



ABO Uvemvane Wind Energy Facility 1 (Pty)
Ltd

ABO USTEMVANE WIND ENERGY FACILITY 1

Geotechnical Impact Assessment Report





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Geotechnical Impact Assessment Report

REPORT (REV4) CONFIDENTIAL

PROJECT NO. 41106304

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1 INTRODUCTION

WSP Group Africa (Pty) Ltd (WSP) has been appointed by ABO Energy South Africa (Pty) Ltd to undertake a geotechnical impact assessment desktop study for the proposed ABO Uvemvane Wind Energy Facility 1 (WEF 1), a commercial wind energy generation facility comprising up to 20 turbines and with a total generation capacity of up to 170 MWac in capacity, as well as associated infrastructure.

The objective of the desktop study is to perform a high-level assessment of the potential impacts of the proposed WEF on the geotechnical conditions on and around the site or vice versa. The geotechnical assessment is required to inform the Environmental Authorisation (EA) process.

This report presents the findings of the geotechnical desktop assessment undertaken for the proposed WEF 1 renewable energy Development.

The development footprint includes the wind turbines and all associated infrastructures as indicated in Table 1-1.

Table 1-1 – ABO Uvemvane WEF 1 Project Details

Aspect	Details
Total Area of Applicable Farm Portions	A preferred study area with a total combined extent of approximately 8,200 ha was identified as a technically suitable project site for the development of the WEF project, within this an affected area of approximately 6000 ha has been assessed.
Total Buildable Area (i.e. likely footprint area)	Approximately 67.2 ha: <ul style="list-style-type: none"> ■ Turbines/ hardstands/foundations: up to 1Ha per turbine (up to 20ha) ■ Roads: up to 31km (approx. 18km of which are existing roads to be widened) and up to 33ha ■ Electrical Infrastructure Hub: up to 7ha ■ Temporary Laydown Areas: 4 x laydown areas (includes concrete batching plant) totalling up to 15ha ■ Internal Underground Cabling: up to 31km, but nothing beyond proposed roads so has been included in road footprint ■ 33kV OHL/underground facility connection: Up to 0.02ha
Export Capacity	Up to 170MWac
Technology	Wind
Number of Wind Turbines	Up to 20
Turbine Specs/ Aspects	<ul style="list-style-type: none"> ■ Maximum hub height 180 m; ■ Maximum blade length 100 m; ■ Maximum rotor diameter 200 m; ■ Maximum capacity per turbine 10 MW; ■ A transformer at the base of each turbine; ■ Concrete turbine foundations up to 1 ha each; ■ Turbine, crane, and blade hardstands (included in the abovementioned 1 ha).
Turbine Specs/ Aspects	Three (3) locations have been assessed and are being applied for noting that only one will be constructed based on technical feasibility to be confirmed at pre-construction stage (Up to 7ha)

Aspect	Details
Construction camp and laydown area	4 temporary laydown areas/ construction compounds (includes concrete batching), totalling up to 15 ha, would be fenced with access control.
Access Routes	Five (5) existing routes; four of these are off existing unnamed farm roads (originating from the D1220 and P243/1), and one is off Lagerspoort Road from Heidelberg - Balfour Road (R23). The Details of the access would be as per the recommendations in the Transport Impact Assessment.
Internal Roads	<ul style="list-style-type: none"> ■ Up to 31 km length (approx. 18km of which are existing roads to be widened). ■ Primary/main access roads as well as internal road reticulation (note that existing roads/disturbed areas would be used as far as possible, and for the proposed roads, a corridor of up to 12 m wide may be temporarily impacted upon during construction and be rehabilitated to up to 10 m wide after construction), inclusive of stormwater infrastructure where relevant.
Associated infrastructure	<p>Includes the following (to be located within the proposed development footprint):</p> <ul style="list-style-type: none"> ■ Associated internal electrical reticulation/ cabling (i.e., low- and medium voltage powerlines), underground as far as is feasible, and to run within the proposed road footprint/route as far as possible; ■ A 33kV overhead/underground line to connect the northern and southern portions of the facility; and ■ On-site electrical infrastructure hub (up to 7 ha in extent). Note there are three (3) locations to be assessed as options, however only 1 one will be constructed, consisting of: <ul style="list-style-type: none"> ■ On-site substation and associated infrastructure; ■ Additional step-up/ transformation /collector /switchyard infrastructure; ■ Auxiliary buildings, including but not limited to O&M building(s) administrative buildings, workshops, gatehouses, security buildings, control centres, offices, visitor centres, warehouses, etc.; ■ The installation of a communications tower (maximum height 32 m) and/or lighting mast (maximum height 25 m); and ■ BESS.

1.1 SPECIALIST CREDENTIALS

The geotechnical desktop study was undertaken by an experienced professionally registered engineering geologist, and the work was overseen by a professionally registered senior geotechnical engineer. The CV's for Khuthadzo Bulala and Heather Davis are included in Appendix A.

Khuthadzo Bulala is an engineering geologist with a Bachelor of Science Honors Degree from the University of Limpopo. She is registered as a Professional Scientist (Pr.Sci.Nat 116482). Khuthadzo has nine years of experience in engineering geology, geotechnical engineering, environmental geology, and soil surveys.

She has extensive experience in conducting renewable energy geotechnical assessments and detailed renewable energy geotechnical investigations.

The desktop studies were reviewed and authorized by **Heather Davis**. Heather is a qualified Professional Engineer (Pr.Eng 960229) with over 40 years of experience. She obtained a BSc Honours degree in Engineering Geology and Geotechnics from the University of Portsmouth (UK) in

1982. A post graduate diploma was obtained from the University of the Witwatersrand in 1993 which focused on geotechnical engineering and rock mechanics.

She is currently the geotechnical team lead at WSP. She has accumulated extensive experience in Sub Saharan Africa which has included work on power plants and renewable energy projects in South Africa.

2 STUDY AREA INFORMATION

The proposed ABO Uvemvane WEF 1 is located approximately 9km west of the town of Balfour in the Mpumalanga Province in the Dipaleseng Local Municipality within the Gert Sibande District Municipality and approximately 14km south-east of the town Heidelberg in the Gauteng Province in the Lesedi and Midvaal Local Municipalities within the Sedibeng District Municipality. The locality of the facility is illustrated in Figure 2-1. The layout of the site is provided in Figure 2-2 and the affected farm portions are listed in Table 2-1. The properties are zoned for agricultural use, cattle grazing and wildlife grazing.

The Heidelberg area has a subtropical Highland climate characterised by dry winters and warm temperate summers. The area receives an average annual rainfall of about 764mm with the highest rainfall occurring between the summer months of October to March. The hottest months are September to February with an average temperature of 25°C. The coldest months are between June and July with an average temperature of 5°C. The site terrain consists of undulating topography with an overall elevation range between 1400m and 1740m.

Table 2-1 – Affected Farm Portions

Farm Name	21-Digit SG Code
The Remaining Extent of Portion 2 of the Farm Lagerspoort Number 406	T0IR00000000040600002
Portion 17 (a Portion of Portion 3) of the Farm Lagerspoort Nr 406	T0IR00000000040600017
Remaining Extent of Portion 4 of the Farm De Hoek 411	T0IR00000000041100004
Portion 45 of the Farm Lagerspoort 406	T0IR00000000040600045
Portion 7 of the Farm Lagerspoort Number 406	T0IR00000000040600007
Portion 19 of the Farm De Hoek No 411	T0IR00000000041100019
Remaining Extent of Portion 2 of the Farm Modderfontein 410	T0IR00000000041000002
The Farm Orion No 413	T0IR00000000041300000
Remaining Extent of Portion 5 of the Farm Lagerspoort 406	T0IR00000000040600005
Portion 7 of the Farm Driefontein 405	T0IR00000000040500007
Remaining Extent of Portion 9 of the Farm Malanskraal No 407	T0IR00000000040700009
Remaining Extent of Portion 2 of the Farm Malanskraal 407	T0IR00000000040700002
Portion 12 (a Portion of Portion 2) of the Farm Malanskraal 407	T0IR00000000040700012
Remaining Extent of Portion 2 of the Farm Driefontein 405	T0IR00000000040500002
Remaining Extent of the Farm Driefontein 405	T0IR00000000040500000
Remainder of Portion 6 (Kingsmead) of the Farm Malanskraal 407	T0IR00000000040700006
Portion 17 (a Portion of Portion 8) of the Farm Malanskraal No 407	T0IR00000000040700017



Farm Name	21-Digit SG Code
Farm Bothas Spruit Nr. 404	T0IR00000000040400000
Portion 16 (a Portion of Portion 4) of the Farm Malanskraal No 407	T0IR00000000040700016
Remaining Extent of Ptn13 (Ptn of Portion 2) of the Farm Malanskraal 407	T0IR00000000040700013
Remainder of Portion 18 (a Portion of Portion 3) of the Farm Malanskraal 407	T0IR00000000040700018
Portion 1 of the Farm Weltevreden Nr. 449	T0IR00000000044900001

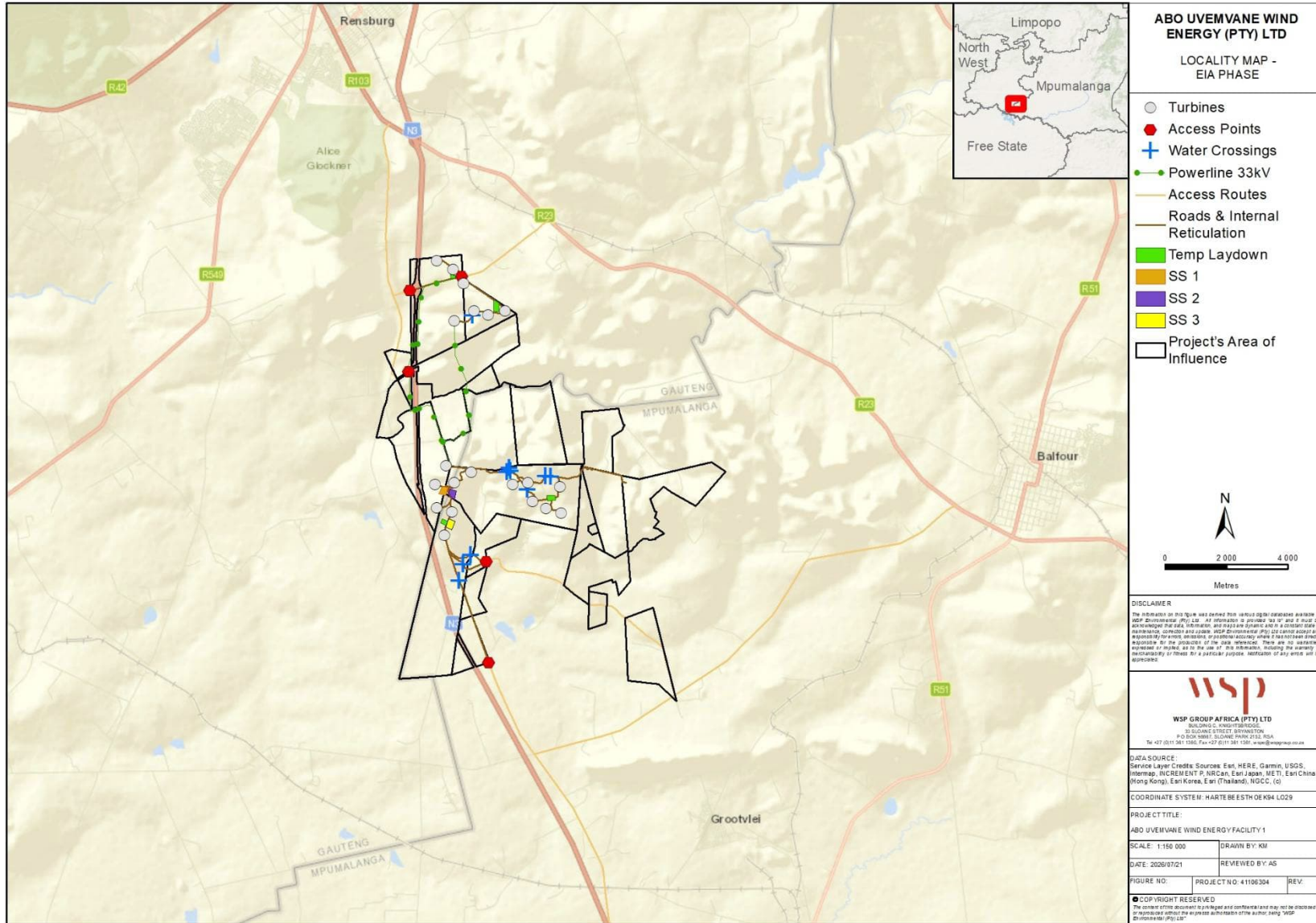


Figure 2-1 - Locality Map

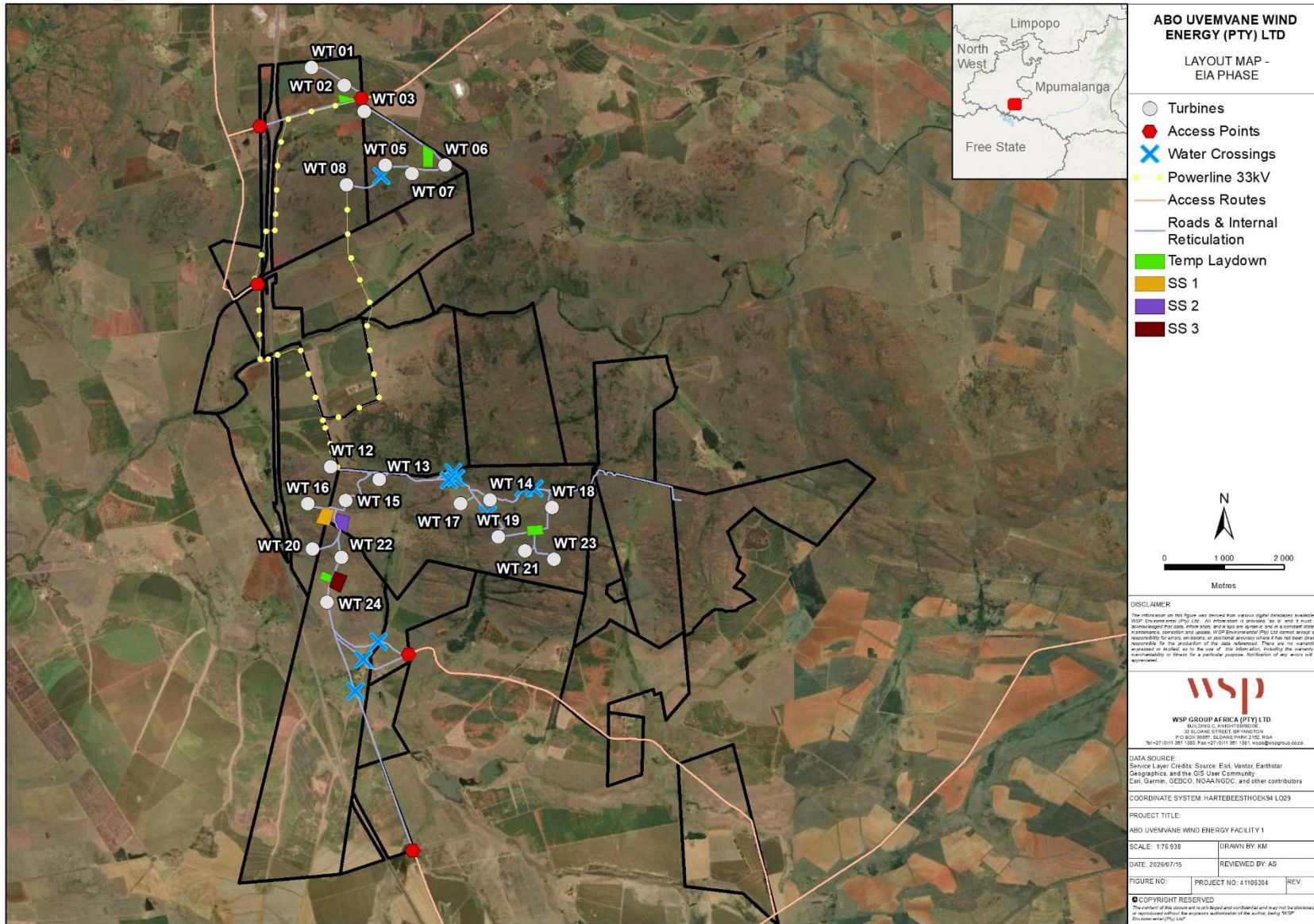


Figure 2-2 - Site Layout Map

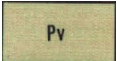
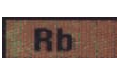
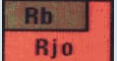
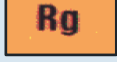
3 GEOLOGY

According to the published 1: 250 000 geological map, Sheet 2628 West Rand the site is underlain by rocks of the West Rand and Central Rand Group (Witwatersrand Supergroup), Kliprivier Group (Ventersdorp Supergroup) and Ecca Group (Karoo Supergroup).

A number of faults characterise the site. The faults are trending in a north-west to south-east or north to south direction. In the Turffontein Subgroup, regional dip of the rocks is approximately 17°, 25°, 28° and 45°. The Kliprivier Group rocks dip in north easterly direction at approximately 50°. The rocks of the Johannesburg group dip at approximately 35° in a northerly direction

An excerpt from the geological sheet is given as Figure 3-1 and the lithostratigraphy along with the map symbols is provided in Table 3-1.

Table 3-1 – Lithostratigraphy of the Area

Supergroup	Group	Subgroup	Formation	Description	Map Symbol
Quaternary Deposits				Alluvium	
Karoo	Ecca		Vryheid	Sandstone, shale, coal beds	
Intrusive				Diabase	
Ventersdorp	Kliprivier			Basaltic lava, agglomerate, tuff	
Witwatersrand	Central Rand	Turffontein		Quartzite, conglomerate, sandy shale	
			Booyens	Shale	
		Johannesburg		Quartzite and conglomerate	
	West Rand	Jeppeshtown		Quartzites with conglomerate layers	
			Roodepoort	Shale and quartzite	
			Crown	Amygdaloidal andesitic lava	
		Government	Florida Quartzite	Quartzite and basal conglomerate	
			Witpoortjie	Magnetic shale	
			Coronation Shale	Black strongly magnetic shale	

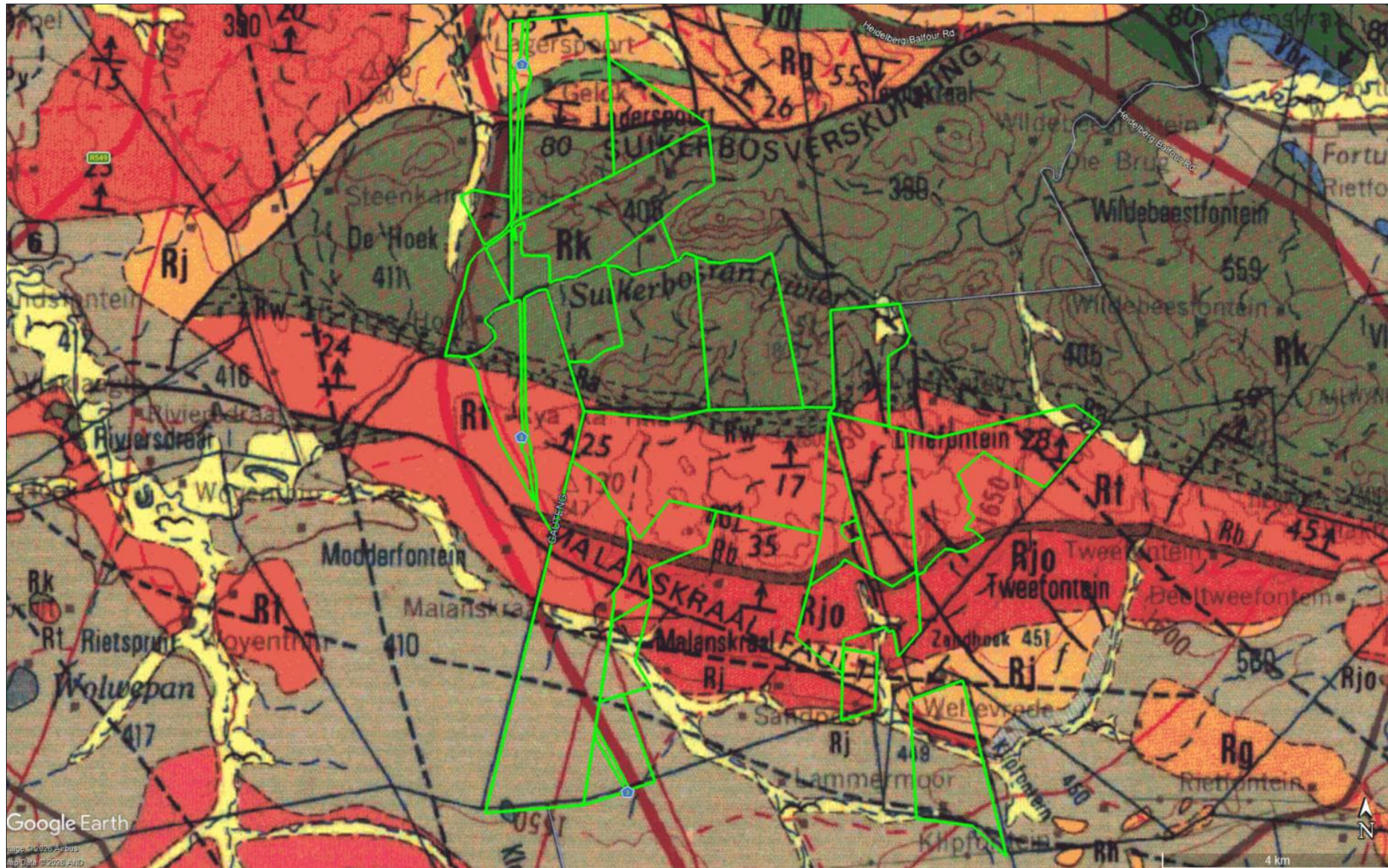


Figure 3-1 - Regional Geology of the Area

4 SITE RECONNAISSANCE

A site reconnaissance was carried out on the 13th of March 2025 during the summer season. The season over which the site visit was conducted does not affect the outcome of the assessment as the geotechnical impacts are more of a technical nature rather than environmental.

The reconnaissance comprised a drive over the site within areas that were accessible by a 4x4 vehicle, profiling of geological exposures and documenting by taking photographs.

The following equipment was used for profiling of exposures:

- Geological hammer
- Hand lens
- Measuring tape
- Handheld GPS device

4.1 EXPOSURES

A total of twelve geological exposures, EXP1 to EXP12, were observed in various areas of the site and were profiled according to the current South African standards and guidelines (SANS 633). This was done to confirm or dispute the baseline geological information.

The locations of the exposures are illustrated in Figure 4-2. The exposure profiles and photographs are presented in Appendix B.

A list and description of the exposures indicating the geology encountered on site is presented in Table 4-1.

The site reconnaissance confirmed that the central and northern sections of the site are underlain by the Witwatersrand Supergroup as described in Section 3.

The south eastern and south western section, underlain by the Vryheid Formation, is relatively flat and characterised by agricultural activities. No rock exposures were encountered.

Table 4-1 – Summary of Geological Exposures Encountered Across the Site

Exposure ID	Lat	Long	Rock Exposure Type
EXP1	26°39'31.72"S	28°28'26.93"E	Quartzite – medium hard rock
EXP2	26°39'40.85"S	28°28'7.00"E	Quartzite – medium hard to hard rock
EXP3	26°40'28.27"S	28°27'43.91"E	Quartzite – medium hard to hard rock
EXP4	26°39'19.47"S	28°23'56.40"E	Quartzite – medium hard to hard rock
EXP5	26°40'59.33"S	28°24'13.32"E	Quartzite – medium hard rock
EXP6	26°39'45.32"S	28°24'38.32"E	Conglomeritic Quartzite – medium hard rock
EXP 7	26°40'34.71"S	28°24'59.63"E	Quartzite – hard rock
EXP 8	26°40'0.99"S	28°25'5.08"E	Conglomeritic Quartzite – medium hard rock

Exposure ID	Lat	Long	Rock Exposure Type
EXP9	26°35'52.72"S	28°27'36.32"E	Basalt – soft to medium hard rock
EXP10	26°36'4.63"S	28°27'15.31"E	Quartzite – medium hard rock
EXP11	26°35'42.49"S	28°26'49.64"E	Basalt – soft to medium hard rock
EXP12	26°37'52.34"S	28°27'10.26"E	Possibly Basalt – Basalt rock fragments profiled at the bottom of the hill

4.2 MINING ACTIVITIES

According to the geology map and the South African Mining Map from Council for Geoscience, no mining activities are in and around the proposed development area. During the site reconnaissance, two inactive mine shafts were encountered. The depth of the shaft and the last year of mining is unknown at this point of reporting. One shaft currently has bat activity.

Shaft 1 is located in Portion 17 (a Portion of Portion 8) of the Farm Malanskraal No 407 and the Shaft 2 with bat activity is located in Remaining Extent of the Farm Driefontein 405 as illustrated in Figure 4-1.

The Central Rand Group comprises 2800m of quartzites and gold bearing conglomerates with only one shale horizon of any consequence, the Booyens Shale. (Brink ABA. 1979). The Central Rand Goldfield extends from the western margin of the East Rand Basin to the Witpoortjie Gap. Now largely mined out, it did support 46 mines. (Geology of South Africa, 2006). The most important and extensively developed gold bearing reefs in the Central Rand Group are as follows: -

- Kimberley Reef Turffontein Subgroup
- Elsburg Reef. Turffontein Subgroup
- Main Reef Johannesburg Subgroup
- Bird Reef Johannesburg Subgroup

The West Rand Group, older than the Central Rand Group, is, also, gold bearing with “*some of the deepest and most profitable mines in the world being located within these rocks* “. (Brink ABA, 1979). The Department of Mineral Resources and Energy Affairs (DMRE) were repeatedly contacted and visited over a period of several months to determine the extent of the mining area. In August 2012, a Prospecting Right (File Reference MP 30/5/1/1/2/4247 PR) was granted to Iningi Investment (Pty) Ltd for prospecting coal on various portions of the following farms:

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Malanskraal 407 IR ■ Driefontein 405 IR ■ Vlakfontein 448 IR ■ Zandhoek 451 IR ■ Weltevreden 449 IR ■ Klipfontein 450 IR | <ul style="list-style-type: none"> ■ Panfontein 452 IR, ■ Daspoort 564 IR ■ Modderfontein 562 IR ■ Rietfontein 561 IR ■ Tweefontein 560 IR ■ Vlakfontein 558 IR |
|---|---|

However, no mining plans could be provided by the DMRE. They indicated that they do not have any on file. Attempts were made to contact the Holder of the Mining Rights, but these proved unsuccessful. Documents that were provided by the DMRE are included Appendix C. It is not possible to date these mine shafts without proper documentation from the DMRE and the Iningi

Investments. It must be noted that Clause 10 of the Converted Mining Right (Act No. 28 of 2002) states the following: -

“All boreholes, shafts, adits, excavations and openings sunk or made, by the Holder during the currency of this mining right shall be sealed, closed, fences, made safe by the Holder in accordance with the approved Environmental Management Programme, the Mine Health and Safety Act, 1996 or any other applicable laws and regulations.”

However, this is not always done and there has been a programme by the DMRE, CGS and mining companies to close all mine related excavations. This has not proved a deterrent to illegal miners, often termed Zama Zamas, who often excavate out their own openings into mine workings. The number of illegal miners and illegal mining operations has increased significantly over the last few years.

The Witwatersrand area is not a primary source of coal. South Africa's major coal reserves are found in the overlying Karoo Supergroup (Table 3-1). The Springs area (overlain by Karoo Supergroup) was initially mined for coal. However, in 1908 the first gold mining began in Springs. It would be futile to explore for coal where the two mine shafts are, as there are no coal reserves.

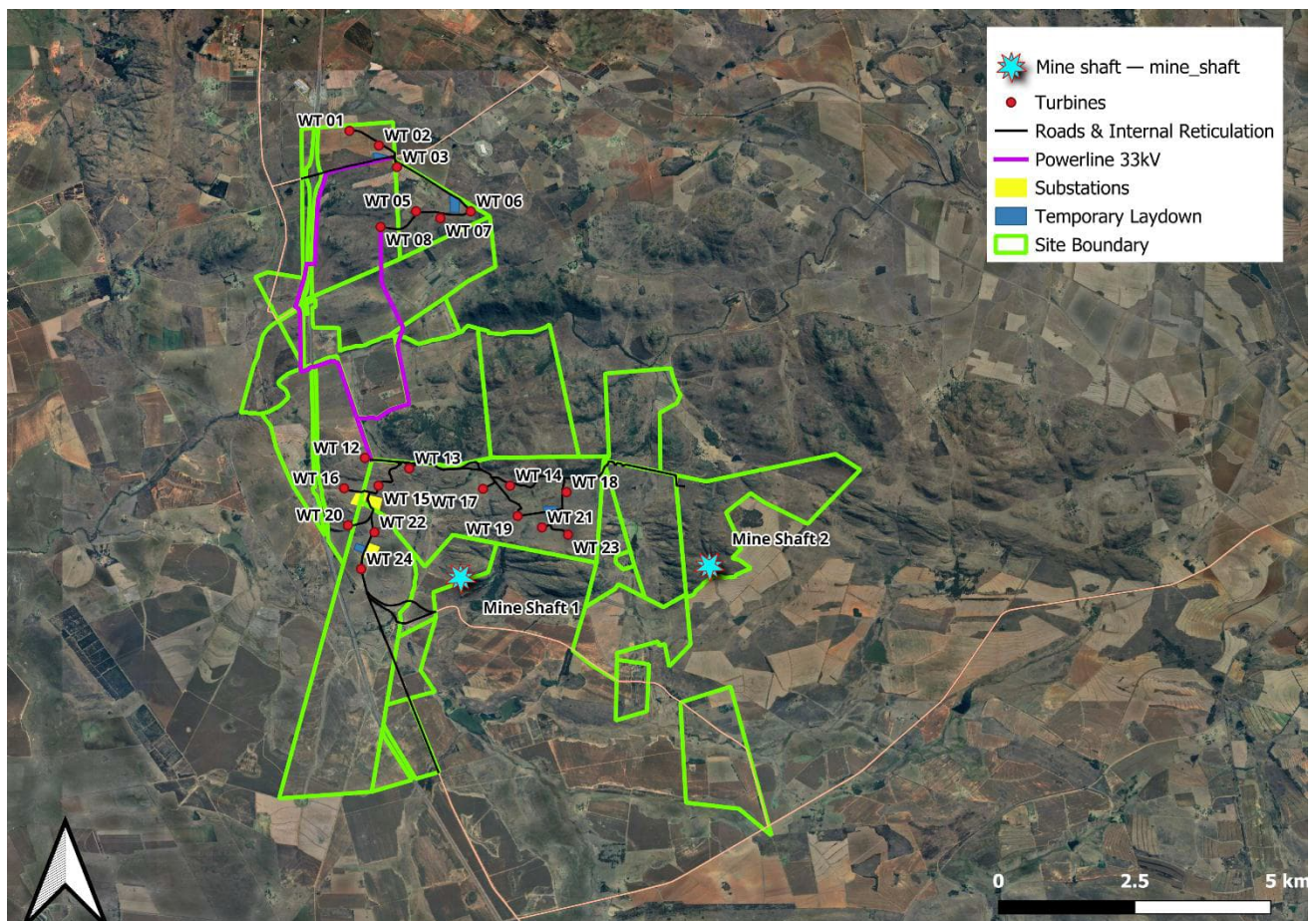


Figure 4-1 - Mine Shafts on Site

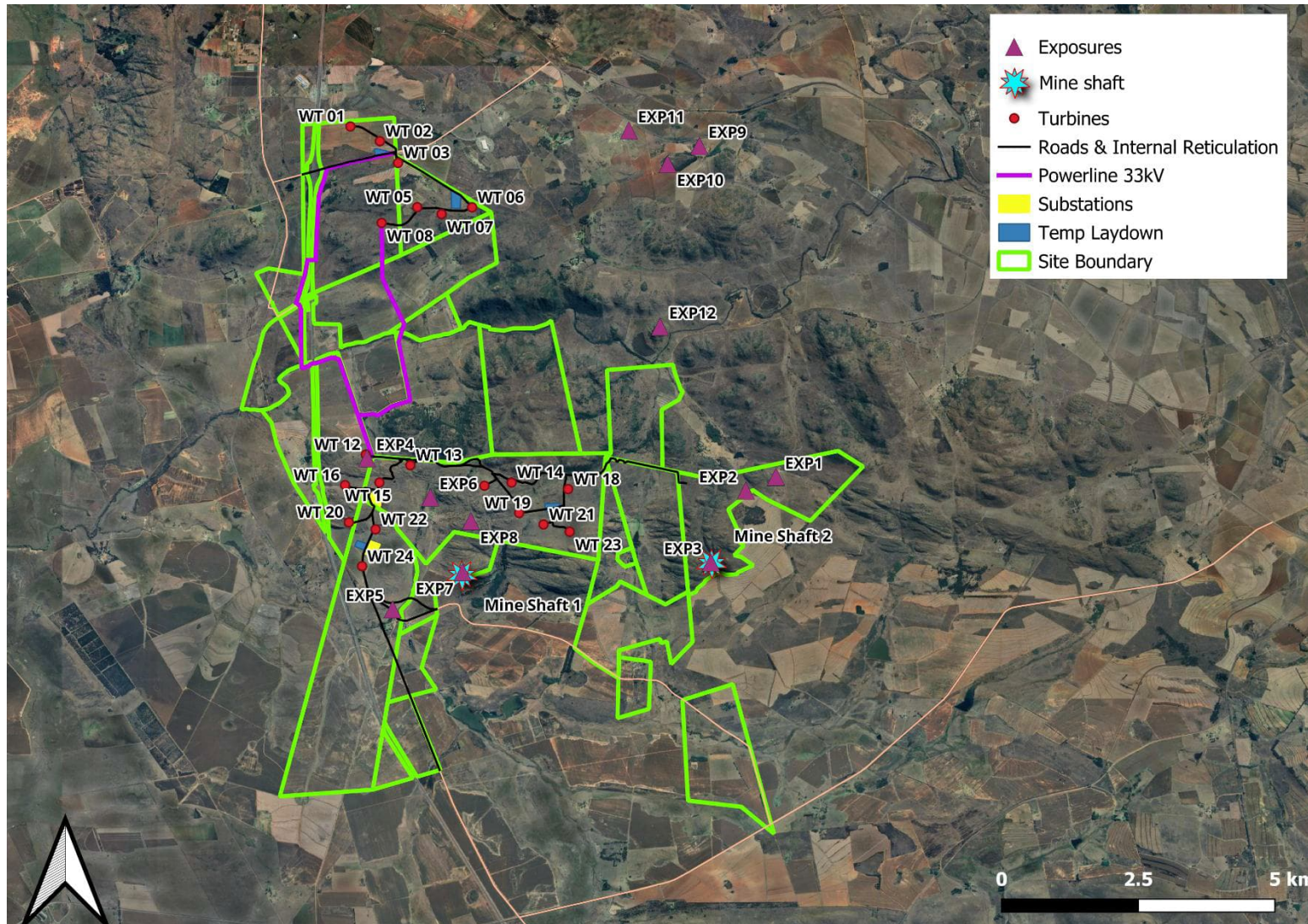


Figure 4-2 - Exposures on Site

5 EXPECTED GROUND CONDITIONS

5.1 VRYHEID FORMATION

Sandstone

Vryheid Formation sandstone generally weathers into sandy residual soils (Brink, 1983). Generally, these soils are thinly developed with bedrock being encountered relatively close to surface.

Sandstone does not weather uniformly, leading to dense layers being underlain by less competent layers of the same soil. The sandy profile will exhibit short term or elastic settlement with, generally, no long-term settlement characteristics.

In some cases, the residual sandstone may develop a potentially collapsible grain structure. Collapsible soils exhibit additional settlement upon wetting without any change in the load. This can occur many years after construction as a result of any inundation. If recognised at investigation stage, these collapsible materials can be easily dealt with during construction with some remediation being required.

Usually, sandstone presents a competent founding medium for relatively heavily loaded structures like pylons.

Where material is required for construction, natural sandstone gravel or crushed sandstone bedrock can potentially be a suitable source. Consideration must be given to the potential presence of excessive pyrite and muscovite which can cause problems where sandstone is used as basecourse (road construction). The material quality will have to be assessed during the geotechnical investigation.

Shale

Vryheid Formation shale generally weathers to a clayey residual soil which is often compressible and potentially expansive (Brink, 1983). Expansive soils are those materials that exhibit volume change with a change in moisture content. These materials “shrink” when the moisture content decreases, and “heave” or “expand” when the moisture content increases.

Where the residual clay profile is thinly developed, it is recommended that the material should be stripped. Where thickly developed, the structural design needs to take cognizance of the potential expansiveness and compressibility of this material.

Shale rock and excavated shale, which presents as a gravel, often deteriorates on exposure. Although shale material can be considered for use in construction, the potential for deterioration needs to be pre-determined in the laboratory. If suitable, the gravel can be used in selected layers in road construction, but seldom as base course. Gravelly shales are occasionally used in the wearing course of gravel roads, but not all types are suitable.

Slope instability may occur when sliding occurs on bedding planes within the rock mass which are inclined sufficiently. Ingress of water into layers and the resulting high pore-water pressure plays a key role in sliding failures. This is considered highly unlikely as the strata are mostly horizontally disposed in the area.

Coal beds

Coal seams are present within the Vryheid Formation with a thickness ranging from centimetres to 10m but are not generally encountered at surface. Coal, if present, will be minor in this area. There are no mines in the vicinity in a 45km radius.

5.2 DIABASE/DOLERITE

Generally, residual doleritic soil is relatively thickly developed above dolerite rock with the profile becoming coarser with depth. Cobbles and boulders are often present above the rock grading upwards into gravel, sand and finally residual clay at the top of the profile. Cobbles and boulders of dolerite, however, can be present throughout the entire residual profile.

Residual doleritic clay is generally compressible and potentially expansive in the “medium to high” range. Where a structure straddles residual dolerite and a different soil type, the structure should be moved to avoid differential settlement or designed accordingly.

Dolerite rock, cobbles, boulders, gravel and sand are generally durable and are suitable for a variety of purposes. Dolerite rock is commonly quarried and used as a construction material such as for concrete aggregate and road construction materials.

5.3 VENTERSDORP SUPERGROUP

Outcrops of andesitic lava are common on land underlain by the Ventersdorp Supergroup. However, although some lava outcrops may be present, a blanket of residual soil of variable thickness, commonly not thicker than 12m, can be expected. Typically, the profile comprises:

- Upper 1m to 2m of residual reddish brown or red, clayey sand.
- Residual yellow clayey silt which transitions into olive green coarser material.
- Large spheroidal boulders of hard rock andesite in a clayey/gravelly matrix.

Previous investigations in the Alberton area indicate that the residual clayey soils have the following, indicative, index properties: -

- Liquid limit 44% to 62%
- Plasticity index 17% to 37%
- Linear shrinkage 9% to 12%
- Clay content 21% to 32%

The residual soils are potentially expansive and potentially compressible in the long term. The site-specific heave and settlement parameters would need to be determined prior to foundation design.

Drainage control in these residual profiles is also of significant importance, as seepage from sources such as leaky pipes and standing water can result in movement and, more importantly, differential movement.

Ventersdorp lavas are commonly used to produce coarse and fine concrete aggregate and depending on the 10 per cent FACT and mix proportions selected, high compressive strength concrete can be achieved.

5.4 WEST RAND AND CENTRAL RAND GROUPS

The two Groups generally comprises shale, quartzite and conglomerate.

The **quartzite** generally weathers to sandy soils which can be present to depths up to 25m. on site, limited residual soil in areas underlain by quartzite is anticipated. The typical profile on the Jeppestown Formation, from an investigation conducted in Johannesburg, comprised the following:

- Residual quartzite – red and yellow medium dense to dense silty sand.
- Residual quartzite – dark yellow very dense silty sand.
- Weathered quartzite – very soft rock quartzite rock increasing in hardness with depth.

Although not observed on site, the **residual quartzite** soil tends to comprise loose silty sand or clayey sand. The residual quartzitic clayey/silty sand may be potentially collapsible. Soils with a collapsible structure experience additional settlement when subjected to an inundation of some kind. This occurs without an increase in loading and may occur many years after construction. Soil improvement, by means of compaction with the addition of water to -1% to +2% of optimum moisture content might be required where the residual soil is thickly developed. This is, however, not expected as rock is expected to be encountered on surface or at depths shallower the 3m.

Quartzite is often quarried and used as concrete aggregate and in road pavement layers.

Witwatersrand **shale** was not encountered on site. The shales weather to clayey residual soil with depths greater than 25m. The clayey residual shale is potentially compressible and expansive. Expansive clays are those materials where changes in moisture content result in volumetric change of the soil structure. The clay material heaves, or swells, when the moisture content increases and shrinks when the moisture content decreases. The wetting up and drying of the soil is rarely uniform across a site or even under a structure leading to differential movement. The wetting up and drying out can be due to seasonal variations or can influenced by man such as leaking pipes.

A geotechnical investigation in Germiston, for a municipal pool, showed residual shale that was potentially expansive in the low to medium range.

Conglomerate in the Witwatersrand Supergroup are, generally, gold-bearing quartz-pebble conglomerates that were deposited in ancient river systems, primarily in the Central Rand Group. They are renowned for containing most of the world's gold. conglomerate weathers and breaks down into its constituent parts: rounded rock fragments, or clasts, and fine-grained matrix sediments. The final weathered material is a mixture of gravel, sand, silt, and clay.

6 GEOTECHNICAL EVALUATION

6.1 PRELIMINARY FOUNDATION CONDITIONS

The turbine structures exert a static load. However, it is loading as a result of the high wind shear that drives the selection of founding medium. A high strength material is required for founding to provide sufficient bearing capacity and strength.

Rock is expected across much of the site north and central section on surface or at depths less than 3.0m, underlain by rocks of the Witwatersrand and Ventersdorp. Therefore, founding will be in rock. Where the site is underlain by Ventersdorp lava, the presence of spheroidal boulders must not be mistaken for solid rock.

Where structures are underlain by Vryheid sandstone, rock is expected at a depth of, generally, less than 3m. Therefore, founding in rock should be possible. Where structures are underlain by shale or dolerite the residual profile may be more thickly developed with rock expected at a depth of, generally, more than 3m but less than 6m. Dolerite boulders in the profile must not be mistaken for solid dolerite rock.

It is recommended that test pits be excavated at each turbine position during the geotechnical site investigation to determine the depth to rock and the strength characteristics thereof. Some rotary cored boreholes would be required to determine the rock strength with depth in, particularly, the shales.

6.2 WATER PRECAUTIONS

Flooding affects flat lying areas; areas confined to drainage channels and flood plains. The ABO Uvemvane WEF 1 site is situated on terrain that slopes in all direction (undulating gradient). A stormwater management system that provides good drainage will need to be considered during development and grading of the final platform level is recommended at all flat areas to facilitate stormwater run-off and to alleviate the possibility of standing water at the foundation positions.

6.3 SLOPE STABILITY

Where excavations are required, up to a depth of 3m, excavations should be excavated at a batter of 1:1.5 in soil where no water or seepage is evident and to 1:2, or flatter, where water is encountered. Rock can be excavated at a batter of 1:0.5 or vertically in the temporary case up to a depth of 3m. Should permanent excavations or deep excavations be proposed for the site, a slope assessment will be required.

6.4 EXCAVATABILITY

The expected excavation characteristics of the soil horizons have been evaluated according to the South African Bureau of Standards standardized excavation classification for earthworks (SABS – 1200D).

The definition of the excavation classes is indicated in

Table 6-1 and the assessment of the in-situ profile in Table 6-2. The ease of excavation is a critical financial factor for any development.

Table 6-1 – SABS 1200D Excavation Classes

Class of Excavation	General Definition
Soft	Excavation in material which can be efficiently removed or loaded by any of the following plant without prior ripping: A bulldozer with a mass of at least 22 tons (which includes the mass of the ripper, if fitted) and an engine developing approximately 145kW at the flywheel. Or A tractor-scraper unit with a mass of at least 28 tons and an engine developing approximately 245kW at the flywheel, pushed during loading by a bulldozer as specified for intermediate excavation. Or A track type front end loader with a mass of at least 22 tons and an engine developing approximately 140kW at the flywheel
Intermediate	Excavation (excluding soft excavation) in material which can be efficiently ripped by a bulldozer with a mass of at least 35 tons when fitted with a single tine ripper and an engine developing approximately 220kW at the flywheel.
Hard	Excavation (excluding boulder excavation) in material which cannot be efficiently ripped by a bulldozer with properties equivalent to those described for intermediate excavation. This type of excavation generally includes excavation in material such as formations of unweathered rock, which can be removed only after blasting.
Boulder Class A	Excavation in material containing in excess of 40% by volume of boulders between 0.03m ³ and 20m ³ in size, in a matrix of softer material or smaller boulders. Excavation of fissured or fractured rock shall not be classed as boulder excavation but as hard or intermediate excavation according to the nature of the material.
Boulder Class B	Where material contains 40% or less by volume of boulders in a matrix or soft material or smaller boulders.

Table 6-2 – Expected Excavatability on site

Material	Excavation Class
Dolerite	Soft excavation in residual clay, sand and gravel. Boulder Class A and Boulder Class B where boulders are encountered. Hard excavation in dolerite rock
Vryheid shale and residual shale	Soft excavation in residual shale and very soft to soft rock shale. Intermediate to hard excavation in medium hard and harder rock shale.
Vryheid Sandstone and residual sandstone	Soft excavation in residual sandstone and very soft to soft rock sandstone. Intermediate to hard excavation in medium hard and harder rock sandstone.

6.5 UNDERMINING AND SUBSIDENCE

Two inactive mine shafts were observed in WEF1 (Section 4.2). According to the information from DMRE, a coal license was issued in 2012 that covers several farms. However, no evidence of authorised mining activities associated with this licence, such as a valid mining right holder record or

mine layout drawings, was identified. Furthermore, no correlation could be established between the 2012 licence and the two existing mine shafts observed on site. The shafts are therefore considered to be potentially unauthorised or illegal mine workings.

Mining (especially illegal) can weaken the structural integrity of the ground by removing rock pillars that are there or were intentionally left to support the surface. This creates a high risk of sinkholes and ground collapse. Types of mine subsidence on the Central Rand Group include:-

- Sinkholes
- Subsidence accompanying cavern development
- Subsidence related to the development of tension fractures
- Normal subsidence of hanging wall due to slope closure

The extent of the subsidence is influenced by the following factors:

- Strength and deformation characteristics of the hanging wall rock.
- Underground pillars.
- Fracture zone around mine openings.
- Dykes and faults
- Mining techniques and the renewal of mining activities in dormant areas.

Fundamental aspects of subsidence:

- Subsidence and surface damage may occur above undermined ground even when the mining depth is more than 160.
- Subsidence may take place in areas which are not currently being mined.
- Slope closure can result in horizontal movements at the surface in addition to vertical subsidence.
- The removal of the pillar from a mined-out area, for example in reclamation mining, may cause renewed subsidence of the surface.

The Department of Mineral Resources requirement is that an in-depth, detailed geotechnical risk assessment be carried if the proposed structures are within a horizontal distance of 100 metres from underground workings. This is defined in the Amended Chapter 17 of the Mine Health and Safety Act (MHSA) regulation 17.8 and 17.9 as amended in Government Gazette, No. 34308 (No. 447) dated 27 May 2011 and as set out below. Regulation 17(8) of this Act states that:

“No person may erect, establish or construct any buildings, roads, railways, dams, waste dumps, reserve land, excavations or any other structures whatsoever within a horizontal distance of 100 (one hundred) metres from workings, unless a lesser distance has been determined safe -

(a) in the case of the employer, by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with; or

(b) in the case of any other person, by a professional geotechnical specialist and all restrictions and conditions determined by him or her or by the Chief Inspector of Mines are complied with”

The gold mining within the rock of the Witwatersrand Group occurs at depths of more than 800m. Shaft 1 is located approximately 1.60km from the closest proposed turbine (WT19). Shaft 2 is located approximately 2.70m away from the closest proposed turbine (WT23). It must be noted that these are surface and not underground distances. The drawings for the mine shafts must be obtained in order to zone the safe distances properly.

Mine shaft drawings are critical engineering records used to map, construct, assess and safely access underground mine workings. These drawings typically provide detailed information on the shaft position, depth, dimensions, underground layout, structural supports, compartments, associated surface infrastructure, and mechanical systems. They may include cross-sectional views, plan views and layouts showing the relationship between the shaft and underground workings. Such drawings are therefore essential for confirming the extent and orientation of historical mine workings and for establishing appropriate safe development setbacks.

The 2012 prospecting right should ordinarily be supported by associated mine or prospecting plans held by the DMRE and/or the licence holder. However, no shaft or mine layout drawings associated with the licence were located by the GIS or administrative staff at the DMRE. It is also expected that the company to which the licence was issued may hold relevant mine plans or supporting documentation. Until such drawings are obtained, the relationship between the 2012 licence and the two observed mine shafts cannot be confirmed.

6.6 SEISMIC HAZARD

The southern African region is characterised by natural and mining-induced seismic activity. Data that was produced by Council for Geoscience placed the site within the zone where the minimum seismic event, with a 10% probability of being exceeded in a 50-year period, is between 0.0387 – 0.0478g as illustrated in Figure 6-1. This basically suggests that the area is expected to have medium levels of seismic hazard. Most of these earthquakes will be mining induced.

There are two seismic activity zones according to SANS 10160-4 (2011):

- Zone I – Regions of natural seismic activity
- Zone II – Regions of mining-induced and natural seismic activity

In accordance with the seismic zones contained in SANS 10160-4, the site falls within zone II (Figure 6-2).

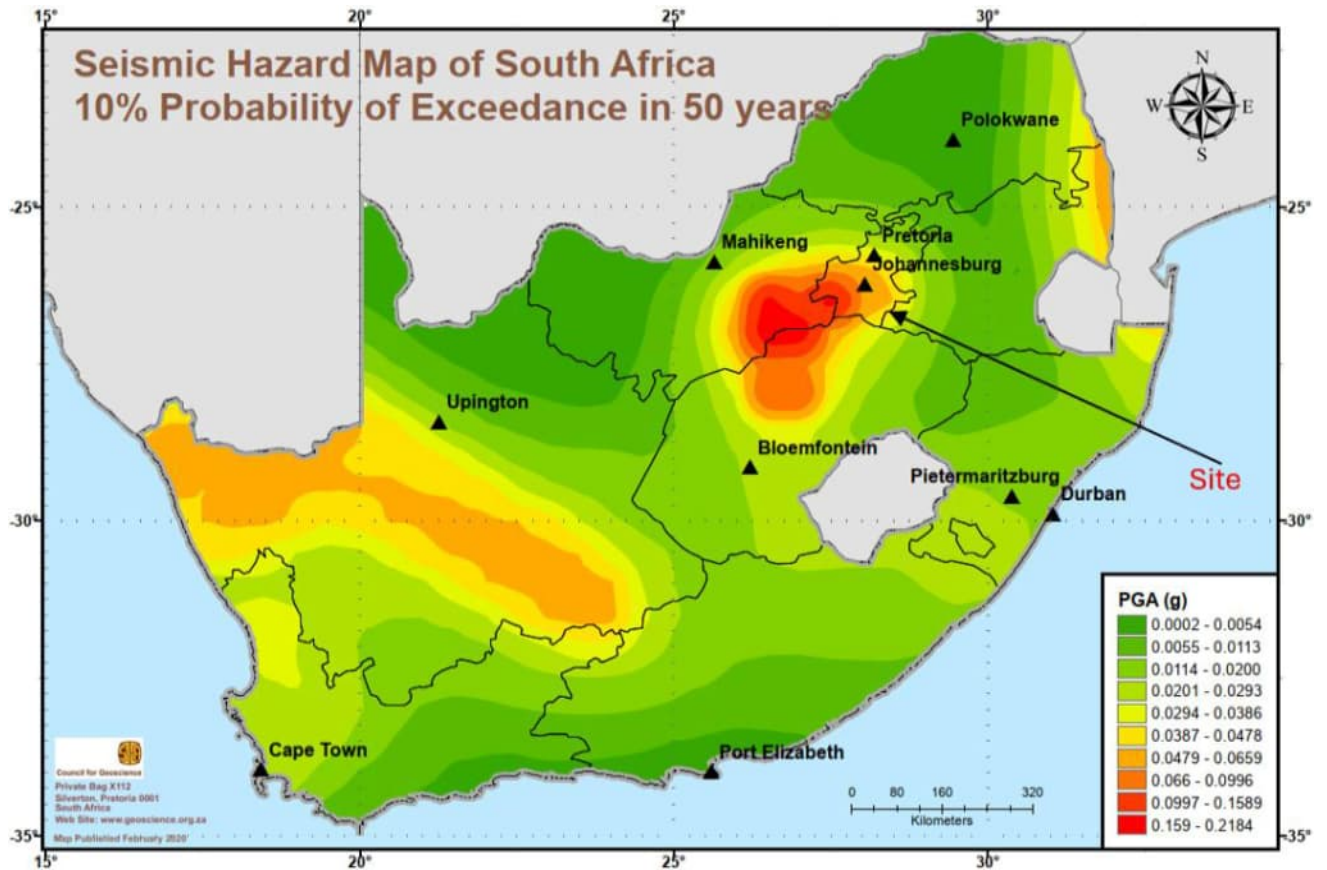


Figure 6-1 - Probabilistic Seismic Hazard Map of South Africa

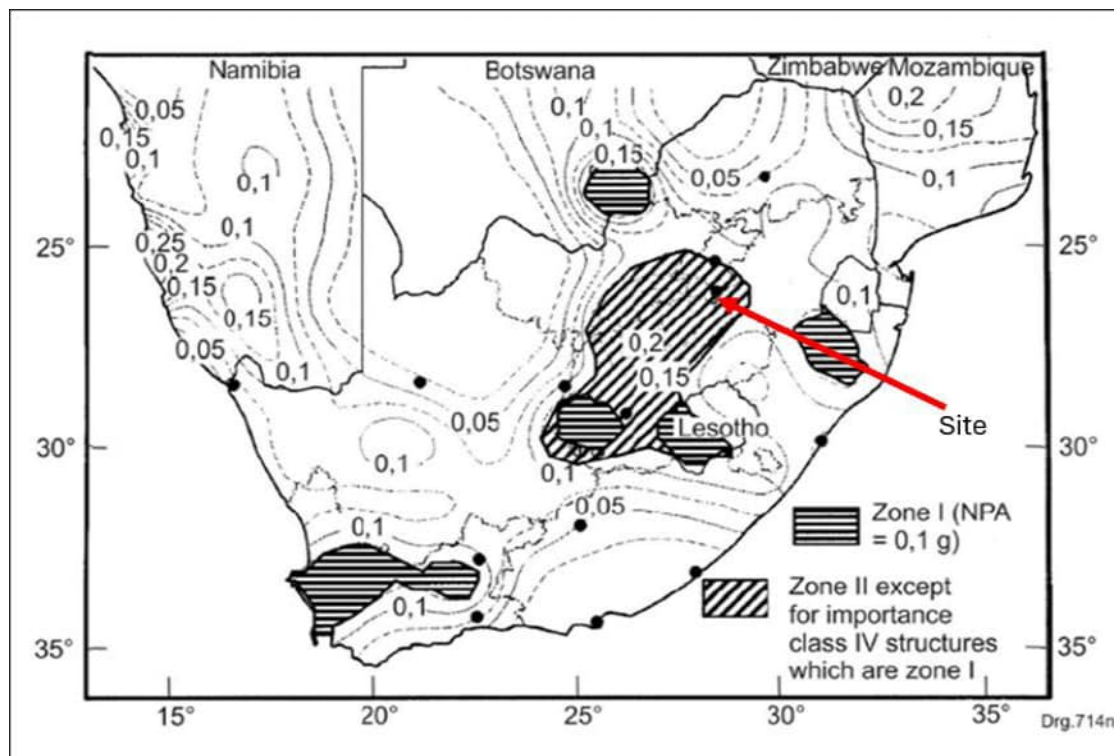


Figure 6-2 - Seismic Zones of South Africa

7 SITE SENSITIVITY VERIFICATION REPORT

There are currently no sensitivity layers/sensitivity ratings in the DFFE Screening Tool Report for geotechnical features.

A site sensitivity verification, based off the desktop study and the site reconnaissance is provided below.

The geotechnical sensitivity rating of the ABO Uvemvane WEF 1 was verified to be “High” as presented in Table 7-1. The rating is due to the presence of two mine shafts on site. The mine depth and side extents are unknown.

Table 7-1 – ABO Uvemvane WEF 1 Site Sensitivity Verification

Sensitivity Rating of Entire Site in DFFE Screening Tool Report	Specialist's Verified Sensitivity Rating
N/A	High

The current layout shows no plans at and around the mine shafts. Nothing is planned for 1.6km around Shaft 1 and 2.70m around Shaft 2. The zones are preliminary; the extent of the mine must be taken into consideration for the final zonation map.

A preliminary zonation map is presented as Figure 7-1.

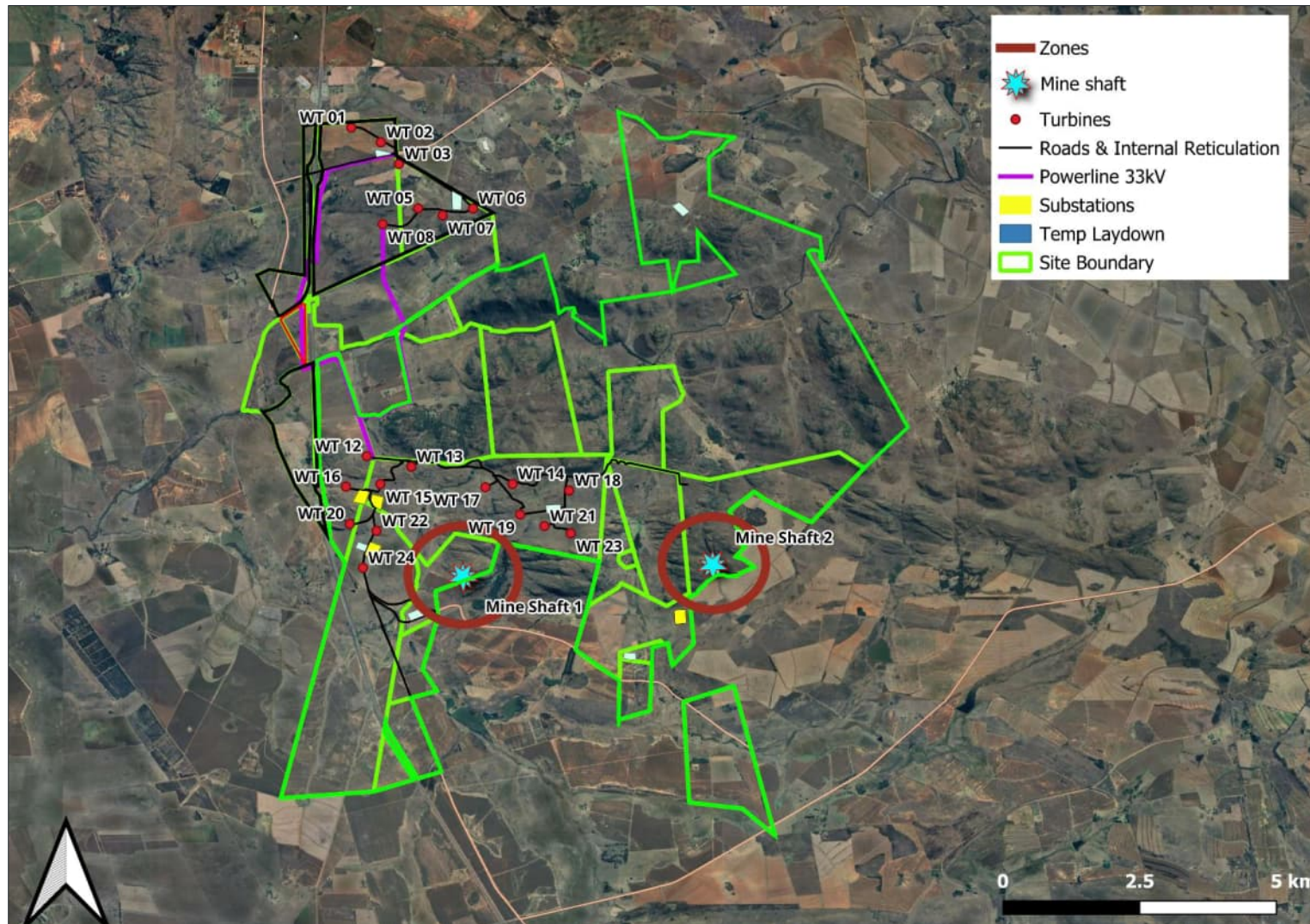


Figure 7-1 - Zones around the Mine Shafts

8 GEOTECHNICAL IMPACT ASSESSMENT

The geotechnical impact assessment of the proposed Uvemvane WEF 1 was performed according to the methodology included in Appendix D.

The detailed impact assessments tables are, also, presented in Appendix D.

Geotechnical impacts need to be taken into account as part of the WEF 1 development. The identified risks can typically be mitigated by the implementation of an appropriate and effective plan. Mitigation measures must be implemented to avoid or reduce negative impacts during the construction, operation and decommissioning phases.

The proposed WEF was found to have an impact significance level range of “Negative Low to Negative High” without mitigation. With mitigation measures impact significance of potential impacts decreases to “Negative Low to Negative Very Low”. The Negative High impact rating assigned under subsidence is primarily influenced by the limited information available on the existing mine shafts. In particular, the depths, orientations and lateral extents of the shafts and any associated underground workings are unknown. As a result, the potential subsidence risk cannot be accurately defined at this stage and has therefore been assessed conservatively.

The Cumulative impact significance level ranges between “Negative Low to Negative High” without mitigation. With mitigation measures Cumulative impact significance of potential impacts decreases to “Negative Low to Negative Very Low”. The cumulative map is presented in Figure 8-1. Other renewable energy projects in the 30km and 50km radius pose minor geotechnical threat, hence no change in the overall impact.

The no-go alternative would be if the project were not to be developed. If the proposed Project does not proceed, it is expected that the existing/current land use practices (i.e., agricultural farming, cattle and wildlife grazing) will continue. Consequently, the condition and character of on-site natural habitat will likely remain unchanged. However, subsidence may still occur whether the project is a Go or No-Go. The No-go impact significance is “Negative High” without mitigation and “Negative Low” with mitigation. This rating is primarily due to the absence of sufficient information regarding the existing mine shafts, including their depths, orientations, lateral extents and any associated underground workings. In the absence of confirmed mine shaft drawings or supporting documentation, the subsidence risk has been assessed conservatively.

The proposed site is considered suitable for the WEF development provided that the recommendations stated in this report are adhered to.

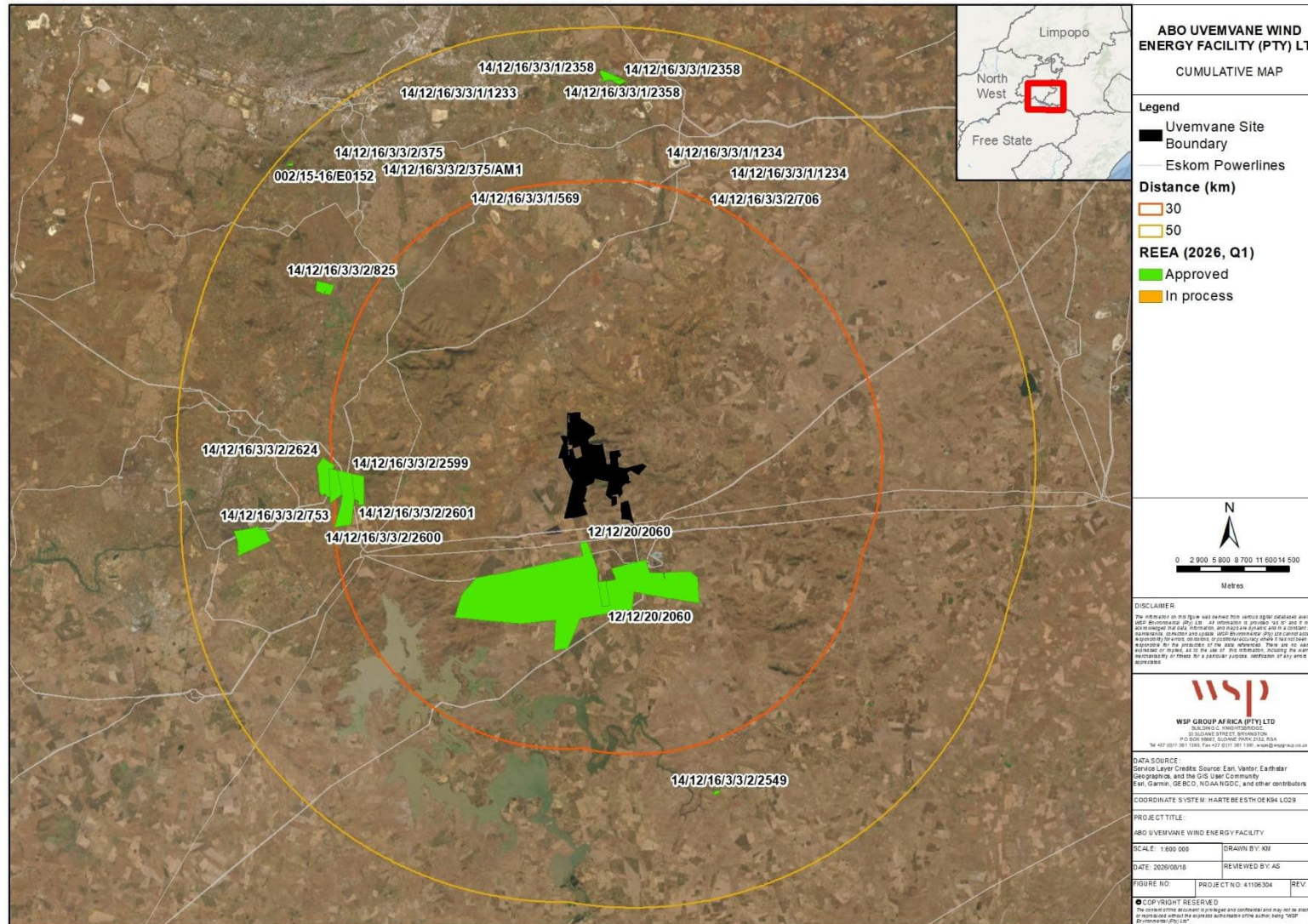


Figure 8-1 - Cumulative Map for a 30km and 50km

9 FURTHER GEOTECHNICAL INVESTIGATION

Should the proposed project be authorised, a detailed intrusive site investigation is recommended. This should be carried out post environmental authorisation, to further characterize site conditions, to better understand the key geotechnical risks characteristics and to optimise the design.

Based on the current lack of previous geotechnical investigation data, the primary objectives of the proposed intrusive investigation must include

- Determination of the founding conditions, especially the depth to rock, for all structures. The scope of the intrusive investigation should comprise the excavation of test pits with an excavator and possibly the drilling of a representative number of boreholes.
- Laboratory testing to determine the behavioural characteristics of the in-situ materials.
- Investigation of subgrade conditions for service roads.
- Investigation of materials to be used during construction.
- Non-intrusive investigation techniques, such as geophysical surveys including thermal and electrical resistivity for ground earthing requirement.
- Geophysics to study the extent of the undermining.

10 CONCLUSIONS

The completed desktop assessment of the geotechnical conditions at the proposed Uvemvane WEF 1 has shown the site to be generally suitable for the proposed development. A verified high sensitivity was assessed due to the presence of two mine Shaft, whose dimensions are unknown.

A “Negative Low to Negative High” impact significance range pre-mitigation was assessed. Post-mitigation, the assessed impact significance decreases to “Negative Very Low to Negative Low”.

The cumulative impacts were found to have a significance level range of “Negative Low to Negative High” without mitigation. With mitigation measures, the significance of potential impacts ranges will be “Negative Very Low to Negative Low”.

It is recommended that a site specific, geotechnical investigation is carried out at the site to validate the expected founding conditions and to ensure that no conditions at variance to those indicated are present.

11 ASSUMPTIONS AND LIMITATIONS

Your attention is drawn to Appendix E: Document Limitations.

The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimize the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by WSP, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

12 REFERENCES

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Appendix A

CURRICULA VITAE





Heather Davis

Earth & Environment, Mine Waste, Geotechnical & Material Services – Geotechnical Team Lead

CAREER SUMMARY

Over forty years of experience within the fields of geotechnical engineering and engineering geology. Most of the work has been gained in Sub Saharan Africa including South Africa, Swaziland, Botswana, Malawi, and Angola. A wide range of projects have been handled ranging from investigations for large projects such as coal fired power stations, hydroelectric power schemes, mine processing plants, major freeways and major pipelines to smaller scale projects for commercial developments and residential buildings. Forensic investigations have, also, been completed for failed tailings facilities, structures and slopes.

Responsibility has been taken for all facets of the geotechnical investigation including the site investigation planning, procurement, drilling supervision, fieldwork, in situ testing, analysis, reporting and supervision during construction. Contract documentation and administration for geotechnical investigations has, also, been handled.

Extensive experience in dolomitic terrain and was involved in the re-drafting of SANS 1936 Parts 1 and 2 and subsequent revisions to the standard. Also, involved in the ECSA feasibility study to have a specified category of registration for D4 level dolomite geo-professionals. Dolomite assessments for large facilities such as the Telkom site in Centurion, the Mispah tailings facility as well as for residential complexes and individual units have been carried out. Linear dolomitic assessments for roads and pipelines have been completed.

Heather is a registered professional engineer, a fellow of the South African Institution of Civil Engineers and served as Treasurer of the Geotechnical Division from 2006 to 2020.

2 years with WSP

40 years of experience

Area of expertise

Site Investigations
Forensic Assessments
Dolomitic Terrain Assessments
Problem Soil Assessments

Language

English – Fluent

EDUCATION

Graduate Diploma in Civil Engineering in the field of Geotechnical Engineering, University of the Witwatersrand SA	1993
BSc (Honours) Engineering Geology and Geotechnics, Portsmouth University, England	1982

PROFESSIONAL MEMBERSHIPS

ECSA – Professional Engineer, Engineering Council of South Africa – Member No. 960229	1996
SAICE - Fellow of the South African Institution of Civil Engineering	1998

PROFESSIONAL HISTORY

WSP Group Africa (Pty) Ltd	April 2022 – present
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Heather Davis

Earth & Environment, Mine Waste, Geotechnical & Material Services – Geotechnical Team Lead

Jones & Wagener (Pty) Ltd (following the merger with Verdi Consulting)	January 2018 – March 2022
Verdi Consulting Engineers (Pty) Ltd	March 2014 – December 2017
AECOM SA (Pty) Ltd (formerly BKS (Pty) Ltd.	February 2007 – February 2014
ARQ (Pty) Ltd	January 2003 – January 2007
Knight Hall Hendry (Pty) Ltd	January 2001 – December 2003
VKE Engineers (Pty) Ltd	November 1987 – December 2000
National Building Research Institute of the CSIR	November 1985 – October 1987
Geological Survey of South Africa	November 1982 – October 1985

PROFESSIONAL EXPERIENCE

Western Range Iron Ore Mine Development, Liberia 2022 - 2023

Lead Geotechnical Engineer: South Africa Team

Design level geotechnical investigations for the Processing Plant, Quarries and several Tailings Residual Facilities were undertaken. The investigations included rotary core drilling, Cone Penetration testing and test pitting. All the data was analysed and assessed with recommendations provided for founding and required remedial measures. A challenging project due to the shallow water table which reaches the surface during the wet season.

Wessels and Mamotwan Mine Geotechnical Investigations, Hotazel, South Africa 2022 – 2024

Lead Geotechnical Engineer.

Geotechnical investigations carried out to allow the Mine to comply with International Standards with regard to information pertaining to the Tailings Residue Facilities (TSF). In addition, rail lines are to be constructed across the TSFs in places. Investigations including rotary core drilling, Cone Penetration Testing, test pitting and sampling of the tailings streams were undertaken. Comprehensive reports issued.

SANRAL, N1 Sections 20 and 21 Geotechnical Investigation, Brakfontein, South Africa 2008 to 2012

Lead Geotechnical Engineer

Upgrade, extensions and additions to the N1 Ben Schoeman Freeway, Sections 20 and 21, between the Brakfontein and Allandale Interchanges as part of the Gauteng Freeway Improvement Project (GFIP) carried out for South African National Roads Agency SOC Ltd (SANRAL). Contract documentation for the subsurface investigation was drafted and all components of the project management of the SANRAL contract were handled. The site investigation included extensive rotary core drilling, percussion drilling and test pitting. Work included the analysis, assessment and provision of founding recommendations for the 22km of dual carriageway. Design components included culverts, retaining walls, cut slopes, embankments and bridges founded on ancient granite, sedimentary rocks of the Pretoria Group along with dolomite and dolomitic residuum. Both conventional and piled foundations were used for the various bridge structures and elements.

SANRAL, N11 Section 9, Hendrina, South Africa 2015 to 2016

Lead Geotechnical Engineer

Upgrade of National route N11 Section 9 between Hendrina and Hendrina Power Station. Planning and supervision of the linear investigation, by means of rotary drilling and test pitting, of 18.56km of roadway including two river bridges, cuts, fills and culverts. Full report compiled including recommendations for all



Heather Davis

Earth & Environment, Mine Waste, Geotechnical & Material Services – Geotechnical Team Lead

facets of the project. All work carried out as per the current SANRAL requirements and all contract administration for the drilling investigation handled.

SANRAL, National Route N5, between Harrismith and Kestell, Harrismith and Kestell, Orange Free State, South Africa 2011 to 2013

Lead Geotechnical Engineer

Carried out for SANRAL, which included drafting the contract documentation for the subsurface investigation which included extensive rotary core drilling and test pitting. The project includes the rehabilitation of the National Route 5 involving extending existing bridges, design and construction of new bridges and design of significant culvert structures. The bridge structures included river bridges, road over rail and road over road structures. Work carried out included supervision of the site investigation, analysis and provision of founding recommendations for all structures, contract administration and arbitration of claims.

Anglo Platinum. Mogalakwena Platinum Mine, New Northern Concentrator, Limpopo, South Africa. 2020 to 2021

Lead Geotechnical Engineer

Pre-feasibility and feasibility level investigations for the New Northern Concentrator. Supervision of all field work and provision of recommendations for all the structural elements. Additional design level investigation carried out for the M3C BOS Low Grade Stockpile.

NMPP/ Transnet, Multi Products Pipeline, Geotechnical Investigation, Johannesburg. South Africa 2008 to 2009

Section Lead Geotechnical Engineer

Geotechnical input for pipeline section running from Kendal to Waltloo and Jameson Park to Langlaagte in Johannesburg. Investigations have included test pitting; in situ testing and borehole have included test pitting, in situ testing and borehole drilling. The assessment of the route underlain by dolomite and dolomitic residuum was, also undertaken.

TCTA, Vaal River Eastern Sub-System Augmentation, Vaal, South Africa 2006 to 2008

Lead Geotechnical Investigation

Geotechnical investigation for TCTA for a pipeline to carry water from the Vaal Dam to Secunda for use by SASOL and ESKOM. Planning and preparation of contract documentation for drilling, trenching programmes, laboratory and in situ testing. Extensive field work was completed, and recommendations provided for trench sidewall stability, excavatability, construction through problem areas and recommendations for design and construction of the surge tanks, pipe bridges, abstraction works, de-silting works and access roads.

Aquarius Mining. Marikana, Mine Processing Plant, Rustenburg, South Africa 2001 to 2002

Geotechnical Engineer – Plant side

Several candidate sites and the detailed Geotechnical investigation of the final site for the processing plant for new platinum mine. Foundation recommendations for all plant elements were provided including those for silos, mills, crushers and conveyor trestles. Foundation design for large vibratory plant elements. Ongoing foundation inspections and providing geotechnical advice and recommendations to the client throughout construction.

Eskom, Medupi and Kusile Power Stations, Investigations and Foundation Assessments, Limpopo, South Africa 2008 to 2014

Lead Geotechnical engineer for AECOM

Assessment carried out for Hitachi/Eskom of existing information regarding the founding conditions. Provision of structure specific foundation recommendations which included settlement analysis, assessment of bearing capacity and determination of parameters for dynamic design. Site inspections and assessment of ground



Heather Davis

Earth & Environment, Mine Waste, Geotechnical & Material Services – Geotechnical Team Lead

conditions during construction for both Kusile and Medupi. Also, project manager for an additional geotechnical investigation carried out at Medupi Power Station due to unforeseen ground conditions. Investigation included percussion drilling with the Jean Lutz computerised system along with triple tube rotary drilling. Analysis of data allowing optimisation of the power station design.

Harmony Goldfields, Mispah, Tailings Storage Facility, Far West Rand 2017 to 2018

Geotechnical Team Lead

Failure of a section of the Mispah Tailings Storage Facility (TSF) which is underlain by dolomite, dolomitic residuum and rocks of the Karoo Supergroup. The initial assessment lead to the entire facility being re-assessed and candidate sites for new facilities being investigated. Of specific note was the liaison with several other geotechnical/engineering geological consulting firms regarding the failure.

Irene Village, Mall Extensions, Centurion, South Africa 2015 to 2018

Dolomite Specialist

In depth assessment of existing information applicable to the Irene Village Mall retail development in Irene. Dolomite stability assessments for extensions to the existing shopping mall including the addition of a multi-level parkade and additional retail space. Provision of founding recommendations for all facets of the development including earthworks, roadways and foundations.

Gautrans. Gautrain Project, Centurion, South Africa 2007 to 2014

Geotechnical Engineer

Input and comment on aspects of the route underlain by dolomite including the Centurion Gautrain Station were provided. Assessment of the efficacy of the remedial measures utilised at the station including an extensive programme of grouting. Also, investigation of dolomite related subsidence and a sinkhole adjacent to the Gautrain route and below a raised section of the train line in the Centurion area. Subsequent design of the remedial measures for the sinkhole, drainage measures and long-term monitoring of the area.

Africa Kingdom Holdings. Serengeti Golf and Wildlife Estate, Estate Developments, Kempton Park, South Africa 2016 to 2022

Dolomite Specialist

Dolomite stability assessments, coupled with near surface investigations, of parcels of land throughout the Serengeti Golf and Wildlife Estate. Developments have included single, double and triple storey residential units, Hotel, Club House and artificial lake. All reports have been submitted to the Council for Geoscience (CGS) and have included IHC to IHC7 conditions with Dolomite Area Designations of D2 to D4 being represented. NHBRC applications have been made for all the residential developments.

Aerosud, Manufacturing Facility, Pierre van Ryneveld Park, Centurion . South Africa 2016 to 2018

Dolomite Specialist

Various dolomite stability investigations and reviews have been undertaken for warehouses, ablution blocks, workshops, parking areas and other infrastructure elements across the Aerosud manufacturing facility. All work has, and is, being carried out according to SANS 1936 Parts 1 to 4 of 2012. A Dolomite Risk Management Plan was drafted for the Aerosud Facility and is updated on a regular basis. The site manly classifies as IHC4 to IHC7 with Dolomite Area Designation D2 and D3 being applicable to most of the site.



Khuthadzo Bulala

Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant

CAREER SUMMARY

Khuthadzo Bulala is an Engineering Geologist with 8 years' experience in geotechnical investigations. Her experience and technical skills include:

- Compilation of geotechnical investigation reports
- Geotechnical core logging
- Core orientation for inclines boreholes
- Planning, managing, and executing in-situ testing (test-pitting, geotechnical drilling operations, DCP testing and piezometer installations) for geotechnical investigations
- Laboratory testing selection and liaison with laboratories
- Analysis and interpretation of laboratory and in-situ test data
- Geological mapping and sourcing of construction materials and aggregates
- Sourcing, testing and specification of construction materials and aggregates
- Health and safety documentation for fieldwork projects
- Project management including resource management and client liaison

3 years with WSP

Area of expertise

Geotechnical Investigations
Geotechnical Core Logging
Geotechnical Report Writing
Laboratory Sampling Selection
Geological Mapping
H&S Documentation
Project Management

8 years of experience

Language

English – Fluent
Tshivenda – Fluent

EDUCATION

BSc. (Honours) in Geological Sciences, University of Limpopo South Africa	2013
BSc. Degree in Geological Sciences, University of Johannesburg (Auckland Park Campus)	2011

ADDITIONAL TRAINING

Civil Engineering and Renewable Energy, Geopile Africa	2020
Geotubes and Dewatering, Kaytech	2019
Site Monitoring Workshop, JG Afrika	2019



Khuthadzo Bulala

Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant

ArcGIS1, Introduction to Geographic Information System, JG Africa

2018

PROFESSIONAL MEMBERSHIPS

South African Council for Natural Professions – Pr. Sci Nat Member No. 116482

2021

PROFESSIONAL HISTORY

WSP Group Africa (Pty) Ltd

September 2021 – present

JG Afrika (Pty) Ltd

September 2016 – September 2021

Lesotho Highlands Development Agency (LHDA)

March 2016 – August 2016

PROFESSIONAL EXPERIENCE

Geotechnical Investigations

Ib vogt (Pty) Ltd, Ngonyama Solar Energy Facility Detailed Geotechnical Investigation, Bloemfontein, Free State, South Africa

March 2023 – ongoing

Engineering Geologist

Field investigation including test pitting, DCP and sampling and report writing.

South32 Mamatwan Mine, Tailings Storage Facility Geotechnical Investigation, Hotazel, Northern Cape, South Africa

January 2023 – ongoing

Engineering Geologist

Field investigation including test pitting, sampling and report writing.

Sasol Secunda Operations, Inside Ash Geotechnical Inside Ash Seepage Analysis, Secunda, Mpumalanga, South Africa

October 2022 – Ongoing

Geotechnical Desktop Study

Gap analysis and additional investigation executions plans for Inside Ash Seepage Analysis.

Enertrag South Africa (Pty) Ltd, Impumelelo Wind Energy Facility Geotechnical Desktop Study, Secunda, Mpumalanga, South Africa

October 2022 – January 2023

Field Engineering Geologist

Field investigation including test pitting, DCP and sampling. Report writing and foundation recommendation.

Enertrag South Africa (Pty) Ltd, Mukondeleli Wind Energy Facility Geotechnical Desktop Study, Secunda, Mpumalanga, South Africa

October 2022 – December 2022

Field Engineering Geologist

Field investigation including test pitting, DCP and sampling. Report writing and foundation recommendation.

Enertrag South Africa (Pty) Ltd, Vhuvhili Solar Energy Facility Geotechnical Desktop Study, Secunda, Mpumalanga, South Africa

June – August 2022

Project Management and Client Liaison



Khuthadzo Bulala

**Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant**

Geotechnical desktop study for the Vhuvhili Solar Energy Facility and the associated structures to supplement a project Environmental Impact Assessment.

Enertrag South Africa (Pty) Ltd, Vhuvhili Solar Energy Facility Detailed Geotechnical Investigation, Secunda, Mpumalanga, South Africa

October 2020 – July 2021

Field Engineering Geologist

Field investigation including test pitting, DCP and sampling. Report writing and foundation recommendation.

Scaw South Africa (Pty) Ltd, Union Junction Hill Borrow Pit Geotechnical Investigation, Johannesburg, South Africa

February 2022 – May 2022

Project Management and Client Liaison

Geotechnical investigation for clay lining material that is needed for the development of the landfill site for their operations and

ArcelorMittal Mine Extensions, Geotechnical Investigation, Tokadeh, Liberia

January 2022

Geotechnical Report Writing

For the ArcelorMittal facilities; Tokadeh pit, Tokadeh infrastructure, Gangra Pit, Water Storage Dam, Tailings Management Facility, and Bucanan Port.

Debswana Diamond Company, Debswana Mine Facilities, Central District, Botswana

November 2021

Geotechnical Desktop Study

Gap analysis and additional investigation executions plans for Damtshaa, Orapa and Letlhakane mine facilities.

Lesotho Highlands Development Agency (LHDA), Polihali Dam, the Diversion Tunnel and the Transfer Tunnel, Tlokeng, Lesotho

March 2016 – December 2017

Site Supervision

Drilling, water pressure tests, installation of piezometers, rotary core logging for the dam site, the saddle dam, the coffer dam, the diversion tunnel, the Katse Dam transfer tunnel and the proposed borrow pits.

Calvus Properties (Pty) Ltd, Rietfontein Dam, Eastern Cape, South Africa

May 2019 – September 2021

Project Manager

Trial pitting for the dam foundation, spillway construction and the construction material at the site. Evaluation of engineering properties of subsurface material. Geotechnical reporting for dam design purposes. Geotechnical investigation and reporting for construction material borrow pits.

Umgeni Water, Darvil Dam, Pietermaritzburg, Kwa-Zulu Natal, South Africa

August 2018 – December 2018

In-Situ Investigation

Including test pitting for geotechnical soil profiles of the proposed dam site to determine the dam foundation depth. Project management and selection of laboratory tests for study objectives subsequent to the fieldwork. Compilation of a geotechnical report for the dam design and for the construction material.

Sivest SA (Pty) Ltd, Gluckstadt Water Supply Scheme, Tugela Ferry, Kwa-Zulu Natal, South Africa

November 2019 – March 2020

Field Geologist



Khuthadzo Bulala

**Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant**

Evaluation along the proposed water supply pipeline, at the proposed borehole structures and at the proposed reservoir. Assessment of geotechnical properties of potential bedding material for construction. Ntabamhlophe Tank –Responsible for the field investigation and the report writing for the proposed tank.

**JG Afrika Water Division, Ntabamhlophe Tank, Wembezi, Kwa-Zulu Natal, South Africa
January – April 2021**

Project Manager and Client Liaison

Field investigation including test pitting and sampling. Report writing and foundation recommendation. Foundation assessment during construction.

**Scatec Solar South Africa, Kenhardt Solar Farm, Kenhardt, Northern Cape, South Africa
October 2020 - July 2021**

Project and Subcontract Management

Drilling supervision, in-situ investigation for site characterization. Management and selection of laboratory tests for study objectives. Client liaison and geotechnical report for pylon foundations, substation foundation and access road construction.

**Enertrag SA (Pty) Ltd, Dalmanutha Wind Energy Facility, Belfast, Mpumalanga, South Africa
December 2021 – May 2022**

Project Manager and Client Liaison

Geotechnical desktop study for three wind energy facilities and their associated structures to supplement a project Environmental Impact Assessment.

**G7 Renewable Energies (Pty) Ltd, Oya and Yemaya Solar and Wind Energy Facility, Maitjiesfontein,
Western Cape, South Africa
August 2019 – July 2020**

Geotechnical Desktop Study Reports

For the two sites for the two solar sites. Test pitting and sample selection for required tests for the Oya site. Analysing and interpreting fieldwork data and laboratory results.

**Sivest SA (Pty) Ltd, Client, Koup 1 and Koup 2 Wind Energy Facility, Leeu Gamka, Western Cape,
South Africa
February 201 – July 2021**

Project Manager and Client Liaison

Geotechnical desktop study for two wind energy facilities and their associated structures to supplement a project Environmental Impact Assessment.

**WSP Africa, Client, Three Wind Energy Facilities, Northern and Western Cape, South Africa
May – September 2021**

Project Manager and Client Liaison

Project management and client liaison. Geotechnical desktop studies for the proposed Brandvalley, Karreebosch and Rietkloof wind farm energy facilities and three 33kV powerlines and their associated structures.

**WSP Africa Group, Uvuvuselela Railway Line Extensions, South Africa
October 201 – December 2021**

Project Manager and Client Liaison

Geotechnical desktop studies for the proposed Transnet Railway Loop extensions, Port Elizabeth Port extensions and loading yards in Gauteng.

**South African National Road Agency Limited, N2 Pongola to Kangela, Kwa-Zulu Natal, South Africa
2017 – 2021**

Field Geologist



Khuthadzo Bulala

Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant

Responsible for trial pitting, logging, and sample collection for laboratory analysis for the N2 construction borrow pits. Collation of field data and laboratory data.

HHO Consulting Engineers, N3 Borrow Pits, Kwa-Zulu Natal, South Africa

November 2018 – April 2019

Field Engineering Geologist

Rotary core logging and percussion chips logging for the proposed borrow pits located between Durban and Pietermaritzburg for the N3 construction.

ZVK Holdings (Pty) Ltd Mfulamuni Access Road and Aggregates, Pomeroy, Kwa-Zulu Natal, South Africa

January – June 2022

Project Manager and Client Liaison

Fieldwork for the realignment and the re-gravelling of the Mfulamuni access road. Ensuring adequate laboratory testing for the road and the potential borrow pits. Report compilation for the road and the material investigation.

Naidu Consulting, P77 Culverts, Dududu, Kwa-Zulu Natal, South Africa

January – July 2020

Project Manager and Client Liaison

Responsible for trial pitting, logging and DPL testing to determine the subsurface characteristics for the proposed seven culverts. Compilation of an interpretive geotechnical report highlighting the foundation depths for each culvert and the geotechnical constraints thereof.

Royal HaskoningDHV, Kikwood to Addo Borrow Pit and Retaining Walls, Kirkwood, Eastern Cape, South Africa

April – December 2019

Project Manager and Client Liaison

Soil profiling and interpretation of the field profiles and laboratory results for the borrow pit and retaining walls. Material volume calculations for the borrow pits. Dynamic cone penetration and interpretation for the competent foundations for the retaining walls. Data assimilation and assessment for report writing.

High End Construction, Eastwood Pedestrian Bridge, Pietermaritzburg, Kwa-Zulu Natal, South Africa

February – May 2019

Project Manager and Client Liaison

Construction of a pedestrian bridge. Fieldwork including test pitting and DPL testing. Analysing and interpreting the field data to recommend foundation levels.

Eskom, Refurbishment of 9 Eskom Towers, Eastern Cape, South Africa

August 2019 – September 2019

Engineering Geologist

Test pitting for geotechnical ground profiles of each site. Management and selection of laboratory tests for study objectives. Foundation recommendations for each site. Geotechnical report for design purposes.

KZN Department of Public Works, Nkweletsheni Primary School, Richmond, Kwa-Zulu Natal, South Africa

January – March 2020

Project Manager and Client Liaison

School refurbishment. Test pitting, percolation testing and DPL testing for geotechnical ground profiles of the site. Management and selection of laboratory tests for study objectives. Geotechnical report for foundations, recommendations for the soak-away and for the multipurpose sports ground.

JG Afrika (Pty) Ltd Water Department, Zwelisha Moyeni Water Treatment Works, Bergville, Kwa-Zulu Natal, South Africa



Khuthadzo Bulala

Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant

January – March 2021

Project Manager and Client Liaison

Test pitting and DPL testing for geotechnical ground profiles of the site. Management and selection of laboratory tests for study objectives. Geotechnical report for foundations of treatment works structure founded at depth of 4-5m below NGL.

**JG Afrika (Pty) Ltd Water Department, Hammersdale Waste-Water Treatment Works,
Hammersdale, Kwa-Zulu Natal, South Africa**

May 2020 – March 2021

Engineering Geologist

Subsurface profiling and DPL testing for the extensions to the existing Hammersdale WWTW. Analysis of the profiles and selection of laboratory tests for study objectives. Data analysis and report compilation for structure foundations.

Sultex Holdings (Pty) Ltd, Proposed Giba Industrial Development, Pinetown, Kwa-Zulu Natal, South Africa

May 2019 – July 2019

Engineering Geologist

Test pitting for soil profiling, disturbed and undisturbed sampling, delineation of groundwater seepage areas. Management and selection of laboratory tests. Analysing and interpretation of laboratory test results. Compilation of geotechnical report for foundations and groundwater management recommendations.

Smec, Cornubia Fills, Cornubia, Kwa-Zulu Natal, South Africa

March 2020 – January 2021

Project Manager and Client Liaison

In-situ testing for geotechnical soil profiles of the site and general site characterization for fills for the proposed housing development. Engineering geological report for the study for the fills. Reviewing the rotary drilling report for the client.

Mariswe (Pty) Ltd, Ward 7 Community Hall, Taylors Halt, Kwa-Zulu Natal, South Africa

January 2020 – March 2020

Project Manager and Client Liaison

Conducting the geotechnical investigation that included trial pitting, laboratory testing and percolation testing. Fieldwork and laboratory data processing for geotechnical report compilation.

**Dartingo Consulting Engineers (Pty) Ltd, Mandalathi Community Hall, Kwa-Zulu Natal, South Africa
2020**

Project Manager and Client Liaison

Conducting the geotechnical investigation that included trial pitting, laboratory testing and percolation testing. Fieldwork and laboratory data processing for geotechnical report compilation.

Ethekwini Municipality: Human Settlements and Infrastructure, Austerville Sites, Durban, Kwa-Zulu Natal, South Africa

February 2021 – June 2021

Project Manager and Client Liaison

In situ soil profiling and interpretation of the profiles. Consistency tests (DPL) and interpretation of the results evaluate the EASPB. Data compilation and report writing to determine the site's suitability for temporary housing development and recommending relevant foundation measures.

JG Afrika (Pty) Ltd Agricultural Engineering Division, Five ADA Rabbitry Sites, Kwa-Zulu Natal, South Africa

August 2019 – October 2019

Project Manager and Client Liaison

Khuthadzo Bulala

**Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant**

In situ soil profiling and interpretation of the profiles. Consistency tests (DPL) and interpretation of the results evaluate the EASPB and sample collection for laboratory analysis. Report compilation with foundation recommendations.

**Private Developers, Several Intaba Ridge Estate Houses Pietermaritzburg, Kwa-Zulu Natal, South Africa
2017 – 2020**

Project Manager and Client Liaison with Property Developers

In situ soil profiling, conducting in-situ consistency tests (DPL) and sampling for laboratory analysis. Report writing to determine the site's suitability for the house developments and recommending foundation depths and types as per NHBRC guidelines.

**Private Developer, Student Accommodation, Pietermaritzburg, Kwa-Zulu Natal, South Africa
April 2019 – July 2019**

Project Manager and Client Liaison

For the proposed three storey student accommodation development. In situ soil profiling, conducting in-situ consistency tests (DPL) and sampling for laboratory analysis. Report writing to determine the site's suitability for the housing development and recommending foundation depths and type as per NHBRC guidelines.

Green Door Environmental, 220 Murray Road Development, Pietermaritzburg, Kwa-Zulu Natal, South Africa

June 2019 – August 2019

Project Manager and Client Liaison

Report writing and field data analysis for the infill geotechnical investigation report for a multi-story development in Hayfields. The development includes a school, a shopping complex, a drive through, a petrol filling station and a residential area.

Marang Environmental and Associates (Pty) Ltd, Heidelberg Cemetery Extension, Heidelberg, Gauteng, South Africa

June 2020 – December 2020

Project Manager and Client Liaison

For the extension of the existing Heidelberg cemetery. Subsurface profiling and interpretation of the profiles. Field sampling for laboratory analysis. Geotechnical report writing and evaluating the site as per the South African Council for Geoscience Guidelines for Cemeteries.

Ziphelele Planning and Environmental Consultancy, Three Proposed Umhlathuze Cemeteries, Empangeni, Kwa-Zulu Natal, South Africa

May 2018 – February 2019

Project Manager and Client Liaison

For the development of three cemetery sites. Subsurface profiling, percolation testing and field sampling for laboratory analysis. Geotechnical report writing, evaluating and rating the sites as per the South African Council for Geoscience Guidelines for Cemetery Development.

Ziphele Planning and Environmental Consultancy, Alfred Duma Cemeteries, Ladysmith, Kwa-Zulu Natal, South Africa

June 2019 – October 2019

Project Manager and Client Liaison

For the development of cemetery sites in the municipality. Geotechnical desktop studies to evaluate and rate the proposed sites in Colenso, Ladysmith and Ezakheni. The desktop study reports were written as per the South African Council for Geoscience Guidelines for Cemeteries.

**Alfred Duma Municipality, Closure of Acaciavale Landfill Site, Ladysmith, Kwa-Zulu Natal, South Africa
2018 – 2020**

Engineering Geologist



Khuthadzo Bulala

Earth & Environment, Mine Waste, Geotechnical & Engineering Services –
Senior Consultant

Fieldwork including test pit profiling and interpretation from test pitting and sampling for study objectives. Data analysis and report compilation for the closure of the landfill site and recommendations on closure material.

**Alfred Duma Municipality, Danskraal Landfill Site, Ladysmith, Kwa-Zulu Natal, South Africa
2020**

Project Manager and Client Liaison

Including GIS work to identify and shortlist potential landfill sites. Fieldwork including test pit profiling and interpretation from test pitting for landfill site development investigation. Data analysis and report compilation.

**Department of Rural Development and Land Reform, UMgungundlovu Landfill Site, Pietermaritzburg,
Kwa-Zulu Natal, South Africa
March 2020**

Site Supervision

For the percussion drilling contract for the proposed new landfill site. Subcontractor management and client liaison. Percussion chip logging. Borehole water level and yield measurements. Hydrocensus and sampling existing boreholes in a 1km radius.

**Department of Rural Development and Land Reform, Agricultural Potential Assessment for the Ground
Truthing: New Irrigation Schemes Survey in Harry Gwala District, Umzimkhulu, Kwa-Zulu Natal, South
Africa**

July 2017 – August 2019

Project Manager and Client Liaison

Agricultural soil survey and sampling. Data analysis and report compilation for the agricultural potential and the irrigation potential of 7500ha land in the district municipality. Presentation of the final findings to the client.

Appendix B

EXPOSURE PROFILES AND PHOTOGRAPHS



EXP1





TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP2
X COORD: - 26.66
Y COORD: 28.47
DATUM: WGS84
ELEVATION:

Page 1 of 1

Scale	Legend	Depth	Description
		0.00	Pink, moderately weathered, medium grained, <u>medium hard to hard rock</u> . QUARTZITE.
0.5		0.50	End of exposure
			End of log

NOTES: 1: Surface exposure
2: No samples obtained

WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP2



EXP3





EXP4



TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP5
X COORD: - 26.68
Y COORD: 28.40
DATUM: WGS84
ELEVATION:

Page 1 of 1

[illegible]

NOTES: 1: Surface exposure
2: No samples obtained

WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVEMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP5



TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP6
X COORD: - 26.66
Y COORD: 28.41
DATUM: WGS84
ELEVATION:

Page 1 of 1

[illegible]

NOTES: 1: Surface exposure
2: No samples obtained

WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVEMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP6



[illegible]

EXP7

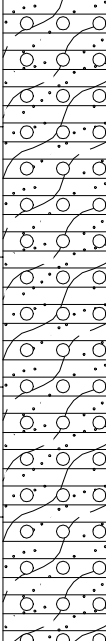


TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP8
X COORD: - 26.67
Y COORD: 28.42
DATUM: WGS84
ELEVATION:

Page 1 of 1

Scale	Legend	Depth	Description
		0.00	Pink to dark grey, moderately to slightly weathered, medium to coarse grained, <u>medium hard to hard rock</u> with occasional coarse sized quartz CONGLOMERITIC QUARTZITE .
0.5		0.50	<p>End of exposure</p> <p>End of log</p>

NOTES: 1: Surface exposure
2: No samples obtained

WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVEMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP8





EXP9





EXP10





TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP11
X COORD: - 26.60
Y COORD: 28.45
DATUM: WGS84
ELEVATION:

Page 1 of 1

Scale	Legend	Depth	Description
		0.00	Black stained maroon on the outside, moderately weathered, massive, fine grained, <u>medium hard rock</u> . BASALT .
		0.20	End of exposure
0.5			End of log

NOTES: 1: Surface exposure
2: No samples obtained

WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVEMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP11





TEST PIT PROFILE

CLIENT: ABO Renewable Energy (Pty) Ltd
PROJECT: Uvemvane WEF 1
LOCATION: Gauteng Province
PROJECT NO: 41106304

HOLE No: EXP12
X COORD: - 26.63
Y COORD: 28.45
DATUM: WGS84
ELEVATION:

Page 1 of 1

Scale	Legend	Depth	Description
		0.00	Possibly BASALT .
0.5		0.50	End of exposure
			End of log

NOTES: 1: Surface exposure
2: No samples obtained

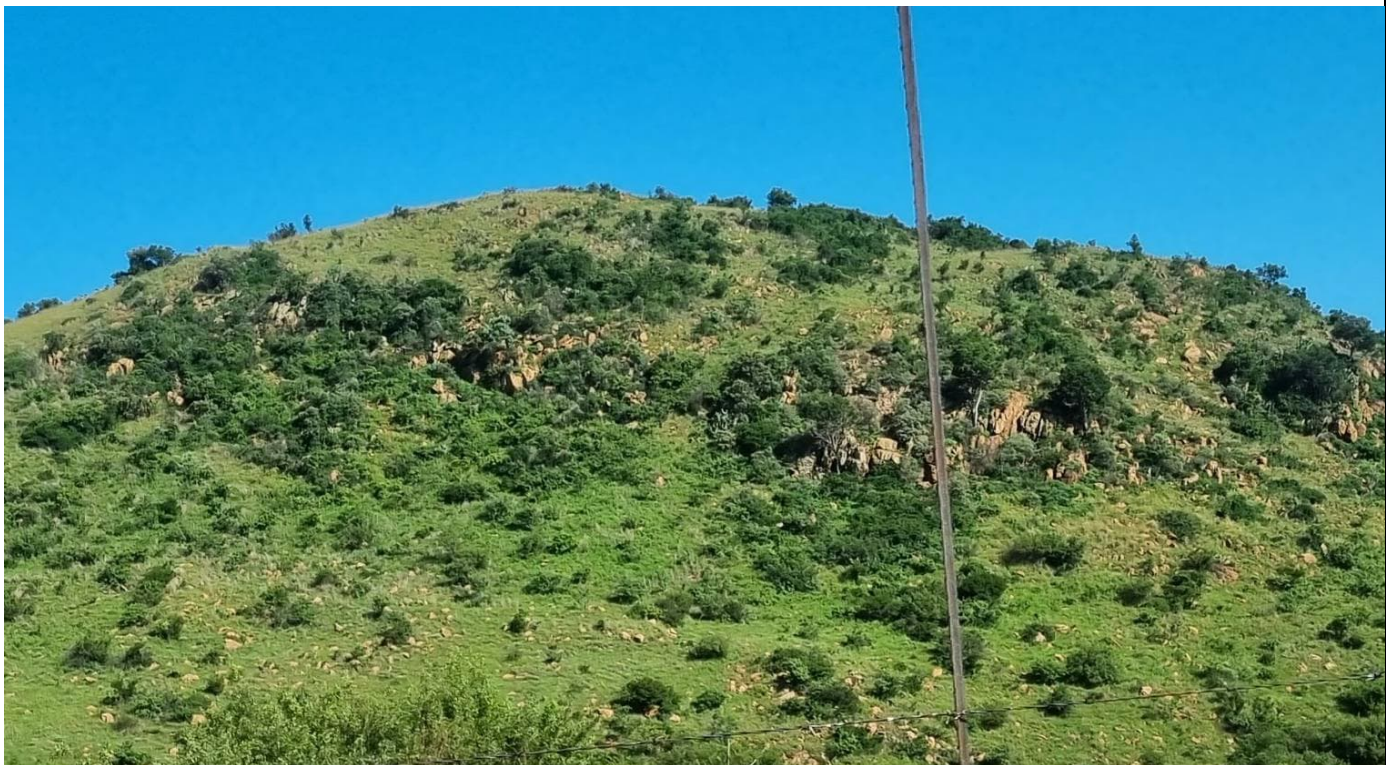
WSP AFRICA

CONTRACTOR: WSP
MACHINE: Exposure
PIT LxB:
FILE REF: UVMVANE WEF 1 EXPOSURES.GPJ

DATE EXCAVATED:
DATE PROFILED: 2025/03/13
PROFILED BY: K BULALA
CHECKED BY: H Davis



EXP12



Appendix C

DMRE DOCUMENTS





mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DMR 10

Private Bag X7279, Emalahleni, 1035, Tel: 013 653 0500, Fax (013) 690 3288
Province Building, Cnr Botha Avenue & Paul Kruger Street, Emalahleni, 1035

From: Directorate: Mineral Regulation: Mpumalanga Region

Enquiries: Ms SP Buka Ref: MP 30/5/1/1/2/4247 PR

Sub directorate: Mineral Laws

Registered Mail

The Members
Iningi Investment (Pty) Ltd
c/o Landmark Offices
P.O.Box 4
The Place
Sandrton
2196

Fax No. 011 269 4306

Attention: CC Munby

APPLICATION FOR A PROSPECTING RIGHT IN TERMS OF SECTION 16 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002): IN RESPECT OF VARIOUS PORTIONS OF THE FARMS MALANSKRAAL 407 IR, DRIEFONTEIN 405 IR, VLAKFONTEIN 448 IR, ZANDHOEK 451 IR, WELTEVREDEN 449 IR, KLIPFONTEIN 450 IR, PANFONTEIN 452 IR, DASPOORT 564 IR, MODDERFONTEIN 562 IR, RIETFONTEIN 561 IR, TWEEFONTEIN 560 IR, VLAKFONTEIN 558 IR, SITUATED IN THE MAGISTERIAL DISTRICT OF BALFOUR

1. This serves to inform you that your abovementioned application for a prospecting right to prospect for **Coal (C)** in respect of the abovementioned properties has been granted in terms of Section 17(1) of the abovementioned Act. The Regional Office will prepare the final copies of the right to be signed.
2. Take note that the Regional Manager intends to approve the relevant Environmental Management Plan and sign the right within 30 days of receipt of this letter.
3. Further note that in terms of Section 17(5) of the Act, the prospecting right comes into effect on the date on which the Environmental Management Plan is approved. In terms of Section 19(2) prospecting activities must commence within 120 days of the effective date.

4. In light of the afore-going, you are requested to:

4.1. Ensure that all outstanding matters regarding your application are finalized and that relevant documents are submitted to the Regional Office no later than 30 days prior to the date mentioned in paragraph 2 above, which outstanding matters include the submission of:

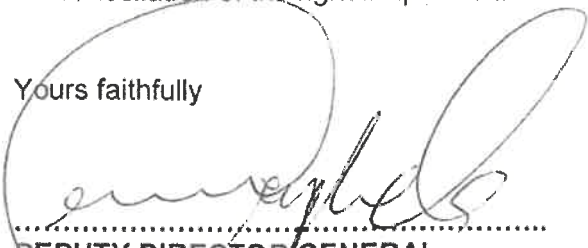
- (a) financial provision in the amount of **R19, 180.50**
- (b) The payment of prospecting fees for the first year
- (c) the particulars of your authorized representative who will sign the right,
- (d) the particulars of the public notary, before whom the right must be signed,
- (e) two copies of the final consolidated prospecting work programme,
- (f) six copies of the prescribed plans prepared by a surveyor in accordance with the Mining Titles Registration Act.
- (g) Three copy of the shareholders agreement and share certificates.

4.2. Please make arrangements for the public notary, authorized representative(s) of your company and a witness to be present and attend the signing of the prospecting right once the aforesaid outstanding matters are verified and finalized.

5. Note further that in terms of Section 19(2)(a), the signed/executed prospecting right must be lodged for registration at the Mineral and Petroleum Titles Registration Office, Pretoria, within 30 days as from the date of approval of the relevant environmental management plan.

6. Failure to comply may result in the withdrawal, suspension or cancellation of the right in question.

Yours faithfully


.....
DEPUTY DIRECTOR GENERAL
MINERAL REGULATION

DATE: 25/9/2012

Appendix D

GEOTECHNICAL IMPACT ASSESSMENT



ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct¹, indirect², secondary³ as well as cumulative⁴ impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria⁵ presented in **Table A**.

Table A: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ <i>Significance = (Extent + Duration + Reversibility + Magnitude) × Probability</i>				
IMPACT SIGNIFICANCE RATING					

¹ Impacts that arise directly from activities that form an integral part of the Project.

² Impacts that arise indirectly from activities not explicitly forming part of the Project.

³ Secondary or induced impacts caused by a change in the Project environment.

⁴ Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

⁵ The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High

IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure** below.

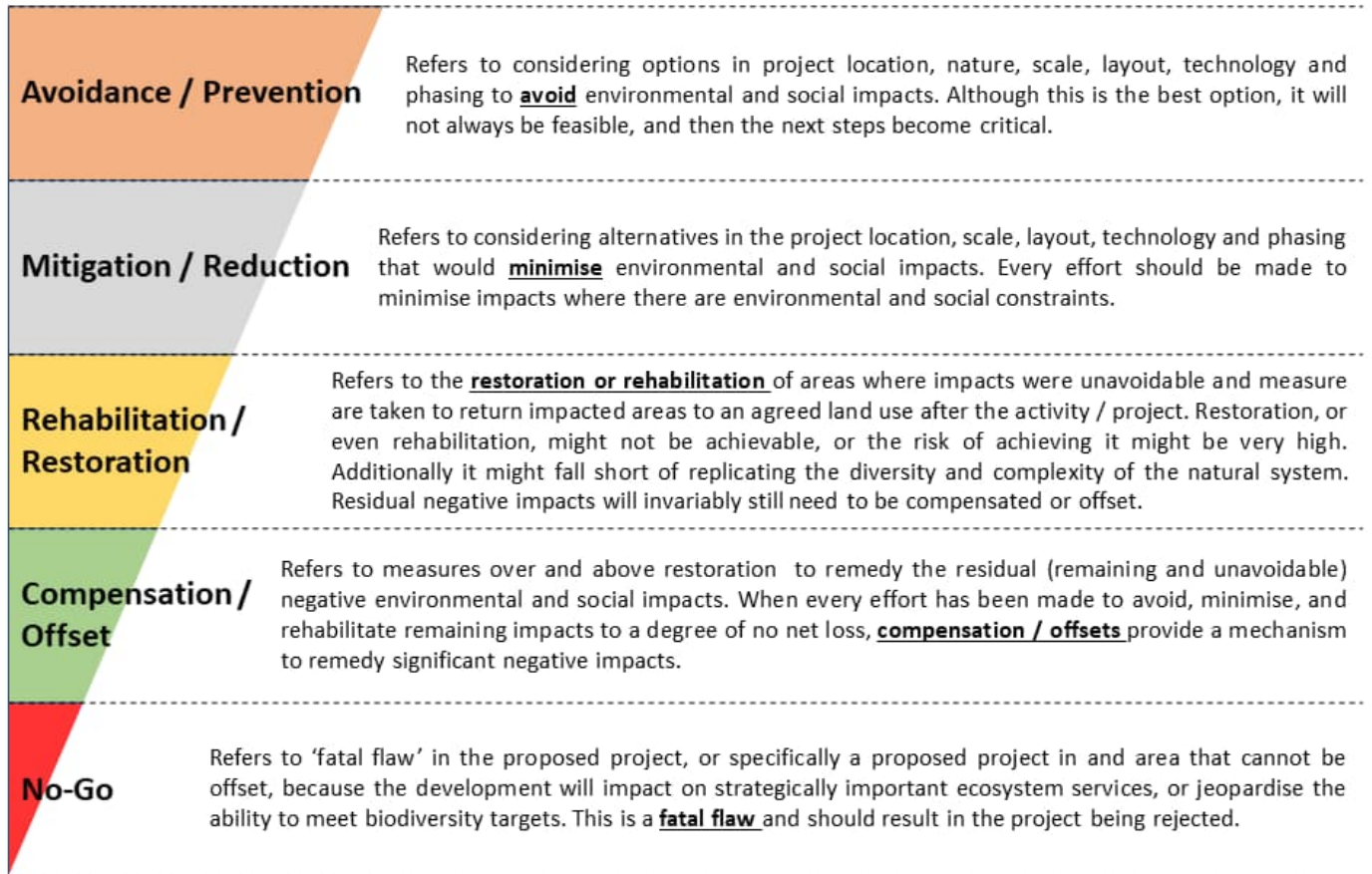


Figure A: Mitigation Sequence/Hierarchy

Project Name	ABO Uvemvane Wind Energy Facility 1
Impact Assessment	Geotechnical

CONSTRUCTION AND OPERATION

Impact number	Aspect	Description	Mitigation Measures	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
							(M+)	E+	R+	D x	P=	S	Rating	(M+)	E+	R+	D x	P=	S	Rating
Impact 1:	Slope stability	•Slope instability around structures, •Steeply dipping joints in rock or boulders in soil mass may prove treacherous in cuttings and deep foundation excavation leading to collapse of sidewalls,	•Avoid steep slopes areas, as far as practicably possible, •Design cut slopes according to detailed geotechnical analysis and adopt appropriate support mechanisms,	Construction and Operation	Negative	moderate	2	1	3	3	2	18	N2	1	1	3	2	2	14	N1
Significance							N2 - Low							N1 - Very Low						
Impact 2:	Seismic activity	Damage of proposed development.	•Design according to expected peak ground acceleration, •Ensure the proposed development meets the minimum requirements for infrastructure in a seismic zone.	Construction and Operation	Negative		4	1	3	4	3	36	N3	2	1	3	3	3	27	N2
Significance							N3 - Moderate							N2 - Low						
Impact 3:	Soil erosion from clearing of sites for drilling and test pitting	•Increase stormwater velocity, •Increase in soil and wind erosion due to cleared vegetation, •Creation of drainage paths along access tracks and side slopes, •Sedimentation of non-perennial features and excessive dust,	•Rehabilitation of affected areas (such as revegetation), •Construction of temporary berms and drainage channels to divert surface water, •Minimize earthworks and fills, •Use existing road network and access tracks, •Correct engineering design and construction of gravel roads and water crossings, •Control stormwater flow, •Dust suppression measures for wind erosion,	Construction and Operation	Negative		3	3	3	3	4	48	N3	2	1	1	2	2	12	N1
Significance							N3 - Moderate							N1 - Very Low						
Impact 4:	Potential hydrocarbon (including oil, fuels, chemicals) spillages	Potential groundwater and drainage feature contamination from geotechnical heavy machinery,	•Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection (i.e. on impermeable surfaces or with the use of drip trays), •Spill kit to be maintained on site, spills and contaminated soils to be collected and disposed appropriately, •Frequent checks and conditional monitoring,	Construction and Operation	Negative		3	3	3	3	4	48	N3	2	2	1	1	2	12	N1
Significance							N3 - Moderate							N1 - Very Low						
Impact 5:	Disturbance of fauna and flora from clearing of sites	The displacement of natural earth material and overlying vegetation leading to erosion and displacement of natural ecosystems,	Limit excavations to developmental areas,	Construction and Operation	Negative		3	1	3	3	3	30	N2	2	1	1	2	2	12	N1
Significance							N2 - Low							N1 - Very Low						
Impact 6:	Subsidence	The existing informal mine shaft are of unknown conditions including depths and how far across they go.This creates a high risk of sinkholes and ground collapse	During the planning and pre-construction phase conduct geophysical studies to map out the extent of the mine, this can be followed by drilling to for the structural layout of the shaft, Numerical modeling and monitoring to assess the risk and effects on the surface, No structures within a 100m radius of the mine shaft,	Construction and Operation	Negative		4	1	5	5	5	75	N4	2	1	3	4	3	30	N2
Significance							N4 - High							N2 - Low						
DECOMMISSIONING																				
Impact number	Receptor	Description	Mitigation Measures	Stage	Character	Ease of Mitigation	Pre-Mitigation						Post-Mitigation							
							(M+)	E+	R+	D x	P=	S		(M+)	E+	R+	D x	P=	S	
Impact 1:	Slope stability	Slope instability around structures,	Adopt appropriate support mechanisms in excavation, •Design cut slopes according to detailed geotechnical analysis,	Decommissioning	Negative		2	1	3	3	2	18	N2	1	1	3	2	2	14	N1
Significance							N2 - Low						N1 - Very Low							
Impact 2:	Soil erosion	•Increase in soil and wind erosion due to clearance of structures, •Displacement of soil and damage to vegetation by vehicles	•Use existing road network and access tracks, •Use of temporary berms and drainage channels to divert surface water, •Minimize earthworks and demolishing footprints, •Rehabilitation of affected areas (such as revegetation), •Reinstate channelized drainage features, •Strip, stockpile and re-spread topsoil, •Dust suppression measures for wind erosion	Decommissioning	Negative		4	2	3	3	4	48	N3	2	1	1	2	2	12	N1
Significance							N3 - Moderate						N1 - Very Low							
Impact 3:	Potential hydrocarbon (including oil, fuels, chemicals) spillages	Potential hydrocarbon spillages in machinery due to clearance of structures,	•Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection (i.e. on impermeable surfaces or with the use of drip trays), •Spill kit to be maintained on site, spills and contaminated soils to be collected and disposed appropriately, •Frequent checks and conditional monitoring	Decommissioning	Negative		3	3	3	3	4	48	N3	2	1	3	1	2	14	N1
Significance							N3 - Moderate						N1 - Very Low							

Impact 4:	Disturbance of fauna and flora	The displacement of natural earth material and overlying vegetation leading to erosion and displacement of natural ecosystems.	Limit excavations to decommissioning areas.	Decommissioning	Negative		3	1	3	3	3	30	N2	2	1	1	2	2	12	N1
Significance							N2 - Low							N1 - Very Low						
Impact 5:	Subsidence	The existing informal mine shaft are of unknown conditions including depths and how far across they go.This creates a high risk of sinkholes and ground collapse	During the planning and pre-construction phase conduct geophysical studies to map out the extent of the mine, this can be followed by drilling to for the structural layout of the shaft, Numerical modeling and monitoring to assess the risk and effects on the surface, No structures within a 100m radius of the mine shaft,	Decommissioning	Negative		4	1	5	5	5	75	N4	2	1	3	4	3	30	N2
Significance							N4 - High							N2 - Low						
CUMULATIVE																				
Impact number	Receptor	Description	Mitigation Measures	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
							(M+)	E+	R+	D)x	P=	S		(M+)	E+	R+	D)x	P=	S	
Impact 1:	Seismic activity	Damage of proposed development,	•Design according to expected peak ground acceleration, •Frequent monitoring of functionality and servicing of seismic dampening measures,	Cumulative	Negative		4	1	3	4	3	36	N3	2	1	3	3	3	27	N2
Significance							N3 - Moderate							N2 - Low						
Impact 2:	Soil erosion	•The displacement of natural earth material and overlying vegetation leading to: •Exposure of upper soil layer, •Increase in stormwater velocity, •Soil washed downslope into drainage channels leading to sedimentation, •Erosion will be exacerbated during periods of heavy rainfall,	•Use existing road network and access tracks, •Use temporary berms and drainage channels to divert surface water, •Minimize earthworks and demolishing footprints, •Rehabilitation of affected areas (such as revegetation), •Control stormwater flow,	Cumulative	Negative		3	2	3	3	4	44	N3	2	1	1	2	2	12	N1
Significance							N3 - Moderate							N1 - Very Low						
Impact 3:	Potential hydrocarbon (including oil, fuels, chemicals) spillages	Contamination of ground and surface water from heavy plant and service vehicles,	•Service vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection, •Frequent checks and conditional monitoring,	Cumulative	Negative		4	4	3	4	4	60	N3	2	1	3	1	2	14	N1
Significance							N3 - Moderate							N1 - Very Low						
Impact 4:	Disturbance of fauna and flora	The displacement of natural earth material and overlying vegetation leading to erosion and displacement of natural ecosystems.	Limit excavations developmental/ decommissioning areas.	Cumulative	Negative		3	1	3	3	3	30	N2	2	1	1	2	2	12	N1
Significance							N2 - Low							N1 - Very Low						
Impact 5:	Subsidence	The existing informal mine shaft are of unknown conditions including depths and how far across they go.This creates a high risk of sinkholes and ground collapse	During the planning and pre-construction phase conduct geophysical studies to map out the extent of the mine, this can be followed by drilling to for the structural layout of the shaft, Numerical modeling and monitoring to assess the risk and effects on the surface, No structures within a 100m radius of the mine shaft,	Cumulative	Negative		4	1	5	5	5	75	N4	2	1	3	4	3	30	N2
Significance							N4 - High							N2 - Low						

Appendix E

DOCUMENT LIMITATIONS





DOCUMENT LIMITATIONS

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