THE BASIC ASSESSMENT FOR THE PROPOSED KOMAS WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE NEAR KLEINSEE IN THE NORTHERN CAPE PROVINCE.

APPENDIX C.11

Geotechnical Assessment



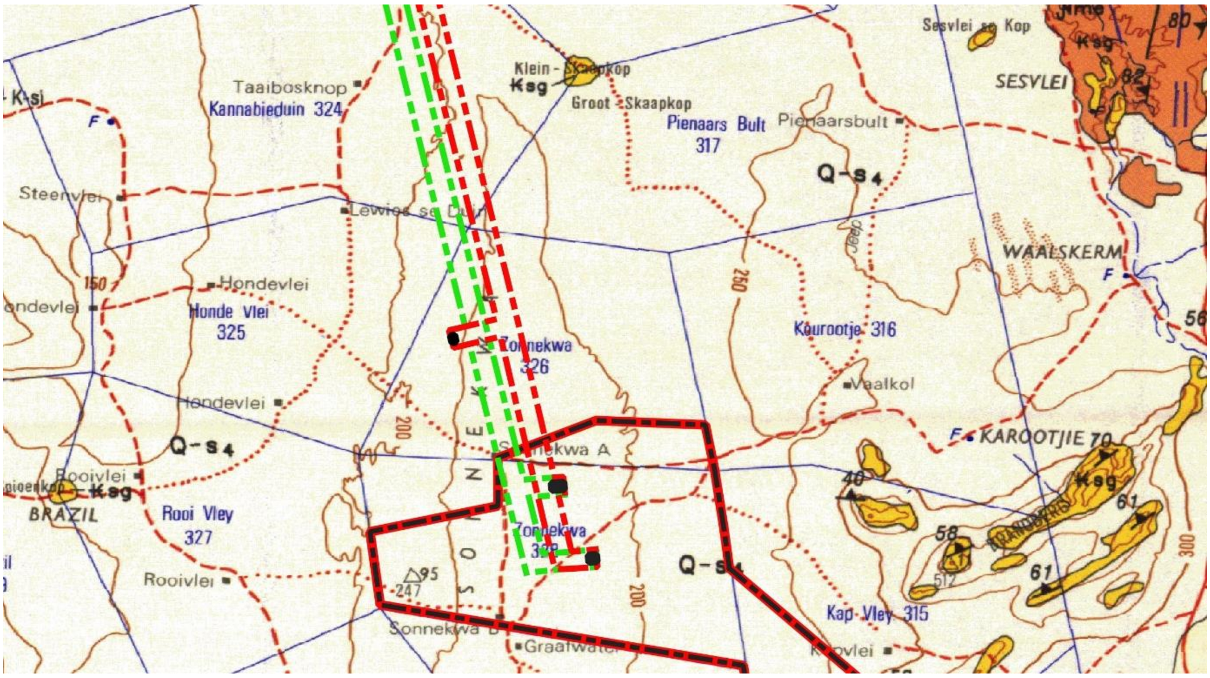


GENESIS ENERTRAG KOMAS (PTY) LTD

KOMAS WIND ENERGY FACILITY & ASSOCIATED POWER LINE & ELECTRICAL INFRASTRUCTURE

DESKTOP GEOTECHNICAL IMPACT ASSESSMENT

JANUARY 29, 2021 FINAL



KOMAS WIND ENERGY FACILITY & ASSOCIATED POWER LINE & ELECTRICAL INFRASTRUCTURE

DESKTOP GEOTECHNICAL IMPACT ASSESSMENT

GENESIS ENERTRAG KOMAS (PTY) LTD

FINAL

PROJECT NO.: 41102874
DATE: JANUARY 2021

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1 INTRODUCTION

1.1 PROJECT BACKGROUND AND AIMS

WSP Environmental (Pty) Ltd (WSP) has performed a geological assessment of the proposed Komas Wind Energy Facility (WEF) and grid infrastructure in the Nama Khoi Local Municipality, Northern Cape. The site is located approximately 35km southeast of Kleinsee and 53km southwest of Springbok while the proposed grid servitude extends from the site northwards to the R355 road that joins Kleinsee and Springbok (Figure 1).

The site is being evaluated for future development as a permanent renewable energy generation facility. The primary objective of the investigation is to perform an interpretive general assessment of the impacts of the proposed development on the geotechnical conditions or vice versa.

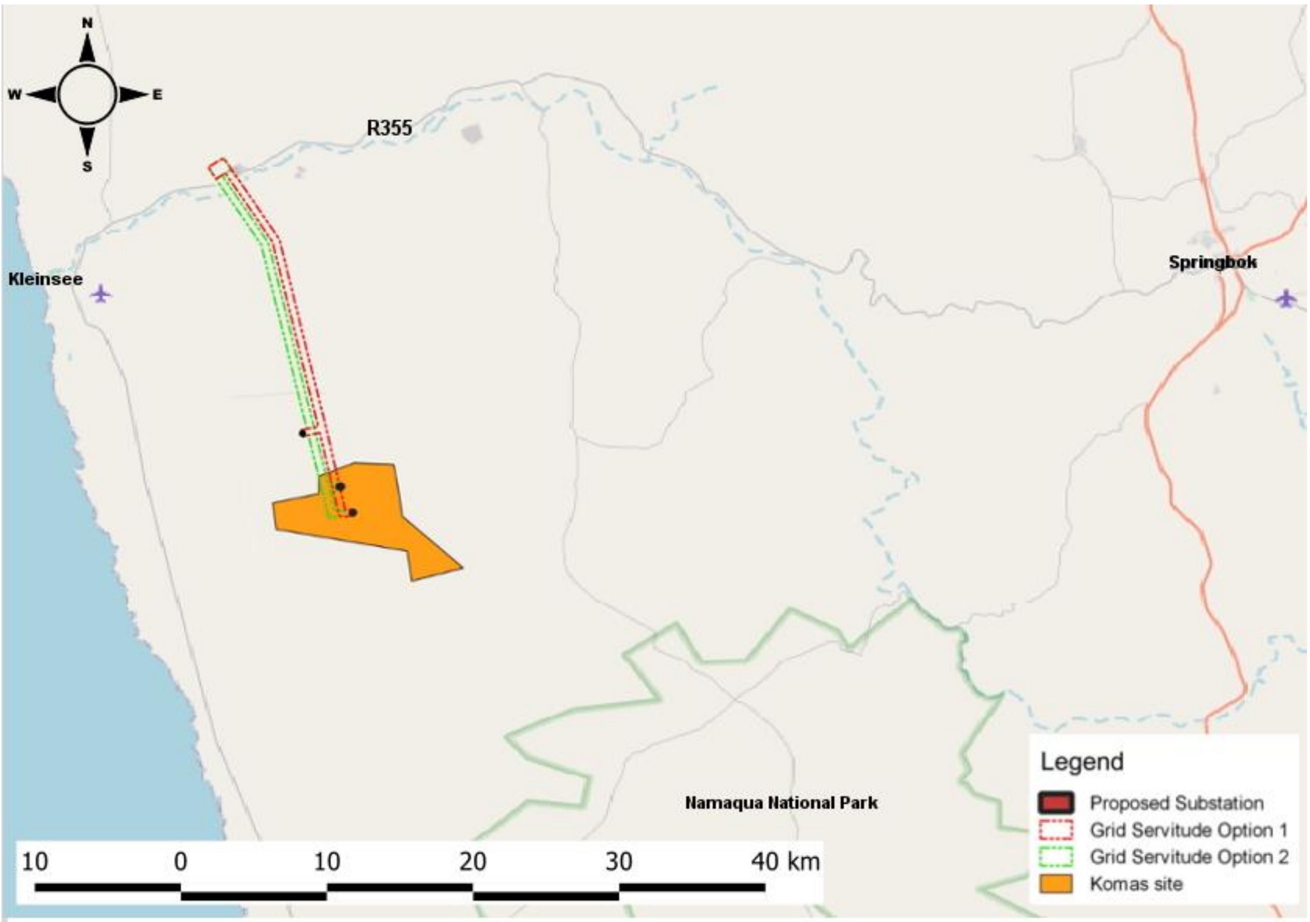

Figure 1. Location of the proposed Komas WEF and grid servitude, please note the proposed Substation area includes the Battery Energy Storage System (BESS) (Created by report authors during this report's generation for use in the assessment as described in this report. Source data: Base map from OpenStreetMap and OpenStreetMap Foundation).

1.2 SCOPE OF WORKS AND LIMITATIONS

The scope of works is limited to a desktop review and interpretative reporting on the findings. This report details the findings the required interpretation thereof. As no site investigations were completed there is a degree of uncertainty associated with the data as conditions may have changed since data sources were created. The uncertainty is however considered to be acceptable for the purposes of the basic assessment stage, especially considering the geographic location and the geomorphological history of the area.

All interpretations are presented in light of the proposed development and are therefore project specific. The data and interpretation thereof, as presented in this report, is therefore not intended to be used for any other purpose.

1.3 REPORTING REQUIREMENTS

Appendix 6 of the EIA Regulations (GNR326 EIA Regulations - 7 April 2017) specify the requirements listed in Table 1. The section of this report that deals with each of the requirements is also included in the table.

Table 1. EIA regulation requirements and the

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	***Addressed in the Specialist Report***
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	*Section 2 and Annexure A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Annexure C*
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Section 1*
(cA) an indication of the quality and age of base data used for the specialist report;	*Section 3 and Section 4*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 8 and 9*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*NA*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 1.2*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*N/A*
g) an identification of any areas to be avoided, including buffers;	*N/A*
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*N/A*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 1.2*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and 7*
k) any mitigation measures for inclusion in the EMPr;	*Section 8*
l) any conditions for inclusion in the environmental authorisation;	*N/A*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*N/A*
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii) if the opinion is that the proposed activity, activities or portions thereof	*Section 9*

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	*Addressed in the Specialist Report*
should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	*N/A*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. This specifically includes Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed. As at September 2020, there are no sensitivity layers on the Screening Tool for Geotechnical features. Part A has therefore not been compiled for this assessment

2 SPECIALIST INFORMATION

The report was prepared by Dr Robert Leyland, a professionally Registered Natural Scientist (Engineering Geologist) with 11 years of experience. The report was reviewed by Dr Jon McStay, an engineering geologist with 28 years of experience. The curriculum vitae of both specialists are included as Annexure A to this report.

3 SITE GEOLOGICAL SETTING

The Geological Map (1:250 000, 2916 Springbok, 2001) indicates that the proposed development area is predominantly underlain directly by Quarternary deposits described as semi consolidated piedmont deposits and red sands (Figure 2). These are deposited on the wide (±30km) coastal foreland that stretched from the west coast to the escarpment, east of the site. Due to the widespread nature of these recent deposits the distribution of geological units under the sediments is not well defined. The deposits are known to be underlain by the Bushmanland Terrane which consists of basement granitic gneisses, granulite grade supracrustal rocks and late granitoid intrusions.

The Steinkopf Gneiss of the Gladkop Suite is exposed in the north where the Buffels River has eroded into the underlying bedrock. This unit is part of the older basement of the Bushmanland Terrane. The next unit that is mapped in the area, and is mapped as outcrop in close proximity to the proposed development is the Khurisberg Subgroup which is part of the Bushmanland Group supracrustal rocks that were deposited on the basement and later metamorphosed to form gneiss, quartzite and schist. Younger units mapped in the area, but only significantly to the east of the development area include the Mesklip Gneiss (Little Namaqua Suite) and the Rietberg Granite (Spektakel Suite). These both represent late stage granitic intrusions, some of which were metamorphosed.

4 TOPOGRAPHY AND LAND USE

As mentioned, the site is located in the coastal foreland that stretched from the west coast to the escarpment, east of the site. The area can be described as slightly undulating plains while the low mountains of the escapement are located further east (Figure 3). On the proposed WEF site there is very little relief with the east and west sides of the site being at an elevation of 200-235m above sea level while the central plane at a level of 180m (Figure 4). In the far south-eastern corner is a small ridge that reaches 400m above sea level. This ridge related to the occurrence of Khurisberg Subgroup rock outcrops mapped just outside the site boundary in that area.

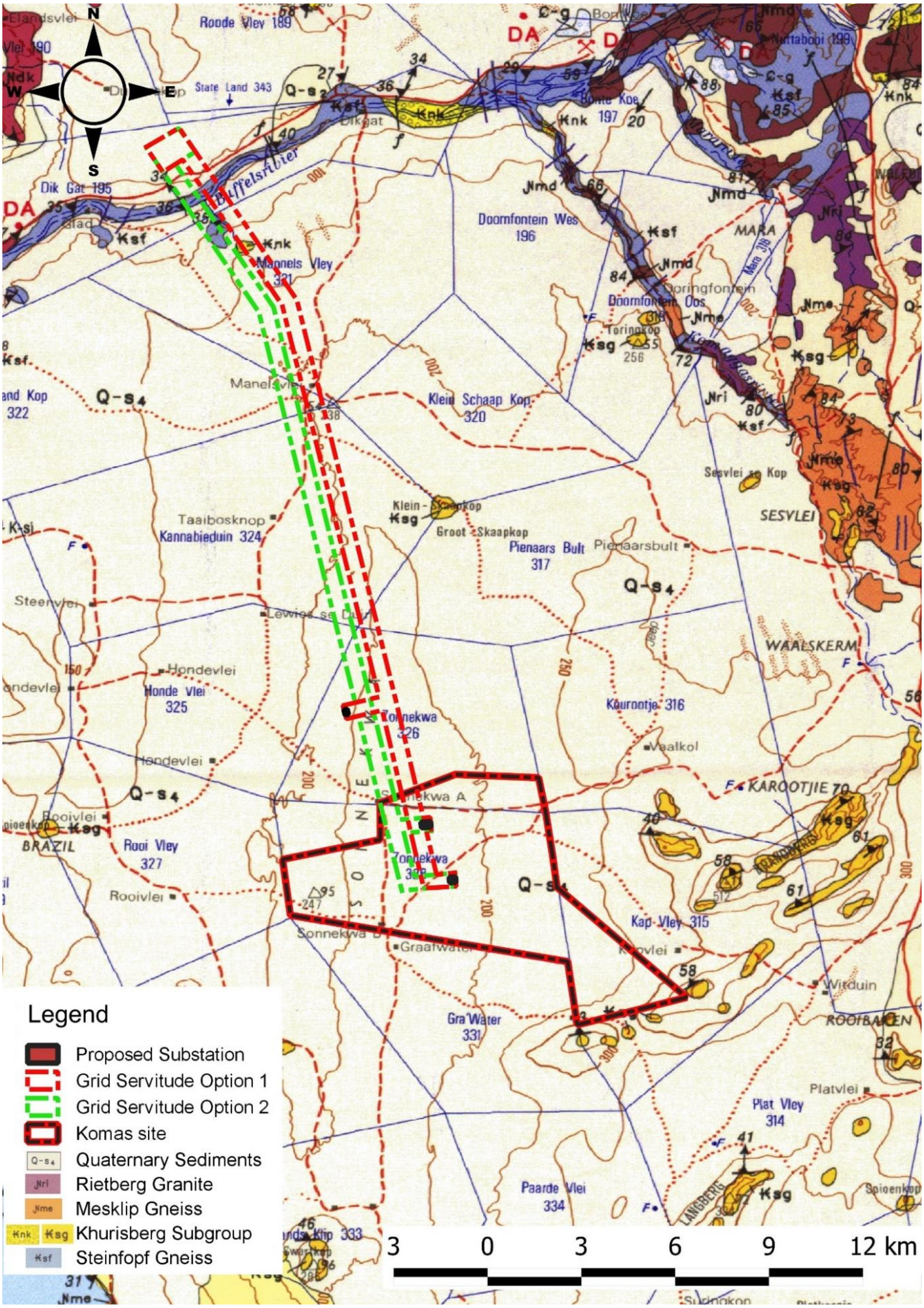

Figure 2. Site geological setting, please note the proposed Substation area includes the BESS (Created by report authors during this report's generation for use in the assessment as described in this report. Source data: 2916 Springbok 1:250 000 Geological Map, 2001).

A greater percentage of the land within the site and the region that surrounds the site area is occupied by shrubland with some patches of barren land (Department of Environmental Affairs, South African National Land-Cover, 2018).

Minor mines and quarries are indicated on road that crosses the central part of the servitudes but aerial photograph interpretation of these indicates them to be minor borrow pits, likely for gravel road maintenance. The northernmost parts of the servitude line show the mine workings of the Dikgat Mine Diamond Mine (currently non-operational).

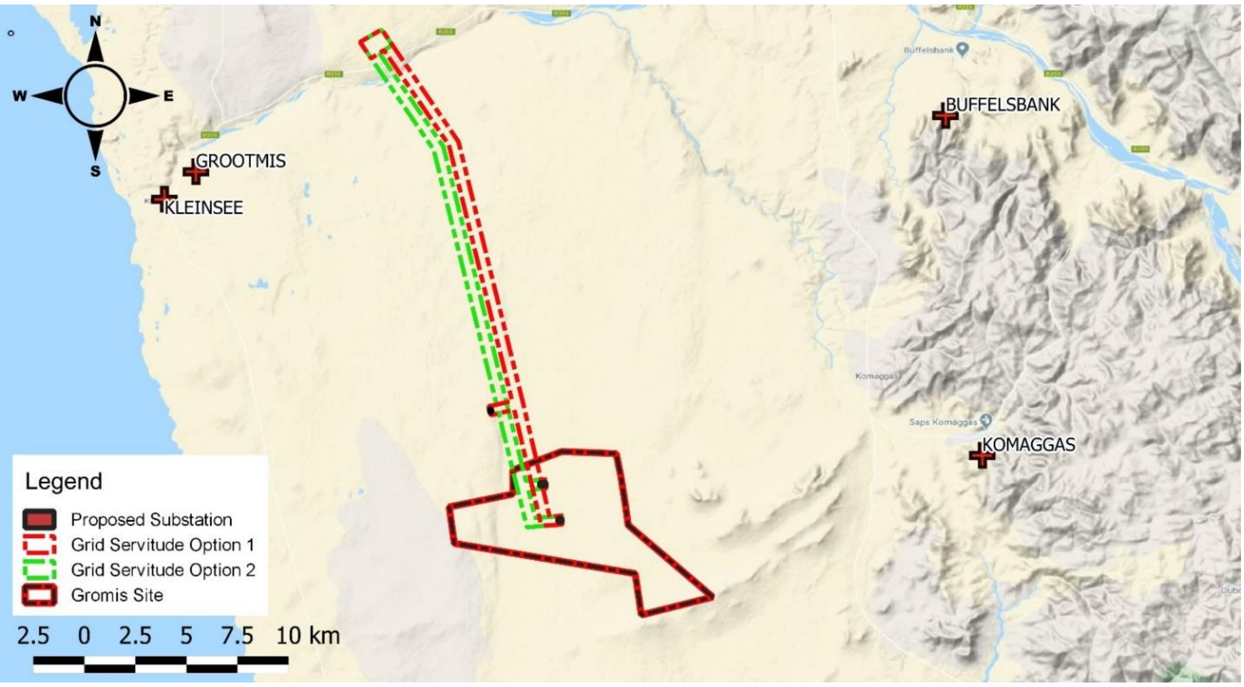

Figure 3. Regional Terrain, please note the proposed Substation area includes the BESS (Created by report authors during this report's generation for use in the assessment as described in this report. Source data: Google Maps).

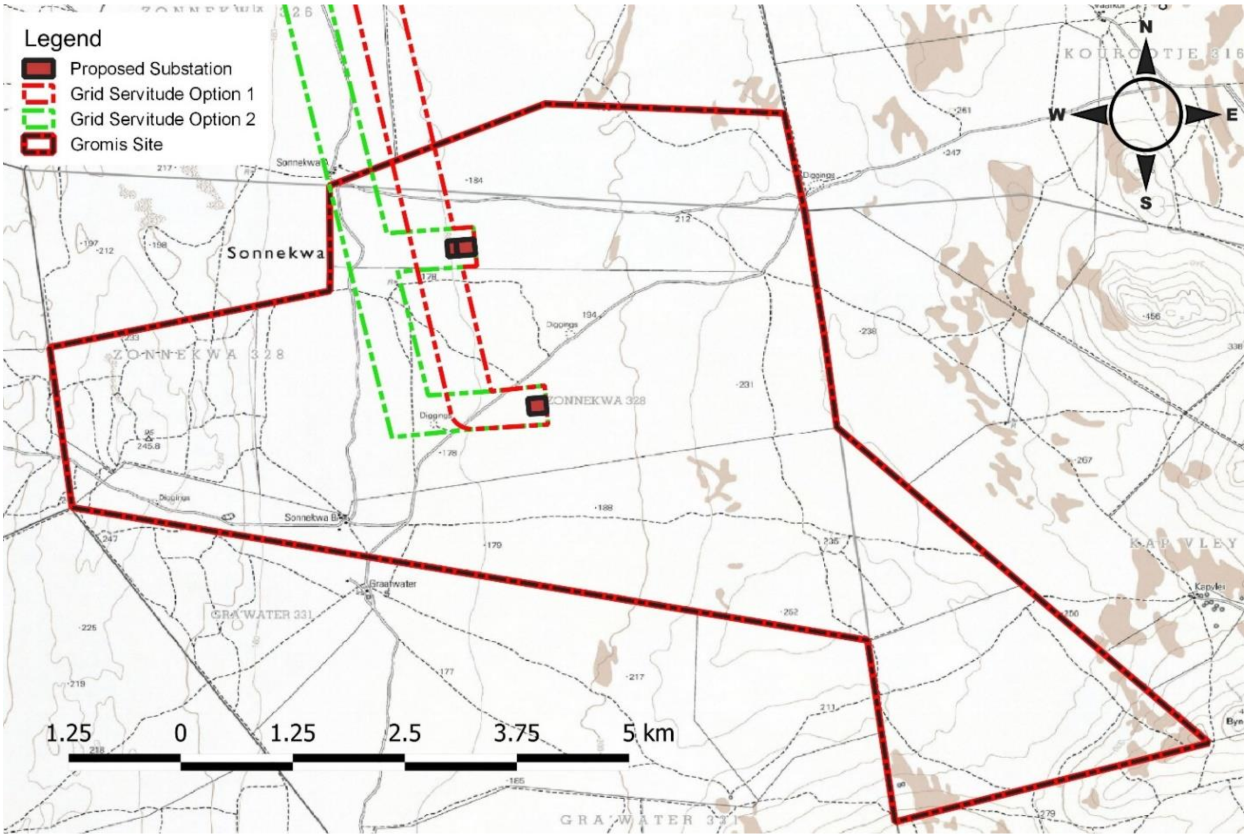

Figure 4. Komas WEF site topography, please note the proposed Substation area includes the BESS (Created by report authors during this report's generation for use in the assessment as described in this report. Source data: National Geo-spatial Information (NGI) 1:50 000 topocadastral maps accessed at https://gis.elsenburg.com/apps/cfm).

5 SOIL COVER

The expected soil conditions are interpreted primarily from the data on Land Types sourced from the online Agricultural Geo Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, 2007) and supplemented by a knowledge of the geological setting and experience.

The Komas WEF site is characterized by 3 Land Types, Ai 13, Ah38 and Hb 80 with a fourth (Ib123) only being present in small ridge area along the south-eastern corner. A summary of the soil conditions relevant to the geotechnical assessment of each Land Type is given in Table 2. The grid servitude areas cross areas of the same Land Types as the site and a small area of Land Type Af17 north of the Buffels River.

All land classes are characterized by sandy top soils with minimal clay contents. The majority of the Land Types have shallow soils but the depth limiting material is rarely rock. In most cases soil depth is limited by pedocrete layers such as calcrete and silcrete (dorbank) or a gleyed clay horizon. In the servitude areas the soils are expected to be similar to that in the WEF site area.

The major soil categories in all the Land Types are all sandy soils that are free draining but in some cases plinthic (partially or fully indurated) layers are expected.

Table 2. Summary of soil properties in in Land Type encountered on the Komas WEF site and the associated grid servitude.

LAND TYPE	DEPTH LIMITING MATERIALS	AVERAGE DEPTH (mm)	AVERAGE DEPTH CLASS	MAJOR SOIL CATEGORIES	TOPSOIL CLAY %
Ah38	ca, ka, db, ne, gc	904	901-1200mm	67% Free draining structureless 23% Excessively drained sandy	1.3

Ai13	gc, ne	955	901-1200mm	68% Free draining structureless 13% Structureless with plinthic horizon	3.0
Hb80	R, ka	861	601-900mm	43% Excessively drained sandy 16% Structureless with plinthic horizon 16% Shallow soils on rock <10% Free draining structureless	2.1
Af17	Rare	1271	>1200	93% Free draining structureless	4.0
Ib123	R	168	<300mm	64% Rock 17% Shallow soils on rock	3.0

R: Rock, ca: accumulation of carbonates of alkali earths, ka: indurated calcrete, db: dorbank, ne: unconsolidated material, gc: gleyed clay.

6 GEOTECHNICAL CONDITIONS

6.1 INTRODUCTION

The following sections describe the expected geotechnical conditions as inferred from the known geological and topographical conditions.

6.2 DRAINAGE (SURFACE)

The site surface drainage is acceptable given the slight gradients and the arid environment coupled with sandy free draining soils that prevent excessive runoff. There are no signs of widespread water ponding on the Komas WEF site, despite the low gradients in the central parts of the site. There may be an accumulation of shallow groundwater in these areas during wet periods, followed by evaporation and the deposition in the evaporite minerals in surface soil layers.

The site is also located on a regional high area with both the main rivers draining the escarpment to the east of the site flowing around the site.

6.3 EROSION

The low site gradients coupled with the arid environment make the likelihood of soil erosion unlikely. The presence of strong winds coupled with the generally sparse vegetation does result in a high risk of soil erosion by wind. As such areas disturbed during construction will result in additional soil erosion. Wind erosion is however a slower process and as such no significant erosion is expected. The WEF site does contain some very localized sandy deposits that are likely to be aeolian deposits.

Along both grid servitudes there is evidence of minor erosion in the Buffels River vicinity but this appears to be related to a localized outcrop of Khurisberg Subgroup rocks.

6.4 EXCAVATION ASSESSMENT

The majority of the Komas WEF site area is expected to have hard excavation difficulties for any excavations deeper than 1m. This is due to the occurrence of calcrete or silcrete horizons at shallow depths. The thickness of these horizons should be investigated during further geotechnical investigations. Isolated areas where aeolian sand deposits have accumulated may have deeper soils but excavation conditions are expected to be generally hard.

6.5 FOUNDATION RECOMMENDATIONS

The conditions at the Komas WEF site are such that the use of shallow foundation solutions is feasible and will prevent the need for excessive excavations in pedocretes or hard rock. The proposed structures are however very tall and subject to high moments which require the foundations to prevent overturn. The use of a foundation anchoring system will therefore be required as an alternative to deep excavated bases. The proposed base footprints will require detailed geotechnical investigations to ensure the foundation design accounts for the geotechnical characteristics of the predocrete and bedrock conditions.

Along the servitude line the use of shallow foundations for grid infrastructure with similar foundations anchoring systems is recommended to prevent the need for excessive excavations.

6.6 GROUNDWATER

The groundwater across the entire proposed development area is expected to be located in deep fractures in the bedrock. Groundwater is not expected to affect the development and no shallow water table is expected, with the exception of localised accumulations after rainfall episodes.

The natural groundwater in the fractured rock aquifer may be slightly to highly saline and does not always meet the full requirements for drinking water.

6.7 SLOPE STABILITY

The Komis WEF has generally very low slope angles but on the slopes of the ridge in the south-eastern corner the gradient reaches up to 9 degrees. The geological map indicates the rock in Khurisberg Subgroup to dip at 40-58 degrees to the north and the slopes are therefore unlikely to be unstable with respect to deep seated plain failures.

Development on the site is unlikely to cause any slope instability as no significant cut slopes will be developed. Where deep excavations into bedrock are required a detailed geotechnical investigation should be done to determine the excavation side slope stability.

6.8 DOLOMITIC GROUND AND SUBSIDENCE

The entire proposed development area is not located in a carbonate terrain and no known karst features are present in the area. The possibility of karst related ground subsidence is therefore not considered to be negligible.

6.9 PROBLEM SOILS

The proposed development area is located on an area where no expansive soils are known to occur. The limited soil thickness and sandy nature of the soils is expected to result in no problems related to the densification of soils under loads. This includes consolidation settlements (due to the expected unsaturated soils) and the collapse of low density skeletal soils.

Some soils on site may be dispersive but this is not expected to be significant as no developments of dams is proposed. Saline soils may be present locally and the effects thereof on underground infrastructure should be considered in all designs.

6.10 SEISMIC ACTIVITY

According to the maps produced by Fernández and Du Plessis (1992) the site area has a low seismic hazard with a 10% probability of a peak horizontal acceleration of 50-100 cm/s^2 and a potential maximum Modified Mercalli scale intensity event of of VI being exceeded once every 50 years. Such an event (Modified Mercalli scale VI-VII) are considered sufficient to cause damage to poorly build or badly designed structures.

The Namakwa District is considered to be generally tectonically inactive and earthquakes are mostly absent. The distribution of recorded eathquakes in the IRIS (Incorporated Research Institutions for Seismology) database (Figure 5) confirms the lack of earthquakes recorded in the region and that all quakes recorded within 300km of the site are small, (Richter scale <4) shallow quakes. The presence of the nuclear waste disposal site at Vaalputs in Namaqualand means that the seismic database for this region is well established and hence predictions of seismic risk have a high level of confidence.

The Global Facility for Disaster Reduction and Recovery (GFDRR) earthquake hazard level for Namakwa District is "low" which means that there is a 2% chance of potentially-damaging earthquake induced ground accelerations in the next 50 years (http://thinkhazard.org). Based on this information the seismic risk associated with the project is considered to be low and is not considered further in this geotechnical investigation. It is recommended that structures are designed to withstand a peak horizontal acceleration of 50-100 cm/s^2.

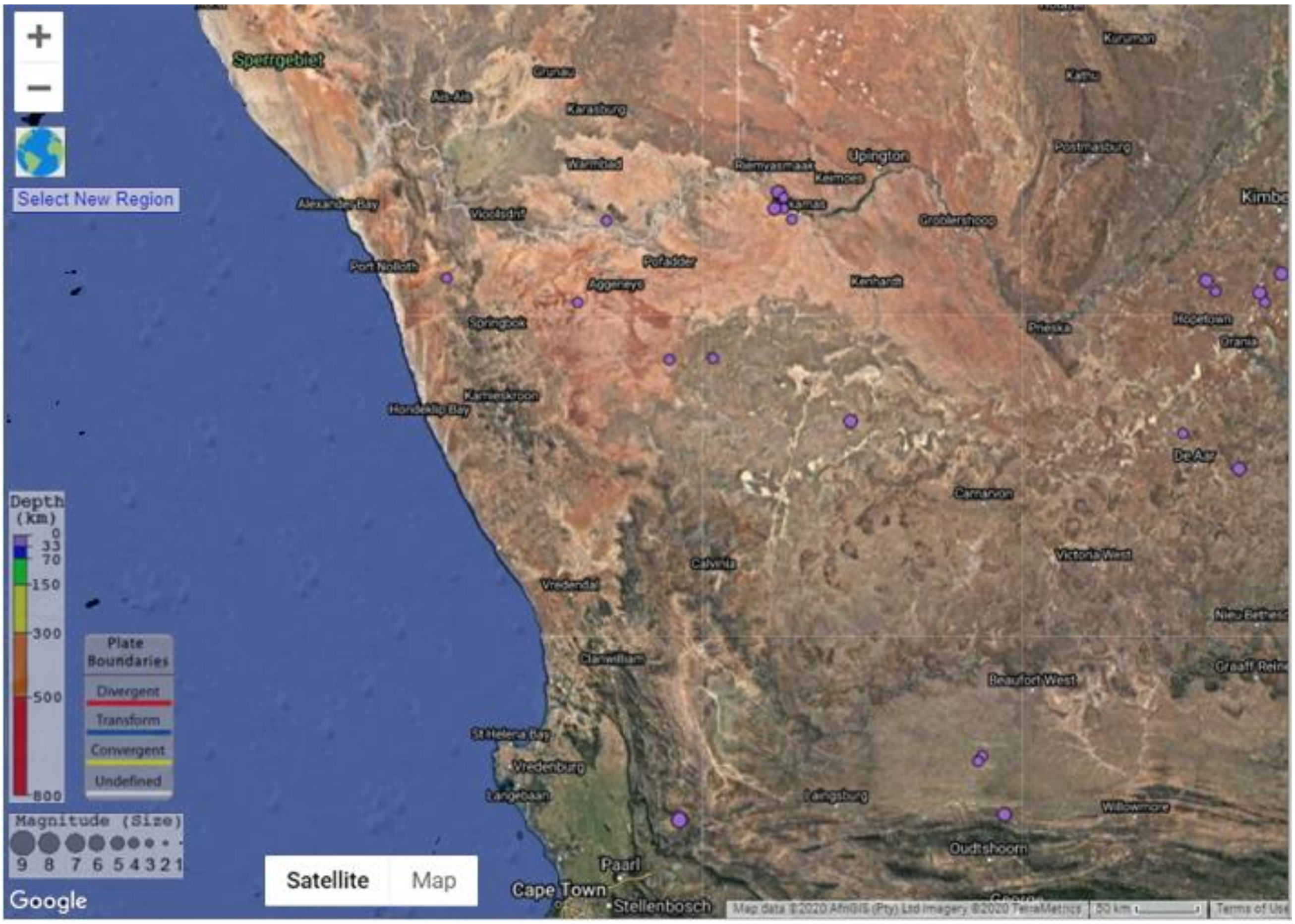

Figure 5. Distribution of recorded earthquakes in vast area surrounding the site (Incorporated Research Institutions for Seismology, iris.edu/hq/).

7 GEOTECHNICAL ASSESSMENT

7.1 FOUNDATION CONDITIONS

Wind turbines are normally founded on large round or square raft-like concrete bases with a central base surrounded by a concrete raft with the size depending on the overall height of the mast. The mast structures are not particularly heavy in terms of foundation loading, as the load is distributed evenly over the large foundation area. However, the masts are subjected to high wind shear and thus dense soil with a moderate to high shear strength and bearing capacity is required for founding. Therefore foundation conditions are a key constraint on engineering costs and affect project feasibility.

The rock condition in this area is generally considered favourable for founding the masts. However the metamorphic nature of the sub-outcrop can result in highly variable and unpredictable rock mass properties. This can result in significant lateral variations in excavation and anchoring conditions. Additionally the presence of superficial pedocrete deposits over weaker soils can result in inadequate foundation conditions for the bases.

In general founding depth would be approximately 2.0m, which will result in some difficult excavation and potentially the need for rock blasting to create an even rock surface for casting the base. The removal of some indurated pedocrete horizons may also be required. The bearing capacity in the bedrock is expected to be well in excess of the required bearing capacity for the anticipated loads of the operating wind turbines.

7.2 CABLE TRENCHES

Excavation conditions for trenches will require heavy ripping with a large hydraulic excavator and may require blasting of rock or pedocretes, depending on the depth of excavation and the sub-outcrop pattern of the bedrock and the soil thickness.

The ground conditions are generally very dry over most of the site. The majority of the excavated material will not be suitable for bedding or backfill and as such materials may have to be imported. This and the thermal conductivity of materials should be investigated at later stages of the development as they are not considered to impact the proposed development.

Saline soils conditions will result in cathodic protection or insulation on most underground cables.

7.3 ACCESS ROADS

The road subgrade conditions are generally good due to the sandy and gravelly nature of the shallow soil cover. Road development will however disturb large areas and erosion, especially by wind, of disturbed materials may occur. Temporary access roads require the importation of a suitable wearing-course gravel to improve trafficability for heavy vehicles and reduce the risk of erosion of the natural subgrade. The use of local calcrete deposits and calcrete obtained from foundation excavations, as a suitable gravel wearing-course should be possible.

8 GEOTECHNICAL IMPACT ASSESSMENT

The geotechnical impact assessment of the proposed Komas WEF and associated grid servitude development was performed according to the methodology provided and included in Annexure B of this report. The assessment considers the entire development but the three main parts of the development, namely large structures (turbines and pylons), cable trenches and access roads are the primary consideration. The impacts are presented separately for the WEF development (Table 3) and the grid servitude (Table 4).

8.1 COMPARATIVE ASSESSMENT OF ALTERNATIVES

The two grid servitude options do not have differing geotechnical conditions and as such the one assessment applies to both options. This also results in there being no preferred options provided. There is no preferred option between Substation Option 1 and Option 2 with respect to the geotechnical impact assessment. Both alternatives are favourable.

8.2 ASSESSMENT OF NO-GO ALTERNATIVE

Should the proposed Komas WEF and associated infrastructure not be developed, there will be no geotechnical impacts associated with the proposed development.

Table 3. Komas WEF Impact Assessment: Geotechnical

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance without mitigation	Significance with mitigation	Rank	Confidence
Construction													
Construction related soil erosion	Topsoil degradation	Negative	Site	Short-term	Slight	Unlikely	Moderate	Replaceable	Maintain vegetation cover as far as possible; strip, stockpile and re-spread topsoil, Proper construction management	Very Low	Very Low	5	High
Construction related disturbance of development areas	Disturbance of fauna and flora	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Replaceable	Foundation design to avoid blasting and deep excavation into sound rock	Very Low	Very Low	5	High
Slope stability	Erosion and slope instability around structures	Negative	Excavations	Medium-term	Slight	Unlikely	Moderate	Low	Avoid steep slope areas, design any cuts slopes according to detailed geotechnical analysis	Very Low	Very Low	5	High
Seismic activity	Damage / Destruction of proposed development	Negative	Site	Long-term	Moderate	Extremely unlikely	Moderate	Low	Design according to expected peak ground acceleration	Very Low	Very Low	5	High
Decommissioning													
Decommission related soil erosion	Topsoil degradation	Negative	Site	Short-term	Slight	Unlikely	Moderate	Replaceable	Maintain vegetation cover as far as possible; strip, stockpile and re-spread topsoil, Proper construction management	Very Low	Very Low	5	High
Decommission related disturbance of development areas	Disturbance of fauna and flora	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Replaceable	Foundation design to avoid blasting and deep excavation into sound rock	Very Low	Very Low	5	High
Slope stability	Erosion and slope instability in areas where structures are removed	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Low	Fill any excavations or flatten any slopes that may form due to/during removing infrastructure	Very Low	Very Low	5	High
Cumulative Impacts													
Soil erosion	Topsoil degradation	Negative	Site	Short-term	Slight	Unlikely	Moderate	Replaceable	Maintain vegetation cover as far as possible; strip, stockpile and re-spread topsoil, Proper construction management	Very Low	Very Low	5	High
Disturbance of development areas	Disturbance of fauna and flora	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Replaceable	Foundation design to avoid blasting and deep excavation into sound rock	Very Low	Very Low	5	High
Slope stability	Erosion and slope instability around existing and removed structures	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Low	Avoid steep slope areas, design any cuts slopes according to detailed geotechnical analysis	Very Low	Very Low	5	High
Seismic activity	Damage / Destruction of proposed development	Negative	Site	Long-term	Moderate	Extremely unlikely	Moderate	Low	Design according to expected peak ground acceleration	Very Low	Very Low	5	High

Table 4. Komas Grid Servitude Impact Assessment: Geotechnical

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance without mitigation	Significance with mitigation	Rank	Confidence
Construction													
Construction related soil erosion	Topsoil degradation	Negative	Site	Short-term	Slight	Unlikely	Moderate	Replaceable	Maintain vegetation cover as far as possible; strip, stockpile and re-spread topsoil, Proper construction management	Very Low	Very Low	5	High
Construction related disturbance of development areas	Disturbance of fauna and flora	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Replaceable	Foundation design to avoid blasting and deep excavation into sound rock, proper access road development and maintenance along servitude	Very Low	Very Low	5	High
Slope stability	Erosion and slope instability around structures	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Low	Avoid steep slope areas, design any cuts slopes according to detailed geotechnical analysis	Very Low	Very Low	5	High
Seismic activity	Damage / Destruction of proposed development	Negative	Site	Long-term	Moderate	Extremely unlikely	Moderate	Low	Design according to expected peak ground acceleration	Very Low	Very Low	5	High
Decommissioning													
Decommission related soil erosion	Topsoil degradation	Negative	Site	Short-term	Slight	Unlikely	Moderate	Replaceable	Maintain vegetation cover as far as possible; strip, stockpile and re-spread topsoil, Proper construction management	Very Low	Very Low	5	High
Decommission related disturbance of development areas	Disturbance of fauna and flora	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Replaceable	Foundation design to avoid blasting and deep excavation into sound rock	Very Low	Very Low	5	High
Slope stability	Erosion and slope instability in areas where structures are removed	Negative	Site	Medium-term	Slight	Unlikely	Moderate	Low	Fill any excavations or flatten any slopes that may form due to/during removing infrastructure	Very Low	Very Low	5	High
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Seismic activity	Damage / Destruction of proposed development	Negative	Site	Long-term	Moderate	Extremely unlikely	Moderate	Low	Design according to expected peak ground acceleration	Very Low	Very Low	5	High

9 CONCLUSIONS AND RECOMMENDATIONS

The completed desktop assessment of the geotechnical conditions at the proposed development site and grid servitude of the Komas WEF has shown the site to be generally suitable for the proposed development. The proposed development should, from a geotechnical impact perspective, be authorised. There is no preferred grid servitude option with respect to the geotechnical impact assessment.

The most significant geotechnical condition that will affect the development is the expected hard excavation conditions. It is therefore recommended that shallow foundations that are anchored to the bedrock are considered. This will require a detailed study of the rock mass and pedocrete properties at the wind turbine locations. The excavation conditions will also affect the trench excavation costs negatively.

Minimal slope stability issues are expected as slope areas are minimal. No other problem soils or problem geotechnical conditions are expected on site.

Access roads can be developed as gravel road with suitable wearing-course to protect the subgrade likely being obtained from local calcrete deposits.

The impacts of the development have been assessed and all geotechnical impacts are considered to have a very low significance.

REFERENCES

Agricultural Research Council, 2007. Land types of South Africa, 1:250 000 map and memoir series. ARC-Institute for Soil, Climate and Water. Pretoria, South Africa.

Fernández L.M., and Du Plessis A., 1992. Seismic hazard maps for Southern Africa. Published by the Government printer for the Geological Survey of South Africa (presently known as the Council for Geoscience).

Department of Environmental Affairs, South African National Land-Cover, 2018. Dataset downloaded from https://egis.environment.gov.za/gis_data_downloads.

ANNEXURES

A SPECIALIST CURRICULUM VITAE

JON McSTAY, B.Sc.H, Ph.D

Director (Engineering and Environmental Geologist), Environment and Energy

Years with the firm

17

Years of experience

28

Areas of expertise

Geotechnical Investigations

Geophysical Investigations

Engineering Geology and Ground Engineering

CAREER SUMMARY

An engineering and environmental geologist with twenty five years of consulting experience, Dr Jon McStay has considerable experience in geotechnical site investigation and ground engineering for buildings, major infrastructure, roads, ports and harbours.

His key experience includes, Geotechnical Investigations, Geophysical Investigations, Engineering Geology and Ground Engineering, Marine Geotechnical and Reclamation and Expert Witness

Dr McStay was Lecturer in Engineering Geology at the University of Cape Town from 1989 to 1995.

EDUCATION

Doctor of Philosophy, Geology and Mineralogy, University of Cape Town, South Africa 1992

Bachelor of Science (Honours), Geological Services, University of Birmingham, United Kingdom 1982

PROFESSIONAL EXPERIENCE

Foundation Engineering and Bulk Infrastructure

- River Club, Observatory, Cape Town, South Africa (2019). Project Director for geotechnical investigations for proposed multi-use development. Investigation involved combined use of geotechnical drilling and seismic refraction surveys to evaluate foundation and lateral support conditions with drilling and pump testing of groundwater to assess dewatering of fractured rock. Liesbeek Leisure Properties Trust.
- Growth Point Site B (2017), Foreshore Cape Town, South Africa. Project Direct for geotechnical investigations for proposed high-rise complex with deep basement in area of reclaimed land. Investigation involved combined use of geotechnical drilling and seismic refraction surveys to evaluate foundation and lateral support conditions with drilling and pump testing of groundwater well to assess potential for water supply. Growth Point.
- St Helena Deep Aquifer Exploration (2017). St Helena.Project Director for pilot project to evaluate groundwater supply from volcanic aquifer units on St Helena with the successful drilling of ten exploratory wells. Connect Project Managers.
- Dias versus Petropolus and Others, Camps Bay, Cape Town, South Africa (2017-2019) Expert Witness in the Cape Town High Court. Technical evaluation related to removal of lateral support and subsequent damage to property. Land mark case in South African property law was judged in favour of the plaintiff with costs.
- Contermanskloof 100 ML reservoir, Cape Town, South Africa (2014-2016). Project leader for geotechnical investigations and ground engineering of concrete reservoir. Client: City of Cape Town.
- Sir Lowry's Pass Bulk Sewer, Somerset West, South Africa (2015) Project leader. Geotechnical investigation of bulk sewer. Client: City of Cape Town.
- FNB Offices, Bloemfontein, Free State, South Africa (2014): Project leader. Geotechnical investigation for multi-storey office block with deep basement, including piling design and lateral support measures. Client: GNG Family Trust Group.

- Firgrove Rolling Stock Depot, Cape Town, Western Cape, South Africa (2014): Project leader. Geotechnical investigations of existing structures and heavy crane gantries for refurbishment and extension to rolling stock repair depot. Client: PRASA.
- Cape Flats 3 Bulk Sewer, Cape Town, South Africa.(2013) Project leader. Geotechnical investigation of bulk sewer. Client : City of Cape Town.
- Labadi Beach Hotel, Accra, Ghana, Africa (2010): Project leader. Geotechnical investigation for beachside hotel and resort development. Client: Constant Capital
- Maputo Waterfront, Mozambique, Africa (2010): Project leader. Geotechnical investigations for multi-storey structures with deep basements for beachfront development. Client: CR Holdings.
- Cape Town Stadium, Cape Town, Western Cape, South Africa (2006-2010): Project Leader. Geotechnical discipline responsible for all ground engineering and remediation of contaminated land for the 2010 FIFA World Cup Stadium and Green Point Urban Park. Including quality assurance of all foundations and bulk earthworks. Client: City of Cape Town.
- SARC Khayelitsha Rail, Cape Town, Western Cape, South Africa (2005): Project leader Detailed in-situ testing to determine elastic modulus and compressibility of carbonate sands for founding road over rail bridges. Client: SARC.
- Garden Route Shopping Mall, George, Western Cape, South Africa (2004): Project leader. Geotechnical investigation of foundation conditions, piling specifications and earthworks for regional shopping centre. Client: Arcus Gibb.
- Sonangol Headquarter Building, Luanda, Angola, Africa (2000-2001): Project leader. Geotechnical investigation and design of piled foundations for a 20 storey building with a deep basement. Client: Sonangol.
- US Consulate Steenberg, Cape Town, Western Cape, South Africa (2001-2005): Project leader. Preliminary geotechnical and environmental site investigation and site geologist for detailed geotechnical investigation and construction supervision of new office building foundations and earthworks, including driven cast in-situ piles. Client: US OBO and Hensel Phelps.
- Century City, Cape Town, Western Cape, South Africa (1995-2001): Project leader. Geotechnical investigations for site planning and specific investigations and foundation design specifications for Theme Park, various office buildings and associated infrastructure. Client: Monex.

Marine Geotechnical

- Port of Pemba Oil and Gas Hub, Mozambique, Africa (2014): Project leader. Geotechnical investigations, including onshore and offshore drilling and testing. Design review of geotechnical aspects of quaywall design and reclamation works. Client: ENILS.
- Port of Walvis Bay, North Port Expansion, Namibia, Africa (2013-2014): Geotechnical review consultant for port expansion projects, including offshore and onshore geotechnical drilling investigations and assessment of sediment quality for offshore disposal. Client: Namport.
- Port of Durban – Bayhead, Durban, KwaZulu-Natal, South Africa (2014): Project Leader. Geotechnical investigation for waste handling facilities. Client: Transnet National Ports Authority (TNPA).
- Port of Durban Pier 1 Phase 2, Durban, KwaZulu-Natal, South Africa (2012): Geotechnical review consultant. Geotechnical review of foundation conditions. Client: Transnet National Ports Authority (TNPA).

- Port of Walvis Bay, Container Terminal EPC, Nambia, Africa (2009-2016): Geotechnical review consultant. Design and construction of container terminal. Client: Namport.
- Port of Ngqura, Ore Terminal Feasibility Study, Coega, Eastern Cape, South Africa (2007-2008): Project Leader. Onshore geotechnical drilling and geophysical investigation of foundation conditions for quay walls and dredgeability of a deep water industrial harbour. Client: Portnet.

ROBERT LEYLAND, Ph.D., M.Sc.

Principal Consultant & Engineering Geologist, Environment & Energy

YEARS WITH THE FIRM

5

YEARS TOTAL

12

PROFESSIONAL QUALIFICATIONS

Pri.Sci.Nat (South Africa)

AREAS OF PRACTICE

Geotechnical foundation investigations

Geological pavement material investigations

Engineering Geology assessments

Soil and groundwater contamination investigations

LANGUAGES

English

Afrikaans

CAREER SUMMARY

An engineering and environmental geologist, Robert Leyland, has worked in both consulting and research environments for 12 years. During this time he gained field experience by performing mapping, geotechnical, geological and hydrogeological investigations and project management as a project leader. His fields of experience include investigations for large commercial developments, geological pavement material investigations, pipeline and shallow foundation investigations, aquifer exploration and vulnerability mapping.

EDUCATION

Doctor of Philosophy, Mining, Geological and Geophysical Engineering, University of Arizona	2014
Master of Science, Environmental and Engineering Geology, University of Pretoria, South Africa	2008
Bachelor of Science (Honours), Environmental and Engineering Geology, University of Pretoria	2006
Bachelor of Science, Environmental and Engineering Geology, University of Pretoria, South Africa	2005

PROFESSIONAL MEMBERSHIPS

South African Council for Natural Scientific Profession, Professional Natural Scientist – Geological Science	SACNASP
South African Institute for Engineering and Environmental Geologists	SAIEG
Association of Engineering Geologists	AEG

PROFESSIONAL EXPERIENCE

Geotechnical investigations

— Geotechnical Investigation for the detailed engineering design for the rehabilitation of Kolongo Landfill, Bangui, Central African Republic (2020). Geotechnical Investigation Lead. Geotechnical investigation including on site rotary percussion drilling, regional soil profiling, groundwater investigation and capping material assessment. Client: UNOPS.

— Geotechnical Investigation for the proposed upgrades of Port Victotia Quay, Mahe, Seychelles (2019): Geotechnical Investigation Lead. Comprehensive geotechnical investigation including seismic surveys, core drilling and offshore sediment sampling. Client: Seychelles Port Authority / Project Planning & Management (Ltd).

— Geotechnical investigation at Mananga Weir in the Komati River, Mananga, eSwatini (2019): Geotechnical Investigation Lead. Core drilling and sediment sampling from floating river barge. Client: Climate Resilient Infrastructure Development Facility (CRIDF).

— Geotechnical Investigation for Biomass Power Plant development in Northern Namibia (2019). Geotechnical Investigation Lead. Comprehensive geotechnical investigation including gravity surveys, electrical resistivity surveys, core drilling and trial pitting. Client: Nampower / Burmeister & Partners (Pty) Ltd.

— Geotechnical Investigation of Proposed Brewery Site, Marracuene, Mozambique (2018): Project manager and lead consultant. Comprehensive geotechnical investigation including trial pitting, core drilling and on site testing. Client: AB InBev.

- Geotechnical Investigation for the development of a munitions storage facility in Bouar, Central African Republic (2018): Project manager and lead consultant. Comprehensive geotechnical investigation including trial pitting and laboratory testing. Client: United Nations Mine Action Services (UNMAS).
- Deep foundation and basement investigation for proposed hotel development in Cape Town city (2018): Project manager and lead consultant. Comprehensive geotechnical investigation including seismic survey, trial pitting and core drilling. Client: Growth Point Properties Limited.
- Shallow and deep foundation conditions at proposed site of desalination plant, Bluff, Durban (2017): Project manager and lead consultant. Comprehensive geotechnical investigation including GPR surveys, trial pitting and core drilling. Client: Hitachi / WSP Coastal Engineering.
- Sinkhole investigation under rail loading terminal, Mpumalanga (2016): Project manager and lead consultant. Forensic investigation into the cause of the development of a sinkhole within the SACE Rapid Loading Terminal near Emalahleni, Mpumalanga using ground penetrating radar. Client: WSP Development, Transport and Infrastructure.
- Slope stability and foundation assessment, Bloemfontein (2016): Project manager and lead consultant. Geotechnical slope stability and foundation analysis of proposed development on Naval Hill, Bloemfontein including core drilling, sampling, testing and slope stability modelling. Client: WSP Transport and Infrastructure.
- Geotechnical Investigation for proposed school development, Retreat, Cape Town (2016): Project manager and lead consultant. Shallow foundation and geotechnical investigation of proposed site for LSEN school development, Retreat, Cape Town. Client: Gibb (Pty) Ltd.
- Geotechnical Investigation for proposed school development, Sir Lowry's Village, Western Cape (2016): Project manager and lead consultant. Shallow foundation and geotechnical investigation of proposed site for Sir Lowry's Pass Secondary School development, Sir Lowry's Village, Cape Town. Client: Gibb (Pty) Ltd.
- Bulk Water Pipeline Investigation, Gansbaai (2016): Project manager and lead consultant. Geotechnical investigation for upgrading of the bulk water supply to Gansbaai. Client: Bigen Africa Services (Pty) Ltd.
- Proposed Fuel Station investigation, Modderfontein (2016): Project manager and lead consultant. Geotechnical Investigation of proposed new Fuel Station development. Client: Engen / WSP Civils.
- Phase 2 geotechnical investigation of Highbury Phase 3 Low Cost Housing development (2016): Project manager and lead consultant. Phase 2 geotechnical investigation of low cost housing development in Highbury, Kuils River, Cape Town. Client: Power Construction.
- Geotechnical foundation conditions for proposed Kommetjie Extension (2016): Project manager and lead consultant. Geotechnical investigation at proposed extension to Kommetjie residential area. Client: Gibb (Pty) Ltd.
- Geotechnical conditions along Belhar CBD Bulk Water Pipeline, Cape Town (2016): Project manager and lead consultant. Geotechnical investigation along Belhar large diameter water pipeline. Client: Bigen Africa.
- Geotechnical foundation conditions at Wierda Valley, Sandton (2016): Project manager and lead consultant. Geotechnical investigation at proposed

construction site to determine foundation conditions. Client: Group 5 Engineering.

- Geotechnical foundation conditions for Delft High School, Delft, Cape Town (2016): Project manager and lead consultant. Geotechnical investigation at proposed construction site to determine foundation conditions. Client: Gibb (Pty) Ltd.
- Geotechnical investigation for Tyre Feed Scheme and Cement Mill Upgrade, De Hoek, Western Cape, South Africa (2015): Project manager and lead consultant. Geotechnical investigation at existing cement plant for development of large-scale plant upgrades. Client: PPC De Hoek.
- Geotechnical and sinkhole Investigation, Mpumalanga, South Africa (2015): Geotechnical investigation leader. Geophysical survey and ground truthing of potential subsurface erosion features for use in infrastructure stability assessments. Client: Eskom.

Pavement Material Investigations

- Drilling investigation of potential dolerite quarry in Flagstaff area, Eastern Cape (2016). Drilling investigation to delineate dolerite intrusion dimensions and potential use of material as concrete aggregate. Client: SMEC.
- Evaluation of quarry rock suitability, Lesotho, Africa (2015): Project Leader. Mapping and sampling of extended quarry pit walls, stockpiles and road layers. Client: CMC Di Ravenna - Lesotho Branch.
- Evaluation of salt deposits on G1 base course from Qwa Qwa quarry, Harrismith, South Africa (2014): Project Leader. Road and quarry investigation to determine the severity and source of salt deposits developing from crushed stone base course. Client: DMV Consultants.
- Identifying factors producing observed variations, from expected quarry rock properties, Lesotho, Africa (2013): Project Leader. Mapping and sampling of extended quarry pit walls and muck piles to identify causes of poor material properties. Client: Roughton Gabarone.
- Investigation into possible causes of bleeding on sections of road P16/1, Vrede, South Africa (2012): Project leader. Sampling and comprehensive testing of road base aggregates to determine reasons for pavement failures developed during construction. Miletus Engineering.
- Variability of Basic Igneous Rock Road Aggregate Properties within Quarries, Lesotho, Africa (2012): Project Leader. Detailed sampling and testing of geological and geotechnical properties of potential crushed rock aggregate quarries in Lesotho. Client: Roughton Gabarone.

Specialized construction investigations

- Investigation into use of intelligent compaction as a possible quality control tool and general compaction process aid, Bethal, South Africa (2012-2013): Project Leader. Construction monitoring and planning combined with routine and novel pavement layer testing to determine the correlation between traditional and new pavement layer property testing results. Client: South African National Roads Agency Limited (SANRAL).

Soil and groundwater contamination investigations

- Waste landfill facility closure assessment, Newcastle (2017). Project manager and lead consultant. Waste material quantification, classification and waste capping assessment. Client: Silicon Technologies (Pty) Ltd.
- Soil contamination baseline assessment for the potential presence of petroleum hydrocarbons and lead within shallow soils underlying a tank farm in Paarden Eiland, Cape Town (2016). Project manager and lead consultant.

Groundwater and soil sampling, analysis and contamination assessment. Client: FFS Refiners (Pty) Ltd

— Soil contamination assessment at hydrocarbon solvent blending and lube oil, storage depo, Epping, Cape Town (2016). Project manager and lead consultant. Soil sampling, analysis and contamination assessment. Client: Engen Petroleum Ltd

Hydrogeological Investigations

— Hydrogeological assessment and development of proposed desalination plant site, Bluff, Durban (2017): Project manager and lead consultant. Characterization of hydrogeology, assessment of potential well sites and development and testing of water supply well for a proposed desalination plant. Client: Hitachi/WSP Coastal Engineering.

— Assessment and exploration for deep aquifer water supply wells, St Helena Island (2017): Project manager. Assessment of St Helena deep aquifers with respect to water supply potential followed by exploration drilling at selected locations to provide preliminary assessment of water supply well development feasibility. Client: Connect St Helena.

AWARDS

Excellence award presented by South African Institute of Environmental and Engineering Geologists	2008
Academic Honorary Colours, University of Pretoria	2005, 2006, 2008

PUBLICATIONS AND PRESENTATIONS

Publications

— Leyland R.C., Witthüser K.T. and van Rooy J.L. 2008. Vulnerability mapping in karst terrains, Exemplified in the Wider Cradle of Humankind World Heritage Site. WRC Report No. KV 208/08. Water Research Commission, Pretoria.

— Leyland, R.C. and Witthüser, K.T. 2008. Regional description of the groundwater chemistry of the Kruger National Park. WRC Report No. KV 211/08. Water Research Commission, Pretoria.

— Leyland, R.C. and Witthüser, K.T. 2010. VUKA: a modified COP vulnerability mapping method for karst terrains in South Africa. Quarterly Journal of Engineering Geology and Hydrogeology, 43, 107-116.

— Leyland, RC, Paige-Green, P and Momayez, M., 2013. Development of the road aggregate test specifications for the modified ethylene glycol durability index for basic crystalline materials. Journal of Materials in Civil Engineering, 26(7).

— Leyland, RC, Verryn, S and Momayez, M., 2014. Smectite clay identification and quantification as an indicator of basic igneous rock durability. Bulletin of Engineering Geology and the Environment. DOI 10.1007/s10064-014-0669-6.

— Leyland, RC. A Case Study of Intelligent Compaction Used in Road Upgrades. Engineering Geology for Society and Territory, 7 Education, Professional Ethics and Public Recognition of Engineering Geology, 2014, pp 201-206.

— Leyland, RC. Some Variations in Petrography of South African Karoo Dolerites and the Effects Thereof on Aggregate Properties. Engineering Geology for Society and Territory, 5 Urban Geology, Sustainable Planning and Landscape Exploitation, 2015, pp 65-70.

— Leyland, RC, Momayez, M. and van Rooy, J.L., 2016. The identification and treatment of poor durability Karoo dolerite base course aggregate –

evidence from case studies. Journal of the South African Institute of Civil Engineering. Vol. 58, No 1, pp 26-33.

Presentations

- Leyland, R.C. and McStay, L. 2016. Geological investigations for the future expansion of the SADC Gateway Port of Walvis Bay, Namibia: influence of terrestrial and marine sedimentology on Port development. 35th International Geological Congress, ICC Cape Town, August 2016,
- Leyland, R.C., Witthüser, K.T. and van Rooy, J.L. 2006. Vulnerability mapping in the Cradle of Humankind World Heritage Site. Proceedings of the 8th conference on limestone hydrology. Neuchatel, Switzerland, pp 173-178.
- Leyland, R.C. and Schneider, M. 2009. Regional Description of the Groundwater Chemistry of the Kruger National Park (KNP) using Multivariate Statistics. Fourth Biennial Groundwater Conference, Somerset West. 15-18 November 2009
- Leyland, R.C. The development of a strategic slope management system for use in South Africa. In, Williams, A.L., Pinches, G.M., Chin, C.Y., McMorran, T.J. and Massey, C.I. (Eds.). Geologically Active. Proceedings of the 11th IAEG Congress, Auckland, New Zealand, 5-10 September, 2010, pp 1265-1277.
- Leyland, R and Paige-Green, P., 2011. A simple slope hazard management system for the South African Primary Road Network. 8th International Conference on Managing Pavement Assets, Santiago, Chile, November, 2011.
- Leyland, R.C, 2014. A case study of intelligent compaction used in road upgrades. 12th IAEG Congress, Turino, Italy, 15-19 September 2014.
- Leyland, R.C, 2014. Some variations in petrography of South African Karoo Dolerites and the effects thereof on aggregate properties. 12th IAEG Congress, Turino, Italy, 15-19 September 2014.

THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Robert Clive Leyland
Registration number: 400078/09

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Geological Science **13 May 2009**

13 May 2009		
Pretoria	President	Chief Executive Officer

B IMPACT ASSESSMENT METHODOLOGY

Impact Assessment Methodology

Note from the CSIR: The following impact assessment must be used to assess the potential impacts and significance thereof.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
  - *Positive - environment overall will benefit from the impact/risk;*
  - *Negative - environment overall will be adversely affected by the impact/risk; or*
  - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
  - *Site specific;*
  - *Local (<10 km from site);*
  - *Regional (<100 km of site);*
  - *National; or*
  - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
  - *Very short term (instantaneous);*
  - *Short term (less than 1 year);*
  - *Medium term (1 to 10 years);*

    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
    - *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
    - *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
    - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
    - *Moderate reversibility of impacts;*
    - *Low reversibility of impacts; or*
    - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
    - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
    - *Moderate irreplaceability of resources;*
    - *Low irreplaceability of resources; or*
    - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
    - *Extremely unlikely (little to no chance of occurring);*
    - *Very unlikely (<30% chance of occurring);*
    - *Unlikely (30-50% chance of occurring)*
    - *Likely (51 – 90% chance of occurring); or*
    - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1).

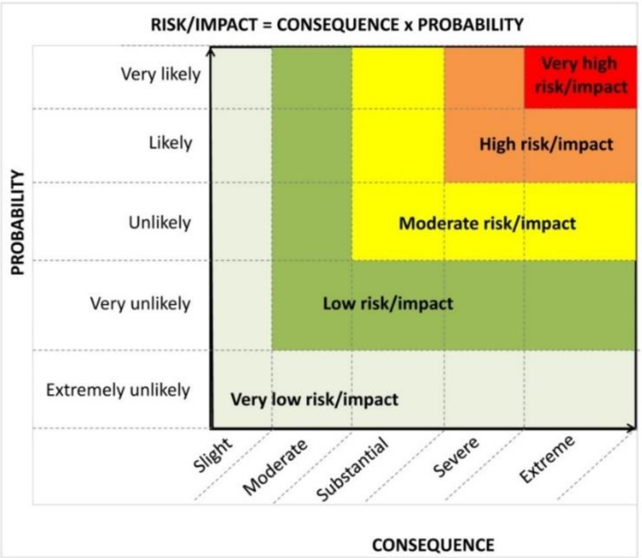

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*

- *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
- *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

C SPECIALIST DECLARATION OF INTEREST

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

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

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

PROJECT TITLE

Basic Assessment for the proposed power line and associated electrical infrastructure to support the proposed Komas Wind Energy Facility near Kleinsee in the Northern Cape Province: Geotechnical Impact Assessment

Kindly note the following:

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

Departmental Details

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

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

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

MARNAY SHERRISA ANDERSON
Commissioner of Oaths
HR Professional (HRP)
Member number: 58676109
Cape Town
Western Cape
8001
SABPP™ SA BOARD FOR PEOPLE PRACTICES Setting HR standards

1. SPECIALIST INFORMATION

Specialist Company Name:	WSP Environmental (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%
Specialist name:	Robert Leyland			
Specialist Qualifications:	BSc, BSc (Hons), MSc, PhD.			
Professional affiliation/registration:	SACNASP, Pri Sci Nat.			
Physical address:	1st floor, the Paviliion, Waterfront, Cape Town			
Postal address:	PO BOX 98867, SLOANE PARK, 2152			
Postal code:	8001	Cell:	0828211157	
Telephone:	021 481 8663	Fax:		
E-mail:	Robert.Leyland@wsp.com			

2. DECLARATION BY THE SPECIALIST

I, ______________ Robert Leyland ____________________, declare that –

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

Signature of the Specialist

WSP Environmental (Pty) Ltd

Name of Company:

5/1/2021

Date

MARNAY SHERRISA ANDERSON
Commissioner of Oaths
HR Professional (HRP)
Member number: 58676109
Cape Town
Western Cape

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3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _______ Robert Leyland __________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

WSP Environmental (Pty) Ltd

Name of Company

5/1/2021

Date

Signature of the Commissioner of Oaths

05/01/2021

Date

MARNAY SHERRISA ANDERSON
Commissioner of Oaths
HR Professional (HRP)
Member number: 58676109
Cape Town
Western Cape
8001
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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessment for the proposed Komas Wind Energy Facility and associated infrastructure near Kleinsee in the Northern Cape Province: Geotechnical Impact Assessment

Kindly note the following:

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

Departmental Details

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

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

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

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1. SPECIALIST INFORMATION

Specialist Company Name:	WSP Environmental (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%
Specialist name:	Robert Leyland			
Specialist Qualifications:	BSc, BSc (Hons), MSc, PhD.			
Professional affiliation/registration:	SACNASP, Pri Sci Nat.			
Physical address:	1st floor, the Paviliion, Waterfront, Cape Town			
Postal address:	PO BOX 98867, SLOANE PARK, 2152			
Postal code:	8001	Cell:	0828211157	
Telephone:	021 481 8663	Fax:		
E-mail:	Robert.Leyland@wsp.com			

2. DECLARATION BY THE SPECIALIST

I, ___Robert Leyland__________, declare that –

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

Signature of the Specialist

WSP Environmental (Pty) Ltd

Name of Company:

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