

PALAEONTOLOGICAL HERITAGE REPORT: COMBINED DESKTOP & FIELD-BASED STUDY

AUTHORISED 140MW RIETRUG (DFFE Ref: 12/12/20/1782/1/AM5) AND 140MW SUTHERLAND (DFFE Ref: 12/12/20/1782/2/AM6) WIND ENERGY FACILITIES (WEFS) AND THEIR ASSOCIATED GRID CONNECTIONS (DFFE REF: 14/12/16/3/3/1/2457/AM1, 14/12/16/3/3/1/2458 & 14/12/16/3/3/1/2077/AM2) BETWEEN SUTHERLAND & MERWEVILLE, KAROO HOOGLAND MUNICIPALITY (NAMAQUA DISTRICT), NORTHERN CAPE AND LAINGSBURG MUNICIPALITY (CENTRAL KAROO DISTRICT), WESTERN CAPE PROVINCES

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EXECUTIVE SUMMARY

Sutherland Wind Farm (Pty) Ltd and Rietrug Wind Farm (Pty) Ltd are proposing to construct two adjoining wind energy facilities (WEFs) – namely the authorised Sutherland (DFFE Ref: 12/12/20/1782/2/AM6) and Rietrug (DFFE Ref: 12/12/20/1782/1/AM5) WEFs - each with a total generation capacity of up to 140 MWac, some 40km SE of Sutherland, falling within the Karoo Hoogland Municipality (Namaqua District) of the Northern Cape and the Laingsburg Municipality (Central Karoo District) of the Western Cape.

Associated WEF infrastructure includes wind turbines, an internal road network, on-site substations, powerlines, laydown areas and offices. The two WEFs will be connected to a new Main Transmission Station (MTS), located c. 24 km west of Merweville, Western Cape, by a new 132 kV transmission line with associated service track. The existing gravel access road from the R354 to the two WEFs will be widened and upgraded.

The combined project areas for the Sutherland and Rietrug WEFs is underlain by continental sediments of the Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) that are known elsewhere to contain import fossil biotas of late Middle Permian age (*Tapinocephalus* Assemblage Zone). These fluvial and lacustrine bedrocks are extensively mantled by Late Caenozoic superficial sediments (colluvium, alluvium, surface gravels, soils *etc*) that are, at most, very sparsely fossiliferous.

Apart from a modest number of tetrapod and petrified wood fossils recorded in previous palaeontological assessment (PIA) studies for the associated grid connection, MTS and access road (Almond 2017a, 2019, 2021a-d), very few significant fossil sites have been previously recorded in this sector of the Roggeveld Plateau (Nicolas 2007). Approximately 120 new fossil sites were recorded during a recent 11-day palaeontological field study (period 10 to 21 February 2022) of the combined WEF project area by three experienced Karoo heritage specialists. They include skeletal remains of large pareiasaur reptiles, various therapsid or “mammal-like reptile” subgroups (large-bodied dinocephalians, small-bodied dicynodonts, medium-sized therocephalians

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and gorgonopsians), small tetrapod burrows, locally abundant lungfish burrow casts, rare coprolites, low-diversity invertebrate burrows, small blocks of petrified wood and impressions of sphenophyte ferns.

1. 140MW Sutherland Wind Energy Facility and Grid Connection Infrastructure

• Conclusions

Scientifically valuable, conservation-worthy vertebrate and other fossil sites are scattered across the project area, especially in areas of good mudrock exposure, but are largely unpredictable in distribution (Appendix 1, Figures A1.4 to A1.6, A1.7 & A1.8). With a few exceptions, the majority of the fossil sites are of limited scientific or conservation value while large portions of the area are mantled in Late Caenozoic superficial deposits and therefore in practice of Low Palaeosensitivity.

None of the new fossil sites lies directly within or close to (< 20 m) the WEF and grid connection project footprints, while scientifically valuable sites have already been sampled for curation in the palaeontological collections of the Evolutionary Studies Institute (ESI), Wits University Johannesburg (Fossil Collection Permit of Professor Bruce Rubidge). **No mitigation measures - including micro-siting of the proposed final layouts - are therefore proposed in their regard.** Given the very large project areas concerned, the substantial number of fossil sites now recorded in the region as well as the inherent unpredictability of these sites, the potential occurrence of additional *unrecorded* sites of scientific and conservation value at or beneath the ground surface within the WEF and grid connection development footprints cannot be completely excluded.

The proposed final layout of the Sutherland WEF and associated Grid Connection Infrastructure (including new MTS) is unlikely to entail highly significant impacts on known palaeontological heritage resources, provided that the recommended palaeontological mitigation measures are fully implemented (Negative Low significance after mitigation). Cumulative impacts associated with comparable renewable energy developments in the region (Negative Low significance after mitigation) fall within acceptable limits.

• Recommendations

(1) The final, approved layouts of the WEF and its associated Grid Connection Infrastructure must be cross-checked by a professional palaeontologist against the available palaeontological database prior to commencement of site clearing and excavation activities. Residual, potentially sensitive, unsurveyed sectors of the project footprint must be surveyed and mitigated in the Pre-construction Phase (*prior* to any site clearance and bedrock excavations) by a professional palaeontologist, with recording and judicious sampling or collection of scientifically valuable fossil material.

(2) New fossil material encountered or exposed during the Construction Phase is best handled through the Chance Fossil Finds Protocol outlined in Appendix 2. This tabulated protocol should be incorporated into the EMPr for each development and fully implemented by the responsible ECO / ESO. The Environmental Control Officer (ECO) / Environmental Site Officer (ESO) responsible for the WEF and grid connection developments should be made aware of the possibility of important fossil remains (vertebrate bones, teeth and burrows, petrified wood, plant-rich horizons *etc.*) being found or unearthed during the construction phase of the projects. Monitoring for fossil material of all major surface clearance (including access roads) and deeper (>1m) excavations by the Environmental Site Officer on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded, preferably *in situ*, and reported at the earliest opportunity to Heritage Western Cape / SAHRA for recording and sampling by a professional palaeontologist. If triggered, these mitigation actions to conserve legally-protected fossil heritage are considered to be essential.

(3) The palaeontologist responsible for any mitigation work in the Western Cape will need to submit a Work Plan for approval by Heritage Western Cape (HWC) and apply for a Fossil Collection Permit from SAHRA

for professional mitigation in the Northern Cape. All fieldwork and reporting should meet the standards of international best practice as well as those developed for PIA reports by SAHRA (2013) and Heritage Western Cape (2021). Fossil material collected must be safeguarded and curated within an approved palaeontological repository (e.g. museum or university collection) with full collection data.

2. 140MW Rietrug Wind Energy Facility and Grid Connection Infrastructure

- **Conclusions**

Scientifically valuable, conservation-worthy vertebrate and other fossil sites are scattered across the project area, especially in areas of good mudrock exposure, but are largely unpredictable in distribution (Appendix 1, Figures A1.1 to A1.3, A1.7 & A1.8). With a few exceptions, the majority of the fossil sites are of limited scientific or conservation value while large portions of the area are mantled in Late Caenozoic superficial deposits and therefore in practice of Low Palaeosensitivity.

None of the new fossil sites lies directly within or close to (< 20 m) the WEF and grid connection project footprints while scientifically valuable sites have already been sampled for curation in the palaeontological collections of the Evolutionary Studies Institute (ESI), Wits University Johannesburg (Fossil Collection Permit of Professor Bruce Rubidge). **No mitigation measures - including micro-siting of the proposed final layouts - are therefore proposed in their regard.** Given the very large project areas concerned, the substantial number of fossil sites now recorded in the region as well as the inherent unpredictability of these sites, the potential occurrence of additional *unrecorded* sites of scientific and conservation value at or beneath the ground surface within the WEF and grid connection development footprints cannot be completely excluded.

The proposed final layout of the Rietrug WEF and associated Grid Connection Infrastructure (including new MTS) is unlikely to entail highly significant impacts on known palaeontological heritage resources, provided that the recommended palaeontological mitigation measures are fully implemented (Negative Low significance after mitigation). Cumulative impacts associated with comparable renewable energy developments in the region (Negative Low significance after mitigation) fall within acceptable limits.

- **Recommendations**

(1) The final, approved layouts of the WEF and its associated Grid Connection Infrastructure must be cross-checked by a professional palaeontologist against the available palaeontological database prior to commencement of site clearing and excavation activities. Residual, potentially sensitive, unsurveyed sectors of the project footprint must be surveyed and mitigated in the Pre-construction Phase (*prior* to any site clearance and bedrock excavations) by a professional palaeontologist, with recording and judicious sampling or collection of scientifically valuable fossil material.

(2) New fossil material encountered or exposed during the Construction Phase is best handled through the Chance Fossil Finds Protocol outlined in Appendix 2. This tabulated protocol should be incorporated into the EMPr for each development and fully implemented by the responsible ECO / ESO. The Environmental Control Officer (ECO) / Environmental Site Officer (ESO) responsible for the WEF and grid connection developments should be made aware of the possibility of important fossil remains (vertebrate bones, teeth and burrows, petrified wood, plant-rich horizons *etc.*) being found or unearthed during the construction phase of the projects. Monitoring for fossil material of all major surface clearance (including access roads) and deeper (>1m) excavations by the Environmental Site Officer on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded, preferably *in situ*, and reported at the earliest opportunity to Heritage Western Cape / SAHRA for recording and sampling by a professional palaeontologist. If triggered, these mitigation actions to conserve legally-protected fossil heritage are considered to be essential.

(3) The palaeontologist responsible for any mitigation work in the Western Cape will need to submit a Work Plan for approval by Heritage Western Cape (HWC) and apply for a Fossil Collection Permit from SAHRA for professional mitigation in the Northern Cape. All fieldwork and reporting should meet the standards of international best practice as well as those developed for PIA reports by SAHRA (2013) and Heritage Western Cape (2021). Fossil material collected must be safeguarded and curated within an approved palaeontological repository (e.g. museum or university collection) with full collection data.

1. PROJECT OUTLINES AND BRIEF

Sutherland Wind Farm (Pty) Ltd and Rietrug Wind Farm (Pty) Ltd are proposing to construct two adjoining wind energy facilities (WEFs), each with a total generation capacity of up to 140 MWac, on the Roggeveld Plateau near Sutherland. The two WEFs, known as the Rietrug WEF (37 turbines) and the Sutherland WEF (34 turbines) have already received Environmental Authorisation from the Department of Forestry, Fisheries and the Environment (DFFE) (Sutherland - DFFE Ref: 12/12/20/1782/2/AM6; Rietrug - DFFE Ref: 12/12/20/1782/1/AM5). Their adjoining project sites are situated along the southern margins of the Upper Karoo, approximately 40 km southeast of Sutherland, and lie within the Karoo Hoogland Municipality (Namaqua District) of the Northern Cape Province and the Laingsburg Municipality (Central Karoo District) of the Western Cape Province. Associated WEF infrastructure includes wind turbines, an internal road network, on-site substations, powerlines, laydown areas and offices. The two WEFs will be connected to a new Main Transmission Station (MTS) located in the Moordenaars Karoo region c. 24 km west of Merweville, Western Cape, by a new 132 kV transmission line with an associated service track (authorised under DFFE REF: 14/12/16/3/3/1/2457/AM1, 14/12/16/3/3/1/2458 & 14/12/16/3/3/1/2077/AM2). The existing gravel access road from the R354 to the two WEFs will be widened and upgraded. Land parcels concerned in the two WEF and Grid Connection projects are mapped in Figures 1 and 2 and listed in Tables 1 and 2. Detailed descriptions for each project are provided below with maps showing the final layouts presented in Figure 3 and Figure 4.

Desktop and field-based palaeontological heritage assessment reports (PIAs) for the Sutherland WEF and Rietrug WEF grid connections - including the new MTS Substation near Merweville, WEF on-site electrical infrastructure as well as for the upgraded access road to the combined WEF project area - have been submitted in recent years by the present author (Almond 2017a, 2019, 2021a-d). The present report provides a desktop and field-based palaeontological heritage assessment of the combined Rietrug WEF and Sutherland WEF project areas themselves, since this has not been previously undertaken. It includes an evaluation of the proposed final layouts of the two WEFs and their grid connections to the new MTS Substation near Merweville, with separate recommendations regarding each combined WEF and grid connection project for any further palaeontological input, palaeontological monitoring or mitigation, if required.

This PIA report has been commissioned by the independent EAP Nala Environmental Consultants (Contact details: Ms Arlene Singh of Nala Environmental Consultants. Corner of Old Pretoria Main Road & Maxwell Drive, Waterfall, Johannesburg, 2090. Tel: +27 84 277 7074. E-mail: Arlene@veersgroup.com). It will contribute to the pre-construction heritage evaluations ("heritage walkdowns") of the final layouts as well as to the Environmental Management Programmes (EMPrs) for the proposed renewable energy developments (including associated grid connections).

1.1. 140MW Rietrug Wind Energy Facility and Grid Connection Infrastructure – project description

Rietrug Wind Farm (Pty) Ltd received an Environmental Authorisation (EA) (DFFE Ref: 12/12/20/1782/1), dated 10/11/2016), for the development of a 140MW Wind Energy Facility (WEF) and associated infrastructure near Sutherland, and located within the Komsberg Renewable Energy Development Zone (REDZ), in the Northern Cape Province, with further amendments to the EA as stated below:

- Replacement of the first issue EA Reference: 12/12/20/1782/1 issued on: 10 November 2016;
- First Amendment - Amendment of Listed activities on the EA Reference: 12/12/20/1782/1/AM1 issued on 25 November 2016;
- Second Amendment – Amendment of turbine specifications & change of technical details of the proposed facility EA Reference: 12/12/20/1782/2/AM2 issued on: 25 August 2017;
- Third Amendment - Change in contact details of the holder of the EA & selected project description changes EA Reference: 12/12/20/1782/1/AM3 Issued on: 10 March 2020;
- Fourth Amendment – Name correction EA Reference: 12/12/20/1782/1/AM4 issued on 27 July 2021; and

- Fifth Amendment - Amendment to the co-ordinates of the access road EA Reference: 12/12/20/1782/1/AM5 issued on 06 December 2021.

The project will include (as authorised):

- Up to 37 wind turbines with a height of up to 200m and rotor diameter of up to 200m.
- The wind turbines will be connected to another by means of medium voltage cable.
- An internal gravel road network will be constructed to facilitate movement between turbines on site. These roads will include drainage and cabling.
- A hard standing laydown area of a maximum of 10 000 m² will be constructed; and
- A temporary site office will be constructed on site for all contractors, this would be approximately 5000m² in size.
- A 10km portion of the existing access road will be upgraded and widened to a width of 7 metres to facilitate abnormal loads to the Rietrug WEF site

The properties associated with the Rietrug WEF include:

- Portion 1 of Beeren Valley Farm 150;
- Remaining Extent of Beeren Valley Farm 150; and
- Remaining Extent of Nooitgedacht Farm 148.

Rietrug Wind Farm (Pty) Ltd will also share the on-site Acrux substation located on the adjacent Sutherland WEF site.

Rietrug Wind Farm (Pty) Ltd also received EAs for a new proposed onsite substation and associated electrical grid infrastructure, issued on 14 March 2022, for the Sutherland WEF in the Northern Cape Province of South Africa. The EA for the onsite substation has been split into an Independent Power Producer (IPP) Portion (EA Reference: 14/12/16/3/3/1/2458), Switching Station Portion and 132kV powerline (EA Reference 14/12/16/3/3/1/2457/AM1). Both will be included in the layout for the Rietrug WEF for completeness and demonstrate its connection to the National Grid. The authorised Rietrug WEF and Sutherland WEF are located adjacent to each other and will operate as a cluster.

The infrastructure associated with the IPP Portion of the on-site substation located on Remaining Extent of Nooitgedacht Farm 148 includes:

- IPP Portion of the on-site substation (Acrux);
- Laydown area;
- Operation & Maintenance (O&M) Building;
- Fencing of the proposed on-site substation;
- Battery Energy Storage Infrastructure (BESS).

The infrastructure associated with the Switching Station portion of the on-site substation and 132kV Powerline located on Remaining Extent of Nooitgedacht Farm 148 (DFFE Ref: 14/12/16/3/3/1/2457/AM1) includes:

- Switching Station portion of the on-site substation:
- Fencing;
- 132kV Powerline from the proposed Sutherland WEF on-site substation to the third party Koring Main Transmission Substation (MTS) including tower/pylon infrastructure and foundations;
- Connection to the Koring MTS third party substation;
- Service road below the powerline;
- Switching Station portion of the on-site substation.

The Rietrug WEF will also consider the EA for Electrical Grid Infrastructure that supports the Sutherland, Sutherland 2 and Rietrug WEFs, Northern & Western Cape Provinces (DFFE Ref: 14/12/16/3/3/1/2077/AM2), authorised within a 500m grid corridor.

The infrastructure associated with the electrical grid project includes:

- Koring Main Transmission Substation (MTS); including O&M building and laydown area.
- Fencing of the proposed on-site substation
- Overhead 132kV powerline from the Sutherland WEF on-site substation to the Koring MTS;
- Overhead 400kV powerline connecting to the proposed 400kV Koring MTS and an existing 400kV Eskom powerline
- Service roads will be constructed below the powerline (jeep tracks)

The properties associated with the Electrical Grid Infrastructure to support the Rietrug WEF include:

- Remaining extent of Hartebeeste Fontein Farm 147;
- Remaining Extent of Nooitgedacht Farm 148;
- Remaining Extent of Beeren Valley Farm 150;
- Portion 1 of Farm 219;
- Remaining extent of Farm 219;
- Remaining extent of Farm 280;
- Portion 1 of Rheebokkenfontein Farm 4;
- Portion 2 of Rheebokkenfontein Farm 4;
- Portion 2 of De Molen Farm 5;
- Portion 6 of Hamelkraal Farm 16; and
- Portion 7 of Farm Hamelkraal 16
- Remainder of Spitzkop Farm 20

The Rietrug WEF has been awarded preferred bidder status in round 5 of the Renewable Energy IPP Procurement Programme (REIPPPP) and in order to meet financial close requirements and comply with the requirements of the EA (as amended), as per condition 16 and 18 of the EAs, which specifies that the applicant must submit a Final Layout plan and EMPr to the DFFE for written approval prior to commencement of the activity.

Nala Environmental (Pty) Ltd has been commissioned to undertake the Final Layout plan and EMPr approval process associated with the authorised WEF and its authorised grid infrastructure. As per the conditions of the relevant EAs, various specialist pre-construction walkthroughs must be undertaken to inform the placement of infrastructure for the Final Layout.

1.2. 140MW Sutherland Wind Energy Facility and Grid Connection Infrastructure – project description

Sutherland Wind Farm (Pty) Ltd received an EA (DFFE Ref: 12/12/20/1782/2), dated 22/02/2012, for the development of the 140MW Sutherland WEF and associated infrastructure near Sutherland, and located within the Komsberg Renewable Energy Development Zone (REDZ), in the Northern and Western Cape Provinces, with further amendments to the EA as stated below:

- Replacement of the first issue EA Reference: 12/12/20/1782/2 issued on 10 November 2016;
- First Amendment - Amendment of Listed activities on the EA Reference: 12/12/20/1782/2/AM1 issued on 25 November 2016;
- Second Amendment – Amendment of turbine specifications & change of technical details of the proposed facility EA Reference: 12/12/20/1782/2/AM2 issued on: 25 August 2017;

- Third Amendment – Change in contact details of the holder of the EA & selected project description changes EA Reference: 12/12/20/1782/2/AM3 issued on 10 March 2020;
- Fourth Amendment - Name correction EA Reference: 12/12/20/1782/2/AM4 issued on 08 June 2020;
- Fifth Amendment – Extension and name change to SPV EA Reference 12/12/20/1782/2/AM5 issued on 20 July 2021;
- Sixth Amendment - Amendment to the co-ordinates of the access road EA Reference: 12/12/20/1782/2/AM6 issued on 06 December 2021.

The project will include (as authorised):

- Up to 34 wind turbines with a height of up to 200m and rotor diameter of up to 200m.
- The wind turbines will be connected to another by means of medium voltage cable.
- An internal gravel road network will be constructed to facilitate movement between turbines on site. These roads will include drainage and cabling.
- A hard standing laydown area of a maximum of 10 000 m² will be constructed; and
- A temporary site office will be constructed on site for all contractors, this would be approximately 5000m² in size.
- A 10km portion of the existing access road will be upgraded and widened to a width of 7 metres to facilitate abnormal loads to the Sutherland WEF site

The properties associated with the Sutherland WEF include:

- Portion 1 of Beeren Valley Farm 150;
- Remaining Extent of Beeren Valley Farm 150;
- Portion 1 of Boschmanskloof Farm 9;
- Remaining Extent of Nooitgedacht Farm 148.

Sutherland Wind Farm (Pty) Ltd also received EAs for a new proposed onsite substation and associated electrical grid infrastructure, issued on 14 March 2022, for the Sutherland WEF in the Northern Cape Province of South Africa. The EA for the onsite substation has been split into an Independent Power Producer (IPP) Portion (EA Reference: 14/12/16/3/3/1/2458), Switching Station Portion and 132kV powerline (EA Reference: 14/12/16/3/3/1/2457).

The infrastructure associated with the IPP Portion of the on-site substation is located on Remaining Extent of Nooitgedacht Farm 148 and includes:

- An IPP portion of the on-site substation (Acrux);
- Laydown area;
- O&M Building;
- Fencing of the proposed on-site substation;
- BESS.

The infrastructure associated with the Switching Station Portion of the on-site substation and 132kV powerline is located on Remaining Extent of Nooitgedacht Farm 148 (DFFE Ref: 14/12/16/3/3/1/2457/AM1) and includes:

- Switching Station portion of the on-site substation:
- Fencing;
- 132kV distribution line from the proposed Sutherland WEF on-site substation to the Koring MTS third party substation including tower/pylon infrastructure and foundations;
- Connection to the Koring MTS third party substation; and
- Service road below the powerline.

Sutherland Wind Farm (Pty) Ltd has also been issued with an EA for Electrical Grid Infrastructure that supports the Sutherland, Sutherland 2 and Rietrug WEF, Northern & Western Cape Provinces (Ref: 14/12/16/3/3/1/2077/AM2), authorised within a 500m grid corridor.

The infrastructure associated with the electrical grid project includes:

- Koring MTS, including O&M building and laydown area;
- Fencing of the proposed on-site substation;
- Overhead 132kV powerline from the Sutherland WEF on-site substation to the Koring MTS;
- Overhead 400kV powerline connecting to the proposed 400kV Koring MTS and an existing 400kV Eskom powerline;
- Service roads to be constructed below the powerline (jeep tracks).

The properties associated with the Electrical Grid Infrastructure to support the Sutherland WEF include:

- Remaining extent of Hartebeeste Fontein Farm 147;
- Remaining Extent of Nooitgedacht Farm 148;
- Remaining Extent of Beeren Valley Farm 150;
- Portion 1 of Farm 219;
- Remaining extent of Farm 219;
- Remaining extent of Farm 280;
- Portion 1 of Rheebockenfontein Farm 4;
- Portion 2 of Rheebockenfontein Farm 4;
- Portion 2 of De Molen Farm 5;
- Portion 6 of Hamelkraal Farm 16;
- Portion 7 of Hamelkraal Farm 16; and
- Remainder of Spitzkop Farm 20

The Sutherland WEF has been awarded preferred bidder status in round 5 of the Renewable Energy IPP Procurement Programme (REIPPPP), and in order to meet financial close requirements and comply with the requirements of the EAs (as amended), as per conditions 16 and 18 of the EAs, which specifies that the applicant must submit a Final Layout plan and EMPr to DFFE for written approval prior to commencement of the activity.

Nala Environmental (Pty) Ltd has been commissioned to undertake the Final Layout plan and EMPr approval process associated with the authorised WEF and its authorised grid infrastructure. As per the conditions of the relevant EAs, various specialist pre-construction walkthroughs must be undertaken to inform the placement of infrastructure for the Final Layout.

Table 1: List of properties concerned with the Rietrug WEF and Grid Connection Infrastructure projects (see also map Figure 1)

Farm name & number	Project	Registration Province	Division,
Remainder of Nooitgedacht 148	Rietrug WEF	Sutherland, Northern Cape	
Remainder of Beerenvally 150	Rietrug WEF	Sutherland, Northern Cape	
Portion 1 of Beerenvally 150	Rietrug WEF	Sutherland, Northern Cape	
Remainder of Lange Kuil 136	Access Road	Sutherland, Northern Cape	
Portion 1 of Nooitgedacht 148	Access Road	Sutherland, Northern Cape	
Remainder of Hartebeestefontein 147	Grid connection	Sutherland, Northern Cape	
Remainder of Farm 219	Grid connection	Sutherland, Northern Cape	
Portion 1 of Farm 219	Grid connection	Sutherland, Northern Cape	
Remainder of Farm 280	Grid connection	Laingsburg, Western Cape	
Portion 1 of Rheebockenfontein 4	Grid connection	Laingsburg, Western Cape	
Portion 2 of Rheebockenfontein 4	Grid connection	Laingsburg, Western Cape	
Portion 2 of De Molen 5	Grid connection	Laingsburg, Western Cape	
Portion 6 of Hamelkraal 16	Grid connection	Laingsburg, Western Cape	
Portion 7 of Hamelkraal 16	Grid connection & MTS	Laingsburg, Western Cape	
Remainder of Spitzkop 20	Grid connection	Laingsburg, Western Cape	

Table 2: List of properties concerned with the Sutherland WEF and Grid Connection Infrastructure projects (see also map Figure 2)

Farm name & number	Project	Registration Province	Division,
Portion 1 of Boschmans Kloof 9	Sutherland WEF	Laingsburg, Western Cape	
Remainder of Botmanshoek 10	Sutherland WEF	Laingsburg, Western Cape	
Remainder of Nooitgedacht 148	Sutherland WEF	Sutherland, Northern Cape	
Remainder of Beerenvally 150	Sutherland WEF	Sutherland, Northern Cape	
Portion 1 of Beerenvally 150	Sutherland WEF	Sutherland, Northern Cape	
Remainder of Lange Kuil 136	Access Road	Sutherland, Northern Cape	
Portion 1 of Nooitgedacht 148	Access Road	Sutherland, Northern Cape	
Remainder of Hartebeestefontein 147	Grid connection	Sutherland, Northern Cape	
Remainder of Farm 219	Grid connection	Sutherland, Northern Cape	
Portion 1 of Farm 219	Grid connection	Sutherland, Northern Cape	
Remainder of Farm 280	Grid connection	Laingsburg, Western Cape	
Portion 1 of Rheebockenfontein 4	Grid connection	Laingsburg, Western Cape	
Portion 2 of Rheebockenfontein 4	Grid connection	Laingsburg, Western Cape	
Portion 2 of De Molen 5	Grid connection	Laingsburg, Western Cape	
Portion 6 of Hamelkraal 16	Grid connection	Laingsburg, Western Cape	
Portion 7 of Hamelkraal 16	Grid connection & MTS	Laingsburg, Western Cape	
Remainder of Spitzkop 20	Grid connection	Laingsburg, Western Cape	

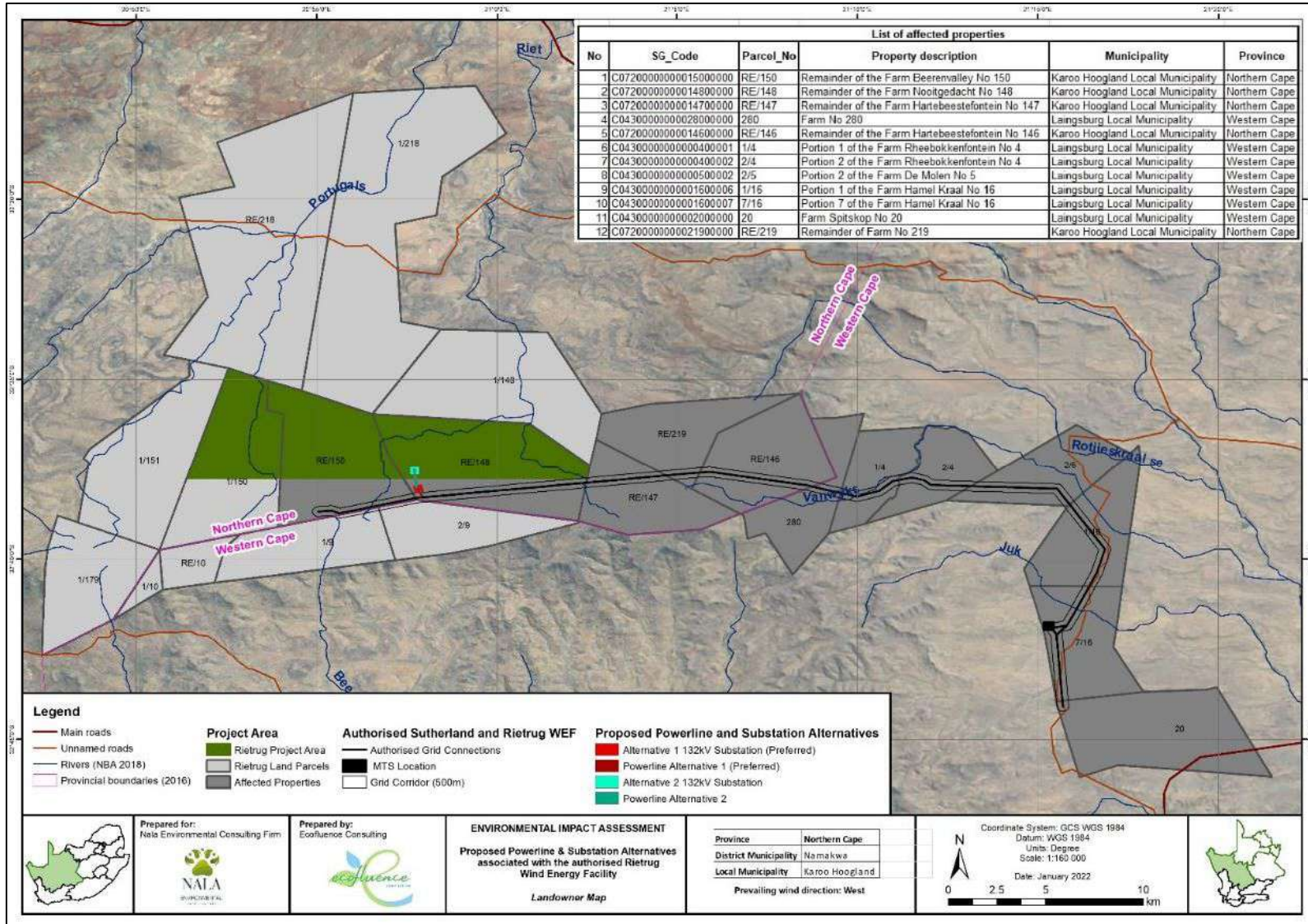


Figure 1: Map showing the location of the authorized Rietrug WEF on the Roggeveld Plateau c. 40 km southeast of Sutherland and its associated Grid Connection to the proposed new MTS in the Moordenaars Karoo near Merweville, together with land parcels concerned, spanning the boundary between the Northern and Western Cape Provinces.

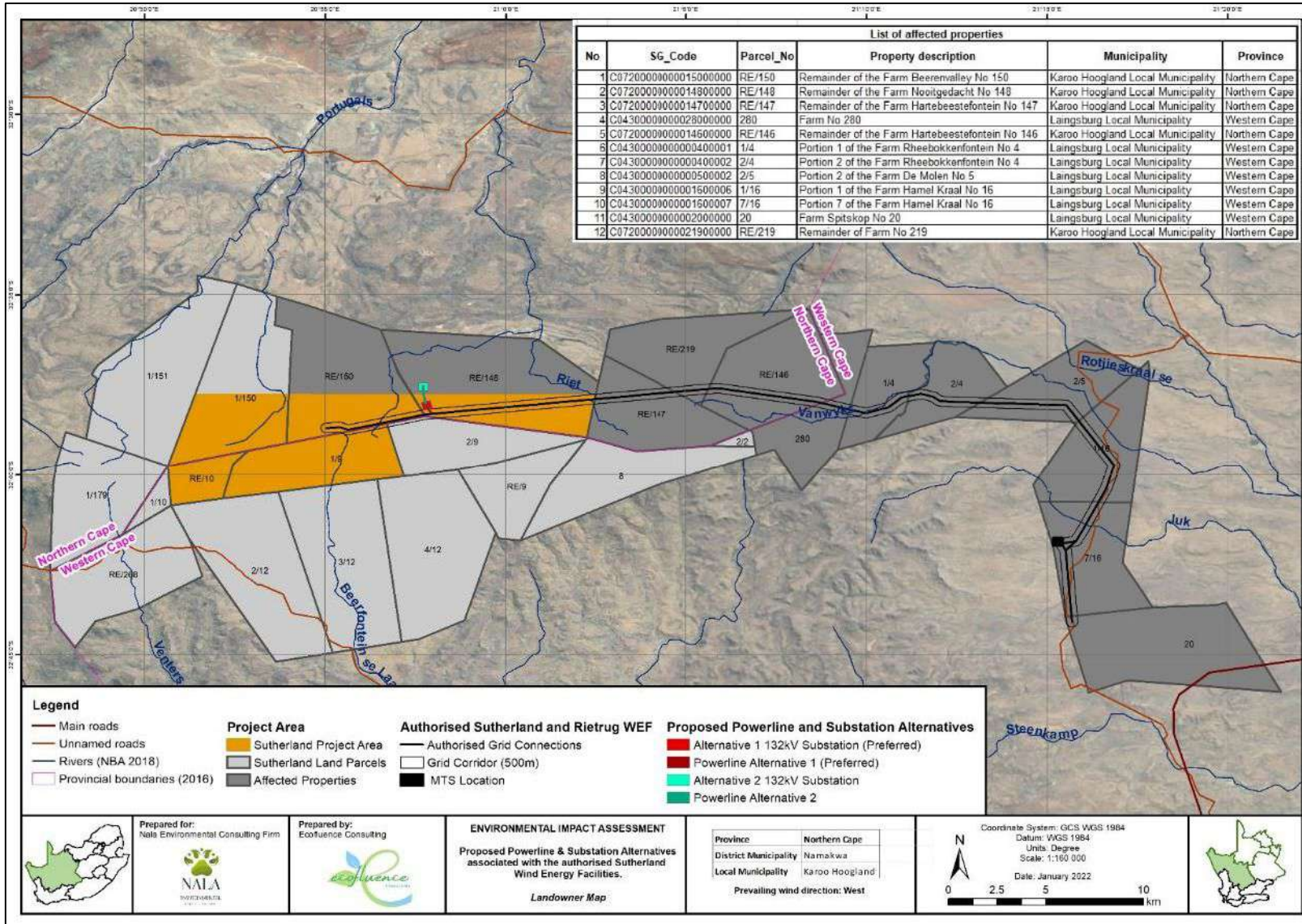


Figure 2: Map showing the location of the authorized Sutherland WEF on the Roggeveld Plateau c. 40 km southeast of Sutherland and its associated Grid Connection to the proposed new MTS in the Moordenaars Karoo near Merweville, together with land parcels concerned, spanning the boundary between the Northern and Western Cape Provinces.

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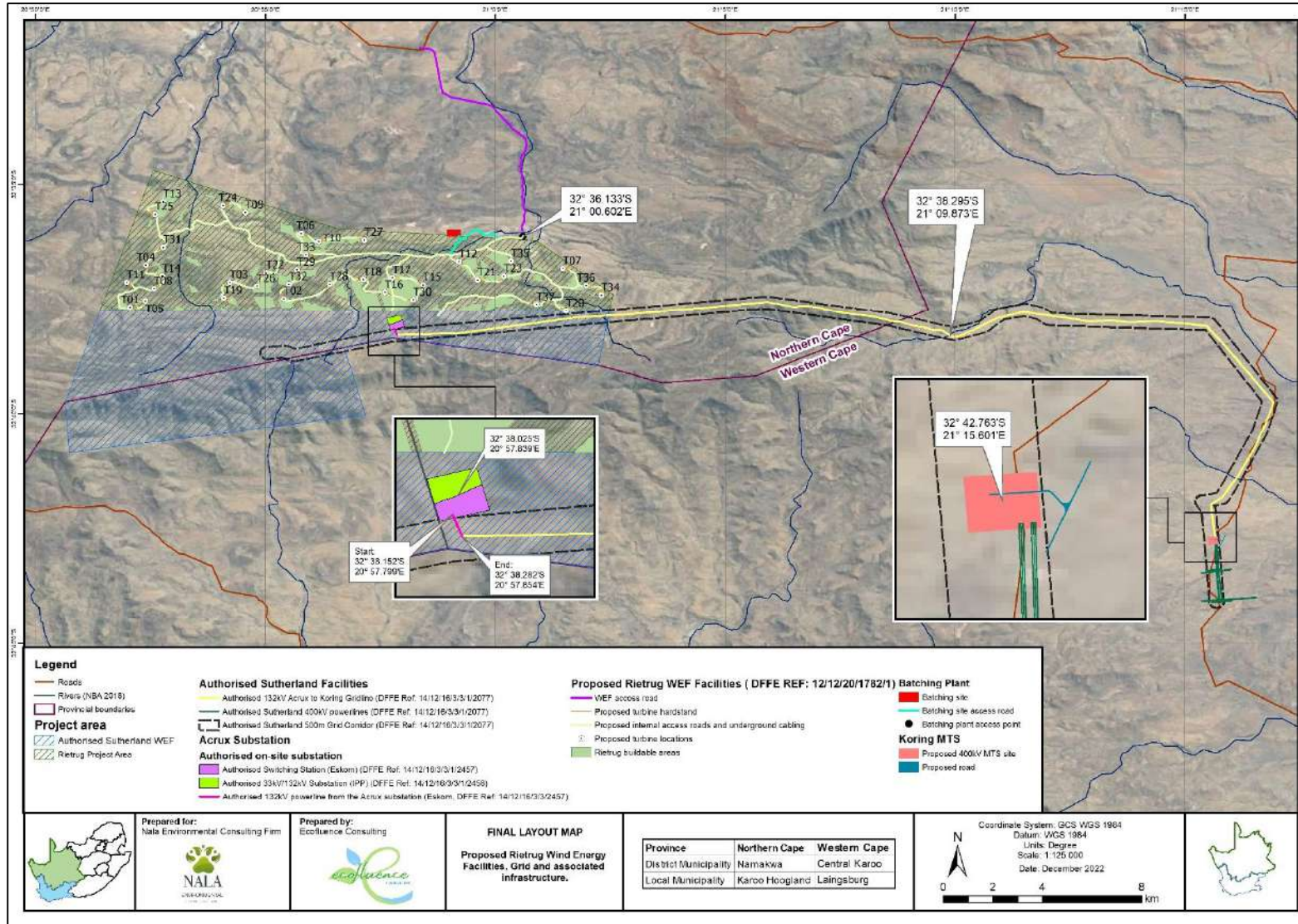


Figure 3: Final layout of the Rietrug WEF

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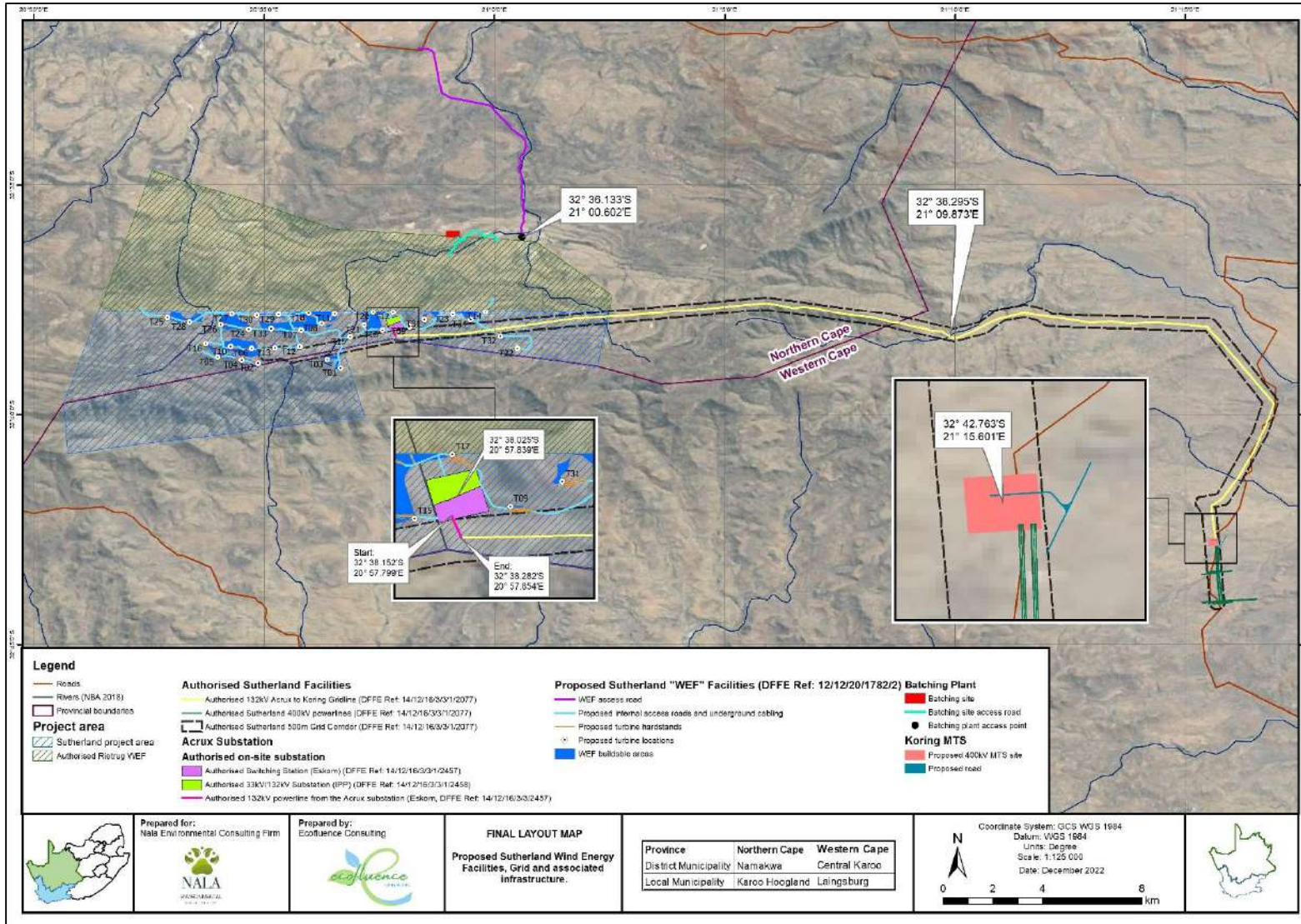


Figure 4: Final layout of the Sutherland WEF

2. DATA SOURCES & METHODOLOGY

This study evaluates the implications for palaeontological heritage resources posed by the proposed final layouts of the authorized Sutherland and Rietrug WEFs near Sutherland, together with their respective Grid Connections, within the Northern and Western Cape Provinces, as shown in map Figures 1 and 2 as well as satellite images (See Figures A1.1 to A1.8 in Appendix 1). It will also inform the Environmental Management Programmes (EMPRs) for these two renewable energy projects and the relevant Generic EMPRs for the associated grid connection infrastructure. These developments fall under Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999). The various categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

The desktop and field-based palaeontological heritage study of the combined Sutherland and Rietrug WEF and Grid Connection Infrastructure project areas was based on the following information resources:

1. A short project outline, kmz files and maps provided by Nala Environmental Consultants;
2. A desktop review of:
 - (a) the relevant 1:50 000 scale topographic maps (3221CA Besemgoedberg, 3220DB Komsberg, 3321CB Ongeluksfontein) as well as the 1:250 000 scale topographic map 3220 Sutherland;
 - (b) Google Earth© satellite imagery;
 - (c) published geological and palaeontological literature, including 1:250 000 geological and metallogenic maps 3220 Sutherland and accompanying sheet explanations (Theron 1983, Cole & Vorster 1999) as well as
 - (d) several previous fossil heritage assessments (PIAs) in the Sutherland – Merweville region by the author listed in the References (especially Almond 2017a, 2019, 2021a-d which relate directly to the Sutherland Cluster WEFs and their grid connections and access roads)
3. The author's field experience with the formations concerned and their palaeontological heritage (*cf* Almond & Pether 2008 and PIA reports listed in the References); and
4. An 11-day field assessment of the combined WEF project area, including portions of all land parcels involved, by the author and two experienced field assistants (*viz.* Dr Marc van den Brandt of Wits University and Ms Madelon Tusenius, *Natura Viva* cc, Cape Town), during the period 10 to 21 February 2022.

Following an initial desktop study based on the resources listed above as well as identification of potentially sensitive bedrock exposures using Google Earth© satellite imagery, the palaeontological site visit involved the examination of representative exposures of bedrock units and superficial sediments within and close to the combined Sutherland and Rietrug WEF project areas, including portions – but *not* all - of the proposed final footprints (*N.B.* most sectors of the project footprints are mantled in palaeontologically insensitive superficial deposits). The primary focus was on mudrock exposures with well-developed palaeosol horizons marked by pedogenic calcrete concretions. This study was undertaken in order to (1) evaluate the palaeontological heritage implications of the proposed WEF's layouts on local fossil heritage resources and (2) evaluate the need, if any, for further palaeontological input, monitoring or mitigation during the final layout design, pre-construction or construction phases of the two WEF developments. Over 200 potentially fossiliferous exposures of Karoo Supergroup bedrocks and Late Caenozoic superficial sediments were examined, with recording of key sedimentary and other geological features of scientific interest as well as of any fossil finds (See Sections 5 and 6 of this report and data table, satellite maps provided in Appendix 1). Fieldwork focussed almost entirely

on the two adjoining WEF project areas themselves, most of which have not been previously assessed. The Grid Connection, MTS and access road project areas have already been covered in some detail by previous PIA studies by the author, as listed above and in the References, and so no further time was invested here during the recent field study.

3. ASSUMPTIONS & LIMITATIONS

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (*e.g.* of commercial mining companies) - that is not readily available for desktop studies.
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

- (a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- (b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

Palaeontological surveys in the Roggeveld Plateau region are generally constrained by bedrock exposure levels due to widespread cover by Late Caenozoic superficial sediments and karroid vegetation. However, numerous good bedrock exposures - including mudrock facies that were the primary target for palaeontological surveying - are available in the present study area. Due to inevitable

time limitations and the huge project areas involved, it was not possible to pay much attention to extensive sandstone outcrop areas, although these may also yield sporadic, scientifically valuable fossil material in the Abrahamskraal Formation outcrop area. Nevertheless, given the involvement of three experienced heritage specialists over 11 days, confidence levels for the present PIA report are rated as Medium.

The season in which the site visit took place has no critical bearing on the palaeontological study, although palaeontological fieldwork in the Upper Karoo following recent heavy rains was occasionally hampered by mud, with the consequent loss of several hours fieldwork time to recover our 4x4 vehicle.

4. LEGISLATIVE CONTEXT

The present combined desktop and field-based palaeontological heritage report for the Sutherland and Rietrug WEF developments falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the EMPs for these two renewable energy projects. The responsible Provincial Heritage Resources Agencies for the Northern and Western Cape are SAHRA and HWC respectively.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

- (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

- (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
- (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
- (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013) and by Heritage Western Cape (2021).

5. GEOLOGICAL CONTEXT

This section of the report focusses on the geology of the adjoining Sutherland WEF and Rietrug WEF project areas on the Roggeveld Plateau. The geological context for the associated grid connections, MTS site and access road from the R354 has already been treated in some detail in the relevant, extensively illustrated reports by the author (e.g. Almond 2017a, 2017b, 2019, 2021d).

The combined Sutherland WEF and Rietrug WEF project area comprises, for the most part, low relief, gently undulating, rocky to sandy and gravelly terrain of the Roggeveld Plateau at elevations between c. 1500-1690 m amsl. Low, W-E trending ridges and outcrops of bare to bouldery sandstone and colluvial to eluvial surface gravels are vegetated by sparse to dense, low karroid shrubby vegetation and grasses (*cf* Figs. 8 to 12). North of the escarpment edge minor, shallowly-incised streams, initially confined to shallow W-E valleys by folded bedrocks, drain northwards into the Portugalsrivier and Rietrivier systems. Areas of lower relief, such as wider valley floors, are mantled by thin to thick, gravelly to sandy or silty alluvial sediments as well as bare, shallow, pan-like areas (*brak-kolle*) with sparse surface gravels. The southern margins of the combined WEF project area extend onto the somewhat elevated edge of the Bontberg - Besemgoedberg Escarpment (e.g. Tafelberg 1666 m amsl, and Boesmanskop at 1715 m amsl, the latter located just outside the WEF project area) which builds a sector of the Great Escarpment of southern Africa. This steep, stepped, south-facing escarpment (Fig. 38) is highly dissected by numerous small stream tributaries that feed southwards *via* the Koringplaasrivier and Dwarsrivier into the major Buffelsrivier drainage system. While much of the Sutherland and Rietrug WEF project areas are mantled by shrubby karroid vegetation, with sparse woody plants mainly confined to larger water courses, there are also substantial areas featuring good surface exposure of sandstone as well as mudrock bedrocks that are highly favourable to palaeontological prospecting.

The geology of the Roggeveld region to the southeast of Sutherland is outlined on the 1: 250 000 scale geology sheet 3220 Sutherland (Theron 1983) (Fig. 6) as well as on the updated 1: 250 000 Sutherland metallogenic map that includes important new stratigraphic detail for the Lower Beaufort Group succession (Cole & Vorster 1999) (Fig. 7). The Sutherland and Rietrug WEF's project area is entirely underlain by Middle Permian continental sediments of the **Lower Beaufort Group** (Adelaide Subgroup, Karoo Supergroup), and in particular the **Abrahamskraal Formation** (Pa) at the base of the Lower Beaufort Group succession (Johnson *et al.* 2006, Day & Rubidge 2014, Cole *et al.* 2016). According to the most recent geological mapping, the project area is almost entirely underlain by the sandstone-dominated **Moordenaars Member** situated towards the top of the Abrahamskraal succession (See stratigraphic column in Fig. 5). The underlying, sandstone-poor **Swaerskraal Member** crops out along the upper slopes of the Escarpment Zone where it is unlikely to be directly impacted by the proposed WEF developments (Figs. 38 to 40). The mudrock-dominated **Karelskraal Member** at the top of the

Abrahamskraal Formation succession builds the upper slopes of Boesmankop to the southeast of the WEF project area and is very well exposed in dissected hilly terrain on farms Portugals Rivier 218 and Nootgedacht 148 north of and outside the area (Figs. 42 & 43). Sandstone-dominated packages of the overlying **Poortjie Member**, which forms the base of the Teekloof Formation, also occur just outside the WEF project area. Small outcrops of this unit cap higher ground to the north as well as along Komsberg Escarpment to the SE (Platberg and Besemgoedberg) where they are seen as darker areas on satellite imagery along the axis of an E-W syncline (Fig. A1.6).

The striking, swirly-stripey or marbled appearance of the WEF project area on satellite images (see Appendix 1) is due to gentle upright folding of the closely-spaced succession of pale, broadly tabular sandstone packages separated by darker mudrock intervals that typify the Mordenaars Member. A series of W-E trending anticlines and synclines with moderate to low bedding dips fold the Karoo Supergroup bedrocks in this region of the Roggeveld Plateau, as clearly shown on satellite images and the geological maps, where they clearly influence patterns of topography, drainage and bedrock outcrop patterns. No Karoo Dolerite Suite (Early Jurassic) or younger intrusions of the Sutherland Suite (Late Cretaceous) are mapped within the present study region. However, volcanism associated with Salpeterkop some 20 km to the NW (geological map Fig. 6) has clearly affected bedrock dips, fracturing and drainage patterns in the wider region. The Beaufort Group bedrocks within the study area are extensively overlain by unconsolidated Late Caenozoic **superficial deposits** which are largely unfossiliferous and are accordingly not an important focus for the present palaeontological study.

		West of 24° E			East of 24° E
		Le Roux (1985)	This study		
PERMIAN	BEAUFORT GROUP	Teekloof Fm.			
			Steenkampsvlakte Member.		Balfour Fm.
			Oukloof Member		
			Hoedemaker Member		
			Poortjie Member		Middleton Fm.
	Abrahamskraal Fm.		Karelskraal M.	Karelskraal M.	
			Moordenaars M.	Moordenaars M.	
			Wilgerbos M.	Swaerskraal M.	
			Koornplaats M.	Koornplaats M.	Koonap Fm.
			Leeuvlei M.	Leeuvlei M.	
			Combrinkskraal M.	Grootfontein M.	
				Combrinkskraal M.	
			ECCA		Waterford Formation

Figure 5: Revised lithostratigraphy of the Abrahamskraal Formation (Lower Beaufort Group) from Day & Rubidge (2014). Members represented in the wider region of the Sutherland & Rietrug WEFs on the Roggeveld Plateau are outlined in red. Only the Middle Permian Moordenaars Member is likely to be directly impacted by the two proposed WEF developments. The Koornplaats Member is also represented within the grid connection project area (cf Almond 2019, 2021d).

The geology of the various sedimentary rock units represented in this portion of the Roggeveld Plateau have been described and illustrated, with extensive references, in previous PIA reports by the author (cf Almond 2017, 2019, 2021a-d), to which the interested reader is directed. Representative exposures

of the main rock units encountered within, as well as on the periphery of, the Sutherland & Rietrug WEF's project areas are illustrated below in Figures 8 to 49, together with explanatory figure legends.

The Moordenaars Member channel sandstones – which underlie a high proportion of the WEF footprints - are generally laterally extensive, single-storey and highly tabular in geometry, with occasional thicker, broadly lenticular channel bodies (e.g. Swaelkrans) (Figs. 12-14, 43). The component impure sandstones (wackes) are pale brown to yellowish brown, well-sorted, fine to medium-grained and often friable, with occasional occurrences of fine-scale heavy mineral lamination. Emergent exposures of channel sandstones within the project area often show well-developed joint sets, bouldery to cobbly corestone weathering, local development of karstic weathering features (crocodile-skin weathering, case hardening, basin-like solution hollows etc), platy exfoliation as well as lichen etching; many surfaces are patinated by carpets of living lichens (Fig. 19). Jointed sandstone domes and floors are mantled with rounded corestones or scabby, platy sandstone clasts. Steep scarp or riverine cliff sections expose tabular-bedded channel sandstones, variously massive or with horizontal, flaggy bedding or low-angle tabular cross sets. The bases of the sandstone units are usually sharp, occasionally displaying erosive gullying accompanied by thin, lenticular, highly ferruginised breccio-conglomerates. These are composed of mudflake intraclasts, small calcrete concretions and sparse fragments of reworked bone, rare teeth and concentrations of rusty wood moulds (Section 6). Thicker (several dm.) breccia units may show well-developed cross-bedding, pointing to more extreme episodes with dramatic denudation of the floodplain (Fig. 15). Heterolithic packages of thinly interbedded, high tabular wacke and mudrock are probably riverbank / levee deposits or proximal crevasse splay deposits and occasionally show sections through slot-like crevasse incisions generated during overbank flooding events.

Numerous, good but often isolated exposures of Moordenaars Member mudrocks are scattered across the WEF project area – along drainage lines (e.g. riverine cliffs), erosion gullies and locally building gentle low hillslopes which are ideal for fossil prospecting. The grey-green and purple-brown mudrock facies vary from massive and hackly-weathering or crumbly to thinly laminated or medium-bedded. They contain common palaeosol horizons marked by small, pebble-sized, greyish calcrete concretions (sometimes with septarian cracking) or irregular to spheroidal, cobble-sized, brownish concretions of ferruginous carbonate. Meter-scale lenses and blobs of rusty-brown *koffieklip* – diagenetic ferruginous carbonate associated with high water tables – are common within sandstone and mudrock facies and may be associated with concentrations of fossil plant debris.

Thin (one to a few dm), lenticular, highly ferruginised, pebbly breccias may be associated with thin (non-channel) sandstone beds within overbank mudrock successions. They may possibly have accumulated in and around ponds and vegetated wetland depressions on the ancient floodplain. They are commonly associated with abundant, rusty brown moulds of fossil woody material as well as disarticulated, fragmentary reworked bones, ferruginised mudflakes and pedogenic calcrete concretions, all enclosed within a sandy matrix (Figs. 22 & 97).

Thick (c. 10m) packages of massive, crumbly, purple-brown and grey-green overbank mudrocks with few, thin or no crevasse splay sandstones occur within the Moordenaars Member. Although they may give rise to extensive promising exposures, most are disappointingly unfossiliferous, apart from rare tetrapod and lungfish burrow casts; perhaps they are a distal floodplain or even aeolian-influenced facies. Occasional lonestones of exotic, extra-basinal pebbles and cobbles have been recorded from such beds. They were possibly transported into the Karoo Basin on the roots of floating logs or by floating river ice during winter (cf Almond 2017, 2019) (Fig. 30).

Packages of playa lake or distal floodplain pond facies are characterised by massive to laminated or thin-bedded, sometimes dark grey, fine-grained mudrocks, upward-coarsening and -thickening cycles capped by gradationally-based sandstones, wave-rippled sandstone bed tops (locally associated with reedy plant stem casts and invertebrate trace fossils), siliceous gypsum rose pseudomorphs,

sandstone- or gypsum-infilled desiccation cracks, slickensided surfaces, soft-sediment loading, and horizons of lungfish burrow casts (See Section 6). Occasional, straight to sinuous, sharp-edged, prominent-weathering, subvertical neptunian dykes (c. 15 cm wide) infilled with wacke and reworked mudflakes (sometimes in layers) reflect sudden dewatering events penetrating mottled, desiccation cracked mudrocks, possibly triggered by seismic activity (Fig. 36). Occasional episodes of volcanism are reflected in distinctive, sharply-defined, laterally persistent beds (up to several dm thick) of pale yellowish-green to orange-brown weathering, siliceous-splintery, prominent-weathering tuffite, sometimes coarser-grained and speckled (possible feldspars) and showing curious soft-sediment deformation (possibly loading within a lake or pond). These tuffites appear within the uppermost Abrahamskraal Formation as pale zones up to several meters thick (with several component tuffite bands) traversing the landscape on satellite images (e.g. N slopes of Boesmansberg and N margins of WEF project area). Horizons and lobes of fine-grained diamictite composed of small, floating mudchips within a sandy matrix, often ferruginised, are probably of debris flow origin.

Several good exposures of the mudrock-dominated **Swaerskraal Member** are seen below the escarpment edge on Farm Boschmans Kloof 1/9, although the stratigraphy here may be complicated by folding (and perhaps faulting) (Figs. 38 to 40). Purple-brown with subordinate grey-green and dark grey mudrocks predominate here, with occasional thin channel wackes, heterolithic packages of thinly interbedded siltstone and siltstone, calcrete pedocrete horizons and lenses of rusty-brown *koffieklip*. Excellent hillslope exposures of **Karelskraal Member** sandstones and mudrocks are available on Nootgedacht 148 to the north of and outside the combined WEF project area (Figs. 42 to 43) where they are locally intersected by the access road (See Almond 2021a-b). The Karelskraal Member outcrop area towards the crest of Boesmankop in the SE lies almost entirely outside the present Sutherland Cluster project area and will not be directly impacted by the proposed WEF developments.

The Beaufort Group sandstone bedrocks within the project area are largely mantled by unconsolidated **Late Caenozoic superficial deposits** (Figs. 44 to 49). These comprise eluvial (downwasted) gravels composed of rounded sandstone corestones (up to boulder-sized, sometimes split by frost action or thermoclastis), angular, platy slabs and blocks of wacke, coffee-brown ferruginised sandstone, pedocrete concretions, vein quartz and ferricrete glaeboles and also locally by loose quartz sands that have been reworked into low dunes by aeolian processes. Elsewhere the bedrocks are often covered by eluvial and colluvial gravels (angular to subrounded clasts mainly of wacke, calcrete concretions, vein quartz, tuffite, rare calchedony etc), hillwash on lower slopes, gravelly to silty stream and river alluvium which may reach a thickness of several meters along major drainage lines (e.g. the Rietrivier and its tributaries), fine-grained sheetwash and pan sediments, minor Quaternary to Recent pedocretes (calcretes) and various sandy to gravelly skeletal soils. Older – probably Pleistocene - alluvial sands and gravels may be consolidated by calcretisation while unconsolidated, rubbly coarse “High Level Gravels” are elevated several (< 10) meters above present day river beds along the banks of the Rietrivier. Unconsolidated sands along drainage lines may have been locally reworked by aeolian action, especially during drier periods within the Pleistocene.

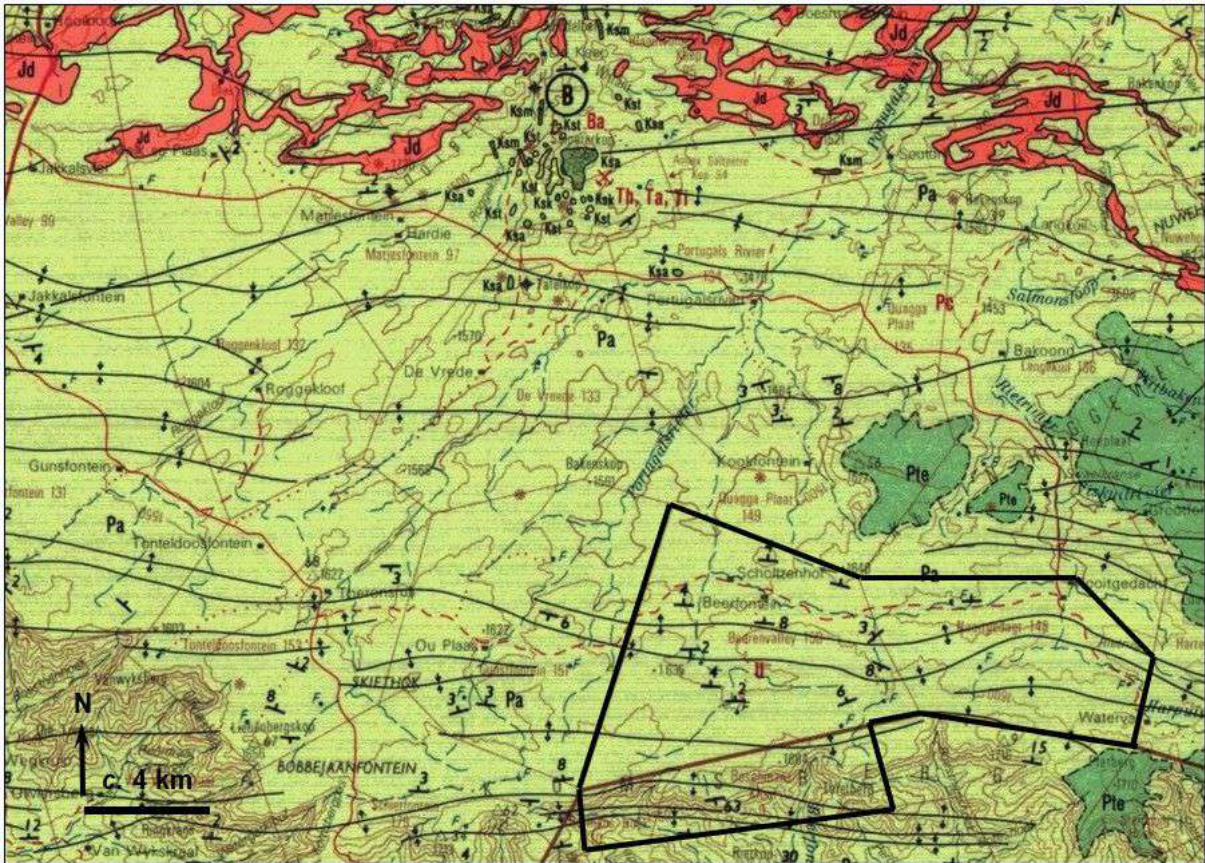


Figure 6: Extract from 1: 250 000 geological sheet 3220 Sutherland (Council for Geoscience, Pretoria) showing the Sutherland WEF and Rietrug WEF combined project area (black polygon) in the Roggeveld Plateau region to the north of and along the Great Escarpment, some 40 km southeast of Sutherland, Northern and Western Cape. No historical fossil sites are mapped here.

The main bedrock units represented in the broader study region include:

Pa (pale green) = Abrahamskraal Formation (Lower Beaufort Group) – Swaerskraal, Moordenarskaroo and Karelskraal Members

Pte (dark green) = Teekloof Formation (Lower Beaufort Group) – Poortjie Member

Jd (red) = Karoo Dolerite Suite (Early Jurassic)

Ksa (green) – Sutherland Suite igneous intrusions and volcanics (Late Cretaceous)

N.B. Late Caenozoic superficial deposits that are not mapped at 1: 250 000 scale also occur here, including alluvium, colluvium, surface gravels, pan sediments, soils and calcrete.

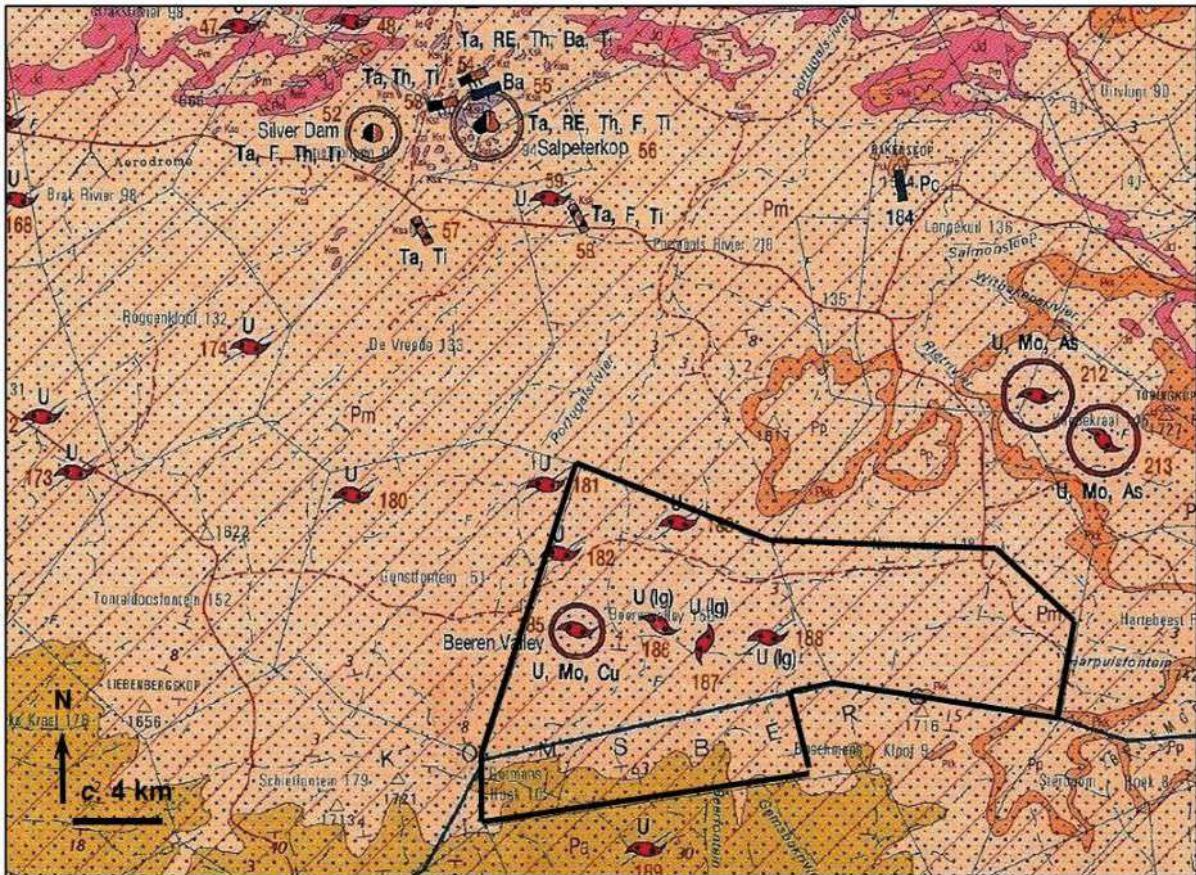


Figure 7: Extract from the 1: 250 000 Sutherland metallogenic map (Cole & Vorster 1999) which differentiates between some of the younger members of the Abrahamskraal and Teekloof Formations in the broader Sutherland & Rietrug WEF project areas (black polygon), viz: Moordenaars Member (Pm with stipple, pale orange), Karelskraal Member (Pkk, dark orange with stipple) and Poortjie Member (Pp, pale orange with stipple). Abrahamskraal members below the Moordenaars Member (including the Koornplaats and Swaerskraal Members) are shown undifferentiated in brown. According to the map, the WEF project area is almost entirely underlain by the Moordenaars Member.

Details of mapped mineral occurrences within the Sutherland & Rietrug WEF's project area (red symbols, U – uranium, Mo – molybdenum, Cu - copper) are provided by Cole & Vorster (1999). It is noted that, according to the Mineral and Petroleum Resources Development Act, 2002, the company proposing the Sutherland Cluster wind farm developments is required to submit a report from the Council for Geoscience on the mineral potential of the development area to the Department of Mineral Resources (Dr Doug Cole, Council for Geoscience, Bellville, pers. comm. 2015).



Figure 8: Gently rolling, hilly landscape of the Roggeveld Plateau seen within the Sutherland & Rietrug WEF project area, here on Farm RE/148 looking south-eastwards towards Boesmankop along the Komsberge Escarpment edge.



Figure 9: View eastwards across the southern portion of Farm RE/148 showing extensive, pale, gently dipping channel sandstone surface of the Moordenaars Member. Much of the WEF infrastructure will be established in similar terrain.



Figure 10: View southwards on Farm RE/148 towards Boesmankop showing several prominent-weathering channel sandstones of the upper Moordenaars Member *plus* well-exposed overbank mudrocks of the same member in the middle ground. Most recessive weathering mudrock intervals are covered by colluvial and alluvial deposits as well as soils.

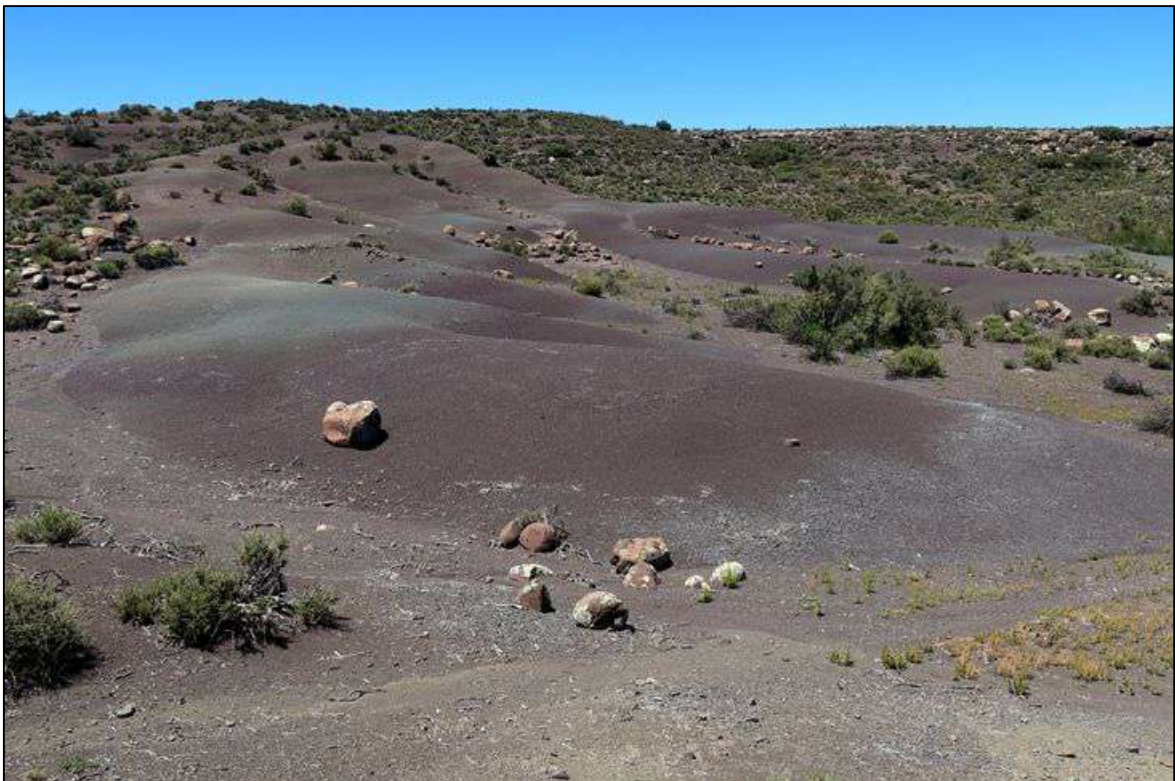


Figure 11: Gently hilly exposures of purple-brown and grey-green overbank mudrocks of the Moordenaars Member on Farm RE/148 – ideal terrain for fossil prospecting!



Figure 12: Typical thin (single-storey), laterally-persistent, tabular channel sandstones of the Moordenaars Member building low, south-facing scarps on the northern sector of Farm RE/148.



Figure 13: Close-up of a riverine *kranz* of tabular-bedded, Moordenaars Member channel wackes along the Rietrivier south of Nooitgedacht homestead on Farm RE/148. The channel infill is erosive, sharp-based with an apron of colluvial debris mantling underlying overbank mudrocks.



Figure 14: Lenticular channel sandstone body of the Moordenaars Member sharply incised into tabular, thin-bedded, purple-brown overbank mudrocks, tributary of the Rietrivier on Farm RE/148.



Figure 15: Cross-bedded package of purple-brown mudflake intraclast breccia towards the base of a Moordenaars Member channel wacke, stream gully exposure on the NE slopes of Boesmankop, Farm RE/148 (hammer = 30 cm). These beds yielded an isolated pareiasaur tooth (Fig. 77).



Figure 16: Lenticular, rusty-brown basal breccias beneath a channel sandstone on Farm RE/148 (hammer = 30 cm). The breccias are composed of ferruginised mudrock intraclasts and reworked calcrete glaebules in a sandy matrix with sparse fragments of reworked fossil bone and rusty-brown wood moulds.



Figure 17: Typical weathered and eroded sandstone scenery – seen here on Farm RE/148 - with poorly-sorted, subrounded blocks of downwasted wacke and angular eluvial debris.



Figure 18: Platy, angular sandstone clasts overlying a channel sandstone body in a shallow bedrock pan on RE/150. Weathering processes here may include rock-splitting by salt crystallisation as well as ice-wedging.



Figure 19: Well-rounded, lichen-patinated corestones on the margins of a channel wacke on Farm 1/150. Biological etching by lichen acids as well as karstic solution are clearly important weathering processes in the Roggeveld Plateau region.



Figure 20: Excellent, low hilly exposures of Moordenaars Member mudrocks on Farm 1/150 (seen in background) with eluvial sandstone corestones in the foreground.



Figure 21: Good stream gully exposures of upper Moordenaars Member channel sandstones and thick, purple-brown mudrock packages on the north-facing slopes of Boesmankop, Farm RE/148.



Figure 22: Thin sandstone bed and associated pebbly breccias (on left) within a mudrock package, Moordenaars Member, Farm RE/148 (hammer = 30 cm). The breccias here contain numerous reworked blocks of fossil bone as well as rusty moulds of fossil wood which may have accumulated in and around a floodplain pond.



Figure 23: Sandstone palaeosurface with well-developed small-scale wave ripples generated by wind action across a shallow floodplain pond, Farm 1/150 (scale is 15 cm long). Such surfaces are a focus of searches for trace fossils of invertebrates, fish and tetrapod trackways.



Figure 24: Moordenaars Member channel wacke sharply overlain by a thick purple-brown overbank mudrock package, Farm 1/150.



Figure 25: Excellent riverine cliff sections through Moordenaars Member tabular-bedded, grey-green and purple-brown mudrocks capped by channel sandstones, tributary stream of the Rietrivier on Farm RE/148.



Figure 26: Well-developed, rusty-brown lens (c. 20-30 cm thick) of diagenetic ferruginous carbonate - perhaps indicative of locally high floodplain water tables - within grey-green and purple-brown overbank mudrocks of the Moordenaars Member, banks of a tributary of the Rietrivier, Farm RE/148.



Figure 27: Well-developed palaeosol (ancient soil) horizon marked by irregular to sphaeroidal, brownish-weathering ferruginous calcrete concretions within Moordenaars Member overbank mudrocks, banks of the Rietrivier on Farm RE/148 (hammer = 30 cm).



Figure 28: Surface concentration of weathered-out, ferruginous pedocrete concretions overlying Moordenaars Member mudrocks on Farm 1/ 150. Concentrations of bone breccia within calcrete concretions have been recorded here (Fig. 54).



Figure 29: Excellent hillslope exposures of a thick, purple-brown overbank mudrock package within the upper Moordenaars Member, Farm RE/148. In most cases, this widely occurring facies has proved to be very sparsely fossiliferous, however.



Figure 30: Exceptional concentration of pebble- to cobble-sized exotic clasts – possibly andesitic - within the thick package of fine-grained mudrocks of the Moordenaars Member on Farm RE/148 shown above (image abstracted from Almond 2019) (scale in cm and mm). These are among the largest clasts recorded within the Lower Beaufort Group in the SW Karoo and were possibly transported downstream and onto the floodplain by floating tree roots during a major flood event.



Figure 31: Thin crevasse splay sandstone showing evidence of loading into overbank mudrocks (possibly lacustrine), Moordenaars Member on Farm 1/150.



Figure 32: Thin-bedded, heterolithic river bank or levee facies within the Moordenaars Member showing slot-like incisions probably generated by crevasse splays during overbank flooding events (arrowed), Farm RE/148.



Figure 33: Highly tabular, lacustrine succession within the Moordenaars Member comprising thin-bedded, dark grey siltstones and loaded wackes, Farm RE/148 (hammer = 30 cm). Wave rippled surfaces with invertebrate traces as well as horizons of lungfish burrow casts occur in the vicinity.



Figure 34: Massive to tabular-bedded siltstones and fine-grained wackes of the Moordenaars Member showing horizons of calcrete concretions (arrowed below) as well as upward-coarsening packages of possible lacustrine origin, banks of the Rietrivier on Farm RE/148. Lungfish burrow casts occur along strike.



Figure 35: Prominent, blocky-weathering band of pale yellow-green, siliceous tuffite (mixed volcanic ash and terrigenous sediment) within the upper Moordenaars Member on Farm RE/150 (hammer = 30 cm). Tuffite exposures at a similar stratigraphic level on the southern margins of the combined WEF project area indicate that these ash-rich horizons are laterally very extensive.



Figure 36: Straight to sinuous exposure of a thin neptunian dyke infilled with sandstone and mudflake breccia intruding overbank mudrocks of the Moordenaars Member on the bed of the Rietrivier near Nooigedacht homestead, Farm RE/148 (hammer = 30 cm).



Figure 37: Enigmatic, pillar-like sandstone structure embedded within crumbly overbank mudrocks of the Moordenaars Member on the northern slopes of Boesmankop, Farm RE/148 (scale = c. 15 cm). This might be a dewatering structure, tree trunk cast or expanded base of a lungfish burrow.

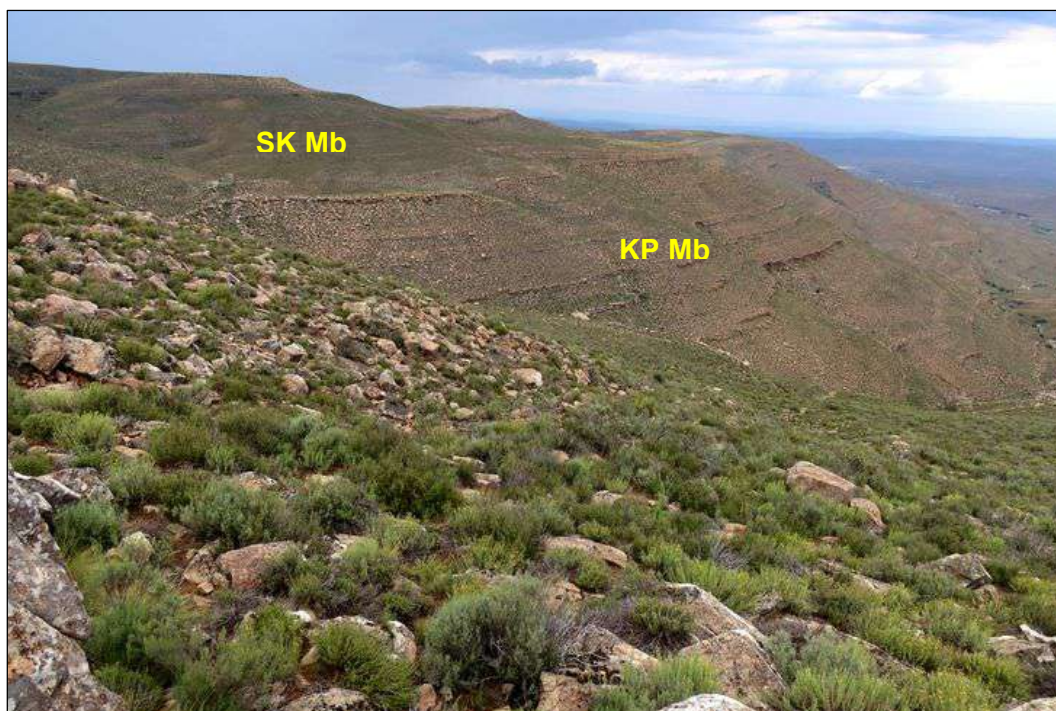


Figure 38: View towards the SW along the Komsberg – Besemgoedberg Escarpment on Farm 1/9 showing Abrahamskraal Formation subunits beneath the Moordenaars Member which underlies almost all of the combined Sutherland & Rietrug WEF project area. The lower package of closely-spaced channel sandstones is the Koornplaats Member (KP Mb) while the overlying thick package of purple-brown mudrocks is the Swaerskraal Member (SL Mb) (See stratigraphic column in Fig. 5).



Figure 39: Thick packages of crumbly, dusky purple-brown mudrocks and thin, greyish-green crevasse-splay wackes of the Swaerskraal Member exposed on the upper escarpment slopes on Farm 1 /9.



Figure 40: Stream gully section through heterolithic package of thinly interbedded siltstone and fine-grained wacke with occasional brownish pedocrete concretions that is assigned to the Swaerskraal Member, Farm 1/9 (hammer = 30 cm).



Figure 41: Moderately steep bedding dips are developed locally within the Abrahamskraal Formation bedrocks due to open folding along west-east hinge lines, seen here south of the farmstead on Farm RE/148. This folding (and perhaps related faulting) has strongly influenced the outcrop patterns the Moordenaars Member packages within the combined Sutherland & Rietrug WEF project area, as well seen on satellite images.

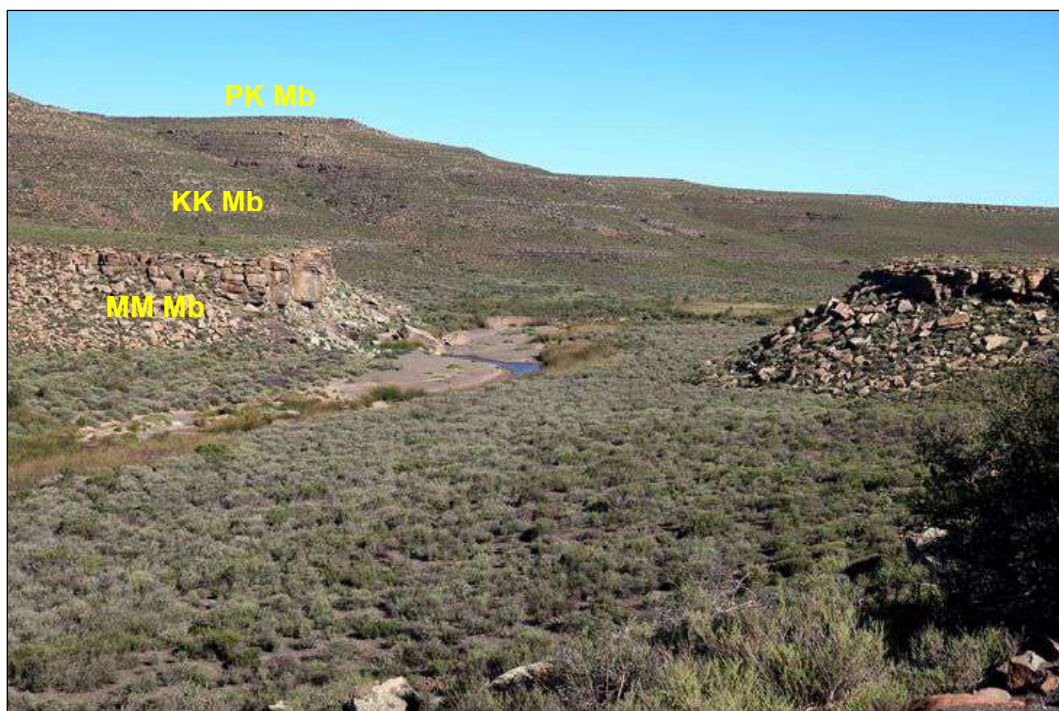


Figure 42: Lenticular channel sandstones at the top of the Moordenaars Member (MM), sharply overlain by the recessive weathering Karelskraal Member (KK) with Poortjie Member sandstones on the skyline (PK), Rietrivier Valley at Swaelkrans, c. 4 km north of the combined Sutherland & Rietrug WEF project area.



Figure 43: Excellent hillslope exposures of the mudrock-dominated Karelskraal Member on Farm Nootgedagt 148, c. 4.4 km north of the combined Sutherland & Rietrug WEF project area. Apart from well-preserved tetrapod burrows, vertebrate remains are very scarce in these beds – possibly a consequence of the end Middle Permian Extinction Event.



Figure 44: Coarse, rubbly “High Level Gravels” with some well-rounded wacke boulders and perched well above present day river levels on the edge of the Rietriver Valley, Farm RE/148. These ancient relict alluvial deposits are probably Pleistocene in age.



Figure 45: Basal gravelly and overlying sandy alluvium exposed in the banks of the Rietrivier on Farm RE/148 (hammer = 30 cm). Semi-consolidated, calcretised older alluvial deposits in the Karoo region may contain trace fossils (e.g. termitaria, rhizoliths), freshwater molluscs as well as rare concentrations of mammalian bones and teeth.



Figure 46: Thick prism of coarse, angular breccia of wacke mantling the northern slopes of the Boesmankop on Farm RE/148. On steeper hillslopes such pervasive colluvial deposits often completely mask underlying, potentially fossiliferous Abrahamskraal Formation mudrocks.



Figure 47: Surface carpet of poorly-sorted, angular wacke clasts of eluvial origin overlying sandy soils, as widely seen across extensive lower-lying sectors of the combined Sutherland & Rietrug WEF project area, seen here on Farm RE/148.



Figure 48: Gullied exposure of extensive, unconsolidated, mixed gravelly to sandy colluvial deposits mantling Abrahamskraal Formation bedrocks in footslope areas, Farm 1/ 150.



Figure 49: Shallow pan or *brak-koll* floored by fine, pale silty deposits with sparse surface gravels, Farm 1/150. The surface gravels in such settings may sometimes include sparse sheet-washed fragments of fossil bones and wood.

6. PALAEOLOGICAL HERITAGE CONTEXT

The palaeontology of the Roggeveld Plateau region in the vicinity of the Sutherland and Rietrug WEF project area has been outlined with extensive references in recent PIA reports by the author (e.g. Almond 2017a, 2019, 2021a-d). Fossil biotas represented within the project area are referred to the late Middle Permian (Capitanian) **Tapinocephalus Assemblage Zone**. The main categories of fossils recorded within the *Tapinocephalus* fossil biozone (Keyser & Smith 1977-78, Anderson & Anderson 1985, Smith & Keyser 1995a, MacRae 1999, Bamford 1999, Rubidge 1995, 2005, Nicolas 2007, Almond 2010a, Smith *et al.* 2012, Day 2013a, Day 2013b, Day *et al.* 2015b, Marchetti *et al.* 2019, Day & Rubidge 2020) include:

- isolated petrified bones as well as rare articulated, usually partial skeletons of tetrapods (*i.e.* air-breathing terrestrial vertebrates) such as true **reptiles** (notably large herbivorous pareiasaurs like *Bradysaurus*, small insectivorous millerettids, the tortoise-like *Eunotosaurus*), rare pelycosaurs, and diverse **therapsids** or “mammal-like reptiles” (numerous genera of large-bodied herbivorous and carnivorous dinocephalians (e.g. predatory anteosaurs, thick-skulled tapinocephalids), herbivorous dicynodonts (mainly small-bodied forms like *Diictodon*), flesh-eating biarmosuchians, rare, small gorgonopsians and a range of insectivorous to carnivorous therocephalians, including wolf-sized apex predators of their day) (Fig. 50);
- aquatic vertebrates such as large, superficially crocodile-like **temnospondyl amphibians** (*Rhinesuchus*, usually disarticulated), and **palaeoniscoid bony fish** (*Atherstonia*, *Namaichthys*, often represented by scattered scales rather than intact fish);
- freshwater **bivalves** (*Palaeomutela*);
- **trace fossils** such as tracks and burrows of worms, arthropods, lungfishes and tetrapods, coprolites (fossil droppings), fish swimming trails, and plant stem or root casts;
- **vascular plant remains** (usually sparse and fragmentary), including leaves, twigs, roots and petrified woods (“*Dadoxylon*”, now referred to *Australoxylon* and *Prototaxoxylon*) of the *Glossopteris* Flora, especially glossopterid trees and reedy arthropytes (horsetail ferns) with rare lycopods.

More specifically, the uppermost part of the Abrahamskraal succession - including the Swaerskraal, Moordenaars and Karelskraal Members represented within the present Sutherland & Rietrug WEF project area - is characterised by fossil biotas of the recently defined **Diictodon – Styraocephalus Subzone**. This late Middle Permian biozone extends into the lower part of the Poortjie Member and has an estimated age of 262-260 Ma, *i.e.* late Capitanian (Day & Rubidge 2020). Impoverishment of fossil assemblages, notably with few dinocephalians, within the upper part of the subzone *above* the Moordenaars Member are associated with the catastrophic, global end-Capitanian ecological crisis and Mass Extinction Event (*cf* Day *et al.* 2015).

Previous mapping of vertebrate fossil sites within the Main Karoo Basin by Keyser and Smith (1977-1978) as well as Nicolas (2007) indicates that very few sites have been previously recorded within the present study area (Fig. 51). No historical fossil sites are indicated in the Sutherland or Rietrug WEF’s project areas on the published 1: 250 000 geological map (Fig. 6). A sparse scatter of fossil sites have been mapped within mudrock facies of the Moordenaars and Karelskraal Members of the Abrahamskraal Formation along the WEF access road from the R354 and on Nooitgedacht Farm 148 by Almond (2017a-b, 2019, 2021a-c). These Middle Permian fossils comprise weathered-out concentrations of large tetrapod postcranial material (dinocephalian / pareiasaur), often highly weathered and sun-cracked, fragmentary skulls of small dicynodonts, unidentifiable disarticulated “rolled bones”, horizons of lungfish burrow casts, several tetrapod burrow casts, low diversity

invertebrate burrow assemblages, poorly-preserved fossil wood within ferruginised floodplain pond breccias and impressions of equisetalean ferns. Previous field-based surveys of the WEF project areas, 132 kV grid connection corridor and MTS near Merweville by Almond (2019, 2021d) recorded a limited number of fossil sites within the Abrahamskraal Formation. These include postcranial bones - often fragmentary and poorly preserved - of unidentified large-bodied tetrapods (pareiasaurs / dinocephalians) in surface float and weathering out of basal channel breccias, a large tooth (possibly dinocephalian), invertebrate traces on sandstone palaeosurfaces and within *koffieklip*, ferruginised woody moulds within channel wackes as well as locally abundant but often poorly preserved blocks of silicified wood, especially weathering out from the Koornplaats Member.

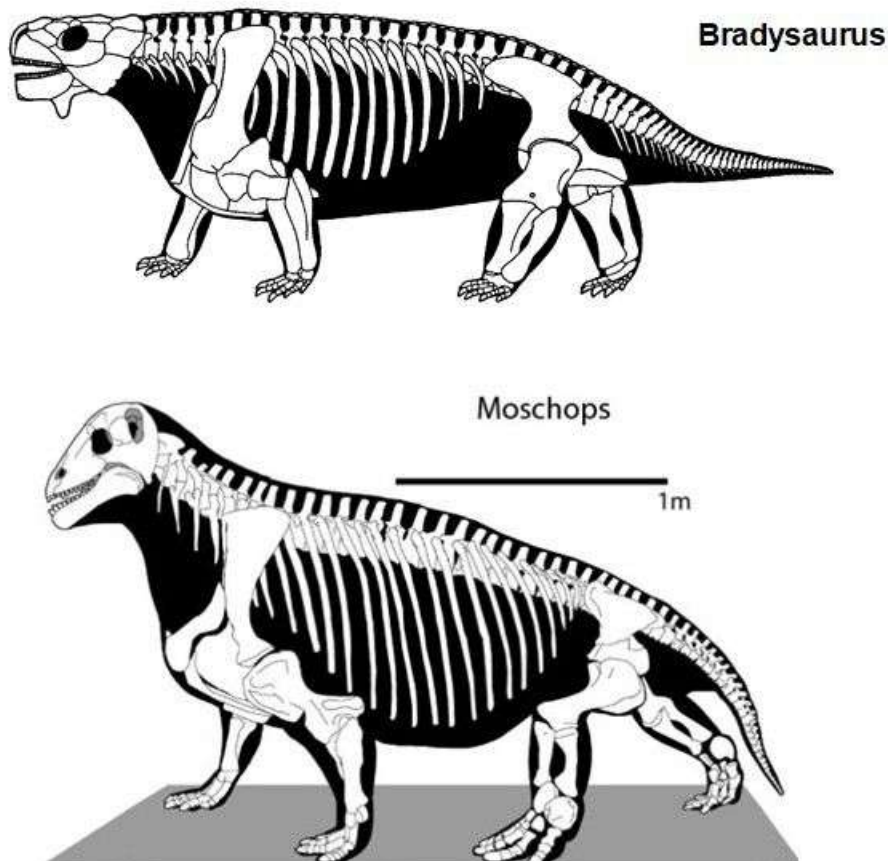


Figure 50: Two unrelated subgroups of cow- to rhino-sized, herbivorous tetrapods that are represented within the Middle Permian *Tapinocephalus* Assemblage Zone: bradysaurine pareiasaur reptiles (above) and tapinocephalid dinocephalian therapsids (below). Fairly abundant fossil remains of both subgroups have been recorded from overbank mudrock and channel sandstone facies within the Sutherland & Rietrug project areas.

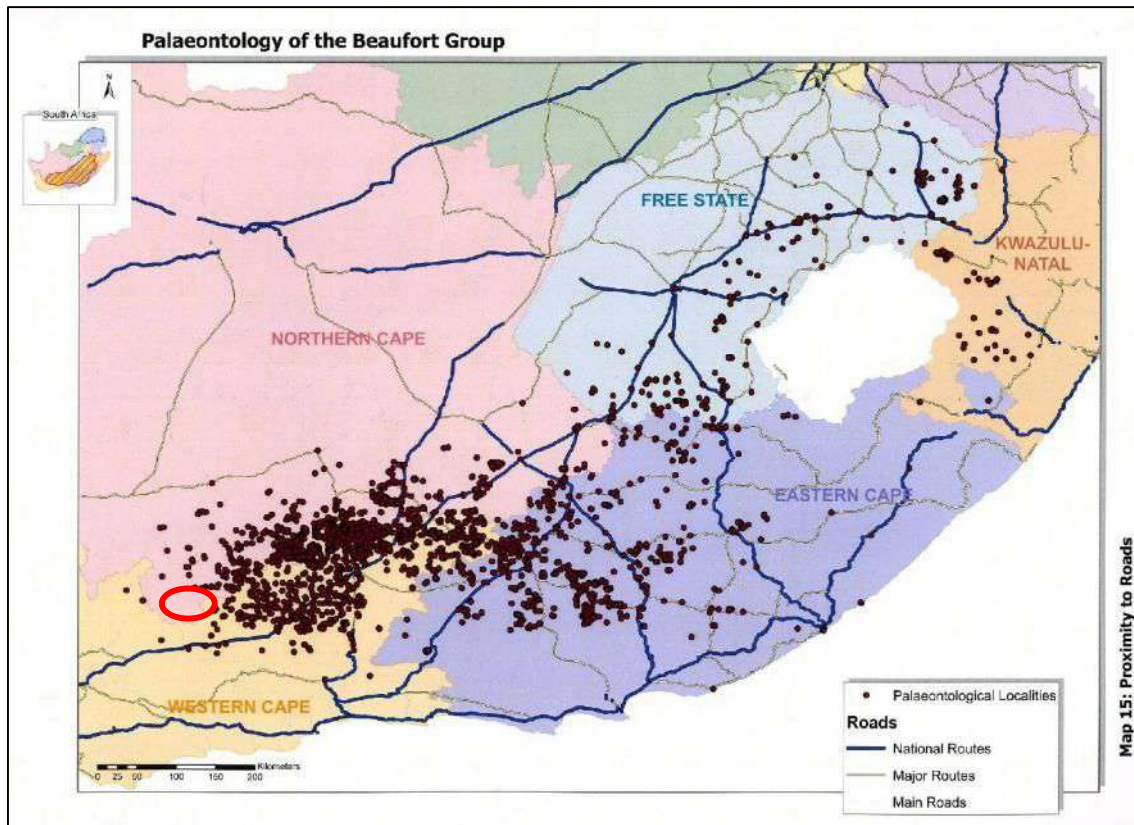


Figure 51: Distribution of recorded vertebrate fossil sites within the Main Karoo Basin (modified from Nicolas 2007). The approximate location of the combined Sutherland & Rietrug project areas on the edge of the Roggeveld Escarpment to the southeast of Sutherland is *approximately* indicated by the red ellipse. Note that hitherto few vertebrate fossils have been recorded in this area, so the new finds recorded here are of some scientific interest.

7. NEW PALAEOLOGICAL FIELD OBSERVATIONS

New fossil sites recorded during the recent palaeontological field study of the combined Rietrug and Sutherland WEF project areas are tabulated in Appendix 1 where the sites are also mapped on satellite images in the context of the proposed final layouts of the two WEFs (Figs. A1.1 to A1.8). A representative selection of the new fossil material is illustrated below in Figures 52 to 101, together with explanatory figure legends.

The commonest fossil sites recorded in the Sutherland & Rietrug WEF project areas comprise fragmentary, disarticulated and often highly-weathered postcranial (and more rarely cranial) bones of large-bodied herbivorous tetrapods – pareiasaur reptiles or dinocephalian therapsids – preserved in surface float. Rarer skeletal remains are preserved *in situ* within overbank mudrocks, channel wackes, ferruginised basal channel breccias as well as thin floodplain breccias of possible floodplain wetland origin. The breccias may contain isolated pareiasaur teeth as well as reworked, highly fragmented and “rolled” bone material. Isolated postcranial remains of the large-bodied tetrapods are often difficult to assign to one or other tetrapod subgroup, especially when weathered, as is often the case for material exposure at surface. The pareiasaurs, several partial skeletons of which have been recorded *in situ* here, are typical large, Middle Permian bradysaurines which can occasionally be identified to genus (*cf* Van den Brandt 2021 and earlier references). The dinocephalians are usually more fragmentary and include thick-skulled herbivorous tapinocephalids (*cf* Neumann 2020) as well as the rare *in situ* skull of a possible juvenile anteosaur predator. Dicynodonts are limited to small bodied forms and are surprisingly rare, with only a few partial skulls and one possible *in situ* skeleton recorded so far. Partial cranial and postcranial remains of several carnivorous theriodont therapsids – including both

gorgonopsians and therocephalians - have also been found. Fragmentary bone breccias of these last as well as of pareiasaurs are occasionally preserved within ferruginous pedoconcretions.

The most abundant vertebrate trace fossil occurrences comprise lacustrine mudrock horizons packed with columnar, subvertical sandstone casts of lungfish burrows (*Dipnoichnus*) which are especially common high within the Moordenaars Member succession (cf Hasiotis *et al.* 1993, Odendaal & Loock 2015). Occasional much wider sandstone plugs in the same or similar settings may represent the swollen bases of lungfish burrows (cf Sennikova 2018) while others might be tree trunk / root casts or even dewatering structures. No tetrapod trackways were recorded here, though there is potential for these on well-preserved wave-rippled sandstone palaeosurfaces (cf Marchetti *et al.* 2019). These do show occasional sinuous fish swimming trails and tool marks which may have been generated by swimming animals and / or driftwood. A single, phosphatized tetrapod coprolite (fossil dropping) was found; these are probably common at some horizons but are usually difficult to recognise. Several occurrences of gently inclined, straight to curved or sinuous tetrapod burrow casts were recorded, some with bioturbated floors and possible evidence for binding by microbial mats. However, several of the possible examples are equivocal and might be dubiofossils (e.g. erosional scours). The clearest examples, with ventro-lateral scratch marks, are found in the Karelskraal Member outside and north of the project area. Invertebrate trace fossil assemblages are not widely recorded, consisting of indistinct small burrows of the *Scoyenia* ichnofacies and possible undermat miners. They may be confused in part with plant root traces.

Fossil plant material within the combined Sutherland & Rietrug WEF project areas is dominated by generally scarce, but locally common, silicified and ferruginised blocks of petrified wood found among surface gravels, some of which show good preservation of woody fabrics (cf Bamford 1999, 2004, 2016). The main fossil wood occurrences overlie the very top of the Moordenaars Member and might have been reworked from the overlying Karelskraal Member. Rusty-brown moulds of reworked woody material may occur abundantly within ferruginised basal channel breccias as well as in thin sandstone-associated breccia lenses which may have accumulated in floodplain wetlands and pond depressions. Other plant fossils include local concentrations of sphenophyte (horsetail) stem impressions in wetland mudrocks and stem casts or moulds associated with wave-rippled sandstone palaeosurfaces (cf Anderson & Anderson 1985).

No fossil material was recorded from the diverse late Cenozoic superficial deposits represented within the combined Sutherland & Rietrug project areas. Calcretised plant rootlets occur widely within older alluvial deposits in the Karoo region but are of wide occurrence and limited scientific interest.



Figure 52: Distorted partial skull (c. 12 cm long) of a small-bodied, carnivorous therocephalian therapsid with bluish bone preservation, preserved within a channel wacke, Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 207). The inset shows the reconstruction of a therocephalian skull.

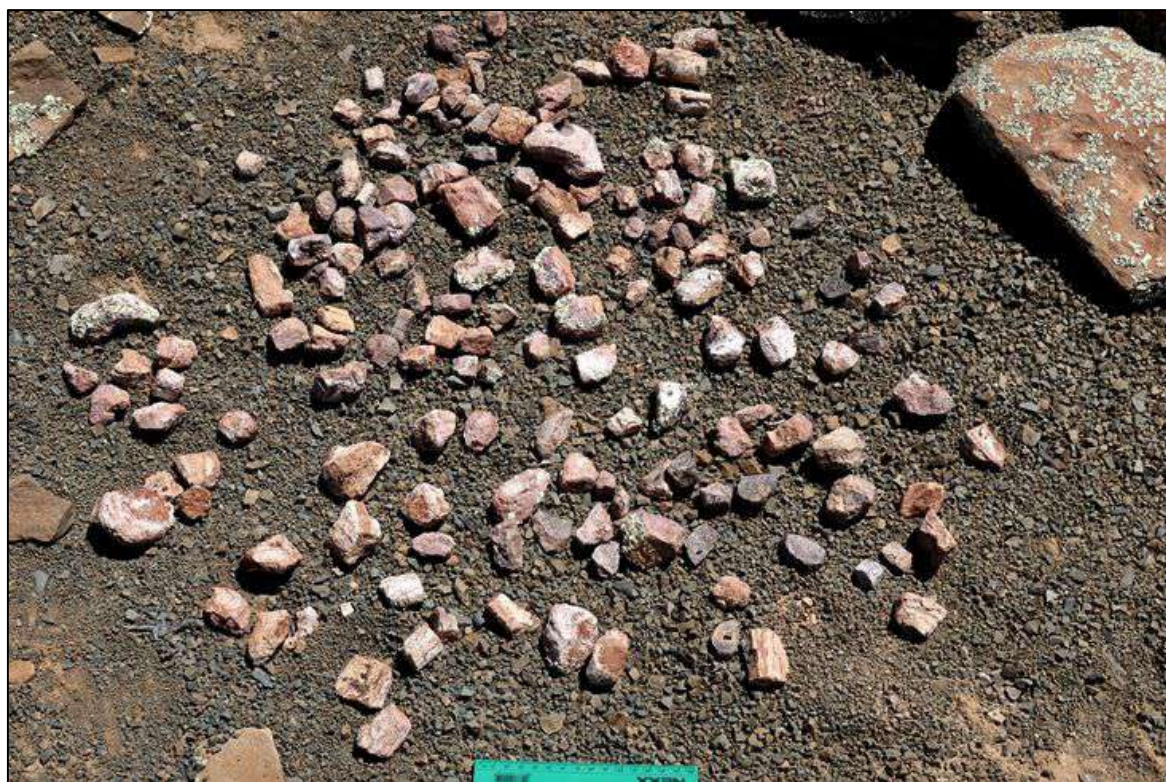


Figure 53: Numerus small, pinkish postcranial bone fragments collected at surface, probably of a small- to medium-sized therapsid such as a therocephalian, Moordenaars Member, Farm Beerenvally 1/150 (Loc. 187).



Figure 54: Bone breccia of a small therapsid (probably therocephalian) preserved within ferruginous pedogenic calcrete concretions, Moordenaars Member, Farm Beerenvally 1/150 (Loc. 169). The concretion at the bottom is c. 10 cm long.



Figure 55: Portions of the lower jaw (mandible) with teeth of a small carnivorous gorgonopsian therapsid, Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 213). Specimen as seen here is 8 cm wide.



Figure 56: Portions of the backbone and limb of a carnivorous gorgonopsian therapsid, Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 213, the same individual as illustrated above). Scale in cm.



Figure 57: *In situ* large skull (c. 18-20cm wide), possibly of juvenile dinocephalian such as an anteosaur, Moordenaars Member, Farm Beerenvally 1/150 (Loc. 170). This potentially important specimen is earmarked for professional collection by ESI (Wits University).



Figure 58: Two robust, pachyostosed cranial fragments from a partially *In situ* skeleton of a large tapinocephalid dinocephalian skeleton, Moordenaars Member, Farm Beerenvally 1/150 (Loc. 185). Scale in cm and mm.



Figure 59: Cranial fragments of a tapinocephalid dinocephalian, including part of the pachyostosed skull roof on the bottom left, Moordenaars Member, Farm Beerenvally RE/150 (Loc. 137). Scale in cm.



Figure 60: *Ex situ*, weathered, unidentifiable long bone fragments from either a dinocephalian or a bradysaurian pareiasaur. Moordenaars Member, Farm Beerenvally RE/150 (Loc. 138). Scale in cm and mm.



Figure 61: Group of approximately 20 *ex situ*, large, badly weathered, postcranial bone fragments of a dinocephalian, Moordenaars Member, Farm Nooitgedagt RE/148. Moordenaars Member (Loc. 201). Scale = 15 cm.



Figure 62: Partial femur of a large-bodied tetrapod (c. 30 cm long) – probably dinocephalian – found weathering-out among other postcranial bones from the Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 221).



Figure 63: Partially *in situ*, incomplete postcranial skeleton of a dinocephalian, including probable digit on the LHS of image, Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 230). Scale in cm and mm.



Figure 64: Partial pelvis of a large-bodied pareiasaur associated with floodplain breccias in the Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 037). Scale in cm.



Figure 65: *Ex situ* dorsal scapula of a large bradysaurian pareiasaur reptile showing extensive sun-cracking, probable Swaerskraal Member, Farm Boschmans Kloof 1/9 (Loc. 157). Scale in cm and mm.



Figure 66: Tooth fragments of a pareiasaur reptile weathered-out of a floodplain breccia horizon, Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 039). Specimen on right is c. 11 mm across.



Figure 67: Cranial and postcranial fragments of a large dinocephalian skeleton, Moordenaars Member, Farm Beerenvally RE/150 (Loc. 130). Scale = 15 cm.



Figure 68: Weathered terminal long bone of the dinocephalian specimen illustrated above, Moordenaars Member, Farm Beerenvally RE/150 (Loc. 130). Scale = 15 cm.



Figure 69: Large partial scapula blade (LHS) and other fragments of the dinocephalian specimen illustrated above, Moordenaars Member, Farm Beerenvally RE/150 (Loc. 130). Scale = 15 cm.



Figure 70: Partial skull, including snout, of a small dicynodont, Moordenaars Member, Farm Nootgedagt RE/148 (Loc. 214). Scale in cm and mm.



Figure 71: Incomplete skull of a small dicynodont with a broad skull table (*i.e.* not *Diictodon*), Moordenaars Member, Farm Nootgedagt RE/148 (Loc. 120). Skull as seen is c. 7 cm long.



Figure 72: Partial *in situ* skeleton of a small therocephalian or dicynodont, Moordenaars Member on Farm Beerenvally 1/150 (Loc. 197). Field of view is c. 20 cm across.



Figure 73: Partial, *in situ* skeleton of a pareiasaur reptile, Moordenaars Member mudrock exposure near the farmstead on Farm Nootgedagt RE/148 (Loc. 100). The width of the skeleton as seen is here is approximately one meter.



Figure 74: *In situ* partial skeleton of a large bradysaurian pareiasaur (probably *Nochelesaurus*), Moordenaars Member on the Farm Beerenvally 1/150 (Loc. 176). Hammer = 30 cm. Arrows indicate two prominent-weathering, mushroom-shaped neural spines of the vertebrae.



Figure 75: Cranial fragment of the pareiasaur specimen illustrated above showing characteristic, deeply incised surface ornamentation (Loc. 176). Scale in cm.



Figure 76: *In situ* partial postcranial skeleton of a bradysaurian pareiasaur reptile, Moordenaars Member on Farm Beerenvally RE/150 (Loc. 018). Scale = 15 cm.



Figure 77: Isolated partial tooth of a pareiasaur reptile (c. 10 mm across) extracted from a thin mudflake intraclast breccia within the upper Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 045) (See Figure 15 for context).



Figure 78: Ferruginous breccia (possible floodplain pond-related) containing a bone breccia of pareisaurian reptile skeletal remains, Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 099). Scale in cm and mm.



Figure 79: Further bone fragments, including pieces of rib, from the same pareiasaur fossil locality illustrated above, Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 099). Scale in cm and mm.



Figure 80: Characteristic disc-like to subcylindrical segments of fragmented lungfish burrow casts collected from surface float, upper Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 121). Scale is 15 cm long.



Figure 81: Assemblage of *in situ*, vertical, subcylindrical sandstone casts of lungfish burrows excavated into lacustrine mudrocks of the upper Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 109). Hammer = 30 cm.



Figure 82: Vertical lungfish burrow casts up to 30 cm deep, upper Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 120). Hammer = 30 cm.



Figure 83: Vertical to slightly inclined lungfish burrow casts extending beneath a thin crevasse-splay sandstone, Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 080). Hammer = 30 cm.

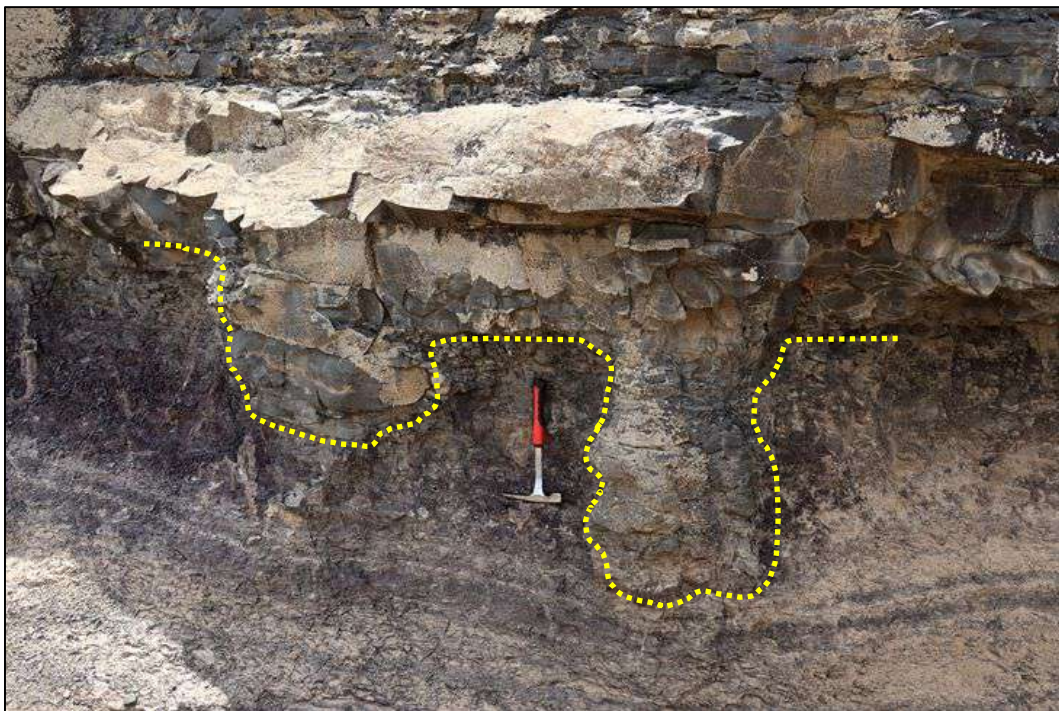


Figure 84: Channel sandstone base within the Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 072) showing substantial, sandstone-infilled structures deeply incising the underlying mudrocks (outlined in yellow). These *might* be related to lungfish burrows that also occur along strike. Hammer = 30 cm.



Figure 85: Columnar pillar of sandstone (c. 30 cm wide) extending downwards from a hackly, grey-green wacke bed – possibly a de-watering feature, or a cast of a large plant stem, or a burrow infill (e.g. enlarged basal chamber of a lungfish burrow), Moordenaars Member on Farm Nooitgedacht RE/148 (Loc. 013). Hammer = 30 cm.



Figure 86: Subcylindrical, grey-green sandstone column (c. 15 cm wide) within purple-brown massive siltstones a section through the enlarged terminal burrow of lungfish. Moordenaars Member on Farm Nootgedagt RE/148 (Loc. 114) (“Normal-sized” lungfish burrows about half the width or less occur at the same horizon.)



Figure 87: Piece of rib from an assemblage of fragmentary pareiasaurian postcranial remains, here showing small-scale (< 1mm wide) borings into the cortical bone, Moordenaars Member on Farm Nootgedagt RE/148 (Loc. 037). Scale in cm and mm.



Figure 88: Pale grey, phosphatised coprolite (c. 4cm long) of a carnivore containing comminuted bone fragments of prey items. Collected among float, upper Mordenaars Member, Farm Nooitgedagt RE/148 (Loc. 106).

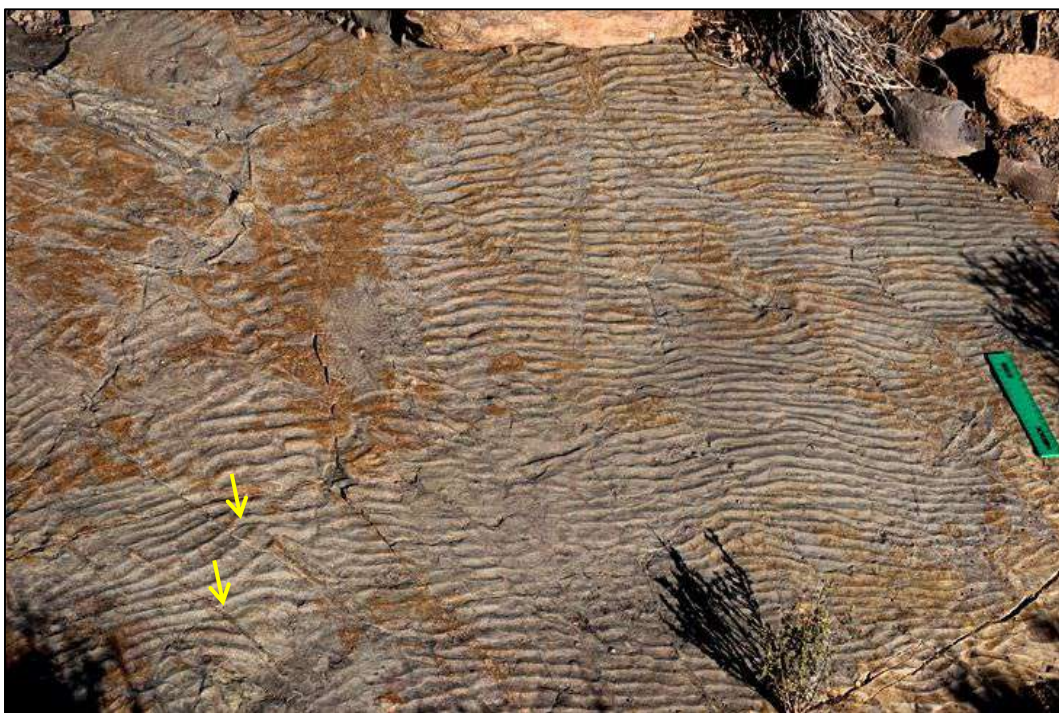


Figure 89: Wave rippled sandstone bedding surface from the Moordenaars Member on Farm Beerenvally 1/150 (Loc. 178) showing various drag marks (possibly biogenic – e.g. due to floating wood), sparse invertebrate burrows and probable paired, sinuous fish swimming trails (arrowed).

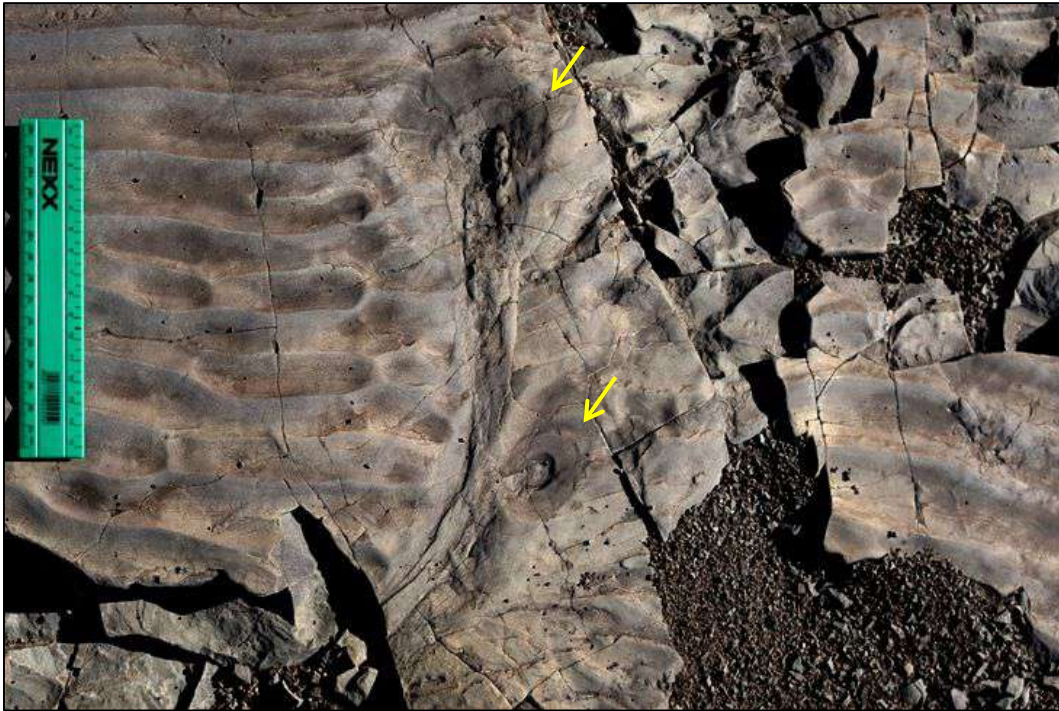


Figure 90: Detail of the wave rippled palaeosurface illustrated above showing possible invertebrate burrows or - more likely- impressions of rooted plant stems (arrowed) (Loc. 178). Scale in cm and mm.



Figure 91: Float block of calcretised siltstone containing ill-defined ferruginised plant root casts and / or invertebrate burrows, probable Swaerskraal Member on Farm Boschmans Kloof 1/9 (Loc. 156). Scale in cm and mm.



Figure 92: Sizeable (c. 30 cm wide), curved and gently inclined tetrapod burrow cast of grey-green sandstone embedded within crumbly mudrocks with ferruginous carbonate lenses of the Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 075). Hammer = 30 cm.



Figure 93: Two superimposed or overlapping tetrapod burrow casts (arrowed) within hackly mudrocks beneath a brownish channel wacke of the Moordenaars Member on Farm Beerenvally 1/150 (Loc. 181). Hammer = 30 cm.



Figure 94: Possible but equivocal, somewhat sinuous tetrapod burrow casts embedded within crumbly siltstone of the Moordenaars Member, Farm Nooitgedagt RE/148 (Loc. 036). Hammer = 30 cm.



Figure 95: *Equivocal* inclined, tetrapod burrow cast penetrating overbank siltstones beneath a tabular, sharp-based channel wacke, Moordenaars Member on Farm Nooitgedagt RE/148 (Loc. 067). Hammer = 30 cm.



Figure 96: Another, much larger possible tetrapod burrow cast recorded at the same horizon and locality as seen in the previous illustration (Loc. 067). Hammer = 30 cm.



Figure 97: Several float blocks of ferruginised mudflake breccia containing ferruginised mudrock clasts as well as fragments of fossil wood (arrowed) and paler bones, floodplain breccia lens within the Moordenaars Member, Farm Nooitgedagt RE/148 (Fig. 042).



Figure 98: Medium-sized block (c. 10 cm long) of ferruginised petrified wood recorded among surface gravels overlying the Moordenaars Member on Farm Beerenvally 1/150 (Loc. 175). Scale in cm.



Figure 99: Abundant small (c. 1 to 8 cm long), angular blocks of ferruginised, dark brown petrified wood (some with well-preserved woody fabric) scattered among surface gravels overlying the uppermost Moordenaars Member on the border between Farms Beeren Vallei RE/150 and Farm Nooitgedagt RE/148 (Loc. 123). Scale = 15 cm.



Figure 100: Numerous small blocks of petrified wood collected from surface gravels at the locality illustrated above (Loc. 123). Scale = 15 cm. *N.B.* The fossil wood *might* have been reworked from the overlying Karelskraal Member.



Figure 101: Impressions of fragments of equisetalean fern stems (“horsetails”) - often associated with riverine and floodplain pond margin wetlands - preserved within dark, purple-brown mudrocks of the Moordenaars Member on Farm Nooitgedacht RE/148 (Loc. 004). Scale in cm.

8. ASSESSMENT OF IMPACT SIGNIFICANCE

Existing impacts on local palaeontological heritage resources within the Sutherland & Rietrug WEF and Grid Connection Infrastructure project areas include (1) background, low-level damage to or loss of fossils exposed at the ground surface due to small-stock farming (e.g. vehicle activity, irrigation infrastructure, small-scale agriculture) as well as (2) on-going natural weathering and erosion processes that both destroy fossil material as well as expose and prepare-out previously-buried fossils. Loss of fossils through illegal collection is a potentially important, but hopefully minor, factor at present in the Sutherland area; it has been known to take place within the present study area (Sybrand Burger, pers. comm., 2022).

The proposed Rietrug and Sutherland WEFs and associated Grid Connection Infrastructure developments will entail excavations into the superficial sediment cover (soils, surface gravels, alluvium *etc*) as well as into the underlying, potentially fossiliferous Lower Beaufort Group bedrocks during the construction phase. The developments may adversely affect legally protected and scientifically important fossil heritage within the project footprints by destroying, damaging, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

The uppermost Abrahamskraal Formation bedrocks that will be directly impacted by the proposed renewable energy developments belong to parts of the Lower Beaufort Group succession (mainly the Moordenaars Member) that is characterised by common but sparsely distributed fossil sites which may include occasional scientifically important specimens of unpredictable occurrence – most notably fossil vertebrate remains. **None of the numerous fossil sites recorded here lie directly within the proposed final footprints of the WEFs and associated grid connection projects.** Where feasible, a high proportion of scientifically valuable material has already been collected for evaluation and curation in the palaeontological collections of the Evolutionary Studies Institute (Wits University; Fossil Collection Permit of Professor Bruce Rubidge). **These recorded sites are accordingly not threatened by the proposed developments and no further mitigation is required in regard to them.** The bedrocks within most of the access road project footprint are extensively mantled with Late Caenozoic colluvial, eluvial and alluvial deposits and gravely soils that are usually palaeontologically insensitive over most of the Roggeveld Plateau region. Rare fossil mammalian remains might potentially occur within older, calcretised alluvium but none have been recorded here so far.

The significance of overall anticipated impacts on fossil heritage resources within the Sutherland & Rietrug WEF and associated grid infrastructure footprints as a consequence of the proposed renewable energy developments (including the new MTS) is assessed for the **Construction Phase** in Table 3, both with and without mitigation. It is concluded that each of the proposed developments will have a NEGATIVE MEDIUM impact significance without mitigation, decreasing to **NEGATIVE LOW following full implementation of the proposed mitigation measures** (See Section 9 and Appendix 2). Negative residual impacts during the construction phase will be partially offset by an improved palaeontological data base and fossil collections due to mitigation (*positive* impacts). Confidence levels for this assessment are Medium, given the reasonably good bedrock exposure levels encountered in the broader project area.

Once constructed, the **Operational and De-commissioning Phases** of the WEF and grid connection infrastructure developments **will not involve further adverse impacts on palaeontological heritage**, so these are not assessed here.

In the case of the **No-Go Option** - *i.e.* no development/construction of the Sutherland or Rietrug WEF and grid connection developments - the current processes exerting an impact on local palaeontological heritage, as outlined at the beginning of this section, will continue to operate at low levels. The impact significance of these processes is rated as NEGATIVE LOW (Table 4). They could potentially be

mitigated by a programme of professional palaeontological surveys of the development project areas with recording and judicious collection / sampling of scientifically important fossil material.

Table 3: Assessment of overall impacts on fossil heritage resources of the proposed Sutherland and Rietrug WEF and Grid Connection Infrastructure projects - Construction Phase (Assessment applies equally to both developments)

Nature: Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface through surface clearance and excavations within the project footprint (e.g. wind turbine and pylon footings, access road network, laydown areas, building foundations)		
	Without mitigation	With mitigation
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (36)	Low (20)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Probable	Unlikely
Can impacts be mitigated?	Yes – see below	
Mitigation: The final, approved layouts of the WEF and its associated Grid Connection Infrastructure must be cross-checked by a professional palaeontologist against the available palaeontological database prior to commencement of site clearing and excavation activities. Residual, potentially sensitive, unsurveyed sectors of the project footprint must be surveyed and mitigated in the Pre-construction Phase (<i>prior</i> to any site clearance and bedrock excavations) by a professional palaeontologist, with recording and judicious sampling or collection of scientifically valuable fossil material. On-going Construction Phase monitoring for fossils of surface clearance and bedrock excavations by ECO / ESO. Application of Chance Fossil Finds Protocol during construction phase with recording and collection of significant new finds by qualified palaeontologist.		
Residual Impacts: Small residual impacts may be partially off-set by improved palaeontological database and collections following mitigation.		

Table 4: Assessment of impacts on fossil heritage resources of the No-Go Option (i.e. no development of Sutherland Cluster WEFs and grid infrastructure)

Nature: Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface within project area through small stock farming, natural weathering and erosion, illegal fossil collection.		
	Without mitigation	With mitigation
Extent	Low (1)	n/a
Duration	Permanent (5)	n/a
Magnitude	Minor (2)	n/a
Probability	Possible (2)	n/a
Significance	Low (16)	n/a
Status (positive or negative)	Negative	n/a
Reversibility	Low	n/a
Irreplaceable loss of resources?	Possible	n/a
Can impacts be mitigated?	Yes	
Mitigation: n/a		
Residual Impacts: n/a		

- **Cumulative impacts**

As shown by the DFFE Renewable Energy EIA Applications Database (REEA) and the map in Figure 102, a considerable number of renewable energy facilities (notably WEFs) and associated grid connection infrastructure developments have been authorised or proposed for the Roggeveld Plateau and adjoining Klein-Roggeveld regions to the southeast and south of Sutherland. Of these, several have been the subject of combined desktop and field-based palaeontological heritage impact studies (PIAs) by the author and others (See References under Almond). However, only a desktop level PIA has been submitted for the Moyeng Energy Suurplaat WEF to the east (Almond 2010b). Given these important data lacunae, it is not yet feasible to meaningfully assess cumulative palaeontological impacts for the Sutherland Cluster developments. Among available palaeontological impact studies for other developments proposed for the region, the most relevant are those on the Roggeveld Plateau for Jakhals Valley solar project (Almond 2011) and the Gunsfontein WEF (Almond 2015g), both located to the south of Sutherland and west of the present study area. The Gamma-Omega 765 kV powerline study by Almond (2012a) considers fossil heritage in the Koups region of the Moordenaars Karoo to the west of Merweville. There are numerous further WEF projects proposed for the Klein-Roggeveld region, below the Great Escarpment and south or southwest of the present study area, but for the most part these concern rocks and fossil assemblages that are older than those encountered in the present WEF study area where the main palaeontological impacts are anticipated; exceptions include the Maralla East and Maralla West WEFs (Almond 2015h, 2015i) as well as the Komsberg West and Komsberg East WEFs (Almond 2015j, 2015k).

Given the extensive outstanding palaeontological heritage field data in the south-eastern Roggeveld region relevant to this development, and following the previous analysis by Almond (2019), it is concluded that it is not yet feasible to meaningfully assess cumulative palaeontological impacts for the proposed renewable energy developments under consideration in this report. However, pending the outcome of outstanding palaeontological field-based studies for WEF projects in the Sutherland – Merweville region, it is *provisionally* concluded that the cumulative impact significance of the proposed access road upgrade in the context of renewable energy developments in the region is NEGATIVE MEDIUM without mitigation (Table 5). This would fall to *NEGATIVE LOW provided that* the proposed monitoring and mitigation recommendations made for *all* these various renewable energy projects are consistently and fully implemented (this is unfortunately open to question).

These anticipated cumulative impacts following full mitigation – including those associated with the Sutherland & Rietrug WEFs and associated Grid Connection Infrastructure projects - lie within acceptable limits. Unavoidable residual negative impacts may be partially offset by the improved understanding of Karoo palaeontology resulting from appropriate professional mitigation. This is regarded as a *positive* impact for Karoo palaeontological heritage.

Table 5: Assessment of cumulative impacts on fossil heritage resources of the proposed Sutherland & Rietrug WEFs and Grid Connection Infrastructure in the context of other comparable renewable energy developments in the region.

Nature: Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface through surface clearance and excavations within the project footprint		
	Without mitigation	With mitigation
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	Medium (60)	Low (30)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Probably
Can impacts be mitigated?	Yes – see below	
Mitigation: Following approval of final layouts and prior to any surface clearance or excavation activities, specialist palaeontological surveys in the pre-construction phase within sectors of project footprint where a full, field-based palaeontological study has not yet been conducted. On-going Construction Phase monitoring for fossils of surface clearance and excavations by ECO / ESO. Application of Chance Fossil Finds Protocol during construction phase with recording and collection of significant new finds by qualified palaeontologist.		
Residual Impacts: Residual impacts may be partially off-set by improved palaeontological database following mitigation.		

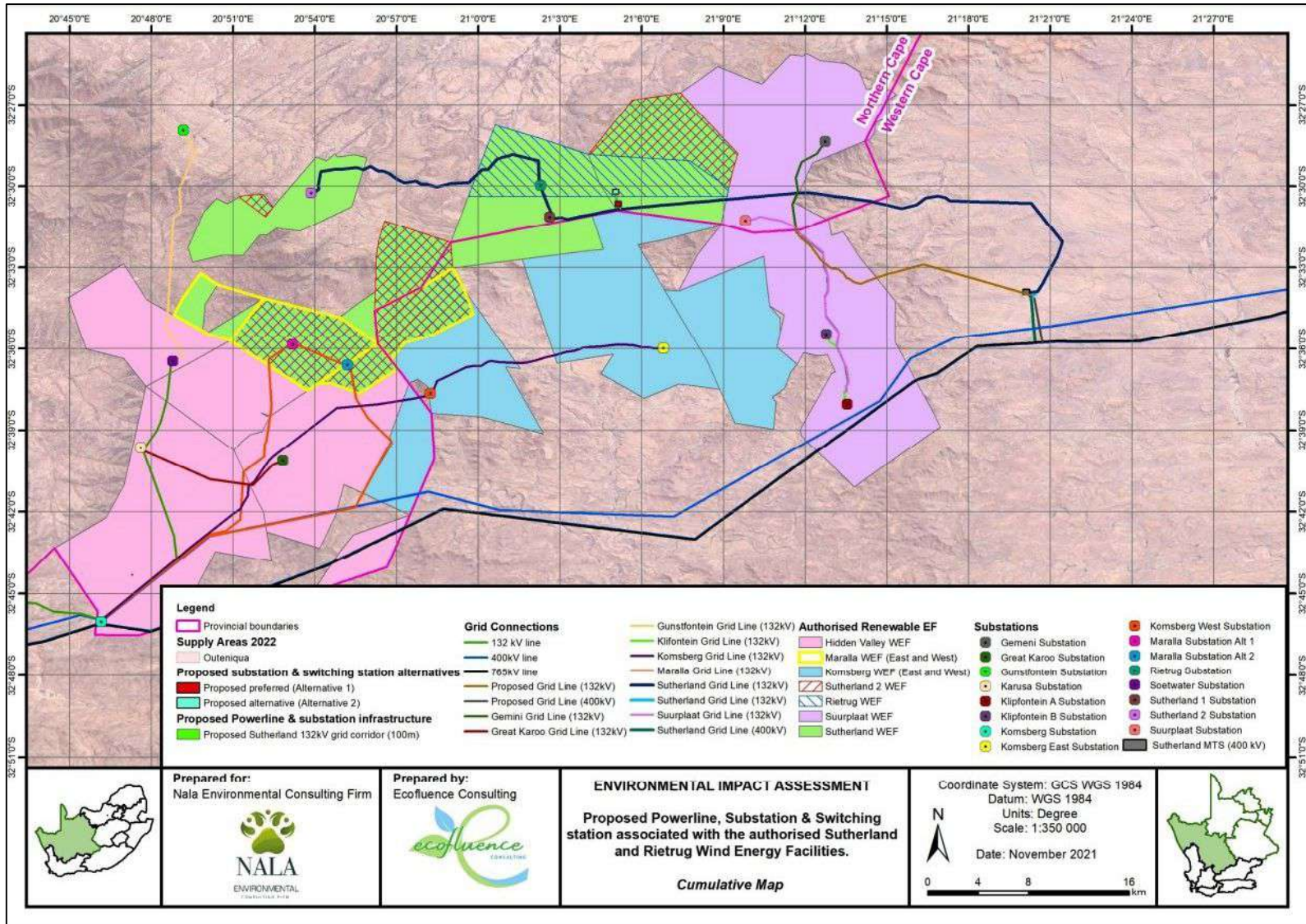


Figure 102: Map showing the large number of authorised or proposed WEF and grid infrastructure projects in the vicinity of the Sutherland & Rietrug WEFs and associated Grid Connection Infrastructure projects.

9. CONCLUSIONS & INPUT INTO EMPs

The following conclusions and recommendations - for inclusion in the relevant Environmental Management Programme (EMPs) - apply equally to the Sutherland WEF and Rietrug WEF projects as well as their accompanying Grid Connection Infrastructure projects (including the new MTS).

The relevant Provincial Heritage Resources Agencies for these renewable energy developments is Heritage Western Cape for the Western Cape and SAHRA for the Northern Cape (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za. SAHRA: 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za).

Desktop studies - including provisional palaeosensitivity mapping by SAHRIS and the DFFE (see Appendix 3) - as well as several successive palaeontological site visits to the region indicate that the Sutherland & Rietrug WEF and Grid Connection Infrastructure project areas are potentially of HIGH palaeosensitivity. Numerous vertebrate skeletal remains as well as trace fossils (e.g. lungfish and tetrapod burrows) and locally abundant blocks of petrified wood have now been recorded within the WEF and Grid Connection Infrastructure project areas, reinforcing the high palaeontological heritage potential of the Roggeveld Plateau – Moordenaars Karoo region of the Karoo. However, *scientifically valuable, conservation-worthy* fossil remains have a sparse and largely unpredictable distribution here. Most of the recorded fossils here are of limited scientific or conservation value (see Provisional Field Rating tabulated in Appendix 1 as well as previous PIA reports by Almond in the References), while **none of the significant fossil sites lies within or close to (< 20 m) the relevant development footprints** (see satellite maps in Appendix 1, Figs. A1.1 to A1.8). Furthermore, where feasible, scientifically valuable fossil material from these project areas has already been sampled or collected (as listed in Appendix 1) for curation in the collections of the Evolutionary Studies Institute at Wits University, Johannesburg (Contact details: Evolutionary Studies Institute (ESI), University of the Witwatersrand. 1 Jan Smuts Avenue, Braamfontein 2000, Johannesburg, South Africa. Tel: +27 (0)11 717 1000).

Anticipated impacts on fossil heritage resources of each of the proposed renewable energy developments in the **Construction Phase** will have a NEGATIVE MEDIUM significance without mitigation, decreasing to **NEGATIVE LOW following full implementation of the proposed mitigation measures** (See Section 8). Negative residual impacts during the construction phase will be partially offset by an improved palaeontological data base and fossil collections due to mitigation (*positive* impacts). Confidence levels for this assessment are Medium, given the reasonably good bedrock exposure levels encountered in the broader project area. Once constructed, the **Operational and De-commissioning Phases** of the WEF and grid connection infrastructure developments **will not involve further adverse impacts on palaeontological heritage, so these are not assessed here.**

The cumulative impact significance of each of the proposed WEF and grid connection projects in the context of other proposed or authorised renewable energy developments in the region is NEGATIVE MEDIUM without mitigation. This would fall to *NEGATIVE LOW provided that* the proposed monitoring and mitigation recommendations made for *all* these various renewable energy projects are consistently and fully implemented. The **anticipated cumulative impacts fall within acceptable limits.**

For these reasons, there are no palaeontological heritage reservations concerning the proposed final Sutherland and Rietrug WEFs, associated Grid Connection Infrastructure and MTS layouts. No mitigation regarding the recorded fossil sites - including micro-siting of the proposed final layouts – is recommended here. Following approval of the final layout, and prior to construction activities commencing (including any site clearance and bedrock excavation), a professional

palaeontologist must be commissioned to survey and mitigate - i.e. through recording and sampling of any scientifically valuable fossil sites at surface - residual, potentially sensitive, unsurveyed sectors of the project footprint.

- **Input into the EMPs**

Given the very large project areas concerned, the substantial number of fossil sites now recorded in the region as well as the inherent unpredictability of these sites, the potential occurrence of additional *unrecorded* sites of scientific and conservation value at or beneath the ground surface within the WEF and grid connection development footprints cannot be completely excluded.

It is therefore recommended that:

(1) The final, approved layouts of the WEFs and their associated Grid Connection Infrastructure must be cross-checked by a professional palaeontologist against the available palaeontological database prior to commencement of site clearing and excavation activities. Residual, potentially sensitive, unsurveyed sectors of the project footprint must be surveyed and mitigated in the Pre-construction Phase (*prior* to any site clearance and bedrock excavations) by a professional palaeontologist, with recording and judicious sampling or collection of scientifically valuable fossil material.

(2) New fossil material encountered or exposed during the Construction Phase is best handled through the Chance Fossil Finds Protocol outlined in Appendix 2. This tabulated protocol should be incorporated into the EMP for each development (WEFs and grid connection) and fully implemented by the responsible Environmental Control Officer (ECO) / Environmental Site Officer (ESO).

The ECO / ESO responsible for the monitoring of the WEF and Grid Connection Infrastructure developments should be made aware of the possibility of important fossil remains (vertebrate bones, teeth and burrows, petrified wood, plant-rich horizons *etc.*) being found or unearthed during the construction phase of the projects. Monitoring for fossil material of all major surface clearance (including access roads) and deeper (>1m) excavations by the ESO on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded, preferably *in situ*, and reported at the earliest opportunity to Heritage Western Cape / SAHRA for recording and sampling by a professional palaeontologist. If triggered, these mitigation actions to conserve legally-protected fossil heritage are considered to be essential.

(3) The palaeontologist responsible for any mitigation work in the Western Cape will need to submit a Work Plan for approval by Heritage Western Cape (HWC) and apply for a Fossil Collection Permit from SAHRA for professional mitigation in the Northern Cape. All fieldwork and reporting should meet the standards of international best practice as well as those developed for PIA reports by SAHRA (2013) and Heritage Western Cape (2021). Fossil material collected must be safeguarded and curated within an approved palaeontological repository (*e.g.* museum or university collection) with full collection data.

It should be emphasized that, ***providing appropriate mitigation is carried out, the majority of developments involving bedrock excavation can make a positive contribution to our understanding of local palaeontological heritage.***

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12. JOHN ALMOND SHORT CV

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and the University of Tübingen in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian – Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



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APPENDIX 1: PALAEOLOGICAL SITE DATA

GPS readings were taken in the field using a hand-held Garmin GPSmap 62sc instrument (pre-2022) or GPSmap 62s instrument (2022). The datum used is WGS 84.

Fossil sites are mapped in the context of the proposed final layouts of the Rietrug and Sutherland WEFs and associated Grid Connection Infrastructure on satellite images in Figures A1.1 to A1.8 below. The fossil sites tabulated and mapped here obviously do not (and cannot) represent *all* fossil sites at surface within the very extensive Karoo project areas but, at most, a representative sample of these. Therefore the absence of recorded fossil sites in a particular area does *not* mean that fossils are not present here at surface or in the subsurface. For this reason, a Chance Fossil Finds Protocol is appended to this report.

Note that locality data for South African fossil sites is not for public release due to conservation concerns.

Table A1. Fossil site data for Sutherland and Rietrug WEF project areas (February 2022)

Loc.	GPS data	Comments
1062	S32° 33' 48.5" E21° 10' 14.2"	Farm Nooitgedacht RE/148. Karelskraal Member, stream gully and low waterfall exposure of grey-green siltstones. Several medium-sized (c. 15-20 cm wide) tetrapod burrow casts , gently inclined, broadly elliptical cross-section. Locally show smooth (possibly bioturbated) burrow floors, probable arrays of scratch marks on ventro-lateral surfaces as well as folded microbial mat textures. Fragment of small tetrapod fossil vertebrae found in vicinity. Proposed Field Rating IIIB. No mitigation recommended (outside WEF project area).
002 [M65]	-32.607644° 20.983074°	Farm Nooitgedacht RE/148. Moordenaars Member. Thick, grey, sandy to finely gravelly semi-consolidated alluvium exposed in banks of stream showing plant root moulds . Proposed Field Rating IIIC Local Resource. No mitigation required.
003	-32.606038° 20.983570°	Farm Nooitgedacht RE/148. Upper Moordenaars Member. Thin calcareous breccias at base of cross-bedded channel sandstone body with small flakes of reworked bone . Proposed Field Rating IIIC. No mitigation recommended.
004	-32.607594° 20.977737°	Farm Nooitgedacht RE/148. Upper Moordenaars Member. Purple-brown siltstones exposed beneath tabular channel sandstone body. Former contain sparse fragments of equisetalean fern stems . Proposed Field Rating IIIC. No mitigation recommended.
013	-32.615613° 20.960184°	Farm Nooitgedacht RE/148. Moordenaars Member. Desiccation-cracked horizon of thin-bedded, purple-brown siltstones beneath sharp, undulose base of purplish-brown, fine-grained silty wacke containing occasional columnar sandstone pillar (c. 30 cm wide) – possibly a de-watering feature or perhaps a cast of a large plant stem or burrow (e.g. enlarged basal chamber of lungfish burrow). Proposed Field Rating IIIC. No mitigation recommended.
018	-32.610241° 20.924791°	Farm Beerenvally RE/150. Upper Moordenaars Member grey-green & purple-brown siltstone package. Partial in situ pareiasaur skeleton (not collected) . Partially preserved, large bradysaurian pareiasaur, in green-grey mudstone. <i>In situ</i> partial postcrania comprising partial right lateral

[M81]		<p>clavicle with articulated proximal right scapula, six dorsal vertebrae with neural spines sheared-off and with pre-and post-zygapophyses exposed, partial dorsal ribs, limb bones, partial pelvis. <i>Ex situ</i> dorsal scapula blade in four pieces and one interclavicular lateral arm. Proposed Field Rating IIIB Local Resource.</p> <p>No mitigation required.</p>
019	-32.610380° 20.924984°	<p>Farm Beerenvally RE/150. Upper Moordenaars Member. Grey-green crumbly siltstone package with possible but equivocal sandstone casts of small tetrapod burrows. Proposed Field Rating IIIC.</p> <p>No mitigation recommended.</p>
026	-32.594262° 20.870369°	<p>Farm Beerenvally RE/150. Moordenaars Member. Disc-like fragments (4 cm wide) of weathered-out lungfish sandstone burrow casts among surface gravels. Proposed Field Rating IIIC.</p> <p>No mitigation recommended.</p>
028 [M85]	-32.608613° 21.008211°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. In situ, partially preserved skeleton of large bradysaurian pareiasaur, embedded in purple mudstone near Nooitgedacht Farmstead (not collected). In situ partial postcrania comprising four articulated ornamented dorsal osteoderms, partial vertebrae. Ex situ proximal ulna with large olecranon process, partial humerus, partial radius and/or tibia, other postcranial fragments. Identified as <i>Embrithosaurus</i> by Marc Van den Brandt due to the ornamentation style of the osteoderms on vertebrae (small central boss with very distinct “E” or “L”-shaped, tab-like rugose ridges). Proposed Field Rating IIIB Local Resource.</p> <p>No mitigation required.</p>
030	-32.615907° 20.973980°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. <i>Ex situ</i> large, ferruginised chunk of unidentified post-cranial bone from large-bodied tetrapod (bradysaurian pareiasaur / dinocephalian) (not collected). Proposed Field Rating IIIC.</p> <p>No mitigation recommended.</p>
031 [M88]	-32.614642° 20.973421°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ fibula shaft? (not collected). Eroded and weathered fibula shaft? From either a dinocephalian or a bradysaurian Ppareiasaur, ex situ, on grey mudstone. Proposed Field Rating IIIC Local Resource.</p> <p>No mitigation recommended.</p>
032 [M86]	-32.614627° 20.973581°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. In situ large rib fragment (not collected). Large rib fragment (5cm long) in grey mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource.</p> <p>No mitigation recommended.</p>
033 [M87]	-32.614457° 20.973405°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large proximal pareiasaurian radius (not collected). Proximal radius of a large bradysaurian pareiasaur, ex situ, on grey mudstone. Proposed Field Rating IIIC Local Resource.</p> <p>No mitigation recommended.</p>
034 [M89]	-32.613878° 20.972926°	<p>Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ partial femur? (not collected). Large partial femur? From either a dinocephalian or a bradysaurian pareiasaur, ex situ, on grey mudstone. Proposed Field Rating IIIC Local Resource.</p> <p>No mitigation recommended.</p>

036	-32.619814° 20.975794°	Farm Nooitgedagt RE/148. Moordenaars Member. Several isolated or intersecting, linear, inclined, sharply-defined sandstone structures (25-30 cm across) embedded within crumbly grey-green mudrock. Equivocal tetrapod burrow casts (require confirmation). Proposed Field Rating IIC Local Resource. No mitigation recommended.
037 [M90]	-32.620283° 20.976894°	Farm Nooitgedagt RE/148. Moordenaars Member. Ferruginised channel or floodplain breccias with abundant rusty-brown moulds of fossil wood , mudflake intraclasts – probably associated with wetland / pond area on floodplain. Ex situ large pareiasaurian postcranial fragments (not collected). Large postcranial fragments comprising, a distal humerus with entepicondylar flange, the base of a large iliac blade, ribs (some with superficial invertebrate borings) and other postcranial fragments, tooth fragment. Bradysaurian pareiasaur. Proposed Field Rating IIC Local Resource. No mitigation recommended.
039	-32.620247° 20.976915°	Farm Nooitgedagt RE/148. Moordenaars Member. Further ferruginised breccias and associated fossil material downwasted from Loc. 037 – glassy to pearly black pareiasaur tooth base, possible radius. Proposed Field Rating IIC Local Resource. No mitigation recommended.
040	-32.620043° 20.977273°	Farm Nooitgedagt RE/148. Moordenaars Member. Thin sandstone lens associated with ferruginised mudflake breccias containing reworked bone fragments. Proposed Field Rating IIC Local Resource. No mitigation recommended.
041	-32.619930° 20.977450°	Farm Nooitgedagt RE/148. Moordenaars Member. Thin sandstone lens associated with ferruginised mudflake / palaeocalcrete breccias containing rounded, reworked bone fragments. Proposed Field Rating IIC Local Resource. No mitigation recommended.
042	-32.619871° 20.977546°	Farm Nooitgedagt RE/148. Moordenaars Member. Blocks of ferruginised mudflake breccia containing ferruginised wood moulds , silicified wood. Proposed Field Rating IIC Local Resource. No mitigation recommended.
043	-32.618153° 20.977998°	Farm Nooitgedagt RE/148. Moordenaars Member. Blocks of ferruginised mudflake breccia containing ferruginised wood moulds , rounded, reworked bone fragments. Proposed Field Rating IIC Local Resource. No mitigation recommended.
045	-32.640685° 20.985226°	Farm Nooitgedagt RE/148. Upper Moordenaars Member. Tabular-bedded channel sandstone with thin (<30 cm), cross-bedded, purple-brown basal breccia containing isolated partial tooth of a pareiasaur Proposed Field Rating IIC Local Resource. Specimen collected – no mitigation required.
052	-32.638775° 20.990980°	Farm Nooitgedagt RE/148. Upper Moordenaars Member. Lungfish burrow casts (some equivocal – possibly pedogenic calcrete bodies) with in mottled purple-brown / grey-green overbank siltstones. Proposed Field Rating IIC Local Resource. No mitigation required.
053	-32.639135° 20.990836°	Farm Nooitgedagt RE/148. Upper Moordenaars Member. Vertical sandstone plug of greenish wacke with oval cross-section (> 20 cm

		wide), embedded within crumbly purple-brown mudrock c. 1 m below a crevasse splay sandstone. Dubiofossil. Possibly a de-watering pipe or cast of tree trunk or enlarged terminal chamber of lungfish burrow . Proposed Field Rating IIIC Local Resource. No mitigation required.
065	-32.620394° 21.010514°	Farm Nooitgedagt RE/148. Riverbank sections through thick, silty to gravelly alluvial sediments of the Rietrivier. Extensive calcretised horizon of invertebrate burrows and / or plant rootlets . Proposed Field Rating IIIC Local Resource. Protected within riverine buffer zone – no mitigation required.
066	-32.626203° 21.009866°	Farm Nooitgedagt RE/148. Moordenaars Member. Stream bank exposure of tabular, thin-bedded, dark grey lacustrine siltstones and loaded / boudinaged fine-grained wackes, locally with wave-rippled tops. Poorly preserved invertebrate trace fossil assemblages of the <i>Scoyenia</i> Ichnofacies on wacke bed tops. Proposed Field Rating IIIC Local Resource. Protected within riverine buffer zone – no mitigation required.
067	-32.625141° 21.010341°	Farm Nooitgedagt RE/148. Moordenaars Member. Stream bank exposure of sharp-based, lenticular channel wacke overlying dark, grey-green and purple-brown, thick-laminated overbank mudrocks with one or more equivocal inclined, tetrapod burrow casts (c. 15 – ?50 cm wide) of sandstone at the interface. Proposed Field Rating IIIC Local Resource. Protected within riverine buffer zone – no mitigation required.
068	-32.627071° 21.010611°	Farm Nooitgedagt RE/148. Moordenaars Member. Stream gully exposure of thin-bedded grey-green and purple-brown mudrocks and thin wackes with well-preserved, narrow (c. 4 cm wide) lungfish burrow casts . Proposed Field Rating IIIC Local Resource. Protected within riverine buffer zone – no mitigation required.
069 [M1]	-32.627179° 21.010439°	Farm Nooitgedagt RE/148. Moordenaars Member. Thick package of grey-green crumbly mudrocks with gypsum pseudomorphs. In situ large, badly preserved, disarticulated partial postcranial elements of a large bradysaurian pareiasaur , comprising 4 vertebrae, possible partial femur, and other postcrania, embedded within green-grey mudstone (one neural spine already sampled). Proposed Field Rating IIIB Local Resource. No mitigation required.
071	-32.627243° 21.011074°	Farm Nooitgedagt RE/148. Moordenaars Member. Crumbly purple-brown mudrocks with poorly preserved lungfish burrow casts (c. 5 cm across) exposed in erosion gully. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
072	-32.627646° 21.011908°	Farm Nooitgedagt RE/148. Moordenaars Member. Crumbly purple-brown mudrocks with lungfish burrow casts exposed in erosion gully. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
073	-32.627675° 21.012061°	Farm Nooitgedagt RE/148. Moordenaars Member. Crumbly purple-brown and grey-green mudrocks with thin crevasse-splay sandstones, horizon of well-preserved lungfish burrow casts (up to c. 6 cm across, 20 cm deep) exposed in erosion gully. Proposed Field Rating IIIB Local Resource. No mitigation recommended.

074	-32.628338° 21.011780°	Farm Nooitgedagt RE/148. Moordenaars Member. Thick, well-exposed package of crumbly grey-green mudrocks with occasional lungfish burrow casts, float sandstone blocks with poorly-preserved invertebrate burrows . Proposed Field Rating IIIC Local Resource. No mitigation recommended.
075	-32.628824° 21.012645°	Farm Nooitgedagt RE/148. Moordenaars Member. As above. Several tetrapod burrow casts , including one good example c. 30 cm wide, gently inclined and curving with shallow elliptical greenish sandstone infill. Proposed Field Rating IIIB Local Resource. Recording of burrow if threatened by development (if lies within 20 m of footprint).
080 [M2]	-32.624336° 21.026548°	Farm Nooitgedagt RE/148. Moordenaars Member. Riverbank section through purple-brown and grey-green siltstones, heterolithic packages. Occasional vertical to slightly inclined lungfish burrow casts extending beneath thin crevasse-splay sandstone. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
084	-32.632245° 21.038937°	Farm Nooitgedagt RE/148. Moordenaars Member. Riverbank section through purple-brown and grey-green siltstones with well-developed ?calcified desiccation crack networks, heterolithic packages. Problematic column- and lobe-like sandstone features (up to c. 60 cm or more wide) at base of channel sandstone – possibly an erosional feature. Occasional vertical to slightly inclined lungfish burrow casts extending beneath thin crevasse-splay sandstone. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
085	-32.632319° 21.039119°	Farm Nooitgedagt RE/148. Moordenaars Member. As above. Incised major lenticular channel sandstone body overlies thin-bedded overbnk mudrocks with networks deeply penetrative, calcified cracks, dispersed spheroidal calcareous concretions, occasional lungfish burrow casts . Proposed Field Rating IIIC Local Resource. No mitigation recommended.
093	-32.641649° 21.008114°	Farm Nooitgedagt RE/148. Upper Moordenaars Member. Poorly-preserved sandstone lungfish burrow casts within purple-brown mudrocks. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
099 [M8]	-32.623507° 20.988189°	Farm Nooitgedagt RE/148. Moordenaars Member. Low relief, valley floor exposure of grey-green and purple brown mudrocks, with mudflake breccias and spheroidal sandstone bodies (possible load casts). Ex situ partial large pareiasaurian skeleton (collected five large pieces) . 40-50 ex situ ferruginised, sun-cracked postcranial fragments from a large bradysaurian pareiasaur, including two large fragments with osteoderms in cross section, neural spines, partial pelvis, vertebrae, ribs fragments and long bone fragments. Proposed Field Rating IIIB Local Resource. Collected five large pieces for species identification. No further mitigation required.
101 [M9]	S32.61290° E21.00845°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ lungfish burrow cast (not collected) (5 cm in diameter) overlying grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
102	-32.612255° 21.007711°	Farm Nooitgedagt RE/148. Moordenaars Member. Three small ex situ blocks of weathered bone of large-bodied tetrapod at surface. Proposed Field Rating IIIC Local Resource.

		No mitigation recommended.
104	-32.608188° 21.011989°	Farm Nooitgedagt RE/148. Moordenaars Member. Good riverine exposures of overbank mudrocks with ferruginous pedocrete horizons, thin, cross-bedded channel sandstone, wave rippled bed tops, possible loading and upward-coarsening packages, occasional lungfish burrow casts . Proposed Field Rating IIIC Local Resource. No mitigation recommended.
106 [M10]	-32.607376° 20.958048°	Farm Nooitgedagt RE/148. Moordenaars Member. Pale grey, phosphatised, ex situ coprolite (collected) (4cm long) containing small bones, overlying grey mudstone, close to pale tuffite horizon. Proposed Field Rating IIIB Local Resource. Collected. No mitigation required.
108	-32.604301° 20.958079°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). Abundant weathered-out disc-like fragments of ferruginised sandstone-infilled lungfish burrow casts among surface gravels. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
109	-32.604209° 20.957850°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). In situ vertical, subcylindrical lungfish burrow casts within purple-brown siltstone, just below horizon of dark brown wacke. Proposed Field Rating IIIB Local Resource. No mitigation recommended.
110	-32.604350° 20.957676°	As above.
111	-32.604362° 20.957551°	As above.
112	-32.604133° 20.957787°	As above.
113	-32.604118° 20.957881°	As above
114	-32.604088° 20.957947°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). Subcylindrical, grey-green sandstone column (c. 15 cm wide) within purple-brown massive siltstones (lungfish burrow horizon) – possibly a dewatering structure / cast of tree trunk or enlarged terminal burrow of lungfish. Proposed Field Rating IIIB Local Resource. No mitigation recommended.
115	-32.604039° 20.957978°	As above but 20-25 cm across. Proposed Field Rating IIIB Local Resource. No mitigation recommended.
116	-32.603978° 20.958043°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). In situ vertical, subcylindrical lungfish burrow casts within purple-brown siltstone, just below horizon of dark brown wacke. Proposed Field Rating IIIB Local Resource. No mitigation recommended.
117	-32.603894° 20.958062°	As above.
118	-32.603806° 20.958084°	As above.
119	-32.603753° 20.958224°	As above.

120 [M11]	-32.603778° 20.958292°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). Well-preserved, in situ vertical, subcylindrical lungfish burrow casts up to 7 cm diameter, 30 cm deep. Proposed Field Rating IIIB Local Resource. No mitigation recommended. Ex situ small dicynodont skull (collected) (7cm long) with shiny purple bone preservation in green-grey mudstone, and wide intertemporal, so not <i>Diictodon</i> (possibly <i>Robertia</i> or <i>Emydops</i>). Proposed Field Rating IIIB Local Resource. No mitigation required.
121	-32.604161° 20.958307°	Farm Nooitgedagt RE/148. Upper Moordenaars Member (close to top of member succession). Abundant fragments of lungfish burrow casts within surface gravels. Proposed Field Rating IIIC Local Resource. No mitigation required.
123 [M12]	-32.605183° 20.946891°	Farm Beeren Vallei RE/150. Top of Moordenaars Member (possibly includes material reworked by downwasting or water transport from overlying Karelskraal Member). Abundant small (c. 1-8 cm long), usually angular blocks of ferruginised, dark brown petrified wood (some with well-preserved woody fabric) among surface gravels and sands (in part collected by previous visitors). Proposed Field Rating IIIB Local Resource. No mitigation required.
124 [M13]	-32.606160° 20.947116°	Farm Beeren Vallei RE/150. Upper Moordenaars Member. Ex situ large postcranial fragments of large tetrapod (not collected) . Large, badly eroded and weathered, unidentifiable postcranial fragments from either a dinocephalian or a bradysaurian pareiasaur, ex situ, overlying grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
127 [M14]	-32.620047° 20.921154°	Farm Beeren Vallei RE/150. Moordenaars Member. Ex situ partial large pareiasaurian skeleton (collected proximal and distal left tibia) . 18-20 ex situ, mostly unidentifiable and weathered postcranial fragments from a large bradysaurian pareiasaur, including proximal and distal left tibia and other unidentified large postcranial fragments, on green-grey mudstone. Proposed Field Rating IIIB Local Resource. Specimen sampled. No mitigation required.
130 [M15]	-32.622430° 20.924092°	Farm Beerenvally RE/150. Moordenaars Member. In-situ and ex situ partial large dinocephalian skeleton (collected four large postcranial fragments, including a 30 cm wide proximal scapula blade and several large cranial fragments). Partial Tapinocephalid Dinocephalian (possibly <i>Styracocephalus</i>) skeleton comprising two-three dozen ex situ large cranial and postcranial fragments and a few small in situ fragments, preserved within grey-purple mudstone or sandstone. Some material probably weathered-out from overlying sandstone unit. Proposed Field Rating IIIB Local Resource. No further mitigation required.
131 [M16]	-32.622885° 20.925324°	Farm Beerenvally RE/150. Moordenaars Member. Two large ex situ unidentifiable long bone fragments from either a dinocephalian or a bradysaurian pareiasaur (not collected) overlying grey-purple mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
132 [M17]	-32.622237° 20.925344°	Farm Beerenvally RE/150. Moordenaars Member. Isolated, ex situ, unidentifiable large block of weathered bone of large-bodied tetrapod

		in surface gravels overlying pale grey-green mudrock (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
133	-32.621991° 20.925362°	Farm Beerenvally RE/150. Moordenaars Member. Small transported bone fragment embedded within float block of wacke. Proposed Field Rating IIIC Local Resource. No mitigation required.
137 [M19]	-32.624324° 20.927097°	Farm Beerenvally RE/150. Moordenaars Member. Ex situ tapinocephalid dinocephalian cranial fragments (collected two large cranial fragments). Six small and two large tapinocephalid cranial (skull roof) fragments overlying light grey-green-purple mudstone. Proposed Field Rating IIIB Local Resource. No mitigation required.
138 [M20]	-32.624623° 20.926983°	Farm Beerenvally RE/150. Moordenaars Member. Five large ex situ weathered, unidentifiable long bone fragments from either a dinocephalian or a bradysaurian pareiasaur within stream gravels (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
139 [M21]	-32.624313° 20.926446°	Farm Beerenvally RE/150. Moordenaars Member. Chunk of weathered unidentifiable long bone of large-bodied tetrapod in surface float. Proposed Field Rating IIIC Local Resource. No mitigation required.
140	-32.652607° 20.935130°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Thin sandstone beds with ill-defined endichnial and hypichnial trace fossils . Proposed Field Rating IIIC Local Resource. No mitigation required.
145	-32.654938° 20.935009°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Float block of mudrock intraclast breccia with moulds of wood blocks . Proposed Field Rating IIIC Local Resource. No mitigation required.
153 [M23]	-32.655168° 20.906568°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Ex situ unidentifiable large, partial long bone fragment (not collected) overlying light grey-green mudrock, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
154	-32.654738° 20.906560°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Several sandstone burrow casts (c. 15 cm wide) of small tetrapods excavated into purple-brown siltstone beneath sandstone bed. Proposed Field Rating IIIC Local Resource. No mitigation required.
156	-32.651813° 20.908191°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Ferruginised horizons and lenses within grey-green mudrock with poorly-defined invertebrate burrows / plant rootlets . Proposed Field Rating IIIC Local Resource. No mitigation required.
157	-32.651701° 20.906389°	Farm Boschmans Kloof 1/9. Probable Swaerskraal Member. Ex situ dorsal scapula of a large bradysaurian pareiasaur , comprising three highly weathered fragments, on light grey-green mudstone (not collected). Proposed Field Rating IIIC Local Resource.

		No mitigation required.
164 [M24]	-32.617716° 20.889231°	Farm Beerenvally 1/150. Moordenaars Member. Ex situ unidentifiable large, long bone fragment (not collected). Large ex situ unidentifiable partial long bone fragment on light grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
165 [M26]	-32.617897° 20.890256°	Farm Beerenvally 1/150. Moordenaars Member. Ex situ small weathered bone fragment (not collected). Either part of a very large, long bone (probably from a dinocephalian with 2cm thick cortical bone) or even highly ornamented skull fragment of a pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
167	-32.618537° 20.891051°	Farm Beerenvally 1/ 150. Moordenaars Member. Rounded float block of ferruginous bone breccia among surface gravels. Proposed Field Rating IIIC Local Resource. No mitigation required.
168 [M27]	-32.618613° 20.891263°	Farm Beerenvally 1/150. Moordenaars Member. Four large ex situ long bone fragments (not collected), including possible pelvic pieces, and distal radius and tibia, overlying light grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
169 [M28]	-32.618188° 20.891375°	Farm Beerenvally 1/150. Moordenaars Member. Ex situ cranial and postcranial remains of a medium-sized tetrapod – probably a therocephalian (10 largest fragments collected). Total of 20-30 cranial and postcranial, small (1cm) to large (10cm) fragments among ferruginous carbonate bone-rich breccias overlying light grey-green mudstone. Proposed Field Rating IIIB Local Resource. No mitigation required.
170	-32.616623° 20.885567°	Farm Beerenvally 1/150. Moordenaars Member. In situ large skull (18-20cm wide) possibly of juvenile anteosaur dinocephalian (not collected) embedded within light grey-green mudstone, with large temporal fenestra and occiput exposed. Potentially important specimen since <i>Anteosaurus</i> skulls, especially juveniles, are rare. Proposed Field Rating IIIA Local Resource. Earmarked for professional collection by ESI (Wits University).
174 [M30]	-32.624487° 20.880768°	Farm Beerenvally 1/150. Several small blocks of ferruginised petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource. No mitigation required.
175 [M31]	-32.624620° 20.880428°	Farm Beerenvally 1/150. Medium-sized block (c. 10 cm long) of ferruginised petrified wood in surface gravels. Proposed Field Rating IIIC Local Resource. No mitigation required.
175a [M32]	-32.61782° 20.89009°	Farm Beerenvally 1/150. Moordenaars Member. Two ex situ unidentifiable small bone fragments on light grey-green mudstone (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
175b [M33]	-32.61852° 20.89067°	Farm Beerenvally 1/150. Moordenaars Member. Ex situ large bone fragment (15 cm wide) overlying light grey-green mudstone, from either

		a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
176 [M34]	-32.619570° 20.890091°	Farm Beerenvally 1/150. Moordenaars Member. Partially preserved, large bradysaurian pareiasaur (probably Nochelesaurus) , in situ within and weathering out of green-grey mudstone (3 pieces collected). Pareiasaur skeleton elements comprising a cranial fragment with ornamentation, partial left maxilla with sheared off teeth, partial interclavicle and clavicle, right scapula, 1-20 vertebrae with large, mushroom-shaped dorsal neural spines preserved, left iliac blade, left femur, one phalanx, and other postcranial fragments. Identified as <i>Nochelesaurus</i> by Marc Van den Brandt due to the ornamentation style of the cranial fragment (very distinct ridges and bosses). Collected the cranial fragment, partial left maxilla and the phalanx. Proposed Field Rating IIIB Local Resource. No mitigation required.
178	-32.622286° 20.892728°	Farm Beerenvally 1/150. Moordenaars Member. Well-exposed wave rippled sandstone bedding surfaces with drag marks (possibly biogenic – e.g. floating wood), sparse invertebrate burrows, possible rooted plant stem traces and paired sinuous fish swimming trails . Proposed Field Rating IIIC Local Resource. No mitigation required.
180 [M35]	-32.603915° 20.874943°	Farm Beerenvally 1/150. Moordenaars Member. Small, rolled and white-weathered, unidentifiable postcranial fragment from a large dinocephalian or a bradysaurian pareiasaur , ex situ, overlying grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
181	-32.604250° 20.874811°	Farm Beerenvally 1/150. Moordenaars Member. Two or more overlapping sandstone casts of tetrapod burrows (15-30 cm across, broader structure possibly a terminal chamber) excavated into purple-brown mudrock beneath dirty brown wacke bed. Burrow floors show evidence of small-scale burrowing (possibly insects). Proposed Field Rating IIIC Local Resource. No mitigation required.
182 [M36]	-32.604325° 20.874116°	Farm Beerenvally 1/150. Moordenaars Member. Two small, badly eroded and white-weathered, unidentifiable bone fragments (not collected), ex situ, overlying grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
183 [M37]	-32.604108° 20.873686°	Farm Beerenvally 1/150. Moordenaars Member. Small, badly eroded and blue-coloured unidentifiable bone fragment , possibly proximal rib (not collected), ex situ, within dirty grey-green wacke block. On grey mudstone scree. Proposed Field Rating IIIC Local Resource. No mitigation required.
184	-32.604012° 20.873680°	Farm Beerenvally 1/150. Moordenaars Member. Small, elongated, white, bone fragment , in situ, with broken off pieces, in grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
185 [M39]	-32.603416° 20.873562°	Farm Beerenvally 1/150. Moordenaars Member. In situ partial large tapinocephalid dinocephalian skeleton embedded within grey-green mudrock and ferruginous pedoconcrete concretions (three large cranial pieces and five large postcranial fragments collected) with several dozen

		cranial and postcranial fragments ex situ, identified by the extremely thick cranial fragments (pachyostosis of skull roof). Partial cranial, pelvic, scapular and vertebral fragments. Proposed Field Rating IIIB Local Resource. No mitigation required.
187 [M40]	-32.603378° 20.872565°	Farm Beerenvally 1/150. Moordenaars Member. Numerous ex situ small bone fragments, with pink-white preservation among surface gravels. Partial postcranial bones, including large rib fragments and other unidentifiable postcranial fragments of medium- to large-bodied tetrapod. Proposed Field Rating IIIC Local Resource. No mitigation required.
188	-32.602812° 20.872589°	Farm Beerenvally 1/150. Moordenaars Member. Two weathered bone fragments of a large-bodied tetrapod weathered out into stream bed (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
189 [M41]	-32.603531° 20.872407°	Farm Beerenvally 1/150. Moordenaars Member. Four unidentifiable ex situ, weathered large, long bone fragments , with blue-brown preservation (not collected), overlying light grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
190 [M42]	-32.603428° 20.873456°	Farm Beerenvally 1/150. Moordenaars Member. Ex situ large fragment of a long bone shaft , fits with part of tapinocephalid at Loc. 185. Proposed Field Rating IIIC Local Resource. No mitigation required.
191	-32.603431° 20.873549°	Farm Beerenvally 1/150. Moordenaars Member. In situ postcranial skeletal material of medium- to large-bodied tetrapod embedded within ferruginous pedocrete lens at base of wacke bed. Proposed Field Rating IIIC Local Resource. No mitigation required.
196 [M43]	-32.620341° 20.872576°	Farm Beerenvally 1/150. Shallow pan (brak-kolle) area. Rare, v. small rolled bone fragments among sparse surface gravels (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
197 [M44]	-32.608749° 20.873496°	Farm Beerenvally 1/150. Moordenaars Member. In situ, partial, weathered skeleton of a small therocephalian or dicynodont , comprising ribs, gastralia, a distal humerus, partial vertebrae, with blue preservation, embedded within green-grey mudstone. Also rolled bone fragment within float block of wacke. Proposed Field Rating IIIC Local Resource. No mitigation required
198 [M45]	-32.613576° 21.022921°	Farm Nooitgedagt RE/148. Moordenaars Member. Two ex situ large cranial bone fragments, probably dinocephalian , overlying grey-purple mudstone (collected). Proposed Field Rating IIIB Local Resource. No mitigation required.
199 [M46]	-32.614299° 21.022928°	Farm Nooitgedagt RE/148. Moordenaars Member. Farm Nooitgedagt RE/148. Moordenaars Member. Unidentifiable ex situ large weathered long bone fragment , overlying grey-purple mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource.

		No mitigation required.
200 [M47]	-32.614507° 21.022880°	Farm Nooitgedagt RE/148. Moordenaars Member. Six ex situ large, badly weathered, postcranial bone fragments (not collected) and one upper or lower jaw fragment with 3 tooth roots, probably belonging to a dinocephalian (collected). Proposed Field Rating IIIB Local Resource. No mitigation required.
201 [M48]	-32.615405° 21.023520°	Farm Nooitgedagt RE/148. Moordenaars Member. C. 20 ex situ, large, badly weathered, postcranial bone fragments , including partial vertebrae, two partial centra, partial femur, parts of a pelvis, and other unidentifiable postcranial long bone fragments, belonging to a dinocephalian (three largest fragment collected). Proposed Field Rating IIIB Local Resource. No mitigation required.
202 [M49]	-32.615243° 21.023037°	Farm Nooitgedagt RE/148. Moordenaars Member. Seven ex situ large, badly weathered, postcranial bone fragments from either a dinocephalian or a bradysaurian pareiasaur (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
207 [M50]	-32.632135° 21.018866°	Farm Nooitgedagt RE/148. Moordenaars Member. In situ distorted therocephalian skull (4 fragments, collected), with partial postcrania , with blueish bone preservation, preserved in mottled green-grey wackes exposed in river bank. Proposed Field Rating IIIB Local Resource. No mitigation required.
208 [51]	-32.632901° 21.018779°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large dinocephalian cranial fragments (eight, including on rugose temporal fenestra – collected), near or within a recent rock fall, from steep riverine exposure of green-grey wackes. Proposed Field Rating IIIB Local Resource. No mitigation required.
210	-32.634349° 21.015197°	Farm Nooitgedagt RE/148. Moordenaars Member, good riverine exposures of mudrocks and sandstones. Stem casts of reedy plants (possible equisetalean ferns) within wacke bed. Proposed Field Rating IIIC Local Resource. No mitigation required.
212 [M52]	-32.635566° 21.014554°	Farm Nooitgedagt RE/148. Moordenaars Member. Nine ex situ bone fragments of a small to medium sized tetrapod , badly weathered, overlying green-grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
213 [M53]	-32.633750° 21.010245°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ weathered gorgonopsid partial skull and skeleton overlying purple brown mudstone, comprising left and right lower jaw fragments, maxilla, two partial vertebral columns, distal and proximal femur, and tens of postcranial fragments (collected). Proposed Field Rating IIIB Local Resource. No mitigation required.
214 [M54]	-32.632042° 21.011925°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ partial skull of a small dicynodont comprising a snout, and two occipital pieces, on gullied green-grey mudstones. Proposed Field Rating IIIB Local Resource.

		No mitigation required.
219 [M55]	-32.617298° 20.985235°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large, white- weathered long bone fragment , with thick cortical bone, overlying grey-green mudstone in a riverbed, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
220	-32.617525° 20.985339°	Farm Nooitgedagt RE/148. Moordenaars Member. Possible but equivocal sandstone casts of one or more tetrapod burrows (c. 20 cm across). Proposed Field Rating IIIC Local Resource. No mitigation required.
221 [M56]	-32.619466° 20.987030°	Farm Nooitgedagt RE/148. Moordenaars Member. In-situ Dinocephalian-sized partial femur overlying green-grey sandstone bed on crest of a low <i>koppie</i> . Ten large ex situ broad and flat pelvic fragments and other fragments (not collected). Proposed Field Rating IIIB Local Resource. No recommended mitigation.
223 [M57]	-32.620833° 20.977747°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large, white- weathered long bone fragment , with thick cortical bone, overlying grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur. Proposed Field Rating IIIC Local Resource. No mitigation required.
224 [M58]	-32.621256° 20.977206°	Farm Nooitgedagt RE/148. Moordenaars Member. Six ex situ large, badly weathered bone fragments overlying grey-green mudstone, associated with ferruginous breccia, from either a dinocephalian or a bradysaurian pareiasaur (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
225	-32.621680° 20.977193°	Farm Nooitgedagt RE/148. Moordenaars Member. Vertical in situ lungfish burrow casts within purple-brown mudrock. Proposed Field Rating IIIC Local Resource. No mitigation required.
226 [M59]	-32.621528° 20.976929°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large distal bradysaurian pareiasaur radius , overlying grey-green mudstone in vicinity of ferruginous basal breccias with ferruginous moulds of reworked fossil wood. Proposed Field Rating IIIC Local Resource. No mitigation required.
228 [M60]	-32.621802° 20.977265°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ large, weathered long bone fragment overlying grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
229	-32.621953° 20.976885°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ weathered fragments of large bone overlying grey-green mudstone, from either a dinocephalian or a bradysaurian pareiasaur (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
230 [M61]	-32.622665° 20.975143°	Farm Nooitgedagt RE/148. Moordenaars Member. In situ partial dinocephalian skeleton (3 bones collected: ex situ digit and thick, short, clavicle and in situ vertebrae or curved cranial fragment in four pieces) near the top of a <i>koppie</i> , and 20-30 unidentifiable weathered ex situ postcranial fragments lower down in a trench or gully. Proposed Field Rating IIIB Local Resource.

		No mitigation required.
231	-32.622381° 20.974930°	Farm Nooitgedagt RE/148. Moordenaars Member. Float blocks of ferruginous basal breccia weathering out of 20-30 cm thick lens at base of thin sandstone. Breccia contains reworked fragments of bone and wood . Proposed Field Rating IIIC Local Resource. No mitigation required.
232	-32.621076° 20.977295°	Farm Nooitgedagt RE/148. Moordenaars Member. Ex situ fragments of a large pareiasaur comprising three cranial pieces with rugose “cheek” ornamentation of radial ridges and pits, three dozen small, weathered postcranial fragments, weathering out of green-grey mudstone. Proposed Field Rating IIIC Local Resource. No mitigation required.
234	-32.564648° 21.005272°	Farm Nooitgedagt RE/148. Karelskraal Member. Six small bone fragments of a small- to medium-sized tetrapod – possibly therocephalian (not collected). Proposed Field Rating IIIC Local Resource. No mitigation required.
234a	-32.563453° 21.003938°	Farm Nooitgedagt RE/148. Karelskraal Member. Several sandstone casts of small inclined tetrapod burrows . Cluster of postcranial bones of small tetrapod in float. Proposed Field Rating IIIC Local Resource. No mitigation required.
235	-32.562162° 21.003852°	Farm Nooitgedagt RE/148. Karelskraal Member. Isolated small, suncracked bone in surface float. Proposed Field Rating IIIC Local Resource. No mitigation required.

Table A2. Fossil site data for Sutherland and Rietrug WEF 132 kV grid connection project areas, including original MTS site and access road (Nov. 2016, Feb. 2017, June 2019)

Loc.	GPS data	Comments
003	S32° 38' 42.3" E21° 16' 03.1"	Farm Hamel Kraal. Streambed exposure of fine-grained crevasse-splay sandstone with upper bedding plane showing abundant small-scale invertebrate burrows (c. 5 mm diam.) – probably including <i>Scoyenia</i> – as well as stem casts of reedy plants (possibly equisetalean ferns), microbial mat textures. Probable Koornplaats Member. Proposed Field Rating IIC.
005	S32° 39' 00.1" E21° 16' 30.4"	Farm Hamel Kraal. Fragments of post-cranial bones weathering-out of breccias in the Koornplaats Member which are also associated with rusty-brown ferruginous moulds of transported woody plant axes . Proposed Field Rating IIC.
007	S32° 39' 00.1" E21° 16' 18.8"	Farm Hamel Kraal. Sheetwash gravels with occasional reworked blocks of vuggy silicified wood showing poorly-developed xylem structure – perhaps a result of pre-diagenetic decomposition. Proposed Field Rating IIC.
015	S32° 41' 55.5" E21° 16' 09.4"	Farm Hamel Kraal. Surface gravels with local concentration of blocks of poorly-preserved, silicified and partially ferruginised wood , some showing recognisable woody fabric, others not (possibly due to pre-diagenetic decomposition). Proposed Field Rating IIC.
016	S32° 41' 57.0" E21° 15' 43.5"	Farm Hamel Kraal. Alluvial <i>vlaktes</i> and low bedrock exposures east of MTS site traversed by shallow ephemeral streams with poorly-consolidated, alluvial gravels and sands. Lenses of <i>koffieklip</i> within mudrocks. Patches of sheetwash gravels with occasional reworked blocks of poorly-preserved silicified wood , fine-grained sandstone stone artefacts, calcrete concretions, vein quartz <i>etc.</i> Proposed Field Rating IIC.
017	S32° 41' 56.2" E21° 15' 34.4"	Farm Hamel Kraal. Sparse blocks of poorly-preserved silicified wood in surface gravels. Apron of coarse sandstone colluvial gravels in foothills of Bakenkop. Proposed Field Rating IIC.
018	S32° 41' 59.6" E21° 15' 25.3"	Farm Hamel Kraal. Sparse blocks of poorly-preserved silicified wood in surface gravels. Proposed Field Rating IIC.
022	S32° 41' 51.3" E21° 15' 25.0"	Farm Hamel Kraal. Alluvial gravels and sands on eastern foot of Bakenkop with sparse blocks of poorly-preserved petrified wood . Proposed Field Rating IIC.
023	S32° 41' 51.6" E21° 15' 36.0"	Farm Hamel Kraal. Surface gravels east of MTS site with sparse blocks of silicified wood . Proposed Field Rating IIC.
024	S32° 41' 51.8" E21° 15' 38.7"	Farm Hamel Kraal. Sheetwash surface gravels of sandstone, vein quartz with local concentrations of poorly-preserved, weathered and disarticulated postcranial bones of sizeable tetrapod(s) – possibly dinocephalian or pareiasaur – as well as blocks of poorly-preserved petrified wood. Proposed Field Rating IIC.
025	S32° 41' 53.1" E21° 16' 09.1"	Farm Hamel Kraal. Low hill capped by rusty-brown <i>koffieklip</i> breccias. Streambed exposure of wave-rippled sandstone palaeosurface with small-scale, low-diversity ichnoassemblages (epichnial furrows, narrow sinuous burrows), sandstone-infilled desiccation cracks. Proposed Field Rating IIC.
027	S32° 43' 09.3" E21° 15' 31.0"	Farm Hamel Kraal. Float block fragment of very thick bony skull roof of a tapinocephalid dinocephalian . Weathering-out calcrete palaeosols. Proposed Field Rating IIC.
493	S32° 29' 27.2" E20° 46' 38.0"	Farm Matjesfontein 92. Partial thin-boned skull roof, scapula and unidentified, worn postcranial bones in surface float (probably dinocephalian, possibly tapinocephalid) . Note historical <i>Tapinocephalus</i> Assemblage Zone fossil locality marked around here on 1: 250 000 geology map Sutherland 3220. Proposed Field Rating IIC.
494	S32° 29' 26.3" E20° 46' 38.5"	Farm Matjesfontein 92. End of very robust limb bone (dinocephalian / pareiasaur) – partially embedded in soil. Proposed Field Rating IIC.

495	S32° 29' 29.2" E20° 46' 41.1"	Farm Matjesfontein 92. Highly weathered, worn postcranial bone fragment in float. Proposed Field Rating IIIC.
496	S32° 29' 29.8" E20° 46' 41.4"	Farm Matjesfontein 92. Cluster of several highly weathered, worn postcranial bone fragments in float. Proposed Field Rating IIIC.
502	S32° 30' 38.3" E20° 52' 28.5"	Farm Portugals Rivier 218. Dykes of well-exposed ferruginised pyroclastic breccia of the Sutherland Suite.
509	S32° 31' 04.4" E20° 54' 47.2"	Farm Portugals Rivier 218. Well-developed channel breccias containing several disarticulated and worn tetrapod postcranial bone fragments . Ferruginised oblique burrow (c. 5.5 cm wide) excavated through breccia bed. Proposed Field Rating IIIC.
512	S32° 31' 16.4" E20° 56' 11.0"	Farm Portugals Rivier 218. Horizon with numerous subvertical lungfish burrow casts excavated into maroon overbank mudrocks exposed in cutting on southern side of dust road. Proposed Field Rating IIIB.
513	S32° 31' 42.6" E20° 56' 51.9"	Farm Portugals Rivier 218. Blocks of greyish-purple wacke with assemblage of narrow vertical sand-infilled cylinders – probably casts of reedy plant stems (e.g. sphenophytes or “horsetails”). Proposed Field Rating IIIC.
515	S32° 32' 06.1" E20° 58' 03.4"	Farm Annex Bakoven 135/1. Flaggy sandstone blocks with plant stem casts, small invertebrate traces of the <i>Scoyenia</i> ichnofacies . Proposed Field Rating IIIC.
521	S32° 33' 48.5" E21° 00' 14.1"	Farm Nooigedagt 148. Karelskraal Member. Several large, gently inclined, subcylindrical tetrapod burrow casts (c. 15 cm wide) of sandstone embedded in maroon overbank mudrocks. The best example shows well-developed scratch marks on the ventrolateral surface. These are among the youngest recorded tetrapod burrows within the Abrahamskraal Formation and were possibly constructed by dicynodonts. Proposed Field Rating IIIB.
530	S32° 36' 32.6" E20° 52' 19.0"	Farm Beeren Valley 150. Bioturbated swaley channel sandstone palaeosurface with poorly-preserved horizontal invertebrate burrows and other ill-defined traces . Proposed Field Rating IIIC.
532	S32° 36' 27.6" E20° 54' 24.5"	Farm Beeren Valley 150. Two isolated pieces of highly-weathered postcranial bones in surface float. Proposed Field Rating IIIC.
535	S32° 36' 36.9" E20° 55' 29.2"	Farm Beeren Valley 150. Articulated partial postcranial skeleton of a large pareiasaur embedded in grey-green overbank mudrocks. This specimen is conservation-worthy and should be protected by a buffer zone of 30 m radius. Proposed Field Rating IIIB.
539	S32° 36' 53.5" E20° 57' 34.1"	Farm Nooigedagt 148. Disarticulated limb bone of large tetrapod embedded in maroon mudrocks, showing sun-dried surface texture. Proposed Field Rating IIIC.
540	S32° 36' 53.6" E20° 57' 33.9"	Farm Nooigedagt 148. Fragment of long bone in surface float . Discrete cluster of several pebble- to cobble-sized exotic clasts (“lonestones”) embedded within maroon overbank mudrocks. The larger cobbles are of a greenish-grey igneous rock (possibly andesite) and are subrounded. They are among the largest exotic clasts recorded from the Lower Beaufort Group in the SW Karoo. The conglomeratic lens also contains weathered, dark-grey tillite-like material, suggesting a Dwyka Group provenance for the pebbles which may have been brought into the Mid Permian Karoo Basin by floating tree roots or ice floes.
545	S32° 33' 10.2" E20° 54' 13.0"	Farm Portugals Rivier 218. Several highly weathered postcranial bones in surface float , showing sun-cracked surface textures. Proposed Field Rating IIIB.
546	S32° 33' 11.2" E20° 54' 16.1"	Farm Portugals Rivier 218. Scatter of numerous disarticulated, weathered bones of a large tetrapod (dinocephalian / pareiasaur) among sandstone scree . Proposed Field Rating IIIB.
548	S32° 34' 35.1" E21° 00' 29.7"	Farm Nooigedagt 148. Kareskraal Member. Several vertebrate burrow casts (c. 30 cm wide). Requires confirmation. Proposed Field Rating IIIC.
550	S32° 34' 40.0" E21° 00' 27.4"	Farm Nooigedagt 148. Partial disarticulated skull of small tetrapod with a boat-shaped lower jaw (probably dicynodont) embedded in pedocrete horizon. Proposed Field Rating IIIC.

555	S32° 38' 21.2" E20° 59' 33.7"	Farm Nooigedagt 148. Possible sandstone cast of vertebrate burrow (c. 15 cm wide) within maroon overbank mudrocks (requires confirmation). Proposed Field Rating IIIC.
556	S32° 37' 16.3" E20° 58' 47.9"	Farm Nooigedagt 148. Two highly-weathered post-cranial bones of a large tetrapod in surface float. Proposed Field Rating IIIC.
029	S32° 37' 27.8" E21° 05' 52.4"	Farm 219, escarpment edge nr Blouval. Several small bone fragments (possibly amphibian based on rugose surface texture) within mudflake-rich conglomerate horizon (sandstone float block). Proposed Field Rating IIIC.
030	S32° 37' 29.7" E21° 05' 53.3"	Farm 219, escarpment edge nr Blouval. Extensive hillslope and gully exposure of blue-green, grey-green and purple-brown Abrahamskraal Fm mudrocks, thin crevasse splay sandstones. Well-developed palaeocalcrete pedogenic horizons (sl. Ferruginised). Gypsum pseudomorphs and unidentified bone fragment in float . Proposed Field Rating IIIC.
031	S32° 37' 42.7" E21° 06' 34.7"	Farm 219, upper escarpment zone (Langpunt track). Hillslope exposure of grey-green mudrocks and flaggy sandstones – probably of Koornplaats Member. Isolated rolled bone fragment within thin mudflake breccia.
041	S32° 38' 51.9" E21° 15' 42.1"	Hamel Kraal 16, extensive surface scatter of large blocks of silicified wood and rare blocks of spongy bone on either side of farm track. Probably weathered out from base of local yellowish-brown channel sandstones (Koornplaats Member, Abrahamskraal Fm). And locally associated with <i>koffieklip</i> ferruginous carbonate concretionary lenses containing occasional rolled bone fragments . Wood preservation often poor, ferruginized, vuggy (possibly partially rotted before petrification) but some material shows well-preserved woody fabric (prominent seasonal growth lines). Proposed Field Rating IIIB.
042	S32° 38' 53.7" E21° 15' 42.4"	Hamel Kraal 16, float blocks of robust fossil bone just south of fossil wood surface scatter. Proposed Field Rating IIIB.
043	S32° 38' 53.2" E21° 15' 41.3"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
044	S32° 38' 52.2" E21° 15' 41.3"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
045	S32° 38' 52.3" E21° 15' 41.4"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
046	S32° 38' 52.3" E21° 15' 41.5"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
047	S32° 38' 52.3" E21° 15' 41.5"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
048	S32° 38' 52.2" E21° 15' 41.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
049	S32° 38' 52.1" E21° 15' 41.7"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
050	S32° 38' 51.9" E21° 15' 41.7"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
051	S32° 38' 51.9" E21° 15' 41.7"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
052	S32° 38' 51.8" E21° 15' 41.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
053	S32° 38' 51.8" E21° 15' 41.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
054	S32° 38' 51.6" E21° 15' 41.7"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
055	S32° 38' 51.7" E21° 15' 41.8"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
056	S32° 38' 52.1" E21° 15' 42.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
057	S32° 38' 52.2" E21° 15' 42.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.

058	S32° 38' 52.2" E21° 15' 42.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
059	S32° 38' 52.2" E21° 15' 42.2"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
060	S32° 38' 52.2" E21° 15' 42.2"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
061	S32° 38' 52.0" E21° 15' 42.3"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
062	S32° 38' 52.0" E21° 15' 42.4"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
063	S32° 38' 51.9" E21° 15' 42.5"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
064	S32° 38' 51.8" E21° 15' 42.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
065	S32° 38' 51.8" E21° 15' 42.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
066	S32° 38' 52.2" E21° 15' 43.5"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
067	S32° 38' 52.7" E21° 15' 43.4"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
068	S32° 38' 52.7" E21° 15' 43.3"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
069	S32° 38' 52.6" E21° 15' 43.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
070	S32° 38' 52.6" E21° 15' 43.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
071	S32° 38' 52.5" E21° 15' 43.1"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
072	S32° 38' 52.3" E21° 15' 42.8"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
073	S32° 38' 52.3" E21° 15' 42.7"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
074	S32° 38' 52.3" E21° 15' 42.6"	Petrified wood block within surface scatter on Hamel Kraal 16. Proposed Field Rating IIIB.
077	S32° 40' 19.8" E21° 15' 28.6"	Hamel Kraal 16, N side of Brewelskop. Tabular, flat-laminated sandstones with cylindrical casts of plant stems (probably sphenophytes / horsetails). Proposed Field Rating IIIC.
079	S32° 40' 23.1" E21° 15' 33.1"	Hamel Kraal 16, N side of Brewelskop. Well-developed (c. 50 cm) basal channel breccia packed with reworked calcrete nodules as well as abundant rusty-brown, ferruginized moulds of transported woody plant debris . Plant debris layers or lenses also present within overlying flaggy channel sandstones. Isolated large therapsid tusk (c. 25 mm diam., possibly dinocephalian) in float has probably weathered out from basal breccias, or possibly from calcrete palaeosol within underlying mudocks. Proposed Field Rating IIIC.
081	S32° 40' 48.4" E21° 15' 53.6"	Hamel Kraal 16, south of Brewelskop. Isolated rounded bone fragment (c. 5 cm across) in float. Proposed Field Rating IIIC.
084	S32° 42' 41.8" E21° 15' 51.5"	Hamel Kraal 16. Unusually extensive development of lens of brown-weathering, ferruginous-patinated greyish channel sandstones either side of dust road and c. 1 km SE of proposed Eskom Nuwerust Substation. Dolerite-like sandstone corestones locally show fine internal lamination as well as low-diversity assemblages of prominent-weathering, intrastratal, subcylindrical invertebrate burrows (c. 1 cm wide). Proposed Field Rating IIIC.

Table A3. Fossil site data for revised MTS site near Merweville (June 2021)

Loc.	GPS data	Comments
511	32 42 38.8 S 21 15 53.6 E	Farm Hamel Kraal 16. Scatter in float of fragmentary postcranial bones of a large-bodied tetrapod (pareiasaur or dinocephalian) . Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils lie outside MTS project area.
522	32 42 39.4 S 21 15 48.7 E	Farm Hamel Kraal 16. Low diversity purported invertebrate trace fossil assemblages (possibly pseudofossils) with positive-weathering, horizontal to oblique burrows as well as vertical plug-like components, all preserved within well-developed <i>koffieklip</i> lenses at the top of a channel sandstone body. Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils / pseudofossils lie outside MTS project area. <i>N.B.</i> Numerous similar occurrences of these trace fossil-like features are present within the yellow dotted area shown in Fig. A1.1.
548	32 42 46.1 S 21 15 54.6 E	Farm Hamel Kraal 16. Channel sandstone float blocks containing ferruginised moulds of plant axes (c. 2 cm wide). Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils lie outside MTS project area.

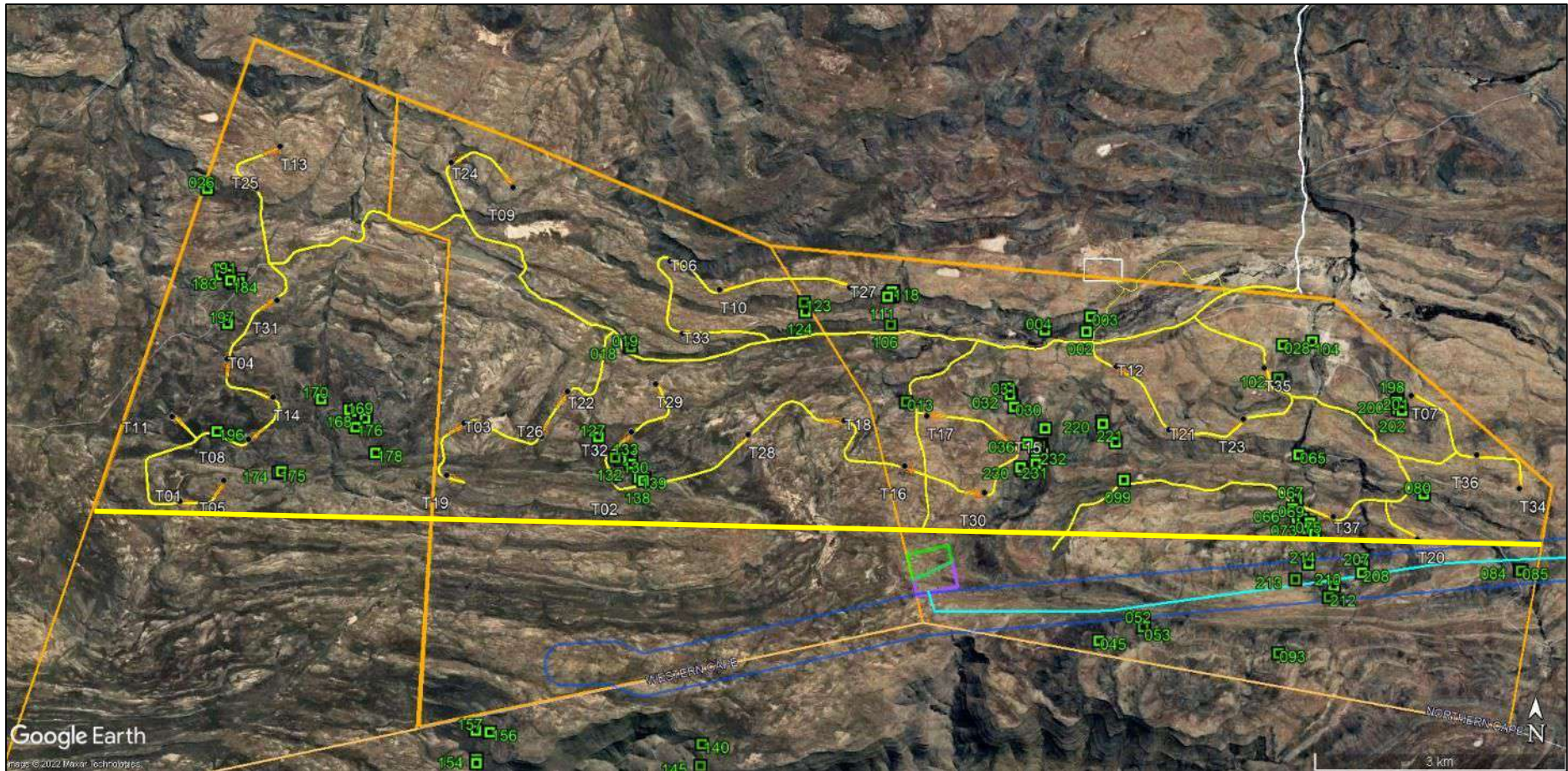


Figure A1.1: Google Earth© satellite image showing the outline of the Rietrug WEF project area with boundaries of relevant land parcels (orange polygons north of thick yellow line). Other key WEF infrastructure includes the Acrux substation (green & purple polygons) located in the adjoining Sutherland WEF site, wind turbine locations (numbered yellow circles), batching plant (white rectangle) and internal access road network (thin yellow lines), as well as the grid connection to the new Koring MTS near Merweville (pale blue line). Recorded fossil sites are shown by the numbered green squares. *None of the fossil sites lies within or close to (≤ 20 m) the proposed WEF footprint.* Recorded scientifically valuable fossil sites have already been mitigated. See following satellite images for more detail.

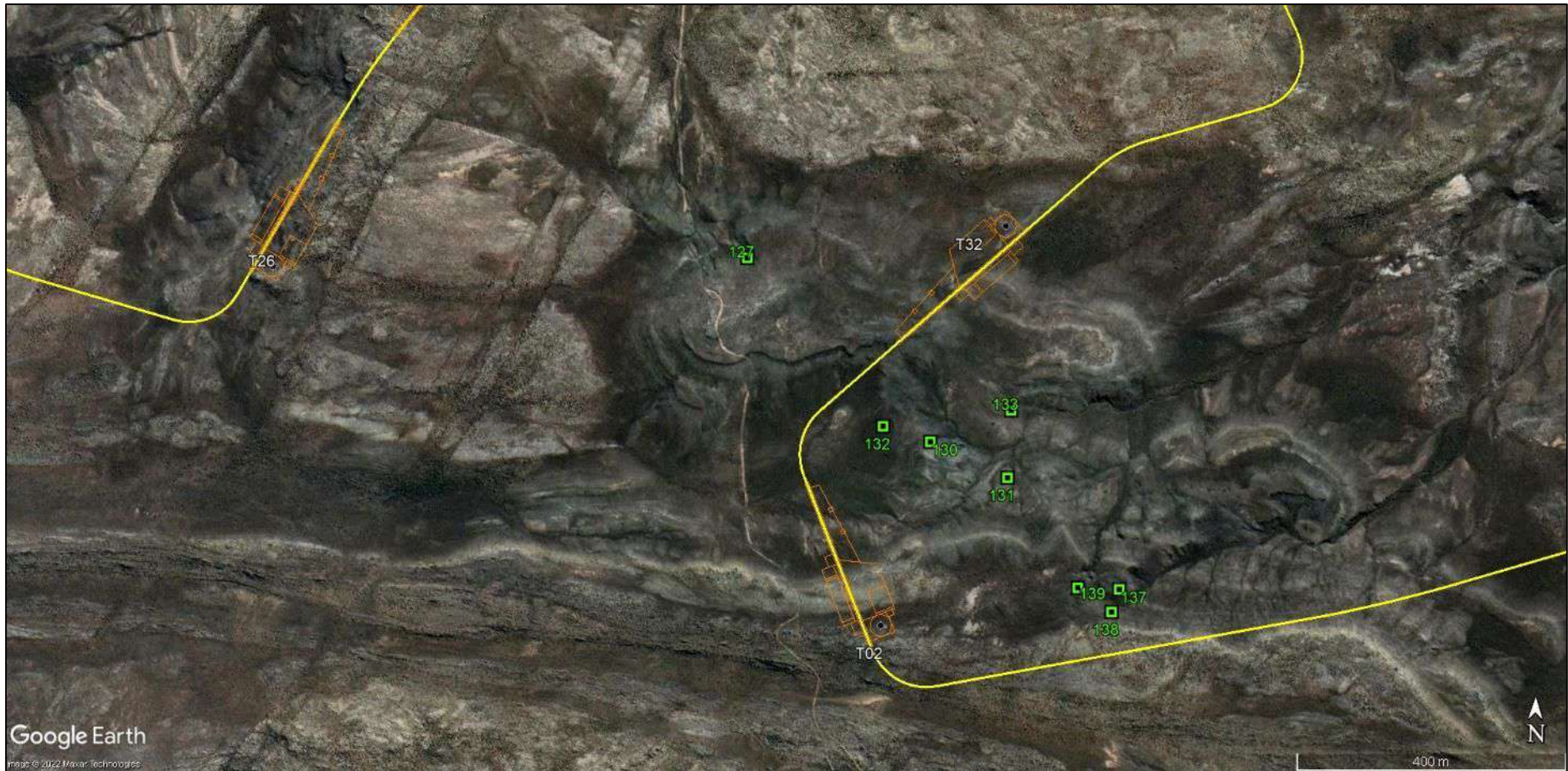


Figure A1.2: Google Earth© satellite image showing a central western portion of the Rietrug WEF project area on Farm RE/150 showing recorded fossil sites (numbered green squares) in relation to the turbine positions and associated hardstands (orange symbols) and internal access road network (yellow lines).

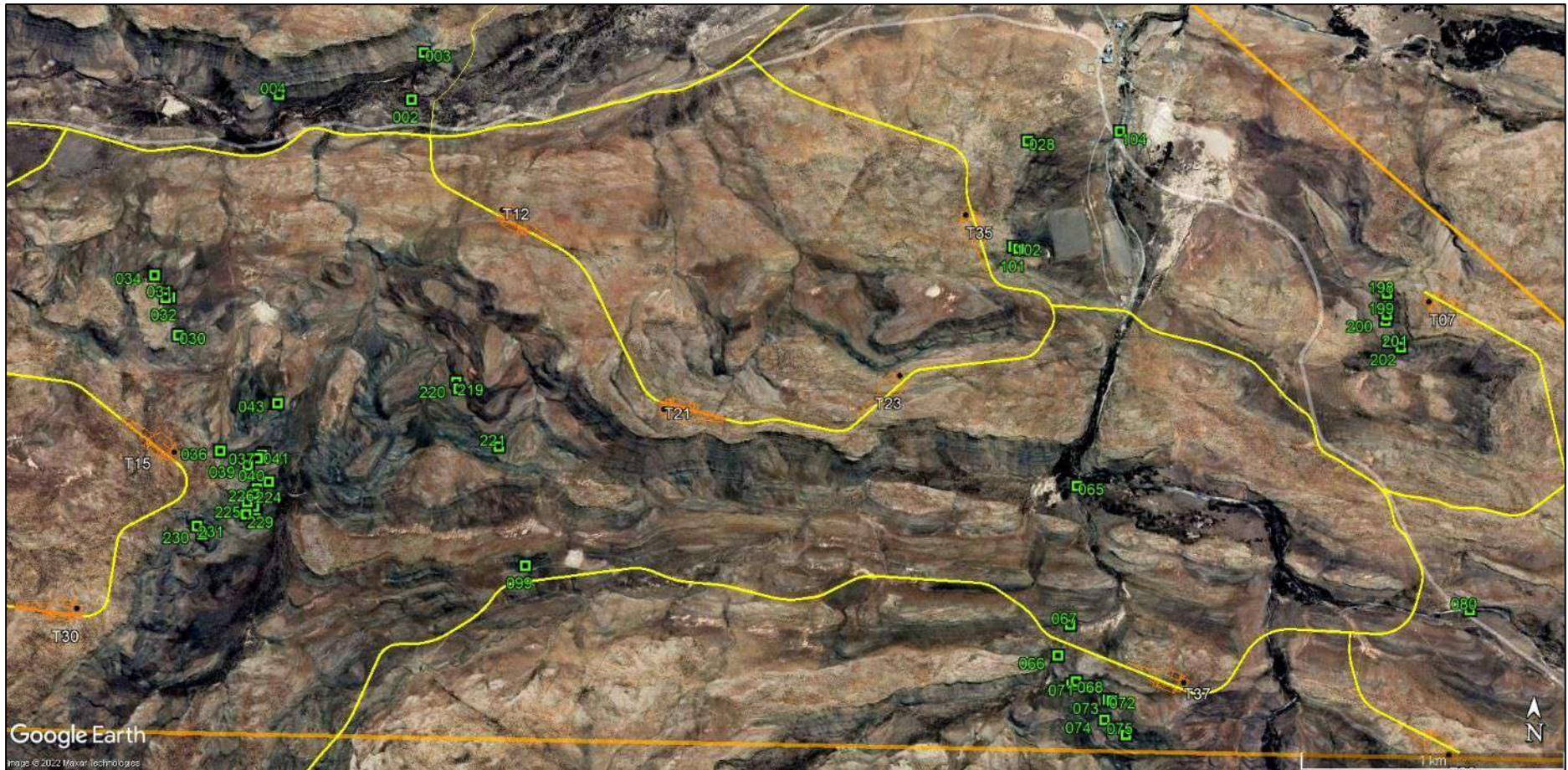


Figure A1.3: Google Earth© satellite image showing an eastern portion of the Rietrug WEF project area on Farm RE/148 showing recorded fossil sites (numbered green squares) in relation to the wind turbines (numbered orange symbols) and internal access road network (yellow lines).

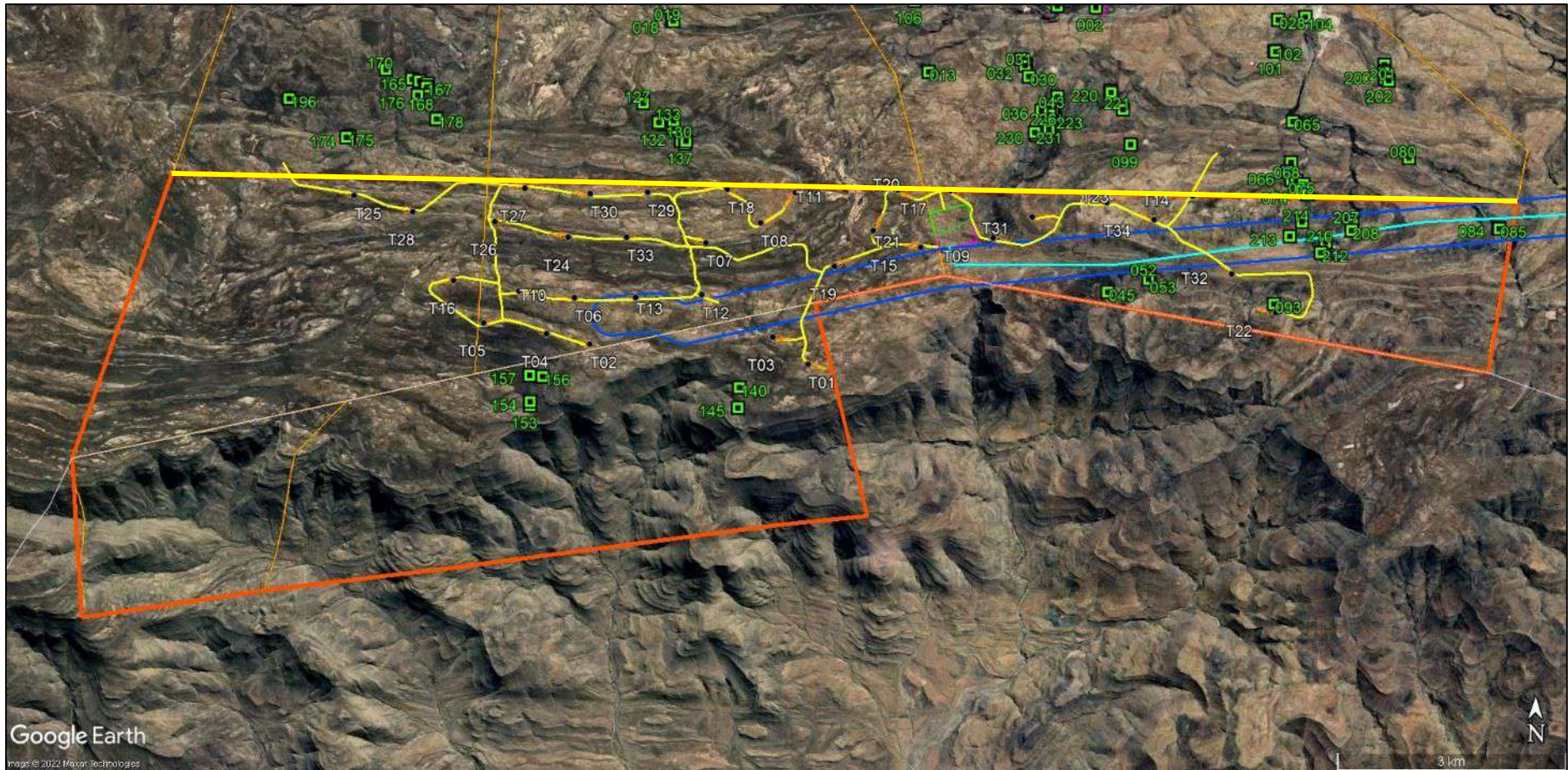


Figure A1.4: Google Earth© satellite image showing the outline of the Sutherland WEF project area (south of thick yellow line) with boundaries of relevant land parcels (orange polygons). Other key WEF infrastructure includes the AcruX on-site substation (green and purple polygons), wind turbine locations (numbered black circles) and internal access road network (thin yellow lines), as well as the grid connection to the new MTS near Merweville (pale blue line). Recorded fossil sites are shown by the numbered green squares. None of the fossil sites lies within or close to (< 20 m) the proposed WEF footprint. Scientifically valuable fossil sites have already been mitigated. See following satellite images for more detail.

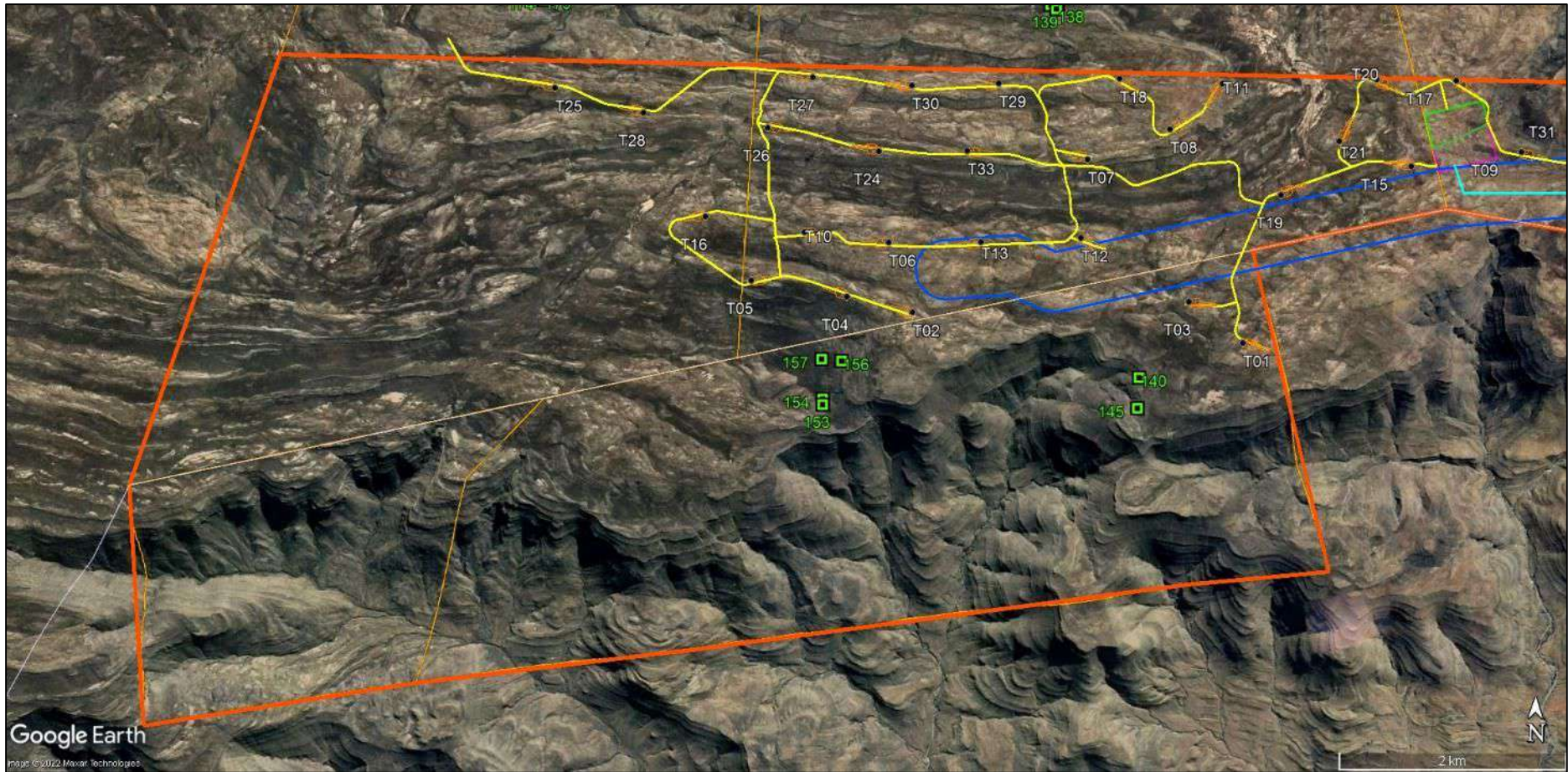


Figure A1.5: Google Earth© satellite image showing the western portion of the Sutherland WEF project area along the Great Escarpment mapping recorded fossil sites (numbered green squares) in relation to the on-site substation (green and purple polygons), wind turbine positions (numbered black circles) and internal access road network (thin yellow lines).

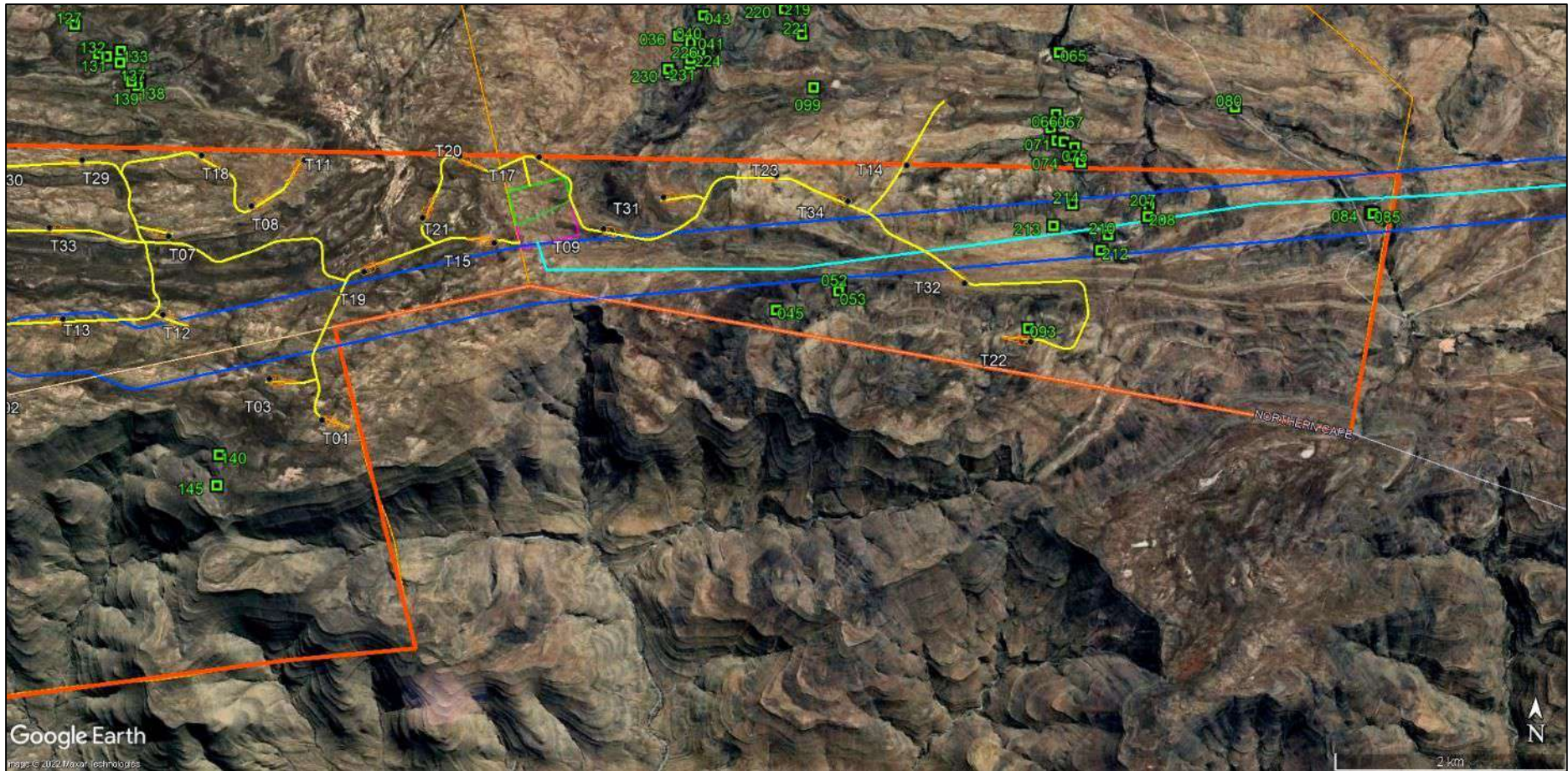


Figure A1.6: Google Earth© satellite image showing the eastern portion of the Sutherland WEF project area along the Great Escarpment near Boesmankop mapping recorded fossil sites (numbered green squares) in relation to the on-site substation (green and purple polygons), wind turbine locations (numbered black circles), internal access road network (thin yellow lines) and the grid connection to the new MTS near Merweville (pale blue line).

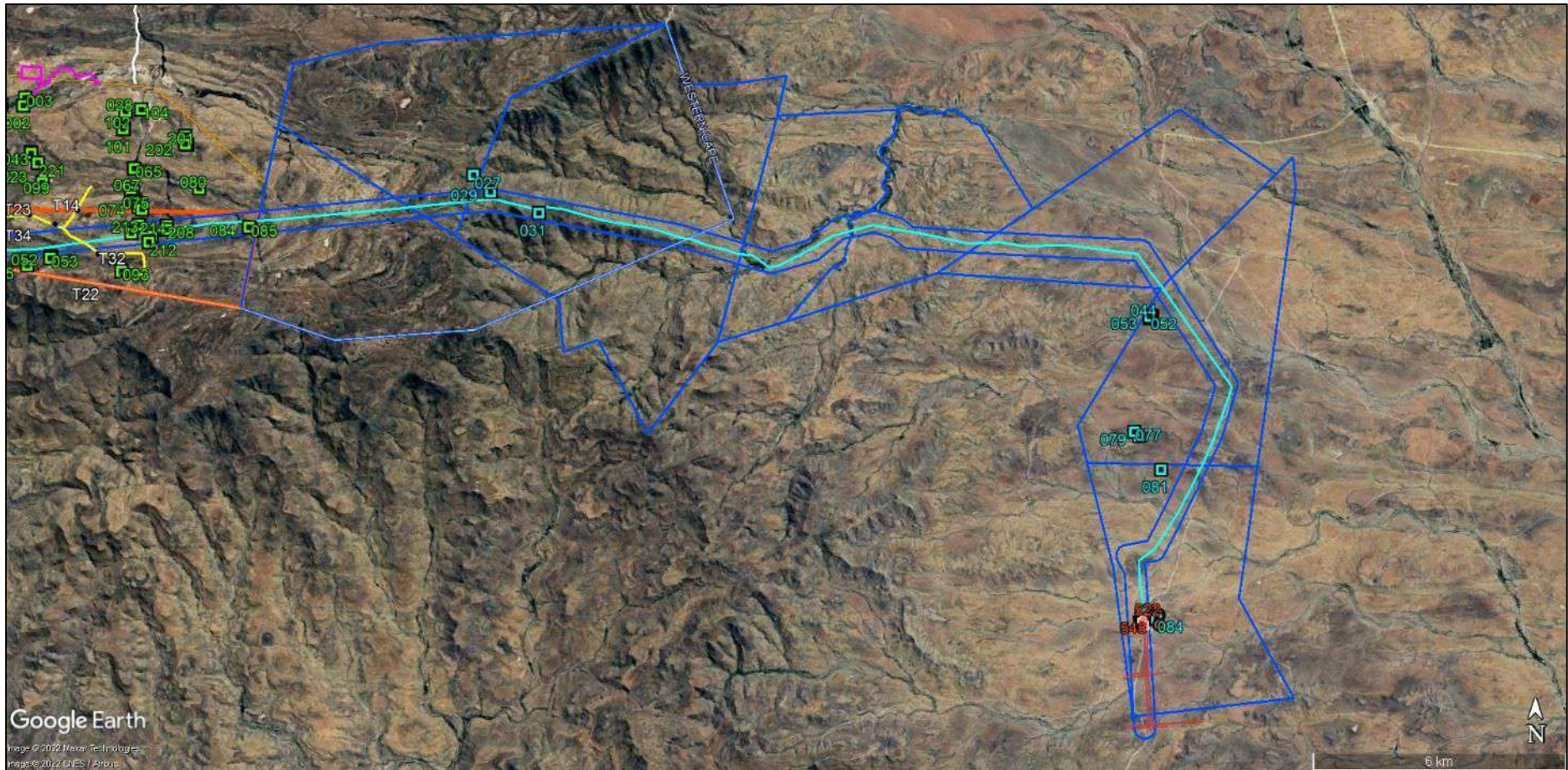


Figure A1.7: Google Earth© satellite image showing the joint Sutherland WEF and Rietrug WEF grid connection (pale blue line) from the edge of the Roggeveld Plateau to the new Koring MTS in the Moordenaars Karoo region to the west of Merweville (pink and black polygons – see following figure). Land parcels concerned are outlined in dark blue. Recorded fossil sites are mapped as numbered blue squares and red circles. **None of the fossil sites lies within or close to (< 20 m) the proposed WEF footprint.** Please see following satellite image for more detail of the MTS project area.

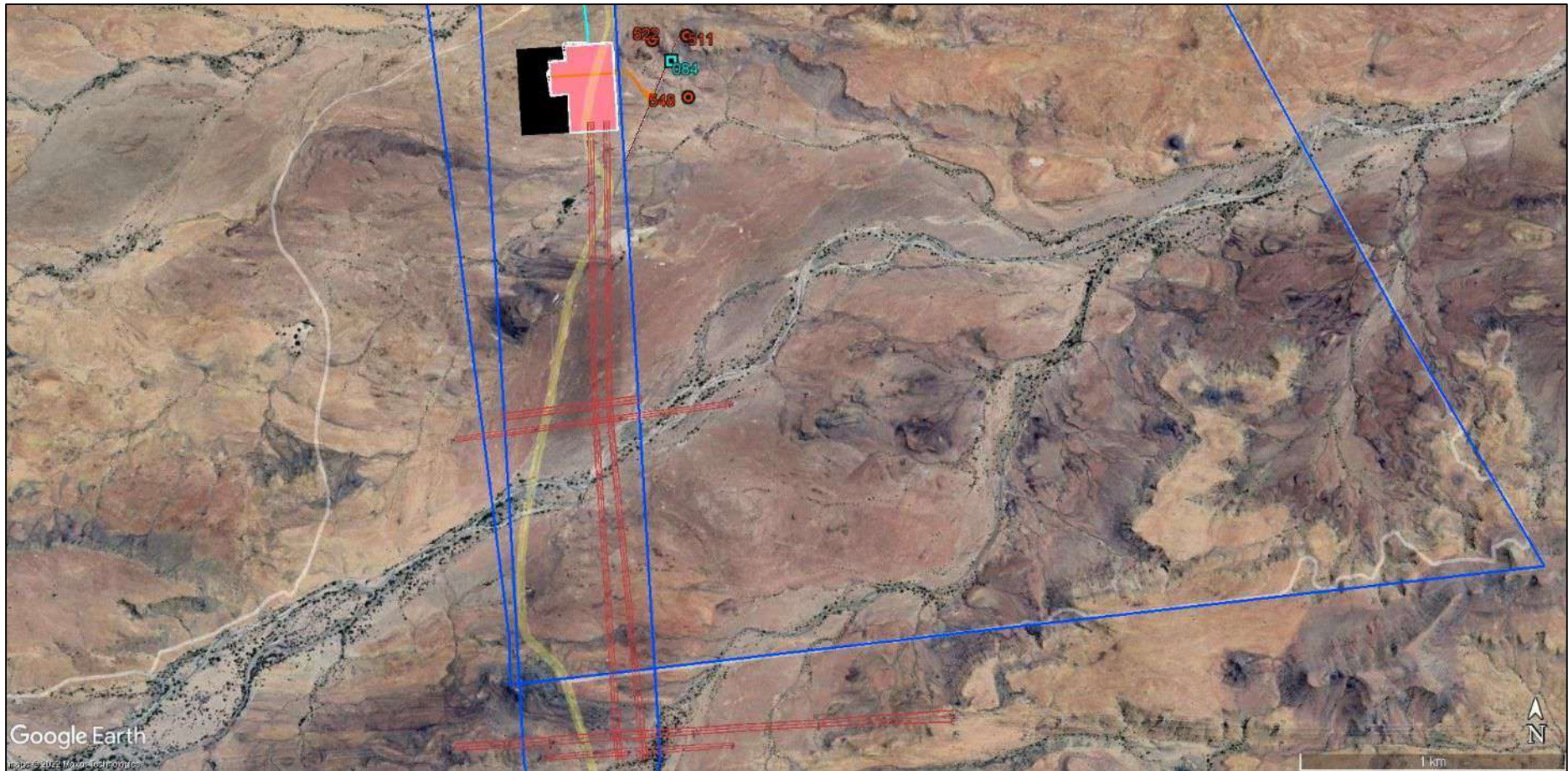


Figure A1.8: Google Earth© satellite image showing the authorised site for the new Koring Main Transmission Station (MTS), located c. 24 km west of Merweville, Western Cape (red rectangle). Recorded fossil sites are mapped as numbered blue squares and red circles. The joint Sutherland WEF and Rietrug WEF grid connection corridor is shown by the central pale blue line. The red lines indicate 400 kV lines from the Koring MTS. **None of the fossil sites lies within or close to (< 20 m) the proposed MTS footprint.**

APPENDIX 2: CHANCE FOSSIL FINDS PROCEDURE: –Authorized Rietrug and Sutherland Wind Energy Facilities and their associated Grid Connection Infrastructure, Northern and Western Cape Provinces	
Province & region:	Northern Cape, Sutherland & Laingsburg Districts
Responsible Heritage Resources Agency	SAHRA , 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za HWC , 3 rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za
Rock unit(s)	Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) Late Caenozoic alluvium along water courses and calcrete hardpans
Potential fossils	Petrified wood and other plant remains, skeletal remains of tetrapods (e.g. therapsids), trace fossils of invertebrates and vertebrates (fish / tetrapod burrows, trails & trackways) in Abrahamskraal Formation bedrocks. Bones, teeth and horn cores of mammals, freshwater molluscs, calcretised termitaria and other trace fossils in older consolidated alluvium.
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering)
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation • Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
	4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority	
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.

APPENDIX 3: SITE SENSITIVITY VERIFICATION

Provisional site sensitivity mapping for palaeontological heritage using the DFFE National Web-Based Environmental Screening Tool (as well as the SAHRIS Palaeosensitivity Map) suggests that the great majority of the project areas for the proposed Rietrug WEF, Sutherland WEF and their associated Grid Connection to the Koring MTS near Merweville (including associated infrastructure such as on-site substations and associated power lines) are of Very High Palaeosensitivity (Figures A3.1 to A3.3). Small sectors of the WEF project areas that are underlain by the Karelskraal Member (Abrahamskraal Formation) are assigned a Medium Palaeosensitivity while areas underlain by dolerite intrusions are palaeontologically Insensitive.

Desktop studies as well as several successive palaeontological site visits to the region also indicate that the Sutherland Cluster WEF and Grid Connection Infrastructure project areas are potentially of HIGH palaeosensitivity. Numerous vertebrate skeletal remains as well as trace fossils (e.g. lungfish and tetrapod burrows) and locally abundant blocks of petrified wood have now been recorded within the WEF and Grid Connection Infrastructure project areas, reinforcing the high palaeontological heritage potential of the Roggeveld Plateau – Moordenaars Karoo region of the Karoo. However *scientifically valuable, conservation-worthy* fossil remains have a sparse and largely unpredictable distribution here. Most of the recorded fossils here are of limited scientific or conservation value (see Appendix 1 as well as previous PIA reports by Almond in the References) while recorded fossils of scientific research value have already been sampled or collected.

It is concluded that *in practice* the majority of the Sutherland WEF Cluster and Grid Connection project areas are of Low Palaeosensitivity with occasional dispersed, small and largely unpredictable sites of HIGH to VERY HIGH PALAEOSENSITIVITY. **The provisional DFFE Screening Tool sensitivity mapping as show in Figures A3.1 to A3.3 is accordingly contested here.**

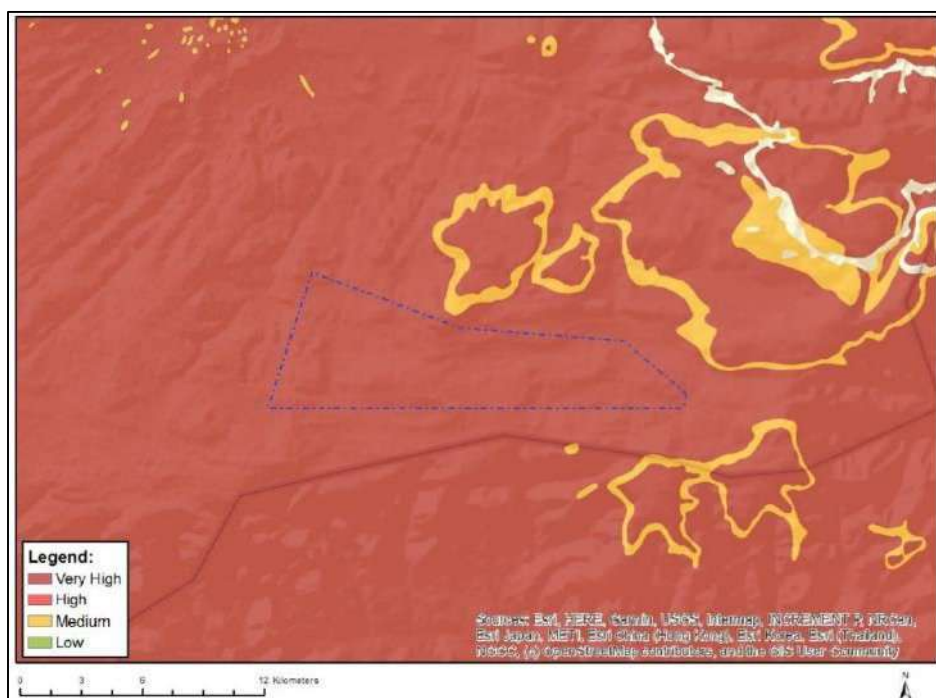


Figure A3.1: Palaeontological sensitivity map for the Rietrug WEF project area (blue dotted polygon), abstracted from the DFFE Screening Report prepared by Nala Environmental (Pty) Ltd (November 2022). Most of WEF project area is designated Very High Sensitivity here with the exception of areas underlain by the Karelskraal Member (Medium Sensitivity) and Karoo dolerite (Zero sensitivity). This provisional sensitivity mapping is *contested* in this report which concludes that most of project area is in fact of LOW PALAEOSENSITIVITY with dispersed, small and largely unpredictable sites of HIGH to VERY HIGH PALAEOSENSITIVITY.

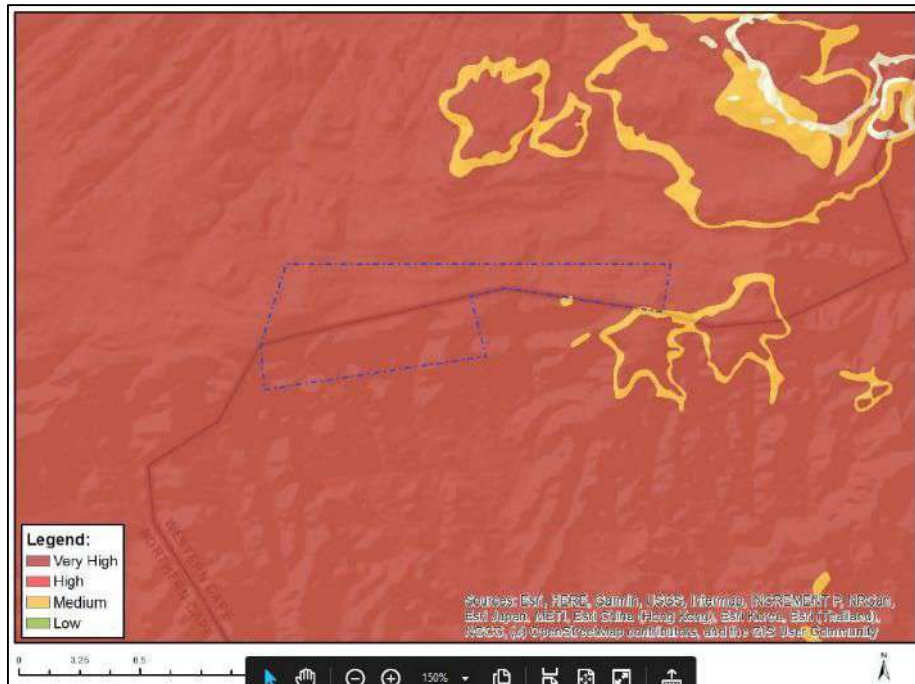


Figure A3.2: Palaeontological sensitivity map for the Sutherland WEF project area (blue dotted polygon), abstracted from the DFFE Screening Report prepared by Nala Environmental (Pty) Ltd (November 2022). Almost the entire WEF project area is designated Very High Sensitivity here with the exception of very small areas underlain by the Karelskraal Member (Medium Sensitivity). This provisional sensitivity mapping is *contested* in this report which concludes that most of project area is in fact of LOW PALAEOSENSITIVITY with dispersed, small and largely unpredictable sites of HIGH to VERY HIGH PALAEOSENSITIVITY.

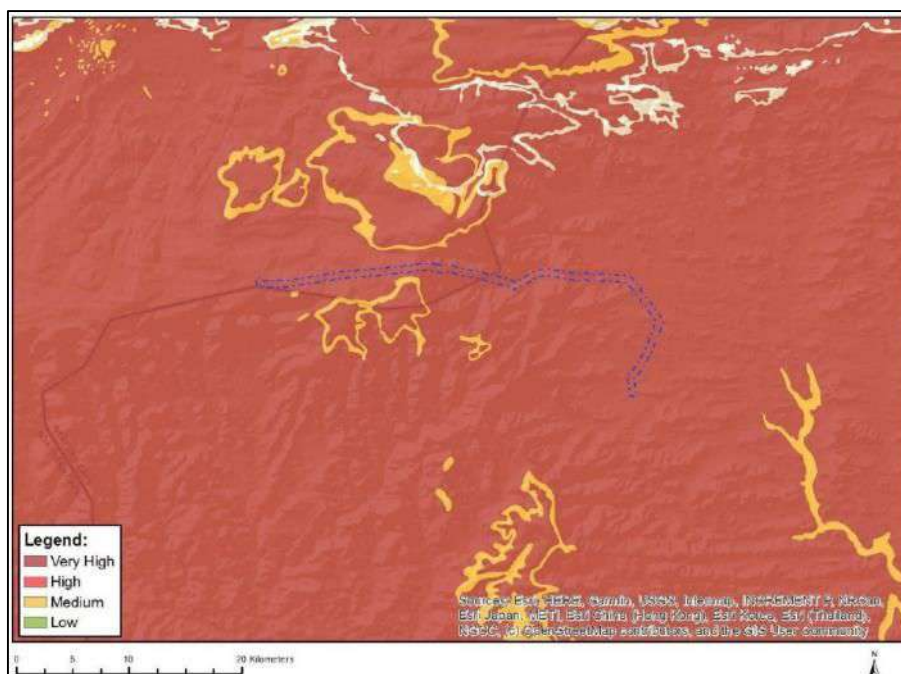


Figure A3.3: Palaeontological sensitivity map for the project area of the 132 kV Grid Connection for the Rietrug WEF and Sutherland WEF (blue dotted polygon), abstracted from the DFFE Screening Report prepared by Nala Environmental (Pty) Ltd (November 2022). The entire Grid Connection project area is designated Very High Sensitivity here. This provisional sensitivity mapping is *contested* in this report which concludes that most of project area is in fact of LOW PALAEOSENSITIVITY with dispersed, small and largely unpredictable sites of HIGH to VERY HIGH PALAEOSENSITIVITY.