HERITAGE IMPACT ASSESSMENT

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

PROPOSED PROSPECTING ON PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153 MATZIKAMA MUNICIPALITY, VREDENDAL DISTRICT, WESTERN CAPE PROVINCE

Prepared by CTS Heritage

CTS HERITAGE

Jenna Lavin

For

EnviroWorks

June 2023

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EXECUTIVE SUMMARY

1. Site Name:

PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153

2. Location:

Located approximately 25km north of Papendorp along the West Coast.

3. Locality Plan:

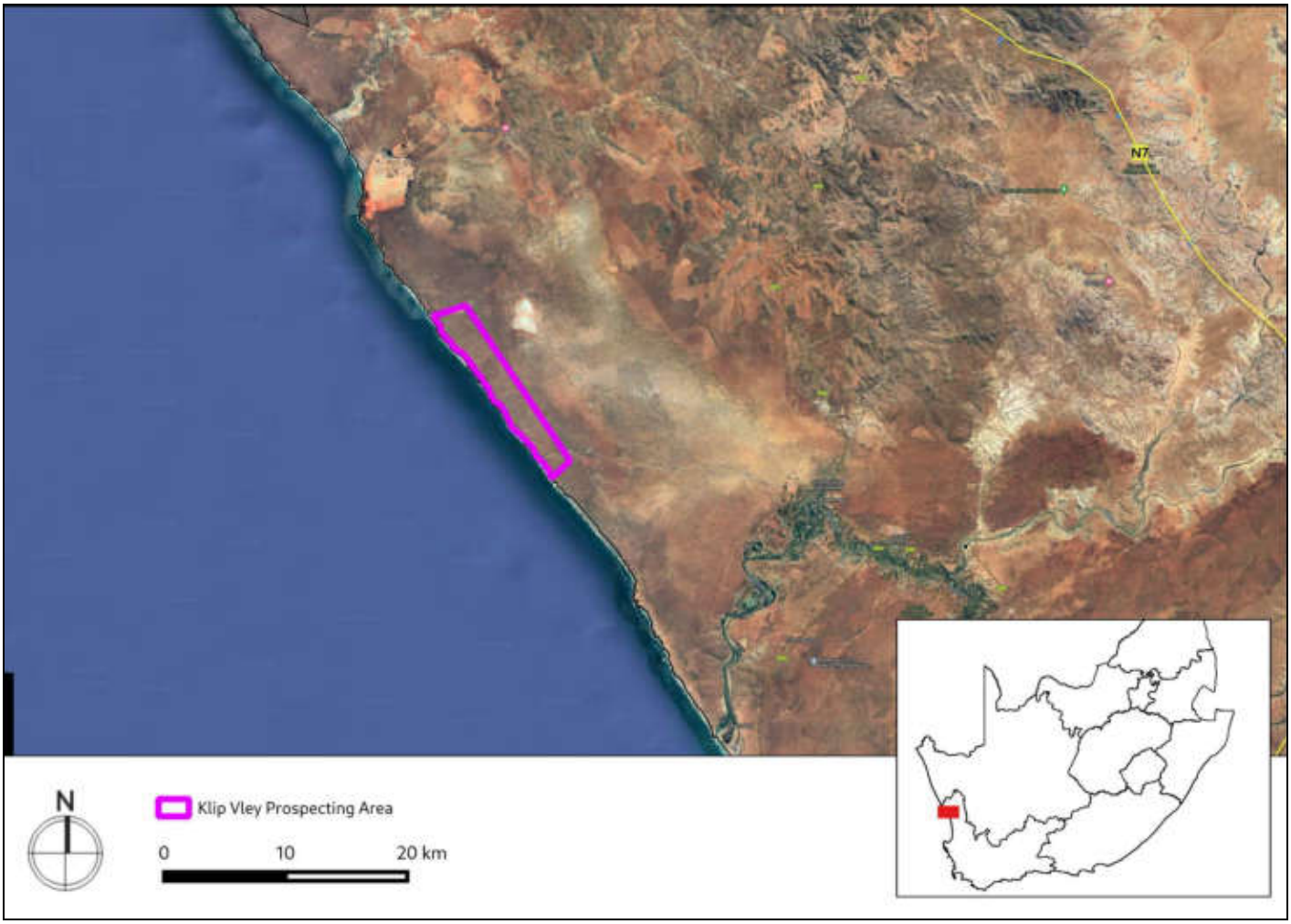

Figure A: Location of the proposed development area

4. Description of Proposed Development:

This report is drafted as part of the request for approval for proposed prospecting on PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153 located approximately 25km north of Papendorp along the West Coast. The existence and possible size of heavy mineral deposits in the application area will be determined as follows:

- Data review and desktop studies
- Mapping and surface sampling
- Reconnaissance Drilling

5. Heritage Resources Identified:

Table A: Heritage Resources identified

Obs#	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
008	Very large midden behind camping screens lining the beach. About 50m from hwm. Dominated by S. argenvillei. Burnupena and black mussel too. Quartzite manuports, some flakes, quartz. Granite. At least 75m long x 30m wide.turbo? Check	Shell Midden	LSA	30+	-31.471229	18.008498	IIIB	100m Buffer
009	Quarry midden dominated by black mussel. Large overburden area on right hand side and less compacted shell lenses on the left. Roadworks cut through it	Shell Midden	LSA	30+	-31.470477	18.008118	IIIB	100m Buffer
011	Concrete structure - possible platform mixed with quartzite rocks and concrete blocks along the sides. Unsure of purpose - perhaps related to earlier mining or WW2 coastal defense structure.	Structure	Historic	n/a	-31.43594	17.981644	IIIA	100m Buffer
015	Large pan/deflation area. Thousands of LSA and MSA artefacts exposed on hard packed palaeo surface. Cobbles, hammerstones, cores. Retouched flakes and many blanks. Quartzite, quartz, haematite. Dominated by quartz. Over extensive area. Bleached bone large antelope?	Artefacts	LSA+MSA	30+	-31.386657	17.966899	IIIB	NO IMPACT PERMITTED EXCLUDE AREA FROM MINING ACTIVITIES
016	Baievlei werf, mudbrick walls	Structure	Historic	n/a	-31.383831	17.973905	IIIC	100m Buffer

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016	Baievlei werf, mudbrick walls plastered with cement plaster, corrugated iron roofs	Structure	Historic	n/a	-31.384835	17.973442	IIIC	100m Buffer
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019	Loubscher family graveyard. 4 graves between 1949 - 2003	Graves/BurialGrounds	Historic	n/a	-31.383935	17.972389	IIIA	100m Buffer
026	Visser graveyard, at least 14 graves, late 19th to 20th c.	Graves/BurialGrounds	Historic	n/a	-31.486804	18.077308	IIIA	100m Buffer

6. Anticipated Impacts on Heritage Resources:

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. Significant archaeological material remains were documented within and outside of the proposed prospecting area. The majority of the significant resources are located outside of the prospecting area, and within the highly sensitive coastal shell-midden zone which extends 300m from the highwater mark. Many archaeological resources have been recorded in this area, and it is likely that these recordings represent a small fraction of the density of resources present here. No impact should take place within this highly sensitive 300m zone.

The significant heritage resources identified within the development area are associated with the deflation pan located in the north east of the prospecting area. It is recommended that the deflation pan as mapped above is excluded from prospecting activities. Additional recommendations are made in Table 1 to ensure that the significant resources identified are not negatively impacted by the proposed prospecting.

In terms of impacts to palaeontological heritage, there are no known outcrops of sensitive fossiliferous strata in the Project Area that require protection as NO-GO sites, such as spots where fossils occur in obvious abundance. The palaeontological resources are predominantly subsurface and consequently considerations of fossil potential do not result in preferred sites and the particular locations of surface sampling and drilling do not affect this assessment. The PIA provides recommendations regarding Chance Fossil Finds during the SURFACE SAMPLING and the RECONNAISSANCE DRILLING phases.

It is important to reiterate that the above findings pertain only to prospecting activities due to their limited scale. As is also noted elsewhere, this part of the West Coast has been subjected to mining activities since the 1960's and as such, the proposed prospecting activities aren't unexpected here. Furthermore, the limited nature and scale of

prospecting is unlikely to negatively impact on the significant scenic and wilderness landscape qualities of the Sandveld area. However, should mining activities proceed, a more careful assessment of impacts to the cultural landscape should be undertaken.

7. Recommendations:

Based on the outcomes of this report, it is not anticipated that the proposed prospecting will negatively impact on significant archaeological heritage on condition that::

- The mitigation measures detailed in Table 1 and mapped in Figures 8.1 to 8.6 are implemented
- The highly sensitive coastal shell-midden zone which extends 300m from the highwater mark is excluded from prospecting activities
- The deflation pan (Site 015) is excluded from prospecting activities
- The recommendations included in the PIA must be implemented. These include;
    - Sensitising personnel involved in shallow pit sampling to the occurrence of fossil bones
    - Fossil material extracted from boreholes be kept and bagged for identification by a palaeontologist
    - Quality images of any fossils material should be forwarded by email to a palaeontologist for the identification of specimens of importance for stratigraphic diagnosis, and for specimens requiring further examination
    - Samples of mud beds from any formation should be taken due to their scientific importance in the preservation of fossil pollen
- The attached Chance Fossil Finds Procedure is adopted for the prospecting
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

8. Author/s and Date:

Jenna Lavin

June 2023

Details of Specialist who prepared the HIA

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

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

Since 2016, Jenna has drafted over 250 Screening and Heritage Impact Assessments throughout South Africa.

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CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

This report is drafted as part of the request for approval for proposed prospecting on PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153 located approximately 25km north of Papendorp along the West Coast. The existence and possible size of heavy mineral deposits in the application area will be determined as follows:

• Data review and desktop studies

• Mapping and surface sampling

• Reconnaissance Drilling

The prospecting will be conducted in 3 phases, each one dependent on the results of the previous.

- Phase 1 will involve the following desk-top activities: data acquisition from government and private sources, and analysis of any existing/previous prospecting and drilling data, satellite (Landsat) imagery, aerial photos, and terrain data, as well as geological map interpretation. The synthesis and interpretation of such information will contribute towards providing a clearer picture of the location and characteristics of the heavy mineral deposit/s, and will guide the in-field prospecting programme.
- Phase 2: Surface mapping will be conducted by the project geologist and assistants, and will take place over a period of 3 months. Such mapping will encompass GPS controlled traverses, and aerial photo mapping. Surface sampling. Where heavy mineral concentrations are noted on surface 25 liter surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be 50cm x 50cm in size and dug to a maximum depth of 1m. The final number of samples will be determined by the size of surface mineralized areas if any, 200 samples are planned for initially. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.
- Phase 3 will involve surveying and pegging of the anticipated deposit. This sub-phase will include the following activities: Surveying of the mapped area to be prospected. A grid (average 500m x 500m) will be marked on the map, after which those positions will be marked in the field by a surveyor with labelled droppers (pegs). Shallow small diameter auger drilling will take place at these positions to an average depth of 4m. A total of 100 auger drill holes are planned initially and may be followed up with additional drilling. Access routes to the drill sites will also be located (existing roads will used and new tracks only permitted in exceptional circumstances)
- Phase 4 will be conducted with Air Core drilling method to access the deeper lying sediment package. A total of 250 Air-core holes are planned down to an average depth of 30m. More drilling may be required depending on results. Drill cutting will be sampled and analysed for heavy mineral content as described above for surface sampling.

- Phase 5 will involve analytical desk-top study. All the data collected will be analysed and compiled into a final report/model in order to determine the potential of the project and to outline possible future drill sampling programs if any.

DESCRIPTION OF PLANNED INVASIVE ACTIVITIES:

Where heavy mineral concentrations are noted on the surface 25 litre surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be ~ 50cm x 50cm in size and dug to a maximum depth of 1m. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.

Auger Drilling.

Hand held engine operated auger drill. The auger is portable and will be walked to site from the closest track. Approximately 100 auger drill holes are anticipated to be drilled. The auger is in essence a corkscrew-type drill where the helical ridge raises the drilled material to the surface for sampling purposes. A total of 100 drill holes are planned for initially to be collected over an estimated 18-month period.

Evaluation Air core Drilling

Air-core drilling uses steel or tungsten blades to bore a hole into unconsolidated ground. The drill cuttings are removed by the injection of compressed air into the hole. This method of drilling is used to drill unconsolidated sands and soft sediments. Where possible, air-core drilling is preferred over RAB drilling as it provides a more representative sample. Air-core drilling is relatively inexpensive and is often used in first pass exploration drill programs. Air-core drilling is limited to depths of 50-60 metres and is drilled using a smaller rig known as an Air-core rig. Such drill is for drilling of deeper holes and use of such will be restricted to existing farm tracks and roads.

1.2 Description of Property and Affected Environment

The proposed prospecting application on Klipvley Karoo lies immediately northwest of the MSR Tormin Mine and the Sere Wind Farm along the West Coast. The site is reached via a dirt road that leaves the R363 at Koekenaap and runs for about 15km in length and just under 3km in width. The study area is characterised by terrain consisting of Dorbank and Koekenaap dunes that slope from about 40m down to the coastal band at sea level. The slope climbs about 10-20m in the coastal band and this area consists of rocky quartzitic bays and headlands interspersed with small sandy beaches. The coastal band is about 300m in width while the rest of the study area east of the coastal band is relatively level and gently undulates along the dune cordon.

The Namaqualand Heuweltjie Strandveld covers much of the area and consists of small shrubland which was currently green and vibrant due to recent good rainfall in the area. The farmers have a number of sheep grazing camps setup which are cut off from the main dirt road linking the security entrance at the MSR Mine to active mining activities primarily on and near the beaches northwest of the study site (there is one smaller area currently active adjacent to the study site). No farm werfs are within the study site but the Baievlei werf is immediately adjacent to the project area in the northeast corner. The rest of the farm werfs lie along a farm road that winds along about 500m east of the study site and eventually links up to the Skaapvlei farm. The only infrastructure in the sheep grazing areas besides jeep tracks are windmills, watering troughs and modern sheep kraals. There are also a large number of older prospecting pits crisscrossing the site which have been dug in linear sampling patterns.

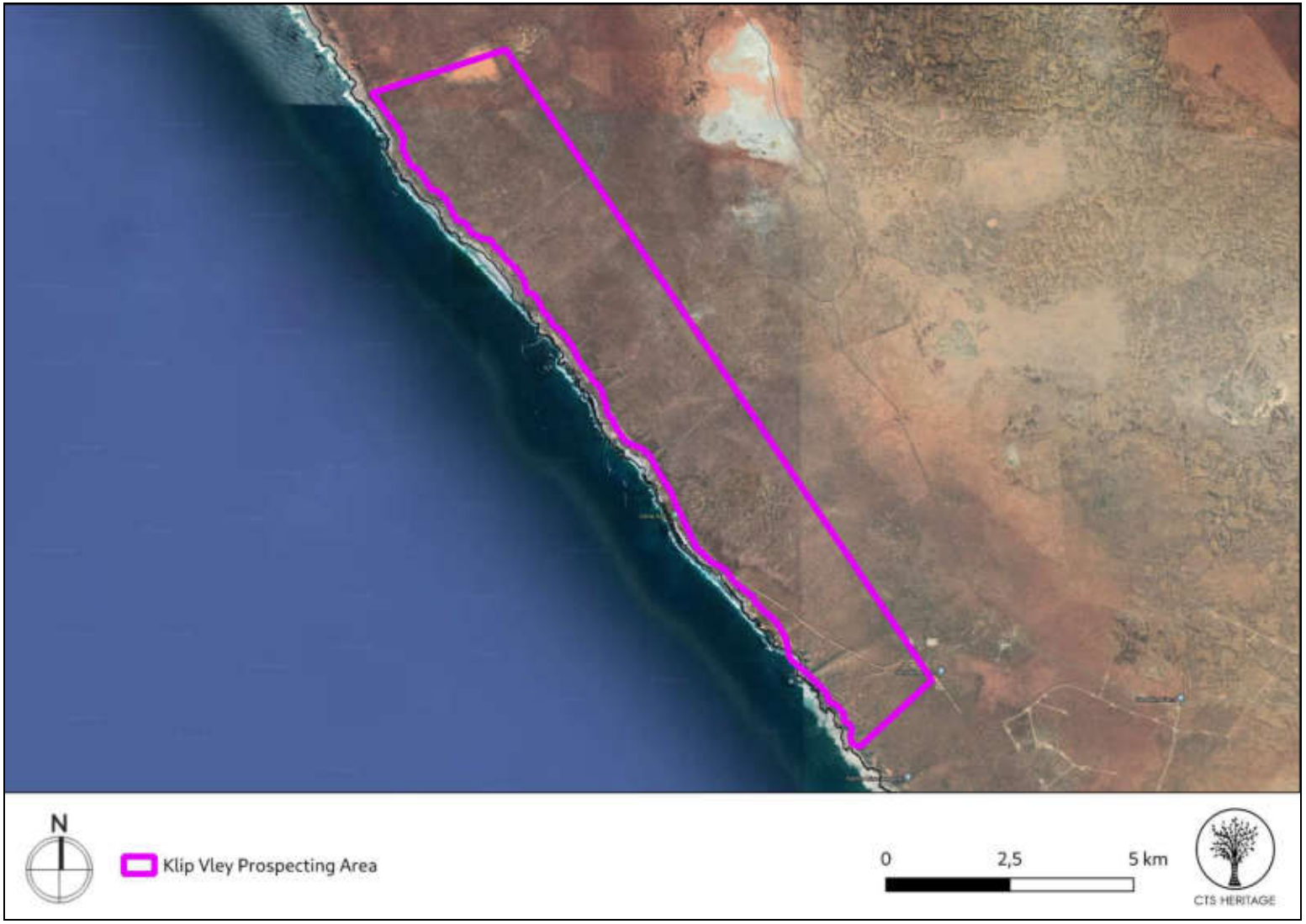

Figure 1.1: Proposed development area

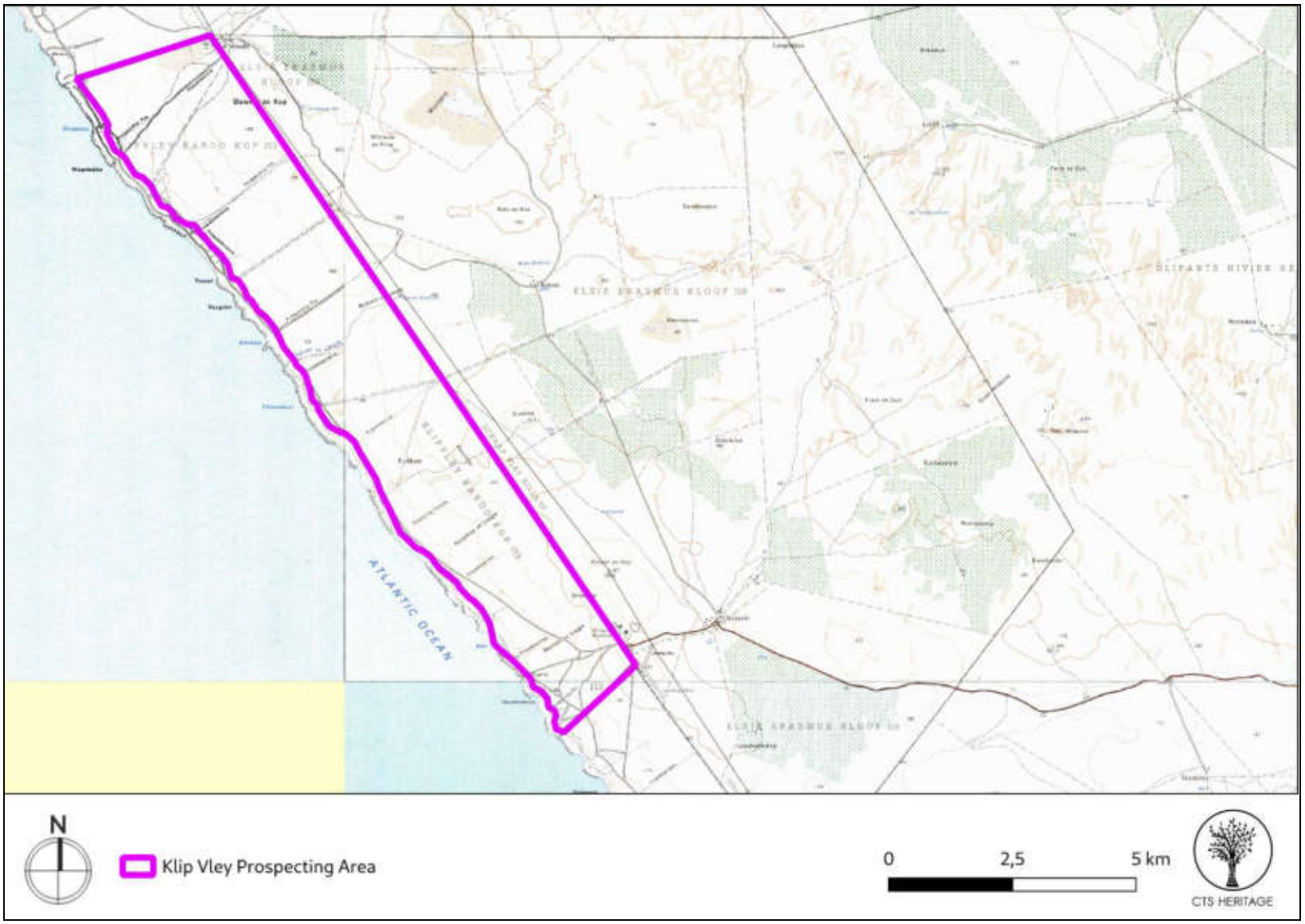

Figure 1.2: The proposed development layout on an extract of the 1:50 000 Topo Map

2. METHODOLOGY

2.1 Purpose of HIA

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

2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used)
- An archaeologist conducted an assessment of archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit from 26 to 28 June 2023
- A palaeontologist conducted a desktop assessment of palaeontological resources likely to be disturbed by the proposed development.
- The identified resources were assessed to evaluate their heritage significance and impacts to these resources were assessed.

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

There were no major constraints to the survey. The terrain is fairly level and access to the various parts of the study area was easily accessible. The recent heavy rain had left the main dirt roads in a poor state but the interconnecting farm tracks were hard packed by the rain which provided good vehicular access. The small shrubland in this area does not cover the surface material and it was therefore possible to identify exposed artefacts on the surface with relative ease.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Desktop Assessment

Background

This application is submitted as part of the assessment process for a proposed prospecting application located approximately 25km north of Papendorp along the west coast of South Africa. Due to the nature and scale of the proposed prospecting, none of the activities listed in section 38(1) of the NHRA is triggered. The area proposed for the prospecting has been previously assessed for impacts to heritage resources by Hart (1999 and 2003). These and other relevant reports are summarised below.

Cultural Landscape and Built Environment Heritage

The area proposed for prospecting is located some distance from any significant towns - with the nearest town being Papendorp located some 25km to the south. The cultural landscape value of the broader area has been identified elsewhere (Winter, 2021) as related to the Sandveld Coastal Region and the Olifants River Estuary which consists of a narrow lagoon, wetlands, coastal dunes and the settlements of Ebenhauser and Papendorp. In particular, the landscape has high local scenic, estuarine and recreational value. The settlements of Ebenhaeser and Papendorp have mostly associational heritage value; Ebenhaeser as an early 19th century mission station, and Papendorp as an early 19th century fishing settlement (Winter and Oberholzer 2014). Despite some associational heritage value, relationship with a natural setting and the mission church at Ebenhaeser being of suggested Grade IIIB value, the settlements in their own right including their access routes off the R362 are not regarded as having considerable heritage value.

As is also noted elsewhere, this part of the West Coast has been subjected to mining activities since the 1960's and as such, the proposed prospecting activities aren't unexpected here. Furthermore, the limited nature and scale of prospecting is unlikely to negatively impact on the significant scenic and wilderness landscape qualities of the Sandveld area. However, should mining activities proceed, a more careful assessment of impacts to the cultural landscape should be undertaken.

Archaeology

Hart (1999 and 2007) provides a brief synopsis of the archaeological history of the area which is not repeated here. According to Hart (2003), "The coastline consists of large expanses of rocky shore (quartzites) punctuated by small bays and coves. There are two long stretches of sandy beach (Langstrand and Liebenberg Bay). Immediately inland of the rocky shore are the remnants of the coastal dune system, most of which has now been disturbed by small mining operations. The low scrub covered coastal plains slope gently down to the shorelines apart from in the south where the slope breaks rather more steeply down to places such as Baaivals and Sam se Baai. Many informal tracks lead off the coastal road to old diamond diggings resulting in deflated and

de-vegetated areas. In general, the area has seen very little development as it was diamond concession land since the early 20th century. The nearest small settlement of any consequence is Koekenaap some 30 km inland. There is one ruined farmhouse situated at Sterkfontein."

Hart (2003) goes on to note that "Pre-colonial archaeological sites are prolific with most Late Stone Age sites located within 1 km of the shoreline. Areas adjacent to rocky shorelines and small bays attracted prehistoric 7 occupation by ancestors of San hunter-gatherers and Khoekhoen herders. The higher slopes and coastal plains show evidence of Early and Middle Stone Age artefact scatters: material is visible in virtually any area where red Aeolian sand have become deflated and the underlying Dorbank (hard calcretised feldspathic soils) exposed. In summary, the heritage of this area is almost entirely archaeological – the cultural landscape consisting of the distribution of a range of pre-colonial archaeological sites from different time periods. The colonial period cultural landscape is almost entirely limited to a legacy of old diggings, prospecting trenches and places where temporary structures were erected to accommodate diamond mining (the exception being a single historical ruin). Virtually all of this recent history is less than 100 years old and does not constitute archaeological material... In summary, the primary sources of risk in terms of heritage are mainly near shore Late Stone Age archaeological sites, Middle Stone Age artefact scatters and buried sites and to a lesser extent, intangible heritage such as visual impacts."

All of the sites identified by Hart (1999 and 2003) have been mapped relative to the area proposed for prospecting in Figures 3a to 3c of the desktop screening assessment (Appendix 3). It is clear that most of these sites are located outside of the prospecting area below the coastal ridge. That being said, it is recommended that the areas proposed for prospecting be assessed for impacts to archaeological heritage in order to inform the micrositing of prospecting locations and to provide information regarding the overall archaeological sensitivity of the prospecting area.

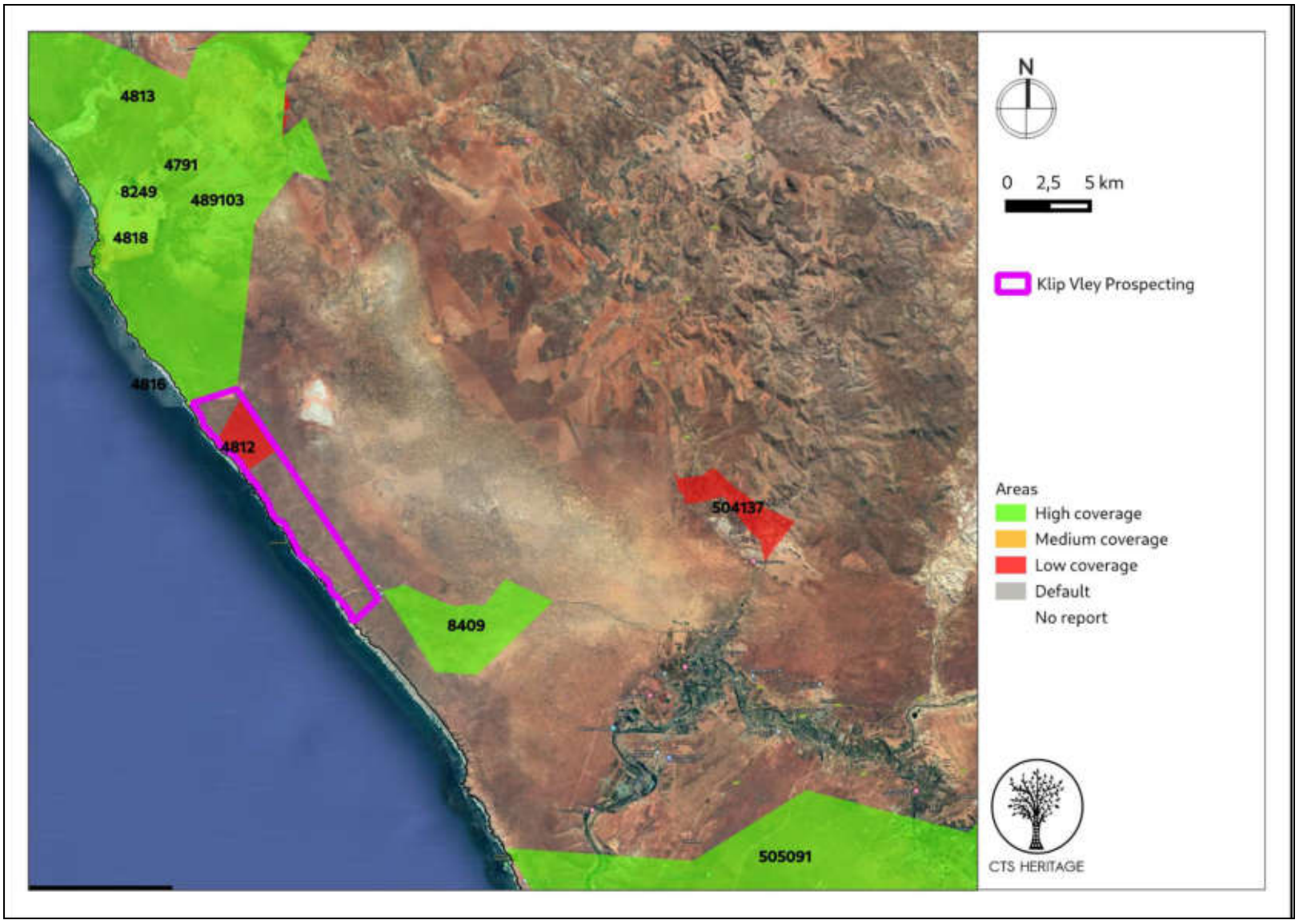

Figure 2: Spatialisation of heritage assessments conducted in proximity to the proposed development

Palaeontology

According to the SAHRIS Palaeosensitvity Map (Figure 4a), the area proposed for prospecting activities is underlain by sediments of very high palaeontological sensitivity. According to the extract from the Council of GeoScience Geology Map for Calvinia (Figure 4b), the sediments underlying the prospecting area consist of late Quaternary surficial sands of the Koekenaap and Hardevlei formations. According to a report completed for prospecting in this area by Pether (2021), "The fossil content of the aeolian formations is presumed to be typical of that observed in correlative formations in the wider area. Fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The bones of larger animals are sparse, but are more persistently present along palaeosurfaces which separate units. Rare caches of bones in large burrows are due to the bone-collecting behaviour of hyaenas. Interbedded pan deposits may occur, possibly with aquatic fossils and organic-rich layers. Fossil shells and sparse marine mammal bones occur in the marine formations and rare patches of offshore muds which sometimes include fossil pollens. Alluvia and colluvia in drainages may also include potential fossil pollen-bearing mud layers. The Koingnaas Fm. includes organic peaty beds with fossil pollen and plant remains."

Pether (2021) concludes that "In the process of the field survey and during the sampling and drilling programme, late Quaternary fossil and archaeological material, including larger mammal bones, may be encountered in deflation areas not discovered during archaeological surveys, or may be noticed in old prospecting excavations and surrounding spoil." Pether (2021) proposed various mitigation measures to limit the negative impact of the prospecting on fossil remains and these recommendations are reiterated here.

Figure 3.1: Palaeontological sensitivity of the proposed development area

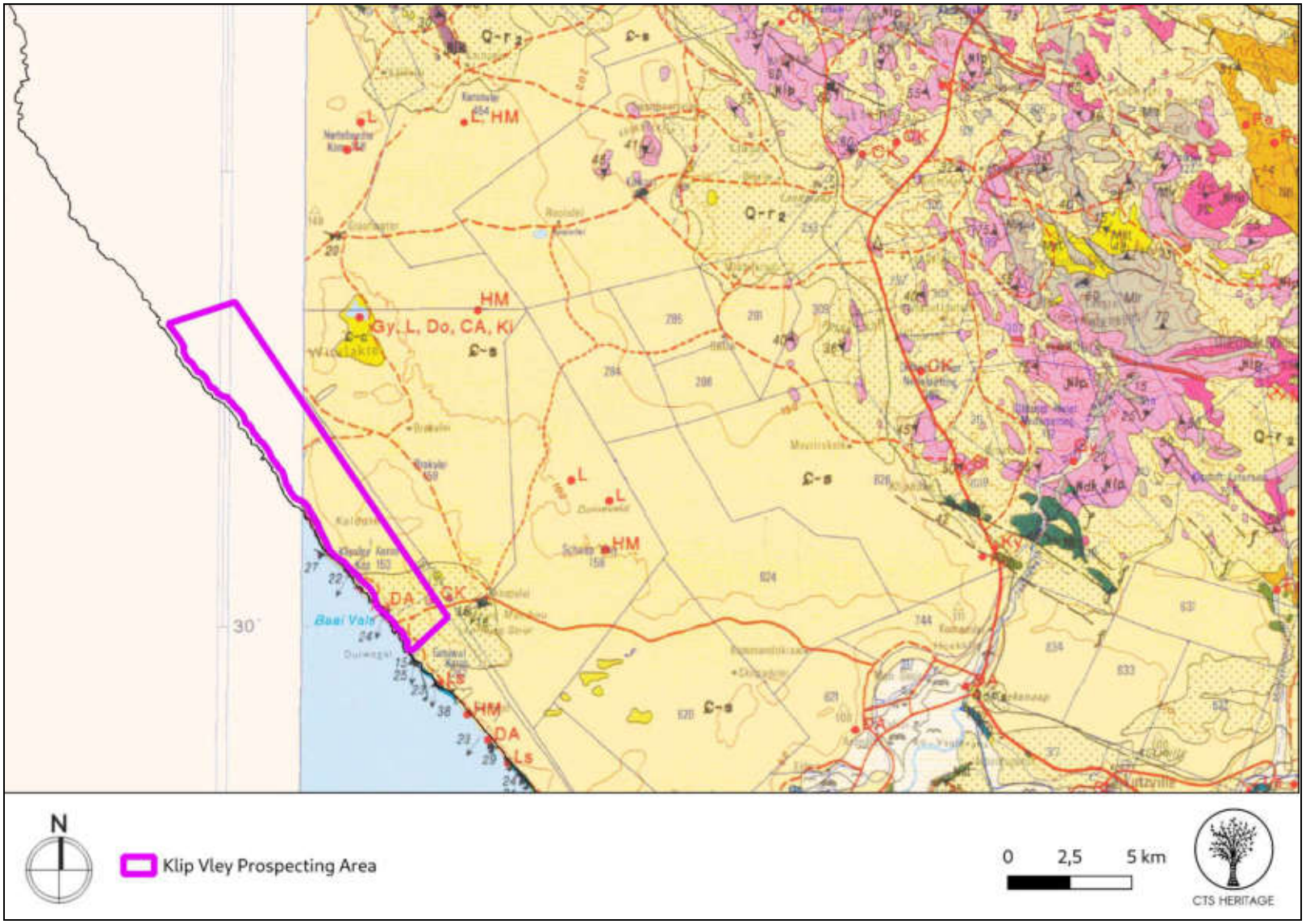

Figure 3.2. Geology Map. Extract from the CGS Map for Calvinia 3118 indicating that the area proposed for prospecting is underlain by Quaternary Sands sediments

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology (Appendix 1)

Most of the significant heritage resources are buried beneath the Koekenaap dunes and lie on the harder Dorbank formation. A large exposed pan/deflation area can be found In the northeast section of the study site where thousands of MSA and LSA artefacts can be found. Local quartzites and quartz dominate all of the assemblages recorded but contributions of fine silcrete and calcrete artefacts and haematite were also noted. Hart (2003) noted that these artefacts have been found in other areas along the West Coast near this development and Pether's (2021) palaeontological report provides some explanation for the prolific numbers of artefacts in the northeast zone due to a palaeo-stream channel that ran nearby. The farm, Baievlei, has a few modern buildings alongside the older, early 20th century buildings that are currently derelict. The name presumably derives from the availability of water in this area as the name translates from Afrikaans to English as "Many wetlands/water spots".

The appropriate grading for this area has been given a IIIB rating as there is high potential for mitigation and a series of deeper investigations in this area which would provide valuable archaeological evidence of settlement patterns and climate. A few areas with bleached bone were also seen which is consistent with the findings made elsewhere due to the relatively amenable conditions for bone preservation. The Baievlei werf also has a small graveyard for members of the Loubscher family who died between 1949 and 2003.

The visible archaeological traces drop off outside of the 300m coastal band as one moves inland and only ephemeral traces of shell and LSA quartz, silcrete and quartzite flakes lie across the area. Some of the prospecting pits were inspected and it appears that older MSA material has been brought up to the surface in places which suggests that even more buried MSA material is spread throughout the study site - this was the case at the Tormin mine to the south where MSA tools were uncovered during mining operations when the topsoil layers were removed.

Palaeontology (Appendix 2)

According to the PIA completed by Pether (2021), "The fossil content of the aeolian formations is presumed to be typical of that observed in correlative formations in the wider area. Fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The bones of larger animals are sparse, but are more persistently present along palaeosurfaces which separate units. Rare caches of bones in large burrows are due to the bone-collecting behaviour of hyaenas. Interbedded pan deposits may occur, possibly with aquatic fossils and organic-rich layers. Fossil shells and sparse marine mammal bones occur in the marine formations and rare patches of offshore muds which sometimes include fossil pollens. Alluvia and colluvia in drainages may also include potential fossil pollen-bearing mud layers. The Koingnaas Fm. includes organic

peaty beds with fossil pollen and plant remains."

4.2 Heritage Resources identified

The following significant heritage resources have been identified within and in close proximity to the proposed prospecting area.

Table 1: Heritage Resources identified

Obs#	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
008	Very large midden behind camping screens lining the beach. About 50m from hwm. Dominated by S. argenvillei. Burnupena and black mussel too. Quartzite manuports, some flakes, quartz. Granite. At least 75m long x 30m wide.turbo? Check	Shell Midden	LSA	30+	-31.471229	18.008498	IIIB	100m Buffer
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026	Visser graveyard, at least 14 graves, late 19th to 20th c.	Graves/BurialGrounds	Historic	n/a	-31.486804	18.077308	IIIA	100m Buffer

4.3 Mapping and spatialisation of heritage resources

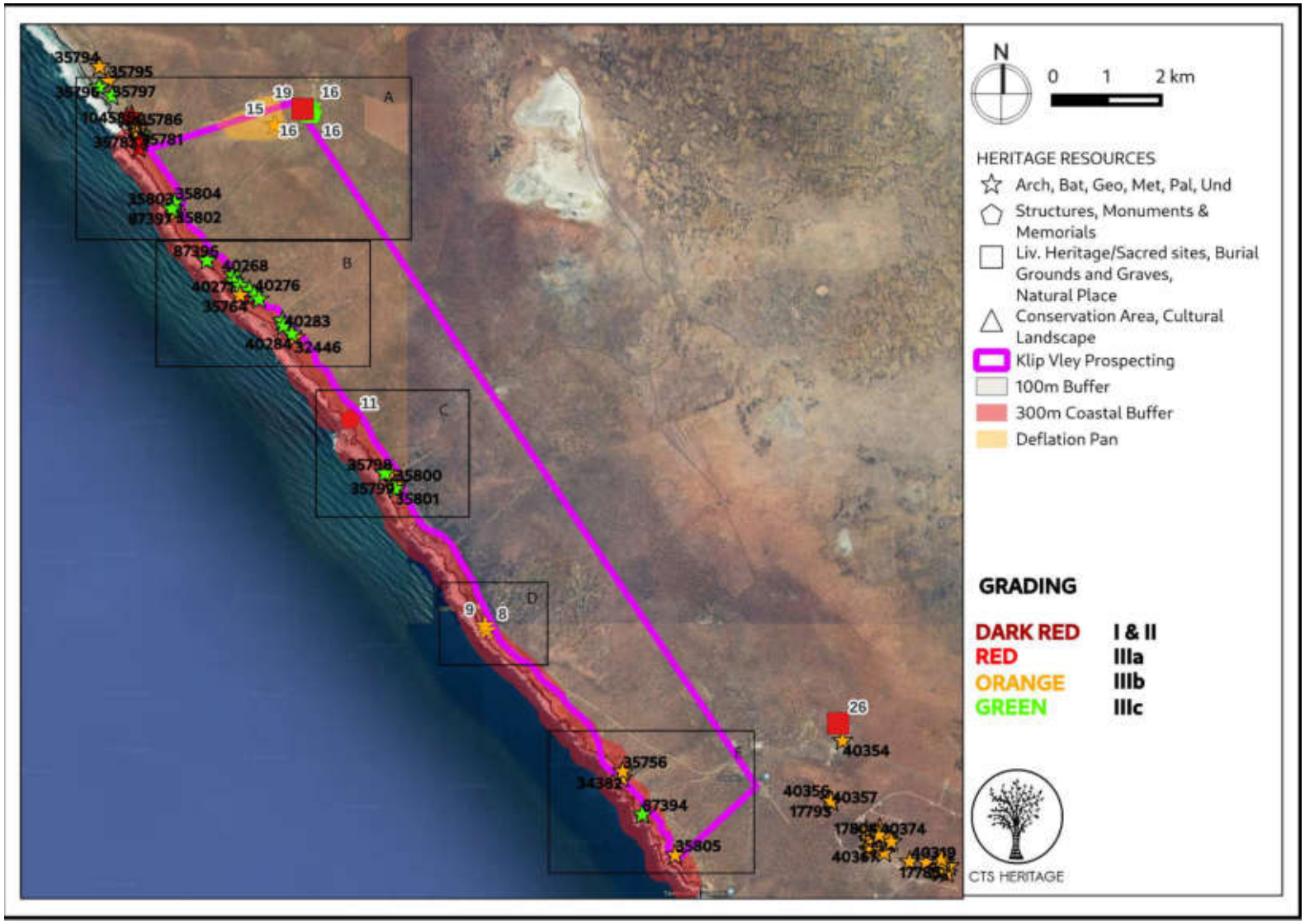


Figure 6.1: Map of known heritage resources relative to the proposed development area

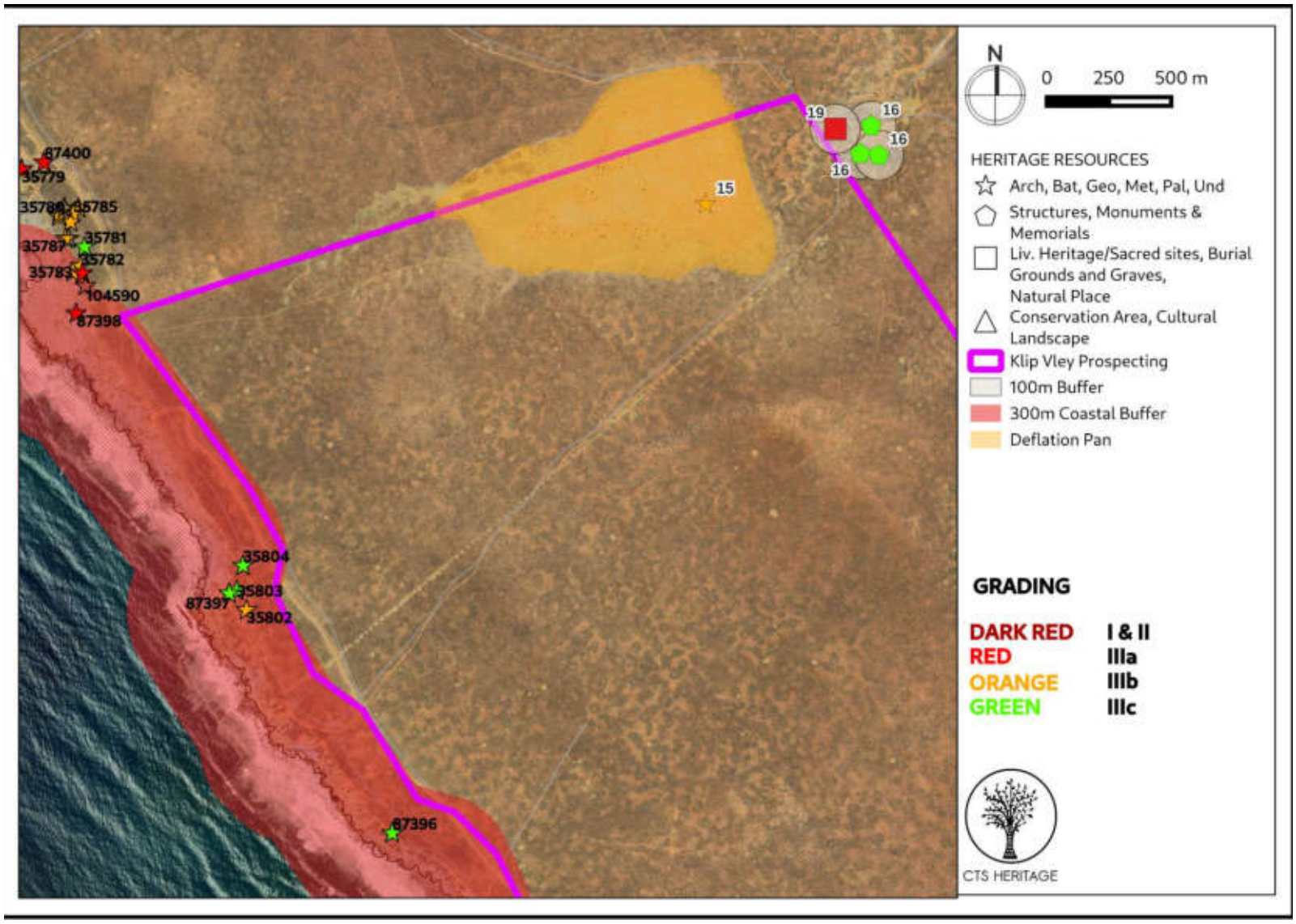
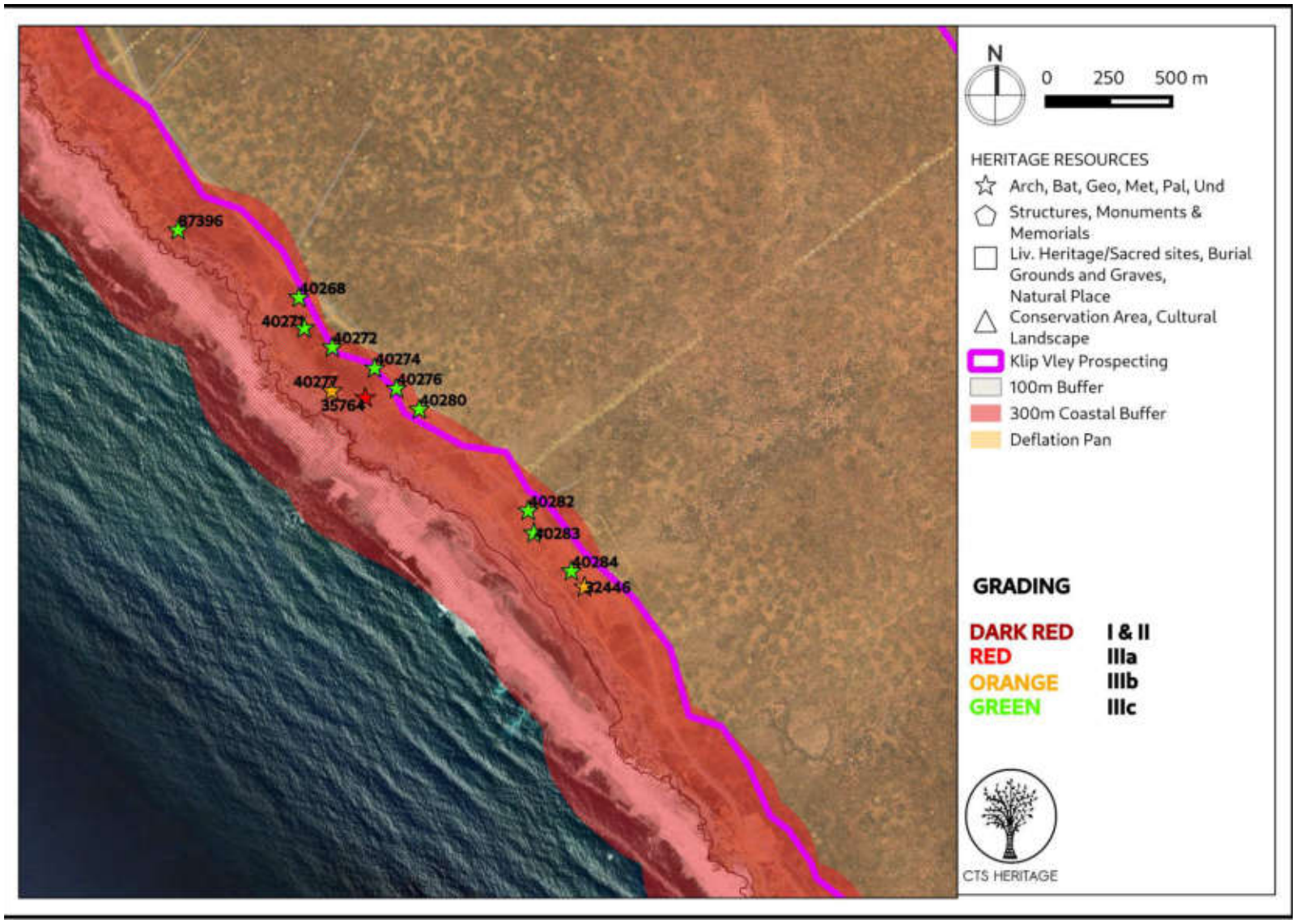


Figure 6.2: Map of all sites and observations noted within the development area with recommended mitigation measures



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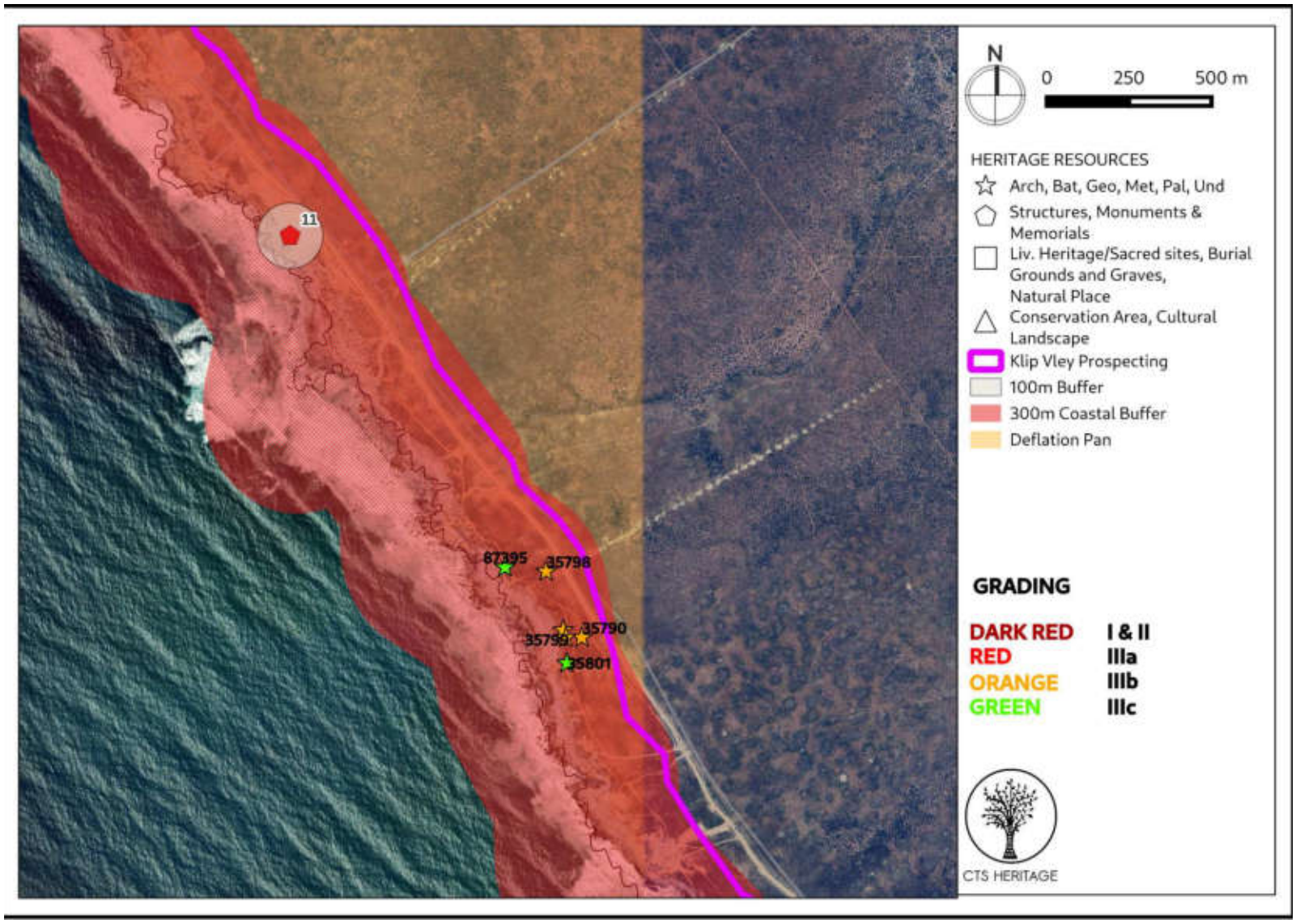

Figure 6.4: Map of all sites and observations noted within the development area with recommended mitigation measures

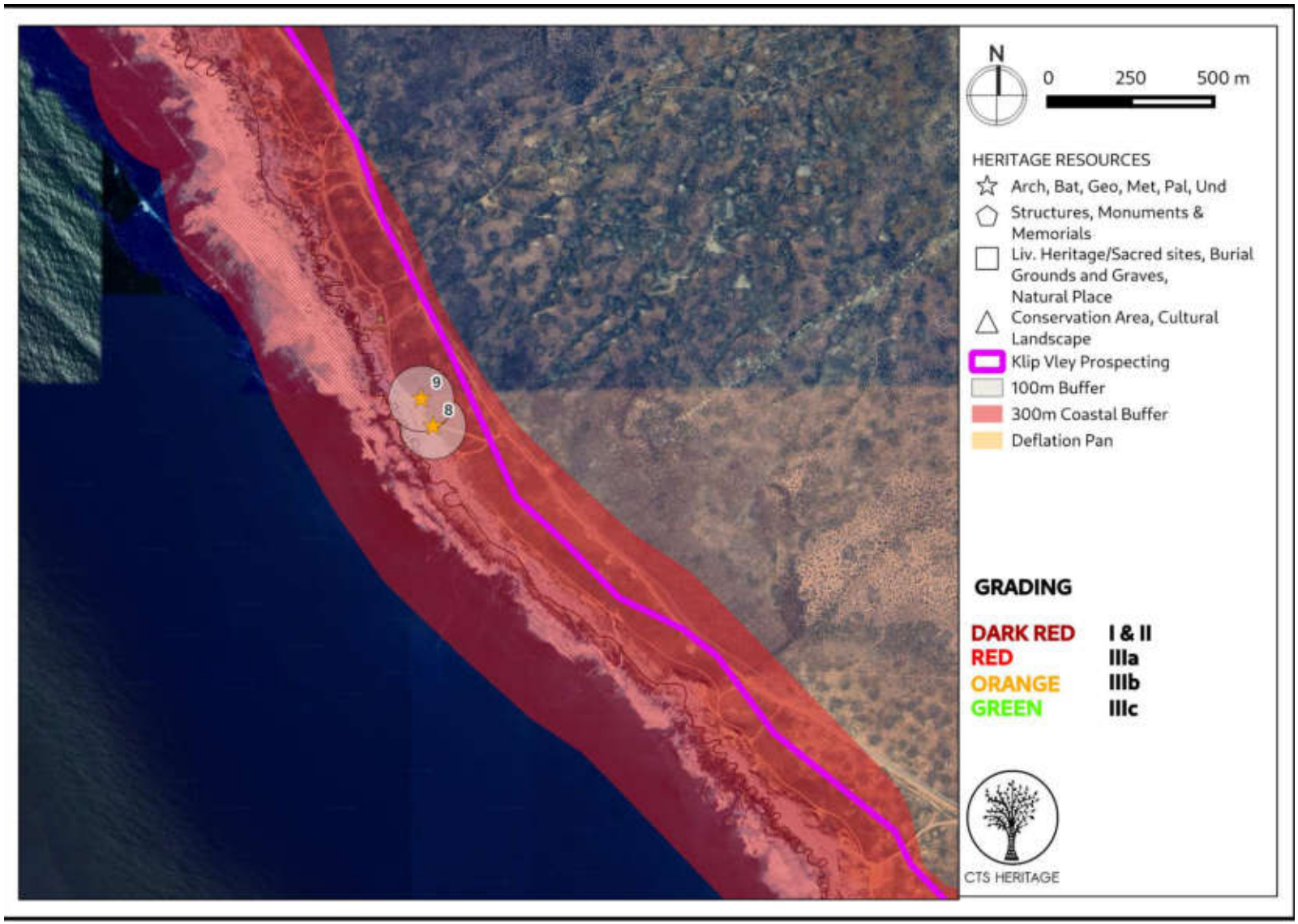

Figure 6.5: Map of all sites and observations noted within the development area with recommended mitigation measures

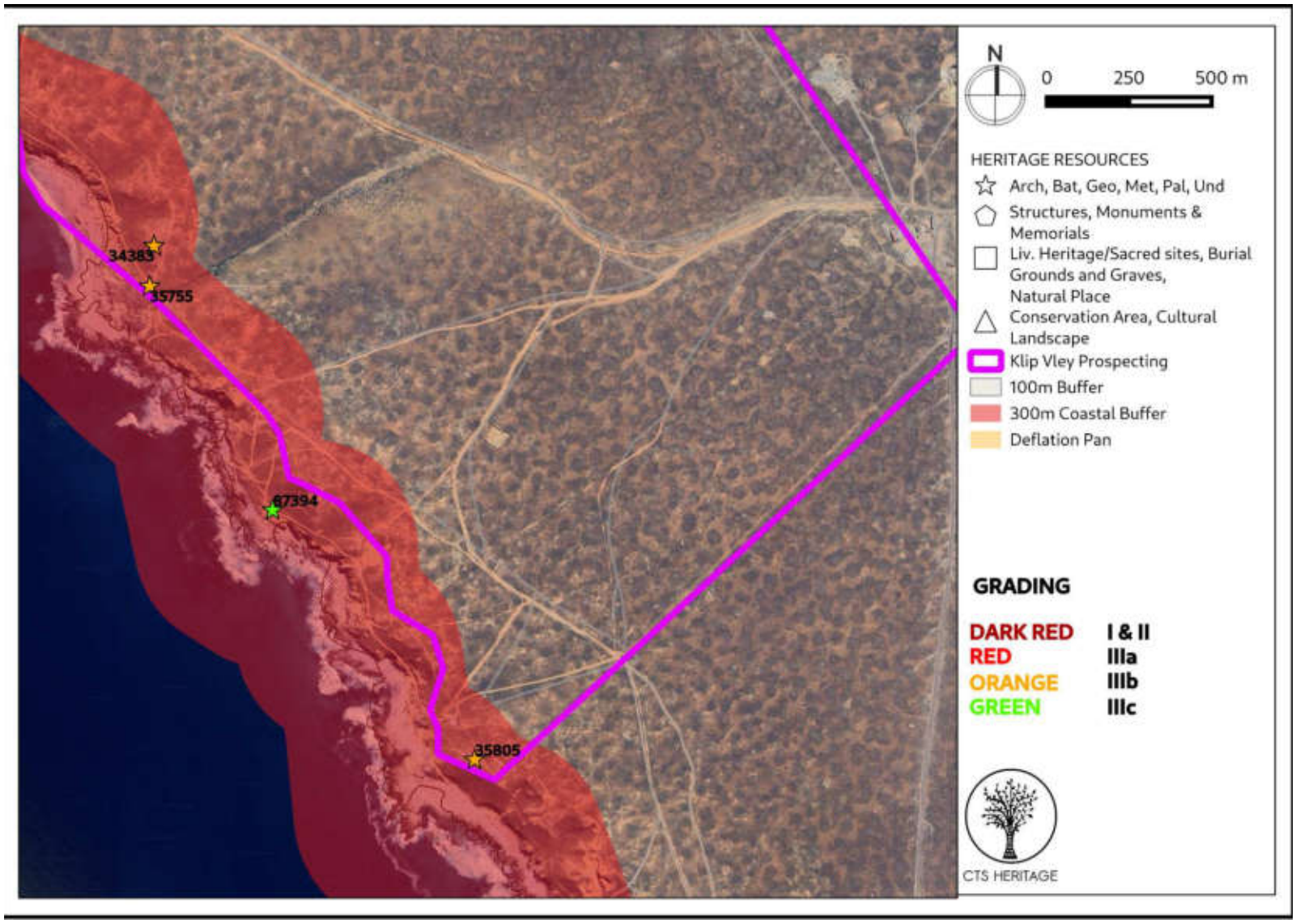

Figure 6.6: Map of all sites and observations noted within the development area with recommended mitigation measures

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

Due to the nature of heritage resources, impacts to archaeological and palaeontological heritage resources are unlikely to occur during the PLANNING phase of the project. Potential impacts to the heritage resources are anticipated during the SURFACE SAMPLING and RECONNAISSANCE DRILLING phases.

Archaeology

It is clear from the field assessment conducted for prospecting, as well as previous field assessments completed in the area, that the significant heritage resources in this context are concentrated along the coastline and around farm werfs. The field assessment identified a cluster of significant heritage resources in the northeast corner of the prospecting area including historic werf structures, an associated burial ground as well as a significant archaeological site within a deflation pan. We would therefore recommend that mining activities are excluded from this northeast zone.

The study boundary has been plotted to exclude the coastal band west of the dirt road from the mine - two large middens opposite Kolduin were recorded on the way past Camp Alpha - these are typical of other middens recorded by John Parkington and Cedric Poggenpoel, Jonathan Kaplan and Tim Hart's teams and one of the shell middens is nearly 3m deep. No impact on these middens is expected from this prospecting application but future mining activities directed towards the beach areas must undergo a proper assessment and mitigation plan should these areas be impacted in any way. While sites have been recorded at other rocky headlands bordering the study area, the tendency for burial of shell midden material beneath the dunes is high as can be seen from the photos taken at observation 009 where a deep layer of overburden is exposed by the quarry.

Transects were made across the study site to confirm whether any other areas of dense archaeological material could be found but only the small ephemeral and isolated finds were made. The actual prospecting activities are small and, in the absence of specific coordinates for these pits, it would not add value to conduct a deeper survey of such a large study site at this stage of the mining process. We would strongly recommend that full-scale mining applications following prospecting undergo a mining area-specific survey to record the LSA sites which will be mined away and to engage in an inspection protocol to record the buried MSA material once the Dorbank formations are exposed.

In order to ensure that significant heritage resources are not impacted by the proposed prospecting activities, it is recommended that a no development buffer of 100m is implemented around the identified heritage resources. The deflation pan with significant archaeological deposit in the north east of the prospecting area is excluded from any prospecting activities. Lastly, the prospecting activities must stay outside of the sensitive coastal shell-midden zone which is located within 300m of the high-water mark (below the coastal road)..

Palaeontology

The prospecting pitting and drilling involve small volumes and the impact relative to mining is marginal. The fossil material likely to be encountered in drill samples from aeolianites is the ambient fossil content. Fossil marine shell is not well-preserved in most of the marine deposits, but fossil shell will be encountered in some drillholes. Though likely fragmentary, it may be diagnostic of the marine formation penetrated. Other fossils which are brought up in boreholes include smaller petrified material such as shark and other fish teeth and casts of shells (steinkerns). Mud beds in any of the formations are important as potentially containing fossil plant pollen. In the process of the field survey and during the sampling and drilling programme, late Quaternary fossil and archaeological material, including larger mammal bones, may be encountered in deflation areas not discovered during archaeological surveys, or may be noticed in old prospecting excavations and surrounding spoil.

There are no known outcrops of sensitive fossiliferous strata in the Project Area that require protection as NO-GO sites, such as spots where fossils occur in obvious abundance. The palaeontological resources are predominantly subsurface and consequently considerations of fossil potential do not result in preferred sites and the particular locations of surface sampling and drilling do not affect this assessment.

The PIA provides recommendations regarding Chance Fossil Finds during the SURFACE SAMPLING and the RECONNAISSANCE DRILLING phases.

5.2 Sustainable Social and Economic Benefit

According to information received from the client, “The proposed labour component of the activity will be six employees. The operation will contribute to the local economy in the area, both directly and through the multiplier effect that its continued presence will create. Equipment and supplies will be purchased locally, and wages are spent at local businesses, generating both jobs and income in the area. Although the employees are not resident on the site, they will be from the surrounding community.”

On condition that the recommendations outlined below are implemented, the anticipated socio-economic benefits will outweigh any impact to heritage resources for the prospecting phase. It is important to note that this must be re-evaluated should mining be proposed.

5.3 Proposed development alternatives

Site Alternative 1 (Preferred and Only Site Alternative)

Site Alternative 1, which entails the prospecting area in which drilling sites can be moved to various positions in consultation with the landowners depending on sensitivity and accessibility. However, the proposed prospecting

area was identified as the preferred and only viable site alternative. In light of this, S1 was identified during the assessment phase of the environmental impact assessment, by the Applicant and project team due to the following:

- The geological setting of the area is favourable for orogenic gold deposits and informal reports of gold is know from the area.
- Availability of the mineral resource will only be determined should prospecting the prospecting right be granted and drilling can take place.

Site Alternative 2 (Not viable and will not be further assessed and excluded from the application)

Site Alternative 2, which entails the prospecting area with a footprint of approximately 3970 ha over Portion 1,2, 3 and the Remainder of the farm Klipvley Karoo Kop 153, West Coast District Municipality, Western Cape Province. Prospecting will involve exploration within the prospecting area without excluding areas of sensitivity and accessibility. However, the proposed prospecting area was not found viable for the proposed prospecting as it was not found environmentally and practically suitable. S2 was not found viable to be assessed during the assessment phase of the environmental impact assessment by the Applicant and project team. Although the position of Site Alternative 2 will still allow the prospecting on the property, it is believed that the impact associated with this site alternative is of higher significance without the need or motivation justifying it.

There is no objection to the proposed prospecting as per Site Alternative 1 on condition that the recommendations outlined below in section 8 are implemented.

5.4 Cumulative Impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact. But it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

In terms of cumulative impacts to heritage resources, impacts to archaeological and palaeontological resources can be sufficiently dealt with on a case by case basis. The primary concern from a cumulative impact perspective would be to the cultural landscape. The cultural landscape is defined as the interaction between people and the places that they have occupied and impacted. In some places in South Africa, the cultural landscape can be more than 1 million years old where we find evidence of Early Stone Age archaeology (up to 2 million years old), Middle Stone Age archaeology (up to 200 000 years old), Later Stone Age archaeology (up to 20 000 years old), evidence of indigenous herder populations (up to 2000 years old) as well as evidence of colonial frontier settlement (up to 300 years old) and more recent agricultural layers.

Modern interventions into such landscapes, such as prospecting or mining activities, constitute an additional layer onto the cultural landscape. The primary risk in terms of negative impact to the cultural landscape resulting from development lies in the eradication of older layers that make up the cultural landscape. There are various ways that such impact can be mitigated.

Due to the limited nature and scale of prospecting activities, cumulative impact is unlikely to result from this activity. The same conclusion cannot be drawn for mining activities and as such, should mining proceed, cumulative impact of the mining activities on heritage resources would need to be thoroughly assessed.

6. RESULTS OF PUBLIC CONSULTATION

As this application is made in terms of NEMA, the public consultation on the HIA will take place with the broader public consultation process required for the Environmental Impact Assessment process and will be managed by the lead environmental consultants on the project.

7. CONCLUSION

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. Significant archaeological material remains were documented within and outside of the proposed prospecting area. The majority of the significant resources are located outside of the prospecting area, and within the highly sensitive coastal shell-midden zone which extends 300m from the highwater mark. Many archaeological resources have been recorded in this area, and it is likely that these recordings represent a small fraction of the density of resources present here. No impact should take place within this highly sensitive 300m zone.

The significant heritage resources identified within the development area are associated with the deflation pan located in the north east of the prospecting area. It is recommended that the deflation pan as mapped above is excluded from prospecting activities. Additional recommendations are made in Table 1 to ensure that the significant resources identified are not negatively impacted by the proposed prospecting.

In terms of impacts to palaeontological heritage, there are no known outcrops of sensitive fossiliferous strata in the Project Area that require protection as NO-GO sites, such as spots where fossils occur in obvious abundance. The palaeontological resources are predominantly subsurface and consequently considerations of fossil potential do not result in preferred sites and the particular locations of surface sampling and drilling do not affect this assessment. The PIA provides recommendations regarding Chance Fossil Finds during the SURFACE SAMPLING and the RECONNAISSANCE DRILLING phases.

It is important to reiterate that the above findings pertain only to prospecting activities due to their limited scale. As is also noted elsewhere, this part of the West Coast has been subjected to mining activities since the 1960's and as such, the proposed prospecting activities aren't unexpected here. Furthermore, the limited nature and scale of prospecting is unlikely to negatively impact on the significant scenic and wilderness landscape qualities of the Sandveld area. However, should mining activities proceed, a more careful assessment of impacts to the cultural landscape should be undertaken.

8. RECOMMENDATIONS

Based on the outcomes of this report, it is not anticipated that the proposed prospecting will negatively impact on significant archaeological heritage on condition that::

- The mitigation measures detailed in Table 1 and mapped in Figures 8.1 to 8.6 are implemented
- The highly sensitive coastal shell-midden zone which extends 300m from the highwater mark is excluded from prospecting activities
- The deflation pan (Site 015) is excluded from prospecting activities
- The recommendations included in the PIA must be implemented. These include;
    - Sensitising personnel involved in shallow pit sampling to the occurrence of fossil bones
    - Fossil material extracted from boreholes be kept and bagged for identification by a palaeontologist
    - Quality images of any fossils material should be forwarded by email to a palaeontologist for the identification of specimens of importance for stratigraphic diagnosis, and for specimens requiring further examination
    - Samples of mud beds from any formation should be taken due to their scientific importance in the preservation of fossil pollen
- The attached Chance Fossil Finds Procedure is adopted for the prospecting
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

9. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
4744	AIA Phase 1	Jonathan Kaplan	01/09/2000	Archaeological Study Portion 1 and 2 and the Remainder of the Farm Luiperskop No. 211, Vanrhynsdorp District, Western Cape
4756	AIA Phase 1	Timothy Hart	01/12/1997	An Archaeological Re-Assessment of Boundary Changes, Namakwa Sands Mining Area
4791	AIA Phase 1	John Parkington, Timothy Hart	01/03/1993	Namakwa Sands Main Access Road Archaeological Survey
4812	AIA Phase 1	Timothy Hart	01/09/1999	A Phase One Archaeological Assessment of the Proposed Liebenbergs Bay Mine, Vredendal
4813	AIA Phase 1	Dave Halkett	01/11/2000	An Assessment of the Impacts on Heritage Resources of Proposed Mining on the Farm Karoetjies Kop, Vredendal District
4814	AIA Phase 1	Jonathan Kaplan	01/09/2001	Archaeological Assessment Portion 3 (A Portion of Portion 2) Klip Vley Karoo Kop No. 153 Vredendal District, Cape West Coast
4816	AIA Phase 1	Timothy Hart	01/03/2003	Phase 1 Archaeological Assessment of Proposed Diamond Mining Areas Situated at the Farms Geelwal Karoo, Klipvley Karoo Kop and Graauduinen, Vredendal District, Western Cape
8249	AIA Phase 1	John Parkington, Cedric Poggenpoel	01/01/1991	West Coast Heavy Mineral Sand Project: Archaeological Report
8409	HIA Phase 1	Timothy Hart	01/12/2007	Heritage Impact Assessment (Prepared as Part of an EIA) of a Proposed Wind Energy Facility to Be Situated at Olifants River Settlement 617, 620 and Grave Water Kop 158/5 Situated on the Namaqualand Coast in the Vredendal District, South Western Cape

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APPENDICES

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APPENDIX 1: Archaeological Assessment (2023)

ARCHAEOLOGICAL SPECIALIST STUDY

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

PROPOSED PROSPECTING ON PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153
MATZIKAMA MUNICIPALITY, VREDENDAL DISTRICT, WESTERN CAPE PROVINCE

Prepared by

CTS HERITAGE

Jenna Lavin
And Nicholas Wiltshire

In Association with

EnviroWorks

June 2023

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EXECUTIVE SUMMARY

This report is drafted as part of the request for approval for proposed prospecting on PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153 located approximately 25km north of Papendorp along the West Coast.

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. Significant archaeological material remains were documented within and outside of the proposed prospecting area. The majority of the significant resources are located outside of the prospecting area, and within the highly sensitive coastal shell-midden zone which extends 300m from the highwater mark. Many archaeological resources have been recorded in this area, and it is likely that these recordings represent a small fraction of the density of resources present here. No impact should take place within this highly sensitive 300m zone.

The significant heritage resources identified within the development area are associated with the deflation pan located in the north east of the prospecting area. It is recommended that the deflation pan as mapped above is excluded from prospecting activities. Additional recommendations are made in Table 1 to ensure that the significant resources identified are not negatively impacted by the proposed prospecting.

Recommendations

Based on the outcomes of this report, it is not anticipated that the proposed prospecting will negatively impact on significant archaeological heritage on condition that::

- The mitigation measures detailed in Table 1 and mapped in Figures 8.1 to 8.6 are implemented
- The highly sensitive coastal shell-midden zone which extends 300m from the highwater mark is excluded from prospecting activities
- The deflation pan (Site 015) is excluded from prospecting activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

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CONTENTS

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1. INTRODUCTION

1.1 Background Information on Project

This report is drafted as part of the request for approval for proposed prospecting on PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153 located approximately 25km north of Papendorp along the West Coast. The existence and possible size of heavy mineral deposits in the application area will be determined as follows:

• Data review and desktop studies

• Mapping and surface sampling

• Reconnaissance Drilling

The prospecting will be conducted in 3 phases, each one dependent on the results of the previous.

- Phase 1 will involve the following desk-top activities: data acquisition from government and private sources, and analysis of any existing/previous prospecting and drilling data, satellite (Landsat) imagery, aerial photos, and terrain data, as well as geological map interpretation. The synthesis and interpretation of such information will contribute towards providing a clearer picture of the location and characteristics of the heavy mineral deposit/s, and will guide the in-field prospecting programme.
- Phase 2: Surface mapping will be conducted by the project geologist and assistants, and will take place over a period of 3 months. Such mapping will encompass GPS controlled traverses, and aerial photo mapping. Surface sampling. Where heavy mineral concentrations are noted on surface 25 liter surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be 50cm x 50cm in size and dug to a maximum depth of 1m. The final number of samples will be determined by the size of surface mineralized areas if any, 200 samples are planned for initially. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.
- Phase 3 will involve surveying and pegging of the anticipated deposit. This sub-phase will include the following activities: Surveying of the mapped area to be prospected. A grid (average 500m x 500m) will be marked on the map, after which those positions will be marked in the field by a surveyor with labelled droppers (pegs). Shallow small diameter auger drilling will take place at these positions to an average depth of 4m. A total of 100 auger drill holes are planned initially and may be followed up with additional drilling. Access routes to the drill sites will also be located (existing roads will used and new tracks only permitted in exceptional circumstances)
- Phase 4 will be conducted with Air Core drilling method to access the deeper lying sediment package. A total of 250 Air-core holes are planned down to an average depth of 30m. More drilling may be required depending on results. Drill cutting will be sampled and analysed for heavy mineral content as described above for surface sampling.
- Phase 5 will involve analytical desk-top study. All the data collected will be analysed and compiled into a final report/model in order to determine the potential of the project and to outline possible future drill sampling programs if any.

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DESCRIPTION OF PLANNED INVASIVE ACTIVITIES:

Where heavy mineral concentrations are noted on the surface 25 litre surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be ~ 50cm x 50cm in size and dug to a maximum depth of 1m. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.

Auger Drilling.

Hand held engine operated auger drill. The auger is portable and will be walked to site from the closest track. Approximately 100 auger drill holes are anticipated to be drilled. The auger is in essence a corkscrew-type drill where the helical ridge raises the drilled material to the surface for sampling purposes. A total of 100 drill holes are planned for initially to be collected over an estimated 18-month period.

Evaluation Air core Drilling

Air-core drilling uses steel or tungsten blades to bore a hole into unconsolidated ground. The drill cuttings are removed by the injection of compressed air into the hole. This method of drilling is used to drill unconsolidated sands and soft sediments. Where possible, air-core drilling is preferred over RAB drilling as it provides a more representative sample. Air-core drilling is relatively inexpensive and is often used in first pass exploration drill programs. Air-core drilling is limited to depths of 50-60 metres and is drilled using a smaller rig known as an Air-core rig. Such drill is for drilling of deeper holes and use of such will be restricted to existing farm tracks and roads.

1.2 Description of Property and Affected Environment

The proposed prospecting application on Klipvley Karoo lies immediately northwest of the MSR Tormin Mine and the Sere Wind Farm along the West Coast. The site is reached via a dirt road that leaves the R363 at Koekenaap and runs for about 15km in length and just under 3km in width. The study area is characterised by terrain consisting of Dorbank and Koekenaap dunes that slope from about 40m down to the coastal band at sea level. The slope climbs about 10-20m in the coastal band and this area consists of rocky quartzitic bays and headlands interspersed with small sandy beaches. The coastal band is about 300m in width while the rest of the study area east of the coastal band is relatively level and gently undulates along the dune cordon.

The Namaqualand Heuweltjie Strandveld covers much of the area and consists of small shrubland which was currently green and vibrant due to recent good rainfall in the area. The farmers have a number of sheep grazing camps setup which are cut off from the main dirt road linking the security entrance at the MSR Mine to active mining activities primarily on and near the beaches northwest of the study site (there is one smaller area currently active adjacent to the study site). No farm werfs are within the study site but the Baievlei werf is immediately adjacent to the project area in the northeast corner. The rest of the farm werfs lie along a farm road that winds along about 500m east of the study site and eventually links up to the Skaapvlei farm. The only infrastructure in the sheep grazing areas besides jeep tracks are windmills, watering troughs and modern sheep kraals. There are also a large number of older prospecting pits crisscrossing the site which have been dug in linear sampling patterns.

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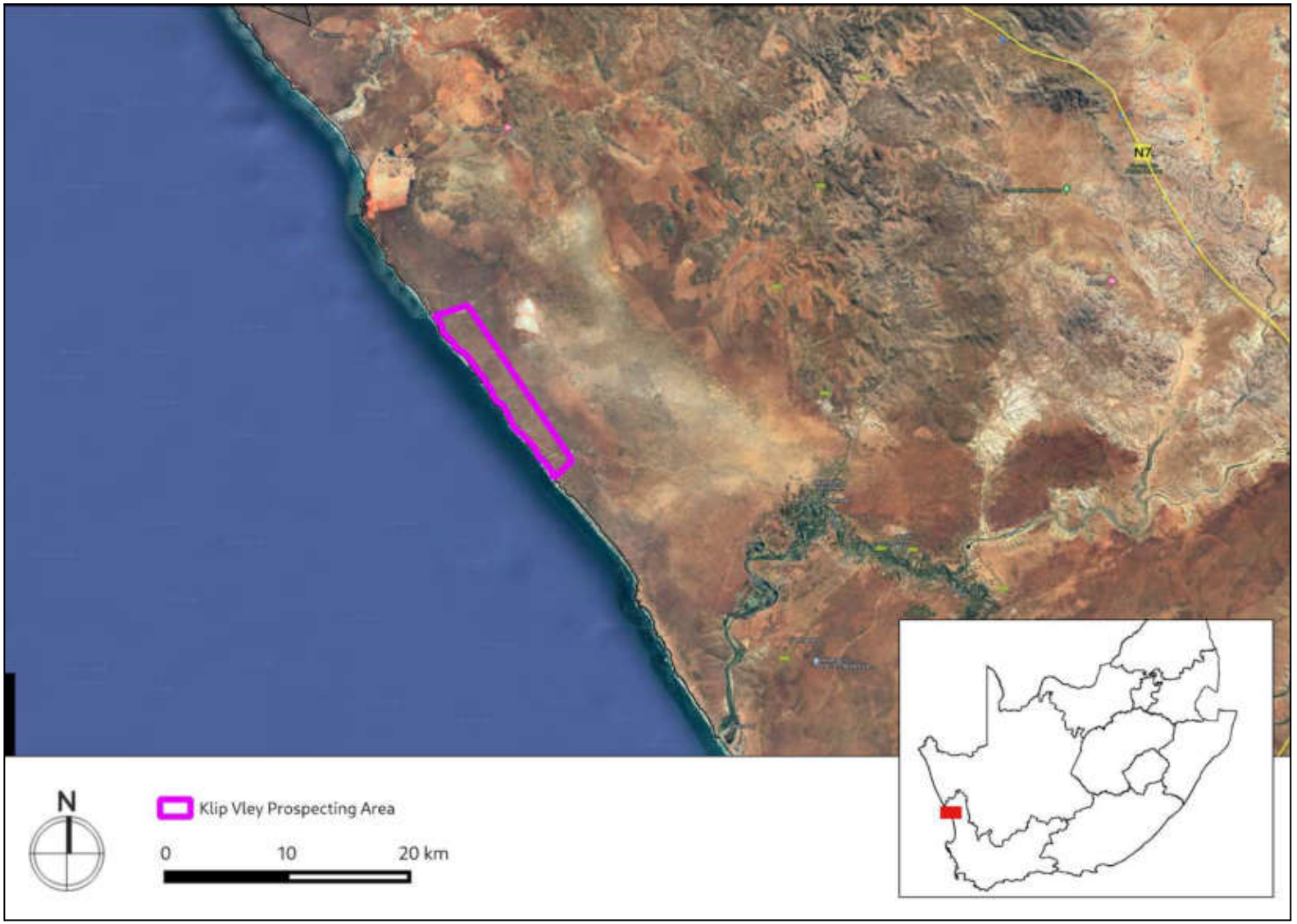

Figure 1.1: Satellite image indicating proposed location of development

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Figure 1.2: Proposed project boundary

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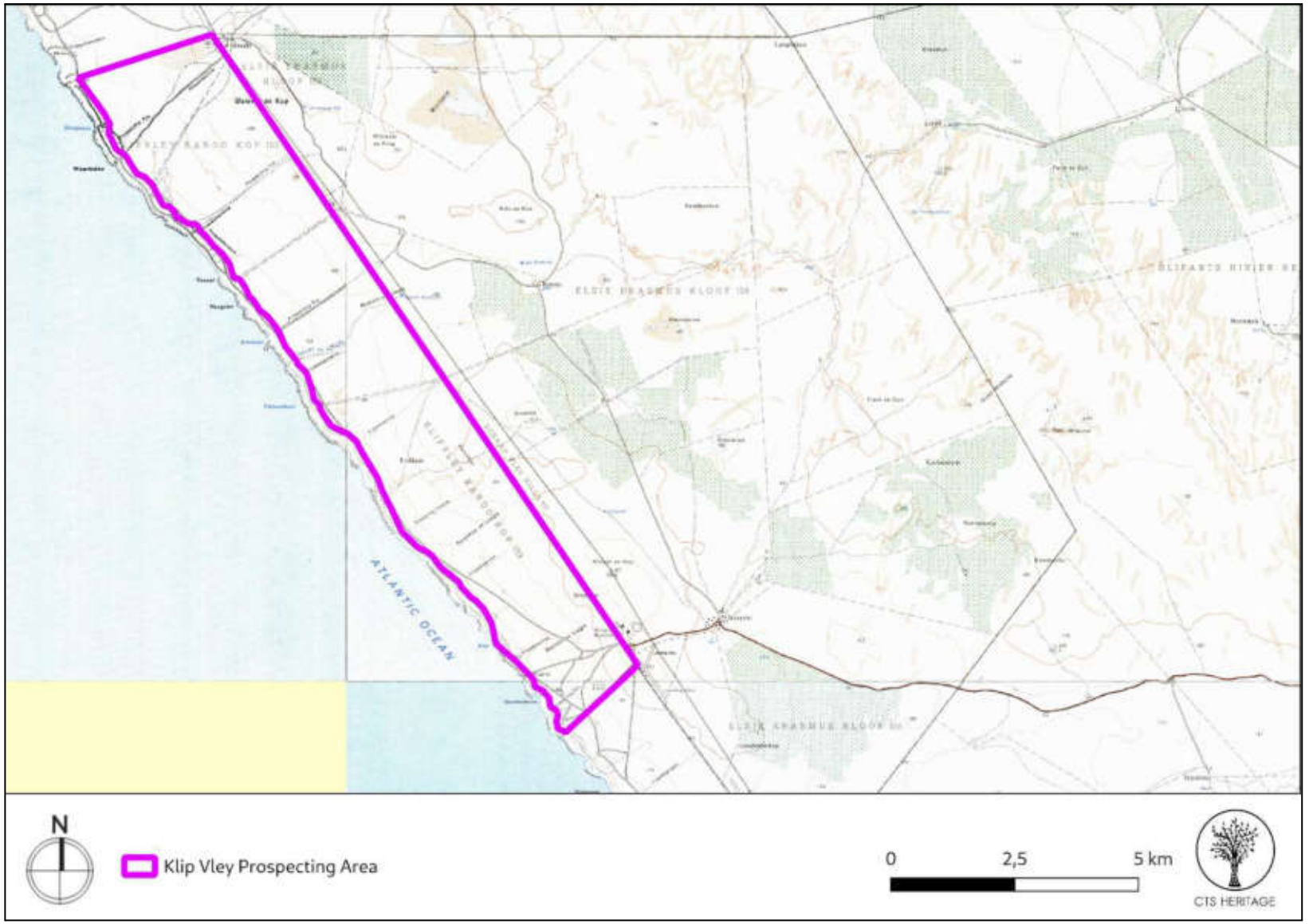

Figure 1.3. Overview Map. Extract from the 1:50 000 Topo Map for this area

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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 26-28 June 2023 to determine what archaeological resources are likely to be impacted by the proposed development.
- The area proposed for development was assessed on foot, photographs of the context and finds were taken, and tracks were recorded using a GPS.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

2.3 Constraints & Limitations

There were no major constraints to the survey. The terrain is fairly level and access to the various parts of the study area was easily accessible. The recent heavy rain had left the main dirt roads in a poor state but the interconnecting farm tracks were hard packed by the rain which provided good vehicular access. The small shrubland in this area does not cover the surface material and it was therefore possible to identify exposed artefacts on the surface with relative ease. The survey therefore managed to accomplish a decent level of coverage characterising the archaeological sensitivity in the area.

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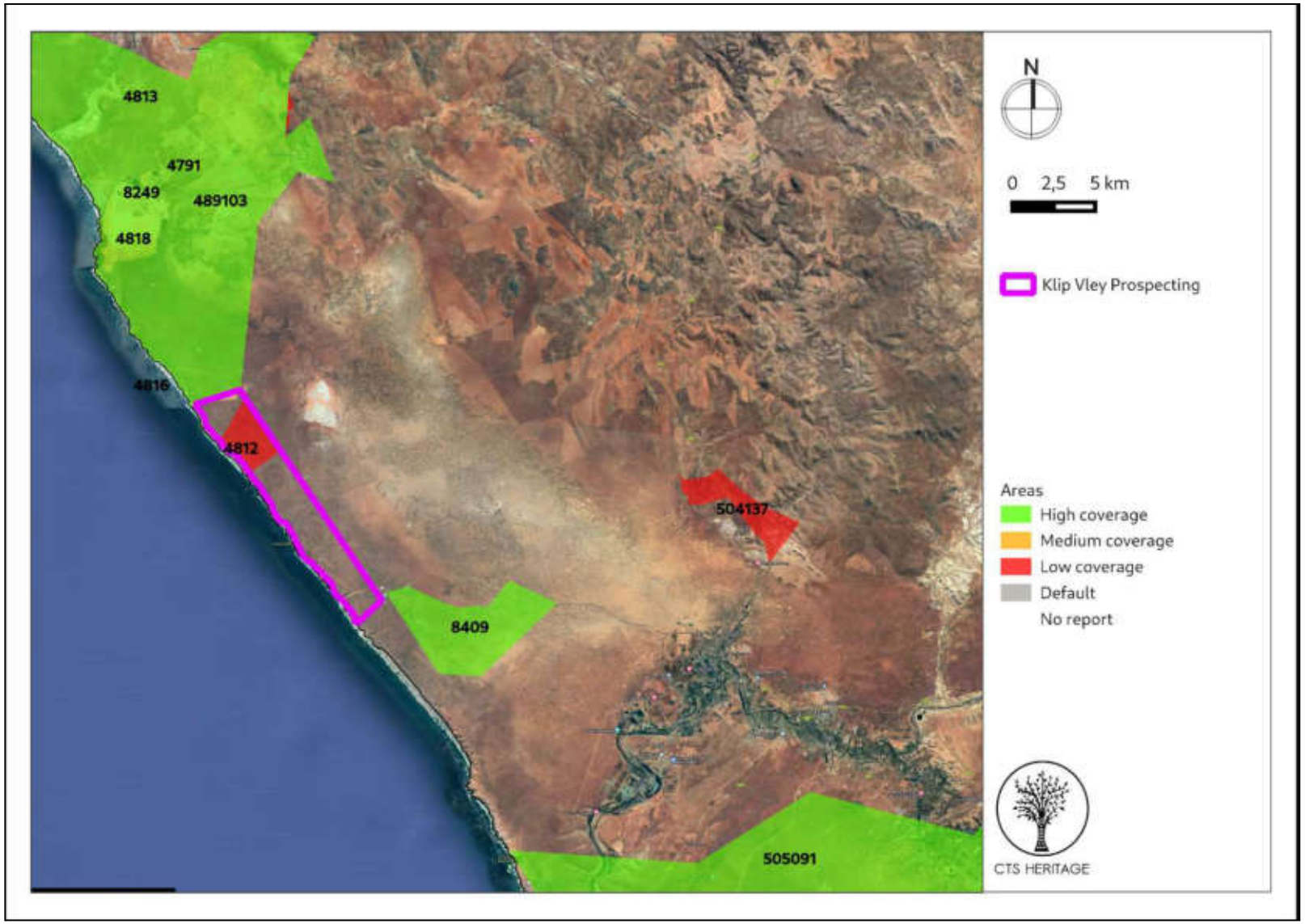

Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted

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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

Background

This application is submitted as part of the assessment process for a proposed prospecting application located approximately 25km north of Papendorp along the west coast of South Africa. Due to the nature and scale of the proposed prospecting, none of the activities listed in section 38(1) of the NHRA is triggered. The area proposed for the prospecting has been previously assessed for impacts to heritage resources by Hart (1999 and 2003). These and other relevant reports are summarised below.

Cultural Landscape and Built Environment Heritage

The area proposed for prospecting is located some distance from any significant towns - with the nearest town being Papendorp located some 25km to the south. The cultural landscape value of the broader area has been identified elsewhere (Winter, 2021) as related to the Sandveld Coastal Region and the Olifants River Estuary which consists of a narrow lagoon, wetlands, coastal dunes and the settlements of Ebenhauser and Papendorp. In particular, the landscape has high local scenic, estuarine and recreational value. The settlements of Ebenhaeser and Papendorp have mostly associational heritage value; Ebenhaeser as an early 19th century mission station, and Papendorp as an early 19th century fishing settlement (Winter and Oberholzer 2014). Despite some associational heritage value, relationship with a natural setting and the mission church at Ebenhaeser being of suggested Grade IIIB value, the settlements in their own right including their access routes off the R362 are not regarded as having considerable heritage value.

As is also noted elsewhere, this part of the West Coast has been subjected to mining activities since the 1960's and as such, the proposed prospecting activities aren't unexpected here. Furthermore, the limited nature and scale of prospecting is unlikely to negatively impact on the significant scenic and wilderness landscape qualities of the Sandveld area. However, should mining activities proceed, a more careful assessment of impacts to the cultural landscape should be undertaken.

Archaeology

Hart (1999 and 2007) provides a brief synopsis of the archaeological history of the area which is not repeated here. According to Hart (2003), "The coastline consists of large expanses of rocky shore (quartzites) punctuated by small bays and coves. There are two long stretches of sandy beach (Langstrand and Liebenberg Bay). Immediately inland of the rocky shore are the remnants of the coastal dune system, most of which has now been disturbed by small mining operations. The low scrub covered coastal plains slope gently down to the shorelines apart from in the south where the slope breaks rather more steeply down to places such as Baaivals and Sam se Baai. Many informal tracks lead off the coastal road to old diamond diggings resulting in deflated and de-vegetated areas. In general, the area has seen very little development as it was diamond concession land since the early 20th century. The nearest small settlement of any consequence is Koekenaap some 30 km inland. There is one ruined farmhouse situated at Sterkfontein."

Hart (2003) goes on to note that "Pre-colonial archaeological sites are prolific with most Late Stone Age sites located within 1 km of the shoreline. Areas adjacent to rocky shorelines and small bays attracted prehistoric 7 occupation by

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ancestors of San hunter-gatherers and Khoekhoen herders. The higher slopes and coastal plains show evidence of Early and Middle Stone Age artefact scatters: material is visible in virtually any area where red Aeolian sand have become deflated and the underlying Dorbank (hard calcretised feldspathic soils) exposed. In summary, the heritage of this area is almost entirely archaeological – the cultural landscape consisting of the distribution of a range of pre-colonial archaeological sites from different time periods. The colonial period cultural landscape is almost entirely limited to a legacy of old diggings, prospecting trenches and places where temporary structures were erected to accommodate diamond mining (the exception being a single historical ruin). Virtually all of this recent history is less than 100 years old and does not constitute archaeological material… In summary, the primary sources of risk in terms of heritage are mainly near shore Late Stone Age archaeological sites, Middle Stone Age artefact scatters and buried sites and to a lesser extent, intangible heritage such as visual impacts."

All of the sites identified by Hart (1999 and 2003) have been mapped relative to the area proposed for prospecting in Figures 3.1 to 3.4. It is clear that most of these sites are located outside of the prospecting area below the coastal ridge. That being said, it is recommended that the areas proposed for prospecting be assessed for impacts to archaeological heritage in order to inform the micrositing of prospecting locations and to provide information regarding the overall archaeological sensitivity of the prospecting area.

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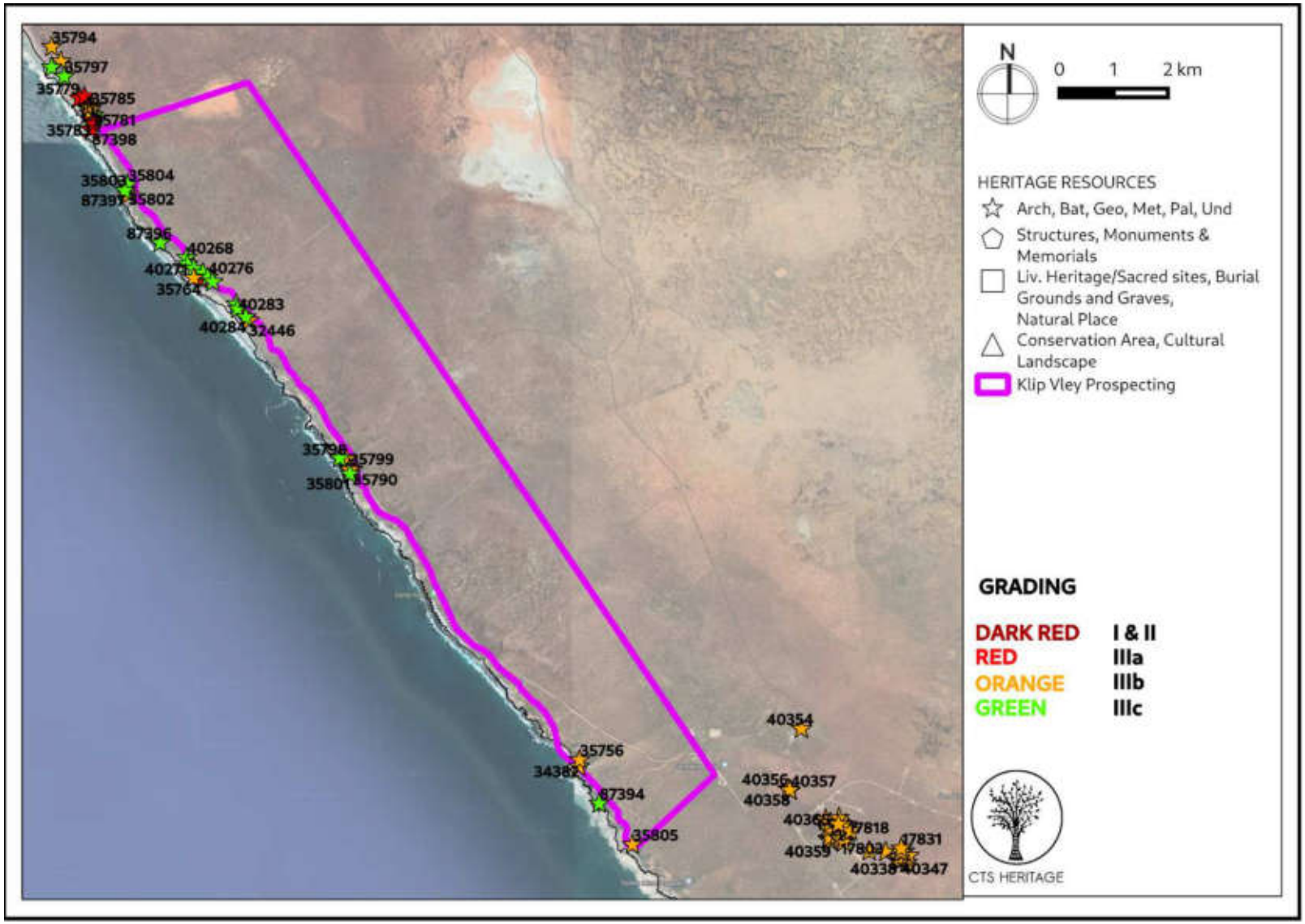

Figure 3.1 Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated

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Figure 3.2. Heritage Resources Map. Heritage Resources Inset A

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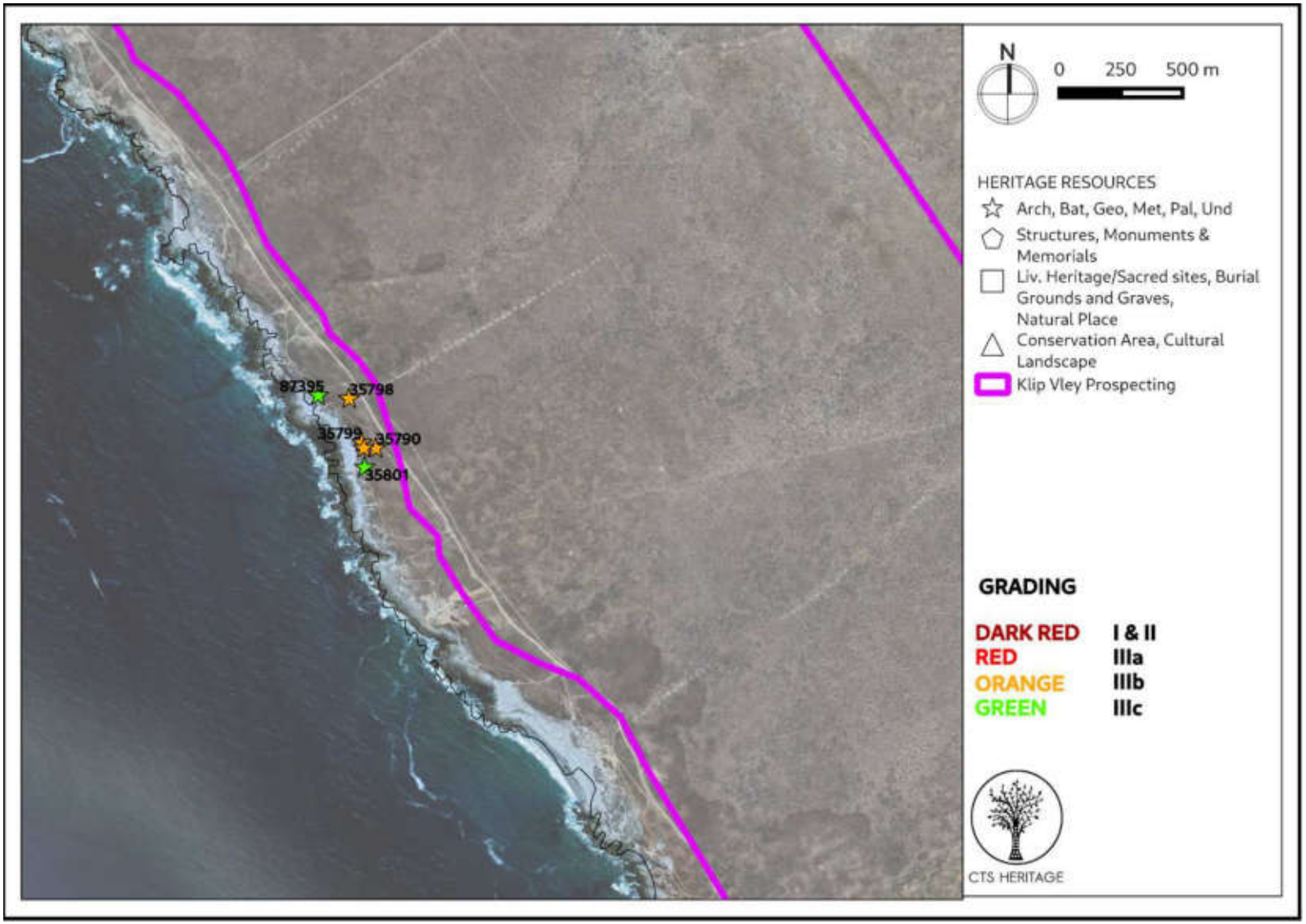

Figure 3.3. Heritage Resources Map. Heritage Resources Inset B

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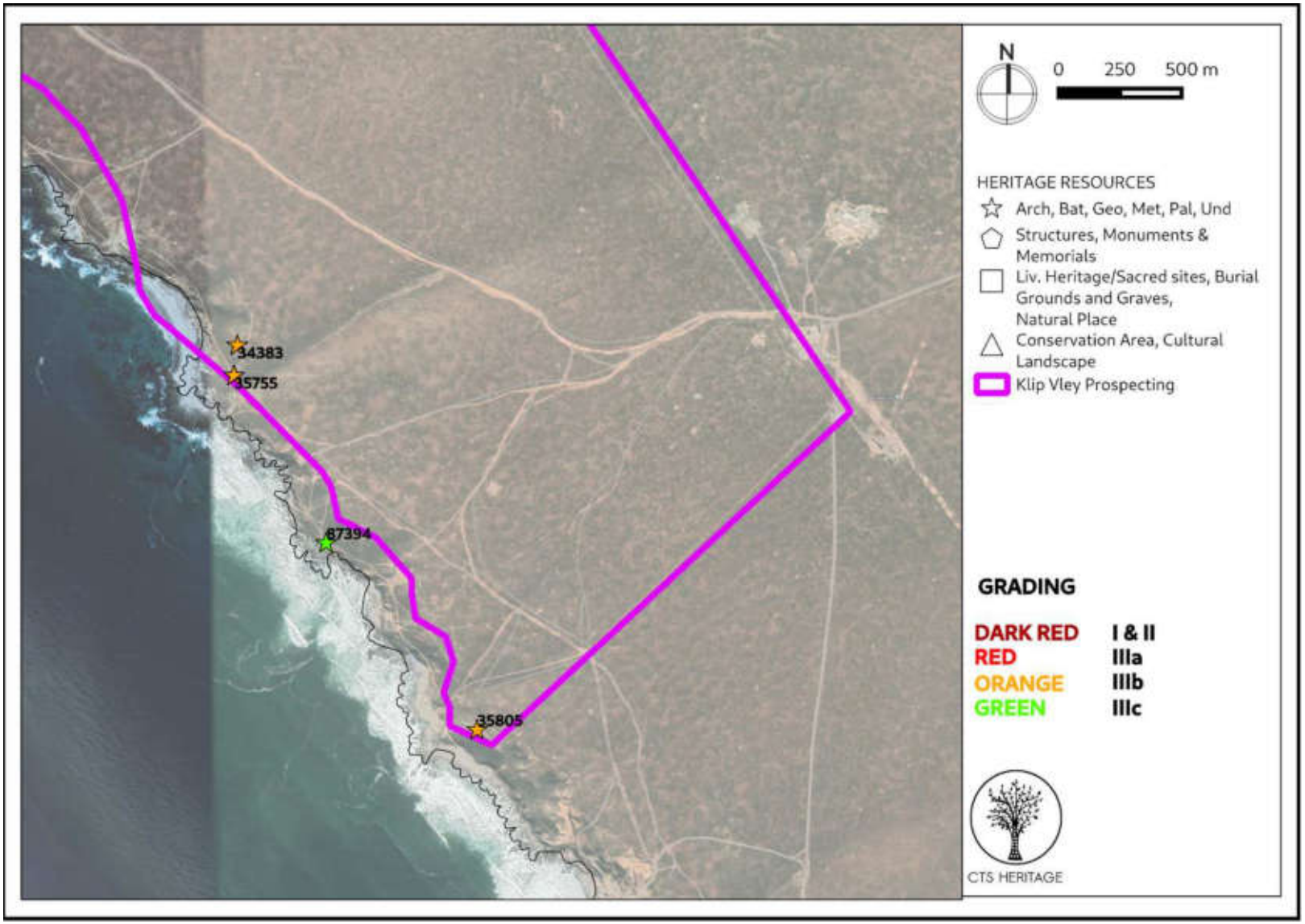

Figure 3.4. Heritage Resources Map. Heritage Resources Inset C

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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

The field assessment took into account the various impact assessments in the area that have been carried out previously as well as the fact that this project is only for prospecting rights and not full mining within the study area. Most of the significant heritage resources are buried beneath the Koekenaap dunes and lie on the harder Dorbank formation. A large exposed pan/deflation area can be found In the northeast section of the study site where thousands of MSA and LSA artefacts can be found. Local quartzites and quartz dominate all of the assemblages recorded but contributions of fine silcrete and calcrete artefacts and haematite were also noted. Hart (2003) noted that these artefacts have been found in other areas along the West Coast near this development and Pether's (2021) palaeontological report provides some explanation for the prolific numbers of artefacts in the northeast zone due to a palaeo-stream channel that ran nearby. The farm, Baievlei, has a few modern buildings alongside the older, early 20th century buildings that are currently derelict. The name presumably derives from the availability of water in this area as the name translates from Afrikaans to English as "Many wetlands/water spots".

The appropriate grading for this area has been given a IIIB rating as there is high potential for mitigation and a series of deeper investigations in this area which would provide valuable archaeological evidence of settlement patterns and climate. A few areas with bleached bone were also seen which is consistent with the findings made elsewhere due to the relatively amenable conditions for bone preservation. The Baievlei werf also has a small graveyard for members of the Loubscher family who died between 1949 and 2003.

The visible archaeological traces drop off outside of the 300m coastal band as one moves inland and only ephemeral traces of shell and LSA quartz, silcrete and quartzite flakes lie across the area. Some of the prospecting pits were inspected and it appears that older MSA material has been brought up to the surface in places which suggests that even more buried MSA material is spread throughout the study site - this was the case at the Tormin mine to the south where MSA tools were uncovered during mining operations when the topsoil layers were removed.

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Figure 4.1: Access road to the MSR Tormin mine and Sere Wind Farm from Koekenaap.

Figure 4.2: View of the study site looking northwestwards from the southeast corner.

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Figure 4.3: View of the small shrubland covering the study site.

Figure 4.4: View of the gentle slope before it drops more abruptly in the coastal band.

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Figure 4.5: View of the small rocky headlands and outcrops in the coastal band.

Figure 4.6: View of the coastal band with heavy impacts from mining roads and jeep tracks onto the beach.

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Figure 4.7: View of the coastal band from the mining road.

Figure 4.8: View of the camping shelters built up from local stones along the beach south of Camp Alpha.

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Figure 4.9: View of the coastal area.

Figure 4.10: View of the shrubland and fairly level ground on the dunes.

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Figure 4.11: View of the study area across the dune cordon.

Figure 4.12: View of the study area and one of the farm jeep tracks.

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Figure 4.13: View looking north across the study site.

Figure 4.14: View of the exposed dunes where more intense sheep farming kraals were found.

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Figure 5.1: Overall track paths of foot survey for development

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4.2 Archaeological Resources identified

Table 1: Heritage Resources identified

Obs#	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
001	Series of modern buildings near security entrance. One older kraal structure	Structure	Modern, Historic	n/a	-31.494757	18.058814	NCW	NA
002	Artefacts exposed in road at Beach 1 entrance. Quartzite and quartz, silcrete. MSA and LSA. Retouched flakes, cores, lower grindstone	Artefacts	LSA+MSA	10 to 30	-31.486809	18.033701	NCW	NA
003	Another set of artefacts exposed by road and S. argenvillei shells possibly in eroded bank	Artefacts	MSA	5 to 10	-31.48178	18.02547	NCW	NA
004	Quartz and quartzite. Flake and small hammerstone on top of road bank.	Artefacts	LSA	0 to 5	-31.479971	18.022428	NCW	NA
005	Quartzite, calcrete, silcrete. Flakes, cores, about 1m below original surface that seem to have been brought up by roadworks.	Artefacts	MSA	10 to 30	-31.480065	18.022317	NCW	NA
006	Eroded midden, black mussel, Burnupena. Generally dispersed by roadworks	Artefacts	LSA+MSA	10 to 30	-31.478988	18.020201	NCW	NA
007	Eroded gully, possibly due to earlier prospecting or the roadworks. Several lower grindstones, cores, flakes, bone (indeterminate context) and ephemeral shell on high ground above beach	Artefacts	LSA+MSA	10 to 30	-31.479064	18.019427	NCW	NA
008	Very large midden behind camping screens lining the beach. About 50m from hwm. Dominated by S. argenvillei. Burnupena and black mussel too. Quartzite manuports, some flakes, quartz. Granite. At least 75m long x 30m wide.turbo? Check	Shell Midden	LSA	30+	-31.471229	18.008498	IIIB	100m Buffer
009	Quarry midden dominated by black mussel. Large overburden area on right hand side and less compacted shell lenses on the left. Roadworks cut through it	Shell Midden	LSA	30+	-31.470477	18.008118	IIIB	100m Buffer
010	View of previous prospecting works	Observation	Modern	n/a	-31.457074	18.001251	NCW	NA
011	Concrete structure - possible platform mixed with quartzite rocks and concrete blocks	Structure	Historic	n/a	-31.43594	17.981644	IIIA	100m Buffer

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	along the sides. Unsure of purpose - perhaps related to earlier mining or WW2 coastal defense structure.							
012	Current mining	Observation	Modern	n/a	-31.417881	17.964525	NCW	NA
013	Previous prospecting pit and quartz flake	Artefacts	MSA	0 to 5	-31.397888	17.958441	NCW	NA
014	Prospecting pit and larger scatter of quartz cores and flakes, likely exposed by pit work	Artefacts	MSA	5 to 10	-31.394418	17.962977	NCW	NA
015	Large pan/deflation area. Thousands of LSA and MSA artefacts exposed on hard packed palaeo surface. Cobbles, hammerstones, cores. Retouched flakes and many blanks. Quartzite, quartz, haematite. Dominated by quartz. Over extensive area. Bleached bone large antelope?	Artefacts	LSA+MSA	30+	-31.386657	17.966899	IIIB	NO IMPACT PERMITTED EXCLUDE AREA FROM MINING ACTIVITIES
016	Baievlei werf, mudbrick walls plastered with cement plaster, corrugated iron roofs	Structure	Historic	n/a	-31.383831	17.973905	IIIC	100m Buffer
016	Baievlei werf, mudbrick walls plastered with cement plaster, corrugated iron roofs	Structure	Historic	n/a	-31.384835	17.973442	IIIC	100m Buffer
016	Baievlei werf, mudbrick walls plastered with cement plaster, corrugated iron roofs	Structure	Historic	n/a	-31.384886	17.974226	IIIC	100m Buffer
017	Another exposure of MSA quartz cores, silcrete in jeep track	Artefacts	MSA	5 to 10	-31.384636	17.973297	NCW	NA
018	Baievlei modern werf	Structure	Modern	n/a	-31.383232	17.972666	NCW	NA
019	Loubscher family graveyard. 4 graves between 1949 - 2003	Graves/BurialGrounds	Historic	n/a	-31.383935	17.972389	IIIA	100m Buffer
020	Ephemeral quartz scatter of flakes, cores	Artefacts	LSA	0 to 5	-31.396879	17.981777	NCW	NA
021	Modern kraal, trough, melons thrown out for the sheep	Structure	Modern	n/a	-31.411688	17.992476	NCW	NA
022	Quartz flakes in kraal	Artefacts	LSA	0 to 5	-31.411666	17.992402	NCW	NA
023	Quartz microlith	Artefacts	LSA	0 to 5	-31.421994	17.986272	NCW	NA
024	Ephemeral scatter of quartz and quartzite flakes exposed by prospecting pit	Artefacts	MSA	0 to 5	-31.432192	17.993507	NCW	NA
025	Onder Brakvlei. Ephemeral quartz flakes in wetland	Artefacts	LSA	0 to 5	-31.430789	18.011272	NCW	NA
026	Visser graveyard, at least 14 graves, late 19th to 20th c.	Graves/BurialGrounds	Historic	n/a	-31.486804	18.077308	IIIA	100m Buffer

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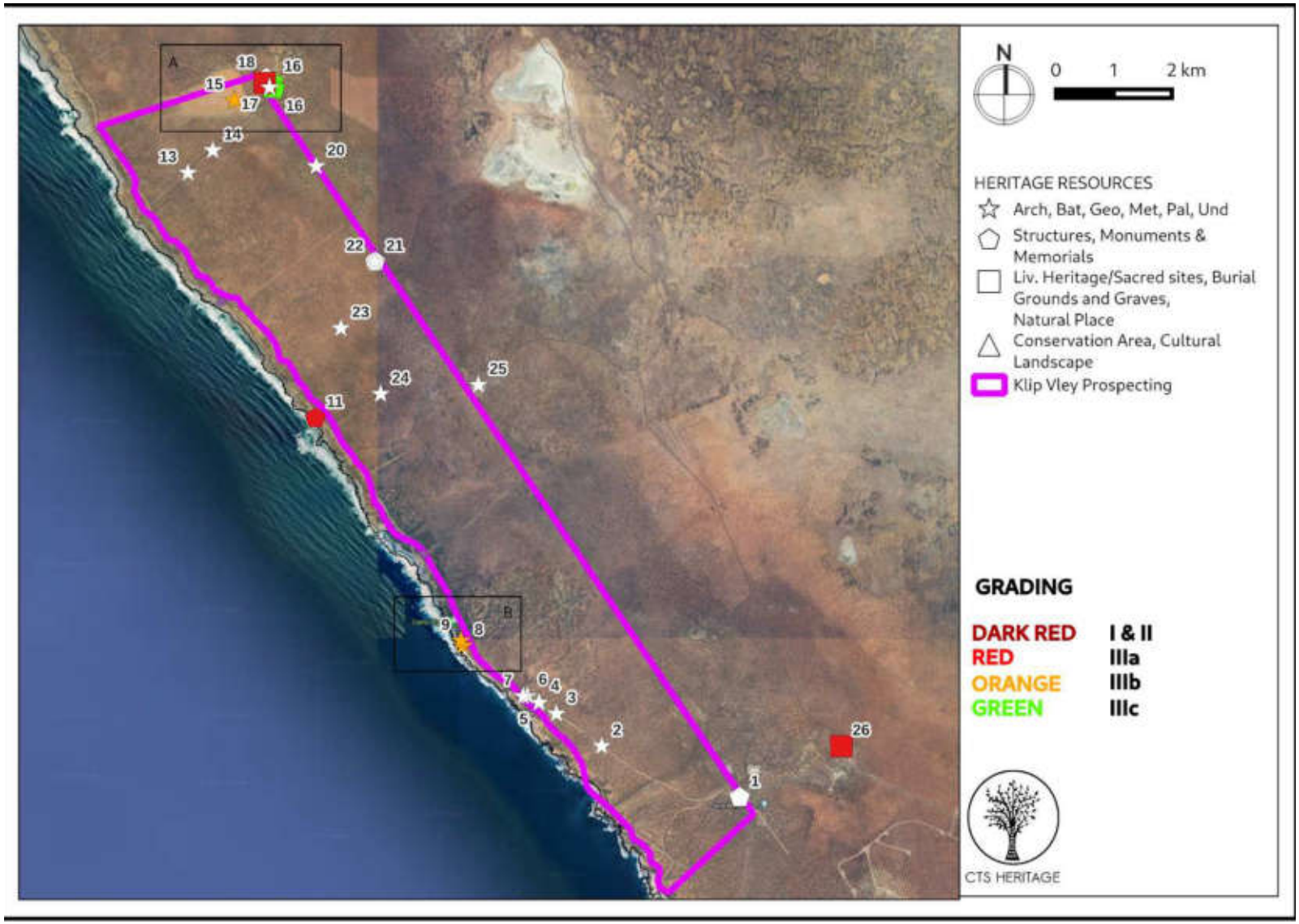

Figure 6.1: Map of all sites and observations noted within the development area

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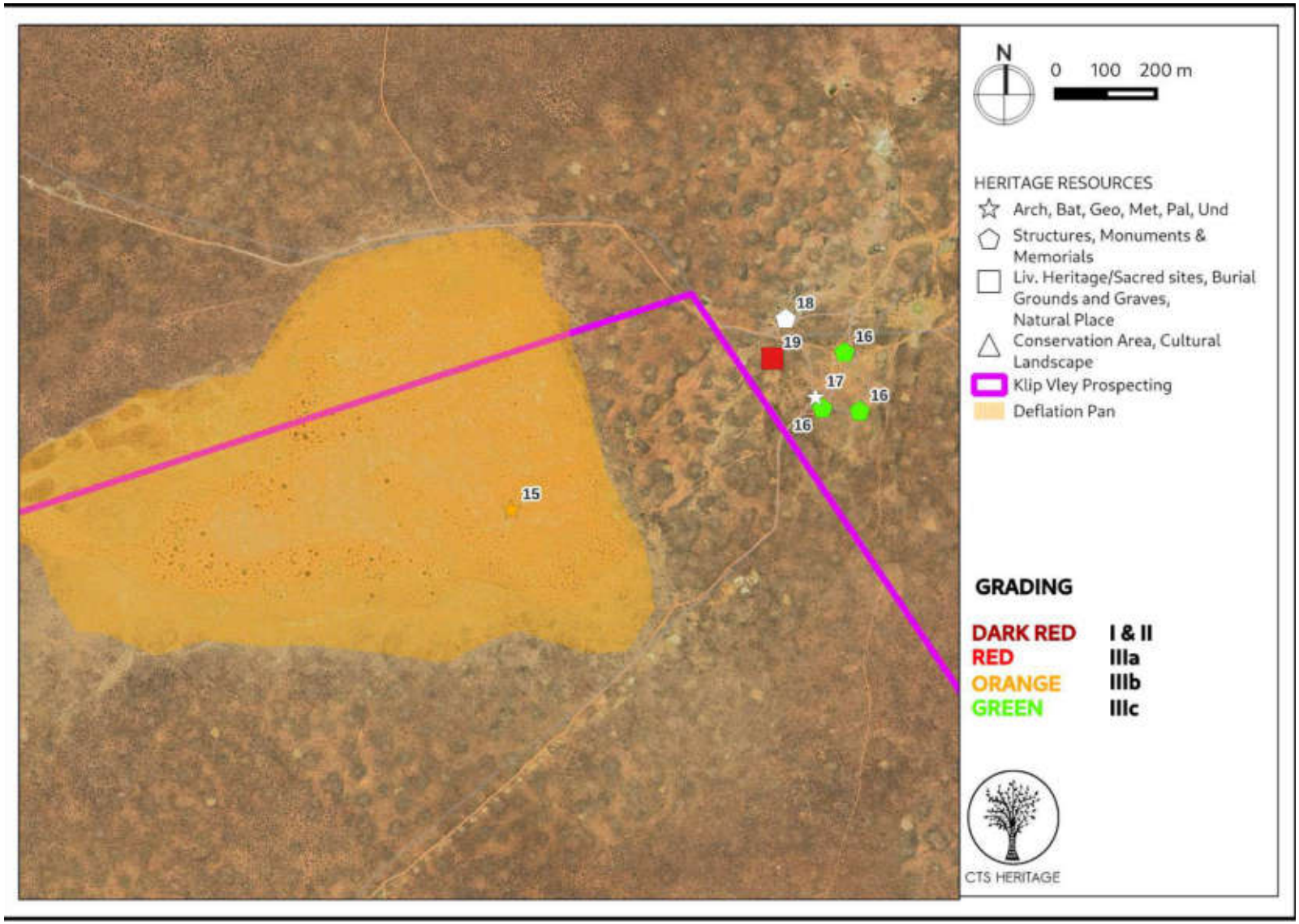

Figure 6.2: Map of all sites and observations noted within the development area - Inset A

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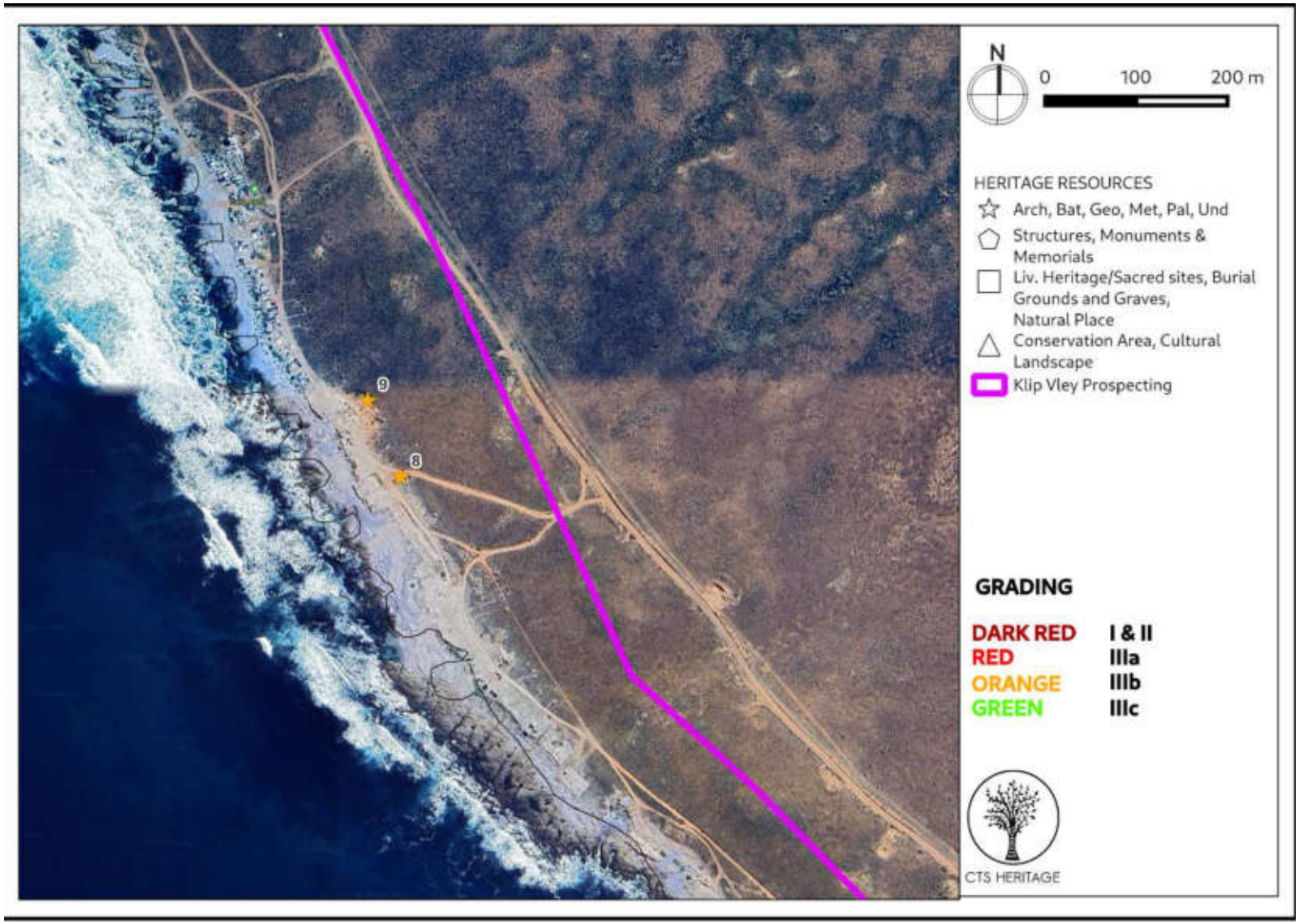

Figure 6.3: Map of all sites and observations noted within the development area - Inset B

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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 004

Figure 7.5: Observation 005

Figure 7.6: Observation 006

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Figure 7.7: Observation 007

Figure 7.8: Observation 008

Figure 7.9: Observation 008

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Figure 7.10: Observation 009

Figure 7.11: Observation 011

Figure 7.12: Observation 011

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Figure 7.13: Observation 013

Figure 7.14: Observation 014

Figure 7.15: Observation 015

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Figure 7.16: Observation 015

Figure 7.17: Observation 015

Figure 7.18: Observation 015

Figure 7.19: Observation 016

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Figure 7.20: Observation 017

Figure 7.21: Observation 018

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Figure 7.22: Observation 019

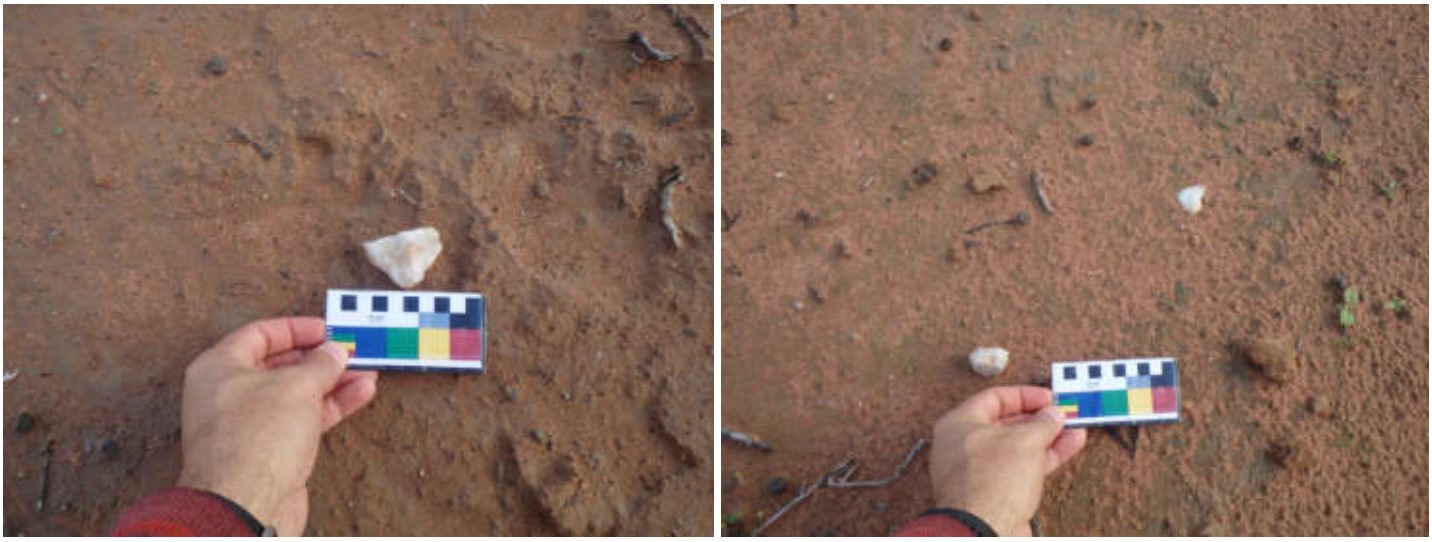

Figure 7.23: Observation 020

Figure 7.24: Observation 022

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Figure 7.25: Observation 024

Figure 7.26: Observation 025

Figure 7.27: Observation 026

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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

It is clear from the field assessment conducted for prospecting, as well as previous field assessments completed in the area, that the significant heritage resources in this context are concentrated along the coastline and around farm werfs. The field assessment identified a cluster of significant heritage resources in the northeast corner of the prospecting area including historic werf structures, an associated burial ground as well as a significant archaeological site within a deflation pan. We would therefore recommend that mining activities are excluded from this northeast zone.

The study boundary has been plotted to exclude the coastal band west of the dirt road from the mine - two large middens opposite Kolduin were recorded on the way past Camp Alpha - these are typical of other middens recorded by John Parkington and Cedric Poggenpoel, Jonathan Kaplan and Tim Hart's teams and one of the shell middens is nearly 3m deep. No impact on these middens is expected from this prospecting application but future mining activities directed towards the beach areas must undergo a proper assessment and mitigation plan should these areas be impacted in any way. While sites have been recorded at other rocky headlands bordering the study area, the tendency for burial of shell midden material beneath the dunes is high as can be seen from the photos taken at observation 009 where a deep layer of overburden is exposed by the quarry.

Transects were made across the study site to confirm whether any other areas of dense archaeological material could be found but only the small ephemeral and isolated finds were made. The actual prospecting activities are small and, in the absence of specific coordinates for these pits, it would not add value to conduct a deeper survey of such a large study site at this stage of the mining process. We would strongly recommend that full-scale mining applications following prospecting undergo a mining area-specific survey to record the LSA sites which will be mined away and to engage in an inspection protocol to record the buried MSA material once the Dorbank formations are exposed.

In order to ensure that significant heritage resources are not impacted by the proposed prospecting activities, it is recommended that a no development buffer of 100m is implemented around the identified heritage resources. The deflation pan with significant archaeological deposit in the north east of the prospecting area is excluded from any prospecting activities. Lastly, the prospecting activities must stay outside of the sensitive coastal shell-midden zone which is located within 300m of the high-water mark (below the coastal road).

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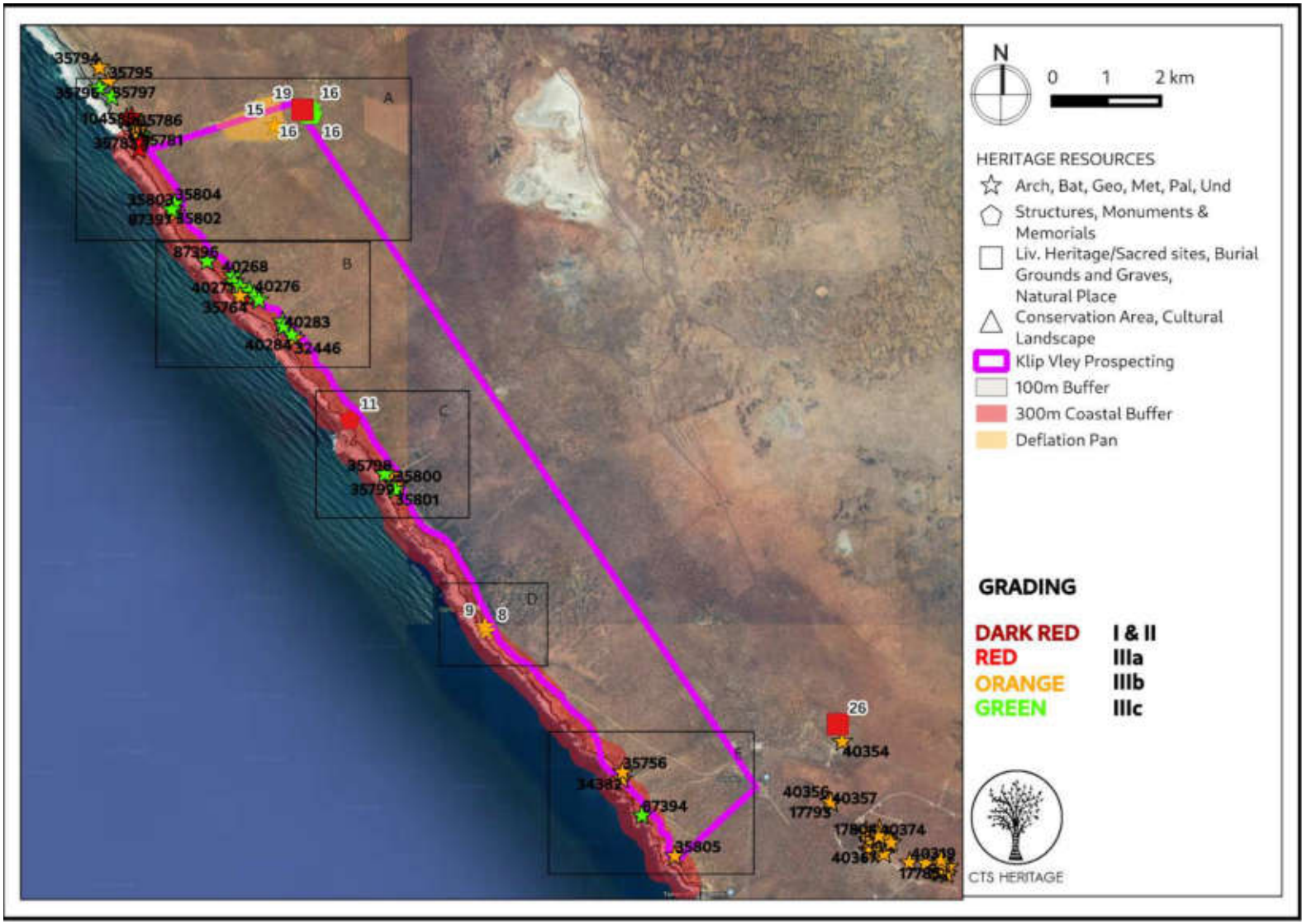

Figure 8.1: Map of known heritage resources relative to the proposed development area

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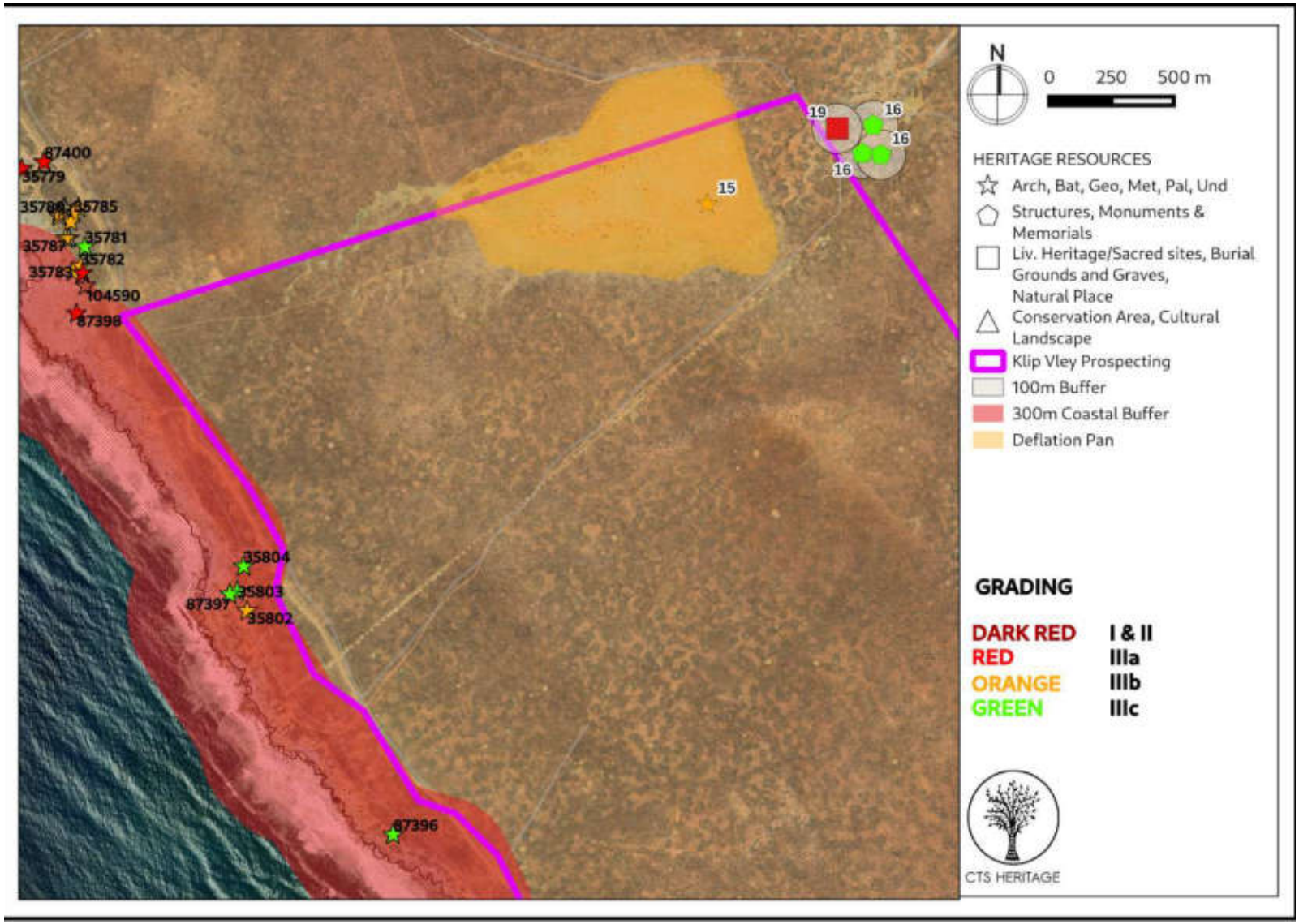

Figure 8.2: Map of all sites and observations noted within the development area with recommended mitigation measures

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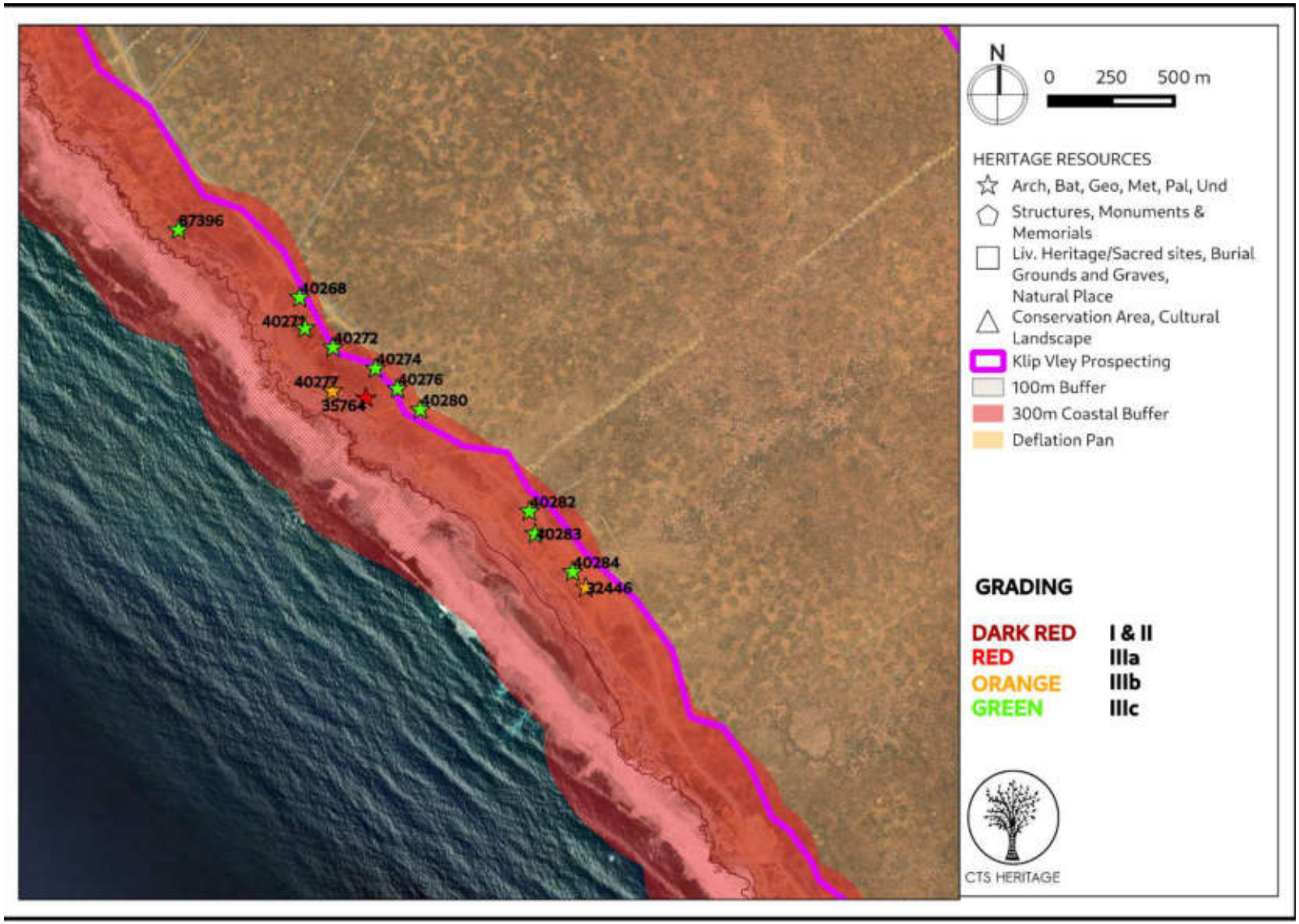

Figure 8.3: Map of all sites and observations noted within the development area with recommended mitigation measures

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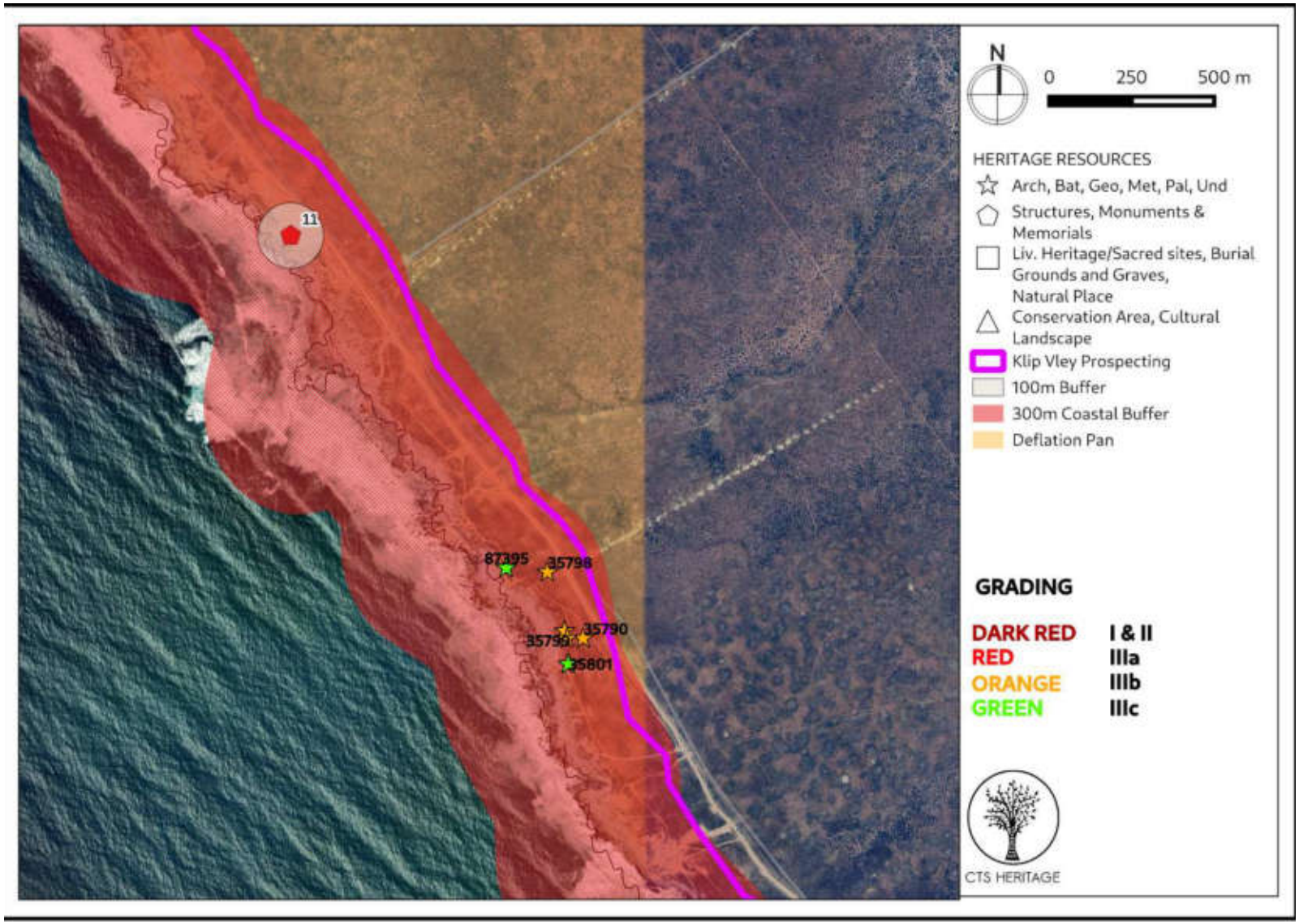

Figure 8.4: Map of all sites and observations noted within the development area with recommended mitigation measures

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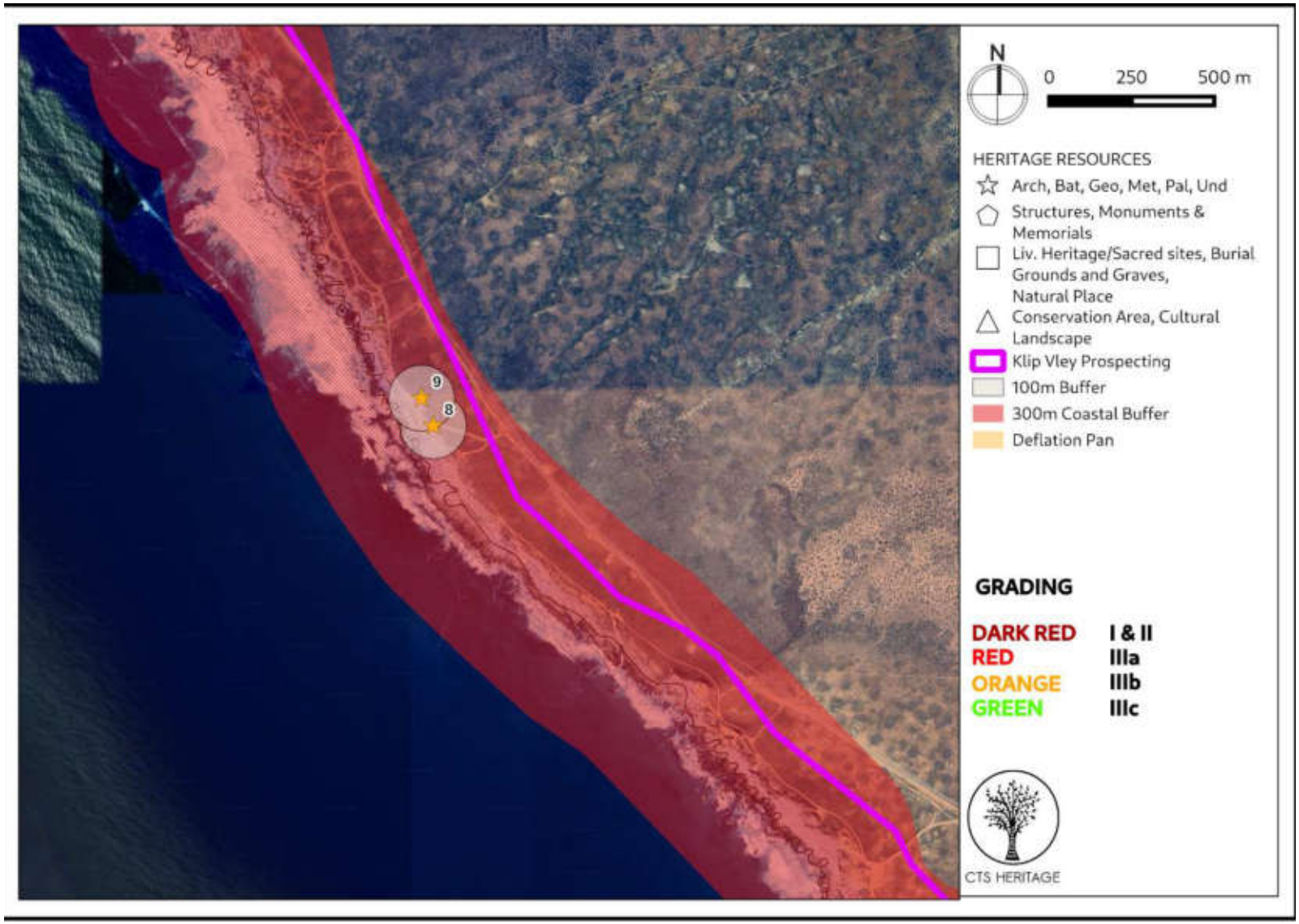

Figure 8.5: Map of all sites and observations noted within the development area with recommended mitigation measures

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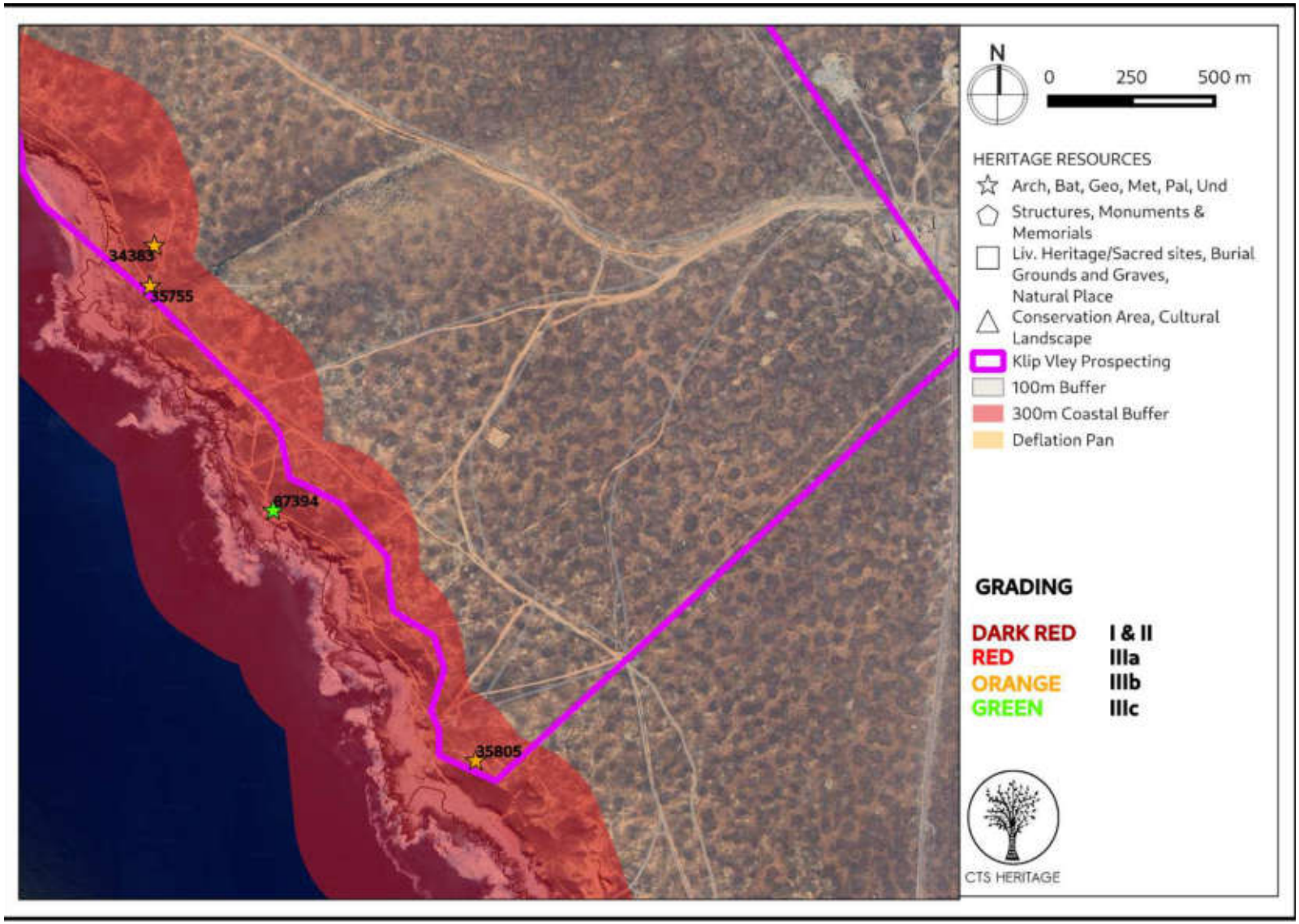

Figure 8.6: Map of all sites and observations noted within the development area with recommended mitigation measures

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6. CONCLUSION AND RECOMMENDATIONS

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. Significant archaeological material remains were documented within and outside of the proposed prospecting area. The majority of the significant resources are located outside of the prospecting area, and within the highly sensitive coastal shell-midden zone which extends 300m from the highwater mark. Many archaeological resources have been recorded in this area, and it is likely that these recordings represent a small fraction of the density of resources present here. No impact should take place within this highly sensitive 300m zone.

The significant heritage resources identified within the development area are associated with the deflation pan located in the north east of the prospecting area. It is recommended that the deflation pan as mapped above is excluded from prospecting activities. Additional recommendations are made in Table 1 to ensure that the significant resources identified are not negatively impacted by the proposed prospecting.

Recommendations

Based on the outcomes of this report, it is not anticipated that the proposed prospecting will negatively impact on significant archaeological heritage on condition that::

- The mitigation measures detailed in Table 1 and mapped in Figures 8.1 to 8.6 are implemented
- The highly sensitive coastal shell-midden zone which extends 300m from the highwater mark is excluded from prospecting activities
- The deflation pan (Site 015) is excluded from prospecting activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

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7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
4744	AIA Phase 1	Jonathan Kaplan	01/09/2000	Archaeological Study Portion 1 and 2 and the Remainder of the Farm Luiperskop No. 211, Vanrhynsdorp District, Western Cape
4756	AIA Phase 1	Timothy Hart	01/12/1997	An Archaeological Re-Assessment of Boundary Changes, Namakwa Sands Mining Area
4791	AIA Phase 1	John Parkington, Timothy Hart	01/03/1993	Namakwa Sands Main Access Road Archaeological Survey
4812	AIA Phase 1	Timothy Hart	01/09/1999	A Phase One Archaeological Assessment of the Proposed Liebenbergs Bay Mine, Vredendal
4813	AIA Phase 1	Dave Halkett	01/11/2000	An Assessment of the Impacts on Heritage Resources of Proposed Mining on the Farm Karoetjies Kop, Vredendal District
4814	AIA Phase 1	Jonathan Kaplan	01/09/2001	Archaeological Assessment Portion 3 (A Portion of Portion 2) Klip Vley Karoo Kop No. 153 Vredendal District, Cape West Coast
4816	AIA Phase 1	Timothy Hart	01/03/2003	Phase 1 Archaeological Assessment of Proposed Diamond Mining Areas Situated at the Farms Geelwal Karoo, Klipvley Karoo Kop and Graauduinen, Vredendal District, Western Cape
8249	AIA Phase 1	John Parkington, Cedric Poggenpoel	01/01/1991	West Coast Heavy Mineral Sand Project: Archaeological Report
8409	HIA Phase 1	Timothy Hart	01/12/2007	Heritage Impact Assessment (Prepared as Part of an EIA) of a Proposed Wind Energy Facility to Be Situated at Olifants River Settlement 617, 620 and Grave Water Kop 158/5 Situated on the Namaqualand Coast in the Vredendal District, South Western Cape

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CTS HERITAGE

APPENDIX 2: Palaeontological Assessment (2023)

PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED MINERAL SANDS RESOURCES (PTY) LTD PROSPECTING ON PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153

MATZIKAMA MUNICIPALITY, VREDENDAL DISTRICT, WESTERN CAPE PROVINCE

DMRE REFERENCE NUMBER: (WC) 30/5/1/3/3/2/1/1/10433PR

By

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Prepared at the Request of

Mineral Sands Resources (Pty) Ltd.

2 February 2021

UPDATED 19 JUNE 2023

NOTES ON UPDATE

The DMRE Ref. No. is updated.

The Prospecting Work Programme (PWP) is the same as the previous one for Klipvley Karoo Kop 13 supplied to me Nov 2020, except for the number of air-core boreholes which is increased from 50 to 250.

This impact assessment and the recommendations remain valid since the initial submission dated 2021-02-02. It involves the subsurface geology and palaeontology which are not subject to rapid change.

EXECUTIVE SUMMARY

1. Project Name

Proposed Mineral Sands Resources (Pty) Ltd. Prospecting on Portions 1, 2, 3 & Re/153 of the Farm Klipvley Karoo Kop 153, Vredendal District, Western Cape Province.

2. Location

The farm Klipvley Karoo Kop 153 is located in the Matzikama Municipality, Vredendal Magisterial District. It is situated at the coast to the west of Lutzville town, from where it is ~30 km distant by road via Koekenaap to Skaapvlei homestead and the old Weskus Mynbou premises (Figure 1).

3. Locality Plan

The locations of the prospecting sampling and drilling will be determined on the basis of the Phase 1 analysis of existing data and the Phase 2 field survey and mapping.

4. Proposed Development

The prospecting is to evaluate the occurrence and abundances in the coastal-plain deposits of the Heavy Minerals (HM):

- Rutile (Rt), Ilmenite (Il), Leucoxene (Lx). For Titanium (Ti) and iron slag.
- Zircon (Zr). For glazes, pigments, high-temperature casting and Zirconium.
- Garnet (Gn). For abrasive.
- Monazite (Mz). For Rare Earth (RE) elements (Th, Ce, La, Nd, Y..
- Diamonds (DA). Marine placer diamonds.

Activities affecting the subsurface involve:

- ~200 surface sampling pits with 0.5 m sides and 1 m deep
- ~100 small-diameter, man-portable auger drill holes to ~4 m depth.
- ~250 air-core drilling rig boreholes to an average depth of ~ 20 m.

5. Affected Formations

The surface sampling in small pits (~1 m) will primarily affect the late Quaternary surficial sands of the Koekenaap and Hardevlei formations. Sampling to depth by auger and air-core drilling will intersect the “Dorbank”, Olifantsrivier, Graauw Duinen and later Miocene aeolianite formations. The marine Kleinzee, Avontuur and Hondeklipbaai formations will also be intersected. Alluvium and colluvium in the local drainages, and possibly the Koingnaas Formation, may be intersected.

6. Palaeontological Resources

The fossil content of the aeolian formations is presumed to be typical of that observed in correlative formations in the wider area. Fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The bones of larger animals are sparse, but are more persistently present along palaeosurfaces which separate units. Rare caches of bones in large burrows are due to the bone-collecting behaviour of hyaenas. Interbedded pan deposits may occur, possibly with aquatic fossils and organic-rich layers. Fossil shells and sparse marine mammal

bones occur in the marine formations and rare patches of offshore muds which sometimes include fossil pollens. Alluvia and colluvia in drainages may also include potential fossil pollen-bearing mud layers. The Koingnaas Fm. includes organic peaty beds with fossil pollen and plant remains.

7. Anticipated Impact

The prospecting pitting and drilling involve small volumes and the impact relative to mining is marginal. The fossil material likely to be encountered in drill samples from aeolianites is the ambient fossil content. Fossil marine shell is not well-preserved in most of the marine deposits, but fossil shell will be encountered in some drillholes. Though likely fragmentary, it may be diagnostic of the marine formation penetrated. Other fossils which are brought up in boreholes include smaller petrified material such as shark and other fish teeth and casts of shells (steinkerns).

Mud beds in any of the formations are important as potentially containing fossil plant pollen.

In the process of the field survey and during the sampling and drilling programme, late Quaternary fossil and archaeological material, including larger mammal bones, may be encountered in deflation areas not discovered during archaeological surveys, or may be noticed in old prospecting excavations and surrounding spoil.

8. Recommendations

There are no known outcrops of sensitive fossiliferous strata in the Project Area that require protection as NO-GO sites, such as spots where fossils occur in obvious abundance. The palaeontological resources are predominantly subsurface and consequently considerations of fossil potential do not result in preferred sites and the particular locations of surface sampling and drilling do not affect this assessment.

Under supervision of the Environmental Control Officer (ECO) and as part of Environmental and Health & Safety awareness training, personnel involved in the **shallow pit sampling** must be instructed to be alert for the occurrence of fossil bones. Fossil bones may also be noticed weathering out in the sides of old prospecting excavations, or exposed in the adjacent spoil heaps of excavated material. In the event of such discoveries the **Fossil Finds Procedure** provided below (Section 10.2), for incorporation into the Environmental Management Programme for the proposed prospecting, must be followed.

Although the palaeontological impact of the **auger and air-core drilling** is minimal due to the small volumes affected, it is proposed that a degree of mitigation is feasible and could have a positive benefit for the geological interpretation of the stratigraphy of the deposits. It is recommended that fossil material extracted from the boreholes, or later separated during sample analysis, be kept and bagged for identification by a palaeontologist. For preliminary analysis, quality images of the fossil material should be forwarded by email for examination by a specialist, in order to identify specimens of importance for stratigraphic diagnosis, and specimens requiring further examination and diagnosis.

Samples of mud beds from any formation, which may contain fossil pollen, are highly desirable due to their scientific importance and are a standing request from the fossil pollen specialists.

These mitigation measures are deemed adequate for the prospecting sampling and drilling operation. The proposed mitigation actions for the prospecting programme are relatively easily accomplished and their implementation will result in a positive impact for palaeontology arising from the proposed prospecting operation.

CONTENTS

ABBREVIATIONS

asl.	above (mean) sea level.
bsl.	below (mean) sea level.
CD-NGI	Chief Directorate – national geo-spatial Information.
EPWP	Early Pliocene Warm Period.
ESA	Early Stone Age.
Fm.	Formation.
HM	Heavy Minerals.
HWC	Heritage Western Cape.
LIG	Last Interglacial.
LPWP	Late Pliocene Warm Period.
MIS	Marine Isotope Stage.
MMCO	Mid Miocene Climatic Optimum.
MSA	Middle Stone Age.
MTS	Main Transmission Substation.
OSL	Optically stimulated luminescence.
PIA	Palaeontological Impact Assessment.
SAHRA	South African Heritage Resources Agency.
SRTM	Shuttle Radar Topography Mission – NASA.
SS	Substation.

GLOSSARY

~ (tilde): Used herein as “approximately” or “about”.

Aeolian: Pertaining to the wind. Refers to erosion, transport and deposition of sedimentary particles by wind. A rock formed by the solidification of aeolian sediments is an aeolianite.

Alluvium: Sediments deposited by a river or other running water (alluvial).

Archaeology: Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Bedrock: Hard rock formations underlying much younger sedimentary deposits.

Calcareous: Sediment, sedimentary rock, or soil type which is formed from or contains a high proportion of calcium carbonate in the form of calcite or aragonite.

Calcrete: An indurated deposit (duricrust) mainly consisting of Ca and Mg carbonates. The term includes both pedogenic types formed in the near-surface soil context and non-pedogenic or groundwater calcretes related to water tables at depth.

Clast: Fragments of pre-existing rocks, *e.g*. sand grains, pebbles, boulders, produced by weathering and erosion. Clastic – composed of clasts.

Colluvium: Hillwash deposits formed by gravity transport downhill. Includes soil creep, sheetwash, small-scale rainfall rivulets and gullying, slumping and sliding processes that move and deposit material towards the foot of the slopes.

Conglomerate: A cemented gravel deposit.

Coversands: Aeolian blanket deposits of sandsheets and smaller dunes.

Duricrust: A general term for a zone of chemical precipitation and hardening formed at or near the surface of sedimentary bodies through pedogenic and (or) non-pedogenic processes. It is formed by the accumulation of soluble minerals deposited by mineral-bearing waters that move upward, downward, or laterally by capillary action, commonly assisted in arid settings by evaporation. Classified into calcrete, ferricrete, silcrete, gypcrete, sepiocrete etc.

Fluvial deposits: Sedimentary deposits consisting of material transported by, suspended in and laid down by a river or stream.

Fossil: The remains of parts of animals and plants found in sedimentary deposits. Most commonly hard parts such as bones, teeth and shells which in lithified sedimentary rocks are usually altered by petrification (mineralization). Also impressions and mineral films in fine-grained sediments that preserve indications of soft parts. Fossils plants include coals, petrified wood and leaf impressions, as well as microscopic pollen and spores. Marine sediments contain a host of microfossils that reflect the plankton of the past and provide records of ocean changes. Nowadays also includes molecular fossils such as DNA and biogeochemicals such as oils and waxes.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Marine Isotope Stages (MIS). Marine oxygen-isotope stages, or oxygen isotope stages (OIS), are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples. Working backwards from the present-day interglacial which is MIS 1, stages with odd numbers represent warm interglacial intervals and stages with even numbers represent cold glacial periods.

Optically-stimulated Luminescence (OSL). One of the radiation exposure dating methods based on the measurement of trapped electronic charges that accumulate in crystalline materials as a result of low-level natural radioactivity from U, Th and K. In OSL dating of aeolian quartz and feldspar sand grains, the trapped charges are zeroed by exposure to daylight at the time of deposition. Once buried, the charges accumulate and the total radiation exposure (total dose) received by the sample is estimated by laboratory measurements. The level of radioactivity (annual doses) to which the sample grains have been exposed is measured in the field or from the separated minerals containing radioactive elements in the sample. Ages are obtained as the ratio of total dose to annual dose, where the annual dose is assumed to have been similar in the past.

Palaeontology: The study of any fossilised remains or fossil traces of animals or plants which lived in the geological past and any site which contains such fossilised remains or traces.

Palaeosol: An ancient, buried soil formed on a palaeosurface. The soil composition may reflect a climate significantly different from the climate now prevalent in the area where the soil is found. Burial reflects the subsequent environmental change.

Palaeosurface: An ancient land surface, usually buried and marked by a palaeosol or pedocrete, but may be exhumed by erosion (*e.g*. wind erosion/deflation) or by bulk earth works.

Pedogenesis/pedogenic: The process of turning sediment into soil by chemical weathering and the activity of organisms (plants growing in it, burrowing animals such as worms, the addition of humus *etc.*).

Pedocrete: A duricrust formed by pedogenic processes.

Rhizolith: Fossil root. Most commonly formed by pedogenic carbonate deposition around the root and developed in palaeosols.

Sepiocrete: A duricrust with a high content of the magnesian clay mineral sepiolite.

Stone Age: The technological period in human culture when tools were made of stone, wood, bone or horn.

Stratotype locality: The place where deposits regarded as defining the characteristics of a particular geological formation occur.

Tectonic: Relating to the structure of the earth's crust and the large-scale processes which take place within it (faulting and earthquakes, crustal uplift or subsidence.

Trace fossil: A structure or impression in sediments that preserves the behaviour of an organism, such as burrows, borings and nests, feeding traces (sediment processing), farming structures for bacteria and fungi, locomotion burrows and trackways and traces of predation on hard parts (tooth marks on bones, borings into shells by predatory gastropods and octopuses).

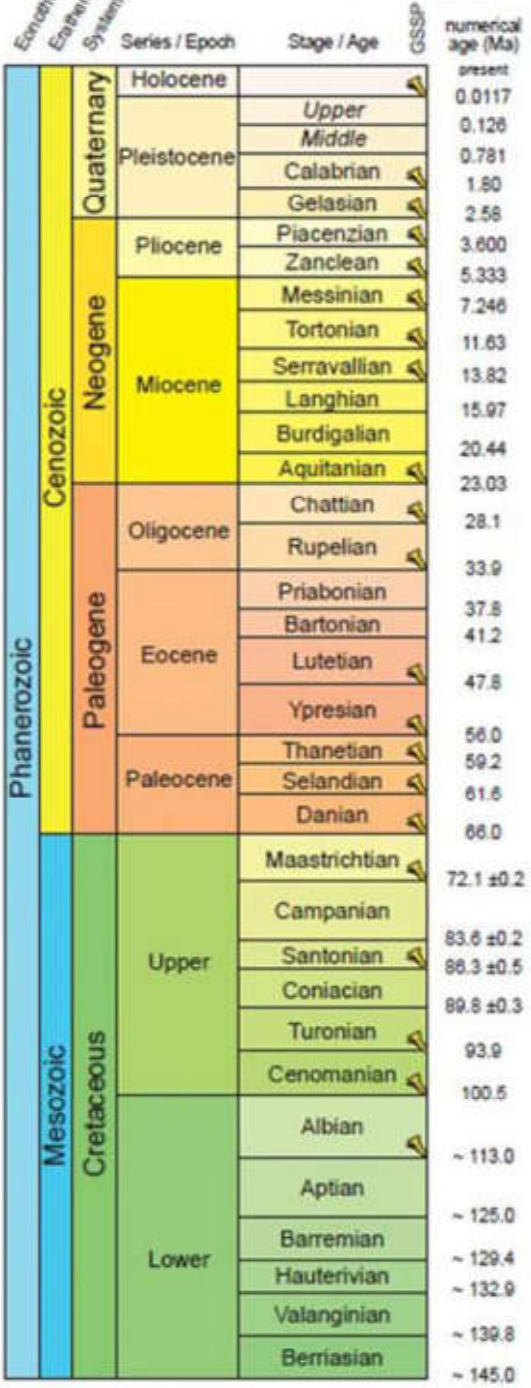
GEOLOGICAL TIME SCALE TERMS

ka: Thousand years or kilo-annum (10^3 years). Implicitly means “ka ago” *i.e*. duration from the present, but “ago” is omitted. The “Present” refers to 1950 AD. Not used for durations not extending from the Present. For a duration only “kyr” is used.

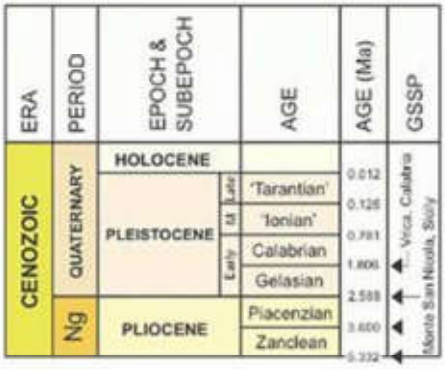
Ma: Millions years, mega-annum (10^6 years). Implicitly means “Ma ago” *i.e.* duration from the present, but “ago” is omitted. The “Present” refers to 1950 AD. Not used for durations not extending from the Present. For a duration only “Myr” is used.

For more detail see www.stratigraphy.org.

Mesozoic and Cenozoic Chronostratigraphy
From: International Commission on Stratigraphy.
Chronostratigraphic Chart 2016-12.pdf



ICS-approved 2009 Quaternary (SQS/INQUA) proposal



Holocene: The most recent geological epoch commencing 11.7 ka till the present.

Pleistocene: Epoch from 2.6 Ma to 11.7 ka.
Late Pleistocene 11.7–126 ka.
Middle Pleistocene 135–781 ka.
Early Pleistocene 781–2588 ka.

Quaternary: The current Period, from 2.6 Ma to the present, in the Cenozoic Era.
The Quaternary includes both the Pleistocene and Holocene epochs. As used herein, early and middle Quaternary correspond with the Pleistocene divisions, but late Quaternary includes the Late Pleistocene and the Holocene.

1 INTRODUCTION

The Applicant, Mineral Sands Resources (Pty) Ltd. (MSR) is applying for a Prospecting Right, in terms of the Mineral and Petroleum Resources Development Act 28 of 2002 (as amended), to prospect for the occurrence of various Heavy Minerals (HM) on four portions of the farm Klipvley Karoo Kop 153 on the coastal plain of southern Namaqualand (Figure 1). Enviroworks is undertaking the environmental authorisation process for the proposed prospecting. This report forms part of the Heritage Impact Assessment (HIA) and its brief is to inform about the palaeontological sensitivity of the Project Area and the probability of palaeontological materials (fossils) being uncovered in the subsurface and being disturbed or destroyed in the process of prospecting, and to provide recommendations for palaeontological mitigation to be included in the Environmental Management Programme (EMPr) for the Construction Phase of the project.

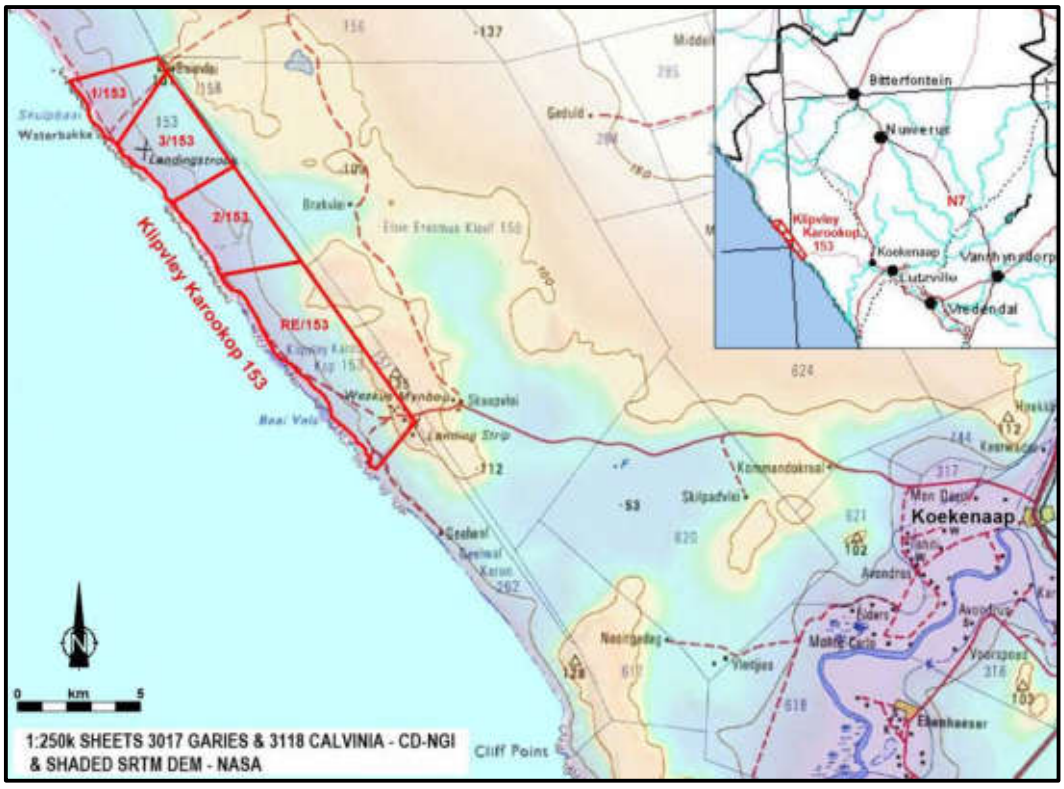


Figure 1. Location of Klipvley Karoo Kop 153 Project Area for the proposed prospecting.

2 LOCATION

The farm Klipvley Karoo Kop 153 is located in the Matzikama Municipality, Vredendal Magisterial District, Western Cape Province. It is situated at the coast to the west of Lutzville town, from where it is ~30 km distant by road via Koekenaap to Skaapvlei homestead and the old Weskus Mynbou premises (Figure 1). The properties involved are:

TABLE 1. KLIPVLEY KAROO KOP 153	
Farm Portions	**Area ha**
Portion 1	451.4
Portion 2	777.7
Portion 3	809.9
Remainder	1596.1
TOTAL AREA	**3635**

CD-NGI Topo-cadastral Mapsheets:

- 1:50000 3117BD BAIEVLEI; 3118AC LANDPLAAS; 3118CA PAPENDORP.
- 1:250000 3017 GARIES; 3118 CALVINIA.

Council for Geoscience Geological Sheets:

- 1:250000 3017 GARIES, 3118 CALVINIA.

The Tormin Mineral Sands Mine, owned by MSR, is located on the adjacent farm Geelwal Karoo 262 where the HM-rich beach sands and the “Western Strandline” deposits just inland are mined.

3 LOCALITY PLAN

The locations of the prospecting sampling and drilling will be determined on the basis of the Phase 1 analysis of existing data and the Phase 2 field survey and mapping.

4 PROPOSED ACTIVITIES

The prospecting is to evaluate the occurrence and abundances in the coastal-plain deposits of the Heavy Minerals (HM):

- Rutile (Rt), Ilmenite (Il), Leucoxene (Lx). For Titanium (Ti) and iron slag.
- Zircon (Zr). For glazes, pigments, high-temperature casting and Zirconium.
- Garnet (Gn). For abrasive.
- Monazite (Mz). For Rare Earth (RE) elements (Th, Ce, La, Nd, Y..
- Diamonds (DA). Marine placer diamonds.

Phase 1 involves desktop activities, *viz*. data sourcing and evaluation of existing geological and prospecting data, satellite imagery and terrain data, in order to inform the choice of prospecting programme targets.

Phase 2 entails surface mapping traverses and the sampling of mineral occurrences by 25 litre samples extracted from ~200 pits with 0.5 m sides and 1 m deep. The pits will be backfilled after sampling.

Phase 3 entails the layout of sampling grids (~500 by 500 m) in areas of interest for shallow drilling and sampling using a small-diameter, man-portable auger drill. Approximately 100 auger holes to ~4 m depth are envisaged initially, but additional holes may be required for improved definition.

Phase 4 involves deeper drilling with an air-core drilling rig mounted on a small truck to acquire samples up to ~20 m depth . Approximately 250 air-core drill holes are planned, but additional holes may be required to follow up on results.

The surface, auger-drill and air-core drill samples will be analysed for their heavy mineral contents and the grades of potentially economic constituents.

Phase 5 entails the evaluation of the sampling results to estimate the mineral resources, the compilation of the prospecting geological report and the economic assessment, and the planning of the next phase of evaluation, if required.

5 APPLICABLE LEGISLATION

The National Heritage Resources Act (NHRA No. 25 of 1999) protects archaeological and palaeontological sites and materials, as well as graves/cemeteries, battlefield sites and buildings, structures and features over 60 years old. The South African Heritage Resources Agency (SAHRA) administers this legislation nationally, with Heritage Resources Agencies acting at provincial level. According to the Act (Sect. 35), it is an offence to destroy, damage, excavate, alter or remove from its original place, or collect, any archaeological, palaeontological and historical material or object, without a permit issued by the South African Heritage Resources Agency (SAHRA) or applicable Provincial Heritage Resources Agency. Notification of SAHRA or the applicable Provincial Heritage Resources Agency is required for proposed developments exceeding certain dimensions (Sect. 38).

6 APPROACH AND METHODOLOGY

6.1 AVAILABLE INFORMATION

This assessment is based on the published scientific literature on the origin and palaeontology of the Namaqualand coastal-plain deposits and the author's comprehensive field experience of the formations involved and their fossil content. Reports on previous prospecting are not readily available.

A account of the literature sources, the stratigraphy and the palaeontology of the coastal exposures between Graauw Duinen 152 and De Punt is given in Pether (2017) to which the reader is referred for more detail:

The relevant 1:250 000 Council for Geoscience geological maps and their explanations are Sheet 3118 CALVINIA (De Beer e*t al*., 2002) and Sheet 3017 GARIES (De Beer, 2010). The annotated and modified pertinent parts of these sheets are presented in Figure 5. The new stratigraphic terminology proposed by De Beer (2010) is mainly used, but is elaborated and modified according to the author's own observations.

Relevant aspects of the regional geology are described in summary below. References are cited in the normal manner and are included in the References section.

6.2 METHODOLOGY

Deposits or formations are rated in terms of their potential to include fossils of scientific importance, *viz*. their palaeontological sensitivity. Palaeontological sensitivity refers to the likelihood of finding significant fossils within a geologic unit, which informs the Intensity/Magnitude/Severity rating in an impact assessment. The rating criteria are included in Appendix 3.

6.3 ASSUMPTIONS AND LIMITATIONS

The assumption is that the fossil potential of a formation will be typical of its genesis/depositional environment and more specifically, similar to that observed in equivalent deposits near the project areas. Scientifically important fossil material is expected to be very sparsely scattered in the coastal-plain deposits and much depends on spotting this material as it is uncovered during digging *i.e.* by monitoring excavations. The relatively few fossils from the Namaqualand coastal plain have been vital to our current understanding of the coastal-plain geological history, not only of Namaqualand, but the fossil findings are also relevant to the coastal plains of the wider southern Africa.

A limitation on predictive capacity exists in that it is not possible to predict the buried fossil content of an area or formation other than in such general terms.

7 REGIONAL STRATIGRAPHY OF THE NAMAQUALAND COASTAL PLAIN

7.1 THE BEDROCK

The bedrock along the shore of Klipvley Karoo Kop 153 consists of various gneisses of the Namaqualand Metamorphic Province (2000-1000 Ma; Ma = million years ago). These previously-molten, crustal basement rock formations are not of palaeontological interest.

7.2 THE WEST COAST GROUP

The bedrock gneisses are overlain by much younger formations deposited during the last 66 million years of the **Cenozoic Era**. The **West Coast Group** is the name proposed to encompass the various named formations comprising the Cenozoic coastal deposits between the Orange River and Elandsbaai (Roberts *et al*., 2006), of both marine and terrestrial origin (Table 2).

7.3 THE EARLY COASTAL PLAIN

The formation of the coastal plain begins with the rifting of the Gondwana supercontinent and the opening of the Atlantic Ocean in the early Cretaceous, 130-120 Ma, which was accompanied by the inception of numerous rivers draining to the new coastline. A few kilometres thickness of Nama and Karoo formations have been stripped off the continental edge, exposing the coastal bedrock of metasediments and gneisses and building up the continental margin wedge offshore.

TABLE 2. NAMAQUALAND COASTAL STRATIGRAPHY – THE WEST COAST GROUP.

Formation Name	Deposit type	Age
Witzand	Aeolian pale dunes & sandsheets.	Holocene, <~12 ka.
Curlew Strand, Holocene High	**Marine, 2-3 m Package.**	**Holocene, 7-4 ka.**
Swartlintjies & Swartduine	Aeolian dune plumes.	Latest Quat., <20 ka.
Hardevlei	Aeolian, semi-active surficial dunes, >100 m asl.	Latest Quat., <25 ka.
Koekenaap	Aeolian, surficial red aeolian sands.	later late Quat., 80-30 ka.
Local Coastal Aeolianites*	Aeolianites, limited pedogenesis, weak pedocrete	Mid-late Quat., ~250-80 ka.
Curlew Strand, MIS 5e, LIG.	**Marine, 4-6 m Package.**	**earliest late Quat., ~125 ka.**
Fossil Heuweltjiesveld palaeosurface on Olifantsrivier & Dorbank fms.		
Dorbank*	Aeolian, reddened, semi-lithified.	later mid-Quat., ~400-140 ka.
Curlew Strand, MIS 11.	**Marine, 8-12 m Package.**	**mid Quat., ~400 ka.**
Olifantsrivier	Aeolianite, colluvia, pedocrete.	early-mid Quat., ~2-0.4 Ma.
Graauw Duinen Member 2	Aeolianite, colluvia, pedocrete.	latest Plio-early Quat.
Hondeklipbaai	**Marine, 30 m Package, LPWP.**	**late Pliocene, ~3 Ma.**
Graauw Duinen Member 1	Aeolianite, colluvia, pedocrete.	mid Pliocene.
Avontuur	**Marine, 50 m Package, EPWP.**	**early Pliocene, ~5 Ma.**
Later Miocene Aeoliannites*	Aeolianites, weathered.	later Miocene (14-5 Ma)
Kleinzee	**Marine, 90 m Package, MMCO.**	**mid Miocene, ~16 Ma.**
Unnamed*	Aeolianites, leached, faulted.	Oligocene
Koingnaas	Fluvial, kaolinized gravels, sands, plant fossils.	late Eocene
De Toren	Silcreted colluvial palaeosurfaces 200-400 m asl.	Paleocene - Eocene
• - Informal		
MMCO – Mid Miocene Climatic Optimum. EPWP – Early Pliocene Warm Period. LPWP – Late Pliocene Warm Period. MIS – Marine Isotope Stage.		

Ongoing erosion has removed nearly all traces of early Cretaceous deposits from the present-day West Coast coastal pain. A rare instance dating from the early Cretaceous rifting is preserved just north of the Buffelsrivier mouth and is evidently the surviving, deepest part of a fault-bounded lake. Rounded cobbles of petrified, early Cretaceous *Podocarpoxylon* woods are found in the onshore marine gravels, having been reworked successively from now nearly-vanished Cretaceous fluvial deposits of the early coastal plain.

The De Toren Formation

Deeply weathered, kaolinized (white china clay) bedrock is a feature of the older, higher parts of the coastal plain, with silcrete cappings in places. The silcretes are silicified bedrock and overlying deposits which originally formed in poorly-drained low spots in the pre-existing landscape, but with erosion these low areas are now “inverted” and occur as silcrete cappings on hills which are remnants of the old palaeosurface. The deep weathering and silcrete formation occurred during humid, tropical weathering such as thought typical of the palaeoclimates during Cretaceous and earlier Cenozoic (Paleeogene) times. The De Toren Formation mapped on the Garies geological sheet (De Beer, 2010) is an example and comprises silcreted angular gravels and sands that overlie deeply-weathered bedrock and which occur as mesa-like features on high ground 200-400 m asl. These silcretes mark an older palaeosurface of the coastal plain and represent talus and colluvial deposits. The fossil potential of these silicified colluvia is low, except perhaps for plant impressions.

The Koingnaas Formation

Buried between the existing, ephemeral Namaqualand rivers are ancient river channels that attest to the wetter climates of the early Cenozoic when more rivers drained the coastal plain. These locally-diamondiferous palaeochannels have fluvial deposit infills that have also been kaolinized and silcrete has formed within the waterlogged channel deposits in places. The deposits in the palaeochannels consist of basal, subangular to subrounded vein-quartz conglomerates overlain by beds of clayey sand, clay and carbonaceous, peaty material containing plant fossils, in a pale matrix of kaolinite (Molyneux, in Rogers *et al*., 1990), with yellow and red ochreous staining in places. Previously referred to as the "**Channel Clays**" by diamond miners, these deposits are now proposed as the **Koingnaas Formation** (De Beer, 2010). It is not shown on the geological maps, being covered by younger deposits. The locations of the ancient channels were influenced by faulting in the bedrock, causing coast-parallel courses in places. Interestingly, the buried channel topography is partly registered in the surface topography (Figure 2).

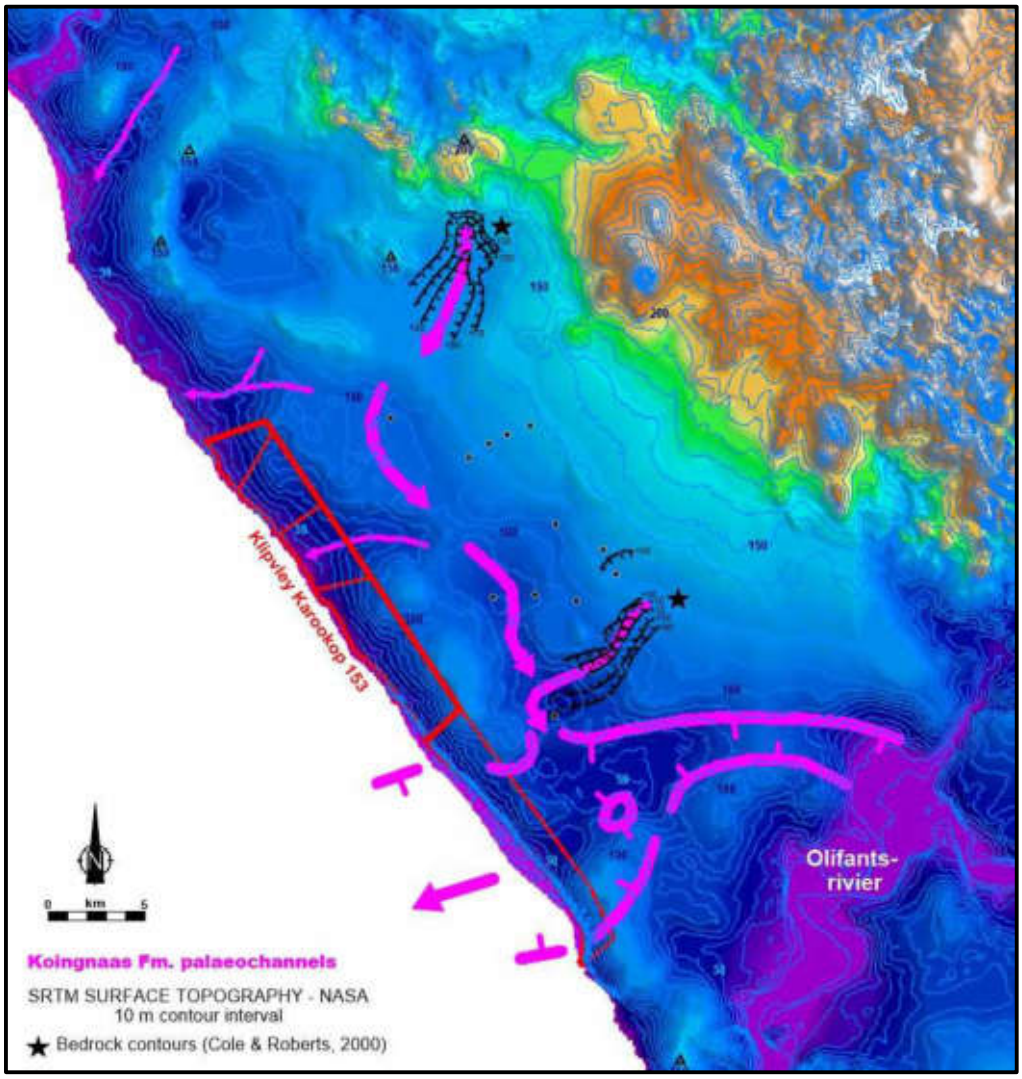


Figure 2. Surface topography (SRTM DEM) of the surrounds of the Project Area and buried palaeochannels of the Koingnaas Formation.

The fossil pollen from the peaty beds has provided evidence of the vegetation type present and the age of the Koingnaas Formation. Yellowwood forest with auracaria conifers, ironwoods and palms dominated the West Coast. Fossil wood similar to as tropical African mahogany has been found. The presence of early forms of pollen of the Asteraceae (daisy family) previously indicated that the age of the deposits was no older than Oligocene (34 Ma). Now new fossil evidence indicates that the Asteraceae have an earlier origin in the Eocene (Mandel *et al*., 2019). The age of Koingnaas Formation is therefore revised to later Eocene (Figure 3), with the aggradation of fluvial deposits in the

palaeochannels likely correlating with times of rising sea levels between 44-34 Ma. However, due to the pervasive kaolinitic weathering of the palaeochannel deposits it is possible that remnants of older, late Cretaceous and/or early Cenozoic deposits may be disguised in places in the bases of the channels. Notably, the Koingnaas pollen assemblage, with many extinct types of uncertain affinity and no analogues elsewhere, indicates that the uniqueness of the Cape Floristic Region is rooted in "deep time" (De Villiers & Cadman, 2002). The Koingnaas Formation deposits are remainders of a fossil landscape when the wooded Namaqualand coast approximately resembled the forests of the South Coast.

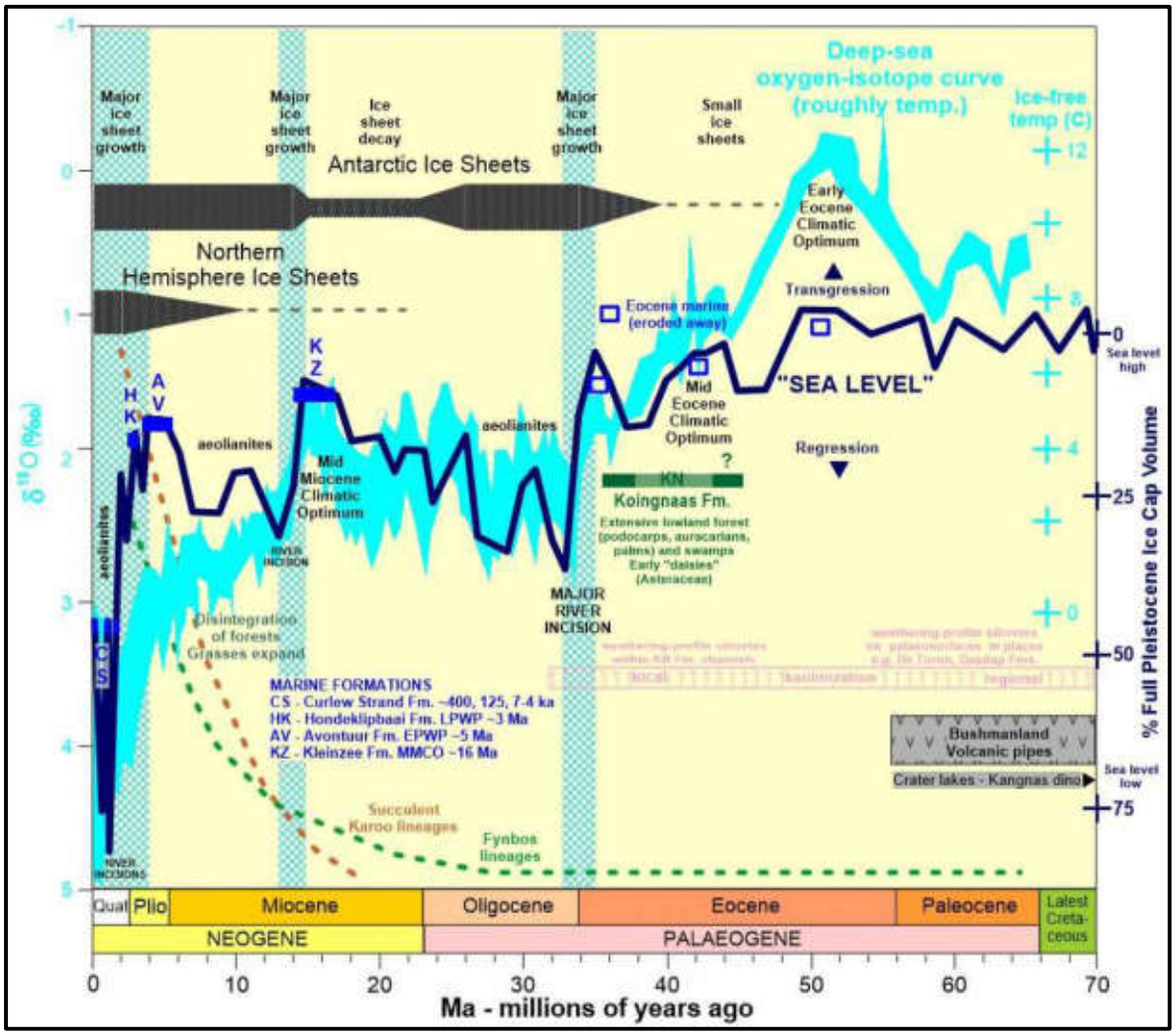


Figure 3: The Cenozoic Era (66 Ma to present) showing global palaeoclimate proxies, aspects of regional vegetation history and the context of marine formations of the West Coast Group, Alexander Bay Subgroup.

Cyan curve - history of deep-ocean temperatures, adapted from Zachos *et al*. (2008). **Blue curve** is an estimate of global ice volumes, adapted from Lear *et al*. (2000). Global ice volumes roughly indicate sea-level history caused by the subtraction from the sea of water as land-ice. The expansion of Fynbos and Karoo floras is adapted from Verboom *et al*. (2009). MMCO – Mid Miocene Climatic Optimum. EPWP – Early Pliocene Warm Period. LPWM - Late Pliocene Warm Period.

7.4 THE MARINE FORMATIONS

The early coastal plain would have been transgressed by the sea during high sea-levels associated with peak global warming intervals during the Paleocene and Eocene (Figure 3), but no deposits of this earlier marine history are known to remain along Namaqualand. Eocene marine remnants are preserved on the southern Namibian coast and in the Eastern Cape and must also have been present

on the Namaqualand coastal plain, but were evidently later flushed off into rivers during the late Eocene and Oligocene.

Towards the end of the Eocene and during the Oligocene the global climate underwent major cooling and polar ice built up on the Antarctic continent, lowering sea level significantly (Figure 3), while drier climatic conditions likely pertained along the West Coast. This "**Oligocene Regression**" is thought to have had an impact on the coastal plain by the incision and entrenchment of the present-day river courses and further erosion back into the Escarpment.

The Kleinzee Formation

Towards the end of the Oligocene the cooler global climate began to ameliorate and with large fluctuations this warming trend continued through the early Miocene and peaked in the middle Miocene during the warm **Mid-Miocene Climatic Optimum** ~17-14 Ma (Figure 3). Melting of the Antarctic ice cap raised sea level and the outer part of the coastal plain was inundated by the sea up to an elevation which is now ~90 m asl. When sea level receded again the marine **Kleinzee Formation** was deposited on the inner, high part of the coastal bevel and extends seawards from ~90 m asl. (also called the 90 m Package).

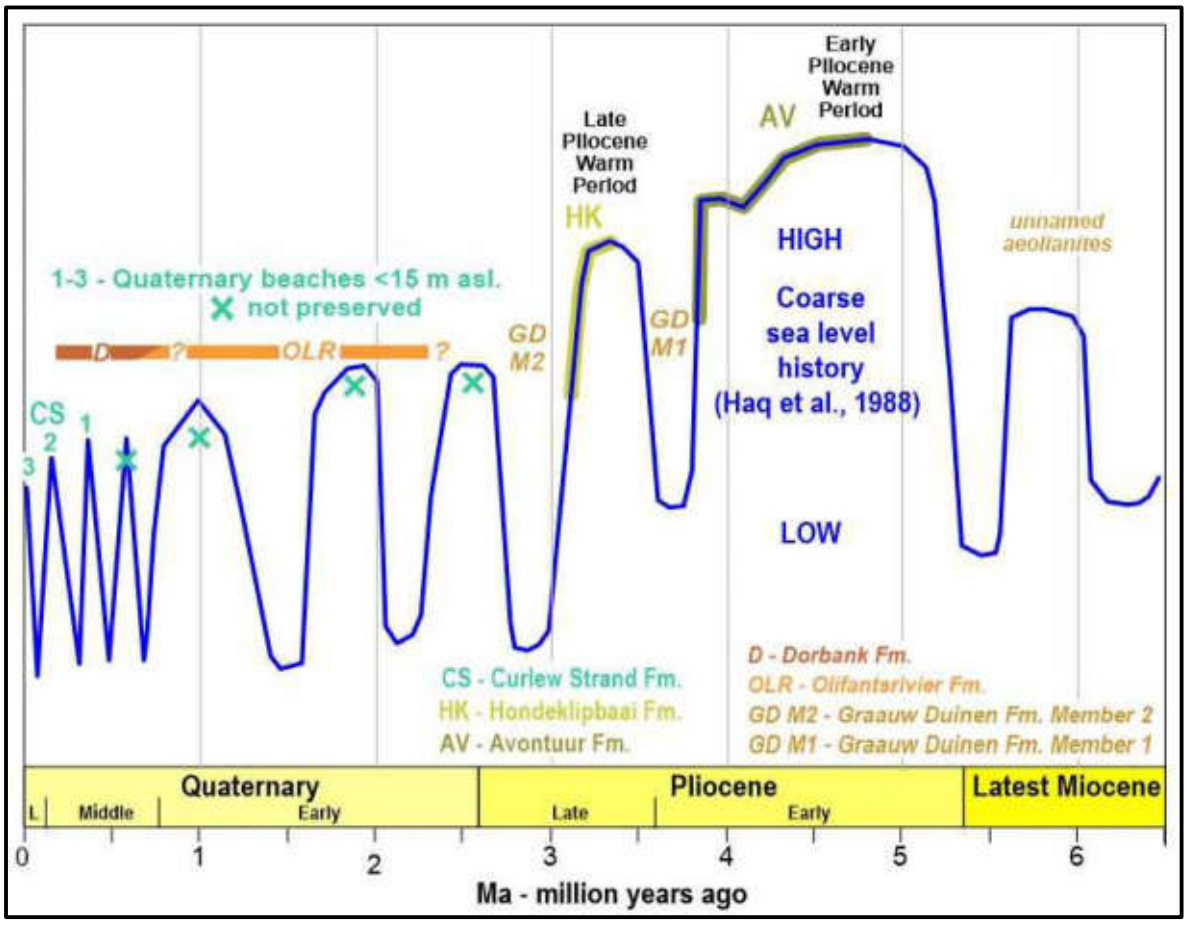


Figure 4. Context of latest Miocene, Pliocene and Quaternary marine and aeolian formations correlated with coarse-scale sea-level history based on major margin unconformities.

The Avontuur Formation

The previous Miocene marine beds were eroded during rising sea-level of the **Early Pliocene Warm Period** and the **Avontuur Formation** (the 50 m Package) was deposited 5-4 Ma as sea-level receded from the transgression maximum of about 50 m asl. and the shoreline prograded seawards (Figure 4).

The Hondeklipbaai Formation

The Avontuur Formation in turn was eroded by yet another rising sea-level associated with the **Late Pliocene Warm Period** 3.3-3.0 Ma (Figure 4). The **Hondeklipbaai Formation** or 30 m Package was deposited as sea level declined from a high of about 30-33 m asl. and a substantial, prograded marine formation built out seawards. This formation, up to a few km wide, underlies the outer part of the coastal plains of the West Coast. The actual sea levels were not at the absolute elevations mentioned above – the ancient palaeoshorelines have attained their present elevations due to uplift of the continental margin. Fossil shells are found in places in these Miocene and Pliocene marine formations and each contains warm-water species and also important extinct fossil shell species which are characteristic of that formation and which facilitate correlation of formations over wide regions.

The Curlew Strand Formation

Close to the seaside, the Hondeklipbaai Formation is eroded and overlain by the younger, Quaternary "raised beaches" that extend up to about 12-15 m asl. The name **Curlew Strand Formation** has been proposed for this composite of raised beaches, equivalent to the Velddrif Formation of the SW Cape Coast. It comprises the **8 - 12 m Package** dating to ~400 ka (ka = thousand years ago) during Marine Isotope Stage 11 (MIS 11), the **4 - 6 m Package** of the Last Interglacial (LIG) ~125 ka and the **2 - 3 m Package** (mid-Holocene High, 7-4 ka) (Figure 4, CS 1, 2, 3). The fossil shells in these "raised beaches" are predominantly the cold-water fauna of modern times.

7.5 THE AEOLIAN FORMATIONS

A variety of terrestrial deposits also make up the coastal plain of Namaqualand. These are predominantly extensive aeolian dune and sandsheet deposits that overlie the eroded tops of the marine sequences near the coast, and as dune plumes extending inland. A glance at the satellite images of the coast show that the dune plumes of various ages occur in specific areas and are linked to topography, sea-level oscillations, the changing locations of sandy beaches and fluvial sediment inputs. Similarly, the deeper-time aeolian record is expected to comprise buried dune fields, dune plumes and sand sheets that accumulated at different times in various areas of the coastal plain. More locally there are colluvial (sheetwash) and ephemeral stream deposits associated with nearby hillslopes; these dominate the thinner cover of the hills of the higher, inner coastal plain. Formed within the terrestrial sequences are pedocretes and palaeosols of a variety of types, compositions and degrees of development which mark times of surface stability and relate to times of reduced aeolian activity (less windy) and/or more humid climatic intervals.

Our embryonic knowledge of the stratigraphic context of these older, buried aeolianite formations comes from the huge mine pits created by diamond and heavy-mineral mining, but these observations are mainly confined to the lower coastal plain (<~100 m asl.) where the dated marine formations underlie or are interbedded with the aeolian formations. The major pedocretes present in the mining pits are regional in extent and will also occur within the unexposed and unknown aeolian sequences of the higher coastal plain, and should be of stratigraphic utility for correlation.

The Later Miocene Aeolianites

The mid-Miocene, marine Kleinzee Formation has been extensively eroded and has been largely reworked into aeolian sands. These old aeolian deposits, the **Later Miocene Aeolianites**, are now quite altered by pedogenic and groundwater processes, transforming them into nearly massive units cemented by partly-silicified, neoformed interstitial clays. They may be basically pale units with extensive mottling and thus superficially similar to underlying Miocene marine deposits, or are extensively pedocreted, with many post-depositional features. These later-Miocene aeolianites occupy the higher part of the coastal notch where they overlie residuals of the Kleinzee Formation and extend into the hinterland. Locally they occur beneath the inner part of the Avontuur Formation

(early Pliocene) marine wedge. The occurrence of petrified teeth of the bear-dog *Agnotherium* sp. (13 - 12 Ma) and the gomphothere *Tetralophodon* (12 - 9 Ma) in the basal gravels of the early Pliocene Avontuur Formation at Hondeklipbaai indicate the pre-existence of terrestrial deposits of this later Miocene age range (Figure 3).

The Graauw Duinen Formation

The **Graauw Duinen Formation** has been proposed to accommodate the aeolianites as exemplified in the Namakwa Sands excavations on Graauw Duinen 152 (Roberts *et al*., 2006; De Beer, 2010) where the aeolianites are excellently, but temporarily, exposed in coast-normal mining faces. Based on personal observations of the aeolianites exposed at Graauw Duinen 152 (Namakwa Sands) there are actually three main, distinct aeolian formations in the subsurface there. The first main aeolianite formation (Member 1) overlies/postdates the marine early Pliocene Avontuur Fm. and is overlain in the west by the marine late Pliocene Hondeklipbaai Fm., *i.e*. it is broadly of mid-Pliocene age (Figure 4). The second aeolian formation ("Member 2") overlies/postdates the Hondeklipbaai Fm. in the west and overlies the pedocreted palaeosurface of the first aeolian formation inland, *i.e*. it is of latest Pliocene to early Quaternary age (Figure 4). The third aeolian formation overlies the pedocreted palaeosurface of Member 2. Notably, this formation contains rare Early Stone Age (ESA) material and is referred to the Olifantsrivier Formation.

The Olifantsrivier Formation

The **Olifantsrivier Formation** (Roberts *et al*., 2006) is a typical, variously reddened aeolianite with interbedded palaeosols, pedocretes, abundant root casts and termite burrows (pers. obs.), as exemplified in cliff exposures up to 30 m thick north of the Olifants River mouth and in the Namakwa Sands mine pit. Isolated cobble manuports and ESA/Acheulean handaxes and cleavers are found within the formation. Middle Stone Age (MSA) artefacts are also reported, but these occur on the eroded surfaces and slopes of the formation.

The ESA artefacts indicate an age range from ~1 Ma to ~350 ka (Figure 6). Fossils eroding out of a channel fill within the aeolianite succession on Geelwal Karoo 262 include *Numidocapra crassicornis*, a bovid hitherto found only in North Africa and Ethiopia where the age range for this fossil species is 2.5-1.7 Ma. Also found were teeth of *Dinofelis barlowi*, an extinct sabre-toothed felid, indicating an age range of 2.5-1.9 Ma. (Stynder & Reed, 2015). These finds suggest that the lower part of the Olifantsrivier Formation is older than ~1.9 Ma and extends from the earliest Quaternary (Figure 4), while the upper part which includes ESA material is latest early Quaternary/earliest middle Quaternary (Figure 6). This broad age range constraint is reflected by the several included member units separated by pedocretes.

The Dorbank Formation

The older aeolian formations, such as the Graauw Duinen and Olifantsrivier formations are rarely exposed on the higher coastal plain inland from ~100 m asl., except as outcrops of their cappings of well-developed pale pedocretes (calcrete, sepiocrete) in places. For the most part, these older formations are buried beneath more aeolianites of varying ages and thicknesses, from several metres thick up to ~15 m thick, which have been transformed by pedogenesis into yellow-brown to red-brown, semi-cemented beds colloquially called "dorbank". For practical purposes these "dorbank" units are lumped together and referred to as the **Dorbank Formation**.

The **Dorbank Formation** is typically a stack of successive sand sheet and dune beds forming units 0.5 m to ~2 m thick, with differing yellowish to reddish-brown hues of the interstitial neoformed pedogenic clays. Due to the pedogenic clays the dorbank is quite hard and incipiently to variously cemented. Many individual units appear initially to be massive, lacking obvious sedimentary structures, but closer inspection reveals features defined by grain-size contrasts, such as bioturbation mixing, wind ripples of coarser sand and relict dune slipface crossbedding in thicker

units. Interbedded lenses of pan muds occur, formed from pedogenic clays washed-out into interdune ponds, as well as occasional lenses of white, alkaline pan carbonates with varying silicification and rare diatomaceous pan deposits.

Notably, where thickly developed this formation generally lacks the development of distinct, laterally continuous, evolved calcareous pedocretes, most likely due to low original calcareous bioclastic content. However, as is the case with all aeolian formations, where the Dorbank Fm. thins out at its edges, the condensed sequence there has been subjected to more pervasive pedogenic alteration and cementing, and where the addition of elements to the soil by dust has had a greater relative role.

Figure 5. Surface geology of the Project Area.

The Dorbank Formation is widespread along the Namaqualand coast where it occupies a spatio-temporal context as the youngest consolidated aeolianite beneath the weakly-compacted to loose surface sand formations mentioned below. Where thickly developed the formation is expressed in the present-day landscape as topographically positive areas, most notably the long, wide ridges of buried dune plumes. The landscape during accumulation of the Dorbank Formation basically resembled that of the present day, with the distribution of aeolian environments (sand sheets, dune fields and transgressive dune plumes) reflecting the roles of the sandy beaches and riverbeds as sand sources for southerly wind.

Notably, Middle Stone Age (MSA) artefacts occur within its upper portion and on its top surface, these suggesting that the age is in the later part of the middle Quaternary, younger than about 400

ka. Dating of the overlying Koekenaap Fm. surficial sands (see below), together with some few dates from the top of the Dorbank Fm. farther south, indicates that the Dorbank Fm. is older than ~130 ka, pre-dating the Last Interglacial (Figure 6).

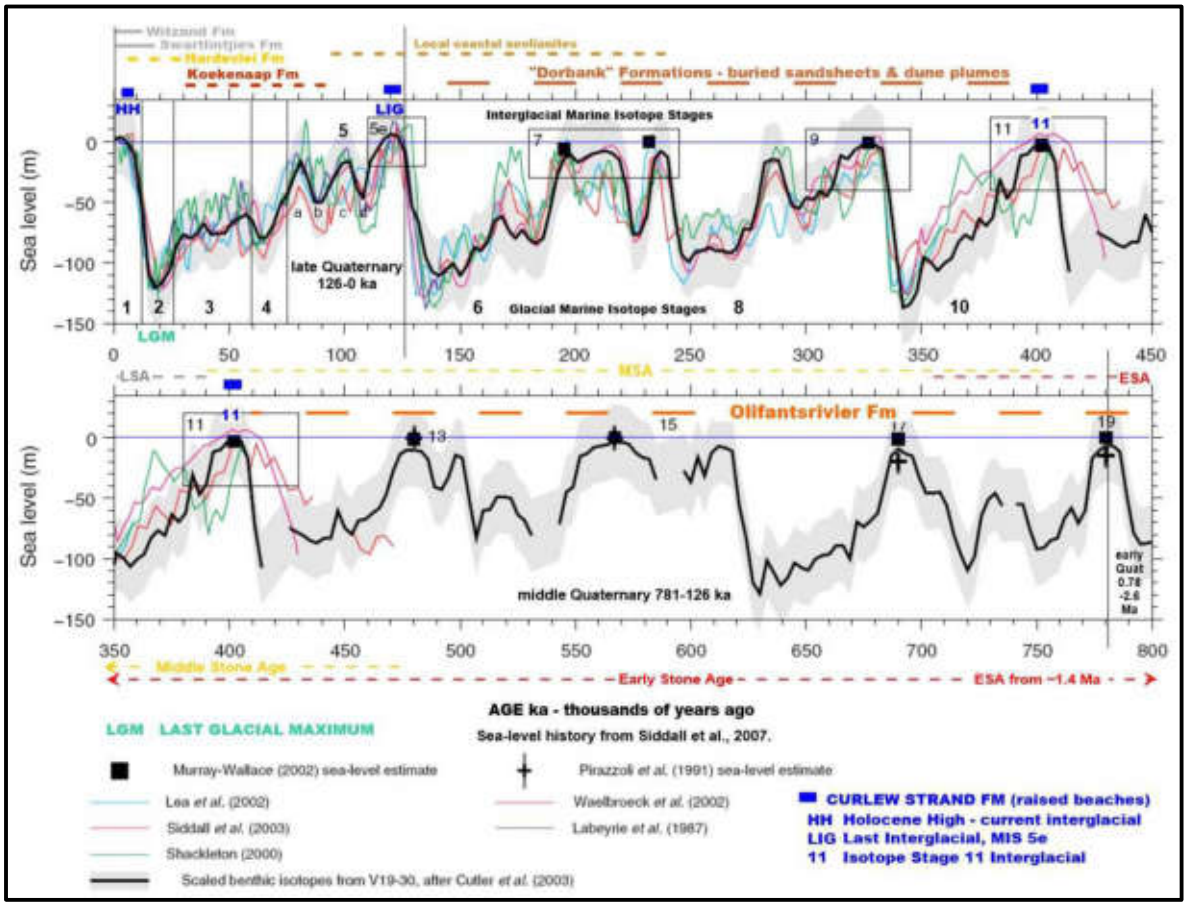


Figure 6. Sea-level history (from Siddall *et al.*, 2007) and the age ranges of middle and late Quaternary formations of Namaqualand.

The "Panvlei Formation" Surfaces

Proposed by De Beer (2010), the **Panvlei Formation** (**Qpa**) "(Figures 5 & 7) represents sands, fluvial deposits and soils derived from bedrock erosion and reworking of Cenozoic sediments of all ages". Semi-silicified dorbank and calcretized and pedocreted deposits are included. The formation is overlain by "unconsolidated sands of Pleistocene to Holocene age". Its purpose is to depict those surface areas that are closely underlain by the capping pedocrete of the underlying formation, or by the hard top of pedogenically partly-cemented "dorbank" sands. Clearly such a broad definition, based on surface outcrop, is a mapping practicality when it is not possible to determine the stratigraphic position of the underlying deposits, which are clearly of differing ages.

These "Panvlei" areas could be referred to instead as "Panvlei Surfaces". The Panvlei Fm. areas near the coast are consequently areas closely underlain by older aeolianite units, such as the calcreted top of the Olifantsrivier Fm. mentioned above, or by the top of the Dorbank Fm.

Panvlei-type surfaces are mapped as Q-r_2 , "calcareous and gypsiferous soil", on the Calvinia geological map. Panvlei-type surfaces also occur extensively on the slopes of the bedrock hills of the coastal hinterland, where pedocreted colluvia underlie the surficial sands and where the typical vegetation is Namaqualand Heuweltjieveld on mounded sands.

Local Coastal Aeolianites

At the coast the aeolianites overlying the Quaternary raised beaches include smaller units that reflect local permutations of aeolian deposition during highstands of MISs 11 and 5e and at other times when sea levels were close to, but did not exceed, the present level *viz*. MISs 9, 7, 5c and 5a (Figure 6). During some of these stages shoreline aeolianite units were deposited at places along the coast, herein called **Local Coastal Aeolianites**. For example, the Last Interglacial (LIG, ~125 ka) raised beach deposits along this stretch of coast are overlain by compact aeolian deposits, beneath the surficial, loose Witzand Fm. sands, that differ from place to place, *i.e*. rubified pink sands, or yellow sands, or grey sands, which are more locally confined to the coast and which are apparently of different ages. These represent discrete phases of local accumulation, compared with the much larger dune plumes extending inland from the vicinity of river mouths, or the widespread sand sheets or fields of degraded small dunes inland on the wider coastal plain. These coastal units of later mid-Quaternary to earlier late-Quaternary age (Figure 6) exhibit variations of pedogenesis and incipient pedocrete development indicative of their relative ages, but lack substantial pedocrete horizons.

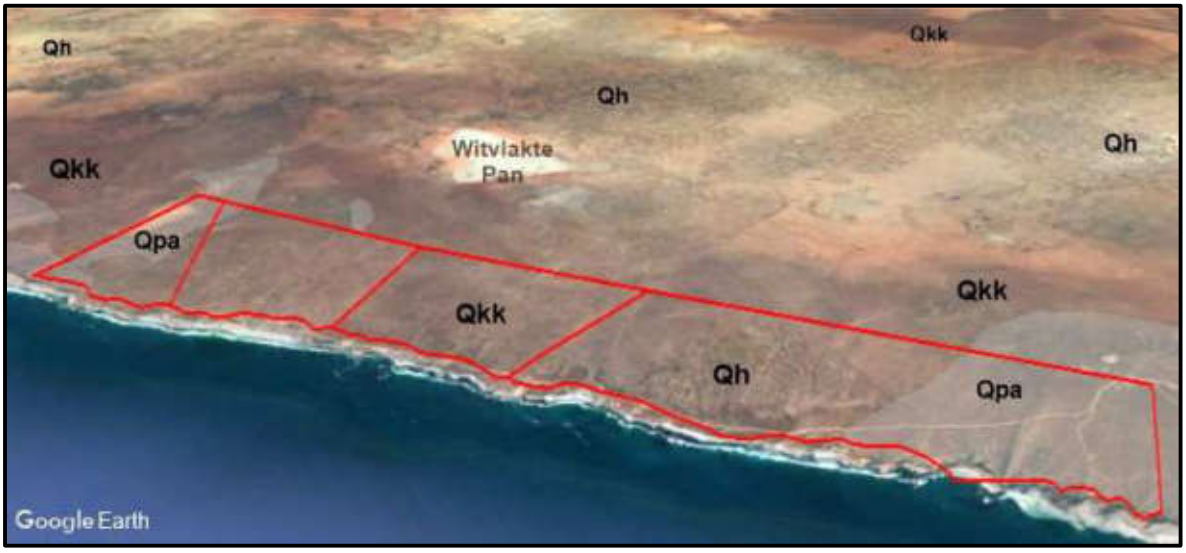


Figure 7. Klipvley Karoo Kop 153 and surrounds. Simulated oblique aerial image showing surficial formations.

The Koekenaap Formation

The **Koekenaap Formation** (**Qkk**) (Roberts *et al.*, 2006; De Beer, 2010) refers to the variously-reddened, unconsolidated coversands and low, degraded dunes which mantle much of the surface of the coastal plain (Figures 5 & 7)), overlying the hard surface of the Dorbank Formation. This surficial unit is depicted as "Red Aeolian Sand" (**Ç-s)** on the Calvinia geological map and denoted as the "RAS" at Namakwa Sands mine. Where thicker, subunits can be distinguished by subtle variations in hue and grain adhesion. The red sands are underlain by scatters of MSA material on top of the palaeosurface formed on the Dorbank Fm. or older aeolian formations. Results of Optically-Stimulated-Luminescence (OSL) dating of some reddened coversands (Chase & Thomas, 2006, 2007) produced late Quaternary ages between ~80 ka and ~20 ka (Figure 6) and suggest phases of accumulation which differ between areas. Sand sources include the coast and the reworking of older sands, while the older red sands on the higher, inner coastal plain have apparently been sourced from the local rivers. The typical vegetation types are Namaqualand Strandveld and Namaqualand Heuweltjie Strandveld.

The Hardevlei Formation

Subsequent aeolian activity is manifested in the yellow dunes of the **Hardevlei Formation** (**Qh**) (De Beer, 2010) which encompasses fields of low, pale-yellow dunes of varied morphology overlying the

Koekenaap-type red sands or the local Dorbank Fm., and which are developed inland from the coast on the higher, inner parts of the coastal plain (Figures 5 & 7). Dune types include both parallel, longitudinal sand ridges formed by the northward migration of vegetation-impeded, parabolic, "hairpin" dunes, and transverse, barchanoid (crescentic) dunes. Both morphologies are combined to form reticulate dune fields formed by directionally-variable winds. The geological maps do not depict the entire area of Hardevlei Fm. dunes and therefore it has been added to Figure 5, as seen in satellite images. The veld type is mainly Namaqualand Sand Fynbos, with Inland Duneveld in places. Dating by the OSL technique indicates ages generally less than ~20 ka (Chase & Thomas, 2006, 2007). A nearby core in a Hardevlei Fm. dune produced an OSL date of ~14 ka near its base (2.5 m depth), ~6.7 ka at 1 m depth and ~2.2 ka at 0.5 m depth (WK03-15; Chase & Thomas, 2006).

The Swartlintjies Formation

The name **Swartlintjies Formation** (**Qsw**) is proposed for the large, pale plumes of semi-stabilized parabolic dunes that extend far inland northwards from the beaches north of the main rivers (Roberts *et al*., 2006; De Beer, 2010) and which are the latest large-volume additions to the coastal plain. The Swartlintjies dune plume is the type example. The plume sands were blown by south winds from the beaches now submerged by rising sea levels since the Last Ice Age maximum ~20 ka (Figure 7, LGM), when the shoreline was ~120 m below present (Tankard & Rogers, 1978). Similarly, large dune plumes blew inland from the coast in the deeper past and are evident as broad low ridges of the Dorbank Fm. in the landscape.

The Witzand Formation

The **Witzand Formation** (**Qwi**) accommodates sand and shell fragments blown from sandy beaches during the Holocene, in the form of partly-vegetated dune cordons backing the beach and the attached small dune plumes transgressing inland. The coast-attached Witzand Fm. dunes are the modern analogue of the older Local Coastal Aeolianites.

8 AFFECTED FORMATIONS IN THE PROJECT AREA

Surface elevations of ~100 m asl. pertain along the eastern boundary of Klipvley Karoo Kop 153 (Figure 1) and evidently reflect relatively steeply-rising underlying bedrock. The high ground is divided by a broad valley trending across Portion 2, Brakvlei se Laagte, which speculatively may mark a palaeochannel possibly preserving Koingnaas Fm. deposits (Figure 2). However, this drainage must have been active during subsequent times, reworking previous deposits and transporting quartz-gravelly sediments derived from the weathered bedrock. Similarly, other minor drainages may host locally-derived colluvium and alluvium. The episodically active drainages very likely later eroded gaps in the Miocene and Pliocene marine deposits along their courses.

Most of the Project Area would have been inundated during the Mid-Miocene Climatic Optimum sea-level transgression to ~90 m asl. The associated Kleinzee Fm. marine deposits are poorly preserved in general and erosion has particularly affected the thin, high edge of the formation above ~70 m asl. Often only residual rounded marine gravels may remain, but in places heavy-mineral-rich, laminated foreshore (beach) deposits are preserved seaward of the ~90 m asl. cliff line, as seen in the exposures north of Kleinzee. Farther seawards the deposits of the early Pliocene Avontuur Fm. overlie the bedrock and are in turn overlapped by the late Pliocene Hondeklipbaai Fm. The Hondeklipbaai Fm. crops out along the coast (Figure 5) where exposures just inland reveal shoreface deposits and indicate that the sea level was about 20 m higher than present at the time when the late Pliocene shoreline prograded past the position of the present shoreline.

The surface sampling in shallow pits (~1 m) will primarily affect the surficial sands of the Koekenaap Fm. There is a patch of dunes named Kolduin which resembles the Hardevlei Fm. type, situated somewhat anomalously adjacent to the coast (Figures 5 & 7). The auger drilling will primarily intersect the underlying, compact, older aeolianites. The drilling depths could be several metres, but

may be limited in places by hard layers such as pedocretes. It is likely that the “Dorbank” Formation will primarily be intersected over most of the area by auger drilling, but the pedocreted, older aeolianites equivalent to Olifantsrivier and Graauw Duinen formations may be close to the surface in places, such as beneath the “Panvlei Surfaces” in the southern and northern parts of the Project Area.

The air-core drilling, with the intention to drill sufficiently deep to intersect the potential heavy mineral content of the marine formations, will intersect most of the coastal-plain aeolianite sequence, *i.e*. the Dorbank, Olifantsrivier and Graauw Duinen aeolian formations, and possibly the Later Miocene Aeolianites below the higher elevations in the Project Area, although the presence and thicknesses of the formations will vary across the area.

9 PALAEONTOLOGICAL IMPACT OF THE PROSPECTING

The proposed surface pit sampling will involve the late Quaternary surficial coversand and dune formations and, where the coversands are thin, will expose the uppermost part of the compact “Dorbank” Fm. Fossils are very sparse in the Hardevlei and Koekenaap formations. Fossil bone material that may occur is likely to be in an archaeological context and both artefacts and fossil bones are most often found on the compact palaeosurface of the “Dorbank” Fm. beneath the surficial sands. These occurrences usually only come to light when large areas of the surficial sands have been blown or mined away, whereas small pits over a large area have a low probability of chancing upon such finds. The impact of the surface pitting is therefore considered to be LOW.

Sampling to depth by auger and air-core drilling will intersect the “Dorbank”, Olifantsrivier and Graauw Duinen aeolianite formations and pedocretes, and possibly aeolianites equivalent to the unnamed later Miocene aeolianite formation. The most common fossil material is the ambient fossil content of sparsely-scattered land snails, tortoise bones and mole bones, but little of this material is expected in the relatively small-volume samples. Even if the drill intersects a cluster of fossil bones only fragments will be produced. These older aeolianites have also been extensively decalcified and drilling will have LOW to MARGINAL impact due to the near absence of fossil material at the scale of drill holes.

The marine deposits are generally quite decalcified except for robust, thick shells, but pockets or zones of well-preserved shell fossils do occur in an unpredictable manner. However, the drilled material will likely be fragmentary and any fossil shell species that may be encountered are unlikely to be new discoveries. Other fossils which are occasionally brought up in boreholes include smaller petrified fossils such as shark and other fish teeth and casts of shells (steinkerns). This material is of interest, although usually not particularly age-diagnostic. The impact of the prospecting on marine fossils is considered to be LOW.

Although it is not intended to drill into the Koingnaas Fm. (which may not be present), it is nevertheless worth mentioning that drilling intersections may produce samples of organic-rich clays containing fossil pollen and lignitic material of plant macrofossils such as leaf and wood fragments. The plant fossils from these ancient rivers and swamps are of ongoing research interest and therefore the palaeontological sensitivity of the Koingnaas Formation may be regarded as HIGH. This is mentioned “just in case” as any opportunity to obtain such samples should not be overlooked.

Organic-rich mud layers may also occur in the younger deposits. Plant fossils are known to occur in the deeper-water, muddy deposits which are locally preserved in the basal beds of the marine formations. Mud beds may occur in association with interdune pond/vlei deposits in the aeolianite formations and may possibly be associated with younger deposits within the drainage lines. Samples of any such material are of similar high scientific importance, due to the large spans of geological time for which there are no fossil pollen samples available to shed more light on the evolution of the modern biomes.

In the process of the field survey and during the sampling and drilling programme, late Quaternary fossil and archaeological material, including larger mammal bones, may be encountered in deflation areas not discovered during archaeological surveys, or may be noticed in old prospecting excavations and surrounding spoil.

9.1 IMPACT SUMMARY TABLE

Due to the limited disturbance involved in the proposed prospecting, as compared with bulk sampling or mining, the overall impact of the proposed prospecting programme on all formations is considered to be LOW.

TABLE 3. SUMMARY IMPACT TABLE.

	Extent	*Intensity*	*Duration*	*Probability*	*Impact*	*Significance*	*Status*	*Confidence*
Without mitigation	Local	Low	Permanent	Possible	Low	**MEDIUM**	**-ve**	Medium
	1	1	4	2	8			
Essential mitigation measures: ▪ Retain fossils (especially bone & teeth fragments) that are unearthed during pitting and drilling and record the details of the find. ▪ Submit images of finds to a palaeontologist to assess their scientific value and conservation worthiness. ▪ Submit finds deemed by a palaeontologist to be of significant scientific value or conservation worthiness to a curatorial institution.								
With mitigation	Local	Low	Permanent	Possible	Low	**LOW**	**+ve**	Medium
	1	1	4	2	8			

10 CONCLUSIONS AND RECOMMENDATIONS

There are no known outcrops of sensitive fossiliferous strata in the Project Area that require protection as NO-GO sites, such as spots where fossil bones occur in obvious abundance and which are not marked as an archaeological site. The palaeontological resources are predominantly subsurface and consequently considerations of fossil potential do not result in preferred sites and the particular locations of surface sampling and drilling do not affect this assessment.

10.1 MITIGATION

It is recommended that a requirement to be alert for fossil materials and archaeological material uncovered during the shallow pitting, or brought up by drilling, be included in the Environmental Management Programme (EMPr) for the proposed prospecting operations.

Under supervision of the Environmental Control Officer (ECO) and as part of Environmental and Health & Safety awareness training, personnel involved in the **shallow pit sampling** must be instructed to be alert for the **occurrence of fossil bones**. Fossil bones may also be noticed weathering out in the sides of **old prospecting excavations**, or exposed in the adjacent spoil heaps of excavated material. In the event of such discoveries the **Fossil Finds Procedure** provided below, for incorporation into the Environmental Management Programme for the proposed prospecting, must be followed. Due to the scarcity of fossil bones in the affected formations it is important that such ephemeral opportunities to rescue fossil bones must not be overlooked.

Although the palaeontological impact of the **auger and air-core drilling** is minimal due to the small volumes affected, it is proposed that a degree of mitigation is feasible and could have a positive benefit for the geological interpretation of the stratigraphy of the deposits. The accomplishment of this proposed mitigation requires the participation of the geologists supervising the drilling sampling and the personnel carrying out the subsequent processing of the samples.

Larger-size fossils, such as shells and smaller bones, may be noticed in the field when material is extracted from the boreholes for sampling and must be retained along with the contextual information (borehole no., location, depth in hole). Subsequently, the laboratory analysis of the borehole

samples initially entails sieving in order to separate coarse material, such as pebbles and small fossils, from the sand fractions containing the heavy minerals. **It is recommended that fossil material extracted from the boreholes, or later separated during sample analysis, be kept and bagged for identification by a palaeontologist**, recording the details of the sample such as its borehole number, depth and the lithology of the material, with such included in the borehole log. For preliminary analysis, quality images of the fossil material should be forwarded by email for examination by a specialist, in order to identify specimens of importance for stratigraphic diagnosis, and specimens requiring further examination and diagnosis.

Organic-rich, dark, peaty layers intersected in boreholes which may contain fossil pollens and plant remains are particularly important, irrespective of which formation in which they may occur. Samples of such material, which lacking heavy minerals is not of economic interest, must be collected, along with the relevant details of the contexts. The possible availability of such material from southern Africa is of international scientific interest and is a standing request from the fossil pollen specialists.

These mitigation measures are deemed adequate for the prospecting sampling and drilling operation. The proposed mitigation actions for the prospecting programme are relatively easily accomplished and their implementation will result in a positive impact for palaeontology arising from the proposed prospecting operation.

10.2 FOSSIL FINDS PROCEDURE

Fossil bones in excavations

Should fossil bones and teeth be encountered in the shallow prospecting pits, work must cease at the site and the works foreman and the ECO for the project must be informed immediately. Scattered, unearthed parts/fragments of the find must be retrieved and returned to the main find site which must be protected from further disturbance. It should be possible to continue with the sampling at other sites.

Fossil bones which may be noticed in old excavations must also be protected from possible loss and be reported.

HWC and/or an appropriate specialist palaeontologist must be informed and supplied with contextual information:

- A description of the nature of the find.
- Detailed images of the finds (with scale included).
- Position of the find and depth.
- Digital images of the context. *i.e*. the excavation (with scales).

HWC and an appropriate specialist palaeontologist will assess the information and liaise with the ECO, the environmental consultants and the developer and a suitable response will be established.

Fossils from borehole samples

The geologists and laboratory personnel must retain small fossil material (teeth, bones, shell) sieved from the samples and liaise with a palaeontologist for identification and possible stratigraphic significance.

All fossils deemed important must be deposited in an appropriate, approved curatorial institution.

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12 APPENDIX 1 – CURRICULUM VITAE

John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)

Independent Consultant/Researcher recognized as an authority with 37 years' experience in the field of coastal-plain and continental-shelf palaeoenvironments, fossils and stratigraphy, mainly involving the West Coast/Shelf of southern Africa. Has been previously employed in academia (South African Museum) and industry (Trans Hex, De Beers Marine). At present an important involvement is in Palaeontological Impact Assessments (PIAs) and mitigation projects in terms of the National Heritage Resources Act 25 (1999) (~350 PIA reports to date) and is an accredited member of the Association of Professional Heritage Practitioners (APHP). Continues to be involved as consultant to offshore and onshore marine diamond exploration ventures. Expertise includes:

- Coastal plain and shelf stratigraphy (interpretation of open-pit exposures, on/offshore cores and exploration drilling).
- Sedimentology and palaeoenvironmental interpretation of shallow marine, aeolian and other terrestrial surficial deposits.
- Marine macrofossil taxonomy (molluscs, barnacles, brachiopods) and biostratigraphy.
- Marine macrofossil taphonomy.
- Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones).

Membership of Professional Bodies

- South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.
- Geological Society of South Africa.
- Palaeontological Society of Southern Africa.
- Southern African Society for Quaternary Research.
- Association of Professional Heritage Practitioners (APHP), Western Cape. Accredited Member No. 48.

Past Clients Palaeontological Assessments

AECOM SA (Pty) Ltd.	Guillaume Nel Environmental Management Consultants.
Agency for Cultural Resource Management (ACRM).	Klomp Group.
AMATHEMBA Environmental.	Megan Anderson, Landscape Architect.
Anél Blignaut Environmental Consultants.	Ninham Shand (Pty) Ltd.
Arcus Gibb (Pty) Ltd.	PD Naidoo & Associates (Pty) Ltd.
ASHA Consulting (Pty) Ltd.	Perception Environmental Planning.
Aurecon SA (Pty) Ltd.	PHS Consulting.
BKS (Pty) Ltd. Engineering and Management.	Resource Management Services.
Bridgette O'Donoghue Heritage Consultant.	Robin Ellis, Heritage Impact Assessor.
Cape Archaeology, Dr Mary Patrick.	Savannah Environmental (Pty) Ltd.
Cape EAPrac (Cape Environmental Assessment Practitioners).	Sharples Environmental Services cc
CCA Environmental (Pty) Ltd.	Site Plan Consulting (Pty) Ltd.
Centre for Heritage & Archaeological Resource Management (CHARM).	SRK Consulting (South Africa) (Pty) Ltd.
Chand Environmental Consultants.	Strategic Environmental Focus (Pty) Ltd.
CK Rumboll & Partners.	UCT Archaeology Contracts Office (ACO).
CNdV Africa	UCT Environmental Evaluation Unit
CSIR - Environmental Management Services.	Urban Dynamics.
Digby Wells & Associates (Pty) Ltd.	Van Zyl Environmental Consultants
Enviro Logic	Western Cape Environmental Consultants (Pty) Ltd, t/a ENVIRO DINAMIK.
Environmental Resources Management SA (ERM).	Wethu Investment Group Ltd.
Greenmined Environmental	Withers Environmental Consultants.

Stratigraphic consulting including palaeontology

Afri-Can Marine Minerals Corp	Council for Geoscience
De Beers Marine (SA) Pty Ltd.	De Beers Namaqualand Mines.
Geological Survey Namibia	IZIKO South African Museum.
Namakwa Sands (Pty) Ltd	NAMDEB

13 APPENDIX 2- SPECIALIST DECLARATION

Palaeontological Impact Assessment.

Proposed Mineral Sands Resources (Pty) Ltd. Prospecting on Portions 1, 2, 3 & Re/153 of the Farm Klipvley Karoo Kop 153.

Matzikama Municipality, Vredendal District, Western Cape Province.

DMRE REFERENCE NUMBER: (WC) 30/5/1/3/3/2/1/1/10433PR.

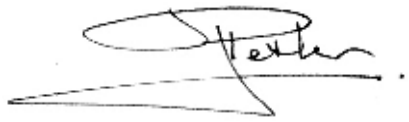
Terms of Reference

This assessment forms part of the Heritage Assessment and it assesses the overall palaeontological (fossil) sensitivities of formations underlying the Project Area in terms of the proposed prospecting and drilling.

Declaration

I …**John Pether**……, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in the compilation of the above report;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed to the EAP any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management act;
- have provided the EAP with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.



Signature of the specialist

Date: 19 JUNE 2023

14 APPENDIX 3- PALAEONTOLOGICAL SENSITIVITY RATING

Palaeontological Sensitivity refers to the likelihood of finding significant fossils within a geologic unit.

VERY HIGH: Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironments and which are of international significance.

HIGH: Assigned to geological formations known to contain palaeontological resources that include rare, well-preserved fossil materials important to on-going palaeoclimatic, palaeobiological and/or evolutionary studies. Fossils of land-dwelling vertebrates are typically considered significant. Such formations have the potential to produce, or have produced, vertebrate remains that are the particular research focus of palaeontologists and can represent important educational resources as well.

MODERATE: Formations known to contain palaeontological localities and that have yielded fossils that are common elsewhere, and/or that are stratigraphically long-ranging, would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven, but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.

LOW: Formations that are relatively recent or that represent a high-energy subaerial depositional environment where fossils are unlikely to be preserved, or are judged unlikely to produce unique fossil remains. A low abundance of invertebrate fossil remains can occur, but the palaeontological sensitivity would remain low due to their being relatively common and their lack of potential to serve as significant scientific resources. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area. Other examples include decalcified marine deposits that preserve casts of shells and marine trace fossils, and fossil soils with terrestrial trace fossils and plant remains (burrows and root fossils)

MARGINAL: Formations that are composed either of volcaniclastic or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain contexts at localized outcrops. Volcaniclastic rock can contain organisms that were fossilized by being covered by ash, dust, mud, or other debris from volcanoes. Sedimentary rocks that have been metamorphosed by the heat and pressure of deep burial are called metasedimentary. If the meta sedimentary rocks had fossils within them, they may have survived the metamorphism and still be identifiable. However, since the probability of this occurring is limited, these formations are considered marginally sensitive.

NO POTENTIAL: Assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no palaeontological resource potential.

Adapted from Society of Vertebrate Paleontology. 1995. Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources - Standard Guidelines. News Bulletin, Vol. 163, p. 22-27.

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APPENDIX 3: Desktop Heritage Screening Assessment and NID

CTS HERITAGE

HERITAGE SCREENER

CTS Reference Number:	**CTS22_251**
SAHRIS Reference:	
Client:	**EnviroWorks**
Date:	**May 2022**
Title:	**PROPOSED PROSPECTING ON PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153** **MATZIKAMA MUNICIPALITY, VREDENDAL DISTRICT, WESTERN CAPE PROVINCE**

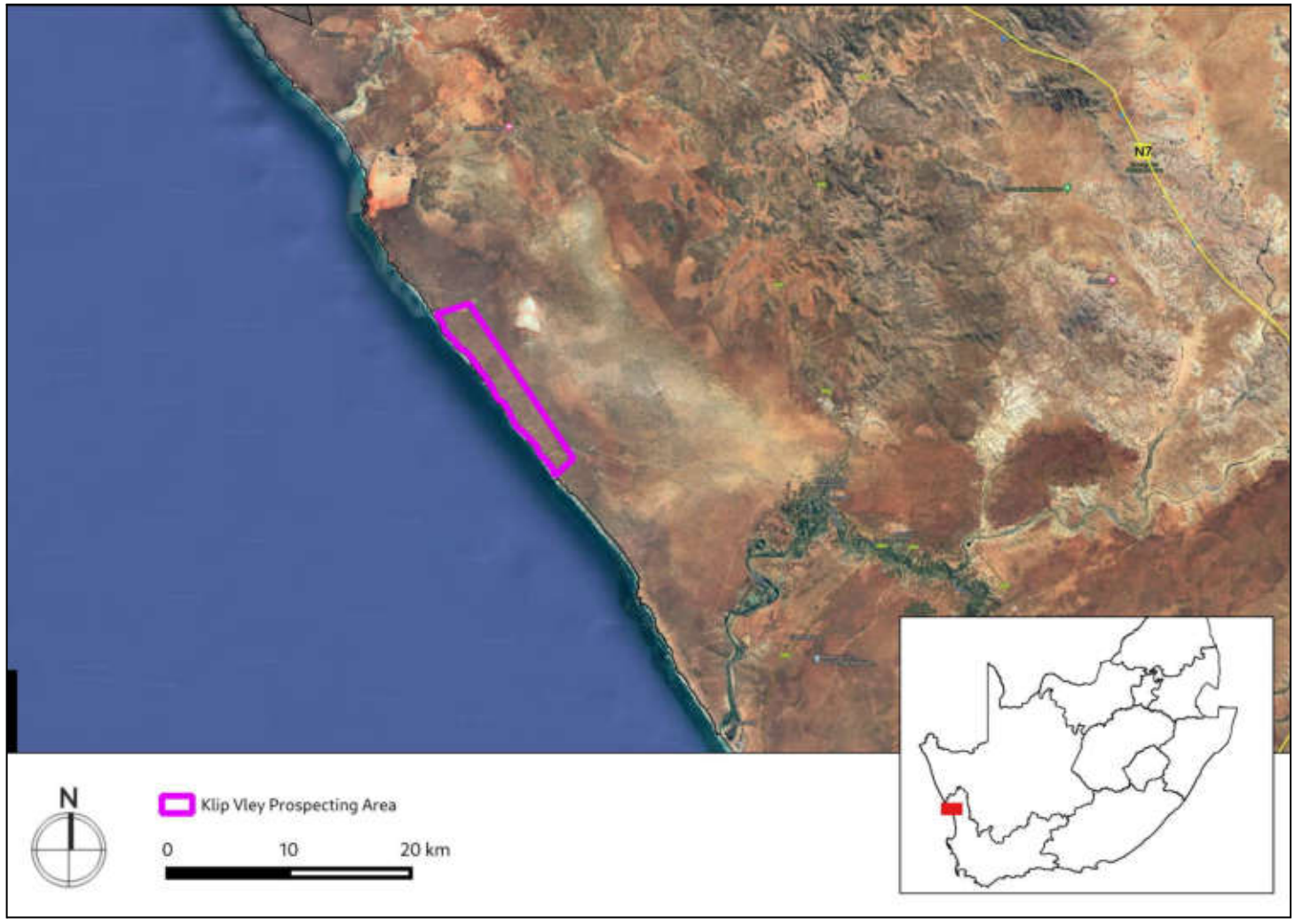

Figure 1a. Satellite map indicating the location of the proposed development in the Western Cape

RECOMMENDATION	**Based on the information available, it is possible that the proposed prospecting will negatively impact on significant heritage resources and as such it is recommended that a Heritage Impact Assessment be completed for this work.**

CTS Heritage
238 Queens Road, Simons Town
Email: info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

1. Proposed Development Summary

The existence and possible size of heavy mineral deposits in the application area will be determined as follows:
• Data review and desktop studies
• Mapping and surface sampling
• Reconnaissance Drilling

The prospecting will be conducted in 3 phases, each one dependent on the results of the previous.

- Phase 1 will involve the following desk-top activities: data acquisition from government and private sources, and analysis of any existing/previous prospecting and drilling data, satellite (Landsat) imagery, aerial photos, and terrain data, as well as geological map interpretation. The synthesis and interpretation of such information will contribute towards providing a clearer picture of the location and characteristics of the heavy mineral deposit/s, and will guide the in-field prospecting programme.
- Phase 2: Surface mapping will be conducted by the project geologist and assistants, and will take place over a period of 3 months. Such mapping will encompass GPS controlled traverses, and aerial photo mapping. Surface sampling. Where heavy mineral concentrations are noted on surface 25 liter surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be 50cm x 50cm in size and dug to a maximum depth of 1m. The final number of samples will be determined by the size of surface mineralized areas if any, 200 samples are planned for initially. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.
- Phase 3 will involve surveying and pegging of the anticipated deposit. This sub-phase will include the following activities: Surveying of the mapped area to be prospected. A grid (average 500m x 500m) will be marked on the map, after which those positions will be marked in the field by a surveyor with labelled droppers (pegs). Shallow small diameter auger drilling will take place at these positions to an average depth of 4m. A total of 100 auger drill holes are planned initially and may be followed up with additional drilling. Access routes to the drill sites will also be located (existing roads will used and new tracks only permitted in exceptional circumstances)
- Phase 4 will be conducted with Air Core drilling method to access the deeper lying sediment package. A total of 250 Air-core holes are planned down to an average depth of 30m. More drilling may be required depending on results. Drill cutting will be sampled and analysed for heavy mineral content as described above for surface sampling.
- Phase 5 will involve analytical desk-top study. All the data collected will be analysed and compiled into a final report/model in order to determine the potential of the project and to outline possible future drill sampling programs if any.

DESCRIPTION OF PLANNED INVASIVE ACTIVITIES:
Where heavy mineral concentrations are noted on the surface 25 litre surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be ~ 50cm x 50cm in size and dug to a maximum depth of 1m. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.

Auger Drilling.
Hand held engine operated auger drill. The auger is portable and will be walked to site from the closest track. Approximately 100 auger drill holes are anticipated to be drilled. The auger is in essence a corkscrew-type drill where the helical ridge raises the drilled material to the surface for sampling purposes. A total of 100 drill holes are planned for initially to be collected over an estimated 18-month period.

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Evaluation Air core Drilling
Air-core drilling uses steel or tungsten blades to bore a hole into unconsolidated ground. The drill cuttings are removed by the injection of compressed air into the hole. This method of drilling is used to drill unconsolidated sands and soft sediments. Where possible, air-core drilling is preferred over RAB drilling as it provides a more representative sample. Air-core drilling is relatively inexpensive and is often used in first pass exploration drill programs. Air-core drilling is limited to depths of 50-60 metres and is drilled using a smaller rig known as an Air-core rig. Such drill is for drilling of deeper holes and use of such will be restricted to existing farm tracks and roads.

2. Application References

Name of relevant heritage authority(s)	HWC
Name of decision making authority(s)	Department of Mineral Resources and Energy

3. Property Information

Latitude / Longitude	31°26'46.00"S 18° 0'6.32"E
Erf number / Farm number	PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153
Local Municipality	Matzikama
District Municipality	Vredendal
Province	Western Cape
Current Use	Wilderness
Current Zoning	Agriculture
Size of property	3 634.92ha

4. Nature of the Proposed Development

Total Area	3 634.92ha
Depth of excavation (m)	Max 60m
Height of development (m)	NA

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5. Category of Development

x	**Triggers: Section 38(8) of the National Heritage Resources Act**
	Triggers: Section 38(1) of the National Heritage Resources Act
	1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	2. Construction of a bridge or similar structure exceeding 50m in length.
	3. Any development or activity that will change the character of a site-
	a) exceeding 5 000m^2 in extent
	b) involving three or more existing erven or subdivisions thereof
	c) involving three or more erven or divisions thereof which have been consolidated within the past five years
	4. Rezoning of a site exceeding 10 000m^2
	5. Other (state):

6. Additional Infrastructure Required for this Development

NA

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

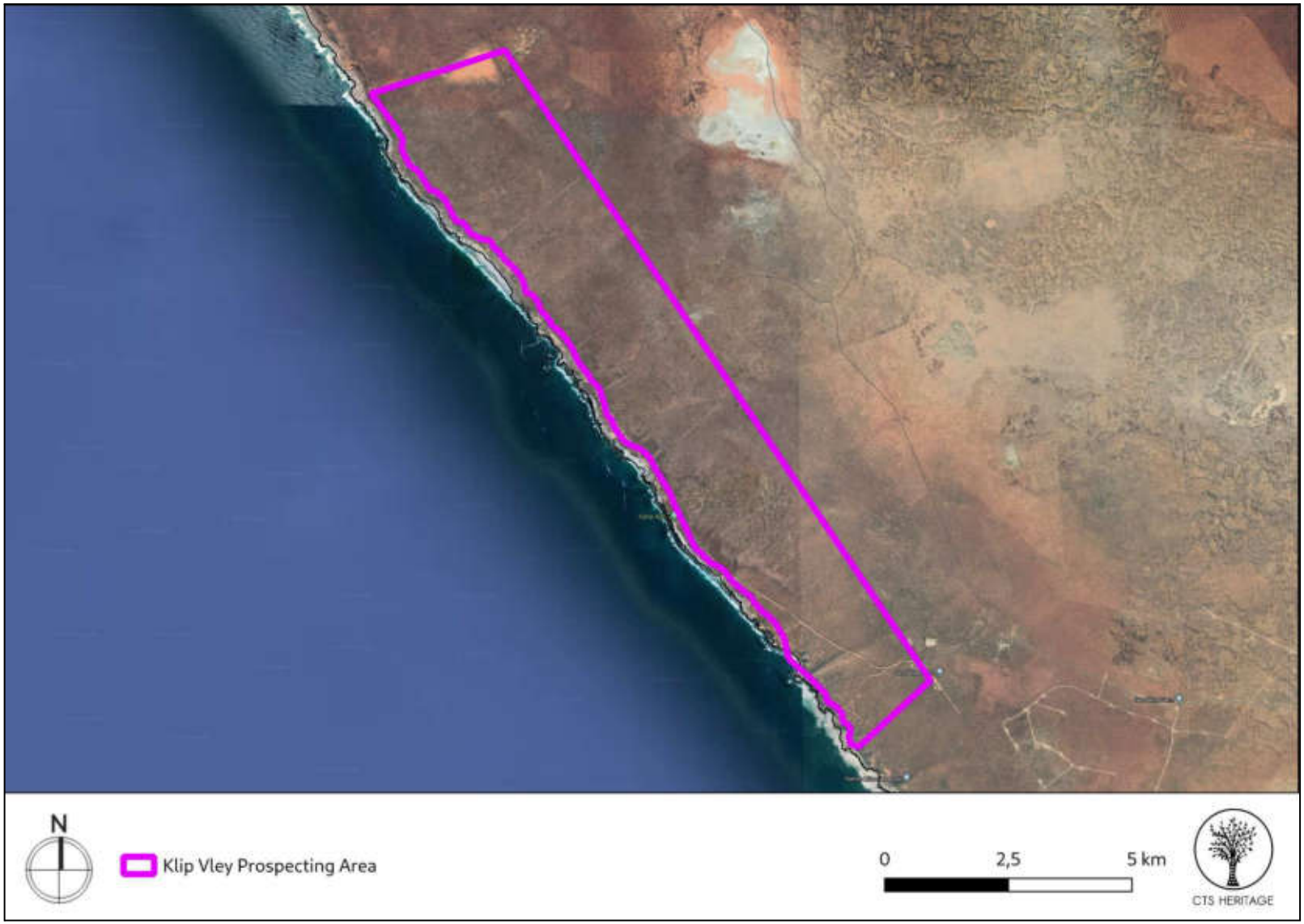

Figure 1b. Overview Map. Satellite image (2023) indicating the proposed development area

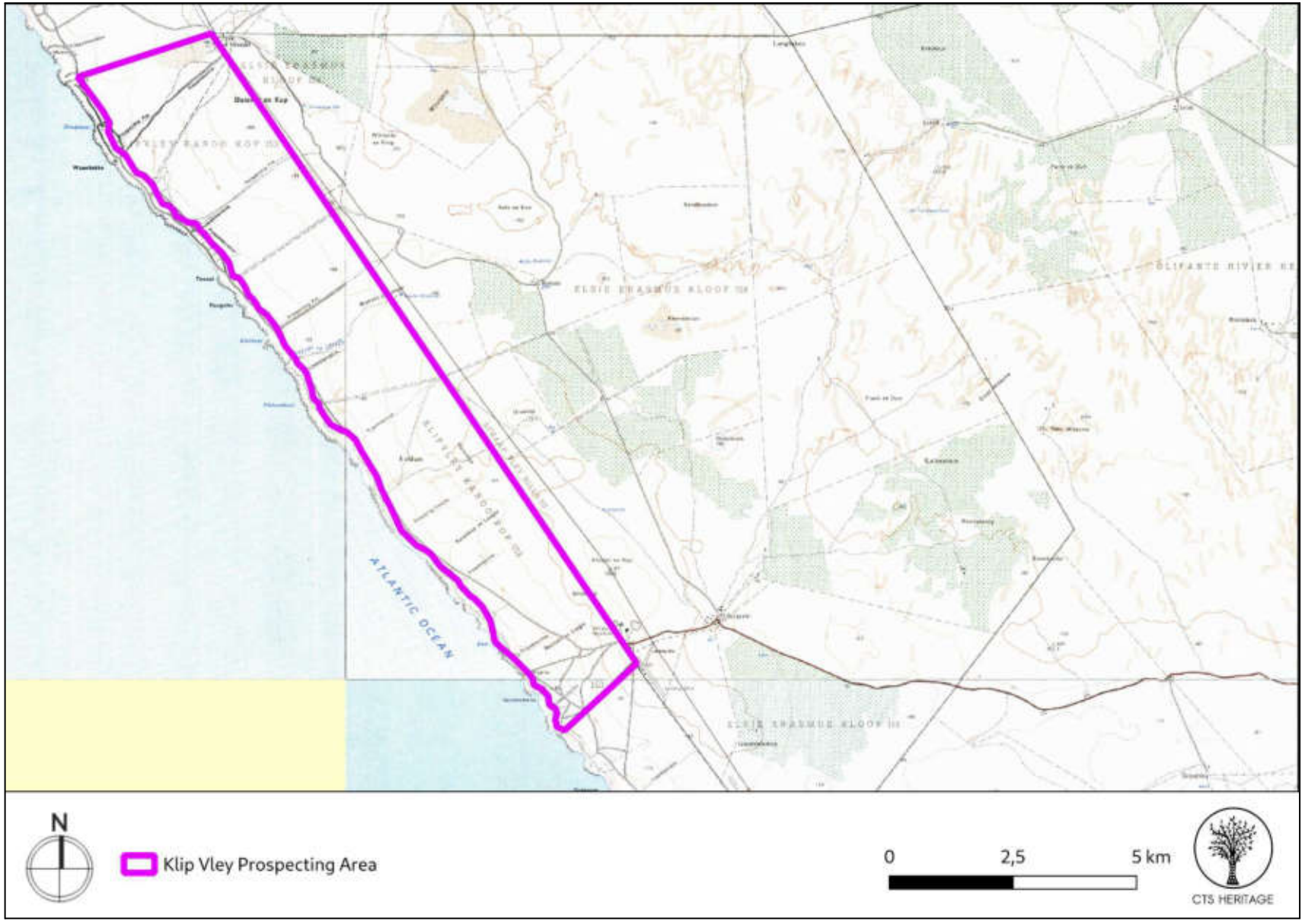

Figure 1c. Overview Map. Extract from the 1:50 000 Topo map indicating the proposed development area

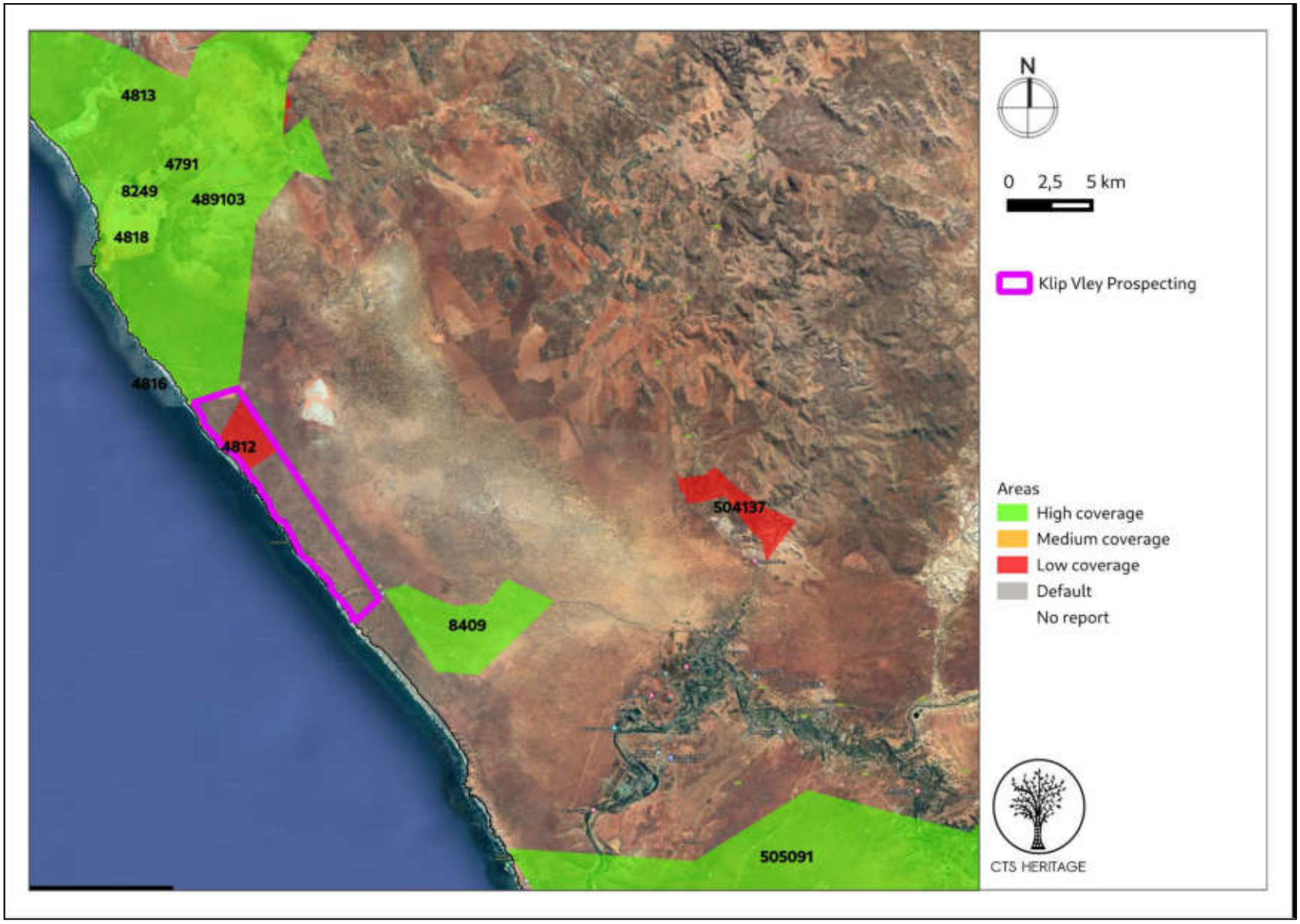

Figure 2. Previous HIAs Map. Previous Heritage Impact Assessments covering the proposed development area with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

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

Figure 3a. Heritage Resources Map. Heritage Resources Inset A

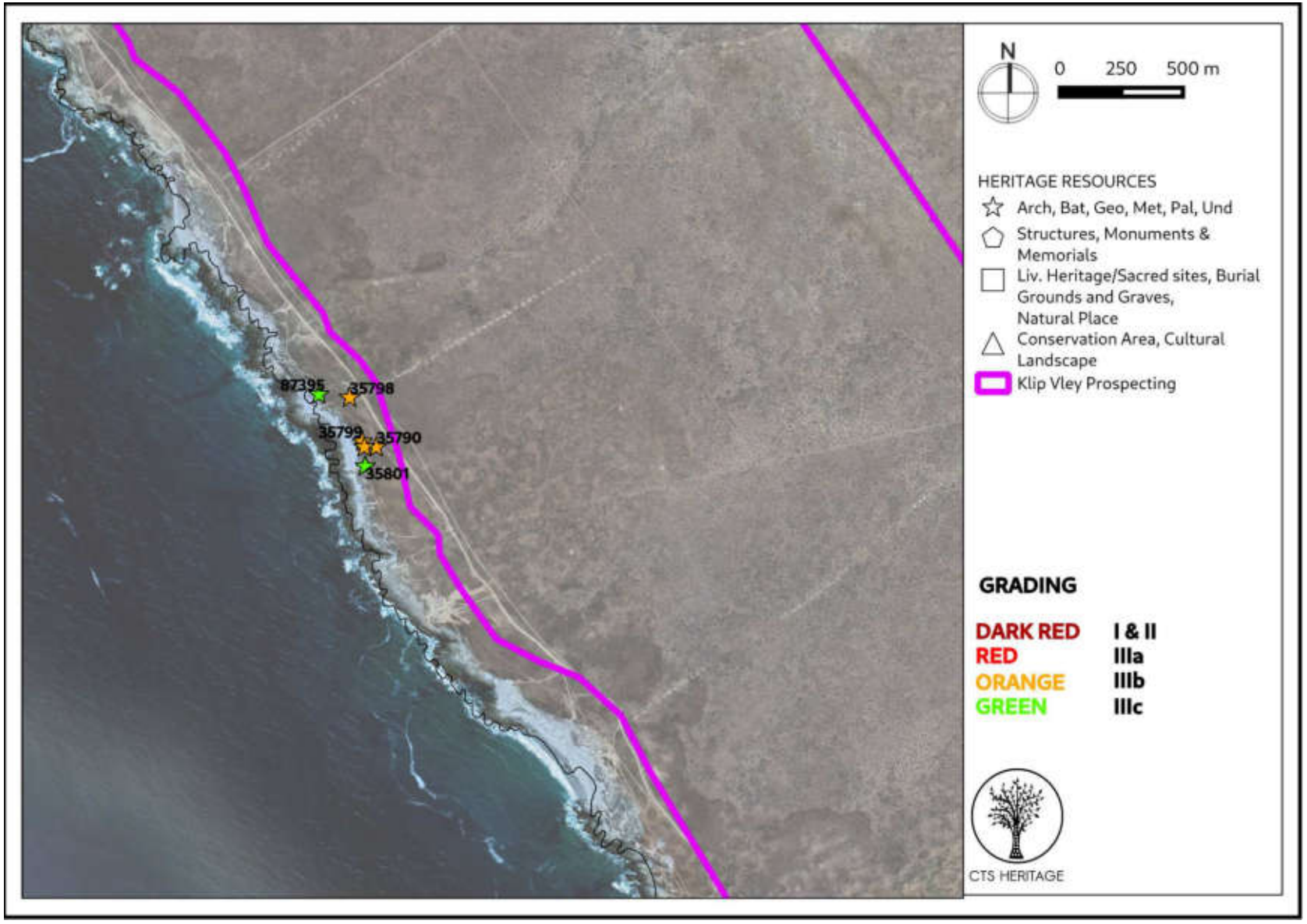

Figure 3b. Heritage Resources Map. Heritage Resources Inset B

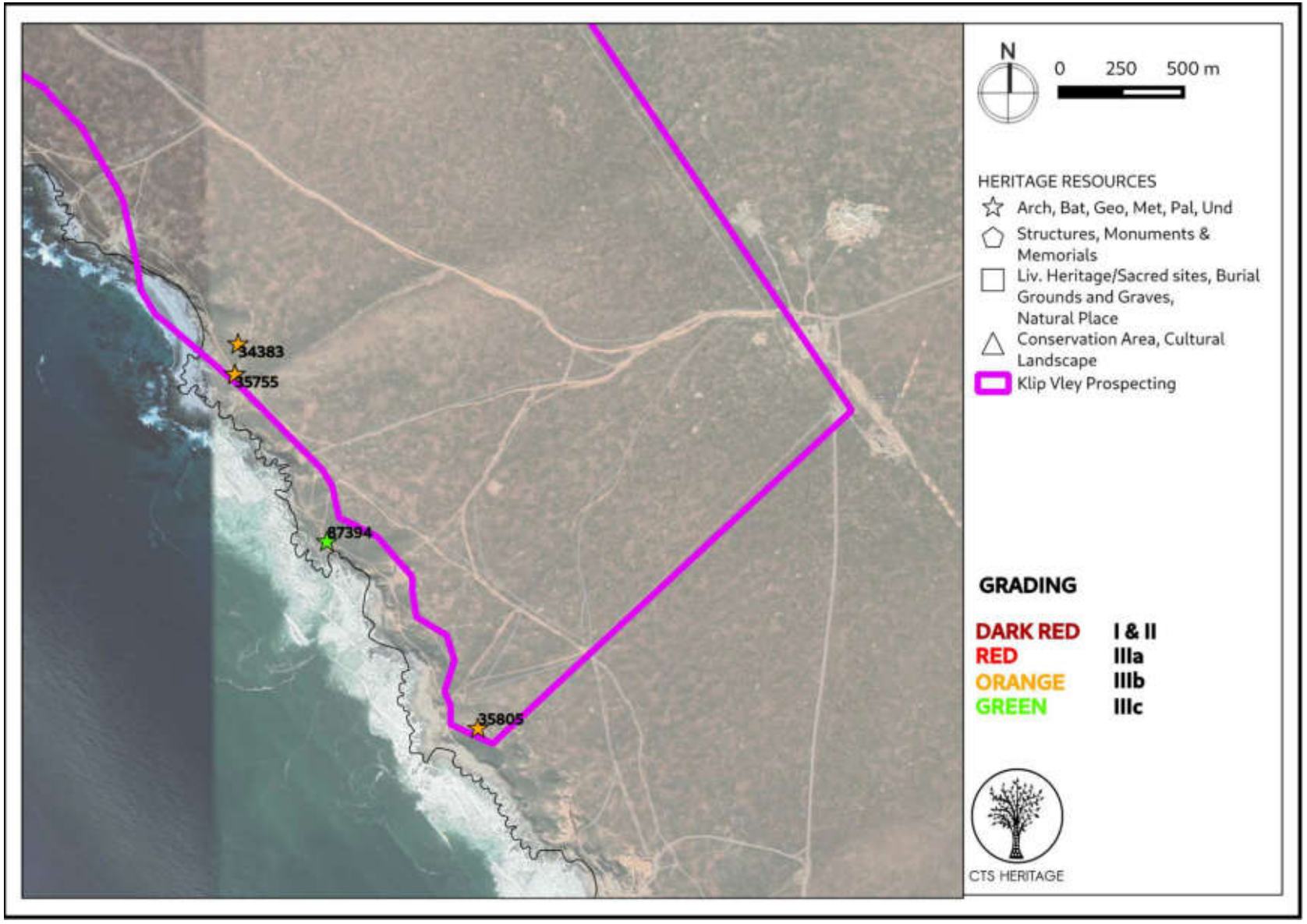

Figure 3c. Heritage Resources Map. Heritage Resources Inset C

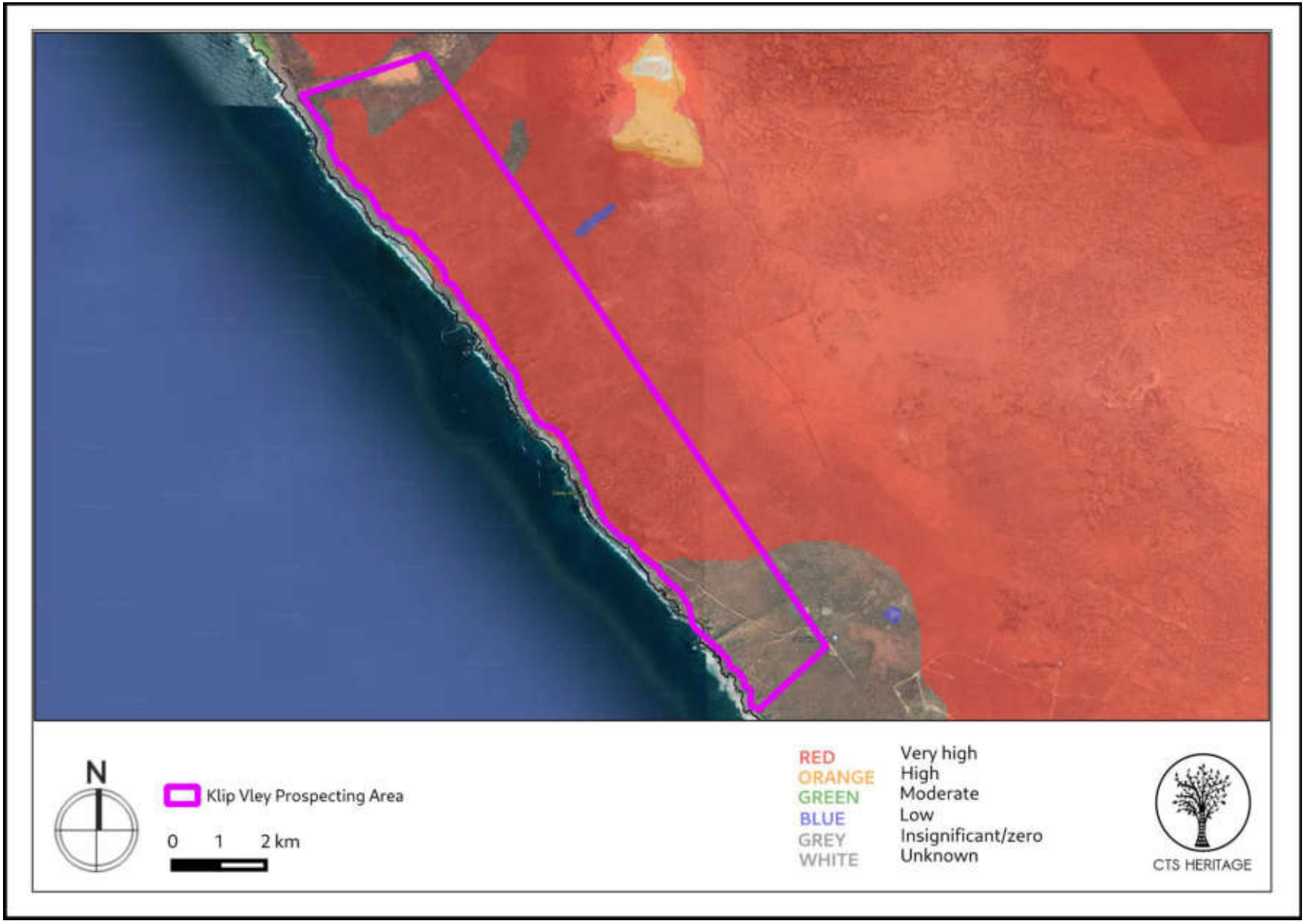

Figure 4a. Palaeosensitivity Map. Indicating fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

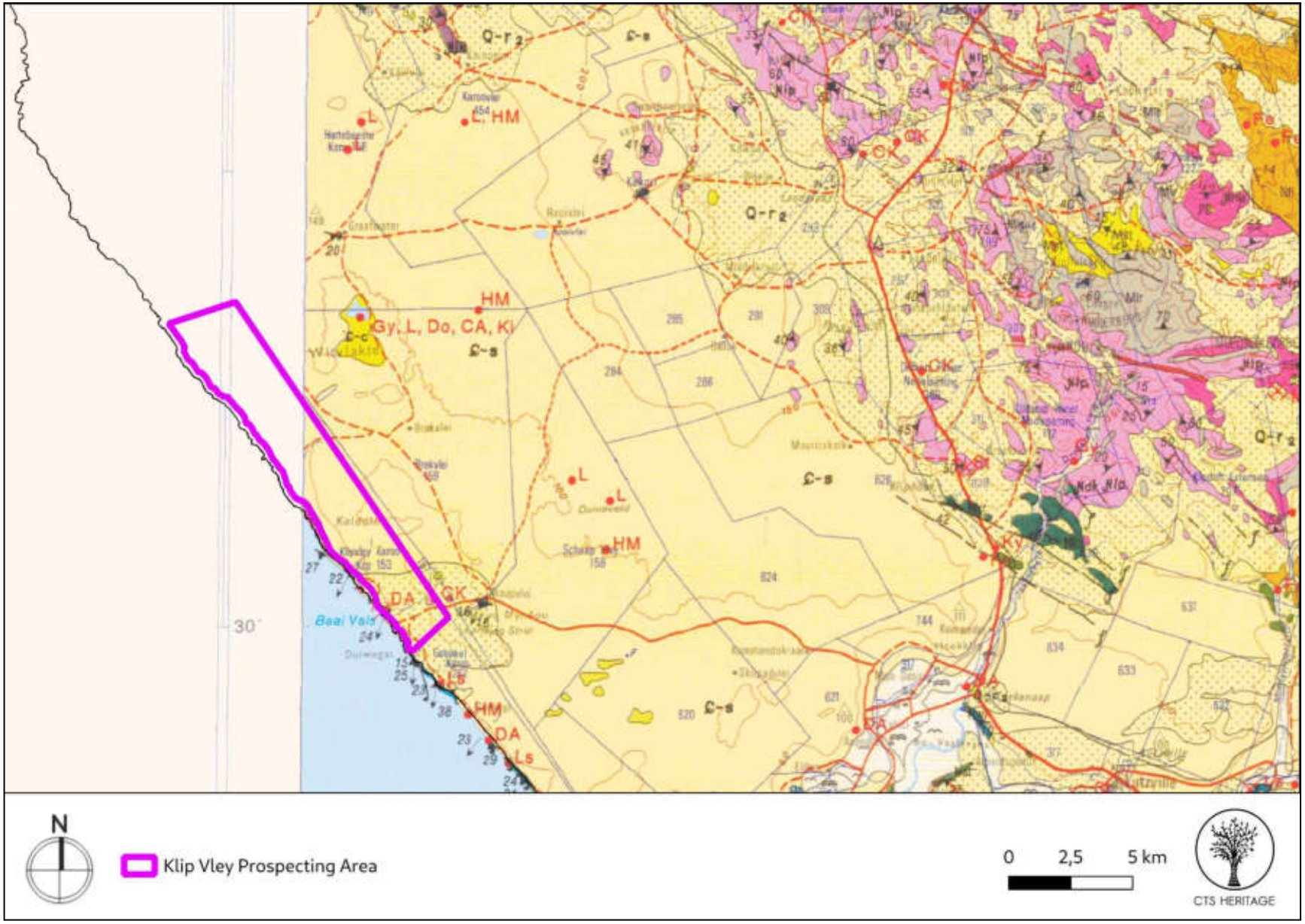

Figure 4b. Geology Map. Extract from the CGS Map for Calvinia 3118 indicating that the area proposed for prospecting is underlain by Quaternary Sands sediments

8. Heritage Assessment

Background

This application is submitted as part of the assessment process for a proposed prospecting application located approximately 25km north of Papendorp along the west coast of South Africa. Due to the nature and scale of the proposed prospecting, none of the activities listed in section 38(1) of the NHRA is triggered. The area proposed for the prospecting has been previously assessed for impacts to heritage resources by Hart (1999 and 2003). These and other relevant reports are summarised below.

Cultural Landscape and Built Environment Heritage

The area proposed for prospecting is located some distance from any significant towns - with the nearest town being Papendorp located some 25km to the south. The cultural landscape value of the broader area has been identified elsewhere (Winter, 2021) as related to the Sandveld Coastal Region and the Olifants River Estuary which consists of a narrow lagoon, wetlands, coastal dunes and the settlements of Ebenhauser and Papendorp. In particular, the landscape has high local scenic, estuarine and recreational value. The settlements of Ebenhaeser and Papendorp have mostly associational heritage value; Ebenhaeser as an early 19th century mission station, and Papendorp as an early 19th century fishing settlement (Winter and Oberholzer 2014). Despite some associational heritage value, relationship with a natural setting and the mission church at Ebenhaeser being of suggested Grade IIIB value, the settlements in their own right including their access routes off the R362 are not regarded as having considerable heritage value.

As is also noted elsewhere, this part of the West Coast has been subjected to mining activities since the 1960's and as such, the proposed prospecting activities aren't unexpected here. Furthermore, the limited nature and scale of prospecting is unlikely to negatively impact on the significant scenic and wilderness landscape qualities of the Sandveld area. However, should mining activities proceed, a more careful assessment of impacts to the cultural landscape should be undertaken.

Archaeology

Hart (1999 and 2007) provides a brief synopsis of the archaeological history of the area which is not repeated here. According to Hart (2003), "The coastline consists of large expanses of rocky shore (quartzites) punctuated by small bays and coves. There are two long stretches of sandy beach (Langstrand and Liebenberg Bay). Immediately inland of the rocky shore are the remnants of the coastal dune system, most of which has now been disturbed by small mining operations. The low scrub covered coastal plains slope gently down to the shorelines apart from in the south where the slope breaks rather more steeply down to places such as Baaivals and Sam se Baai. Many informal tracks lead off the coastal road to old diamond diggings resulting in deflated and de-vegetated areas. In general, the area has seen very little development as it was diamond concession land since the early 20th century. The nearest small settlement of any consequence is Koekenaap some 30 km inland. There is one ruined farmhouse situated at Sterkfontein."

Hart (2003) goes on to note that "Pre-colonial archaeological sites are prolific with most Late Stone Age sites located within 1 km of the shoreline. Areas adjacent to rocky shorelines and small bays attracted prehistoric 7 occupation by ancestors of San hunter-gatherers and Khoekhoen herders. The higher slopes and coastal plains show evidence of Early and Middle Stone Age artefact scatters: material is visible in virtually any area where red Aeolian sand have become deflated and the underlying Dorbank (hard calcretised feldspathic soils) exposed. In summary, the heritage of this area is almost entirely archaeological – the cultural landscape consisting of the distribution of a range of pre-colonial archaeological sites from different time periods. The colonial period cultural landscape is almost entirely limited to a legacy of old diggings, prospecting trenches and places where temporary structures were erected to accommodate diamond mining (the exception being a single historical ruin). Virtually all of this recent history is less than 100 years old and does not constitute archaeological material… In summary, the primary sources of risk in terms of heritage are mainly near shore Late Stone Age archaeological sites, Middle Stone Age artefact scatters and buried sites and to a lesser extent, intangible heritage such as visual impacts."

All of the sites identified by Hart (1999 and 2003) have been mapped relative to the area proposed for prospecting in Figures 3a to 3c. It is clear that most of these sites are located outside of the prospecting area below the coastal ridge. That being said, it is recommended that the areas proposed for prospecting be assessed for impacts to archaeological heritage in order to inform the micrositing of prospecting locations and to provide information regarding the overall archaeological sensitivity of the prospecting area.

Palaeontology

According to the SAHRIS Palaeosensitvity Map (Figure 4a), the area proposed for prospecting activities is underlain by sediments of very high palaeontological sensitivity. According to the extract from the Council of GeoScience Geology Map for Calvinia (Figure 4b), the sediments underlying the prospecting area consist of late Quaternary surficial sands of the Koekenaap and Hardevlei formations. According to a report completed for prospecting in this area by Pether (2021), “The fossil content of the aeolian formations is presumed to be typical of that observed in correlative formations in the wider area. Fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The bones of larger animals are sparse, but are more persistently present along palaeosurfaces which separate units. Rare caches of bones in large burrows are due to the bone-collecting behaviour of hyaenas. Interbedded pan deposits may occur, possibly with aquatic fossils and organic-rich layers. Fossil shells and sparse marine mammal bones occur in the marine formations and rare patches of offshore muds which sometimes include fossil pollens. Alluvia and colluvia in drainages may also include potential fossil pollen-bearing mud layers. The Koingnaas Fm. includes organic peaty beds with fossil pollen and plant remains.”

Pether (2021) concludes that “In the process of the field survey and during the sampling and drilling programme, late Quaternary fossil and archaeological material, including larger mammal bones, may be encountered in deflation areas not discovered during archaeological surveys, or may be noticed in old prospecting excavations and surrounding spoil.” Pether (2021) proposed various mitigation measures to limit the negative impact of the prospecting on fossil remains and these recommendations are reiterated here.

RECOMMENDATION

Based on the information available, it is possible that the proposed prospecting will negatively impact on significant heritage resources and as such it is recommended that a Heritage Impact Assessment be completed for this work.

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Table 2: Impact Assessment Table: Impacts to heritage resources from the proposed prospecting including archaeology, palaeontology, built structures and the cultural landscape

Aspect	Score	Definition
Nature	-1	Likely to result in a negative impact
Extent	1	Impacts limited to the specific activity
Duration	5	Any impacts will be permanent
Magnitude/Intensity	5	Any impacts will be significant
Reversibility	5	Irreversible Impact
Probability	3	Impacts are probable

C = (3+5+5+5)/4
C = 4 x -1
C = -4

ER = -4 x 1

Environmental Risk Score is <9: LOW

CTS HERITAGE

APPENDIX 1

List of heritage resources within close proximity to the development area

Site ID	Site no	Full Site Name	Site Type	Grading
40321	GWK009	Grave Water Kop 009	Artefacts	Grade IIIb
17825	GWK53	Grave Water Kop 53	Artefacts, Shell Midden	Grade IIIb
34383	BAV2	BAAIVALS 2	Artefacts	Grade IIIb
87394	TRAN016	Transhex 016	Artefacts	Grade IIIc
87396	TRAN018	Transhex 018	Artefacts	Grade IIIc
87397	TRAN019	Transhex 019	Shell Midden	Grade IIIc
87398	TRAN020	Transhex 020	Artefacts	Grade IIIa
87399	TRAN021	Transhex 021	Artefacts	Grade IIIa
87400	TRAN022	Transhex 022	Artefacts	Grade IIIa
87395	TRAN017	Transhex 017	Shell Midden	Grade IIIc
40324	GWK010	Grave Water Kop 010	Artefacts	Grade IIIb
32446	NDC Mining-001	NDC Mining	Archaeological	Grade IIIb
17806	GWK36	Grave Water Kop 36	Artefacts, Shell Midden	Grade IIIb
40334	GWK011	Grave Water Kop 011	Artefacts	Grade IIIc
40335	GWK012	Grave Water Kop 012	Artefacts	Grade IIIc
40338	GWK013	Grave Water Kop 013	Artefacts	Grade IIIc

40339	GWK014	Grave Water Kop 014	Artefacts	Grade IIIc
40341	GWK015	Grave Water Kop 015	Artefacts	Grade IIIc
40347	GWK016	Grave Water Kop 016	Artefacts	Grade IIIc
40348	GWK017	Grave Water Kop 017	Artefacts	Grade IIIc
40350	GWK018	Grave Water Kop 018	Artefacts	Grade IIIc
40352	GWK019	Grave Water Kop 019	Artefacts	Grade IIIc
40354	GWK020	Grave Water Kop 020	Artefacts	Grade IIIc
40355	GWK021	Grave Water Kop 021	Archaeological	Grade IIIc
40356	GWK022	Grave Water Kop 022	Artefacts	Grade IIIb
40357	GWK023	Grave Water Kop 023	Artefacts	Grade IIIc
40358	GWK024	Grave Water Kop 024	Artefacts	Grade IIIc
40359	GWK025	Grave Water Kop 025	Archaeological	Grade IIIc
40360	GWK026	Grave Water Kop 026	Archaeological	Grade IIIc
40361	GWK027	Grave Water Kop 027	Archaeological	Grade IIIc
40362	GWK028	Grave Water Kop 028	Archaeological	Grade IIIc
40363	GWK029	Grave Water Kop 029	Archaeological	Grade IIIc
40365	GWK030	Grave Water Kop 030	Artefacts	Grade IIIc
40366	GWK031	Grave Water Kop 031	Archaeological	Grade IIIc
40367	GWK032	Grave Water Kop 032	Artefacts	Grade IIIc

40368	GWK033	Grave Water Kop 033	Archaeological	Grade IIIc
40369	GWK034	Grave Water Kop 034	Archaeological	Grade IIIc
40370	GWK035	Grave Water Kop 035	Archaeological	Grade IIIc
40371	GWK036	Grave Water Kop 036	Archaeological	Grade IIIc
40372	GWK037	Grave Water Kop 037	Archaeological	Grade IIIc
40373	GWK038	Grave Water Kop 038	Archaeological	Grade IIIc
40374	GWK039	Grave Water Kop 039	Archaeological	Grade IIIc
40376	GWK040	Grave Water Kop 040	Archaeological	Grade IIIc
40380	GWK041	Grave Water Kop 041	Archaeological	Grade IIIc
40381	GWK042	Grave Water Kop 042	Archaeological	Grade IIIb
40382	GWK043	Grave Water Kop 043	Artefacts	Grade IIIb
40384	GWK044	Grave Water Kop 044	Archaeological	Grade IIIb
40385	GWK045	Grave Water Kop 045	Archaeological	Grade IIIb
40386	GWK046	Grave Water Kop 046	Artefacts	Grade IIIb
40387	GWK047	Grave Water Kop 047	Archaeological	Grade IIIc
40388	GWK048	Grave Water Kop 048	Archaeological	Grade IIIc
40389	GWK049	Grave Water Kop 049	Archaeological	Grade IIIb
40390	GWK050	Grave Water Kop 050	Archaeological	Grade IIIc
40391	GWK051	Grave Water Kop 051	Archaeological	Grade IIIb

40392	GWK052	Grave Water Kop 052	Archaeological	Grade IIIb
40393	GWK053	Grave Water Kop 053	Archaeological	Grade IIIc
40394	GWK054	Grave Water Kop 054	Archaeological	Grade IIIc
40395	GWK055	Grave Water Kop 055	Archaeological	Grade IIIb
40319	GWK007	Grave Water Kop 007	Artefacts	Grade IIIc
40320	GWK008	Grave Water Kop 008	Artefacts	Grade IIIb
34382	BAV1		Artefacts	Grade IIIb
35755	NDC001	Namakwa Diamond Company 001	Artefacts, Shell Midden	Grade IIIb
35756	NDC002	Namakwa Diamond Company 002	Artefacts	Grade IIIb
35764	NDC010	Namakwa Diamond Company 010	Artefacts, Shell Midden	Grade IIIa
35779	NDC022	Namakwa Diamond Company 022	Artefacts	Grade IIIa
35780	NDC023	Namakwa Diamond Company 023	Artefacts	Grade IIIb
35781	NDC024	Namakwa Diamond Company 024	Artefacts	Grade IIIc
35782	NDC025	Namakwa Diamond Company 025	Artefacts	Grade IIIb
40268	LIEB01	Liebenbergs Bay 01	Artefacts	Grade IIIc
35783	NDC026	Namakwa Diamond Company 026	Artefacts	Grade IIIb
40271	LIEB02	Liebenbergs Bay 02	Artefacts	Grade IIIc
35784	NDC027	Namakwa Diamond Company 027	Artefacts	Grade IIIb
40272	LIEB03	Liebenbergs Bay 03	Artefacts	Grade IIIc

35785	NDC028	Namakwa Diamond Company 028	Artefacts	Grade IIIb
35786	NDC029	Namakwa Diamond Company 029	Artefacts	Grade IIIb
40274	LIEB04	Liebenbergs Bay 04	Artefacts	Grade IIIc
35787	NDC030	Namakwa Diamond Company 030	Artefacts	Grade IIIb
40276	LIEB05	Liebenbergs Bay 05	Artefacts	Grade IIIc
40277	LIEB06	Liebenbergs Bay 06	Artefacts	Grade IIIb
35790	NDC031	Namakwa Diamond Company 031	Artefacts	Grade IIIb
40280	LIEB07	Liebenbergs Bay 07	Artefacts	Grade IIIc
40282	LIEB08	Liebenbergs Bay 08	Artefacts	Grade IIIc
40283	LIEB09	Liebenbergs Bay 09	Artefacts	Grade IIIc
40284	LIEB010	Liebenbergs Bay 010	Artefacts	Grade IIIc
35795	NDC019	Namakwa Diamond Company 019	Artefacts	Grade IIIb
35796	NDC020	Namakwa Diamond Company 020	Artefacts, Shell Midden	Grade IIIc
35797	NDC021	Namakwa Diamond Company 021	Artefacts, Shell Midden	Grade IIIc
35798	NDC032	Namakwa Diamond Company 032	Artefacts	Grade IIIb
35799	NDC033	Namakwa Diamond Company 033	Artefacts	Grade IIIb
35800	NDC034	Namakwa Diamond Company 034	Artefacts	Grade IIIb
35801	NDC035	Namakwa Diamond Company 035	Artefacts	Grade IIIc
35802	NDC036	Namakwa Diamond Company 036	Artefacts	Grade IIIb

35803	NDC037	Namakwa Diamond Company 037	Artefacts	Grade IIIc
35804	NDC038	Namakwa Diamond Company 038	Artefacts	Grade IIIc
35805	NDC039	Namakwa Diamond Company 039	Artefacts	Grade IIIb
17778	GWK10	Grave Water Kop 10	Artefacts, Shell Midden	Grade IIIb
17779	GWK11	Grave Water Kop 11	Shell Midden	Grade IIIb
17780	GWK12	Grave Water Kop 12	Artefacts, Shell Midden	Grade IIIb
17781	GWK13	Grave Water Kop 13	Artefacts	Grade IIIb
17782	GWK14	Grave Water Kop 14	Artefacts, Shell Midden	Grade IIIb
17783	GWK15	Grave Water Kop 15	Artefacts, Shell Midden	Grade IIIb
17784	GWK16	Grave Water Kop 16	Artefacts, Shell Midden	Grade IIIb
17785	GWK17	Grave Water Kop 17	Shell Midden	Grade IIIb
17786	GWK18	Grave Water Kop 18	Artefacts, Shell Midden	Grade IIIb
17787	GWK19	Grave Water Kop 19	Artefacts, Shell Midden	Grade IIIb
17789	GWK20	Grave Water Kop 20	Artefacts, Shell Midden	Grade IIIb
17790	GWK21	Grave Water Kop 21	Artefacts, Shell Midden	Grade IIIb
17791	GWK22	Grave Water Kop 22	Artefacts, Shell Midden	Grade IIIb
17792	GWK23	Grave Water Kop 23	Artefacts, Shell Midden	Grade IIIb
17793	GWK24	Grave Water Kop 24	Artefacts, Shell Midden	Grade IIIb
17794	GWK25	Grave Water Kop 25	Artefacts, Shell Midden	Grade IIIb

17795	GWK26	Grave Water Kop 26	Artefacts, Shell Midden	Grade IIIb
17796	GWK27	Grave Water Kop 27	Artefacts, Shell Midden	Grade IIIb
17797	GWK28	Grave Water Kop 28	Artefacts, Shell Midden	Grade IIIb
17798	GWK29	Grave Water Kop 29	Artefacts, Shell Midden	Grade IIIb
17800	GWK30	Grave Water Kop 30	Artefacts, Shell Midden	Grade IIIb
17801	GWK31	Grave Water Kop 31	Artefacts, Shell Midden	Grade IIIb
17802	GWK32	Grave Water Kop 32	Artefacts, Shell Midden	Grade IIIb
17803	GWK33	Grave Water Kop 33	Artefacts, Shell Midden	Grade IIIb
17804	GWK34	Grave Water Kop 34	Artefacts, Shell Midden	Grade IIIb
17805	GWK35	Grave Water Kop 35	Artefacts, Shell Midden	Grade IIIb
17807	GWK37	Grave Water Kop 37	Artefacts, Shell Midden	Grade IIIb
17808	GWK38	Grave Water Kop 38	Artefacts, Shell Midden	Grade IIIb
17809	GWK39	Grave Water Kop 39	Artefacts, Shell Midden	Grade IIIb
17811	GWK40	Grave Water Kop 40	Artefacts, Shell Midden	Grade IIIb
17812	GWK41	Grave Water Kop 41	Artefacts, Shell Midden	Grade IIIb
17813	GWK42	Grave Water Kop 42	Artefacts, Shell Midden	Grade IIIb
17814	GWK43	Grave Water Kop 43	Artefacts, Shell Midden	Grade IIIb
17815	GWK44	Grave Water Kop 44	Artefacts, Shell Midden	Grade IIIb
17816	GWK45	Grave Water Kop 45	Artefacts, Shell Midden	Grade IIIb

17817	GWK46	Grave Water Kop 46	Artefacts, Shell Midden	Grade IIIb
17818	GWK47	Grave Water Kop 47	Artefacts, Shell Midden	Grade IIIb
17819	GWK48	Grave Water Kop 48	Artefacts, Shell Midden	Grade IIIb
17820	GWK49	Grave Water Kop 49	Artefacts, Shell Midden	Grade IIIb
17822	GWK50	Grave Water Kop 50	Artefacts, Shell Midden	Grade IIIb
17823	GWK51	Grave Water Kop 51	Artefacts, Shell Midden	Grade IIIb
17824	GWK52	Grave Water Kop 52	Artefacts, Shell Midden	Grade IIIb
17826	GWK54	Grave Water Kop 54	Artefacts	Grade IIIb
17827	GWK55	Grave Water Kop 55	Artefacts	Grade IIIb
17829	GWK7	Grave Water Kop 7	Artefacts, Shell Midden	Grade IIIb
17830	GWK8	Grave Water Kop 8	Artefacts, Shell Midden	Grade IIIb
17831	GWK9	Grave Water Kop 9	Artefacts, Shell Midden	Grade IIIb
104588	LSB2A	Nam Sandveld (other)	Archaeological	
104589	LSB2B	Nam Sandveld (other)	Archaeological	
104590	LSB4A	Nam Sandveld (other)	Archaeological	
104591	LSB9A	Nam Sandveld (other)	Archaeological	

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APPENDIX 2

Reference List with relevant AIAs and PIAs

Heritage Impact Assessments				
Case ID	**Report Type**	**Author/s**	**Date**	**Title**
4744	AIA Phase 1	Jonathan Kaplan	01/09/2000	Archaeological Study Portion 1 and 2 and the Remainder of the Farm Luiperskop No. 211, Vanrhynsdorp District, Western Cape
4756	AIA Phase 1	Timothy Hart	01/12/1997	An Archaeological Re-Assessment of Boundary Changes, Namakwa Sands Mining Area
4791	AIA Phase 1	John Parkington, Timothy Hart	01/03/1993	Namakwa Sands Main Access Road Archaeological Survey
4812	AIA Phase 1	Timothy Hart	01/09/1999	A Phase One Archaeological Assessment of the Proposed Liebenbergs Bay Mine, Vredendal
4813	AIA Phase 1	Dave Halkett	01/11/2000	An Assessment of the Impacts on Heritage Resources of Proposed Mining on the Farm Karoetjies Kop, Vredendal District
4814	AIA Phase 1	Jonathan Kaplan	01/09/2001	Archaeological Assessment Portion 3 (A Portion of Portion 2) Klip Vley Karoo Kop No. 153 Vredendal District, Cape West Coast
4816	AIA Phase 1	Timothy Hart	01/03/2003	Phase 1 Archaeological Assessment of Proposed Diamond Mining Areas Situated at the Farms Geelwal Karoo, Klipvley Karoo Kop and Graauduinen, Vredendal District, Western Cape
8249	AIA Phase 1	John Parkington, Cedric Poggenpoel	01/01/1991	West Coast Heavy Mineral Sand Project: Archaeological Report
8409	HIA Phase 1	Timothy Hart	01/12/2007	Heritage Impact Assessment (Prepared as Part of an EIA) of a Proposed Wind Energy Facility to Be Situated at Olifants River Settlement 617, 620 and Grave Water Kop 158/5 Situated on the Namaqualand Coast in the Vredendal District, South Western Cape

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APPENDIX 3 - Keys/Guides

Key/Guide to Acronyms

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

Full guide to Palaeosensitivity Map legend

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

CTS HERITAGE

APPENDIX 4 - Methodology

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

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

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

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

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

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

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

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

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

DETERMINATION OF THE PALAEONTOLOGICAL SENSITIVITY

The possible impact of the proposed development on palaeontological resources is gauged by:

- reviewing the fossil sensitivity maps available on the South African Heritage Resources Information System (SAHRIS)
- considering the nature of the proposed development
- when available, taking information provided by the applicant related to the geological background of the area into account

DETERMINATION OF THE COVERAGE RATING ASCRIBED TO A REPORT POLYGON

Each report assessed for the compilation of the Heritage Screener is colour-coded according to the level of coverage accomplished. The extent of the surveyed coverage is labeled in three categories, namely low, medium and high. In most instances the extent of the map corresponds to the extent of the development for which the specific report was undertaken.

Low coverage will be used for:

- desktop studies where no field assessment of the area was undertaken;
- reports where the sites are listed and described but no GPS coordinates were provided.
- older reports with GPS coordinates with low accuracy ratings;
- reports where the entire property was mapped, but only a small/limited area was surveyed.
- uploads on the National Inventory which are not properly mapped.

Medium coverage will be used for

- reports for which a field survey was undertaken but the area was not extensively covered. This may apply to instances where some impediments did not allow for full coverage such as thick vegetation, etc.
- reports for which the entire property was mapped, but only a specific area was surveyed thoroughly. This is differentiated from low ratings listed above when these surveys cover up to around 50% of the property.

High coverage will be used for

- reports where the area highlighted in the map was extensively surveyed as shown by the GPS track coordinates. This category will also apply to permit reports.

RECOMMENDATION GUIDE

The Heritage Screener includes a set of recommendations to the applicant based on whether an impact on heritage resources is anticipated. One of three possible recommendations is formulated:

(1) The heritage resources in the area proposed for development are sufficiently recorded - The surveys undertaken in the area adequately captured the heritage resources. There are no known sites which require mitigation or management plans. No further heritage work is recommended for the proposed development.

This recommendation is made when:

- enough work has been undertaken in the area
- it is the professional opinion of CTS that the area has already been assessed adequately from a heritage perspective for the type of development proposed

(2) The heritage resources and the area proposed for development are only partially recorded - The surveys undertaken in the area have not adequately captured the heritage resources and/or there are sites which require mitigation or management plans. Further specific heritage work is recommended for the proposed development.

This recommendation is made in instances in which there are already some studies undertaken in the area and/or in the adjacent area for the proposed development. Further studies in a limited HIA may include:

- improvement on some components of the heritage assessments already undertaken, for instance with a renewed field survey and/or with a specific specialist for the type of heritage resources expected in the area
- compilation of a report for a component of a heritage impact assessment not already undertaken in the area

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

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

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

APPENDIX 5 -Summary of Specialist Expertise

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation since 2016, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

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

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

APPLICATION FORM

NOTIFICATION FOR INTENT TO DEVELOP (NID)

Section 38(1) and Section 38(8)

Completion of this form is required by Heritage Western Cape for the initiation of all impact assessment processes under Section 38 (1) & (8) of the National Heritage Resources Act (NHRA).

As per Section 38(1)(e) of the NHRA, submission of the NID must be initiated at the earliest stage of development. Should the development trigger any other legislation, practitioners may submit the NID without formal submission to other statutory bodies in order to comply with the NHRA.

This form is to be read in conjunction with the HWC Notification of Intent to Develop, Heritage Impact Assessment, (Pre-Application), Basic Assessment Reports, Scoping Reports and Environmental Impact Assessments.

All sections of the form must be completed in order to deem the application to be complete.

Making an incorrect statement or providing incorrect information may result in all or part of the application having to be reconsidered by HWC in the future, or submission of a new application.

HERITAGE WESTERN CAPE REFERENCE NO., AS PROVIDED DURING SCRUTINY:

SECTION A

APPLICATION MADE IN TERMS OF:

- [ ] Section 38(1) of the NHRA (This development will not require a NEMA application)
- [x] Section 38(8) of the NHRA (This development requires an application with another authority)
- [ ] Amendment of approved Site Development Plan (SDP) for endorsement. Endorsements are only reviewed upon submission of an assessment by the heritage practitioner confirming heritage design indicators as approved are not compromised by the revision
- [ ] Advice in terms of Section 38(1)

APPLICABILITY OF OTHER LEGISLATION:

Specify the authorised department that makes the final decision in terms of NEMA (National Environmental Act.), i.e. Department of Mineral Resources, Department of Environmental Affairs and Development Planning Western Cape, Department of Forestry, Fisheries and Environment etc.: MPRDA

Reference number of authority / government department: _____

Present phase at which the process with that authority stands: _____

PREVIOUS HWC APPLICATIONS APPLICABLE TO THE SITE AND OR DEVELOPMENT

Provide details of any previous applications submitted to HWC on the site.

HWC Reference No.	NHRA Section	Summary of Proposal	Application Status (Approved, Not Approved, Pending)	Permit / Record of Decision Date

SECTION B

DETAILS OF SITE, PROPERTY OR PLACE

Physical address or Location (e.g., of the R44): 25km North of Papendorp

Erf or Farm Name and No. (including the name of the site): PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153

Coordinates for logical center point (WGS84): 31°26'46.00"S 18° 0'6.32"E

Town: Papendorp District / Municipality: Matzikama

Property Extent: 3 634.92ha Current land Use: Vacant

Current zoning: Agriculture

Predominant land uses of surrounding properties: Mining and agriculture

SECTION C

APPLICANT / AUTHORISED AGENT – Details of person to receive Record of Decision

Name: _____

Company: _____

Address and postal code: _____

Cellular phone number: _____

E-mail: _____

Signature: _____ Date: _____

REGISTERED OWNER OF PROPERTY

Name: _____

Identity number of applicant: _____

Address and postal code: _____

Cellular phone number: _____

E-mail: _____

Declaration: I, _____ am fully aware of this application and accept its contents and declare that I intend to undertake the actions as proposed in this application.

Signature: _____ Date: _____

SECTION D

DETAIL OF PROPOSED DEVELOPMENT

Provide a full description of the nature and extent of the proposed development.

PROPOSED PROSPECTING ON PORTIONS 1, 2, 3 & RE/153 OF THE FARM KLIPVLEY KAROO KOP 153

MATZIKAMA MUNICIPALITY, VREDENDAL DISTRICT, WESTERN CAPE PROVINCE_____

The existence and possible size of heavy mineral deposits in the application area will be determined as follows:
• Data review and desktop studies
• Mapping and surface sampling
• Reconnaissance Drilling

The prospecting will be conducted in 3 phases, each one dependent on the results of the previous.

- Phase 1 will involve the following desk-top activities: data acquisition from government and private sources, and analysis of any existing/previous prospecting and drilling data, satellite (Landsat) imagery, aerial photos, and terrain data, as well as geological map interpretation. The synthesis and interpretation of such information will contribute towards providing a clearer picture of the location and characteristics of the heavy mineral deposit/s, and will guide the in-field prospecting programme.
- Phase 2: Surface mapping will be conducted by the project geologist and assistants, and will take place over a period of 3 months. Such mapping will encompass GPS controlled traverses, and aerial photo mapping. Surface sampling. Where heavy mineral concentrations are noted on surface 25 liter surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be 50cm x 50cm in size and dug to a maximum depth of 1m. The final number of samples will be determined by the size of surface mineralized areas if any, 200 samples are planned for initially. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.
- Phase 3 will involve surveying and pegging of the anticipated deposit. This sub-phase will include the following activities: Surveying of the mapped area to be prospected. A grid (average 500m x 500m) will be marked on the map, after which those positions will be marked in the field by a surveyor with labelled droppers (pegs). Shallow small diameter auger drilling will take place at these positions to an average depth of 4m. A total of 100 auger drill holes are planned initially and may be followed up with additional drilling. Access routes to the drill sites will also be located (existing roads will used and new tracks only permitted in exceptional circumstances)
- Phase 4 will be conducted with Air Core drilling method to access the deeper lying sediment package. A total of 250 Air-core holes are planned down to an average depth of 30m. More drilling may be required depending on

results. Drill cutting will be sampled and analysed for heavy mineral content as described above for surface sampling.

- Phase 5 will involve analytical desk-top study. All the data collected will be analysed and compiled into a final report/model in order to determine the potential of the project and to outline possible future drill sampling programs if any.

DESCRIPTION OF PLANNED INVASIVE ACTIVITIES:

Where heavy mineral concentrations are noted on the surface 25 litre surface samples will be collected manually with a shovel and plastic sampling bag for concentration and laboratory analysis to determine the type of minerals present and the tenor of mineralization. Each pit will be ~ 50cm x 50cm in size and dug to a maximum depth of 1m. Each sample locality will be backfilled and fully rehabilitated concurrently with sampling.

Auger Drilling.

Hand held engine operated auger drill. The auger is portable and will be walked to site from the closest track. Approximately 100 auger drill holes are anticipated to be drilled. The auger is in essence a corkscrew-type drill where the helical ridge raises the drilled material to the surface for sampling purposes. A total of 100 drill holes are planned for initially to be collected over an estimated 18-month period.

Evaluation Air core Drilling

Air-core drilling uses steel or tungsten blades to bore a hole into unconsolidated ground. The drill cuttings are removed by the injection of compressed air into the hole. This method of drilling is used to drill unconsolidated sands and soft sediments. Where possible, air-core drilling is preferred over RAB drilling as it provides a more representative sample. Air-core drilling is relatively inexpensive and is often used in first pass exploration drill programs. Air-core drilling is limited to depths of 50-60 metres and is drilled using a smaller rig known as an Air-core rig. Such drill is for drilling of deeper holes and use of such will be restricted to existing farm tracks and roads

_____

_____

DEVELOPMENT DETAILS – Indicate which sections of the NHRA, or other legislation which requires a NID

PLEASE TICK THE APPROPRIATE BOX	
	Section 38(1)(a) Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	Section 38(1)(b) Construction of a bridge or similar structure exceeding 50m in length.
	Section 38(1)(c) Any development or activity that will change the character of a site:
	(i) exceeding 5 000m² in extent.
	(ii) involving three or more existing erven or subdivisions thereof.
	(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years. *If (i), (ii) and/or (iii) are marked above, describe how the development will change the character of the site _____ _____ _____
	Section 38(1)(d) Rezoning of a site exceeding 10 000m² in extent.
x	**Other triggers e.g., in terms of other legislation (NEMA, etc.)** – Describe the details: __MPRDA Application_____

ESTIMATED CONSTRUCTION COST AND/ OR VALUE OF DEVELOPMENT UPON COMPLETION: R 3.95 Million

SECTION E

PROVIDE A SHORT HISTORY OF THE SITE, PROPERTY OR PLACE – Include sources where applicable

See attached desktop assessment

ANTICIPATED IMPACTS ON HERITAGE RESOURCES

Section 3 of the NHRA sets out the following categories of heritage resource as forming part of the national estate. Please indicate the known presence of any of these by checking the box alongside and then providing a description of each occurrence, including nature, location, size, type

Failure to provide sufficient detail or to anticipate the likely presence of heritage resources on the site may lead to a request for more detailed specialist information.

IDENTIFICATION OF ALL HERITAGE RESOURCES ON THE SITE, PROPERTY OR PLACE AND ITS ENVIRONMENTS

Please indicate where applicable:

	Places, buildings, structures, and equipment of cultural significance: Description of Heritage Resource: Descriptions of Heritage Impact:
	Places to which oral traditions are attached or which are associated with living heritage: Description of Heritage Resource: Descriptions of Heritage Impact:
	Places to which oral traditions are attached or which are associated with living heritage: Description of Heritage Resource: Descriptions of Heritage Impact:
	Historical settlements and townscapes: Description of Heritage Resource: Descriptions of Heritage Impact:
	Landscapes and natural features of cultural significance: Description of Heritage Resource: Descriptions of Heritage Impact:
	Geological resources of scientific or cultural significance: Description of Heritage Resource:

	Descriptions of Heritage Impact:
x	**Archaeological resources –** Incl. archaeological sites and material, rock art, battlefields, and wrecks etc.: Description of Heritage Resource: The primary sources of risk in terms of heritage are mainly near shore Late Stone Age archaeological sites, Middle Stone Age artefact scatters and buried sites Descriptions of Heritage Impact: Destruction
x	**Palaeontological resources –** i.e., fossils, geological formations etc.: Description of Heritage Resource: The fossil content of the aeolian formations is presumed to be typical of that observed in correlative formations in the wider area. Fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The bones of larger animals are sparse, but are more persistently present along palaeosurfaces which separate units. Rare caches of bones in large burrows are due to the bone-collecting behaviour of hyaenas. Interbedded pan deposits may occur, possibly with aquatic fossils and organic-rich layers. Fossil shells and sparse marine mammal bones occur in the marine formations and rare patches of offshore muds which sometimes include fossil pollens. Alluvia and colluvia in drainages may also include potential fossil pollen-bearing mud layers. The Koingnaas Fm. includes organic peaty beds with fossil pollen and plant remains Descriptions of Heritage Impact: Destruction
	Graves and burial grounds – e.g.: ancestral graves, graves of victims of conflict, historical graves, cemeteries etc.: Description of Heritage Resource: Descriptions of Heritage Impact:
	Sites of significance relating to the history of slavery in South Africa: Description of Heritage Resource: Descriptions of Heritage Impact:
	Other heritage resources: Description of Heritage Resource: Descriptions of Heritage Impact:

PROVIDE A SUMMARY OF THE ANTICIPATED IMPACTS ON HERITAGE RESOURCES

Based on the information available, it is possible that the proposed prospecting will negatively impact on significant heritage resources and as such it is recommended that a Heritage Impact Assessment be completed for this work.

SECTION F

RECOMMENDATION

In your opinion, do you believe that a Heritage Impact Assessment (HIA) is required?

[X] **Yes** [ ] **No**

Specialist studies to be provided as part of the HIA:

	Architectural (i.e., fabric analysis, historical analysis, material analysis etc.)
x	Archaeological Impact Assessment
x	Paleontological Impact Assessment
	Townscape Assessment
	Cultural Assessment
	Social Historical Study
	Visual Impact Assessment
	Other:

Recommendations made by: **Jenna Lavin**

Capacity: **Heritage Assessment Practitioner**

PLEASE NOTE

Any further studies which HWC requires should be submitted in the form of a single, consolidated report with a single set of recommendations. Specialist studies must be incorporated in full, either as chapters of the report, or as annexures thereto.

Please refer to the Guidelines for Heritage Impact Assessments required in terms of Section 38 of the National Heritage Resources Act (25 of 1999).

Applications are considered to be public documents and are open to public scrutiny. Should you wish for your application to be kept confidential, please motivate your request on a separate sheet attached to your application form.

For applications that are granted confidentiality, this confidentiality will be limited to one year (12 months).

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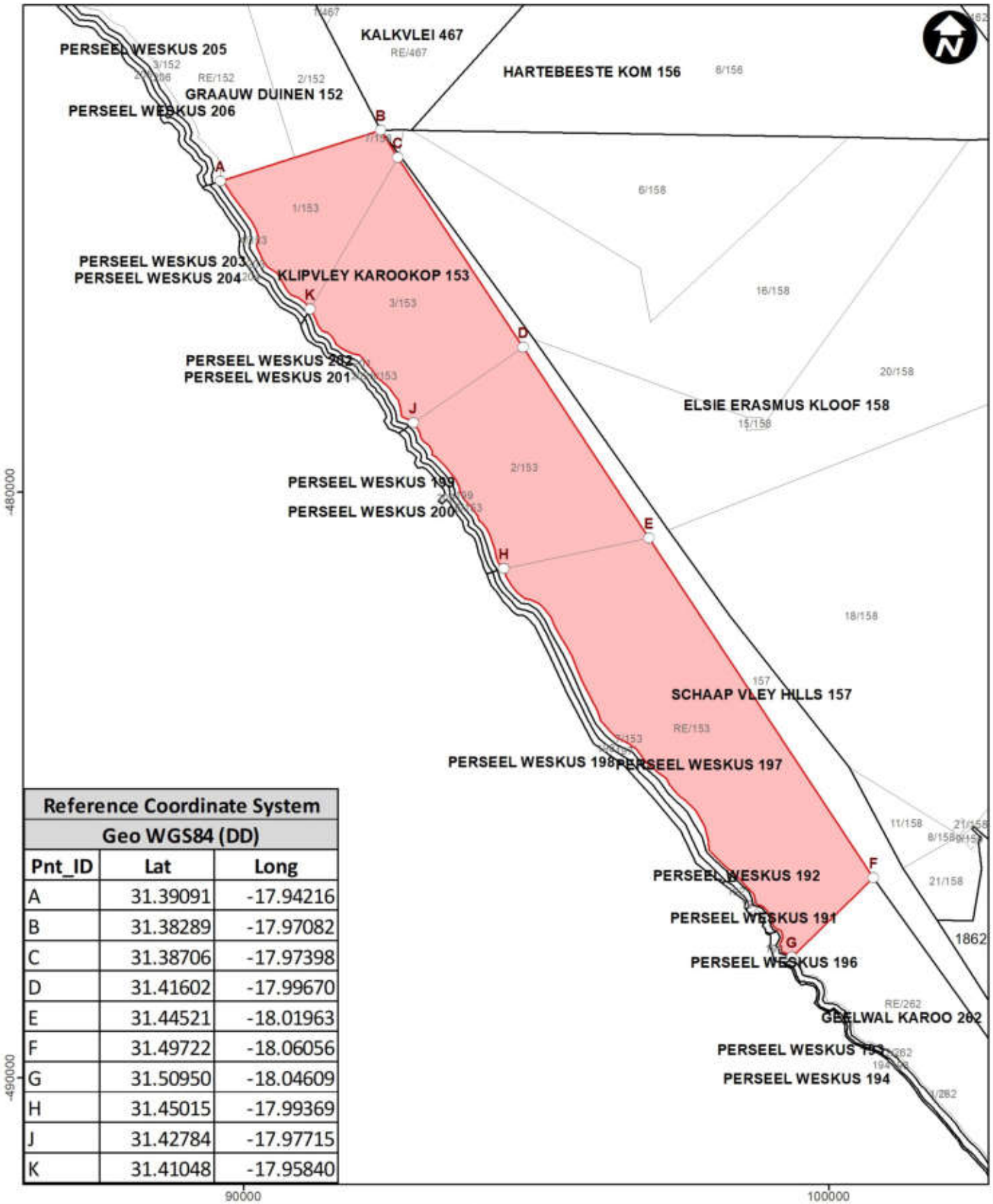

Reference Coordinate System		
Geo WGS84 (DD)		
Pnt_ID	Lat	Long
A	31.39091	-17.94216
B	31.38289	-17.97082
C	31.38706	-17.97398
D	31.41602	-17.99670
E	31.44521	-18.01963
F	31.49722	-18.06056
G	31.50950	-18.04609
H	31.45015	-17.99369
J	31.42784	-17.97715
K	31.41048	-17.95840

LAND SURVEYOR DETAILS

Name:.....

Signature:.....

REGIONAL MANAGER:.....

HOLDER:.....

LEGEND

- Survey Coordinate Point
- Farm Boundaries
- Prospecting Right Application Area

COORDINATE SYSTEM INFORMATION

PROJECTION	TRANSVERSE MERCATOR
SPHEROID	WGS 84
CENTRAL MERIDIAN	17°E
MAP UNITS	METERS

1:90 000

0 0.5 1 2 3 Kilometers

Figure 1 - The Plan

Prospecting Right application in respect of
Portion 1,2,3 and the Remainder of Farm Klipvley Karookop 153
covering A....K in extents 3635ha,
Magisterial district of Vredendal, Western Cape

PROJECT INFORMATION (F:\GIS\Bertust\Fig1_Klipvley_Plan.mxd) 2019/07/21