

Palaeontological Heritage: combined desktop and field-based Compliance Statement

PROPOSED LOXTON WIND ENERGY FACILITY 2, UBUNTU LOCAL MUNICIPALITY (PIXLEY KA SEME DISTRICT MUNICIPALITY) IN THE NORTHERN CAPE PROVINCE.

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April 2023

EXECUTIVE SUMMARY

It is proposed to develop three commercial Wind Energy Facilities (WEFs) - known as Loxton WEF 1, Loxton WEF 2 and Loxton WEF 3 - and associated infrastructure on a site located c. 20-30 km north and east of Loxton within the Ubuntu Local Municipality (Pixley Ka Seme District Municipality) in the Northern Cape Province. The Loxton WEF 2 will involve 62 wind turbines with a contracted capacity of up to 240 MW and a permanent footprint of up to 110 ha. The project site covers approximately 15 000 ha and comprises the following farm portions: Portion 4 of the Farm Rietfontein No. 572; Portion 12 of the Farm Rietfontein No. 572; Portion 11 of the Farm Rietfontein No. 572; Remaining Extent of Farm Rietfontein No. 572; Remaining Extent of the Farm Saaidam No. 574; Remaining Extent of the Farm Yzervarkspoor No. 139; Portion 2 of the Farm Yzervarkspoor No. 139; Remaining Extent of the Farm Springfontein No. 573 and Remaining Extent of Farm 582.

Historical palaeontological site mapping for the region between Loxton and Victoria West reveals a paucity of recorded vertebrate fossil sites within the Loxton WEF Cluster project area. This is supported by recent palaeontological field surveying, both here and in neighbouring WEF project areas, which shows that:

(1) Levels of Beaufort Group bedrock exposure are very limited here due to pervasive cover by Late Caenozoic superficial sediments; (2) Intensive intrusion by dolerite sills and dykes has compromised fossil preservation over large areas; (3) The Beaufort Group bedrocks represented here span the catastrophic end-Middle Permian Extinction Event which is associated with an unusually low abundance of well-preserved fossil remains.

Over the course of eight days, only a handful of fossil sites were recorded within the entire Loxton WEF Cluster project area, the majority of which are poorly preserved and of limited scientific or conservation significance. Even occasional small areas showing excellent, fresh mudrock exposure ideal for palaeontological recording yielded hardly any fossils. Almost no fossil sites were recorded within the Late Caenozoic superficial deposits. **None of the very few (4) new fossil sites recorded within the Loxton WEF 2 project area are of significant scientific or conservation value and no mitigation is recommended here with regard to these known sites (Appendix 1).** The only site which lies very close to the proposed WEF footprint (Site 007) comprises poorly-preserved invertebrate trace fossils of little scientific interest. No known significant or unique palaeontological heritage sites are threatened by the proposed WEF development.

While additional, unrecorded fossil sites of high palaeontological and conservation value are likely to occur at and beneath the land surface within the Loxton WEF Cluster project areas, they are probably very sparse and sporadic in distribution and can be effectively handled in the Construction Phase

through a Chance Fossil Finds Protocol (See Appendix 2). All the recorded sites can, if necessary, be effectively mitigated in the preconstruction phase.

It is concluded that the palaeosensitivity of the combined Loxton WEF Cluster project area is, in practice, LOW. The provisional palaeosensitivity mapping by the DFFE Screening Tool is accordingly *contested* in this report.

Despite the substantial WEF project footprints as well as the known occurrence of important vertebrate and other fossil sites elsewhere in the wider region between Loxton and Victoria West, **the impact significance of the proposed renewable energy developments on local palaeontological heritage – including the Loxton 2 WEF project considered in this report - is anticipated to be LOW.** These impacts, including cumulative impacts considering other renewable energy projects in the broader region (e.g. the adjoining Victoria West WEF Cluster), are expected to fall within acceptable limits. There are therefore no objections on palaeontological heritage grounds to authorisation of the Loxton WEF Cluster developments.

The potential for unrecorded palaeontological sites of scientific and conservation value cannot be completely excluded. These are best mitigated through the application of a Chance Fossil Finds Protocol by the ECO / ESO during the Construction Phase (See Appendix 1) which should be incorporated into the EMPs for the WEF developments. The qualified palaeontologist responsible for mitigation work will need to apply for a Fossil Collection Permit for the Northern Cape from SAHRA. Minimum standards for PIA reports have been compiled by Heritage Western Cape (2021) and SAHRA (2013).

Given the inferred low overall site sensitivity and anticipated impact significance, formal palaeontological heritage impact assessment for the proposed Loxton WEF Cluster projects is not considered necessary. However, a combined desktop and field-based palaeontological heritage study outlining and mapping the recorded fossil sites, their scientific / conservation value and their geological context is provided in this report as part of the Heritage Assessment process for the proposed Loxton 2 WEF development.

1. Project outline

The applicant Loxton Wind Facility 2 (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF), to be known as Loxton WEF 2, and associated infrastructure on a site located approximately 15 km northeast of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

Two additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Loxton WEF 2 and Loxton WEF 3.

A preferred project site with an extent of approximately 58 000 ha has been identified as a technically suitable area for the development of the three WEF projects. Loxton WEF 1 & Loxton WEF 3 comprise 42 and 38 turbines, each with a contracted capacity of up to 240 MW and a permanent footprint of up to 65 ha each whereas Loxton WEF 2 will have up to 62 turbines, with a contracted capacity of up to 480 MW and permanent footprint of up to 110 ha.

The Loxton WEF 2 project site covers approximately 15 000 ha and comprises the following farm portions situated some 15 km NE of Loxton (see map Figure 1):

- Portion 4 of the Farm Rietfontein No. 572;
- Portion 12 of the Farm Rietfontein No. 572;
- Portion 11 of the Farm Rietfontein No.572;
- Remaining Extent of Farm Rietfontein No.572;
- Remaining Extent of the Farm Saaidam No. 574;
- Remaining Extent of the Farm Yzervarkspoor No. 139;
- Portion 2 of the Farm Yzervarkspoor No. 139;
- Remaining Extent of the Farm Springfontein No. 573
- Remaining Extent of Farm 582

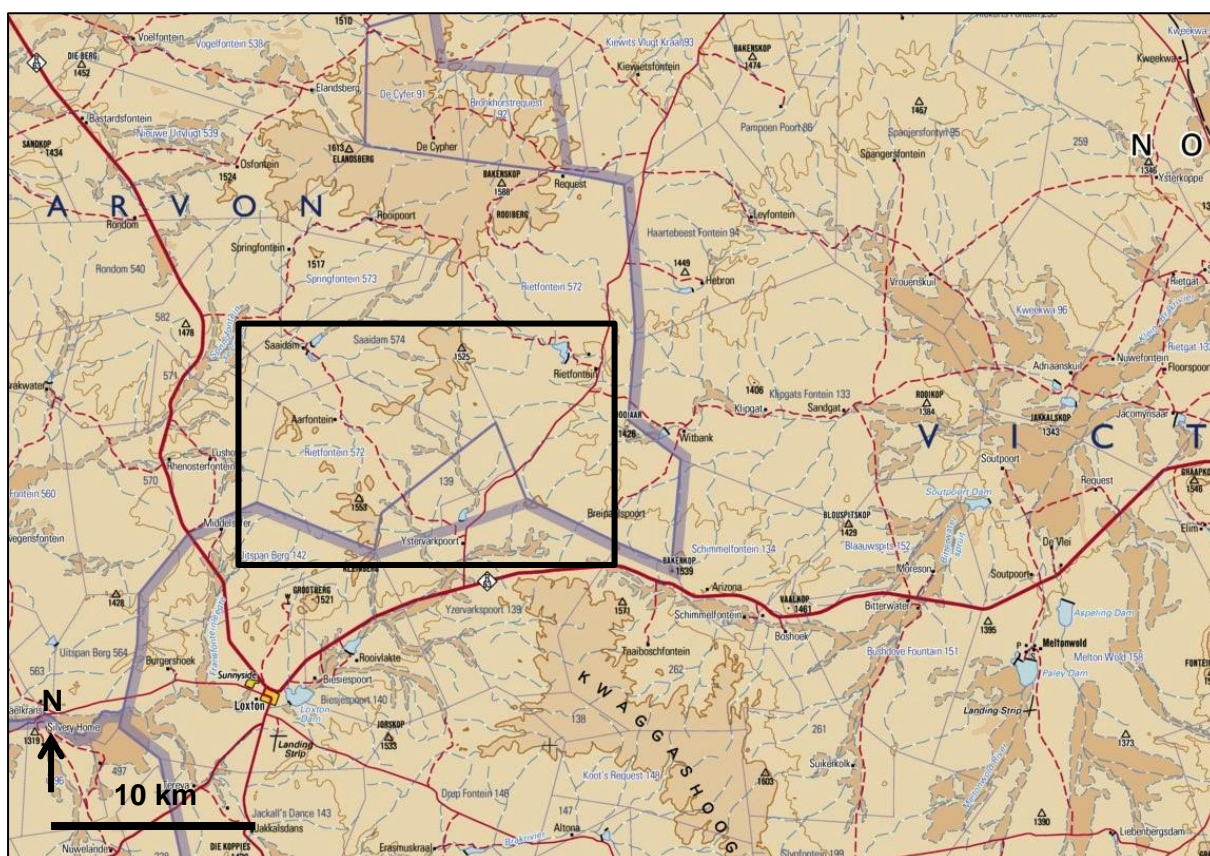


Figure 1: Extract from 1: 250 000 topographical sheet 3122 Loxton showing the *approximate* location of the Loxton WEF 2 project area (black rectangle) some 20 km to the NNE of Loxton, Ubuntu Local Municipality (Pixley ka Seme District Municipality), Northern Cape Province.

The Loxton WEF 2 project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 480 MW (see Appendix 1, Figure A1.1):

- Up to 61 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations with a permanent footprint 9.1 ha;
- Each turbine will have a crane hardstand of 70 m x 45 m. The permanent footprint for turbine hardstands will be up to 12 ha.
- Each turbine will have a temporary blade hardstand of 80 m x 45 m. The temporary footprint for blade hardstands will be up to 23 ha.
- Temporary laydown areas (with a combined footprint of up to 38 ha) which will accommodate the boom erection, storage and assembly area;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- One construction period laydown area (temporary) of up to 6 ha;
- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible.
- One on-site substation of up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 15 m road corridor may be temporarily impacted upon during construction and rehabilitated to 6 m wide after construction. The WEF will have a total road network of up to 100 km.
- one temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2 ha); and
- Operation and Maintenance buildings (with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, parking bays, a workshop and a storage area.

The Electrical Grid Infrastructure (EGI) associated with the Loxton WEF considers a 300m wide corridor route from the Loxton Switching Station / Collector Station to the Gamma MTS near Hutchinson. The EGI will be located within the Central Strategic Powerline Corridor and therefore subject to a separate Basic Assessment process in accordance with GN 113 of 16 February 2018 listed under NEMA, 1998.

2. Data sources

The combined desktop and field-based palaeontological heritage study of the Loxton WEF Cluster project area is based on the following information resources:

1. A project outline, kmz files, screening report and maps provided by the project Applicant being Loxton Wind Facility 2 Pty Ltd.

2. A desktop review of:

(a) the relevant 1:50 000 scale topographic maps (3122AB Alarmkraal, 3122AD Loxton, 3122BC Schimmelfontein, 3122CB Slangfontein, 3122DA Slypfontein) and the 1:250 000 scale topographic map 3122 Victoria West);

(b) Google Earth© satellite imagery;

(c) published geological and palaeontological literature, including 1:250 000 geological map (3122 Victoria West) and the relevant sheet explanation (Le Roux & Keyser 1988), as well as

(d) several previous and on-going fossil heritage (PIA) assessments for renewable energy and transmission line projects in the Karoo region between Beaufort West, Loxton and Victoria West by the author (See References under Almond, especially Almond 2023 for the Victoria West Cluster WEFs which have a very similar geological setting to the present Loxton WEF Cluster projects).

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 eight-day palaeontological heritage survey of the combined Loxton WEF Cluster project area by the author and an experienced field assistant between 17 and 26 October 2022 of which approximately three days were spent within the Loxton WEF 2 project area. The season in which the site visit took place does not have a critical bearing on this palaeontological study. Extensive grass cover as well as locally impassable farm roads limited bedrock visibility and site access in some areas but these constraints do not markedly affect the conclusions reached in this report, confidence levels for which are rated as Medium.

3. Legislative context

All palaeontological heritage resources in the Republic of South Africa are protected by the National Heritage Resources Act (Act 25 of 1999). Heritage resource management in the Northern Cape: is the South African Heritage Resources Agency (Contact details: 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).

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (Act 25 of 1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites; and
- 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 agency.

(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 agency, or to the nearest local agency offices or museum, which must immediately notify such heritage resources Agency.

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

(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 agency 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 agency 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 recently been published by SAHRA (2013) and Heritage Western Cape (2021).

4. Geological context of Loxton WEF Cluster project area

The Loxton WEF Cluster project area comprises semi-arid, gently hilly, rocky to sandy and gravelly terrain of the Upper Karoo, situated at elevations between c. 1390 and 1580m amsl. to the north and east of the small town of Loxton and the Loxton – Carnarvon road (R63) as well as straddling the R63 road sector between Loxton and Victoria West (1: 250 000 sheet 3122 Victoria West; 1: 50 000 sheets 3122AB Alarmskraal, 3122 AD Loxton, 3122BC Schimmelfontein, 3122CB Slangfontein, 3122DB Slypfontein). Much of the terrain is of fairly subdued, rolling relief, with occasional dolerite-capped *koppies* and ridges, especially in the south (e.g. Kleinberg 1534 m, Die Rooikoppie 1514 m, Rooiaar dyke just east of the project area). There are no major rivers; much of the area is drained by a network of small, mostly unnamed, non-perennial streams (e.g. Springbokfontein se Leegte), variously draining SW into the Loxton Dam and Biesjespoort Dam and the Soutpoortrivier or eastwards into the Klein-Brakrivier and the Bitterwaterspruit.

The geology of the WEF Cluster project area is outlined on 1: 250 000 geological sheet 3122 Victoria West (Council for Geoscience, Pretoria) (Figure 2) with a short accompanying explanation by Le Roux & Keyser (1988). The area is largely underlain at depth by continental (fluvial / lacustrine) sediments of the **Lower Beaufort Group** (Karoo Supergroup) of Middle to Late Permian age (c. 260 to 256 Ma = million years ago) (Johnson *et al.* 2006). The sedimentary succession in the north-western sector of the Main Karoo Basin represented here broadly gets younger from north to south. The beds here are assigned to the **Abrahamskraal Formation** and the lowermost, sandstone-rich part of the **Teekloof Formation (Poortjie Member)**, while the overlying mudrock-dominated **Hoedemaker Member** only crops out within the associated Grid Connection corridor towards Victoria West (to be separately assessed).

The fine-scale lithostratigraphy of the Lower Beaufort Group succession in this sector of the Main Karoo Basin - including the correlation of the main channel sandstone packages such as the Moordenaars Member and Poortjie Member - remains unresolved (*cf* Day & Rubidge 2020a, Almond 2023). A major sandstone package within the upper part of the Abrahamskraal Formation in the Loxton WEF Cluster project area is tentatively correlated here with the **Moordenaars Member** while a higher-lying, thick mudrock package may be equivalent to the **Karelskraal Member**. The outcrop area of the **Poortjie Member** has probably been underestimated on the published 1: 250 000 map with several small, unmapped outliers of Poortjie sandstone to the north of the main mapped outcrop area. Le Roux and Keyser (1988 p.6) note that the Moordenaars Member may pass directly up into the Poortjie Member in some areas of the Williston and Victoria West 1: 250 000 sheets, complicating mapping of the

Abrahamskraal Formation – Teekloof Formation contact. However, a well-defined, thick Karelskraal Member package does appear to be present in the Loxton WEF 3 project area; it is recognisable on satellite images by its finely-striped outcrop area (numerous thin sedimentary cycles) which has been emphasized here by thermal metamorphism.

In this subregion of the Upper Karoo the Beaufort Group sediments are intruded by an extensive network of dyke and sill complexes of the Early Jurassic **Karoo Dolerite Suite**, especially in the southern sector of the combined WEF project area where a major dolerite sill – referred to here as the Kwaggashoogte dolerite sill - intrudes close to the Abrahamskraal / Teekloof Formation contact, probably within a thick mudrock package of the lower Poortjie Member (e.g. Kleinberg 1534 m, Die Rooikoppie 1514 m, Rooiaar dyke just east of the project area) (Chevallier & Woodford 1999, Duncan & Marsh 2006). These intrusions have thermally metamorphosed and altered considerable volumes of the adjoining country rocks (e.g. where these overlie shallow, saucer-shaped intrusions), locally compromising fossil preservation as well as generating large volumes of tough quartzitic and doleritic colluvial and eluvial rubble (locally calcretised) that mantles the neighbouring potentially fossiliferous bedrocks. Kimberlite pipes or other intrusions are not mapped within the project area itself but do occur shortly to the east (small black diamond symbols on the geological map).

Levels of tectonic deformation (including folding, cleavage development) within the wider region are probably low; satellite imagery suggests that the Beaufort Group sediments are fairly flat-lying while they are also cut by numerous small faults which are often picked out by dark lines of shrubs as well as by dolerite dykes. Regular sets of rectilinear joints are a prominent feature of quartzitic sandstone cappings in the region, the joints again being picked out on satellite images by dark shrubs.

The Permian and Jurassic bedrocks within the project area are extensively mantled by a range of **Late Cenozoic superficial deposits**, limiting exposure levels of fresh (unweathered), potentially fossiliferous Permian sediments. In addition to thick (up to several meters), gravelly to sandy alluvial sediments along numerous active or defunct drainage lines, these younger cover sediments include pan and spring deposits, gravelly debrite and inundite diamictites, colluvial (slope) and eluvial (downwasted) surface gravels dominated by clasts of quartzite, dolerite, hornfels and palaeocalcrete, pedocretes (e.g. calcrete hardpans, especially in doleritic terrain) *plus* a spectrum of mainly sandy to gravelly soils.

Illustrations of geological scenery and representative rock exposures within the Loxton WEF 2 project area are given below in Figures 3 to 36, together with explanatory figure legends.

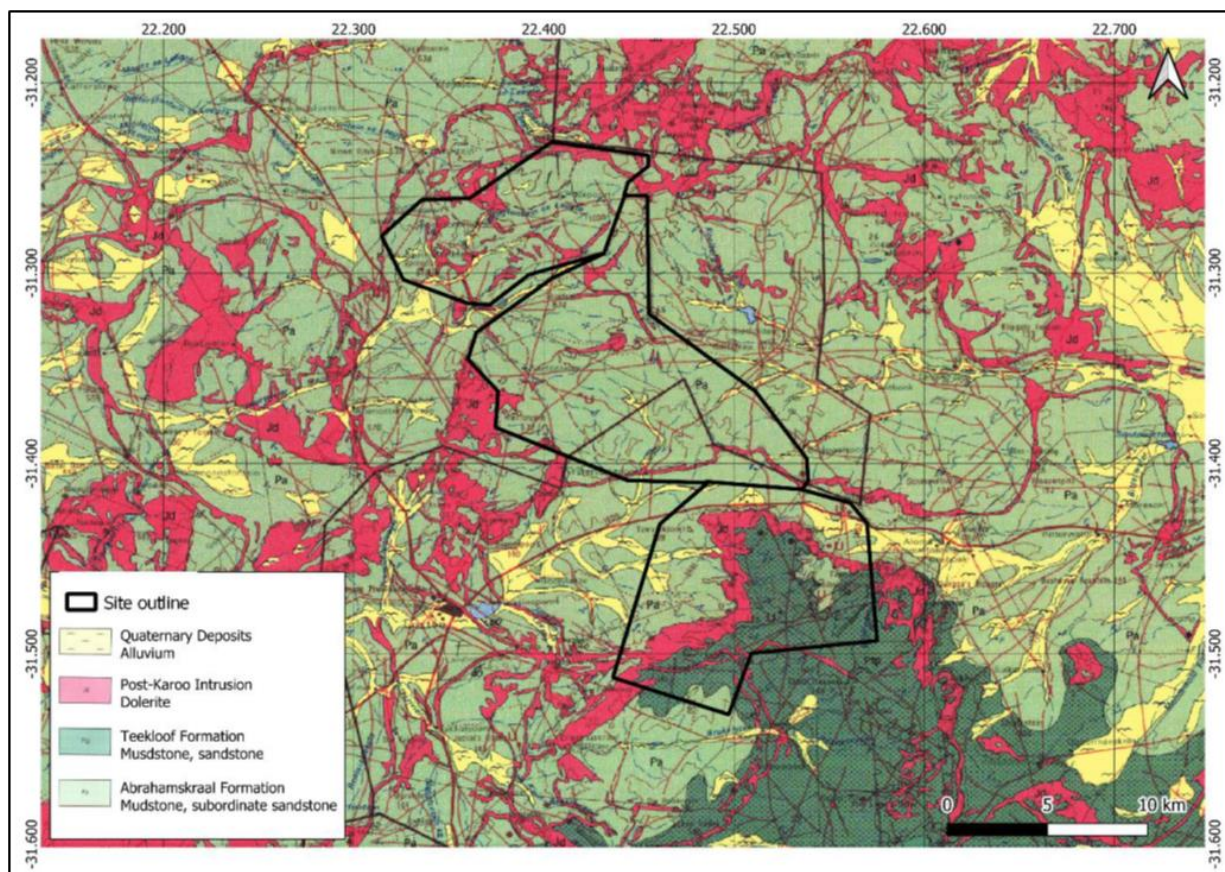


Figure 2: Extract from 1: 250 000 geology sheet 3122 Victoria West showing the location of the proposed Loxton WEF Cluster project areas between Loxton and Victoria West, Northern Cape (Base map published by the Council for Geoscience, Pretoria). The main rock units represented regionally include: Pa (pale green) = Middle to Late Permian Abrahamskraal Formation. Ptp (middle green with stipple) = Late Permian Poortjie Member, Teekloof Formation (Adelaide Subgroup). Pth (middle green without stipple) = Late Permian Hoedemaker Member, Teekloof Formation (Adelaide Subgroup). Jd (red) = dolerite sills and dykes of the Early Jurassic Karoo Dolerite Suite. Pale yellow with flying bird symbol = Late Cenozoic (Neogene / Pleistocene to Recent) alluvium. Small black diamonds – kimberlite pipes. *N.B.* The mapping of the various members within the Abrahamskraal and Teekloof Formations shown in this region is contested.



Figure 3: Typical low relief terrain in the southern sector of the Loxton WEF 2 project area, here on Yzervarkspoor Farm 139/2, with low, flat-topped *koppies* and extensive *vlaktes* mantled by Late caenozoic superficial sediments as well as karroid grassy bossieveld vegetation.



Figure 4: Topographically varied terrain on Rietfontein 572, west of Aarfontein homestead, with a low bench of pale, baked Abrahamskraal Formation sandstone in the middle ground capped by a rubble-covered dolerite ridge on the skyline. Shallow stream incision in the foreground exposes sections through extensive sandy to gravelly alluvium covering bedrocks in lower-lying areas.



Figure 5: Undulating *vlaktes* of readily-weathered, khaki-hued, crumbly mudrocks of the Lower Beaufort Group with stepped hills in the background built of a channel sandstone package – possibly the Poortjie Member but mapped within the Abrahamskraal Formation, Ystervarkspoor Farm 139/RE & 1.



Figure 6: Low, stepped, east-facing escarpment and flat-topped *koppies* capped by Abrahamskraal Formation channel sandstone packages on the southern sector of Saaidam Farm 574 RE with sparse eluvial sandstone gravels overlying weathered mudrock in the foreground.



Figure 7: View westwards towards a low ridge earmarked for wind turbines on the southern sector of Saaidam Farm 574 RE with gullied, gravel-strewn weathered mudrock in the foreground. Low levels of bedrock exposure – especially of fresh mudrock facies – characterises most of the WEF project area.



Figure 8: In many parts of the WEF project area the best bedrock exposures are found along shallow drainage lines, such as the weathered, thinly-interbedded Abrahamskraal Formation mudrocks and wackes seen here on Rietfontein 572.



Figure 9: Exposure of readily-weathered Abrahamskraal Formation mudrocks limited to occasional shallow stream beds in lower-lying areas, as seen here on Saaidam Farm 574 RE 057.



Figure 10: This package of closely-spaced, laterally-persistent, thin channel sandstone units on Rietfontein 572 Ptn 4, just east of and *outside* the WEF project area, may correspond to the Moordenaars Member within the upper Abrahamskraal Formation.



Figure 11: Low-angle cross-bedded within a baked, sharp-based sandstone package on the southern part of Saaidam Farm 574 RE (hammer = 30 cm). Note the large sphaeroidal concretion of pale grey, baked diagenetic carbonate (arrowed) within the underlying weathered, khaki-hued mudrocks.



Figure 12: Blocks of ferruginous carbonate concretion weathering-out at the locality above show striking development of fossil-like cone-in-cone structures. These show that the concretions developed diagenetically beneath a considerable overburden and not near-surface; they are therefore unlikely to be fossiliferous. Scale in cm.



Figure 13: Tabular-bedded, heterolithic package of thinly interbedded wacke and weathered siltstone on Rietfontein 572. Hammer = 30 cm.



Figure 14: Deeply incised valley with edges rimmed by Abrahamskraal channel-sandstones on the eastern margins of Saaidam Farm 574 RE. Occasional horizons of ferruginous carbonate (*koffieklip*) within the underlying mudrocks (foreground) are potentially fossiliferous while most of the mudrock exposure is obscured by colluvial deposits.



Figure 15: Rare good exposure of grey-green overbank mudrocks and interbedded wackes of the Abrahamskraal Formation close to the locality illustrated above, Saaidam Farm 574 RE.



Figure 16: View northwards along the low stepped, east-facing escarpment in the south-eastern corner of Saaidam Farm 574 RE. The laterally-persistent channel sandstone units and interbedded grey-green mudrocks seen here are mapped within the Abrahamskraal Formation and are possibly Moordenaars Member equivalents.



Figure 17: Unusually good exposures of upper Abrahamskraal Formation mudrock and sandstone facies along the gullied face of the escarpment illustrated above, south-eastern corner of Saaidam Farm 574 RE. Note in the foreground a couple of huge, boulder-sized sphaeroidal concretions of diagenetic ferruginous carbonate (*koffieklip*) which also occur *in situ* within the capping sandstone.



Figure 18: A heterolithic package of interbedded, tabular, grey-green mudrock and brownish-weathering wacke underlying the capping channel sandstone at the locality illustrated above, south-eastern corner of Saaidam Farm 574 RE.



Figure 19: Thick package of grey-green overbank mudrocks with ferruginous carbonate pedocrete horizons exposed on gullied hillslopes on Rietfontein 572 Portion 4. These beds might be equivalent to the Karelskraal Member at the top of the Abrahamskraal Formation. An isolated, sun-cracked post-cranial bone of a sizeable tetrapod was recorded here (*cf* Figure 40).



Figure 20: Intermittent exposures of upper Abrahamskraal Formation grey-green mudrocks among colluvial sandstone scree just east of and outside the WEF project area on Rietfontein 572 Portion 4.



Figure 21: Khaki-hued, weathered mudrocks of the Abrahamskraal Formation just east of and outside the WEF project area on Rietfontein 572 Portion 4 containing a pale grey horizon of baked pedogenic calcrete. Hammer = 30 cm.



Figure 22: Unusually thick and extensive exposures of greyish overbank mudrocks in the gullied foothills and elevated slopes of a flat-topped *koppie* on Rietfontein 572. This thick package might be equivalent to the Karelskraal Member at the top of the Abrahamskraal Formation succession.



Figure 23: Detail of the gullied hillslopes illustrated above showing good exposures of greyish mudrocks and thin wackes that might belong to the Karelskraal Member.



Figure 24: View northwards towards a thick sandstone package – possibly an unmapped outlier of the Poortjie Member (lowermost Teekloof Formation) – on the south-western corner of Rietfontein 572 Portion 4.



Figure 25: Low, stepped escarpment on the western margins of Rietfontein 572 Portion 4 with thick, laterally extensive, golden-yellow weathering channel sandstones – possibly within the Poortjie Member rather than the Abrahamskraal Formation as mapped.



Figure 26: Poortjie Member-like medium-grained, cross-bedded channel sandstones on Rietfontein 572 Portion 4 contain locally well-developed lenses of brownish, ferruginised breccio-conglomerate dominated by clasts of reworked palaeocalcrete and mudrock. Hammer = 30 cm. These well-consolidated gravelly lenses might contain reworked tetrapod bones and teeth.



Figure 27: Thick sandstone package – possibly of the Poortjie Member – capping a low escarpment just NW of Ystervarkspoot farmstead on the western margins of Ystervarkspoot Farm 139/RE & 1. Horizons of well-developed, rusty-brown ferruginous carbonate occur within the underlying mudrocks (possibly equivalent to the Karelskraal Member).



Figure 28: Pebbly conglomerate of reworked, grey pedogenic calcrete concretions within possible Karelskraal Member mudrocks exposed in a borrow pit just NW of Ystervarkspoot farmstead on the western margins of Ystervarkspoot Farm 139/RE & 1. Hammer = 30 cm. Such grey concretions are an important focus for fossil vertebrate prospecting.



Figure 29: View along a thick, well-jointed, pale brownish-weathering channel sandstone unit – possibly within the Poortjie Member – on the eastern edge of the WEF project area, Rietfontein 572 Portion 4. The bedrocks here have been baked by an E-W trending dolerite dyke.



Figure 30: Undulose to rubbly sandstone plateau showing extensive evidence of karstic (solution) weathering above the scarp shown in the previous illustration, Rietfontein 572 Portion 4.



Figure 31: Coarse colluvium of huge, downwasted blocks of karstified sandstone along the edge of the plateau illustrated above, Rietfontein 572 Portion 4.



Figure 32: Close-up of a colluvial sandstone block showing pervasive superficial lichen etching – an important mode of biological weathering in the Karoo, Rietfontein 572 Portion 4. Hammer = 30 cm.



Figure 33: Extensive vlaktes on Rietfontein 572 with eluvial surface gravels dominated by downwasted, angular blocks of wacke.



Figure 34: Surface gravels on Ystervarkspoot Farm 139/RE & 1 dominated by pale grey pedogenic calcrete concretionary material. Such areas are a focus for palaeontological prospecting.



Figure 35: Sparse, sheetwashed surface gravels of dolerite, quartzite, hornfels and palaeocalcrete concretions occur widely across the low-relief *vlaktes* within the WEF project area, such as here on Saaidam Farm 574 RE 065.



Figure 36: Thick, orange-brown sandy alluvium is associated with several major drainage lines within the WEF project area, such as here on Saaidam Farm 574 RE 065.

5. Palaeontological heritage context

The Middle to Late Permian Abrahamskraal and Teekloof Formation bedrocks in the combined Loxton Cluster study area are characterised by fossil assemblages of the ***Tapinocephalus* and *Endothiodon* Assemblage Zones** (the latter was previously termed the *Pristerognathus* and *Tropidostoma* Assemblage Zones (Kitching 1977, Keyser & Smith 1977-78, Rubidge 1995, Rubidge 2005, Van der Walt *et al.* 2010, Smith *et al.* 2012, Smith *et al.* 2020, Day & Rubidge 2020b, Day & Smith 2020) (Figures 37 and 38). They include a wide range of fossil tetrapods - especially reptiles and therapsids (“mammal-like reptiles” or protomammals”) - as well as fish, amphibians, plant remains (e.g. petrified wood, plant compressions), microfossils and trace fossils (e.g. vertebrate and invertebrate burrows, trackways). These fossil assemblages and the sedimentary bedrocks within which they occur are of special scientific interest because they span the environmentally critical boundary between the Middle and Late Permian Periods which was associated with the catastrophic end-Capitanian Mass Extinction Event of c. 260 Ma (million years ago) (Day *et al.* 2015).

Only a few historical vertebrate fossil sites are mapped near Loxton on the published 1: 250 000 geological map and in the key early review by Kitching (1977). The Karoo fossil vertebrate site map of Nicolas (2007) shows low density of fossil records east of Loxton with just a few sites recorded south and north of the town (Figure 39). The region between Loxton and Victoria West is the subject of ongoing palaeontological research by Professor Bruce Rubidge of the Evolutionary Studies Institute (ESI), Wits University as well as Dr Mike Day of the Natural History Museum, London. Important concentrations of fossil sites are known c. 20 km east of the WEF project area near Melton Wold and west of Gamma Substation as a result of a long history of palaeontological fieldwork in the Biesiespoort area (close to the eastern sector of the associated Grid Connection Corridor). Recent palaeontological fieldwork by the present author for WEF and SEF project areas in the broader Loxton – Victoria West – Beaufort West region (e.g. Nuweveld WEFs, Hoogland WEFs, Modderfontein WEF, Victoria West WEF Cluster, Skietkuil / iLanga project areas – see References under Almond) and earlier research by other Karoo palaeontologists (e.g. Smith 1993) suggest that unrecorded fossil sites of scientific and conservation value are likely to occur here. However, vertebrate fossil records are often sparse in areas intruded by dolerite. New tetrapod fossil finds within the project area should help resolve outstanding lithostratigraphic ambiguities in the region as well as contributing to on-going scientific research concerning palaeoenvironmental and evolutionary events before and during the catastrophic end-Middle Permian Extinction Event of c. 260 million years ago as well as during the succeeding biotic recovery (Retallack *et al.* 2006, Day *et al.* 2015).

Most of the varied Late Caenozoic superficial sediments within the project area are largely of low palaeosensitivity. However, relict and often consolidated older (Neogene / Pleistocene) alluvial deposits along drainage lines might contain sporadic fossil assemblages of mammals (bones, teeth, horn cores), freshwater invertebrates (e.g. unionid bivalves) and trace fossils (e.g. calcretised termitaria, rhizoliths / plant root casts).

6. New palaeontological heritage data (Loxton WEF 2)

New fossil sites recorded within or just outside the Loxton WEF 2 project area are tabulated with gps data, brief description, provisional Field Rating and any recommended mitigation in Appendix 1 where the sites are also mapped with reference to the provisional WEF layout (Figures A1.1 and A1.2). Selected fossil sites are illustrated below in Figures 40 to 44, together with explanatory legends.

Only four fossil occurrences were recorded during the approximately 3-day site visit to the Loxton WEF 2 project area as well as just to the east, indicating that this area is of low palaeosensitivity overall (Please note that three additional fossil sites, Locs. 005, 007 and 020, which are situated close to the

Loxton WEF 2 access road but within the Loxton WEF 1 project area are tabulated and mapped in Appendix 1 herein but are only illustrated in the separate palaeontological heritage report for Loxton WEF1). Fieldwork mainly focussed on the very limited exposures of Lower Beaufort Group mudrocks (here entirely mapped within the Abrahamskraal Formation outcrop area but probably including small outliers of Poortjie Member beds at the base of the overlying Teekloof Formation) but representative exposures of Beaufort Group sandstones, older alluvial deposits and surface gravels were also examined for palaeontological material.

The only vertebrate fossil remains recorded during the site visit comprised a single, sun-cracked postcranial bone of a sizeable tetrapod (probably dinocephalian therapsid or pareiasaur reptile) as well as concentrations of comminuted bone fragments preserved within a palaeosol horizon (Figures 40 and 41). This scarce tetrapod material is probably too poorly preserved to be identifiable.

Wood plant material recorded from the upper Abrahamskraal Formation includes several blocks of petrified wood, some of which preserve details of seasonal growth lines, from surface gravels as well as poorly-preserved moulds of large woody axis within channel sandstone facies (Figures 42 to 44).

No fossils were recorded from the Late Caenozoic superficial sediments within the Loxton WEF 2 project area.

None of the few new fossil sites recorded within the Loxton WEF 2 project area are of significant scientific or conservation value and none of the sites lies close to or within the proposed WEF footprint. No known significant or unique palaeontological heritage sites are threatened by the proposed development.

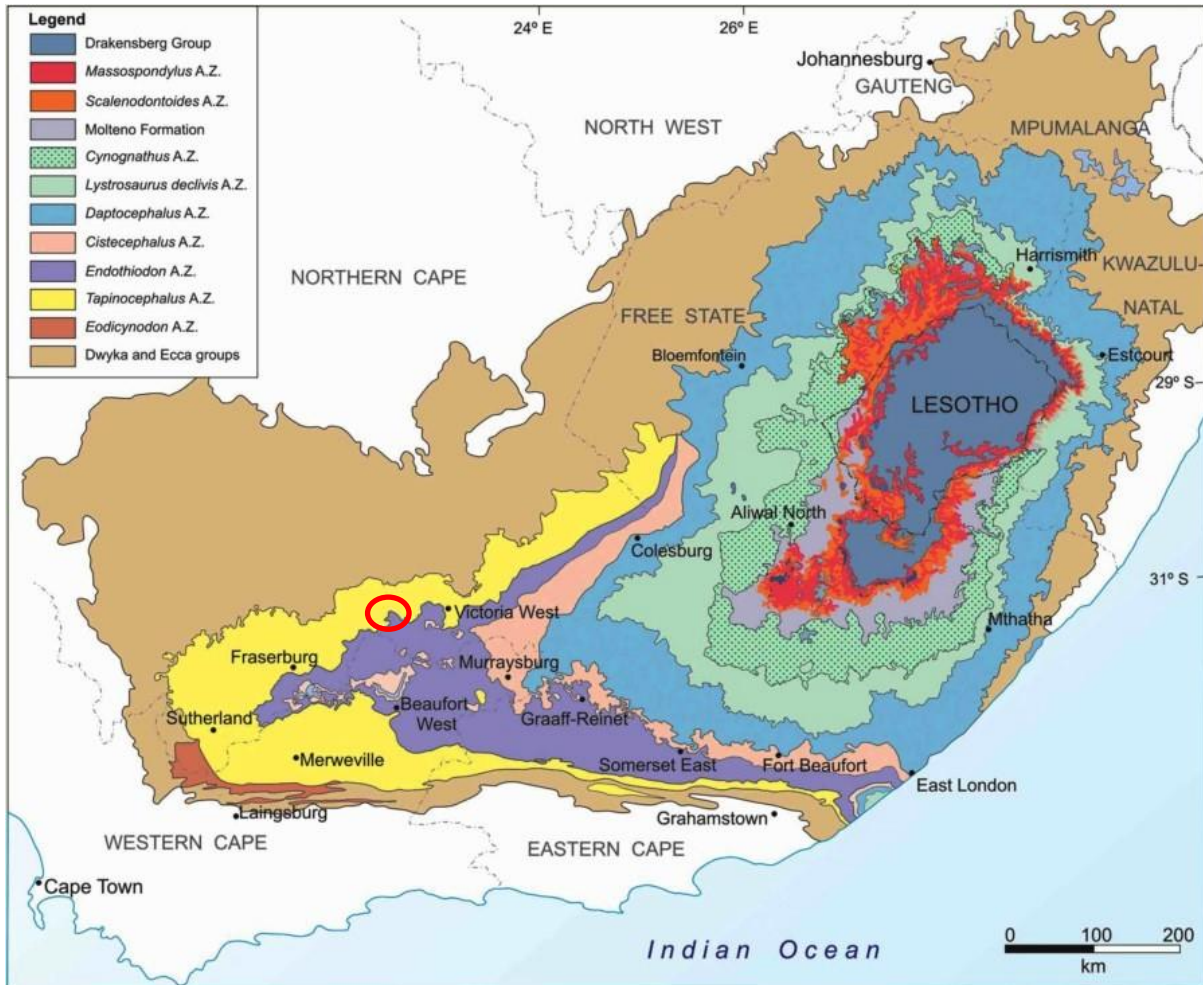


Figure 37: The latest fossil biozonation map for the Main Karoo Basin (Smith *et al.* 2020) shows the occurrence of Mid to Late Permian fossil assemblages of the *Tapinocephalus* Assemblage Zone and perhaps also the succeeding *Endothiodon* Assemblage Zone in the Loxton WEF Cluster project area (small red ellipse).

Age	Gp	West of 24° E	East of 24° E	Free State / KwaZulu-Natal	Vertebrate Assemblage Zones	Vertebrate Subzones	Radiometric dates		
JURASSIC	STORMBERG		Drakensberg Gp	Drakensberg Gp			← 183.0 Ma (A)		
			Clarens Fm	Clarens Fm	Massospondylus		← <187.5 Ma (B)		
			upper Elliot Fm	upper Elliot Fm			← <191.9 Ma (B)		
TRIASSIC	Tarkastad Subgp		lower Elliot Fm	lower Elliot Fm		Scalenodontoides		← <199.9 Ma (B)	
			Molteno Fm	Molteno Fm				← <204 Ma (B)	
			Burgersdorp Fm	Driekoppen Fm		Cynognathus	Cricodon-Ufudocyclops Trirachodon-Kannemeyeria Langbergia-Gargainia		← <219 Ma (B)
		Katberg Fm	Verkykerskop Fm		Lystrosaurus declivis				
PERMIAN	BEAUFORT	Adelaide Subgp	Balfour Fm	Palingkloof M.				← 252.24 Ma (G)	
				Elandsberg M.	Harrismith M.	Daptocephalus	Lystrosaurus maccaigi-Moschorhinus	← 251.7 Ma (C)	
				Ripplemead M.	Schoondraai M.			← 253.02 Ma (D)	
				Daggaboersnek M.	Rooinekke M.		Dicynodon-Theriongnathus		
				Frankfort M.					
			Normandem Fm						
			Teekloof Fm						
			Steenkampsvlakte M.						
			Oukloof M.	Oudeberg M.		Cistecephalus			← 255.2 Ma (E)
			Hoedemaker M.	Middleton Fm					← 256.247 Ma (E)
Poortjie M.			Endothiodon	Tapinocephalus-Gogonyx		← 259.262 Ma (E)			
Abrahamskraal Fm	Koonap Fm	Veljevoel Fm	Tapinocephalus	Lycosuchus-Eunosaurus		← 260.259 Ma (F)			
				Diictodon-Styracocephalus		← 260.407 Ma (E)			
				Eosimops-Glanosuchus		← 261.241 Ma (E)			
ECCA		Waterford Fm	Waterford Fm						
		Tierberg/Fort Brown	Fort Brown						

Figure 38: Chart showing the latest, revised fossil biozonation of the Lower Beaufort Group of the Main Karoo Basin (abstracted from Smith *et al.* 2020). Rock units and fossil assemblage zones mapped within the Loxton WEF Cluster project area are outlined in red respectively. The Hoedemaker Member is only present within the associated Grid Connection corridor (to be assessed separately). The detailed mapping of these lithostratigraphic and biostratigraphic units within the present project area between Loxton and Beaufort West is unresolved at present.

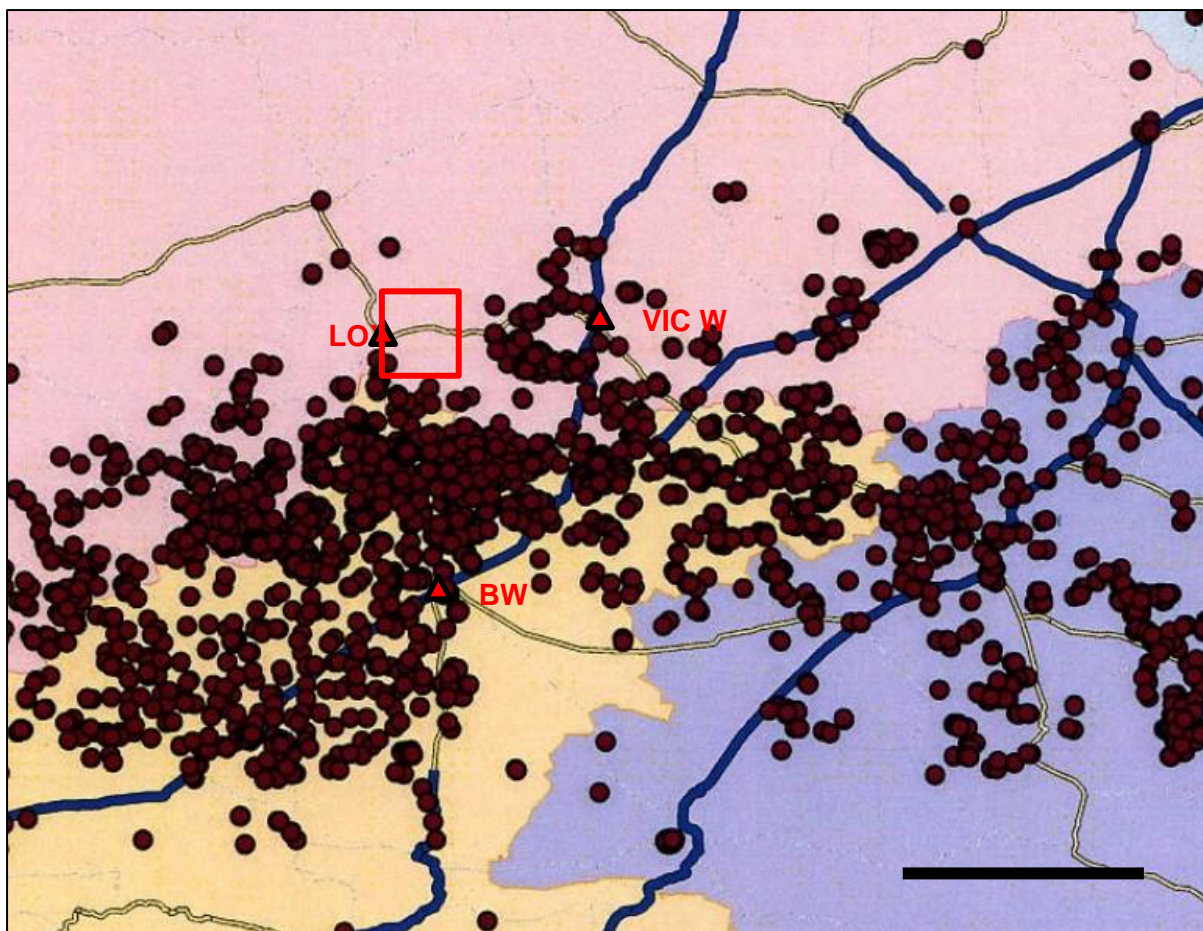


Figure 39: Distribution map of recorded vertebrate fossil sites within the Lower Beaufort Group of the Great Karoo between Loxton (LOX), Victoria West (VIC W) and Beaufort West (BW), showing the very *approximate* outline of the study area for the Loxton WEF Cluster within the red rectangle (map abstracted from Nicolas 2007). Note the scarcity of known sites in the area just to the east of Loxton, with a few sites recorded just to the north and south of the town. The abundance of known fossil sites close to the N1 to the northeast of Three Sisters and south of Victoria West reflects in part the long history (> 100 years) of fossil collection by both academics as well as knowledgeable amateurs at sites close to Biesiespoort Station. Scale bar = 10 km. N towards the top of the image.



Figure 40: Poorly-preserved fragment of long bone (possible femur) of a large-bodied tetrapod – probably dinocephalian therapsid or pareiasaur reptile – showing extensive pre-burial suncracking recorded *ex situ* from Abrahamskraal Formation mudrocks on Rietfontein 572 Portion 4 (Loc. 101). Scale in cm and mm. See Figure 19 for context.



Figure 41: Breccia of comminuted bone fragments (up to 1 cm across) preserved within a concretionary horizon within Abrahamskraal Formation mudrocks on Rietfontein 572 Portion 4 (Loc. 099).



Figure 42: Proposed Field Rating III C. No recommended mitigation. Abrahamskraal Formation on Rietfontein 572 Portion 4, shortly east of and outside the Loxton WEF 2 project area (Loc. 105). Scale = 15 cm. See also following figure.



Figure 43: Channel sandstone body containing poorly-preserved moulds of large woody plant axes, Abrahamskraal Formation on Rietfontein 572 Portion 4, shortly east of and outside the Loxton WEF 2 project area (Loc. 105). Scale = 15 cm. See also previous figure.



Figure 44: Several angular blocks of petrified wood recorded in float overlying the upper Abrahamskraal Formation on Saaidam Farm 574 RE (Loc. 069). The largest block on the right is c. 11.5 cm long. The smaller blocks show well-preserved seasonal growth banding.

7. Palaeontological heritage site sensitivity verification

Provisional sensitivity mapping using the DFFE Screening Tool (Figures 45 and 46) as well as the SAHRIS palaeosensitivity map (SAHRIS Website) suggests that most of the combined Loxton WEF Cluster project area is of **Very High Palaeosensitivity**, primarily based on the presence here of potentially fossiliferous Lower Beaufort Group bedrocks. Thick alluvial deposits are assigned a **Medium Sensitivity** while dolerite intrusions are **Insensitive** (*i.e.* unfossiliferous). Based on (1) recent experience with WEF projects in the broader region (notably the Victoria West WEF Cluster immediately to the east), (2) desktop analysis of vertebrate fossil sites in the Main Karoo Basin, as well as the recent eight-day palaeontological heritage of the Loxton WEF Cluster project area, this preliminary palaeosensitivity mapping is critically re-assessed in this report.

Fossil site maps for the region between Loxton and Victoria West (*e.g.* Nicolas 2007; Figure 39 herein) show a paucity of sites within the Loxton WEF Cluster project area. This cannot be attributed simply to the lack of palaeontological fieldwork in the area, however. Recent palaeontological field surveying shows that:

- (1) Levels of Beaufort Group bedrock exposure are very limited here due to pervasive cover by Late Caenozoic superficial sediments (*e.g.* colluvial and eluvial gravels, alluvial soils);
- (2) Intensive intrusion by dolerite sills and dykes has altered the sedimentary country rocks through thermal metamorphism and hydrothermal activity (*viz.* circulation of hot, mineralizing ground waters) which has compromised fossil preservation over large areas;

(3) The Beaufort Group bedrocks represented here (uppermost Abrahamskraal Formation – Poortjie Member interval) span the catastrophic end-Middle Permian Extinction Event which is associated with an unusually low abundance of well-preserved fossil remains. Over the course of eight days, only a handful of fossil sites were recorded within Beaufort Group bedrocks underlying the WEF Cluster project area, the majority of which are poorly preserved and of limited scientific or conservation significance. Even occasional small areas showing excellent, fresh (*i.e.* unweathered) mudrock exposure ideal for palaeontological recording yielded hardly any fossils. Almost no fossil sites were recorded within the Late Caenozoic superficial deposits.

While additional, unrecorded fossil sites of high palaeontological and conservation value are likely to occur at and beneath the land surface within the Loxton WEF Cluster project areas, they are probably very sparse and sporadic in distribution and can be effectively handled in the Construction Phase through a Chance Fossil Finds Protocol (See Appendix 1). All the recorded sites can, if necessary, be effectively mitigated in the preconstruction phase.

It is concluded that the palaeosensitivity of the combined Loxton WEF Cluster project area is, in practice, LOW. The provisional palaeosensitivity mapping by the DFFE Screening Tool is accordingly *contested* in this report.

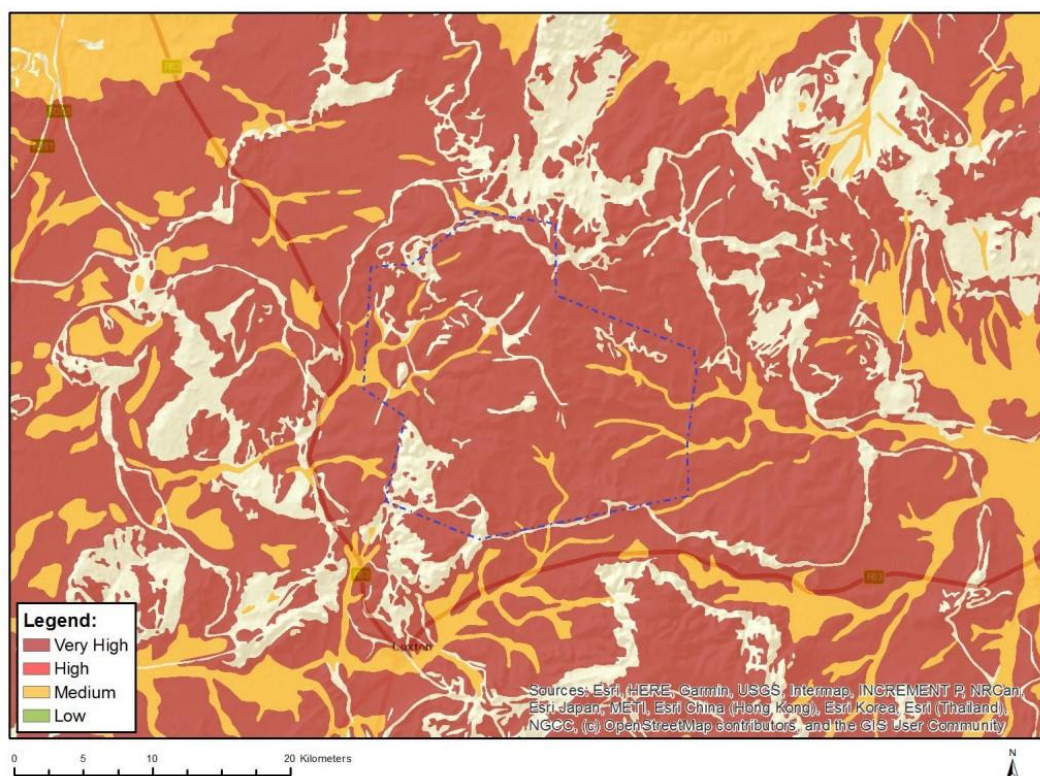


Figure 45: Provisional palaeosensitivity mapping of the northern sector of the Loxton WEF Cluster project area using the DFFE Screening Tool. The Very High sensitivity of most of the project area is *contested* in this report.

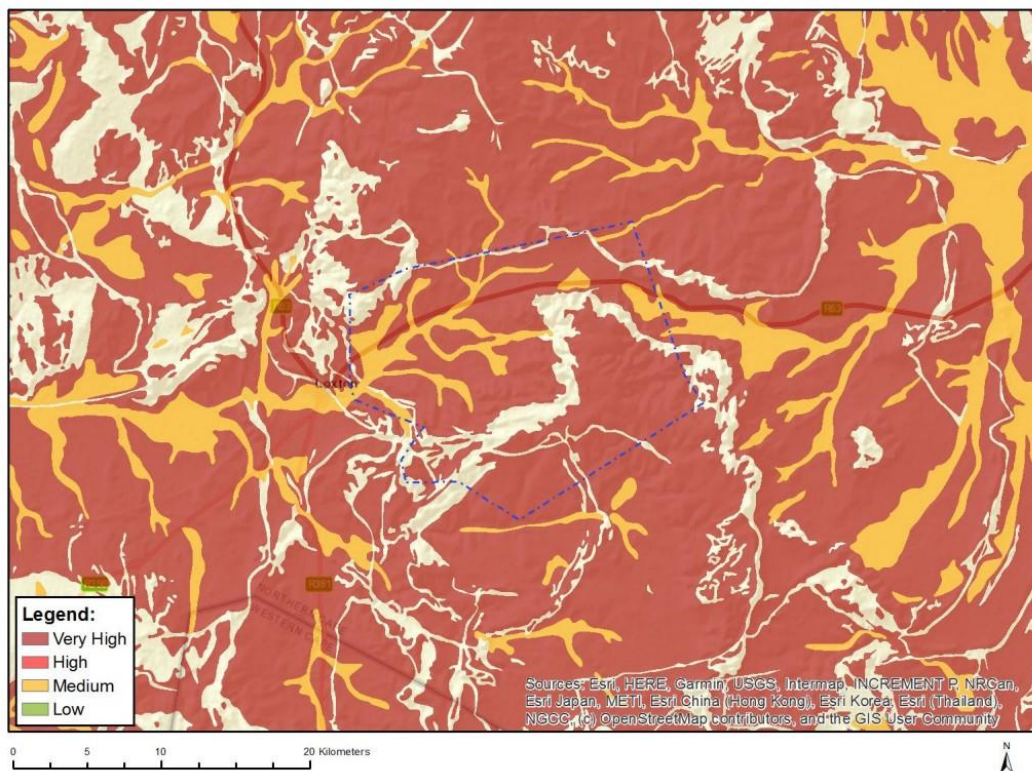


Figure 46: Provisional palaeosensitivity mapping of the southern sector of the Loxton WEF Cluster project area using the DFFE Screening Tool. The Very High sensitivity of most of the project area *contested* in this report.

8. Potential impacts on palaeontological heritage and mitigation

The proposed Loxton WEF Cluster projects will involve substantial surface clearance and bedrock excavations - for example for wind turbine foundations, access road networks, underground cables, construction laydown areas/camps, operation & maintenance buildings, on-site substations and electrical pylon footings - which may disturb, damage or destroy legally projected palaeontological heritage resources of scientific and conservation value.

None of the very few new fossil sites recorded within the Loxton WEF 2 project area are of significant scientific or conservation value. The only site which lies very close to the proposed WEF footprint (Site 007, situated very close to or within the access road footprint) comprises poorly-preserved invertebrate trace fossils of little scientific interest (see Appendix 1). No known significant or unique palaeontological heritage sites are threatened by the proposed development.

Despite the substantial project footprints as well as the known occurrence of important vertebrate and other fossil sites elsewhere in the wider region between Loxton and Victoria West, **the impact significance of the proposed renewable energy developments on local palaeontological heritage is anticipated to be LOW.** This is based on the inferred Low Palaeosensitivity of the project area overall based on desktop and field-based data, as motivated above. These impacts, including cumulative impacts considering other renewable energy projects in the broader region (e.g. Victoria West WEF Cluster), are expected to fall within acceptable limits.

The potential for unrecorded palaeontological sites of scientific and conservation value cannot be completely excluded, however. These are best mitigated through the application of a Chance Fossil Finds Protocol by the ECO / ESO during the Construction Phase (See Appendix 2) which should be incorporated into the EMPs for the WEF developments. The qualified palaeontologist responsible for

mitigation work will need to apply for a Fossil Collection Permit for the Northern Cape from SAHRA. Minimum standards for PIA reports have been compiled by Heritage Western Cape (2021) and SAHRA (2013).

9. Conclusions and recommendations

Historical palaeontological site mapping for the region between Loxton and Victoria West reveals a paucity of recorded vertebrate fossil sites within the Loxton WEF Cluster project area. This is supported by recent palaeontological field surveying, both here and in neighbouring WEF project areas (e.g. Victoria West WEF Cluster studied by Almond 2023), which shows that:

- (1) Levels of Beaufort Group bedrock exposure – especially the potentially most fossiliferous mudrock facies - are very limited here due to pervasive cover by Late Caenozoic superficial sediments;
- (2) Intensive intrusion by dolerite sills and dykes has compromised fossil preservation over large areas;
- (3) The Beaufort Group bedrocks represented here span the catastrophic end-Middle Permian Extinction Event which is associated with an unusually low abundance of well-preserved fossil remains. Over the course of eight days, only a handful of fossil sites were recorded within the entire WEF Cluster project area, the majority of which are poorly preserved and of limited scientific or conservation significance. Even occasional small areas showing excellent, fresh mudrock exposure ideal for palaeontological recording yielded hardly any fossils. Almost no fossil sites were recorded within the Late Caenozoic superficial deposits.

None of the very few new fossil sites recorded within the Loxton WEF 2 project area are of significant scientific or conservation value and no mitigation is recommended here with regard to these known sites (Appendix 1). The only site which lies very close to the proposed WEF footprint (Site 007) comprises poorly-preserved invertebrate trace fossils of little scientific interest. No known significant or unique palaeontological heritage sites are threatened by the proposed WEF development.

While additional, unrecorded fossil sites of high palaeontological and conservation value are likely to occur at and beneath the land surface within the Loxton WEF Cluster project areas, they are probably very sparse and sporadic in distribution and can be effectively handled in the Construction Phase through a Chance Fossil Finds Protocol (See Appendix 2) which should be incorporated into the Environmental Management Programmes for the Loxton Cluster WEF developments. All the recorded sites can, if necessary, be effectively mitigated in the preconstruction phase.

It is concluded that the palaeosensitivity of the combined Loxton WEF Cluster project area is, in practice, LOW. The provisional palaeosensitivity mapping by the DFFE Screening Tool is accordingly *contested* in this report.

Despite the substantial WEF project footprints as well as the known occurrence of important vertebrate and other fossil sites elsewhere in the wider region between Loxton and Victoria West, **the impact significance of the proposed renewable energy developments on local palaeontological heritage is anticipated to be LOW.** These impacts, including cumulative impacts considering other renewable energy projects in the broader region (e.g. the adjoining Victoria West WEF Cluster), are expected to fall within acceptable limits. **There are therefore no objections on palaeontological heritage grounds to authorisation of the Loxton WEF Cluster developments, including the Loxton WEF 2 project considered in this report.**

The potential for unrecorded palaeontological sites of scientific and conservation value cannot be completely excluded. These are best mitigated through the application of a Chance Fossil Finds

Protocol by the ECO / ESO during the Construction Phase (See Appendix 2). The qualified palaeontologist responsible for mitigation work will need to apply for a Fossil Collection Permit for the Northern Cape from SAHRA. Minimum standards for PIA reports have been compiled by Heritage Western Cape (2021) and SAHRA (2013).

10. Acknowledgements

The Project Applicant is thanked for commissioning this palaeontological heritage study and for supplying the necessary project information. I am grateful to the landowner of the Farm Saaidam for facilitating the fieldwork as well as to Ms Madelon Tusenius of *Natura Viva* cc for logistical support, palaeontological input and companionship in the field.

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12. Outline of specialist's experience

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 AHP (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.



Dr John E. Almond
Palaeontologist
Natura Viva cc

APPENDIX 1: LOXTON WEF 2 – NEW FOSSIL SITE DATA (October 2022)

All GPS readings were taken in the field using a hand-held Garmin GPSmap 64s instrument. The datum used is WGS 84.

See Figures A1.1 and A1.2 below for satellite maps showing the distribution of new fossil localities in relation to the proposed WEF infrastructure layouts.

Please note that:

- Locality data for South African fossil sites is *not* for public release, due to conservation concerns.
- The table does *not* represent all potential fossil sites within the WEF project area but only those sites recorded during the site visits. The absence of recorded fossil sites in any area therefore does *not* mean that no fossils are present there.
- The detailed stratigraphic data for each site is provisional (based in part on the published CGS 1: 250 000 geology sheet which requires revision) and has yet to be confirmed.

Loc	GPS data	Comments
LOXTON WEF 2		
005	-31.296344° 22.363090°	Springfontein 573 RE Abrahamskraal Formation Calcretised gravelly alluvium of Late Caenozoic age containing vertical and oblique subcylindrical structures that are probably rhizoliths (root casts or moulds) but in some cases might be burrows. Proposed Field Rating IIIC. No recommended mitigation.
007	-31.291296° 22.364557°	Springfontein 573 RE Abrahamskraal Formation Wave-rippled bed top of a crevasse splay sandstone showing a network of possible sinuous invertebrate burrows (possibly also small-scale mud crack infills). Proposed Field Rating IIIC. No recommended mitigation.
020	-31.284193° 22.403343°	Springfontein 573 RE Abrahamskraal Formation Finely-comminuted bone breccia within ferruginous carbonate concretions within mudrock package. Proposed Field Rating IIIC. No recommended mitigation.
069	-31.342087° 22.437282°	Saaidam Farm 574 RE Upper Abrahamskraal Formation mudrocks. Several angular blocks of petrified wood recorded in float up to 11.5 cm across, someshowing well-preserved woody tissue with seasonal growth rings. Proposed Field Rating IIIC. No recommended mitigation.
099	-31.356558° 22.494570°	Rietfontein 572 Portion 4 Upper Abrahamskraal Formation mudrocks. Breccia of comminuted bone fragments (up to 1 cm across) preserved within a concretionary horizon. Proposed Field Rating IIIC. No recommended mitigation.
101	-31.355520° 22.480747°	Rietfontein 572 Portion 4 Upper Abrahamskraal Formation Poorly-preserved fragment of long bone (possible femur) of a large-bodied tetrapod – probably dinocephalian therapsid or pareiasaur reptile – showing extensive pre-burial suncracking recorded <i>ex situ</i> overlying weathered mudrocks. Proposed Field Rating IIIB. No recommended mitigation.
105	-31.319957° 22.460750°	Rietfontein 572 Portion 4 Upper Abrahamskraal Formation channel sandstones. Concentration of several poorly-preserved moulds of large woody plant axes (up to c.10 cm diameter). Proposed Field Rating IIIC. No recommended mitigation.

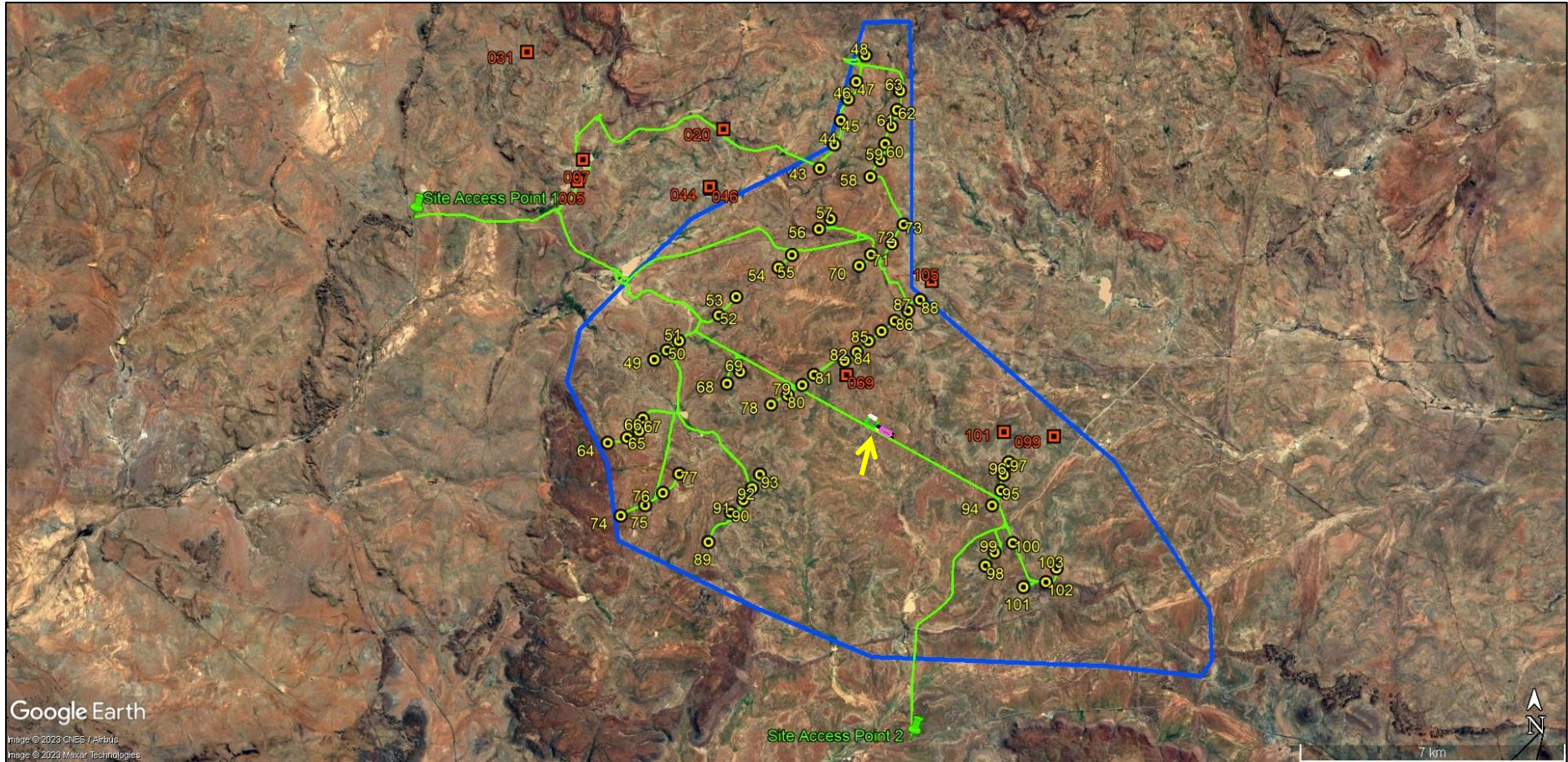


Figure A1.1: Google Earth© satellite image of the Upper Karoo region NNE of Loxton, Northern Cape showing the Loxton WEF 2 project area (blue polygon) and fossil sites (numbered red squares) in relation to the provisional WEF layout (numbered yellow circles = wind turbine locations; pale green lines = access road network; arrowed cluster of rectangles = laydown area, O&M building, on-site substation, BESS etc). None of the recorded fossil sites is of significant scientific or conservation value (see table above). Apart from the low-significance site 007, none of the known sites lies within or close to (< 20m) the WEF project footprint and no mitigation is recommended here with regard to these sites. The sparseness of recorded fossil sites indicates that the WEF project area is of LOW palaeosensitivity overall.

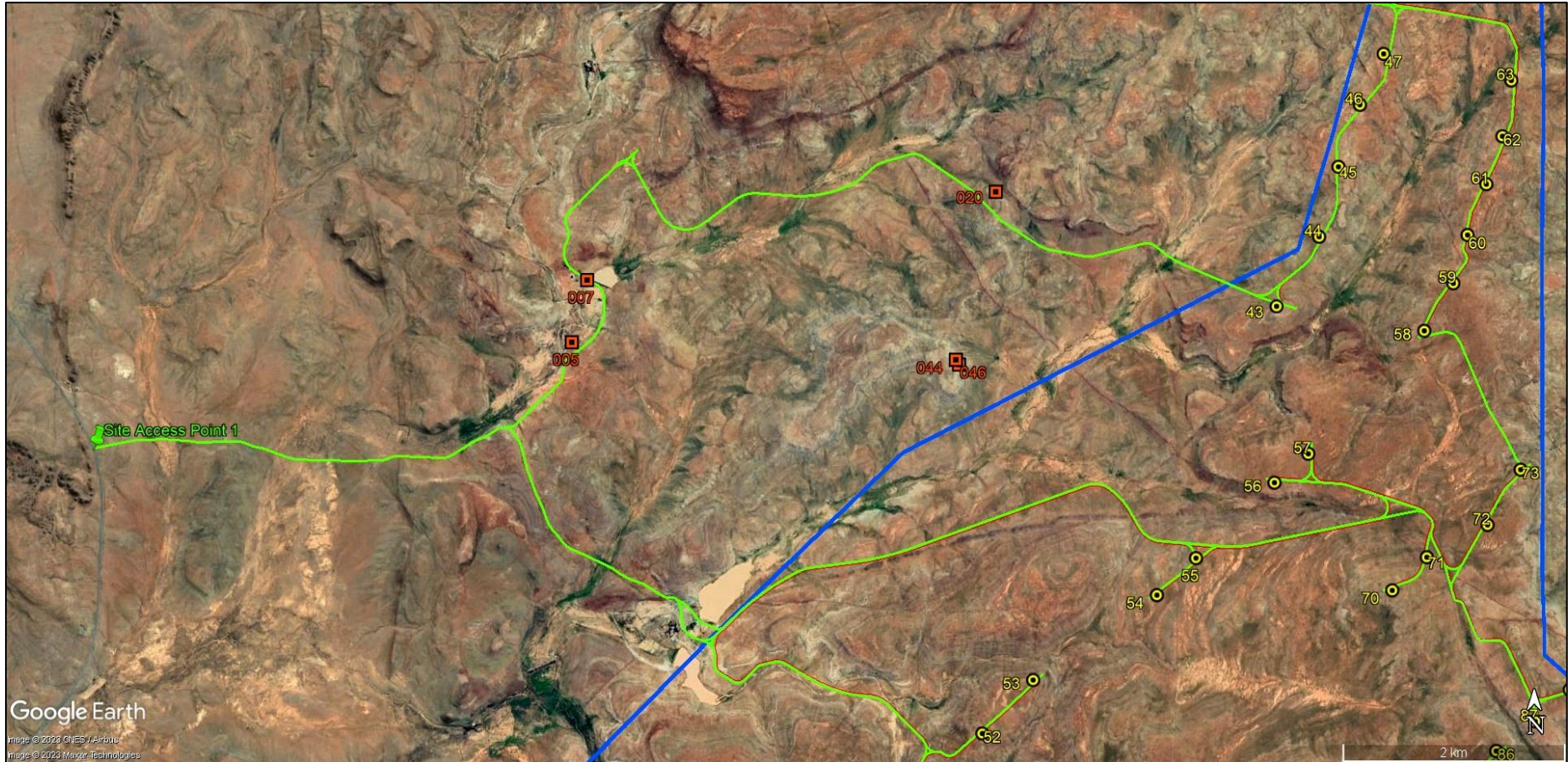
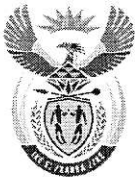


Figure A1.2: Google Earth© satellite image of an area on the northern margins of the main Loxton WEF 2 project area (blue polygon) showing fossil sites within the adjoining Loxton WEF 1 project area that lie close to the northern access road to the former. These sites are tabulated above and illustrated in the separate palaeontological heritage report for the Loxton WEF 1 project. Site 007 (invertebrate trace fossils) lies within or very close to the access road footprint but it is of low palaeontological heritage and conservation value so no mitigation is proposed here with regard to this site.

APPENDIX 2 - CHANCE FOSSIL FINDS PROCEDURE: Loxton WEF Cluster near Loxton, Northern Cape Province	
Province & region:	Northern Cape (Pixley Ka-Seme District, Ubuntu Local Municipality)
Responsible Heritage Management Agencies	SAHRA for N. Cape: 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
Rock unit(s)	Abrahamskraal Formation and Teekloof Formation (Lower Beaufort Group), Late Caenozoic alluvium.
Potential fossils	Fossil skulls, postcrania of tetrapods, amphibians, fish as well as rare petrified wood, vertebrate and invertebrate burrows within bedrocks. Mammalian bones, teeth & horn cores, freshwater molluscs, calcretised trace fossils & rhizoliths and plant material in alluvium.
ECO / ESO 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 (<i>e.g.</i> rock layering)
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Resources Agency 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 (<i>e.g.</i> 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 Agency	
Specialist palaeontologist	Apply for Fossil Collection Permit Record / submit Work Plan to the relevant Heritage Resources Agency. Describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (<i>e.g.</i> 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 Agency minimum standards.



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

File Reference Number:	(For official use only)
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

PROPOSED LOXTON CLUSTER WEF, NORTHERN CAPE PROVINCE

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at <https://www.environment.gov.za/documents/forms>.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:

Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:

Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Project Specialist:	Dr John Edward Almond		
Trading name (if any):	Natura Viva cc		
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E-mail:	naturaviva@universe.co.za		
Qualifications:	PhD (palaeontology) University of Cambridge, UK		
Professional affiliation (s) (if any)	Palaeontological Society of Southern Africa Association of Professional Heritage Practitioners (Western Cape)		

2. DECLARATION BY THE SPECIALIST

I, Dr John Edward Almond, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

NATURA VIVA CC

Name of Company

19 April 2023

Date

