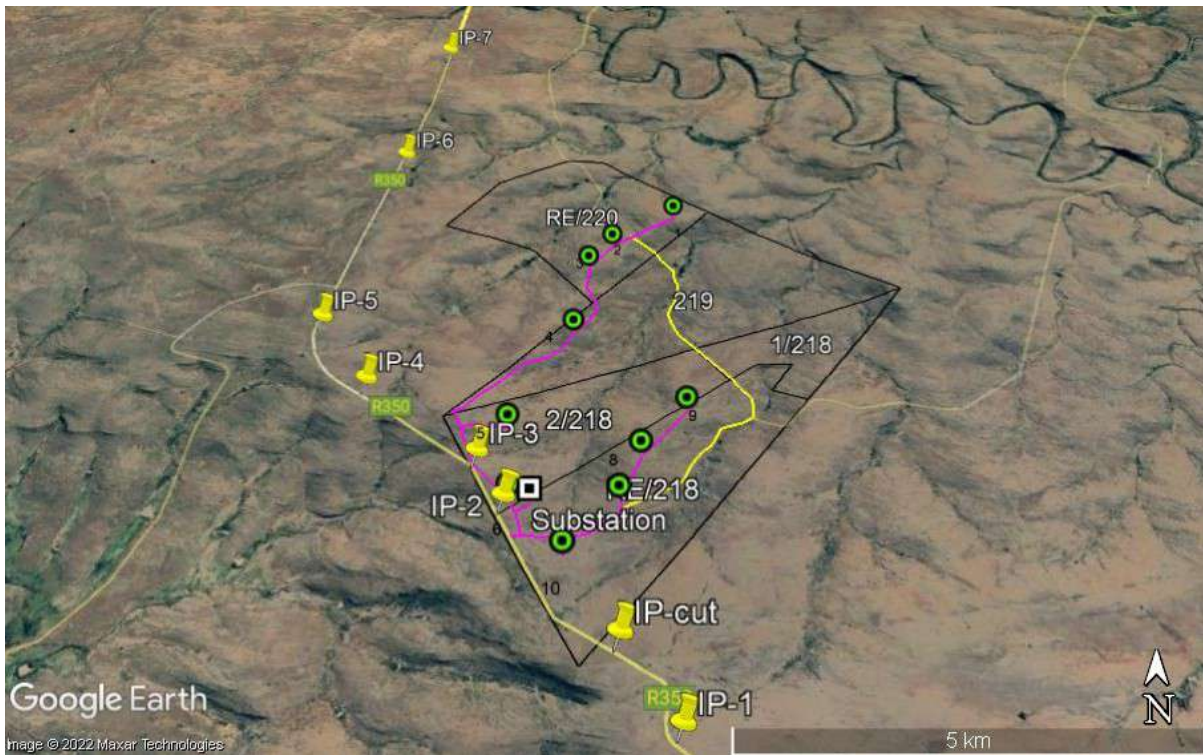


Figure 7: Annotated Google Earth map for the site stops and observations (refer to Table 3). Turbines - Green, proposed road - pink and existing road - yellow

The area was visited by palaeontologist Marion Bamford and student assistant Roxane Matias on 25-26 April 2022. The main site stops/GPS points, photographs and observations are provided in Figure 7 and Table 3. It should be noted that access to the farms was prohibited because they are hunting farms and too dangerous to visit during the hunting season - current. From the public roads the higher ridges were viewed, as well as the exposed rock in the road cuttings. The latter were ideal for determining the richness (or not) of the fossils because the area is covered in soils and thin to thick vegetation.

Table 3: Site observations, GPS points and relevant figures

GPS	Observations	Figures
IP-1 32° 58' 58.95"S 26° 08' 47.46"E	Along the R350 and south of the project area, heading north back to Bedford. This is a high ridge outside the WEF area but affords a good view of the ridges within the area for subsequent closer observation	8A
IP-cut 32° 57' 30.73"S 26° 08'	Road cutting south of the project area but shows the typical Middleton Formation sandstone channels, back-swamp fine shales and mudstone. No fossils and no biotic activity	8 C-D

23.59"E	seen.	
IP-2 32° 56' 28.70"S 26° 07' 37.03"E	Farm Brakkefontein 218. Note the shallow soils and rock scatter.	9 A-B
IP-3 32°56'3.99"S 26° 7'11.50"E	Farm Brakkefontein uphill from the stream crossing. The distant ridge will have a row of turbines. Vegetation cover appears medium dense and consistent.	9 C-D
IP-4 32° 55" 25.22"S 26° 05' 35.52"E	Sweep of road R350 with a view along a ridge that will have turbines to far northwest (RE/220). Similar vegetation, short grasslands and medium grasslands. No rocky outcrops.	10 A-B
IP-5 32° 54' 44.83"S 26° 05' 35.52"E	Along R350 looking north northeast along the southeastern ridge of Farm Leeuwfontein 221 outside of the development area.	10 C-D
IP-6 32° 52' 36.45"S 26° 06' 01.87"E	Farm Leeuwfontein 221 outside the development area. Fairly shallow soils with short grassland, shrubs, some scattered rocks but no rocky outcrops.	11 A-D
IP-7 32° 51' 15.25"S 26° 06' 18.96"E	Road cutting along the R350 north of the project boundary but shows good exposure of the stratigraphy in the area. Thick sandstone channels are wide. Cutting is about 100m long. No fossils in the mudstones or sandstones	12 A-D









Bamford-PIA - Iziduli WEF



Bamford-PIA - Iziduli WEF

vii. Impact assessment

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

Table 4a: Criteria for assessing impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread - Beyond the site boundary. Local
	H	Widespread - Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	H	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 4b: Impact Assessment

PART B: Assessment		
SEVERITY/ NATURE	H	-
	M	-

PART B: Assessment		
	L	Soils and sands do not preserve plant fossils; so far there are no records from the Middleton Fm of plant or animal fossils in this region so it is unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	L	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	L	Since the only possible fossils within the area would be vertebrate fossils of the <i>Cistecephalus</i> AZ (Middleton Fm) in the mudstones, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	H	-
	M	It is unlikely that any fossils would be found in the loose sand and soils that cover the area but they might be below ground in unweathered mudstones. Therefore, a Fossil Chance Find Protocol should be added to the eventual EMPr.
	L	

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were NO FOSSILS in the project footprint. Since there is a small chance that fossils from the *Cistecephalus* Assemblage Zone (AZ) might occur below the surface and soils and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

viii. 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 some do

contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on 25 and 26 April 2022 by Bamford and Matias confirmed that there are NO FOSSILS visible on the surface and there are no visible rocky outcrops that potentially could have vertebrate fossils. A representative section of the ridges was surveyed but not the entire area because of no access, but as far as we could see, and according to the geological map and satellite imagery, there so not appear to be any anomalous areas. It is not known what lies below the soils.

ix. Recommendation

Based on the fossil record but confirmed by the site visit and walk through there are no visible rocky outcrops and NO FOSSILS on the land surface of the *Cistecephalus* Assemblage Zone (upper Middleton Formation, Adelaide Subgroup, Karoo Supergroup) within which this development is located, even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the mudstones of the Middleton Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the contractor, environmental officer, or other responsible person once excavations and drilling have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample.

Based on the findings of this report, the proposed layout should be approved as there is no infrastructure proposed within areas that can impact the site's palaeontological significance on condition that the Fossil Chance Find Protocol is implemented for the duration of all construction activities.

x. References

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xi. Chance Find Protocol

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

1. The following procedure is only required if fossils are seen on the surface and when 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 (trace fossils, fossils of plants, insects, bone or coalified material) 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 13, 14). 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 an ECPHHA or SAHRA permit must be obtained. Annual reports must be submitted to ECPHRA and 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.

xii. Appendix A – Examples of fossils from the Middleton Formation (Beaufort Group).



Figure 13: Photograph of partially exposed bones in the rock, mudstone of the Beaufort Group



Figure 14: Photographs of fossil plants of the Beaufort Group.

Table 5: Lists of plants and vertebrates from the *Cistecephalus* AZ (compiled from Anderson and Anderson, 1985; Rubidge et al., 1995; Smith et al., 2020).

Group/sG/ Fm	Plant Group	Genera	Animal Group	Common Genera
Beaufort, middle	Sphenophyt es	<i>Schizoneura</i> <i>Phyllotheca</i>	Pisces	<i>Namaichthys</i> , <i>Atherstonia</i> ,
Teekloof, lower	Lycopods	<i>Paracalamit es</i>	Amphibia	<i>Rhinesuchus</i> , <i>Laccosaurus</i>
Balfour Fms	Ferns	<i>Asterotheca</i>	Parareptilia	<i>Pareiasaurus</i> , <i>Owenettia</i> , <i>Milleretta</i> , <i>Sauroichtus</i>
Cistecephalus AZ	Glossopterid s	<i>Glossopteris</i> , <i>Plumsteadia</i> , <i>Lidgettonia</i> <i>Estcourtia</i>	Parareptilia	<i>Pareiasaurus</i> , <i>Owenettia</i> , <i>Milleretta</i> , <i>Sauroichtus</i>
			Eureptila	<i>Youngina</i> ,

			Biarmosuchia	<i>Rubidgea,</i> <i>Lycaenodon,</i> <i>Lemurosaurus,</i>
			Anomodontia	<i>Emydops,</i> <i>Priesterodon,</i> <i>Diictodon,</i> <i>Dicynodontoides,</i> <i>Oudeodon,</i> <i>Aulacephalodon,</i> <i>Dianomodon,</i> <i>Dicynodon,</i> <i>Daptocephalus,</i> <i>Cistecephalus</i>
			Gorgonopsia	<i>Gorgonops,</i> <i>Lycaenops</i> <i>Cynosaurus,</i> <i>Rubidgea</i> <i>Smilesaurus,</i> <i>Lontosaurus,</i> <i>Scylacosaurus,</i> <i>Aelurognathus</i>
			Therocephalia	<i>Hofmeyeria,</i> <i>Ictidosuchoides,</i> <i>Euchambersia</i>

xiii. Appendix B - Details of specialist

Marion Bamford (PhD)
Short CV for PIAs - Jan 2022

I) **Personal details**

Present employment : Professor; Director of the Evolutionary Studies Institute.

Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa

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Fax : +27 11 717 6694

Cell : 082 555 6937

E-mail : marion.bamford@wits.ac.za ;
marionbamford12@gmail.com

ii) **Academic qualifications**

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
 1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
 1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
 1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
 1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

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

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/ completed	Current
Honours	11	0
Masters	14	1
PhD	11	6
Postdoctoral fellows	12	2

viii) Undergraduate teaching

Geology II - Palaeobotany GEOL2008 - average 65 students per year
 Biology III - Palaeobotany APES3029 - average 25 students per year
 Honours - Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology - average 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: Cretaceous Research: 2018-2020

Associate Editor: Royal Society Open: 2021 -

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

x) **Palaeontological Impact Assessments**

Selected from recent project only - list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for Enviropro
- 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
- Glosam Mine 2021 for AHSA

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 = 36; i10-index = 95

Conferences: numerous presentations at local and international conferences.



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APPENDIX 2: 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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