Agriculture

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Agricultural assessment of the slightly amended corridor for the project: proposed construction and operation of a Radio Mast, 132kV powerline and 400kV loop in loop out (lilo) powerline located near Dealesville in the Free State Province

1 Introduction

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of one (1) Radio Mast, two (2) x 400kV powerlines and one (1) x 132kV powerline that will connect to the authorised 132kV/400kV Main Transmission Substation (MTS) (14/12/16/3/3/1/2460/AM1) as well as to the approved 100MW Kentani Solar Photovoltaic (PV) Energy Facility (14/12/16/3/3/2/724/AM3) respectively. The Kentani Solar PV Energy Facility is one (1) of eleven (11) solar PV projects collectively known as the Kentani Cluster located near the town of Dealesville, within the Tokologo Local Municipality (Lejweleputswa District) in the Free State Province.

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)].

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, namely Gwede Mantashe, announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities, collectively referred to as the "Kentani Cluster", received Preferred Bidder status i.e.:

- Kentani Solar PV (14/12/16/3/3/2/724/AM3)
- Sonoblomo Solar PV (14/12/16/3/3/2/723/AM2)

- Klipfontein Solar PV (14/12/16/3/3/2/722/AM2)
- Klipfontein 2 Solar PV (14/12/16/3/3/2/726/1/AM1)
- Leliehoek Solar PV (14/12/16/3/3/2/728/AM2)
- Braklaagte Solar PV (14/12/16/3/3/2/727/1)

These Solar Energy Facilities have now become Strategic Infrastructure Projects (SIPs) i.e., SIPs 8 and 10, which target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The approved MTS and associated infrastructure will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the 132kV/400kV MTS development footprint and the 132kV and 400kV corridors (in which the respective powerlines and radio mast which form part of this application / BA process would be situated) were granted authorisation by the DFFE in April 2022 (DFFE Reference Number: 14/12/16/3/3/1/2460/AM1). However, due to technical consideration, the approved 132kV and 400kV corridors are not suited to connect the approved MTS to the National grid nor the authorised Kentani Solar PV (DFFE Reference Number: 14/12/16/3/3/2/724/AM3) to the MTS, and as such additional small portions of the corridors are required to be assessed to accommodate the technical changes.

The powerlines are located within the Kimberly Renewable Energy Development Zone (REDZ) (namely REDZ 4) and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The respective powerlines which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 700m in length) are being proposed and will connect the approved MTS (14/12/16/3/3/1/2460/AM1) to the existing Eskom 400kV powerline, located approximately west of the approved MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 5km in length) is being proposed and will connect the approved MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724/AM3), located approx. 4.85km north-west of the approved MTS site.
3. One (1) up to 90m radio mast will be built within the approved MTS footprint (14/12/16/3/3/1/2460/AM1).

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted).

It must be noted that the majority of the proposed powerlines being proposed are located within existing approved powerline corridors and that only small sections will traverse outside of the approved corridors:

- The portion of the 132kV powerline outside of an existing approved corridors and Eskom servitudes is approximately 700m
- The portion of the each of the 400kV powerlines outside of an existing approved corridors and Eskom servitudes is approximately 150m for one and 250m for the other

Further to the above, the proposed Radio Mast will be located on the approved MTS (14/12/16/3/3/1/2460/AM1).

Considering the above, it is important to note that the location of the corridors for the powerlines being proposed as part of this application have previously been assessed as part of the development footprint for the approved MTS and powerline corridors

(14/12/16/3/3/1/2460/AM1) as well as the Kentani Cluster of solar PV developments, each of which received their own EA in 2016[1].

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed powerline development may have an impact on the environment and trigger certain listed activities in Listing Notice 1 of the EIA Regulations, 2014 (as amended) (Government Notice No. 983, as amended). These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended). To inform the assessment, specialist studies are required.

Due to the fact that majority of the proposed powerline corridors have previously been assessed as part of approved developments (14/12/16/3/3/2/724/AM3 & 14/12/16/3/3/1/2460/AM1), a specialist motivational letter is justified and considered adequate for this assessment. Figure 1 shows the approved and amended layout of the project.

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

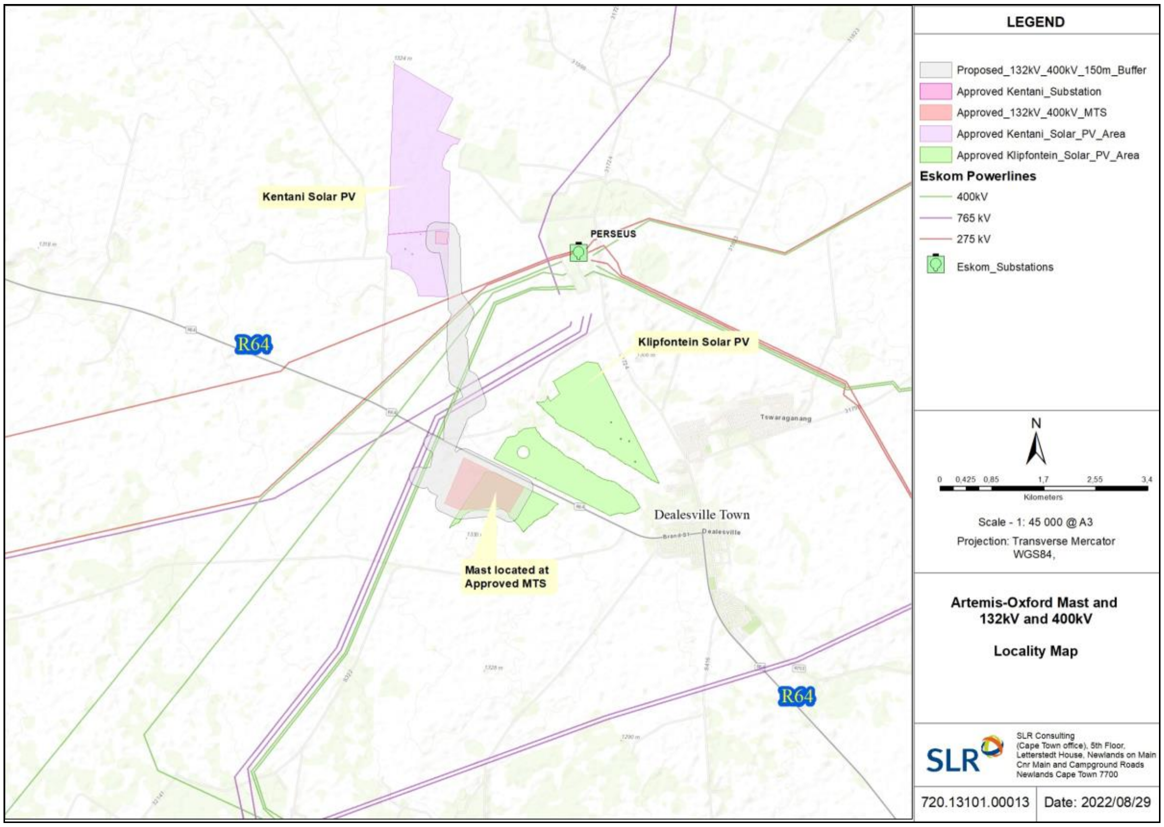

Figure 1. *Layout map of the project.*

2 Assessment

The agricultural impact of the approved project was assessed in the original assessment in October 2021 as very low. The power lines themselves have negligible impact and it is therefore only the footprint of the main transmission substation that contributed anything to that very low impact. The tiny changes that are now proposed to the corridor will make absolutely zero difference to that original assessment, absolutely zero difference to the nature or significance of any of the impacts originally assessed in it, absolutely zero difference to the mitigation measures for agricultural impacts that were recommended in it, and absolutely zero difference to the EMPr. There has been absolutely zero change to the baseline agricultural environment since the last assessment was undertaken in October 2021. Soils change over time scales of centuries, not time scales of months. In my specialist opinion, the requirement to assess this is a waste of time and resources that could be far more constructively allocated to more important environmental issues.

In conclusion, the development is still assessed as acceptable from an agricultural impact point of view, as it was 10 months ago, because absolutely nothing of any significance has changed. From an agricultural impact point of view, it is still recommended that the development be approved.

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22 August 2022

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SITE SENSITIVITY VERIFICATION
AND
AGRICULTURAL COMPLIANCE STATEMENT
FOR
PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Report by
Johann Lanz

27 October 2021

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EXECUTIVE SUMMARY

The key findings of this study are:

- The site has low agricultural potential because of soil and climate constraints and is therefore unsuitable for cultivated crop production. Agricultural land use is limited to grazing.
- The site has been assessed as being of medium agricultural sensitivity.
- Only one negative agricultural impact was identified, namely loss of agricultural potential by occupation of 64 hectares of land.
- The conclusion of this assessment is that the proposed development will have very low agricultural impact and will be acceptable in terms of its impact on the agricultural production capability of the site. This is substantiated by the fact that the loss is of agricultural land of low potential that is only suitable as grazing land.
- From an agricultural impact point of view, it is recommended that the development be approved.

1 INTRODUCTION

Environmental authorisation is being sought for the proposed construction and operation of the 132kv/400kv on-site main transmission substation (MTS) and associated infrastructure located near Dealesville in the Tokologo Local Municipality, Lejweleputswa District in the Free State Province (see location in Figure 1). In terms of the National Environmental Management Act (Act No 107 of 1998) (NEMA), an application for environmental authorisation requires an agricultural assessment, in this case an Agricultural Compliance Statement (see terms of reference, below).

Johann Lanz was appointed as an independent agricultural specialist to provide the Agricultural Compliance Statement. The objective and focus of an Agricultural Compliance Statement is to assess whether or not the proposed development will have an unacceptable agricultural impact or not, and based on this, to make a recommendation on whether it should be approved or not.

The aim of the protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources is to preserve valuable agricultural land for agricultural production.

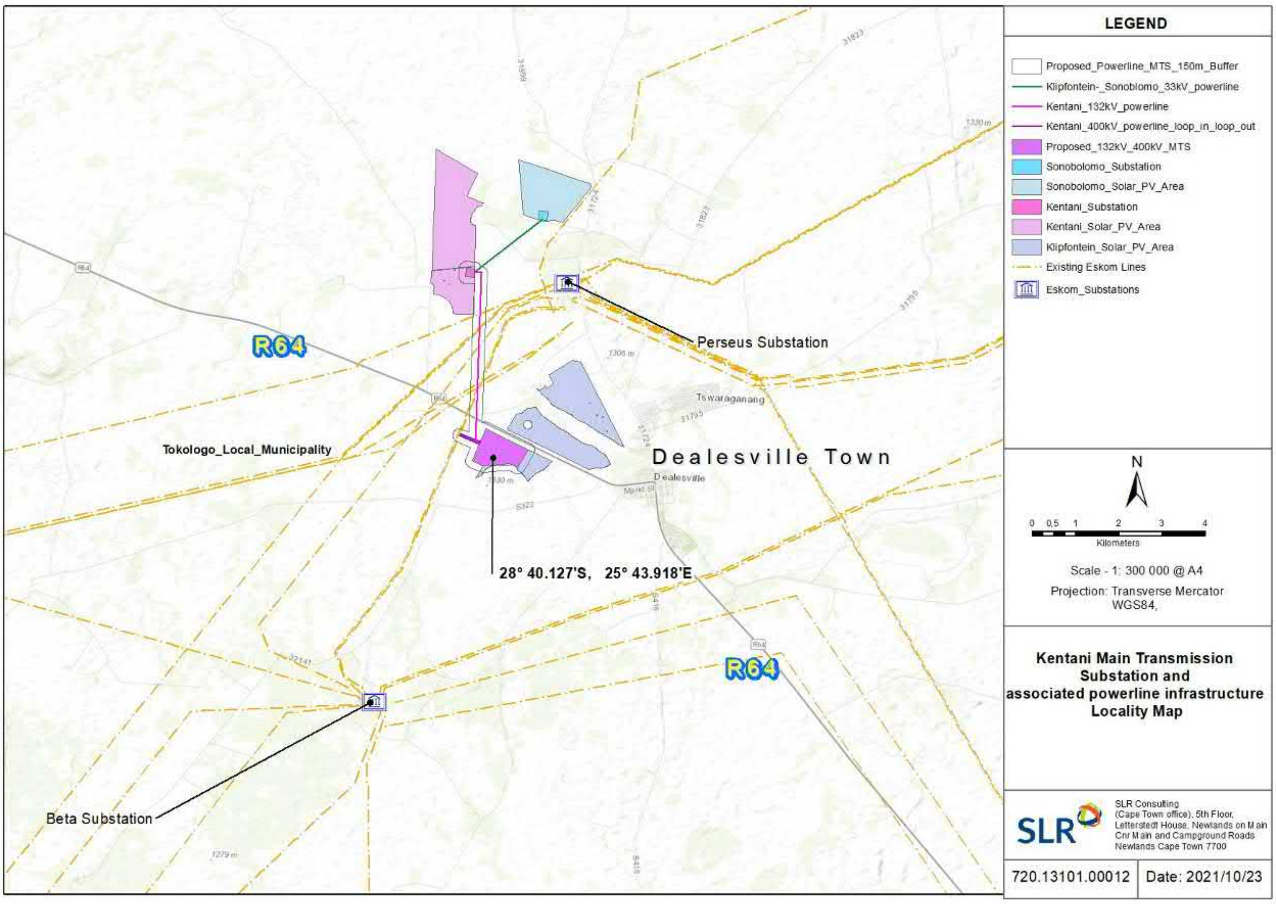

Figure 1: Locality map of the development, west of the town of Dealesville.

2 PROJECT DESCRIPTION

2.1 Project Location

The proposed project is located approximately 2,5km north-west of the town of Dealesville in the Tokologo Local Municipality, within the Lejweleputswa District Municipality of the Free State Province (as shown in Figure 1). The proposed project will be located on the following properties / farm portions:

- Remaining Extent of the Farm Klipfontein No. 305 (F00400000000030500000);
- The Farm Leliehoek No. 748 (F00400000000074800000);
- Remainder of the Farm Oxford No. 1030 (F00400000000103000000);
- The Farm Overschot No. 31 (F00400000000003100000);
- Portion 1 of the Farm Walkerville No. 1031 (F00400000000103100001)[1]; and
- Remainder of the Farm Walkerville No. 1031 (F00400000000103100000).

The proposed MTS and powerlines are located within the within the Kimberly Renewable Energy Development Zone (REDZ)[2] as well as the Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

In addition, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305. The eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] being proposed and assessed as part of this BA process (i.e., this application) fall outside of the authorised corridor.

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV

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[1] Property / farm portion traversed by proposed 33kv powerline which will connect to Kentani onsite substation (14/12/16/3/3/2/724). 33kV powerline does however not require authorisation.

[2] GN R 786 of 2020: Notice of Identification in Terms of Section 24(5)(a) and (b) ff The National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance.

- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

Considering the above, it is important to note that the location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

2.2 Project components

The proposed development involves the addition of one (1) MTS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route.
- An Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the

assessed site footprint

The proposed MTS will have a capacity of 132kV/400kV and will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m)).

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

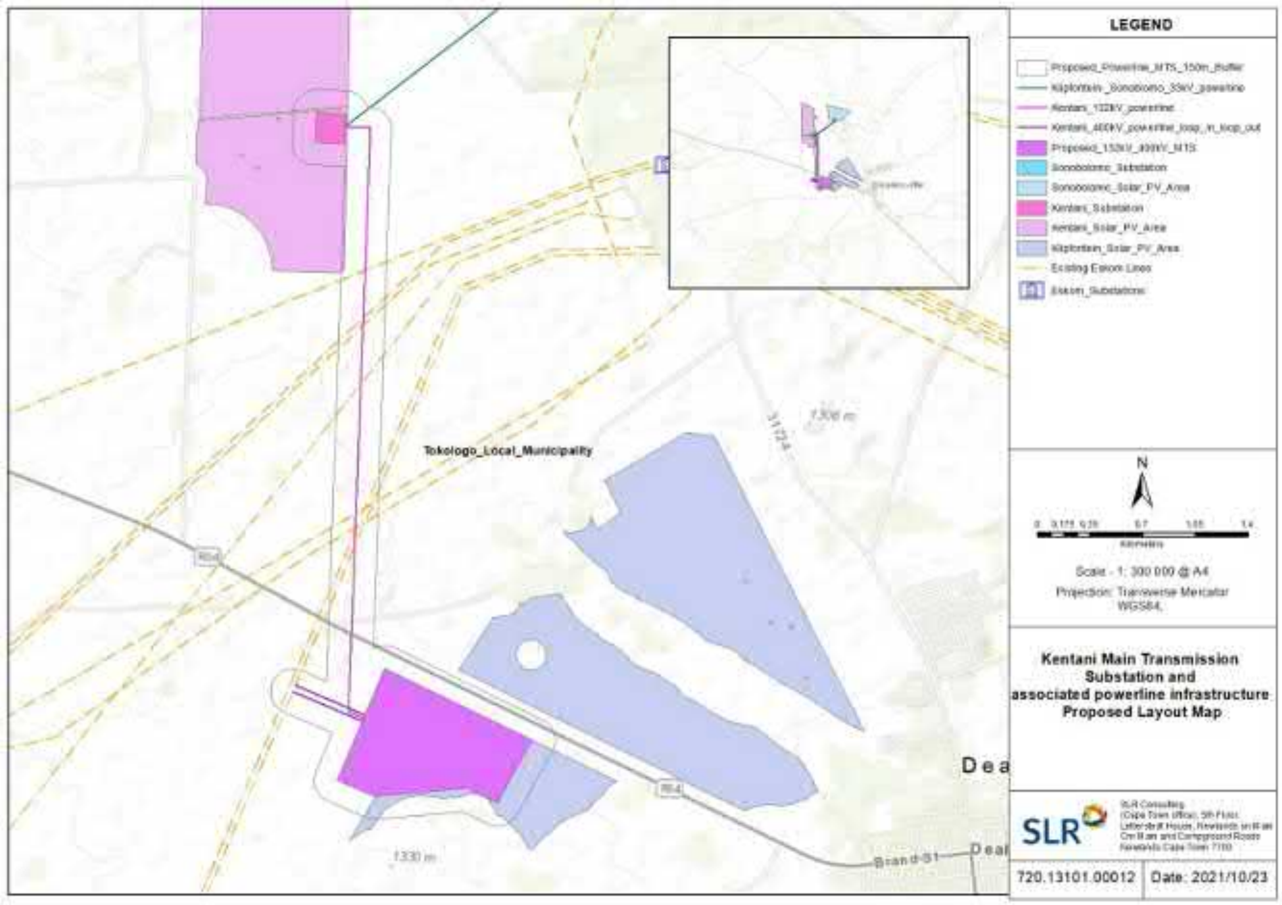
Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

2.3 Site Layout

The site layout for the proposed project makes provision for one (1) MTS location as well as one (1) powerline corridor routing for each of the associated proposed powerlines.. Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines, no site, layout or powerline corridor alternatives will be assessed.

Additionally, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), while the eight (8) 132kV powerlines which require re-routing are also located within the authorised corridor included as part of the authorised Kentani Cluster. The remaining two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.



The site layout being proposed is shown in Figure 2 below.

Figure 2. *Layout map of the proposed development.*

2.4 Alternatives

As mentioned, a comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout BESS technology alternatives or powerline corridor alternatives are therefore being considered and assessed.

With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.

The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor. The site proposed for the MTS and respective powerline corridors will however be assessed against the ‘**no-go’ alternative**. The ‘no-go’ alternative is the option of not constructing the project, where the *status quo* of the current activities on the project site would prevail.

3 LEGAL REQUIREMENT AND GUIDELINES

The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) requires that any long term lease associated with the renewable energy facility be approved by the National Department of Agriculture, Land Reform and Rural Development (DALRRD). The SALA consent is separate from the application for Environmental Authorisation, and needs to be applied for and obtained separately.

Power lines require the registration of a servitude for each farm portion crossed. In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), the registration of a power line servitude requires written consent of the Minister if the following two conditions apply:

- if the servitude width exceeds 15 metres; and
- if Eskom is not the applicant for the servitude.

If one or both of these conditions do not apply, then no agricultural consent is required. Eskom is currently exempt from agricultural consent for power line servitudes.

4 TERMS OF REFERENCE

The terms of reference for this study is to fulfill the requirements of the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources* gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The verified agricultural site sensitivity of the MTS is less than high. The level of agricultural assessment required in terms of the protocol for sites of less than high sensitivity is an Agricultural Compliance Statement. The power lines are linear activities and therefore also require only an Agricultural Compliance Statement.

The terms of reference for an Agricultural Compliance Statement, as stipulated in the protocol, are listed below, and the section number of this report which fulfils each stipulation is given after it in brackets.

1. The Agricultural Compliance Statement must be prepared by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP).
2. The compliance statement must:
   1. be applicable to the preferred site and proposed development footprint;
   2. confirm that the site is of “low” or “medium” sensitivity for agriculture (Section 6); and
   3. indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site (Section 8.7).
3. The Agricultural Compliance Statement must contain, as a minimum, the following information:
   1. details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the statement including a

curriculum vitae (Appendix 1);
2. a signed statement of independence by the specialist (Appendix 2);
3. a map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool (Figure 3);
4. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimize fragmentation and disturbance of agricultural activities (Section 8.5);
5. a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development (Section 8.7);
6. any conditions to which this statement is subjected (Section 10);
7. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase (Section 8.6);
8. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr (Section 9); and
9. a description of the assumptions made and any uncertainties or gaps in knowledge or data (Section 5).

5 METHODOLOGY OF STUDY

5.1 Methodology for assessing the agro-ecosystem

This report adheres to the process and content requirements of the gazetted agricultural protocol as outlined in Section 3 above. As per the requirement, the assessment was based on a desktop analysis of existing soil and agricultural potential data for the site.

The following sources of information were used:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries (DAFF). This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
- Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the DAFF, Pretoria.
- Field crop boundaries were sourced from Crop Estimates Consortium, 2019. *Field Crop Boundary data layer, 2019*. Pretoria. Department of Agriculture, Forestry and

Fisheries.
- Rainfall and evaporation data was sourced from the SA Atlas of Climatology and Agrohydrology (2009, R.E. Schulze) available on Cape Farm Mapper.
- Grazing capacity data was sourced from the 2018 DAFF long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

6 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

There are no specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

7 SITE SENSITIVITY VERIFICATION

In terms of the gazetted agricultural protocol, a site sensitivity verification must be submitted that:

1. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
2. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

Agricultural sensitivity, in terms of environmental impact, and as used in the national web-based environmental screening tool, is a direct function of the capability of the land for agricultural production. This is because a negative impact, or exclusion of agriculture, on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. The general assessment of agricultural sensitivity that is employed in the national web-based environmental screening tool, identifies all arable land that can support viable production of cultivated crops, as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable production of cultivated crops is much less of a priority to conserve for agricultural use, and is rated as medium or low agricultural sensitivity.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is cultivated or not. All cultivated land is classified as at least high sensitivity, based on the logic that if it is under cultivation, it is indeed suitable for cultivation, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for the production of cultivated crops, while lower values are only likely to be suitable as non-arable, grazing land, or at the lowest extreme, not even suitable for grazing.

A map of the development footprint of the MTS and power line corridor, overlaid on the screening tool sensitivity, is given in Figure 3. In the MTS area, none of the land is classified as cultivated land, and agricultural sensitivity is therefore purely a function of land capability. The land capability of the footprint varies from 4 to 9. Values of 4 to 5 translate to a low agricultural sensitivity, values of 7 and 8 translate to medium agricultural sensitivity, and values of 9 translate to high agricultural sensitivity. There are only a few, isolated pixels of high sensitivity within the footprints. The small scale differences in land capability (pixels) across the project area are not very significant and are more a function of how the land capability data is generated by modelling, than actual meaningful differences in agricultural potential on the ground. The pixels of 9 are the result of the particular land type on the site, Ae46, having, on average, a higher soil potential than other surrounding land types. It is the land type on which most of the cultivation in the area is located. However, there are also shallow, non-arable soils within the land type. The land type modelling does not distinguish between different soils within a land type, but basically returns an average for the land type, which is further modified by terrain within that land type. Non-arable soils in an environment such as this one can be identified as the areas that have never been cultivated. They have not been cultivated because they are not suitable for cultivation.

The climate of the site (low rainfall of approximately 432 mm per annum and high evaporation of approximately 1,555 mm per annum) proves the area to be very marginal for crop production. It is only on the best soils within the area that crop production is at all viable.

The land capability of the MTS area, with non-arable soils and marginal climate, should have a maximum land capability of 6 and should therefore be of medium agricultural sensitivity.

There is land classified as cultivated land within the powerline corridor and therefore indicated as high agricultural sensitivity. However, cultivation has long since been abandoned, probably because it was too marginal, and so that land should no longer be classified as cultivated or be high agricultural sensitivity. This is of little importance because the power lines would have no impact on cultivated land, anyway.

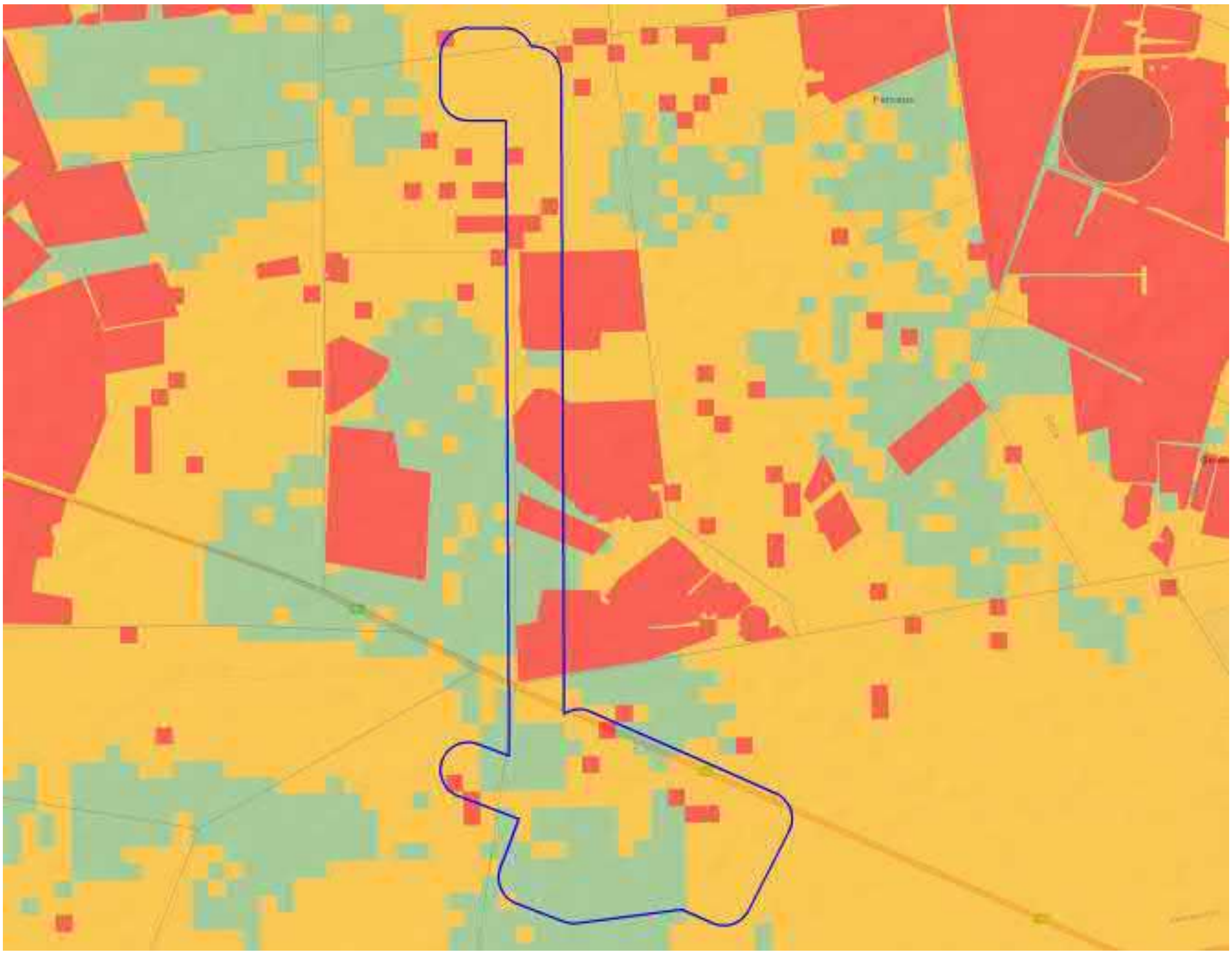


Figure 3. *The footprint within which the proposed development will be located (blue outline) overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high). The MTS will be located within the area to the south of the R64 road. The footprint north of that is the power line corridor (see layout map in Figure 2).*

Based on the above motivation, the high agricultural sensitivity, as identified by the screening tool, is disputed by this assessment. This site sensitivity verification verifies the entire site as being of less than high agricultural sensitivity. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement.

8 AGRICULTURAL LAND USE

The site is used only as grazing land.

9 ASSESSMENT OF AGRICULTURAL IMPACT

9.1 Impact identification and discussion

The focus and defining question of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or potential future agricultural production. The significance of an impact is therefore a direct function of the degree to which that impact will affect current or potential future agricultural production. If there will be no impact on production, then there is no agricultural impact.

It is important to consider the scale at which the significance of an impact is assessed. An agricultural impact equates to a temporary or permanent change in agricultural production potential of the land. The change in production potential of a farm or significant part of a farm will obviously always be highly significant at the scale of that farm, but may be much less so at larger scales. This assessment considers a regional and national scale to be the most appropriate one for assessing the significance of the loss of agricultural production potential.

The exact nature of the different infrastructure within a development has very little bearing on the significance of agricultural impacts. Whether the footprint comprises a solar panel, a road or a substation is largely irrelevant to agricultural impact. What is of most relevance is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land. Powerlines have negligible agricultural impact because all agricultural activities that are viable in this environment, can continue completely unhindered underneath powerlines. This includes a service track under the powerline which will also have minimal impact. The direct, permanent, physical footprint of a power line that has any potential to interfere with agriculture, is of very limited extent and therefore entirely insignificant within this agricultural environment.

Only a single agricultural impact has been identified by this assessment, namely:

- **Loss of agricultural potential by occupation of land** - Agricultural land directly occupied by the development infrastructure, that is the approximately 64 hectares of the MTS, will become unavailable for agricultural use, with consequent potential loss of agricultural productivity. This impact is relevant only in the construction phase. No further loss of agricultural land use occurs in subsequent phases.

9.2 Cumulative impacts

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

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

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of agricultural land, with a consequent decrease in agricultural production. The defining question for assessing the cumulative agricultural impact is this:

> What level of loss of agricultural land use and associated loss of agricultural production is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

DFFE requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

DFFE compliance for this project requires considering all renewable energy projects within a 30 km radius. There are 22 such solar PV projects (see Appendix 3).

Solar PV projects are all located on land that is not suitable for cultivation. In quantifying the cumulative impact, the area of such land taken out of agriculture as a result of these 22 projects plus this one, (total generation capacity of 2,000 MW) will amount to a total of approximately 5,025 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 1.78% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land that is only suitable for grazing, of which there is no scarcity in the country. This is particularly so when considered within the context of the following point:

In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land which has no cultivation potential, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are far higher in this region than in regions with higher agricultural potential.

There are no significant other land uses, apart from renewable energy, that are competing for agricultural land in the area, and so the total cumulative loss of agricultural land from all competing land uses is not significantly higher than what has been considered above.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

9.3 Comparative assessment of alternatives

A comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout or powerline corridor alternatives are therefore being considered and assessed.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.

9.4 Impacts of the no-go alternative

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There is no agricultural impact of the no-go option and the development involves a loss of 64 hectares of agricultural land, so from an isolated agricultural land loss perspective, the no-go is the preferred option. However, the no-go would prevent the proposed development plus the dependent renewable energy developments from contributing to the environmental, social and economic benefits associated with the development of renewable energy in the area.

9.5 Micro-siting to minimize fragmentation and disturbance of agricultural activities

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. However, the agricultural uniformity and low potential and the nature of the agricultural impact mean that the exact positions of all infrastructure will not make any material difference to agricultural impacts.

9.6 Confirmation of linear activity impact

The protocol provision of a linear impact confirmation only makes sense when the requirement for an Agricultural Compliance Statement is based on the fact that the development is a linear activity. In this case the medium agricultural sensitivity determines that an Agricultural Compliance Statement suffices, anyway, even for non-linear activities.

9.7 Impact assessment and statement

Although an Agricultural Compliance Statement is not required to formally rate agricultural impacts, it is hereby confirmed that the agricultural impact of the proposed development is very low. An Agricultural Compliance Statement is only required to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site. It must provide a substantiated statement on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development.

The conclusion of this assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the following points:

- The agricultural footprint of the proposed development will occupy land that is of limited land capability and is not suitable for the production of cultivated crops. There is not a scarcity of such agricultural land in South Africa and its conservation for agriculture is not therefore a priority.
- The location of the MTS and BESS is in keeping with the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.

- Powerlines have insignificant agricultural impact in the agricultural environment of the project.

Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

10 ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

There are no additional mitigation measures required, over and above what has already been included in the Generic EMPr for overhead electricity transmission and distribution infrastructure as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.

11 CONCLUSIONS

The site has low agricultural potential because of soil and climate constraints and is therefore unsuitable for cultivated crop production. Agricultural land use is limited to grazing. The site has been assessed as being of medium agricultural sensitivity.

Only one negative agricultural impact was identified, namely loss of agricultural potential by occupation of 64 hectares of land.

The conclusion of this assessment is that the proposed development will have very low agricultural impact and will be acceptable in terms of its impact on the agricultural production capability of the site. This is substantiated by the fact that the loss is of agricultural land of low potential that is only suitable as grazing land.

From an agricultural impact point of view, it is recommended that the development be approved.

The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions.

12 REFERENCES

Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

Crop Estimates Consortium, 2019. *Field Crop Boundary data layer, 2019*. Pretoria. Department of Agriculture, Forestry and Fisheries.

Department of Agriculture, Forestry and Fisheries, 2017. National land capability evaluation raster data layer, 2017. Pretoria.

Department of Agriculture, Forestry and Fisheries, 2002. National land type inventories data set. Pretoria.

Schulze, R.E. 2009. SA Atlas of Climatology and Agrohydrology, available on Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting Self employed 2002 - present

In the past 5 years of running my soil and agricultural consulting business, I have completed more than 120 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, urban, and agricultural developments. My regular clients include: Aurecon; CSIR; SiVEST; Arcus; SRK; Environamics; Royal Haskoning DHV; Jeffares & Green; JG Afrika; Juwi; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.

In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant Agricultural Consultors International (Tinie du Preez) 1998 - 2001

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist De Beers Namaqualand Mines July 1997 - Jan 1998

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

APPENDIX 2: 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

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Kindly note the following:

- 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.
- 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.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- 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.
- All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Private Bag X447, Pretoria, 0001
Physical address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Environment House, 473 Steve Biko Road, Arcadia
Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)			
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax? I don't	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, 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

Johann Lanz - Soil Scientist (sole proprietor)

Name of Company:

26/09/2021 MASIBULELE

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, 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

Johann Lanz - Soil Scientist (sole proprietor)

Name of Company

26/09/2021

Date

2136935-6

Signature of the Commissioner of Oaths

2021-09-2021

Date

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
WYNBERG
2021-09-26
STASIEBEVELVOEDER
WYNBERG
SOUTH AFRICAN POLICE SERVICE

APPENDIX 3: PROJECTS CONSIDERED FOR CUMULATIVE IMPACT ASSESSMENT

List of projects considered for cumulative impact assessment.

1. 100 MW Kentani PV - 14/12/16/3/3/2/724
2. 100 MW Klipfontein PV - 14/12/16/3/3/2/722
3. 100 MW Braklaagte PV - 14/12/16/3/3/2/727
4. 100 MW Meeding PV - 14/12/16/3/3/2/719
5. 100 MW Irene PV - 14/12/16/3/3/2/718
6. 100 MW Leliehoek PV - 14/12/16/3/3/2/728
7. 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
8. 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
9. 75 MW Braambosch PV - 14/12/16/3/3/2/725
10. 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
11. 75 MW Eksteen PV - 14/12/16/3/3/2/717
12. 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
13. Klipbult solar plant - 14/12/16/3/3/2/432
14. 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
15. 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
16. 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
17. 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853
18. 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
19. 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
20. 100 MW Visserpan solar photovoltaic facility project 2 - 14/12/16/3/3/1/2154
21. 100 MW Visserpan solar photovoltaic facility project 3 - 14/12/16/3/3/1/2155
22. 100 MW Visserpan solar photovoltaic facility project 4 - 14/12/16/3/3/1/2156

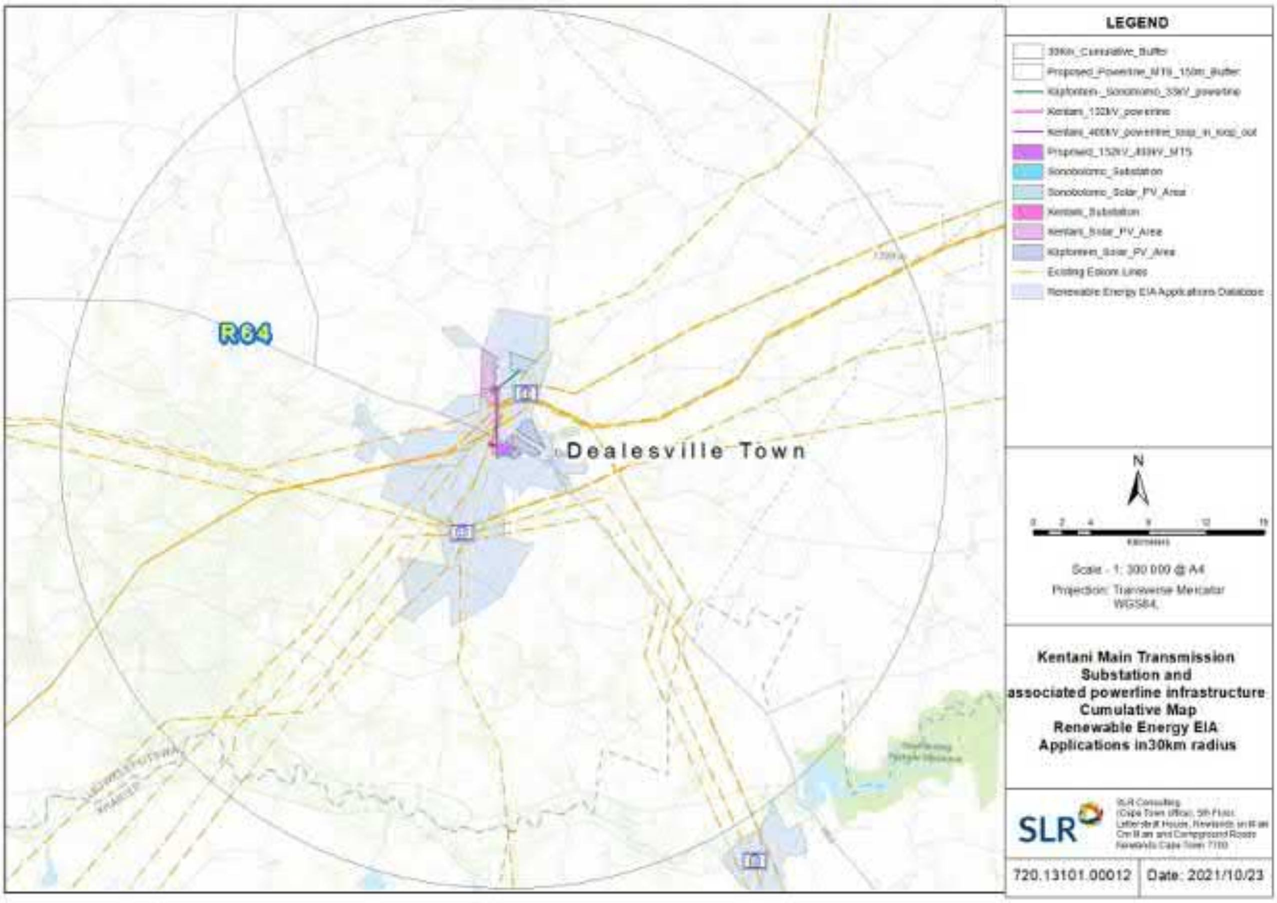


Figure 4. *Projects considered for cumulative impact assessment.*

Aquatic

EnviroSci (Pty) Ltd
Reg Number 2018/462716/07

Dr Brian Colloty
Ecologist (Pr Sci Nat 400268/07)
Member of the South African Wetland Society

Contact Details
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083 498 3299

Address
1 Rossini Rd
Pari Park
Gqeberha
6070

06 September 2022

To Whom It May Concern:

RE: AQUATIC SPECIALIST IMPACT ASSESSMENT REGARD THE PROPOSED CONSTRUCTION AND OPERATION OF A RADIO MAST, 132KV POWERLINE AND 400KV LOOP IN LOOP OUT (LILO) POWERLINE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Background to the Project

South Africa Mainstream Renewable Power Developments (Pty) Ltd (‘Mainstream’) is proposing the development of one (1) Radio Mast, two (2) x 400kV powerlines and one (1) x 132kV powerline that will connect to the authorised 132kV/400kV Main Transmission Substation (MTS) (14/12/16/3/3/1/2460/AM1) as well as to the approved 100MW Kentani Solar Photovoltaic (PV) Energy Facility (14/12/16/3/3/2/724/AM3) respectively. The Kentani Solar PV Energy Facility is one (1) of eleven (11) solar PV projects collectively known as the Kentani Cluster located near the town of Dealesville, within the Tokologo Local Municipality (Lejweleputswa District) in the Free State Province (Figure 1).

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)].

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, namely Gwede Mantashe, announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities, collectively referred to as the “Kentani Cluster”, received Preferred Bidder status i.e.:

- Kentani Solar PV (14/12/16/3/3/2/724/AM3)
- Sonoblomo Solar PV (14/12/16/3/3/2/723/AM2)
- Klipfontein Solar PV (14/12/16/3/3/2/722/AM2)
- Klipfontein 2 Solar PV (14/12/16/3/3/2/726/1/AM1)
- Leliehoek Solar PV (14/12/16/3/3/2/728/AM2)
- Braklaagte Solar PV (14/12/16/3/3/2/727/1)

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e., SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.

- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

It should be noted that the 132kV/400kV MTS development footprint and the 132kV and 400kV corridors (in which the respective powerlines which form part of this application / BA process would be situated) were granted authorisation by the DFFE in April 2022 (DFFE Reference Number: 14/12/16/3/3/1/2460/AM1). However, due to technical consideration, the approved 132kV and 400kV corridors are not suited to connect the approved MTS to the National grid nor the authorised Kentani Solar PV (DFFE Reference Number: 14/12/16/3/3/2/724/AM3) to the MTS, and as such additional small portions of the corridors are required to be assessed to accommodate the technical changes.

The powerlines are located within the Kimberly Renewable Energy Development Zone (REDZ) (namely REDZ 4) and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The respective powerlines which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 700m in length) are being proposed and will connect the approved MTS (14/12/16/3/3/1/2460/AM1) to the existing Eskom 400kV powerline, located approximately west of the approved MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 5km in length) is being proposed and will connect the approved MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724/AM3), located approx. 4.85km north-west of the approved MTS site.
3. One (1) 90m tapered steel lattice radio mast (also referred to as a tower) will be built within the approved MTS footprint (14/12/16/3/3/1/2460/AM1).

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted).

It must be noted that the majority of the proposed powerlines being proposed are located within existing approved powerline corridors and that only small sections will traverse outside of the approved corridors:

- The portion of the 132kV powerline outside of an existing approved corridors and Eskom servitudes is approximately 700m
- The portion of the each of the 400kV powerlines outside of an existing approved corridors and Eskom servitudes is approximately 150m for one and 250m for the other.

Further to the above, the proposed Radio Mast will be located on the approved MTS (14/12/16/3/3/1/2460/AM1).

Considering the above, it is important to note that the location of the corridors for the powerlines being proposed as part of this application have previously been assessed as part of the development footprint for the approved MTS and powerline corridors (14/12/16/3/3/1/2460/AM1) as well as the Kentani Cluster of solar PV developments, each of which received their own EA in 2016[1].

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed powerline development may have an impact on the environment and trigger certain listed activities in Listing Notice 1 of the EIA Regulations, 2014 (as amended) (Government Notice No. 983, as amended). These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended). To inform the assessment, specialist studies are required.

The purpose of this Terms of Reference (ToR) is to provide the specialist team with a consistent approach to the respective specialist studies / input. In the event that the above-mentioned infrastructure does change the outcomes of the original assessment findings that were undertaken between October and November 2021.

Due to the fact that majority of the proposed powerline corridors have previously been assessed as part of approved developments (14/12/16/3/3/2/724/AM3 & 14/12/16/3/3/1/2460/AM1), the specialist is required to write a motivational letter (which will be appended to the specialists' original report) which includes the following information:

---

[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

Specialist Assessment

The undersigned specialist conducted the original EIA assessments in 2014 and received approval as indicated above. Further to this EnviroSci was appointed by the Applicant to undertake detailed walkdowns conducted in February 2022 from an aquatic perspective. This has also included assisting Mainstream with obtaining the necessary Water Use License / General Authorisation approvals as required (2021 – 2022). Therefore the undersigned has a detailed understanding of the site and the project scope, noting that the proposed grid infrastructure as shown above and in Figure 1 are located within a LOW sensitivity aquatic environment, while the proposed MTS is located near a pan that was rated as having a Very High sensitivity, as indicated in the DFFE Screening Tool (Figure 2).

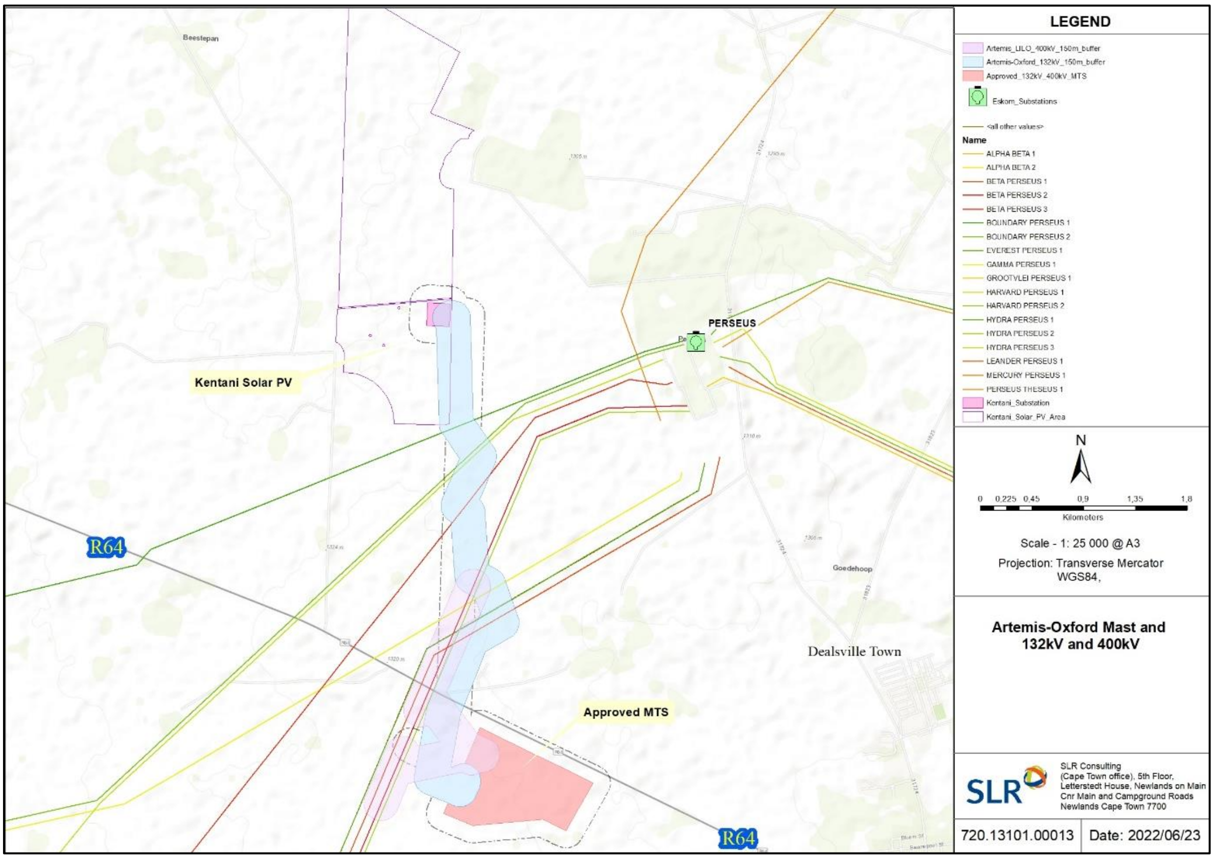
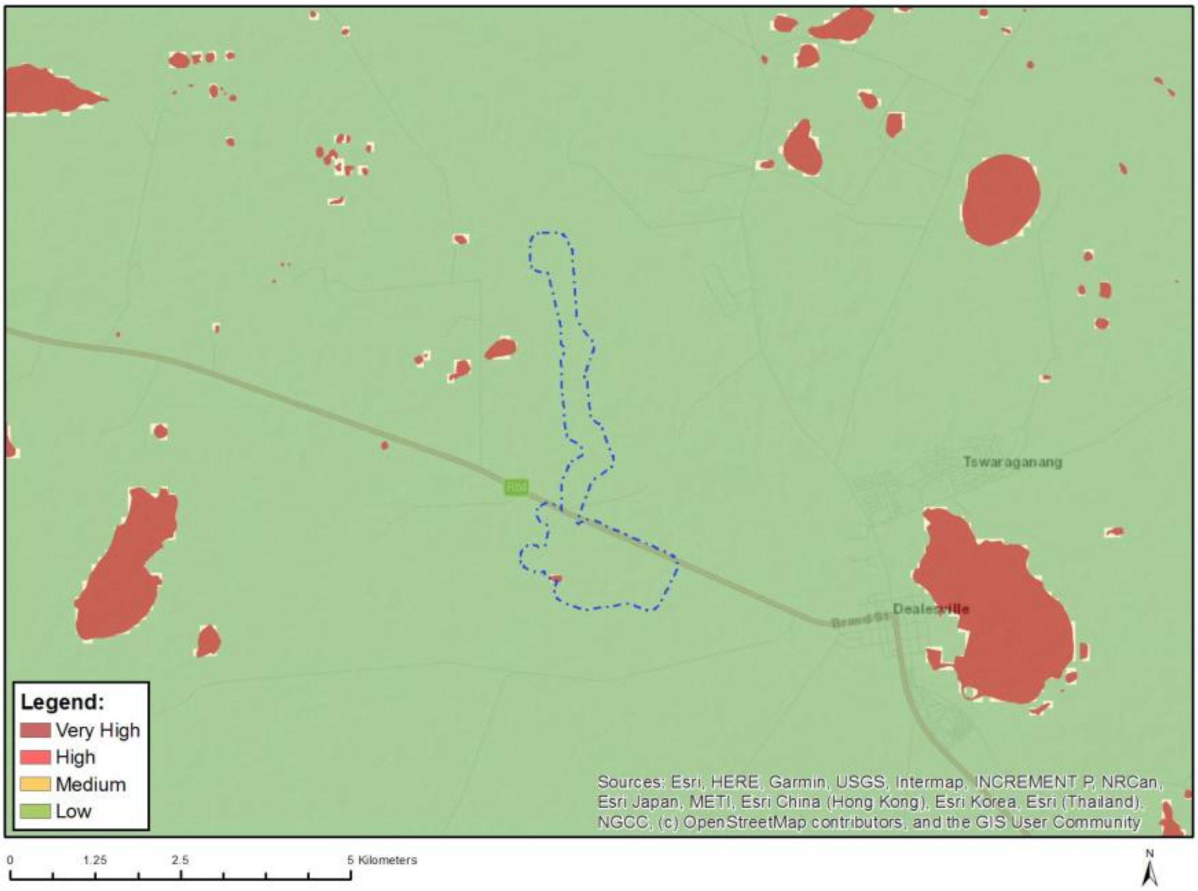


Figure Error! No text of specified style in document.**: Proposed infrastructure**



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Figure 2: DFFE Screening Tool results for the Aquatic Biodiversity Theme

Noting the above considerations, based on the site inspections , I the undersigned hereby confirm that the following from an aquatic specialist perspective:

- That the proposed infrastructure will not impact any aquatic ecosystems and have avoided any of the Very High Sensitivity Areas shown in the Screening Tool (Figure 3), and confirmed by this specialist (Figure 3), but the substations, radio tower and grid connections will either avoid or span these areas.
- Will not change or increase the nature or severity of any of the impacts originally identified and reported on during the various EIAs or the subsequent amendment applications (direct and cumulative impacts).
- Will have no additional impacts to those identified previously in the study (direct and cumulative impacts).
- Will not require any additional management outcomes or mitigation measures for the terrestrial or aquatic environment.

- It is further confirmed that the environment has not changed significantly from that during the original assessment and therefore the revised powerlines and Mast will not result in any additional impacts not considered and assessed before.

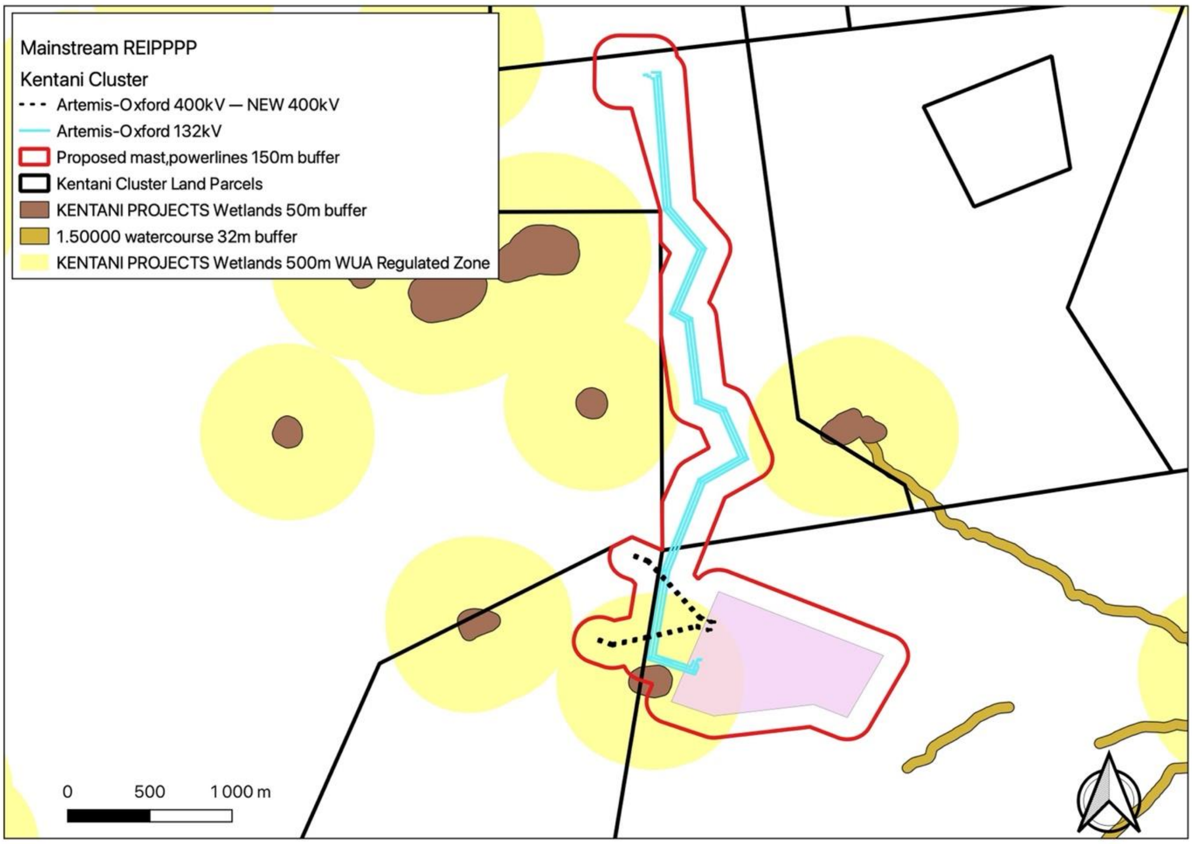


Figure 3: Results of the specialist assessment compared to the proposed infrastructure, with the requisite delineations again confirmed in February 2022

EnviroSci (Pty) Ltd
Reg Number 2018/462716/07

Dr Brian Colloty
Ecologist (Pr Sci Nat 400268/07)
Member of the South African Wetland Society

Contact Details
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083 498 3299

Address
1 Rossini Rd
Pari Park
Gqeberha
6070

The following table addresses the information required to inform the amendment application, as derived from Section 32(1)(a) of the EIA Regulations (2014, as amended):

Assessment of all impacts related to the proposed change	The proposed layout/project changes as is the subject of the current application, has no material change on the assessment, findings, impacts (direct and cumulative) (including nature, significance category and mitigation measures) and recommendations of the specialist report included within the original EIA/BA and walkdown reports. From an aquatic standpoint, the results are identical and the proposed amendments have no material effect on the original specialist assessment conducted for the project as the proposed infrastructure have avoided all of the aquatic ecosystems inclusive of the buffers as shown in Figure 3
Advantages and disadvantages associated with the proposed change	The proposed changes will not result in any disadvantages or advantages from an aquatic perspective, compared to that originally assessed and authorised.
Measures to ensure avoidance, management and mitigation of impacts associated with the proposed change	The amendments that are being proposed, have avoided environmental sensitivities identified, as confirmed in the February 2022 walkthrough. As the proposed amendments do not incur any change in impact (direct or cumulative) from that determined in the original assessment for the project, no additional mitigation measures are required.

This report thereby serves to confirm that an aquatic perspective, the proposed layout as is the subject of the current application, has no material change on the assessment, findings, impacts (including nature, significance and mitigation measures) and recommendations of the original specialist report/s. Therefore, the results of the assessment are identical and the change in location that forms part of the proposed amendments have no material effect on the specialist assessment conducted for the project.

Furthermore, these changes do not impact on an area of higher sensitivity than that originally authorised, thus the recommendations and findings of the report apply without modification to the refined layout.

To conclude, the initial ecological assessment, that included terrestrial ecology and aquatic assessment findings can be upheld, and when coupled to the proposed amended layout, no direct impacts to any critical terrestrial or aquatic ecosystems with a Very High sensitivity are anticipated. The environment has not changed significantly from that during the original assessment and therefore the extension of the validity of the EA will not result in any additional impacts.

The proposed infrastructure is therefore supported in terms of aquatic biodiversity considerations, on the condition that all of the proposed infrastructure:

i. Will remain outside of the delineated freshwater feature footprints
ii. All works within the regulated area of a watercourse are suitably authorised under the National Water Act (No. 36 of 1998), as relevant and applicable, prior to the commencement of construction (Applications are in process)

Please don't hesitate to contact me should you require any additional information.

Yours sincerely

Dr Brian Colloty
Cell: 083 498 3299

PROPOSED 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE PROJECT NEAR DEALESVILLE

SURFACE WATER IMPACT ASSESSMENT

DFFE Reference: To be Allocated
Report Prepared by: **EnviroSci (Pty) Ltd**
Issue Date: 14 November 2021
Version No.: 1

EXECUTIVE SUMMARY

EnviroSci (Pty) has been appointed by SLR South Africa Consulting (PTY) Ltd, of South Africa Mainstream Renewable Power Developments (Pty) Ltd, hereafter referred to as "Mainstream", to undertake a surface water impact assessment for the proposed addition of one (1) Main Transmission Substation (MTS), three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and a Li-Ion Battery Energy Storage System to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development'). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality.

The nature of the substations and transmission lines are such that they carry low intensity impact on aquatic resources. This however this assumes that the HIGH sensitivity systems are spanned and or avoided by the proposed structures.

The study area contained a variety of aquatic features mainly associated with the Depression / Pan Hydrogeomorphic class of aquatic / wetlands systems found within the greater region. These ranged >1ha to 8ha in size. Similarly, some of these could include freshwater habitats, while the larger systems were dominated by saline soils and / or water columns (when inundated).

The other aquatic features observed were as follows:

- Non perennial rivers with or without riparian vegetation. These ranged from narrow channels to broad er flood plain areas in the lower valleys. However, broad riparian zones were only found within the lower valley areas, dominated by a small number of trees, while obligate instream vegetation is limited to a small number of sedges (nut grasses). None of these were located within the proposed development footprint areas.
- Minor drainage lines, with no obligate aquatic vegetation.
- Dams with no wetland or aquatic features mostly used for watering of livestock. Several pans previously assessed in the 2014/2015 assessments was converted into dams but still contain wetland elements.

Little in the way of drainage occurs within the development areas, thus the number of water course were limited. These that do occur drain, forming part of a tributary of the Modder River, associated with the C52 h and C52K Quinary Catchments of the Highveld Ecoregion in the Orange Catchment Management Agency. Due to this limited connectivity via watercourses, the study area was not included in any National Freshwater Ecosystems Priority Areas (NFEPAs) or Strategic Water Resource Areas, although due to the presence of the pans, the pans in the region were included into National Wetland Cluster, NSBA (2018) spatial layers.

With regard the proposed buffers (50m), none of the proposed infrastructure (substation sites and gird corridors), will be affected.

All the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = D or Largely Modified within the greater region (SQ3155). While these were also rated as High in terms of Ecological Sensitivity and High in terms of Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine systems. Overall, these catchment areas and subsequent rivers / watercourses are in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with existing road crossings; and

- Impeded water flow due to several in channel farm dams or weirs.

The pans and depression, range from PES = B (Largely natural) to C (Moderately Modified), link to changes to their catchments being modified by agricultural encroachment.

The DFFE screening tool indicated that several Very High aquatic sensitivity features were located within the greater region (pans), while the remainder of the areas (MTS) were rated a Medium.

The presence of these Very High Sensitivity features was confirmed during this assessment (See Appendix 2 for Verification Statement), as delineated in this assessment.

The study area is also not located within an International Bird Area (IBA) or a Strategic Water Resource Area but is located within a listed Threatened Ecosystems.

With regards impacts, these systems are large influence by changes to any hydrological regimes and direct disturbance. Secondary impacts are most related to water quality (spills) and the increase in surface flows presented by hard surfaces. This if no stormwater management is provided then results in erosion and sedimentation. Although it may be argued erosion and sediment transport is a natural phenomenon within these systems, acceleration of these natural process quickly results in scour and donga formation.

The following impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and include in the table below and assessed against the proposed alignment and potential activities:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Faunal and vegetation communities inhabiting the site	Impact 1 and 2
Fragmentation (physical loss of ecological connectivity = Wetland cluster)	Impact 1 and 2
Changes in numbers and density of species	Impact 1 and 2
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 3
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 4
Streamflow regulation	Impact 2
Erosion control	Impact 4
Cumulative Impacts	Impact 5

As highlighted above the following impacts on the aquatic environment have been identified and will be assessed in greater detail as follows, as well as separately the No-Go and Cumulative impacts:

Construction & Decommissioning Phases

- Impact 1: Loss of aquatic species of special concern
- Impact 2: Damage or loss of riparian systems and disturbance of the waterbodies in the construction phase
- Impact 3: Potential impact on localised surface water quality

Operational phase

- Impact 4: Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion.

The nature of the substations and transmission lines are such that they carry low intensity impact on aquatic resources. This however this assumes that the No-Go areas and Very High sensitivity systems are spanned and or avoided by the proposed structures.

A variety of aquatic features, mostly ephemeral in nature were observed within the study area and these were mapped and buffered as necessary for their protection. The current layout has avoided these sensitive features and buffer areas, negating the potential overall impact and risk to Aquatic resources.

The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the aquatic environment would be Very Low (-).

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented. A key recommendation is also that that during the later design process, that the temporary construction camps and or substations as required be located outside of the aquatic systems and the associated buffer

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of 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;	Appendix 1 CV
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Attached to Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 of this report
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3 and 5
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Appendix 3
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;	Section 5 & 6
g) an identification of any areas to be avoided, including buffers;	Section 5 & 6
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;	Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 6 & 8
k) any mitigation measures for inclusion in the EMPr;	Section 7

l) any conditions for inclusion in the environmental authorisation;	Section 5. 6 and 8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
n) a reasoned opinion- i. (as to) 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 should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8
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.	Yes - Appendix 2

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

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

SPECIALIST INFORMATION

Specialist Company Name:	EnviroSci (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr Brian Colloty			
Specialist Qualifications:	PhD			
Professional affiliation/registration:	SACNASP Ecological 40026/07			
Physical address:	1 Rossini Rd Pari Park Gqeberha			
Postal address:	As Above			
Postal code:	6070	Cell:	08349893299	
Telephone:	-	Fax:	-	
E-mail:	brianc@envirosci.co.za			

DECLARATION BY THE SPECIALIST

I, _______Brian Colloty____________________________, 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

EnviroSci (Pty) Ltd

Name of Company:

20 October 2021

Date:

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GLOSSARY OF TERMS

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -

  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

LIST OF ABBREVIATIONS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GA	General Authorisation (WUA type)
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
OHL	Overhead Line – transmission line cable that is not buried
ORC	Off road cable – underground or overhead transmission cable not within a road reserve
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUA	Water Use Authorisation
WUL	Water Use License
WULA	Water Use License Application

1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, (the 'proposed development') that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor which has been authorised as part of the Kentani Cluster, making provision for this routing in the new proposed MTS (refer to Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)][1]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, of the eleven (11) powerlines, eight (8) are 132kV powerlines which

---

[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

are located within the authorised corridor included as part of the authorised solar PV developments and require re-routing within the authorised corridor. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

In terms of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the proposed development, under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report is the 132kV/400kV On-site MTS and Associated Infrastructure near Dealesville application.

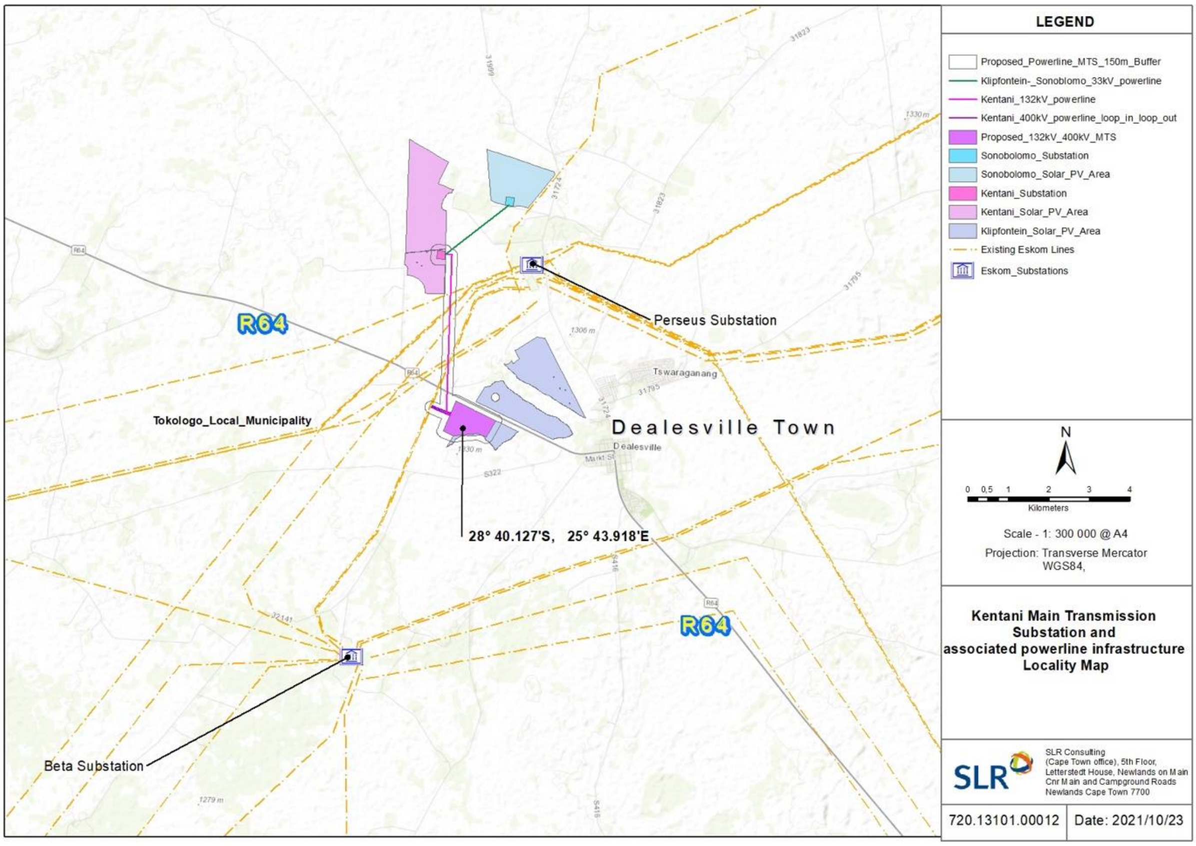

Figure 1:Regional context map

2. ASSESSMENT METHODOLOGY

1.1 Specialist Credentials

Please see Appendix 1 (Specialist CVs)

1.2 Terms of Reference (ToR)

The proposed methods used in this assessment have been developed with the renewable industry in mind, coupled to the minimum requirements stipulated by DFFE and the Department of Water and Sanitation. These have been successful in assessing the direct, indirect and cumulative impacts of 128 renewable energy projects (2010 – 2021), of which 18 have been constructed.

Therefore the surface water and aquatic biodiversity site sensitivity screening, field investigations and impact assessment has included the following:

- Desktop analysis
- Site investigation
- Compilation of one draft and one final report for the project which adheres to the following (this list is not exhaustive):
    - The Initial Site Sensitivity Verification reporting requirements for environmental themes set out in Government Gazette No. 43110 which was promulgated on 20 March 2020 in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (Appendix 2).
    - Identification and mapping of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool.
    - Identification of sensitive areas to be avoided (including corresponding spatial data) and the determination of the respective buffers (if applicable) for each site.
    - Initial recommendations for the layout and allowable development footprint from a surface water and aquatic biodiversity perspective (including corresponding spatial data).
    - Recommendations regarding the areas to be utilised for wind and solar technologies within the project site from a surface water and aquatic biodiversity perspective (including corresponding spatial data)

.

1.3 Approach

These assessments were conducted using the following assessment process based on 2 days field work conducted in September 2021 and again in October 2021 after heavy rainfalls after a significantly long dry period experienced in the region.

Methodology summary (Detailed approached is shown in Appendix 3)

- Initiated the assessment with a review of the available information for the region and the proposed project, this will also include review of the proposed project in relation to any conservation plans or assessments known for the area, e.g. Critical Biodiversity Area maps, National Waterbody Inventory and high-level groundwater availability maps etc.
- Conducted a site visit (September / October 2021) to inspect the surrounding waterbodies / features, to develop maps.
- Prepared a map demarcating the respective watercourses or wetland/s, i.e. the waterbody, its respective catchment and other areas within a 500m radius of the study area. This demonstrated, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. The maps depicting demarcated waterbodies were delineated to a scale of 1:10 000, following the methodology described by the DWS, together with an estimation of their functionality, Habitat Integrity (IHI), Wet-Ecoservices (Wet-Health) and Socio-Cultural Importance of the delineated systems, whichever is relevant to the systems.
- Recommended buffer zones using the Macfarlane & Bredin (2017) approach to indicate any No-go / Sensitive areas around any delineated aquatic zones supported by any relevant legislation, e.g., any bioregional plans, conservation guidelines or best practice.
- Determined the Present Ecological State (PES) of any waterbodies including wetlands, estimating their biodiversity, conservation importance with regard ecosystem services during the site visit using recognised PES / EIS assessment methods to determine the state, importance and sensitivity of the respective wetland / watercourse systems.
- Identified and assessed the potential impacts of the proposed project using the revised project layout and description, based on a supplied impact assessment methodology (provided by Aurecon), including cumulative impacts and for construction, operation and decommissioning phases. Also assess the potential impact of the “no go” alternative.

- Provided recommendations and mitigations regarding project related impacts for inclusion into the Environmental Management Program (EMPr).
- Supplied the client with geo-referenced GIS shape files of the wetland / riverine areas and associated buffers to be used in the finalisation of the project layout and management of the project going forward.
- Provided a separate Risk Assessment Matrix as per the DWS 2016 requirements to determine the Water Use License Application Requirements, i.e., indication of future permitting requirements

1.4 Assumptions and Limitations

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling. This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability, unless otherwise stated.

Therefore, due to the scope of the work presented in this report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

3. LEGAL REQUIREMENT AND GUIDELINES

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999) – could apply if cultural use or heritage is linked to any aquatic resources

NEMA and the CARA identify and categorise invasive plants together with associated obligations on the landowner. Several Category 1 & 2 invasive plants were observed in several areas of the site under investigation.

Based on an assessment of the proposed activities (Table 1) and past engagement with DWS, the following Water Use Authorisations may be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) must determine if a General Authorisation (GA) or full WULA will be required during the pre-application process as it relates to the following, bearing in mind that this will only be conducted once a final project scope is known:

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21a water uses relating to the Abstraction of water.

- **Government Notice 509 in GG 40229 of 26 August 2016 –** Section 21c & 21i water uses relating to the Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.
- **Government Notice 665, 6 September 2013 in GG 36820** - Section 21g relating to disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic wastewater i.e. conservancy tanks under Section 37 of the notice.

4. PROJECT DESCRIPTION

4.1 Project Location

The proposed project is located approximately 2,5km north-west of the town of Dealesville in the Tokologo Local Municipality, within the Lejweleputswa District Municipality of the Free State Province (as shown in **Error! Reference source not found.**). The proposed project will be located on the following properties / farm portions:

- Remaining Extent of the Farm Klipfontein No. 305 (F00400000000030500000);
- The Farm Leliehoek No. 748 (F00400000000074800000);
- The Farm Overschot No. 31 (F00400000000003100000)
- Remainder of the Farm Oxford No. 1030 (F00400000000103000000);
- Portion 1 of the Farm Walkerville No. 1031 (F00400000000103100001)[2]; and
- Remainder of the Farm Walkerville No. 1031 (F00400000000103100000)[2].

The proposed MTS and powerlines are located within the within the Kimberly Renewable Energy Development Zone (REDZ)[3] as well as the Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

In addition, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305. The eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] being proposed and assessed as part of this BA process (i.e., this application) fall outside of the authorised corridor.

Considering the above, it is important to note that the location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 20161

4.2 Project components

The proposed development involves the addition of one (1) MTS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

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[2] Property / farm portion traversed by proposed 33kv powerline which will connect to Kentani onsite substation (14/12/16/3/3/2/724). 33kV powerline does however not require authorisation.

[3] GN R 786 of 2020: Notice of Identification in Terms of Section 24(5)(a) and (b) ff The National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route
- Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

The proposed MTS will have a capacity of 132kV/400kV and will occupy a footprint of approximately 64ha (i.e., 800m x 800m).

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;

2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and

3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site foot print

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

Table 1:Summary of the key project components

Project Components	**Location and size / extent (i.e., Farm Names and Areas)**
Location	• Remaining Extent of the Farm Klipfontein No. 305 - F00400000000030500000 • The Farm Leliehoek No. 748 - F00400000000074800000 • Remainder of the Farm Oxford No. 1030 - F00400000000103000000 • Portion 1 of the Farm Walkerville No. 1031 - F00400000000103100001[2] • Remainder of the Farm Walkerville No. 1031 - F00400000000103100000[2] • The Farm Overschot No. 31 - F00400000000003100000
Onsite Main Transmission Substation (MTS)	• One (1) new MTS with capacity of 132kV/400kV • Total footprint of up to approx. 64ha (i.e., 800m x 800m) • Will contain transformers for voltage step up from medium voltage (132kV) to high voltage (400kV) • Direct Current (DC) power from the authorised Kentani Cluster of solar PV developments (each of which received their own EA in 2016[1]) will be converted into Alternating Current (AC) power in the inverters and the voltage will be stepped up to high voltage in the inverter transformers • Will be located within authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on Remaining Extent of the Farm Klipfontein No. 305
Grid Connection (Powerlines)	• Two (2) new 400kV overhead powerlines connecting MTS to existing Eskom 400kV powerline (approx. 1km west of MTS site) via LILO connection; • One (1) new 132kV overhead powerline connecting MTS to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site); • One (1) new 33kV overhead powerline connecting authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723) (approx. 5km north of MTS site) to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site) • Length of 400kV powerlines = approx. 2km • Length of 132kV powerline = approx. 4,5-5km • Length of 33kV powerline = approx. 2km • Area occupied by powerlines unknown at this stage

	• Powerline corridors with widths of 300m (150m on either side of centre line) being proposed and assessed for 400kV and 132kV powerlines to allow flexibility when routing powerlines within authorised corridor (should EA be granted) • No corridor being considered for 33kV powerline • This will allow for flexibility when routing powerline within the authorised corridor • Eight (8) 132kV powerlines within grid connection corridor authorised as part of Kentani Cluster will also be re-routed and provision will be made for this routing in new proposed MTS
Roads	• One (1) new road in servitude under proposed powerlines • One (1) new access to the R64 provincial route • Widths of up to approx. 4-8m
BESS	• Li-Ion Battery Energy Storage System up to 4 ha in extent within the assessed site foot print

4.3 Site Layout

The site layout for the proposed project makes provision for one (1) MTS location, (1) BESS location as well as one (1) powerline corridor routing for each of the associated proposed powerlines, as detailed in Table 4-1 above. Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines, no site, layout or powerline corridor alternatives will be assessed.

Additionally, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), while the eight (8) 132kV powerlines which require re-routing are also located within the authorised corridor included as part of the authorised Kentani Cluster. The remaining two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.

The BESS and powerlines associated with the MTS which are being proposed are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

The site layout being proposed is shown in the figure below (Figure 2).

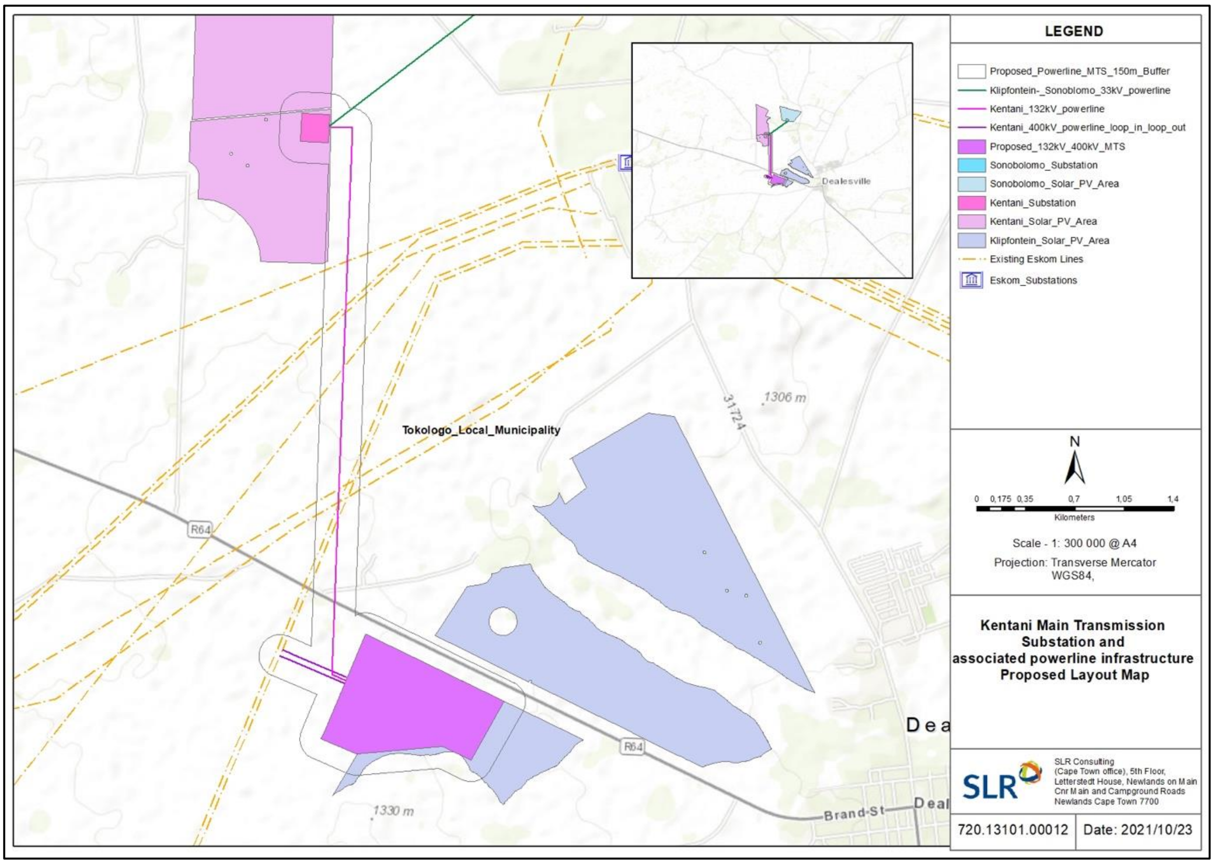

Figure 2: Proposed layout

4.4 Alternatives

As mentioned, a comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout BESS technology alternatives or powerline corridor alternatives are therefore being considered and assessed.

With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.

The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.

The site proposed for the MTS and respective powerline corridors will however be assessed against the ‘**no-go’ alternative**. The ‘no-go’ alternative is the option of not constructing the project, where the *status quo* of the current activities on the project site would prevail.

5. BASELINE DESCRIPTION OF THE RECEIVING ENVIRONMENT

The study area contained a variety of aquatic features mainly associated with the Depression / Pan Hydrogeomorphic class of aquatic / wetlands systems found within the greater region. These ranged >1ha to 8ha in size. (Plate 5.1). Similarly, some of these could include freshwater habitats, while the larger systems were dominated by saline soils and / or water columns (when inundated).

The other aquatic features observed were as follows (Figure 3):

- Non perennial rivers with or without riparian vegetation. These ranged from narrow channels to broad er flood plain areas in the lower valleys. However, broad riparian zones were only found within the lower valley areas, dominated by a small number of trees, while obligate instream vegetation is limited to a small number of sedges (nut grasses). None of these were located within the proposed development footprint areas.
- Minor drainage lines (Plate 5.2), with no obligate aquatic vegetation.
- Dams with no wetland or aquatic features mostly used for watering of livestock. Several pans previously assessed in the 2014/2015 assessments was converted into dams but still contain wetland elements (Figure 5.1)

Little in the way of drainage occurs within the development areas, thus the number of water course were limited. These that do occur drain, forming part of a tributary of the Modder River, associated with the C52 h and C52K Quinary Catchments of the Highveld Ecoregion in the Orange Catchment Management Agency (Figure 5.2). Due to this limited connectivity via watercourses, the study area was not included in any National Freshwater Ecosystems Priority Areas (NFEPAs) or Strategic Water Resource Areas, although due to the presence of the pans, the pans in the region were included into National Wetland Cluster, NSBA (2018) spatial layers.

With regard the proposed buffers (50m), none of the proposed infrastructure (substation sites and gird corridors), will be affected.

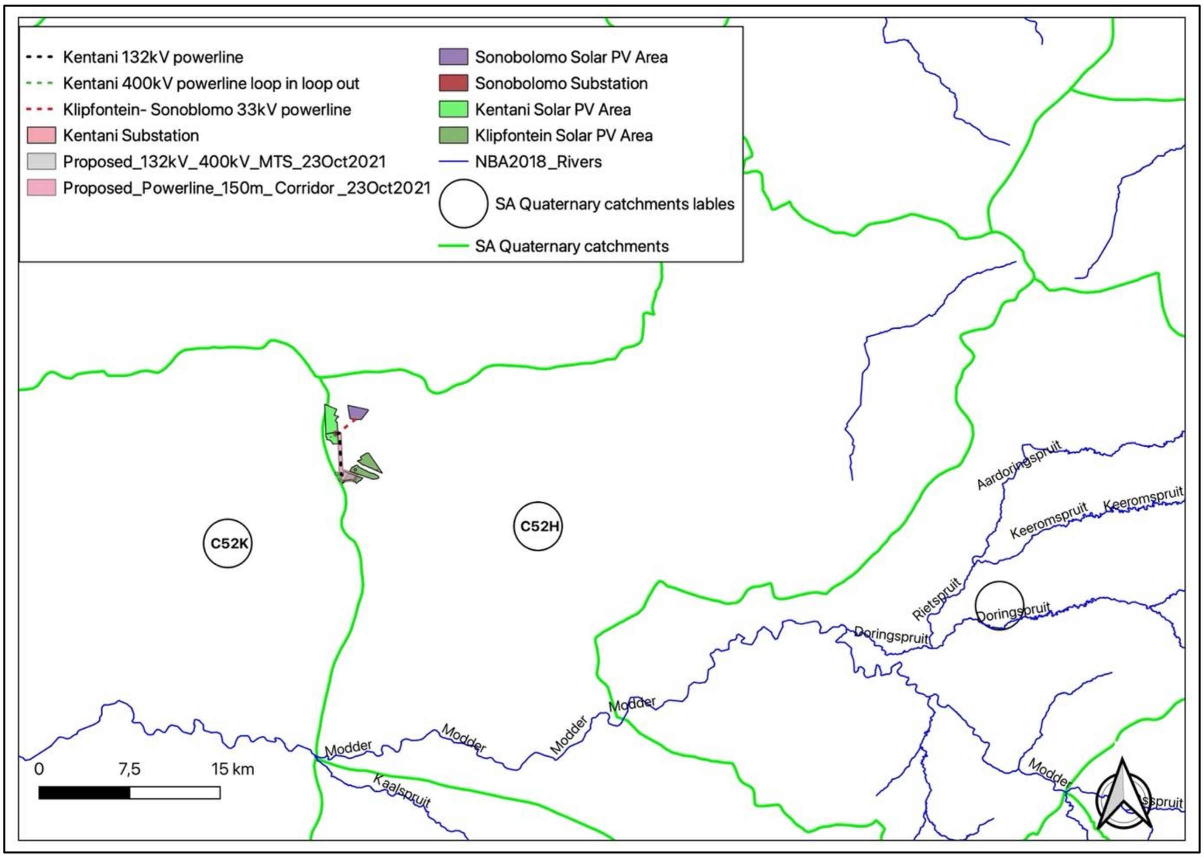

Figure 3: Project locality map indicating the various quaternary catchments and mainstem rivers (Source DWS and NGI) within the project boundary

Plate 5.1: One the larger pans located near (ca 900m) of the Kentani Substation

Plate 5.2: The minor drainage above the Klipfontein PV sites, with one of the farm dams in the background

Figure 4 indicates the available spatial data with regard potential wetlands and or riverine systems within the study area (van Deventer *et al*., 2020). During the field work, the site was then ground-truthed as well as compared to 1: 50 000 topocadastral surveys mapping data and that which was observed on site (Figure 5). A baseline map was then refined using the 2021 survey data, when near the proposed infrastructure (Figure 6).

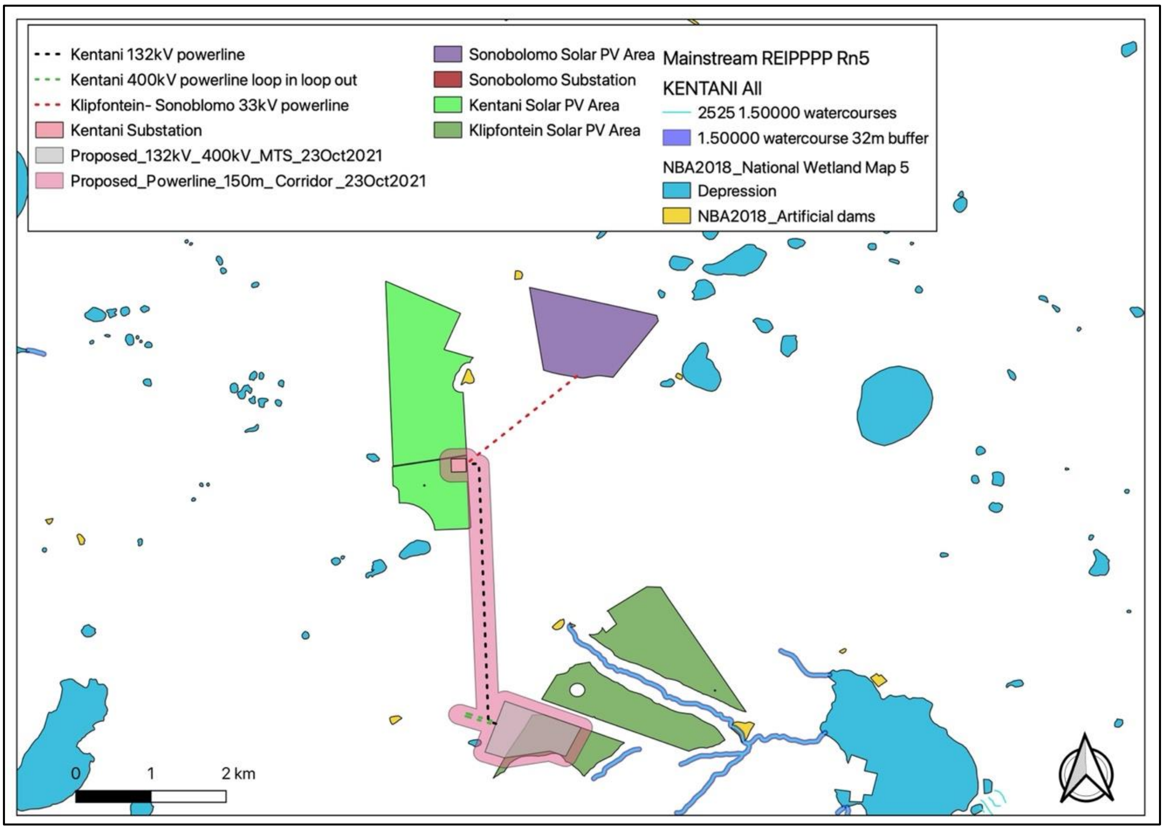

Figure 4:National Wetland Inventory wetlands and waterbodies (van Deventer et al., 2020)

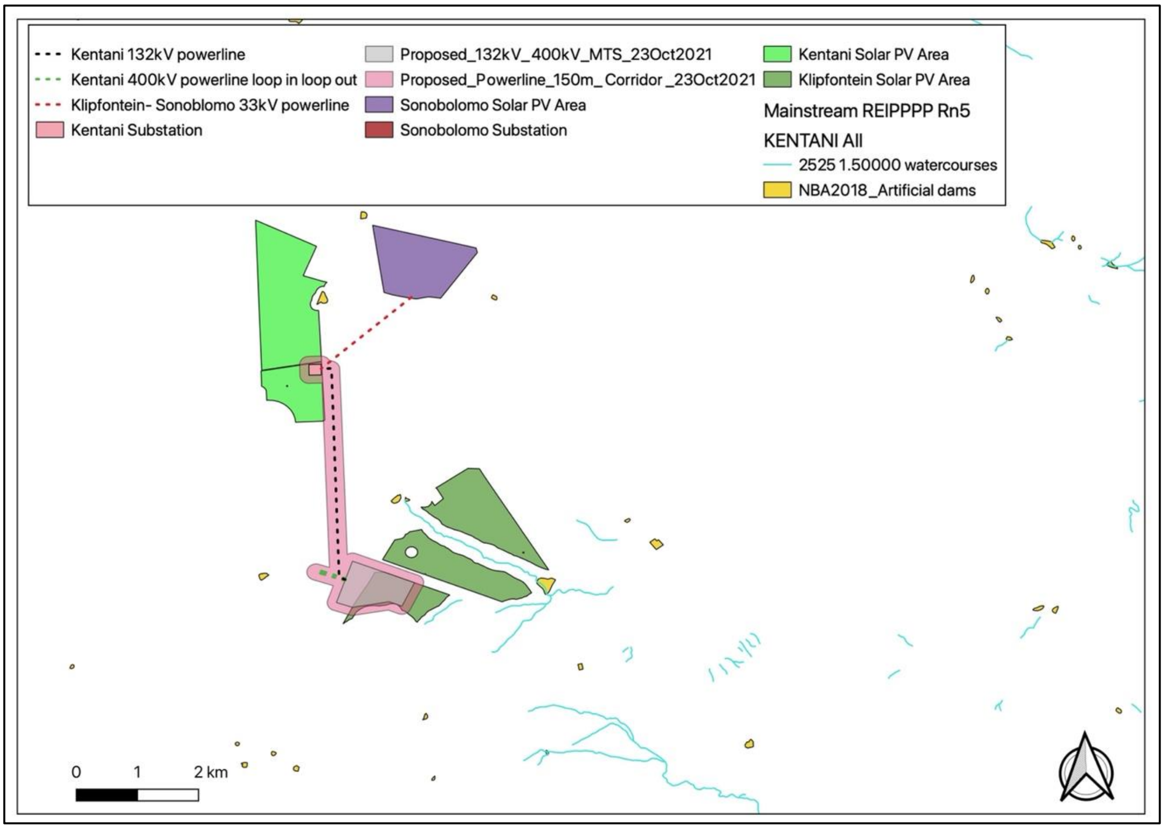

Figure 5: Watercourses indicated by the 1:50 000 topocadastral NGI data

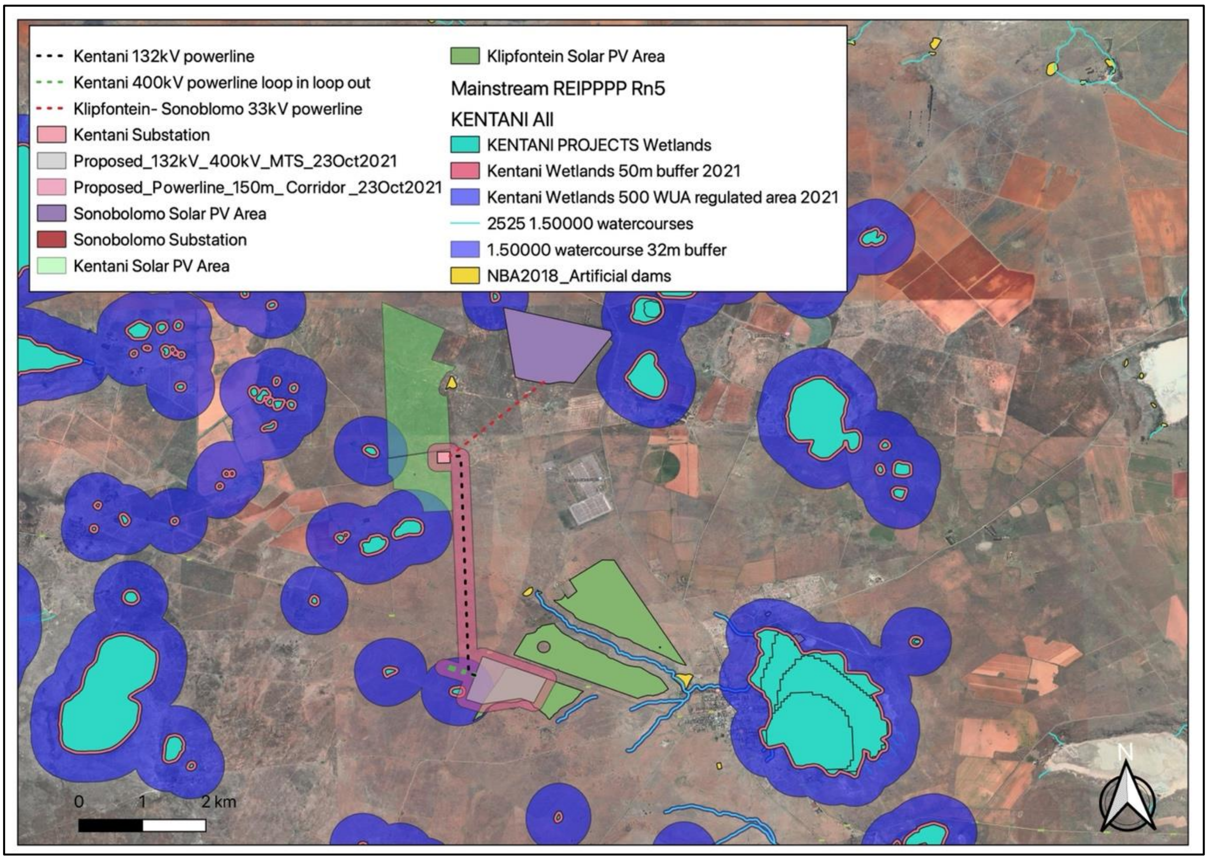

Figure 6: Confirmed and delineated waterbodies in relation to the proposed infrastructure as well as any of the regulated WUA areas

The Present Ecological State (PES) of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores were revised for the country and based on newer models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

All the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = D or Largely Modified within the greater region (SQ3155). While these were also rated as High in terms of Ecological Sensitivity and High in terms of Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine systems. Overall, these catchment areas and subsequent rivers / watercourses are in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with existing road crossings; and
- Impeded water flow due to several in channel farm dams or weirs.

The pans and depression, range from PES = B (Largely natural) to C (Moderately Modified), link to changes to their catchments being modified by agricultural encroachment.

The DFFE screening tool indicated that several Very High aquatic sensitivity features were located within the greater region (pans), while the remainder of the areas (MTS) were rated a Medium.

The presence of these Very High Sensitivity features was confirmed during this assessment (See Appendix 2 for Verification Statement), as delineated in Figure 6.

The study area is also not located within an International Bird Area (IBA) or a Strategic Water Resource Area but is located within a listed Threatened Ecosystems.

6. SENSITIVITY MAPPING

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorized into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning and design processes of the corridor and a suitable alignment for the grid within. Aquatic sensitivity mapping categorizes feature or areas (with their buffers) into the following categories:

No Go	Legislated “no go” areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile
High	Areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity
Low	Areas of low sensitivity or constraints
Neutral	Unconstrained areas (left blank in mapping)

Figure 7 indicates the No-Go areas (pans) and High (watercourses) that have been avoided by the proposed layout options.

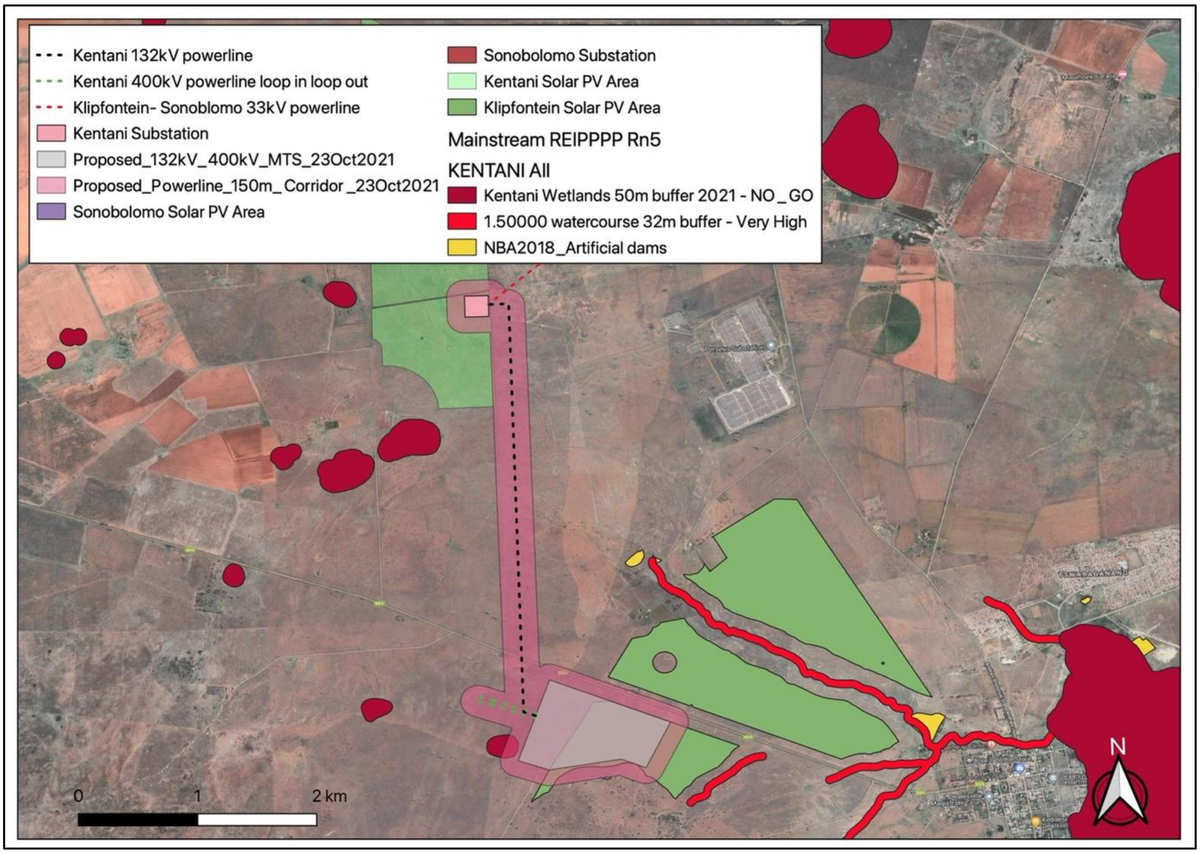

Figure 7: Results of the sensitivity analysis

7. SPECIALIST FINDINGS ASSESSMENT OF IMPACTS

The aquatic environment is typical of this portion of the Highveld ecoregion, being dominated my large numbers of small drainage lines and various pans/depressions. With regards impacts, the pans / depression are highly susceptible to changes to any hydrological regimes as well as direct disturbance withn the small and localised catchments. Secondary impacts are most related to water quality (spills) and the increase in surface flows presented by hard surfaces. This if no stormwater management is provided then this results in erosion and sedimentation.

7.1 Impact assessment

The following impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and include in the table below and assessed against the proposed alignment and potential activities:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Faunal and vegetation communities inhabiting the site	Impact 1 and 2
Fragmentation (physical loss of ecological connectivity = Wetland cluster)	Impact 1 and 2
Changes in numbers and density of species	Impact 1 and 2
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 3
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 4
Streamflow regulation	Impact 2
Erosion control	Impact 4
Cumulative Impacts	Impact 5

As highlighted above the following impacts on the aquatic environment have been identified and will be assessed in greater detail as follows, as well as separately the No-Go and Cumulative impacts:

Construction & Decommissioning Phases

- Impact 1: Loss of aquatic species of special concern
- Impact 2: Damage or loss of riparian systems and disturbance of the waterbodies in the construction phase
- Impact 3: Potential impact on localised surface water quality

Operational phase

- Impact 4: Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion.

Table 2:Table 3 Loss of aquatic species including any Species of Special Concern

Issue	Loss of aquatic species including any Species of Special Concern
Description of Impact	
Potential loss of protected or listed aquatic species, however none were observed on site	
Type of Impact	Direct
Nature of Impact	Negative
Phases	Construction

Issue	Loss of aquatic species including any Species of Special Concern	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Very Low
Duration	Medium-term	Short-term
Extent	Local	Site
Consequence	Medium	Very Low
Probability	Conceivable	Unlikely/ improbable
Significance	Low -	Insignificant
Degree to which impact can be reversed	If any plants are encountered these can be relocated with a limited degree of success	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	High -	
Mitigation actions		
The following measures are recommended:	The current layout must be selected, to ensure all the observed aquatic systems will be avoided, thus avoiding this impact	
Monitoring		
The following monitoring is recommended:	ECO / ESO during construction inspects the area on a regular basis (weekly) for any unique plants (mostly bulbs and succulents) that may appear during the growth seasons	

Table 4: Damage or loss of riparian systems and disturbance of waterbodies in the construction / decommissioning phase

Issue	Damage or loss of riparian systems and disturbance of waterbodies in the construction / decommissioning phase	
Description of Impact		
Construction & decommissioning could result in the loss of drainage systems that are fully functional and provide an ecosystem services within the site especially where new crossing are made or large hard engineered surfaces are placed within these systems (incl the Proposed buffer). Loss can also include a functional loss, through change in vegetation type via alien encroachment for example		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low +
Degree to which impact can be reversed	Yes with a significant amount of rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		

The following measures are recommended:	• The current layout must be selected, to ensure all the observed aquatic systems will be avoided, thus avoiding this impact • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. • Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). This will the avoid any secondary impacts that could affect downstream areas.
Monitoring	
The following monitoring is recommended:	All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings.

Table 5: Water quality changes (increase in sediment, organic loads, chemicals or eutrophication

Issue	Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	
Description of Impact		
During construction earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), with regard safe handling during the construction phase. This to avoid any spills or leaks from this system		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low +
Degree to which impact can be reversed	Yes with a significant amount of rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• All liquid chemicals including fuels and oil, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill	

	kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refuelled or serviced within 100m of a river channel. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses. • Littering and contamination associated with construction activity must be avoided through effective construction camp management; • No stockpiling should take place within or near a water course • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable
Monitoring	
The following monitoring is recommended:	ESO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur a quickly rectified.

Table 6: Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)

Issue	Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	
Description of Impact		
Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosions and sedimentation of downstream areas.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low +
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures	

	and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. • Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil.
Monitoring	
The following monitoring is recommended:	This stormwater control systems must be inspected on an annual basis to ensure these are functional

Table 7-7: Summary of impacts

7.2 Alternatives

No alternatives were assessed as the design process has passed through several iterations, taking cognisance of any No-Go and Very High sensitivity areas.

However, with regard the No-Go, the status quo will remain, coupled to the continued impacts associated with agricultural practices.

7.3 Cumulative Impacts

In relation to an activity, cumulative impact means "*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (NEMA EIA Reg GN R982 of 2014).

The South African Renewable Energy EIA Application Database (REEA) (namely "REEA_OR_2021_Q2") and other information available at the time[4] shows that there are no operational renewable energy developments situated within a 30km radius of the proposed project site. There are however several renewable energy projects (solar) authorised or being proposed within close proximity to the town of Dealesville, including the Kentani Cluster which consists of eleven (11) authorised solar PV projects and associated electrical infrastructure. According to the information available at the time**Error! Bookmark not defined.**, the f ollowing renewable energy applications for EA are either approved (i.e., EA issued) or being proposed within a 30km radius of the proposed project site:

- 100 MW Kentani PV - 14/12/16/3/3/2/724
- 100 MW Klipfontein PV - 14/12/16/3/3/2/722
- 100 MW Braklaagte PV - 14/12/16/3/3/2/727
- 100 MW Meeding PV - 14/12/16/3/3/2/719
- 100 MW Irene PV - 14/12/16/3/3/2/718
- 100 MW Leliehoek PV - 14/12/16/3/3/2/728
- 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
- 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
- 75 MW Braambosch PV - 14/12/16/3/3/2/725
- 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
- 75 MW Eksteen PV - 14/12/16/3/3/2/717

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[4] Information has been based on the latest available version of the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2021_Q2"), the results of the respective online screening tool reports (https://screening.environment.gov.za/screeningtool/#/pages/welcome) and information available on the public domain at the time.

- 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
- Klipbult solar plant - 14/12/16/3/3/2/432
- 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
- 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
- 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
- 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853
- 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
- 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
- 100 MW Visserpan solar photovoltaic facility project 2 - 14/12/16/3/3/1/2154
- 100 MW Visserpan solar photovoltaic facility project 3 - 14/12/16/3/3/1/2155
- 100 MW Visserpan solar photovoltaic facility project 4 - 14/12/16/3/3/1/2156

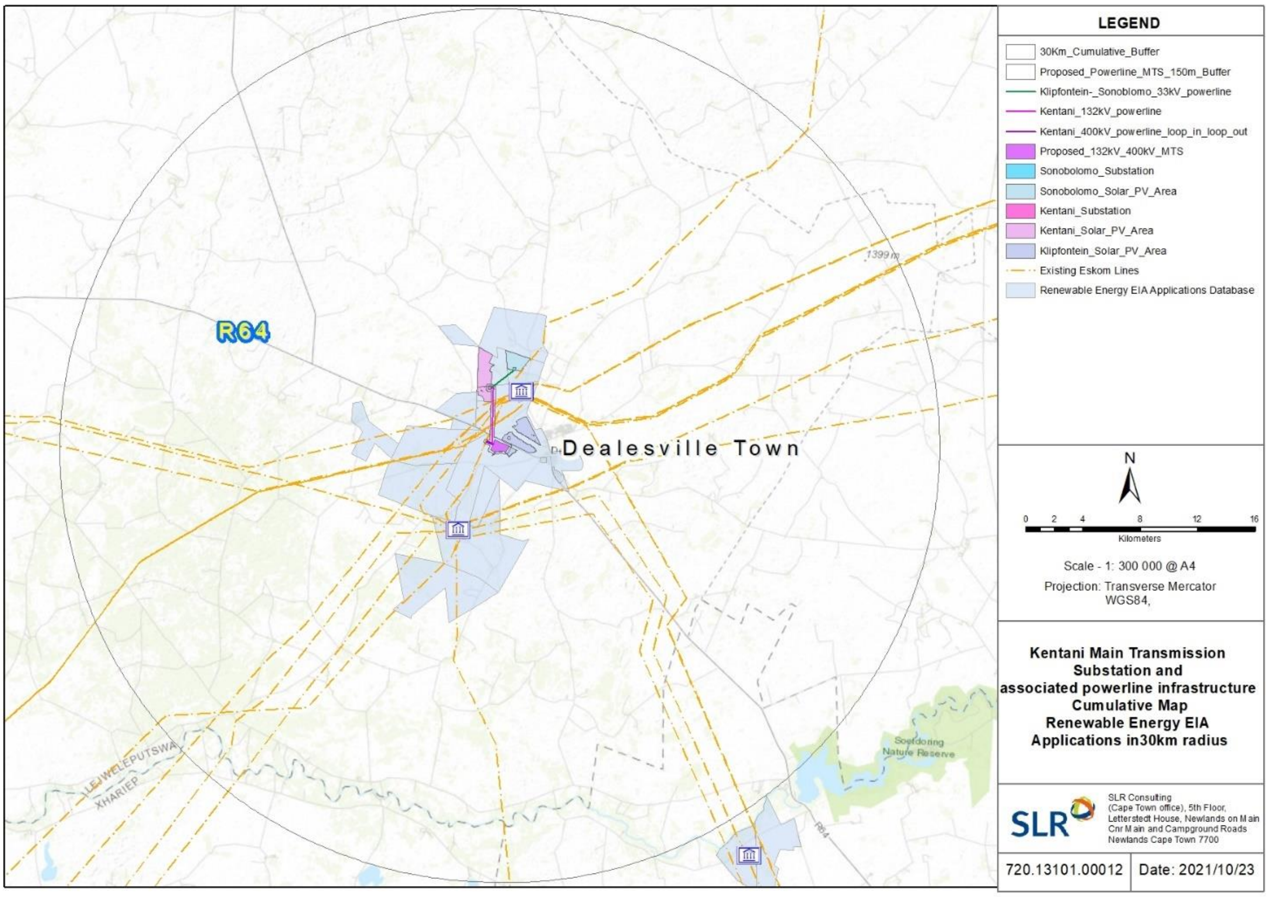

Figure 8: Cumulative map showing renewable energy projects with a 30km buffer

In addition, the Jedwater Solar Power Facility (12/12/20/1972/2) and Letsatsi solar power farm (12/12/20/1972/1) are situated just outside of the project site's 30km radius, to the south-east of the project site.

The cumulative impact assessed will therefore be the collective impact of the proposed MTS and powerline application, along with the above-mentioned renewable energy applications for EA which are either approved or being proposed within a 30km radius of the proposed project site

Table 8: Loss of aquatic species including any Species of Special Concern

Issue	Loss of aquatic species including any Species of Special Concern	
Description of Impact		
Potential loss of protected or listed aquatic species		
Cumulative impacts		
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 35km radius of this site, where the author has either been involved in the assessment of most of these projects and or review of the past assessments as part of any required Water Use Licenses. The premise of all the reviewed or assessed projects has been the avoidance of impacts on the aquatic environment, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines for some of the longer grid connections for those projects.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Insignificant

Table 9: Damage or loss of riparian systems and disturbance of waterbodies in the construction / decommissioning phase

Issue	Damage or loss of riparian systems and disturbance of waterbodies in the construction / decommissioning phase	
Description of Impact		
Construction & decommissioning could result in the loss of drainage systems that are fully functional and provide an ecosystem services within the site especially where new crossing are made or large hard engineered surfaces are placed within these systems (incl the Proposed buffer). Loss can also include a functional loss, through change in vegetation type via alien encroachment for example		
Cumulative impacts		
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 35km radius of this site, where the author has either been involved in the assessment of most of these projects and or review of the past assessments as part of any required Water Use Licenses. The premise of all the reviewed or assessed projects has been the avoidance of impacts on the aquatic environment, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines for some of the longer grid connections for those projects.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

Table 10: Water quality changes (increase in sediment, organic loads, chemicals or eutrophication

Issue	Water quality changes (increase in sediment, organic loads, chemicals or eutrophication
Description of Impact	
During construction earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills	

<table>
<tr><td colspan="3">during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given.
Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), with regard safe handling during the construction phase. This to avoid any spills or leaks from this system</td></tr>
<tr><td colspan="3">Cumulative impacts</td></tr>
<tr><td>Nature of cumulative impacts</td><td colspan="2">Although most of the projects are linear in fashion, while being spread over a wide area, most of the projects are located within the greater Gouritz catchment. However spills and water quality issues remain localised due to the ephemeral nature of the aquatic systems</td></tr>
<tr><td rowspan="2">Rating of cumulative impacts</td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Medium -</td><td>Very Low -</td></tr>
</table>

Table 11: Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)

<table>
<tr><td>Issue</td><td colspan="2">Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)</td></tr>
<tr><td colspan="3">Description of Impact</td></tr>
<tr><td colspan="3">Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosions and sedimentation of downstream areas.</td></tr>
<tr><td colspan="3">Cumulative impacts</td></tr>
<tr><td>Nature of cumulative impacts</td><td colspan="2">The cumulative assessment considers the various proposed renewable projects that occur within a 35km radius of this site, where the author has either been involved in the assessment of most of these projects and or review of the past assessments as part of any required Water Use Licenses. The premise of all the reviewed or assessed projects has been the avoidance of impacts on the aquatic environment, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines for some of the longer grid connections for those projects.</td></tr>
<tr><td rowspan="2">Rating of cumulative impacts</td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Medium -</td><td>Low -</td></tr>
</table>

8. CONCLUSION AND SUMMARY

8.1 Summary of Findings

The nature of the substations and transmission lines are such that they carry low intensity impact on aquatic resources. This however this assumes that the No-Go and Very High sensitivity systems are spanned and or avoided by the proposed structures.

A variety of aquatic features, mostly ephemeral in nature were observed within the study area and these were mapped and buffered as necessary for their protection. The current layout has avoided these sensitive features and buffer areas, negating the potential overall impact and risk to Aquatic resources.

The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the aquatic environment would be Very Low (-).

8.2 Conclusion and Impact Statement

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented. A key recommendation is also that that during the later design process, that the temporary construction camps and or substations as required be located outside of the aquatic systems and the associated buffer.

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10. Appendix 1: Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
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Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07)
Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

- 25 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon -

current

- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Plant and animal search and rescue for the Dassies Ridge Wind Farm on behalf of EDF, Current
- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, Current
- Plant and animal search and rescue for the Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project & OTGC Tank Farm, with development and management of on site nursery (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive) 2018
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – 2017
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - 2018
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay

- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for renewable projects in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farms), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

11. Appendix 2: Site verification / screening report

Part A of the Assessment Protocols published in GN 320 on 20 March 2020 (i.e., Site sensitivity verification is required where a specialist assessment is required but no specific assessment protocol has been prescribed) is applicable where the DEFF Screening Tool has the relevant themes to verify.

Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration (as identified by the screening tool) must be confirmed by undertaking a site sensitivity verification.

INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing to add one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines (namely the associated electrical infrastructure) to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development'). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality.

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). In addition, of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

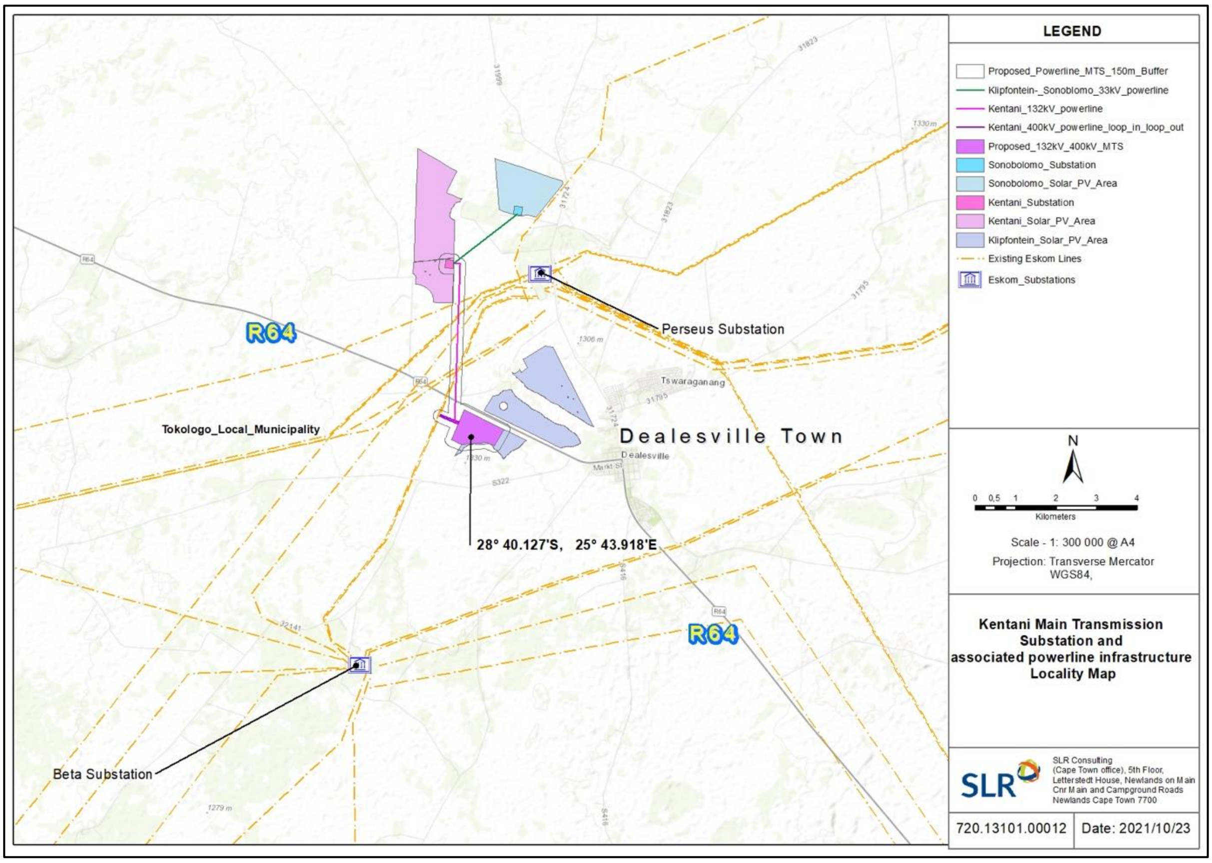

Figure 9: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016[5].

In addition to the above, the proposed MTS and powerlines are located within the Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.
The proposed MTS will occupy a footprint of approximately 64ha (i.e., 800m x 800m) . The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) are being proposed and will connect the proposed MTS to the existing Eskom 400kV powerline, located approximately 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) is being proposed and will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. One (1) 33kv powerline (approx. 2km in length) is being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed

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[5] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site).

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline

SITE SENSITIVITY VERIFICATION

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

Using the result of the specialist aquatic impact assessment, that made use of past and current spatial databases, aerial images and field work conducted within and adjacent to the site over a number of years / seasons, various habitats were delineated and the rated in terms of their sensitivity.

OUTCOME OF SITE SENSITIVITY VERIFICATION

Similar to the results of the Screening Tool, the study area contained two types of sensitivity aquatic habitats, namely Very High and Medium (Figure 10). However, the extent of the Very High Sensitivity areas was found be greater in extent that what is shown in Figure 10 and these were rated as No-Go including a 50m buffer

NATIONAL ENVIRONMENTAL SCREENING TOOL COMPARISON

Based on the DFFE Screening Tool, the site contains areas of very high sensitivity due to the presence of CBAs, NFEPAs and rivers. The remaining area within the development footprint is deemed to be of low sensitivity.

Figure 1 below shows the sensitivity map produced following the desktop assessment as well as a ground-truthing exercises, with mapping of the observed features at a finer scale.

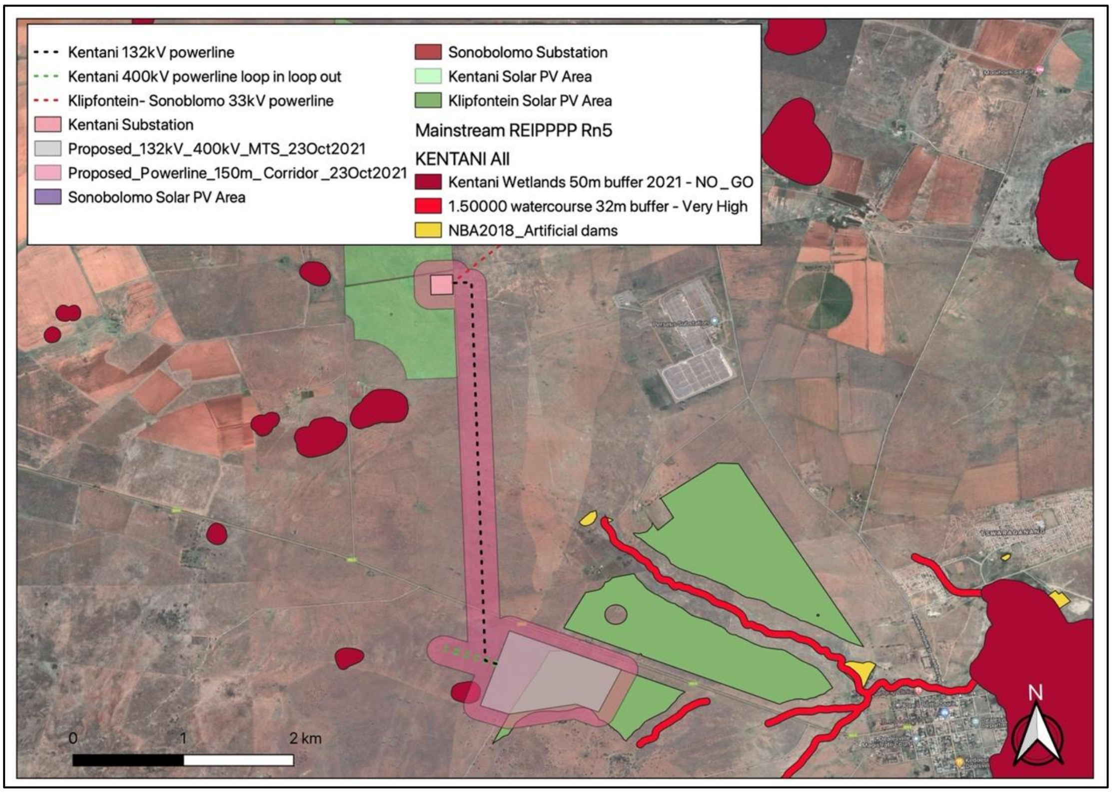

Figure 10:. Environmental sensitivity map produced by the aquatic specialist

CONCLUSION

In conclusion, the DFFE Screening Tool identified two sensitivity ratings within the development study area, very high and low. Although there is some overlap with the findings on site and the Screening Tool’s outcome, the extent of the Very High sensitivity areas was accurately delineated when compared to the Screening Tool.

However an appropriate layout has been developed to minimise the impact on the Very High areas and is presently deemed acceptable by the aquatic ecologist.

12. Appendix 3 - Methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area aquatic systems, applicable to the specific environment and, in a clear and objective manner, identify and assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions.

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand the legal definition of a wetland, the means of assessing wetland conservation and importance and the relevant legislation aimed at protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts. For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: The area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: As per the National Water Act means -

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology, and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment or any other activity that qualifies as a water use.

Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres” (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term ‘fen’ as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as “land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil.” This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. “wetlands”, as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

- A high-water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.

Table 2: Comparison of ecosystems considered to be ‘wetlands’ as defined by the proposed NWCS, the NWA and ecosystems included in DWAF’s (2005) delineation manual.

Ecosystem	NWCS “wetland”	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a ‘watercourse’ in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of ‘riparian areas’ (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF’s (2005) delineation manual.

National Wetland Classification System method

Due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS should be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)

- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.

The HGM unit (Level 4) is the focal point of the NWCS, with the upper levels (Figure 3 Figure – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

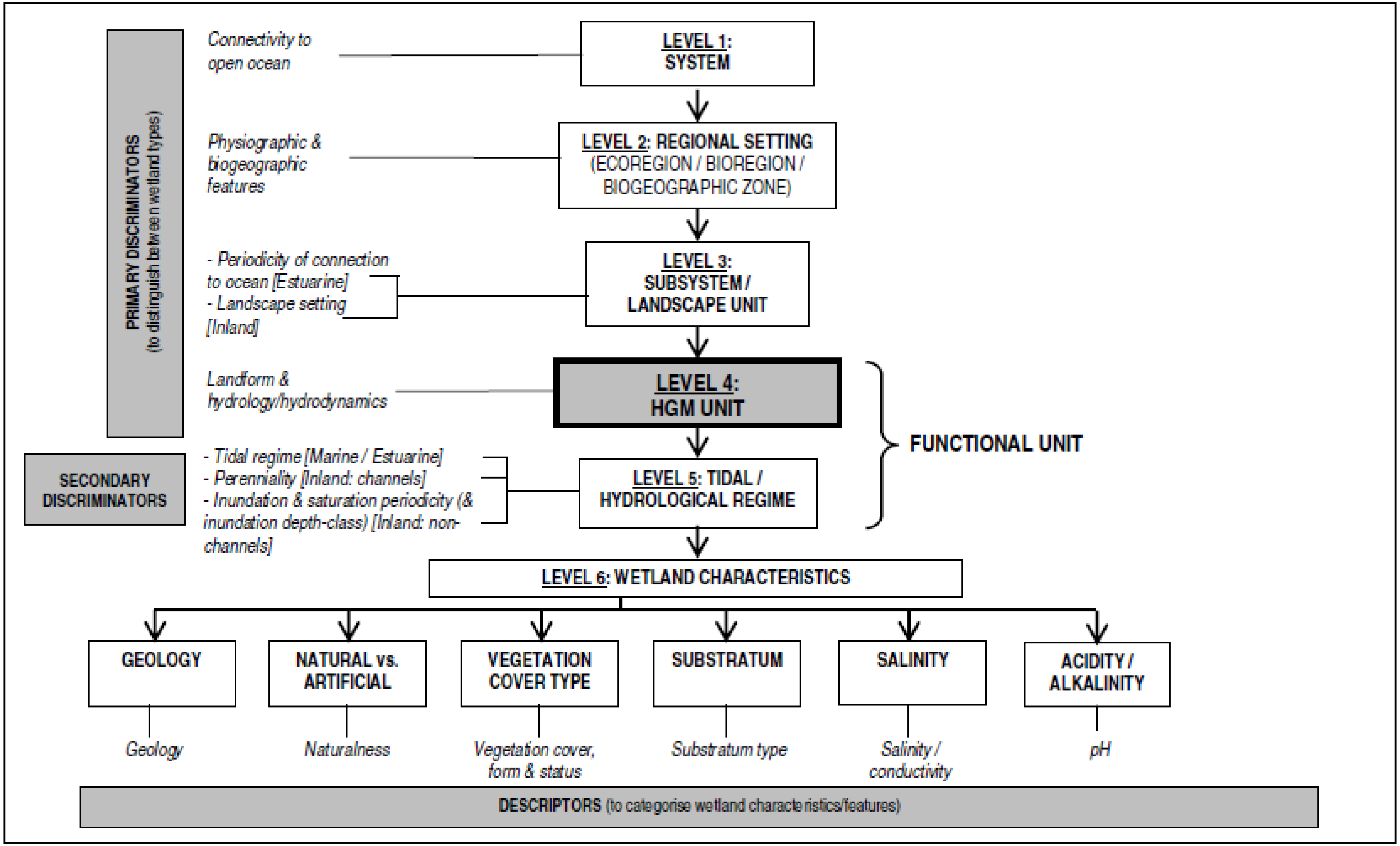

Figure 2: Basic structure of the NWCS, showing how ‘primary discriminators’ are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with ‘secondary discriminators’ applied at Level 5 to classify the tidal/hydrological regime, and ‘descriptors’ applied

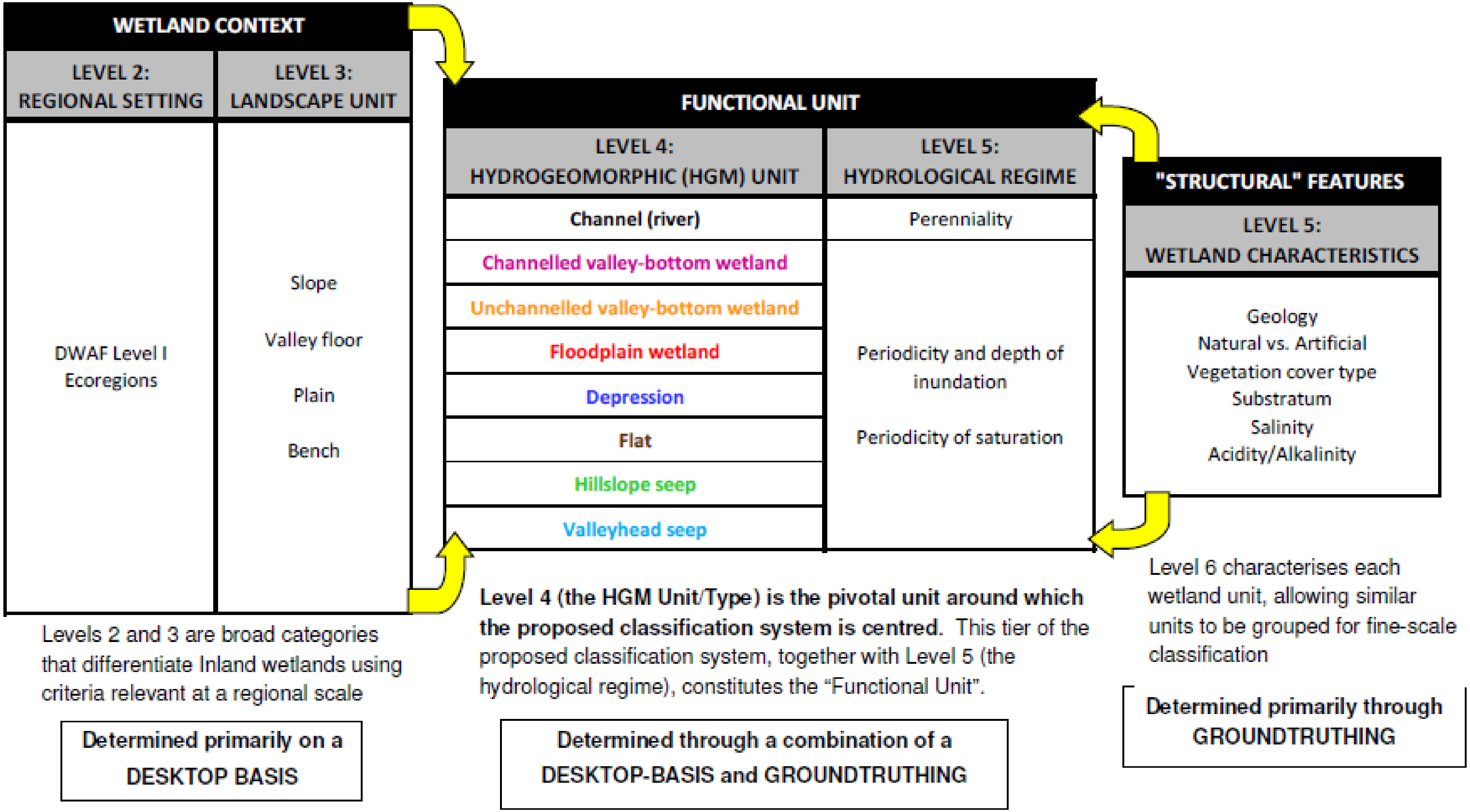

Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al*., 2013)

Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 3: Description of A – F ecological categories based on Kleynhans *et al*., (2005)

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA's River EcoStatus models which are currently used for the assessment of PES in riverine environments.

Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:
- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al.,* 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 4: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al.*, 2008

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits	Flood attenuation	
			Stream flow regulation	
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
			Carbon storage	
		Biodiversity maintenance		
	Direct benefits	*Provision of water for human use*		
		Provision of harvestable resources[2]		
		Provision of cultivated foods		
		Cultural significance		
		Tourism and recreation		
		Education and research		

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors.

Avifauna

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5 August 2022

RE: ARTEMIS OXFORD POWER LINES PROJECT - AVIFAUNA

Dear Ms Scott-Shaw,

South Africa Mainstream Renewable Power Developments (Pty) Ltd (‘Mainstream’) is proposing the development of one (1) Radio Mast, two (2) x 400kV power lines and one (1) x 132kV power line that will connect to the authorised 132kV/400kV Main Transmission Substation (MTS) (14/12/16/3/3/1/2460/AM1) as well as to the approved 100MW Kentani Solar Photovoltaic (PV) Energy Facility (14/12/16/3/3/2/724/AM3) respectively. The Kentani Solar PV Energy Facility is one (1) of eleven (11) solar PV projects collectively known as the Kentani Cluster located near the town of Dealesville, within the Tokologo Local Municipality (Lejweleputswa District) in the Free State Province (Figure 1).

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)].

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, namely Gwede Mantashe, announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the Solar Energy Facilities, collectively referred to as the “Kentani Cluster”, received Preferred Bidder status i.e.:

- Kentani Solar PV (14/12/16/3/3/2/724/AM3)
- Sonoblomo Solar PV (14/12/16/3/3/2/723/AM2)
- Klipfontein Solar PV (14/12/16/3/3/2/722/AM2)
- Klipfontein 2 Solar PV (14/12/16/3/3/2/726/1/AM1)
- Leliehoek Solar PV (14/12/16/3/3/2/728/AM2)
- Braklaagte Solar PV (14/12/16/3/3/2/727/1)

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e., SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The approved MTS and associated infrastructure will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the 132kV/400kV MTS development footprint and the 132kV and 400kV corridors (in which the respective powerlines which form part of this application / BA process would be situated) were granted authorisation by the DFFE in April 2022 (DFFE Reference Number: 14/12/16/3/3/1/2460/AM1). However, due to technical consideration, the approved 132kV and 400kV corridors are not suited to connect the approved MTS to the National grid nor the authorised Kentani Solar PV (DFFE Reference Number: 14/12/16/3/3/2/724/AM3) to the MTS, and as such additional small portions of the corridors are required to be assessed to accommodate the technical changes.

The powerlines are located within the Kimberly Renewable Energy Development Zone (REDZ) (namely REDZ 4) and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

The respective power lines which are being proposed as part of this application and BA process are as follows:

1. **Two (2) 400kV overhead power lines (approx. 1km in length) are being proposed and will connect the approved MTS (14/12/16/3/3/1/2460/AM1) to the existing Eskom 400kV powerline, located approximately 700m west of the approved MTS site, via a Loop-In-Loop Out (LILO) connection; and**
2. **One (1) 132kV power line (approx. 5km in length) is being proposed and will connect the approved MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724/AM3), located approx. 4.85km north-west of the approved MTS site.**
3. **One (1) Radio Mast (approx. 90m height) will be situated within the approved MTS site.**

A road in the servitude under the proposed power lines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, power line corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the power lines within the authorised corridor (should the EA be granted).

It must be noted that the majority of the proposed power lines being proposed are located within existing approved power line corridors and that only small sections will traverse outside of the approved corridors:

- **The portion of the 132kV powerline outside of an existing approved corridors and Eskom servitudes is approximately 700m**
- **The portion of the each of the 400kV powerlines outside of an existing approved corridors and Eskom servitudes is approximately 150m and 250m respectively**
- **The addition of an 90m high radio mast to the approved MTS site**

Further to the above, the proposed Radio Mast will be located on the approved MTS (14/12/16/3/3/1/2460/AM1).

Considering the above, it is important to note that the location of the corridors for the power lines being proposed as part of this application have previously been assessed as part of the development footprint for the approved MTS and power line corridors (14/12/16/3/3/1/2460/AM1) as well as the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed power line development may have an impact on the environment and trigger certain listed activities in Listing Notice 1 of the EIA Regulations, 2014 (as amended) (Government Notice No. 983, as amended). These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended). To inform the assessment, specialist studies are required.

Due to the fact that majority of the proposed powerline corridors and the position of the mast being proposed have previously been assessed as part of approved developments (14/12/16/3/3/2/724/AM3) & 14/12/16/3/3/1/2460/AM1), a full avifaunal impact assessment was not deemed necessary. WildSkies has provided this assessment letter (which will be appended to the specialists' original report). Figure 1 shows the layout.

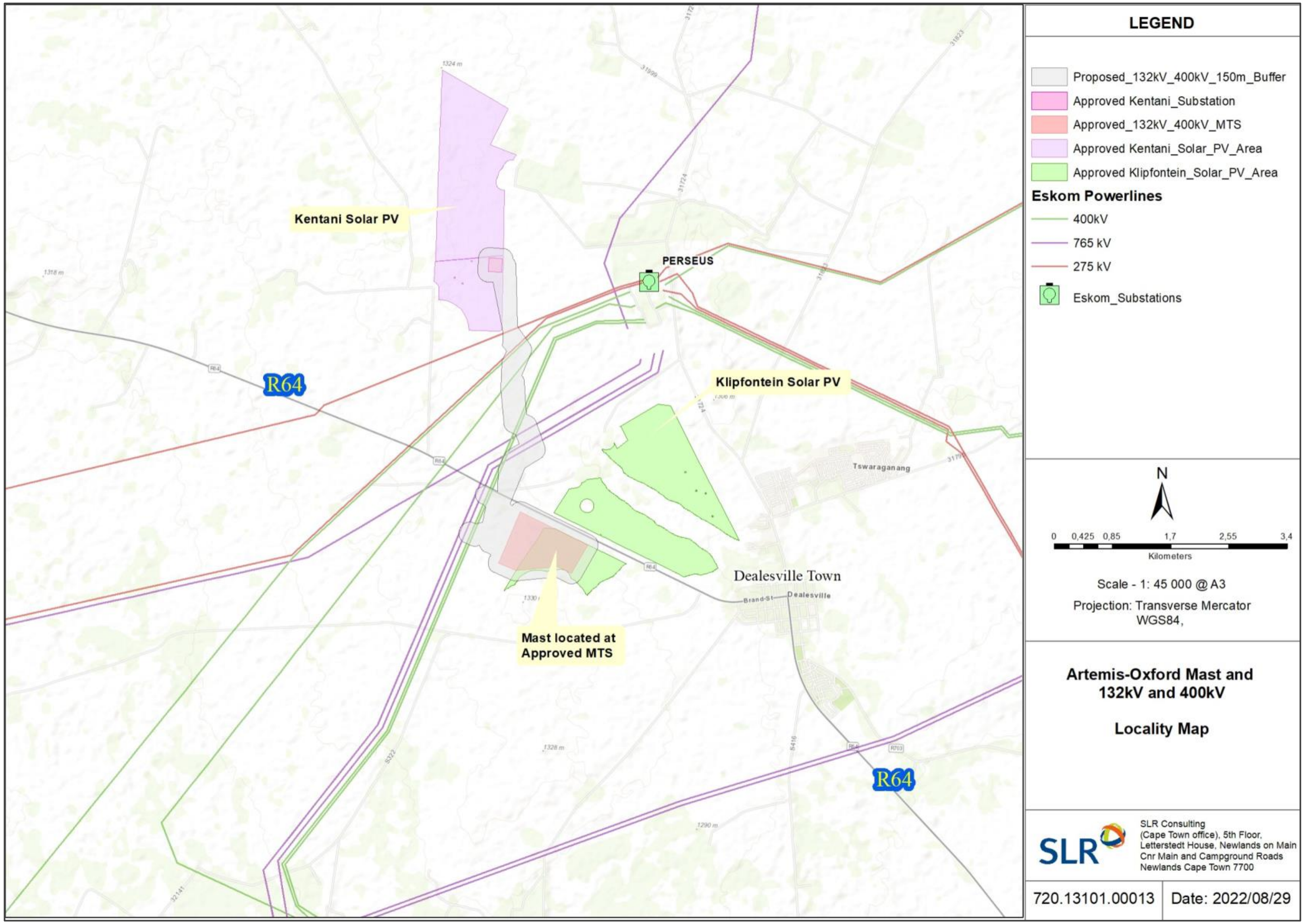

Figure 1. Locality Map of the proposed powerlines (132kV & 400kV) in relation to approved MTS and associated electrical infrastructure (including grid connection corridors) (14/12/16/3/3/1/2460/AM1).

Our findings are as follows:

- The status quo has not changed at all since the last assessment undertaken between October and November 2021
- The small new portions of the proposed powerline corridor do not result in any change to the impact assessments undertaken as part of the original study / assessment. These are repeated below for clarity

Phase	**Impact**	**Pre-mitigation**	**Post mitigation**
Construction	Habitat destruction	Low	Low
	Disturbance of birds	Low	Low
Operations	Collision of birds with overhead cables	Medium	Low
	Electrocution of birds perching on pylons	Low	Low
Cumulative impacts	Cumulative impacts of the project on birds	Medium	Low

- There is no new mitigation or EMP requirements needed as a result of the new small portions
- All findings of the original assessment are still applicable

The proposed project is acceptable from an avifaunal perspective and should receive environmental authorisation.

Please contact me if any further clarity is required.

Kind Regards

Jon Smallie

Kentani Substation & associated power lines

Avifaunal Impact Assessment

November 2021

Prepared by:
WildSkies Ecological Services (Pty) Ltd
Jon Smallie
jon@wildskies.co.za

Submitted to:
SLR Consulting
Liandra Scott-Shaw
lscottshaw@slrconsulting.com

Executive summary

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing to add one (1) Main Transmission Substation (MTS) and four (4) power lines, with varying capacities (namely the associated electrical infrastructure), to their authorised Kentani Cluster of solar developments near the town of Dealesville in the Free State Province (the 'proposed development') (see Figure 1). The Kentani Cluster of solar developments consists of eleven (11) solar photovoltaic (PV) projects and associated electrical infrastructure (including a power line), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)].

Up to approximately 273 bird species occur in the broader area within which the proposed project is located. Included amongst these 273 species are a number of regionally and globally Red Listed bird species and a number of endemics. These include most importantly: 1 Critically Endangered species, White-backed Vulture; and 4 Endangered species – Black Harrier, Ludwig's Bustard, Yellow-billed Stork, Martial Eagle and Tawny Eagle; 6 Vulnerable species; and 10 Near-threatened species.

Based on the formal criteria supplied by SLR, we have rated the potential impacts on avifauna as follows:

Phase	Impact	Pre-mitigation	Post mitigation
Construction	Habitat destruction	Low	Low
	Disturbance of birds	Low	Low
Operations	Collision of birds with overhead cables	Medium	Low
	Electrocution of birds perching on pylons	Low	Low
Cumulative impacts	Cumulative impacts of the project on birds	Medium	Low

These impacts will require the following mitigation measures to be implemented:

- A pre-construction avifaunal walk down should be conducted to:
    - Confirm final layout and identify any sensitivities that may arise between the conclusion of the BA process and the construction phase.
    - Identify any sensitive species breeding on site that may arise between the conclusion of the BA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.

- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.
- A pre-construction avifaunal walk down should be conducted to provide final confirmation of the sections of power line requiring bird collision mitigation.
- The overhead cables on high risk sections of the alignments (should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw *et al*, 2021). The line marking device should be a dynamic (moving – bird flapper type) device. The new power line should be patrolled by Mainstream annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices. Where multiple devices on a span have failed, they should be replaced immediately. Data should be submitted to the Eskom – Endangered Wildlife Trust Strategic Partnership where it will be curated and publicly accessible.
- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed, we are given opportunity to assess the electrocution risk of the new structure and design mitigation measures.

If these mitigation measures are implemented correctly we believe that the impacts of the proposed project will be at an acceptable level and we recommend the proposed project be authorised to proceed.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of 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;	Page 5
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 5
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2.3
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;	Section 5
g) an identification of any areas to be avoided, including buffers;	Section 5
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;	Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 8
l) any conditions for inclusion in the environmental authorisation;	Section 9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8 & 9
n) a reasoned opinion- i. (as to) 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 should be authorised, any avoidance, management and mitigation	Section 9

measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 2.4
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.	n/a

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

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Kindly note the following:

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

Departmental Details

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

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia
Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:

Email: EIAAdmin@environment.gov.za

SPECIALIST INFORMATION

Specialist Company Name:	WILDSKIES ECOLOGICAL SERVICES PTY LTD			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	J. SMALLIE			
Specialist Qualifications:	BSC MSC			
Professional affiliation/registration:	SACNASP 400020/06			
Physical address:	36 UTRECHT AVENUE, EAST LONDON, 5241			
Postal address:				
Postal code:	5241	Cell:	0824448919	
Telephone:		Fax:		
E-mail:	JON@WILDSKIES.CO.ZA			

DECLARATION BY THE SPECIALIST

I, ______J. SMALLIE____________________________, 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

WILDSKIES ECOLOGICAL SERVICES PTY LTD

Name of Company:

8 November 2021

Date:

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1. Introduction

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing to add one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and Li-Ion Battery Energy Storage System (BESS) to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development') (see Figure 1). The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)][1].

The proposed MTS, BESS and associated power lines, which form part of this new application and Basic Assessment (BA) process, will service all eleven (11) of Mainstream's authorised solar PV projects and associated electrical infrastructure. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality.

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

line development to leverage off regulatory approvals, supply chain and project development capacity

It should also be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). It should also be noted that the proposed MTS and power lines are located within one (1) of the Central Strategic Transmission Corridors (namely the Central Corridor), as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. It is important to note that since the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), the location of the proposed MTS has previously been assessed as part of the development footprint for the Klipfontein PV project, which received EA in 2016.

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended).

Mainstream has appointed SLR Consulting Africa (South Africa) Pty Ltd ("SLR") to conduct the necessary Basic Assessment (BA) Process. The project has potential to impact on avifauna and so WildSkies Ecological Services Pty Ltd ("WildSkies") was appointed by SLR to conduct an avifaunal impact assessment.

It should also be noted that the proposed MTS is located within one of the Central Strategic Transmission Corridors (namely the Central Corridor) as defined and in terms of the Government Notice No 113 and No 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

Figure 1 shows the layout of the proposed activities.

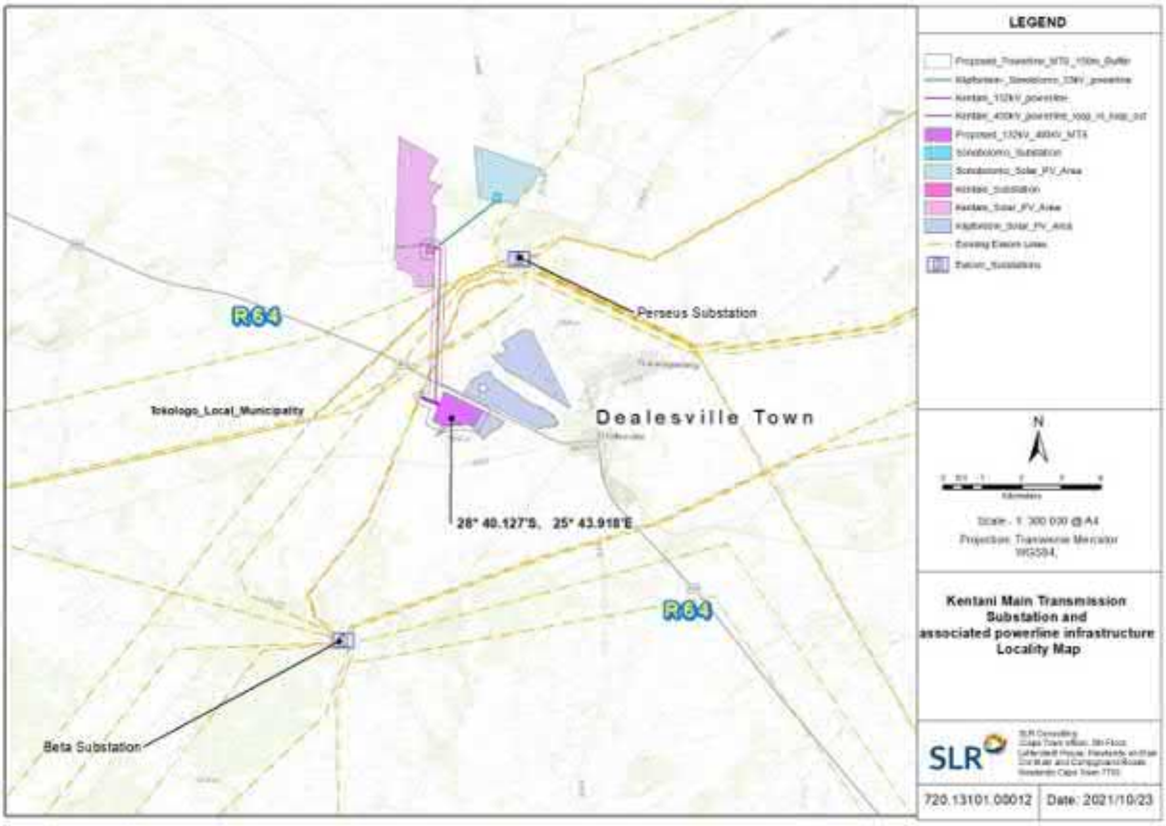


Figure 1. The locality map (SLR).

2. Methods

2.1. Project description

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and

3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site foot print

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.
As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

The typical pylon structures for the proposed power lines are shown below. These typical structures in Figure 2 will be used for all the proposed 400kVpower lines and the structures in Figure 3 will also be used for all the proposed 132kV powerlines, including the 33kV line. Typical 400kV pylon tower designs include the Guyed V type, Cross-Rope suspension type and self-supporting type, the design depending on whether the pylons will be placed within a straight section within the grid connection corridor, or at bends (Figure 2).

Figure 2. Typical 400kV Guyed V type (left) and Cross-Rope suspension (middle) and self-supporting (right) design

Typical 132kV pylon designs are monopole-type or lattice-type pylons the design depending on whether the pylons will be placed within a straight section within the grid connection corridor, or at bends.

Figure 3. Typical 132kV monopole type (left) or lattice-type pylons (right) design

Minimum phase-phase and phase-earth clearances for the above structures will be 2.4m to 3.8m for 132kV and 4m for 400kV.

A road in the servitude under the proposed power lines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required. It should be noted that power line corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV power lines as part of the BA process. This is to allow flexibility when routing the power lines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV power line.

2.2. Scope of work

The appointed specialist is required to conduct an Avifauna (bird) Impact Assessment on the proposed MTS location, BESS, two grid corridors and one 33kV distribution line. Furthermore as mentioned the location of the MTS and associated infrastructure is located within the authorised Klipfontein PV facility, which has been assessed previously by WildSkies.

The scope of work includes the following:

- Review the DFFE online screening tool to assess the site sensitivity;
- Prepare a Site Sensitivity Verification and Impact Assessment Report in line with the Gazetted specialist protocols;
- Undertake a desktop study for initial data collection;
- Conduct a field survey for ground truthing and additional data collection; and
- Compile a report (including updates thereon) at BA level to comply with the latest regulations regarding specialist studies (i.e. site verification report and impact assessment report).

2.3. General approach

In predicting the interactions between the proposed development and birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various avifaunal data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site, and the importance of the study area for these species.
- The substation site and power line routes were surveyed by driving and walking as much as possible of the route. During this field work the following was conducted:

    - Identification of micro habitats/land use on site
        - Representative photographs were taken of available micro habitats (e.g. dams, wetlands, crops, etc.);
        - Identification of any sensitive receptors e.g. wetlands, roosts, raptor nests etc.; and
        - Identification of any constraints to power line routing. For example wetlands and dams that could be avoided with slight route amendment.
- Field survey work was done in October 2021. This qualifies as spring, which is a good time to sample this type of avifaunal community. The timing of the field survey is therefore acceptable.
- A list of priority bird species was determined for this assessment.
- The potential impacts of the proposed project on these above species and habitats were described and evaluated.
- Recommendations were made for the management and mitigation of impacts.

In simple terms, this study assesses which bird species could occur on site, how important they are, how important the site is for them, how the project will affect them, and how to mitigate these effects.

2.4. Information sources

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP1 – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997 & SABAP2 - http://sabap2.adu.org.za) was consulted in order to ascertain which species occur in the study area. The useful source www.mybirdpatch.org.za combines these two data sources.
- The regional conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al,* 2015). The global conservation status was obtained from the IUCN Red List (2021).
- The Important Bird and Biodiversity Areas of South Africa data (Marnewick *et al*. 2015) was consulted. This is described in Section 3.2.
- The Co-ordinated Avifaunal Roadcount (CAR) data from South Africa (www.car.birdmap.africa) was consulted to determine its relevance. The closest route is approximately 3km from the proposed site and is discussed more in Section 3.2.
- The Co-ordinated Waterbird Count (CWAC) data was consulted (www.cwac.birdmap.africa) to determine whether any data is available for the site. This is described more in Section 3.2.

- Information on the micro-habitat level was obtained through visiting the area and obtaining a first-hand perspective.
- Satellite Imagery of the area was studied using Google Earth ©2021.
- Previous studies on the solar photovoltaic site by WildSkies (2015).

2.5. Assumptions & limitations

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

This report is the result of a short term study, no long term studies were conducted on site. This study therefore depends heavily upon secondary or existing data sources such as those listed above. This study assumes a reasonable degree of accuracy of these data.

Predictions in this study are based on experience of these and similar species in different parts of southern Africa, through the authors' experience working in the field of wildlife – energy interaction since 2000. However bird behaviour can't be reduced to formulas that will hold true under all circumstances.

2.6. Legislation and relevant guidelines

The legislation and guidelines relevant to this specialist field and development include the following:

The Convention on Biological Diversity (CBD): dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory to this convention and should therefore abide by its' principles.

An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will not occur lies with the proponent of the activity posing the threat.

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention): aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.

The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA): is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.

The National Environmental Management – Biodiversity Act - Threatened or Protected Species list (TOPS). Those TOPS species relevant to this study and occurring on site are discussed in this report.

The National Environmental Management Act, No. 107 of 1998 (NEMA as amended): An Environmental Authorisation is required for Listed Activities in Regulations pursuant to NEMA The avifaunal assessment feeds into the Scoping and EIA process to inform whether the project can proceed or not.

3. Potential interaction between birds & proposed project

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

3.1. Habitat destruction during construction

During the construction phase of almost any development, some habitat destruction and alteration inevitably takes place. This happens with the construction of the development itself, access roads, and associated infrastructure. This is true of power lines and substations such as those proposed. Birds rely on habitat to meet their needs for foraging, drinking, resting, commuting and breeding. Of these it is probably breeding habitat which is most important to protect, although this varies between bird species. The significance of habitat destruction is influenced by a number of factors, including: size of area to be affected; sensitivity of receiving habitat; uniqueness of the habitat; degree of habitat specialisation of the bird species utilising the habitat; and the conservation status and sensitivity of the species using the habitat.

3.2. Disturbance of birds during construction of the proposed development

The construction and operational activities can impact on birds through disturbance, particularly during bird breeding activities. Particular project activities of concern include blasting, drilling, heavy earth moving general vehicular movement and any other activities which result in noise or increased human activity in an area. Disturbance of non-breeding birds may simply require them to move further away or adjust their activities during the disturbance. This may be either temporary or permanent. Disturbance of breeding birds may result in lower breeding productivity, failed breeding in the relevant season, and temporary or permanent abandonment of a breeding site. All of these reduce the recruitment of young birds to the population and can have significant implications for Red Listed species in particular, many of which are slow to reach breeding age and breed in small numbers.

3.3. Electrocution of birds whilst perched on pylons

This is caused when a bird bridges the gap between either: a live and an earthed component (phase-earth electrocution); or two live phases (phase-phase electrocutions). This type of impact is a function of line design and the dimensions of the birds' extremities. Larger bird species have a greater chance of bridging the critical clearances, causing a short circuit and being electrocuted. This risk is fairly easily managed by designing the pylons in a bird friendly manner from the outset.

3.4. Collision of birds with overhead cables

Collisions are the biggest single threat posed by the larger overhead lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

The Red List bird species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the result that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

4. Description of the affected environment

4.1. Vegetation type & micro habitat

The site is comprised entirely of one vegetation type – "Vaal-Vet Sandy Grassland" as shown in Figure 4 (Mucina & Rutherford, 2018). This is an 'Endangered' and 'Hardly Protected' vegetation type.

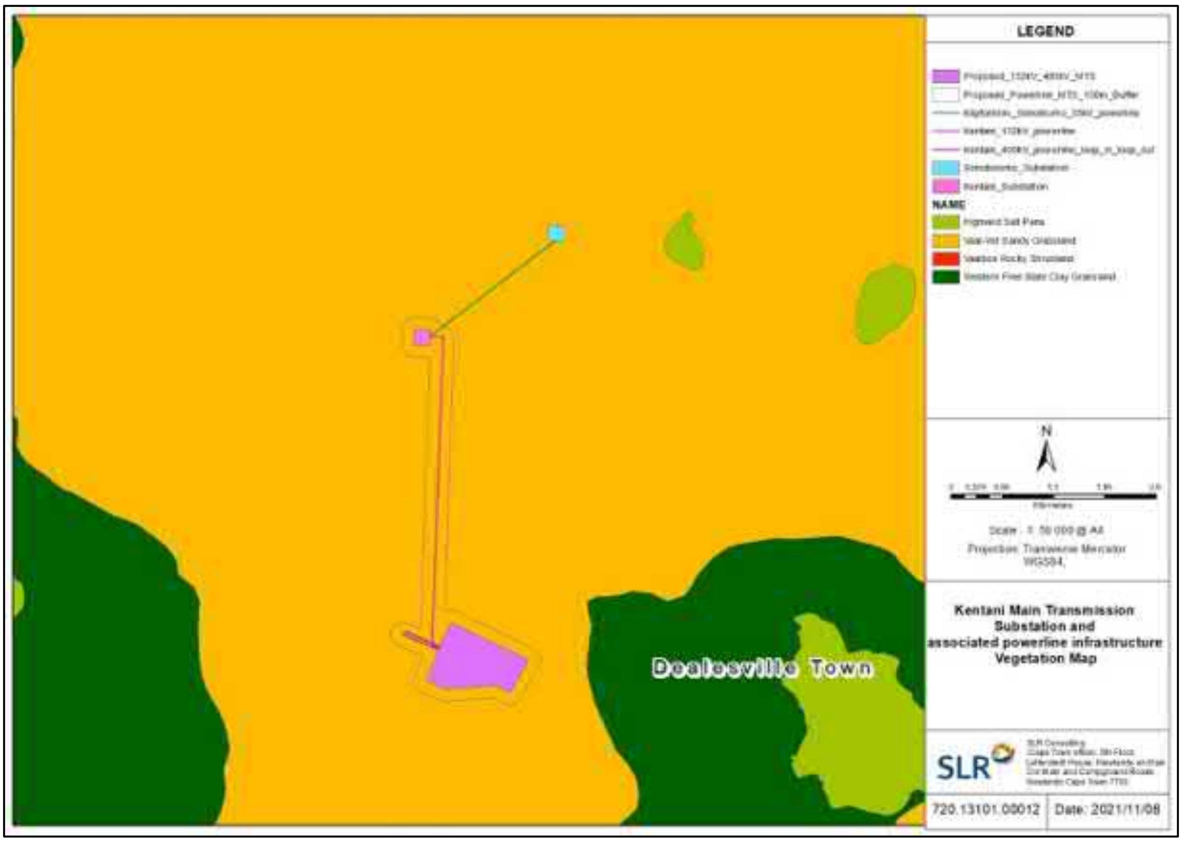


Figure 4. Vegetation types on site (Mucina & Rutherford, 2018).

For avifaunal purposes, the site is predominantly grassland vegetation interspersed with some isolated thorn trees in places. The micro habitats available to birds on the site are: grassland; thorn trees; stands of exotic trees, and small pans. Examples of these are shown Appendix 3.

4.2. Avifaunal community

The first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; and www.sabap2.adu.org.za) recorded a combined total of approximately 273 bird species in the broader area within which the proposed project is located. These are the species which could occur on the proposed site if conditions are right, but they have not all necessarily been confirmed on the site. Included amongst these 273 species are a number of regionally and globally Red Listed bird species and a number of endemics. These species are the priority bird species for this assessment and are presented in Table 1. Our own brief field survey recorded 19 bird species (Appendix 2), including most importantly a pair of Secretarybird *Sagittarius serpentarius*.

Important Bird Areas

No Important Bird and Biodiversity Areas (IBA's) exist on or close to the site. The closest is the Soetdoring Nature Reserve approximately 30km south-east of the site. This is too far to be relevant to this study.

Coordinated Avifaunal Roadcounts

Two to three Coordinated Avifaunal Roadcount (CAR) routes are located close enough to the proposed site for their data to be relevant (Figure 5). The most relevant of these are: FS55 and FS65, which are both situated less than 3km from the proposed site at their closest point. CAR counts are a vehicle based census of birds (focussed on large terrestrial species) performed twice annually (in winter and summer) by volunteer birdwatchers. The purpose is to provide population data for use in science, especially conservation biology, by determining findings about the natural habitats and the birds that use them. Relevant bird species recorded regularly on the FS55 and FS65 routes include Blue Crane *Grus paradisea*, Northern Black Korhaan *Afrotis afraoides*, Secretarybird, and White Stork *Ciconia ciconia*.

Coordinated Waterbird Counts

Coordinated Waterbird Counts (CWAC) consist of a programme of mid-summer and midwinter censuses at a large number of South African wetlands. The counts are conducted by citizen scientists at more than 400 wetlands around the country and provide a useful source of information on wetland bird species in South Africa. No CWAC sites exist close enough to the proposed site to be relevant.

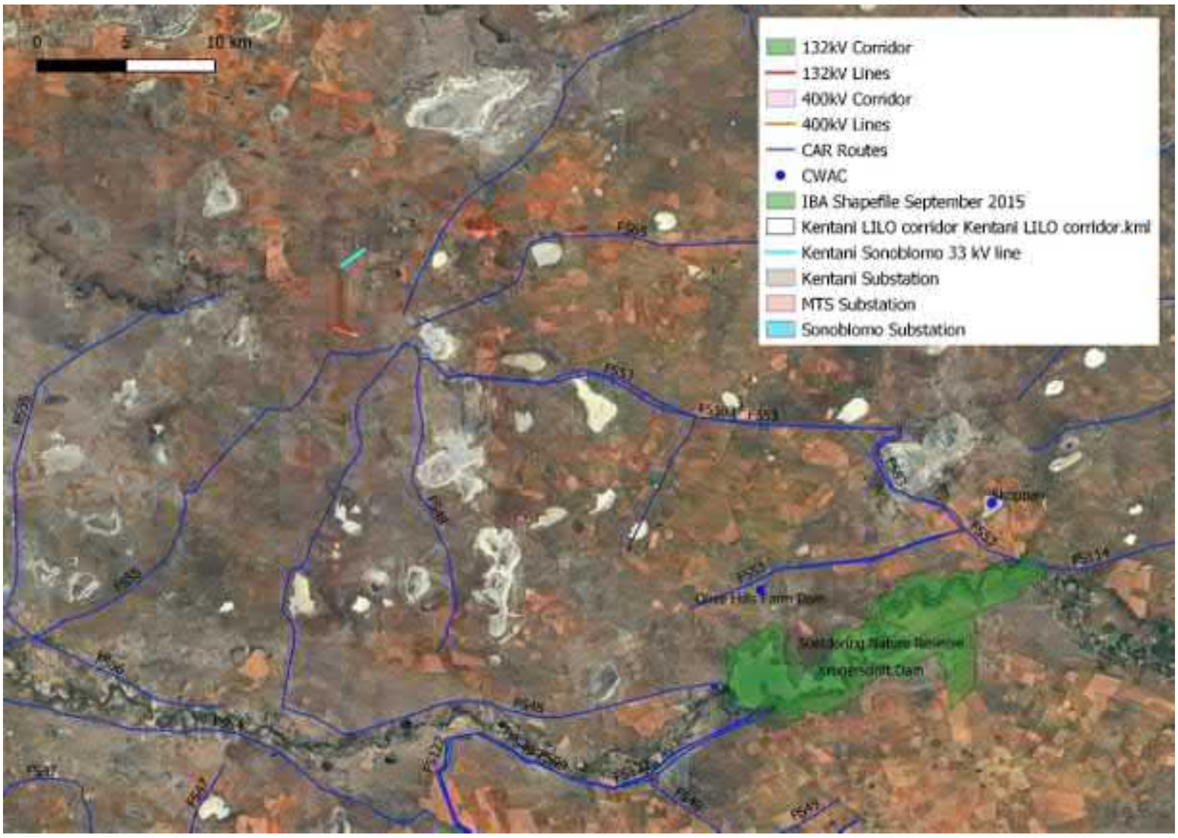


Figure 5. Avifaunal information for the site.

Appendix 2 presents the bird atlas data for the site and includes the species we recorded on the site. Table 1 summarises the priority bird species for the site and their likelihood of occurrence on site and possible impacts.

Three main ecological groups of bird species are relevant to this assessment:

1. Raptors – including White-backed Vulture, Martial *Polemaetus bellicosus* and Tawny Eagles *Aquila rapax*, Black Harrier *Circus maurus*, and Lanner Falcon *Falco biarmicus*. These species will occur throughout the site and will be at some risk of collision with the power line and electrocution on the power line.

2. Large terrestrial species – including Ludwig's Bustard *Neotis ludwigii*, Blue Crane, Secretarybird, Kori Bustard *Ardeotis kori*. These species will occur mostly in the more open areas and will be at high risk of collision with overhead cables.

3. Small terrestrial species – such as pipits, larks, coursers, pratincoles, plovers, and many others. These species will occur on the site and be at risk of habitat destruction and disturbance.

Table 1. Priority bird species for the site.

Common name	***Taxonomic name***	**Regional, Global, Endemic**	**SAB AP1**	**SAB AP2**	**Specialist survey**	**Likelihood of occurring on site**	**Potential impacts**
Vulture, White-backed	*Gyps africanus*	CR, CR		1		Probable, confirmed nearby	Electrocution, collision
Harrier, Black	*Circus maurus*	EN, EN, NE	1	1		Possible	Collision, habitat destruction, disturbance
Bustard, Ludwig's	*Neotis ludwigii*	EN, EN	1	1		Possible	Collision, habitat destruction, disturbance
Stork, Yellow-billed	*Mycteria ibis*	EN, LC	1			Unlikely	-
Eagle, Martial	*Polemaetus bellicosus*	EN, VU	1			Possible	Electrocution, collision
Eagle, Tawny	*Aquila rapax*	EN, VU	1			Possible	Electrocution, collision
Courser, Burchell's	*Cursorius rufus*	VU, LC	1	1		Possible	Habitat destruction, disturbance
Falcon, Lanner	*Falco biarmicus*	VU, LC	1	1		Possible	Collision, habitat destruction, disturbance
Stork, Black	*Ciconia nigra*	VU, LC	1	1		Unlikely	-
Tern, Caspian	*Hydropogne caspia*	VU, LC	1	1		Unlikely	-
Pelican, Pink-backed	*Pelecanus rufescens*	VU, LC	1			Unlikely	-
Secretarybird	*Sagittarius serpentarius*	VU, VU	1	1	1	Confirmed	Collision, habitat destruction, disturbance
Pipit, African Rock	*Anthus crenatus*	NT, LC, SLS		1		Possible	Habitat destruction, disturbance
Flamingo, Greater	*Phoenicopterus roseus*	NT, LC	1	1		Unlikely	-
Roller, European	*Coracias garrulus*	NT, LC	1	1		Possible	Habitat destruction, disturbance
Stork, Abdim's	*Ciconia abdimii*	NT, LC	1	1		Possible	Collision, habitat destruction, disturbance
Bustard, Kori	*Ardeotis kori*	NT, NT	1	1		Possible	Collision, habitat destruction, disturbance
Flamingo, Lesser	*Phoeniconaias minor*	NT, NT	1	1		Unlikely	-
Pratincole, Black-winged	*Glareola nordmanni*	NT, NT	1	1		Possible	Habitat destruction, disturbance
Plover, Chestnut-banded	*Charadrius pallidus*	NT, NT		1		Possible	Habitat destruction, disturbance
Crane, Blue	*Grus paradisea*	NT, VU	1			Possible	Collision, habitat destruction, disturbance
Duck, Maccoa	*Oxyura maccoa*	NT, VU	1			Unlikely	-
Korhaan, Blue	*Eupodotis caerulescens*	LC, NT, SLS	1	1		Possible	Collision, habitat destruction, disturbance
Sandpiper, Curlew	*Calidris ferruginea*	LC, NT	1			Possible	Habitat destruction, disturbance
Egret, Slaty	*Egretta vinaceigula*	NA, VU	1	1		Unlikely	-
Swallow, South African Cliff	*Petrochelidon spilodera*	BSLS	1	1		Possible	Habitat destruction, disturbance

Common name	***Taxonomic name***	**Regional, Global, Endemic**	**SAB AP1**	**SAB AP2**	**Specialist survey**	**Likelihood of occurring on site**	**Potential impacts**
Bulbul, Cape	*Pycnonotus capensis*	E	1	1		Possible	Habitat destruction, disturbance
Buzzard, Jackal	*Buteo rufofuscus*	NE	1	1		Possible	Habitat destruction, disturbance
Chat, Sickle-winged	*Emarginata sinuata*	NE	1	1		Possible	Electrocution, habitat destruction, disturbance
Cisticola, Cloud	*Cisticola textrix*	NE	1	1		Possible	Habitat destruction, disturbance
Flycatcher, Fairy	*Stenostira scita*	NE	1	1		Possible	Habitat destruction, disturbance
Flycatcher, Fiscal	*Melaenornis silens*	NE	1	1		Possible	Habitat destruction, disturbance
Lark, Large-billed	*Galerida magnirostris*	NE	1	1	1	Confirmed	Habitat destruction, disturbance
Lark, Melodious	*Mirafra cheniana*	NE	1	1		Possible	Habitat destruction, disturbance
Thrush, Karoo	*Turdus smithi*	NE	1	1		Possible	Habitat destruction, disturbance
Warbler, Namaqua	*Phragmacia substriata*	NE	1	1		Possible	Habitat destruction, disturbance
White-eye, Cape	*Zosterops virens*	NE	1	1		Possible	Habitat destruction, disturbance
Canary, Black-headed	*Serinus alario*	NE	1			Possible	Habitat destruction, disturbance
Prinia, Karoo	*Prinia maculosa*	NE	1			Possible	Habitat destruction, disturbance
Tit-Babbler (Warbler), Layard's	*Sylvia layardi*	NE		1		Possible	Habitat destruction, disturbance
Starling, Pied	*Lamprotornis bicolor*	SLS	1	1	1	Confirmed	Habitat destruction, disturbance
Lark, Eastern Long-billed	*Certhilauda semitorquata*	SLS	1			Possible	Habitat destruction, disturbance
Prinia, Drakensberg	*Prinia hypoxantha*	SLS	1			Possible	Habitat destruction, disturbance

Regional: Red Data regional (Taylor et al, 2015). CR- Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near-threatened; LC-Least concern

Global: IUCN, 2021

Endemic: E-Endemic; NE-Near-endemic; SLS-Endemic to South Africa, Lesotho, Swaziland; BSLS=Endemic to Botswana, SA, Lesotho, Swaziland

SABAP1, 2 = Southern African Bird Atlas Project 1 and 2. '1' denotes presence, not abundance

5. Screening verification & Sensitivity mapping

5.1. Site sensitivity verification report

In accordance with GN 320 and GN 1150 (20 March 2020) of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool).

We examined the Screening Tool output and found the following:

- MTS Substation – Animal Theme is classed as Medium sensitivity (Figure 6), with Ludwig's Bustard highlighted. Avian Theme is not rated.
- The various power lines – Animal Theme is classed as Medium sensitivity (Figure 7), again with Ludwig's Bustard highlighted. Avian Theme is not rated.

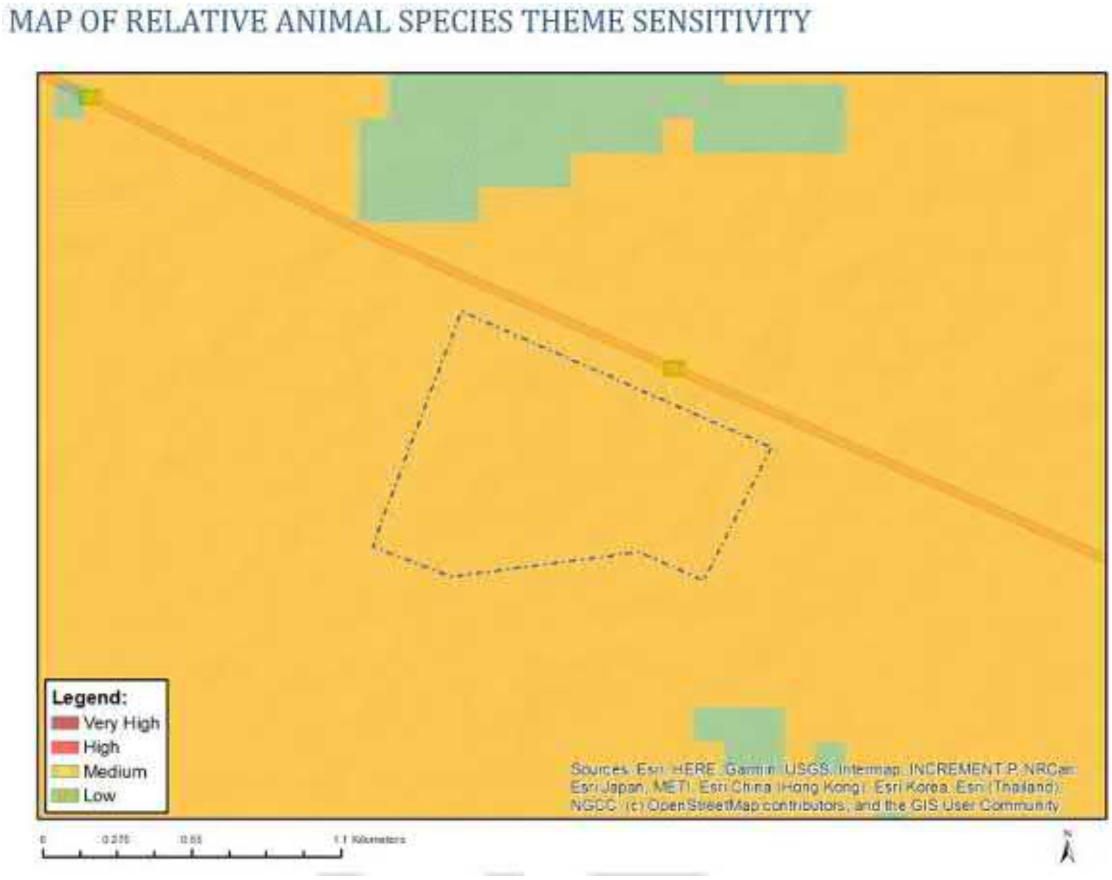
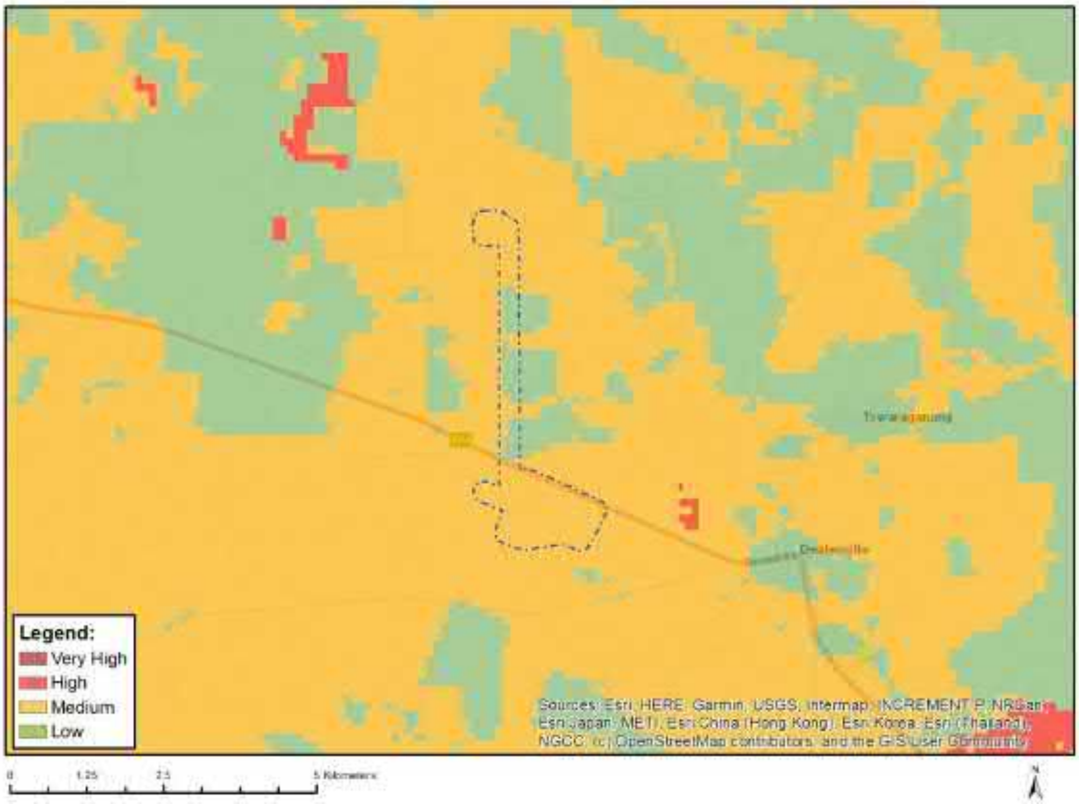


Figure 6. DEFF Screening Tool output for MTS Substation – Animal Theme.

Figure 7. DEFF Screening Tool output for power lines – Animal Theme.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



The environmental sensitivity of the proposed development area for the “Animal Theme” and by implication the “Avian Theme” (although not rated by the tool) was established by our own work as follows:

- desk top analysis, using all available data sources (specified in Section 2.4); and
- field survey on site as described in Section 2.3

Based on our work we confirm that the site is of Medium sensitivity for avifauna.

5.2. Site sensitivity mapping

There are no sensitive features on the site that can be identified spatially. The site is uniform in its’ sensitivity and no constraints or sensitivities exist.

6. Assessment of impacts

The impacts have been assessed formally below according to the criteria supplied by SLR (Appendix 1).

6.1. Destruction of bird habitat during construction of power line & substation

Table 2. Habitat destruction during construction

Issue	Habitat destruction during construction & maintenance	
Description of Impact		
The impact of habitat destruction will be of Low significance both pre and post mitigation. The amount of habitat to be transformed for the MTS substation and the associated power lines is relatively small in this landscape and the habitat is not particularly unique or limited in availability. We recommend several mitigation measures which will slightly reduce the impact significance, but not sufficiently to reduce below Low.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low - natural habitat will be transformed	
Degree to which impact may cause irreplaceable loss of resources	High - habitat will not easily be restored to original state	
Degree to which impact can be mitigated	Low - certain amount of habitat transformation is inevitable	
Mitigation actions		
The following measures are recommended:	• A pre-construction avifaunal walk down should be conducted to: ○ Confirm final layout and identify any sensitivities that may arise between the conclusion of the BA process and the construction phase. ○ Identify any sensitive species breeding on site that may arise between the conclusion of the BA process and the construction phase. • All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. • All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.	
Monitoring		
The following monitoring is recommended:	N/A	

6.2. Disturbance of birds during construction of the power line & substation

Table 3. Disturbance of birds during construction

<table>
<tr><td>Issue</td><td colspan="2">Disturbance of birds during construction</td></tr>
<tr><td colspan="3" align="center">Description of Impact</td></tr>
<tr><td colspan="3">We judge the significance of this impact to be Low for both pre and post mitigation. Disturbance of birds typically reaches significant levels when the receptor is a breeding site for a sensitive species, or some other important feature, such as a roost. We have identified no such features on site.</td></tr>
<tr><td>Type of Impact</td><td colspan="2" align="center">Indirect</td></tr>
<tr><td>Nature of Impact</td><td colspan="2" align="center">Negative</td></tr>
<tr><td>Phases</td><td colspan="2" align="center">Construction</td></tr>
<tr><td>Criteria</td><td align="center">Without Mitigation</td><td align="center">With Mitigation</td></tr>
<tr><td>Intensity</td><td>Low</td><td>Low</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Short-term</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td></tr>
<tr><td>Consequence</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Possible / frequent</td><td>Possible / frequent</td></tr>
<tr><td>Significance</td><td>Low -</td><td>Low -</td></tr>
<tr><td>Degree to which impact can be reversed</td><td colspan="2">Highly reversible, as soon as construction stops impact will cease</td></tr>
<tr><td>Degree to which impact may cause irreplaceable loss of resources</td><td colspan="2">Low - any impacts are reversible and no irreplaceable loss</td></tr>
<tr><td>Degree to which impact can be mitigated</td><td colspan="2">Low - certain amount of disturbance during construction is inevitable</td></tr>
<tr><td colspan="3">Mitigation actions</td></tr>
<tr><td>The following measures are recommended:</td><td colspan="2">• A pre-construction avifaunal walk down should be conducted to:
○ Confirm final layout and identify any sensitivities that may arise between the conclusion of the BA process and the construction phase.
○ Identify any sensitive species breeding on site that may arise between the conclusion of the BA process and the construction phase.
• All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
• All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.</td></tr>
<tr><td colspan="3">Monitoring</td></tr>
<tr><td>The following monitoring is recommended:</td><td colspan="2">N/A</td></tr>
</table>

6.3. Collision of birds with overhead cables during operations of the power line

Table 4. Collision of birds with overhead cables during operations

<table>
<tr><td>Issue</td><td>Collision of birds with overhead cables</td></tr>
<tr><td colspan="2" align="center">Description of Impact</td></tr>
<tr><td colspan="2">We judge the significance of this impact to be Medium pre and Low post mitigation. Several regionally Red Listed bird species which are known to be susceptible to collision with overhead power lines occur in the study area, including Ludwig's Bustard, Blue Crane and Secretarybird. The significance of this risk is slightly diminished by the placement of the proposed power line within a corridor of existing power lines</td></tr>
</table>

(some of which are higher above the ground than the proposed line and will provide some shielding for birds in flight).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• A pre-construction avifaunal walk down should be conducted to provide final confirmation of the sections of power line requiring bird collision mitigation. • The overhead cables on high risk sections of the alignments (should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw et al, 2021). The line marking device should be a dynamic (moving – bird flapper type) device.	
Monitoring		
The following monitoring is recommended:	The new power line should be patrolled during operation by ESKOM annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices Where multiple devices on a span have failed they should be replaced immediately. Data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.	

6.4. Electrocution of birds on pylons during operations of the power line

Table 5. Electrocution of birds on pylons during operations

Issue	Electrocution of birds perched on power lines
Description of Impact	
The significance of bird electrocution on the proposed power lines will be of Low significance pre mitigation since the proposed pylon structures have phase-phase and phase-earth clearances greater than 1800mm so even vultures and large eagles can perch safely without bridging these critical clearances. It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted	

to all pole tops to further provide safe perching substrate well above dangerous hardware. It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Conceivable	Conceivable
Significance	Low -	Low -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	Very high - It is possible to mitigate this fully by designing the power lines correctly	
Mitigation actions		
The following measures are recommended:	• It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching space well above dangerous hardware. • It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structures and design mitigation.	

6.5. Cumulative impacts of the proposed project

In relation to an activity, cumulative impact means "*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (NEMA EIA Reg GN R982 of 2014).

The South African Renewable Energy EIA Application Database (REEA) (namely "REEA_OR_2021_Q2") and other information available at the time[2] shows that there are no operational renewable energy developments situated within a 30km radius of the proposed project site. There are however several renewable energy projects (solar) authorised or being proposed within close proximity to the town of Dealesville, including the Kentani Cluster which consists of

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[2] Information has been based on the latest available version of the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2021_Q2"), the results of the respective online screening tool reports (https://screening.environment.gov.za/screeningtool/#/pages/welcome) and information available on the public domain at the time.

eleven (11) authorised solar PV projects and associated electrical infrastructure. According to the information available at the time[2], the following renewable energy applications for EA are either approved (i.e., EA issued) or being proposed within a 30km radius of the proposed project site:

- 100 MW Kentani PV - 14/12/16/3/3/2/724
- 100 MW Klipfontein PV - 14/12/16/3/3/2/722
- 100 MW Braklaagte PV - 14/12/16/3/3/2/727
- 100 MW Meeding PV - 14/12/16/3/3/2/719
- 100 MW Irene PV - 14/12/16/3/3/2/718
- 100 MW Leliehoek PV - 14/12/16/3/3/2/728
- 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
- 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
- 75 MW Braambosch PV - 14/12/16/3/3/2/725
- 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
- 75 MW Eksteen PV - 14/12/16/3/3/2/717
- 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
- Klipbult solar plant - 14/12/16/3/3/2/432
- 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
- 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
- 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
- 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853
- 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
- 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
- 100 MW Visserpan solar photovoltaic facility project 2 - 14/12/16/3/3/1/2154
- 100 MW Visserpan solar photovoltaic facility project 3 - 14/12/16/3/3/1/2155
- 100 MW Visserpan solar photovoltaic facility project 4 - 14/12/16/3/3/1/2156

In addition, the Jedwater Solar Power Facility (12/12/20/1972/2) and Letsatsi solar power farm (12/12/20/1972/1) are situated just outside of the project site's 30km radius, to the south-east of the project site.

The cumulative impact assessed will therefore be the collective impact of the proposed MTS and power line application, along with the above-mentioned renewable energy applications for EA which are either approved or being proposed within a 30km radius of the proposed project site. Figure 8 summarises the above information.

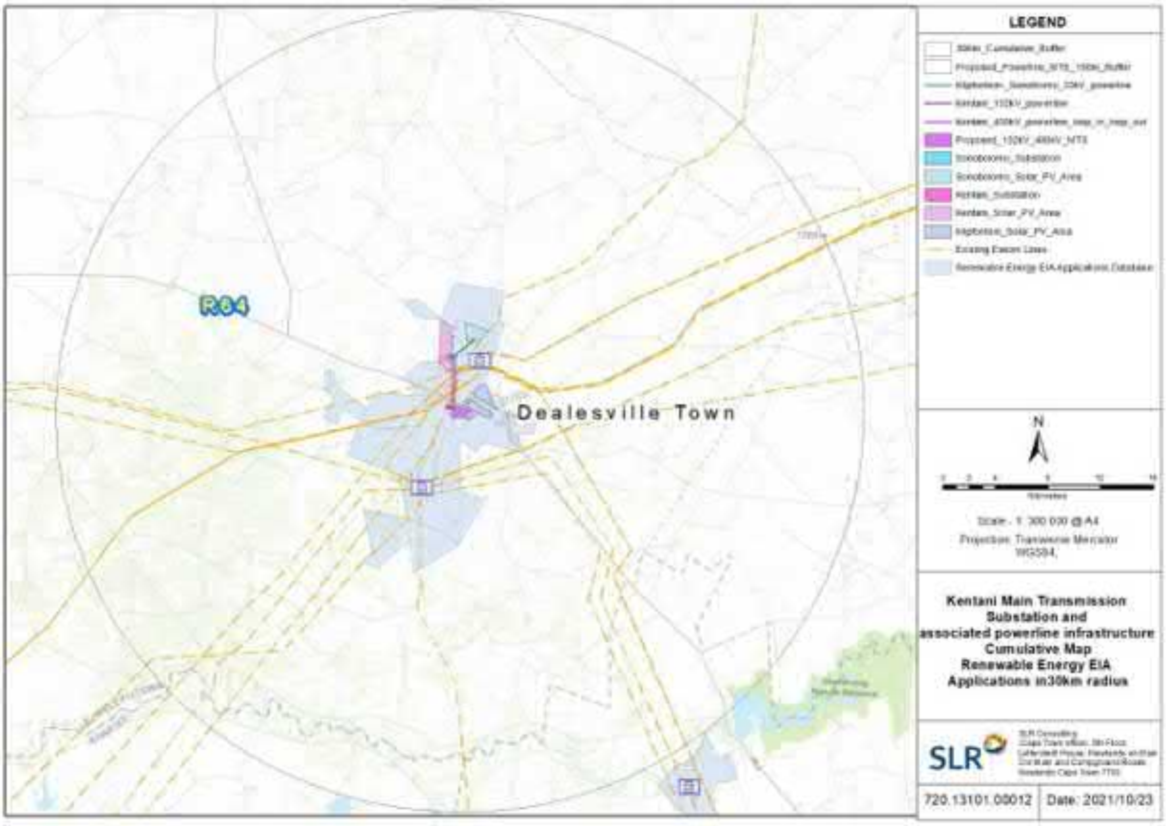

Figure 8. Cumulative Map indicating REFs within the 30km buffer of the proposed MTS and Power lines (including Powerline Corridors)

Table 6. Cumulative impacts of renewable energy & electrical infrastructure on birds.

Issue	Cumulative impacts of renewable energy & electrical infrastructure on birds	
Description of Impact		
Overall we judge the cumulative impact of power lines, substations and renewable energy on avifauna in the area to be of Medium (-) significance pre-mitigation. If all proposed facilities implement mitigation correctly this can be reduced to Low (-).		
Cumulative impacts		
Nature of cumulative impacts	The two direct impacts of collision & electrocution are relatively easily mitigated as presented in the Impact Assessment Tables in Section 6.1-6.4.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7. Assessment of alternatives

As mentioned, a comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout

BESS technology alternatives or powerline corridor alternatives are therefore being considered and assessed.

With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.

The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor. The site proposed for the MTS and respective powerline corridors will however be assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the project, where the status quo of the current activities on the project site would prevail.

8. Required mitigation measures

To summarise, the following mitigation measures are necessary:

- A pre-construction avifaunal walk down should be conducted to:
  - Confirm final layout and identify any sensitivities that may arise between the conclusion of the BA process and the construction phase.
  - Identify any sensitive species breeding on site that may arise between the conclusion of the BA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

- A pre-construction avifaunal walk down should be conducted to provide final confirmation of the sections of power line requiring bird collision mitigation.
- The overhead cables on high risk sections of the alignments (should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw *et al*, 2021). The line marking device should be a dynamic (moving – bird flapper type) device. The new power line should be patrolled by Mainstream annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices. Where multiple devices on a span have failed they should be replaced immediately. Data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.
- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation measures.

9. Conclusions

Up to approximately 273 bird species occur in the broader area within which the proposed project is located. Included amongst these 273 species are a number of regionally and globally Red Listed bird species and a number of endemics. These include most importantly: 1 Critically Endangered species, White-backed Vulture; and 4 Endangered species – Black Harrier, Ludwig's Bustard, Yellow-billed Stork, Martial Eagle and Tawny Eagle; 6 Vulnerable species; and 10 Near-threatened species.

Based on the formal criteria supplied by SLR, we have rated the potential impacts on avifauna as follows:

Phase	Impact	Pre-mitigation	Post mitigation
Construction	Habitat destruction	Low	Low
	Disturbance of birds	Low	Low
Operations	Collision of birds with overhead cables	Medium	Low
	Electrocution of birds perching on pylons	Low	Low
Cumulative impacts	Cumulative impacts of the project on birds	Medium	Low

These impacts will require the following mitigation measures to be implemented:

- A pre-construction avifaunal walk down should be conducted to:
    - Confirm final layout and identify any sensitivities that may arise between the conclusion of the BA process and the construction phase.
    - Identify any sensitive species breeding on site that may arise between the conclusion of the BA process and the construction phase.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.
- A pre-construction avifaunal walk down should be conducted to provide final confirmation of the sections of power line requiring bird collision mitigation.
- The overhead cables on high risk sections of the alignments (should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw *et al*, 2021). The line marking device should be a dynamic (moving – bird flapper type) device. The new power line should be patrolled by Mainstream annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices. Where multiple devices on a span have failed they should be replaced immediately. Data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.
- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation measures.

If these mitigation measures are implemented correctly we believe that the impacts of the proposed project will be at an acceptable level and we recommend the proposed project be authorised to proceed.

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Appendix 1. Impact assessment criteria

The impacts of the proposed development (during the Pre-Construction, Construction, Operation and Decommissioning phases) are to be assessed and rated according to the methodology described below, which was developed by SLR to align with the requirements of the EIA Regulations, 2014 (as amended).

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Table 1. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). Part A provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In Part B, a matrix is applied to determine this impact consequence. In Part C, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in Part D.

Table 1: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE	**Consequence is a function of intensity, spatial extent and duration**	
Determination of SIGNIFICANCE	**Significance is a function of consequence and probability**	
Criteria for ranking of the INTENSITY of environmental impacts	**Very High**	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.
	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.
	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.
Criteria for ranking the DURATION of impacts	**Very Short-term**	The duration of the impact will be < 1 year or may be intermittent.
	Short-term	The duration of the impact will be between 1 - 5 years.
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.
	Long-term	The duration of the impact will be Long-term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity).
	Permanent	The duration of the impact will be permanent
Criteria for ranking the EXTENT of impacts	**Site**	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.
	Local	Impact is confined to within the project site / area and its nearby surroundings.

	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium-term	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short-term	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very Short-term	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
Intensity -Low						
DURATION	Permanent	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium-term	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very Short-term	**Very low**	**Low**	**Low**	**Low**	**Medium**
Intensity- Medium						
DURATION	Permanent	**Medium**	**High**	**High**	**High**	**Very High**
	Long-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Very Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
Intensity -High						
DURATION	Permanent	**High**	**High**	**High**	**Very High**	**Very High**
	Long-term	**Medium**	**High**	**High**	**High**	**Very High**
	Medium-term	**Medium**	**Medium**	**High**	**High**	**High**
	Short-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
Intensity - Very High						
DURATION	Permanent	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long-term	**High**	**High**	**High**	**Very High**	**Very High**
	Medium-term	**Medium**	**High**	**High**	**High**	**Very High**
	Short-term	**Medium**	**Medium**	**High**	**High**	**High**

	Very Short-term	**Low**	**Medium**	**Medium**	**High**	**High**
		Site	Local	Regional	National	International
		EXTENT				
PART C: DETERMINING SIGNIFICANCE						
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
		Very Low	Low	Medium	High	Very High
		CONSEQUENCE				
PART D: INTERPRETATION OF SIGNIFICANCE						

Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.
Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

The specialists are also required to include a comment, as follows, on the degree to which the impact:

1. Can be reversed;
2. May cause irreplaceable loss of resources; and
3. Can be avoided, managed or mitigated.

Appendix 2. Bird data for the site

Regional: Red Data regional (Taylor et al, 2015). CR- Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near-threatened; LC-Least concern

Global: IUCN, 2021

Endemic: E-Endemic; NE-Near-endemic; SLS-Endemic to South Africa, Lesotho, Swaziland; BSLS=Endemic to Botswana, SA, Lesotho, Swaziland

SABAP1, 2 = Southern African Bird Atlas Project 1 and 2. '1' denotes presence, not abundance

Specialist site visit = recorded on the specialists site visit in September 2021

Common name	***Taxonomic Name***	**Regional, Global, Endemic**	**SAB AP1**	**SAB AP2**	**Specialist survey**
Vulture, White-backed	*Gyps africanus*	CR, CR		1	
Harrier, Black	*Circus maurus*	EN, EN, NE	1	1	
Bustard, Ludwig's	*Neotis ludwigii*	EN, EN	1	1	
Stork, Yellow-billed	*Mycteria ibis*	EN, LC	1		
Eagle, Martial	*Polemaetus bellicosus*	EN, VU	1		
Eagle, Tawny	*Aquila rapax*	EN, VU	1		
Courser, Burchell's	*Cursorius rufus*	VU, LC	1	1	
Falcon, Lanner	*Falco biarmicus*	VU, LC	1	1	
Stork, Black	*Ciconia nigra*	VU, LC	1	1	
Tern, Caspian	*Hydropogne caspia*	VU, LC	1	1	
Pelican, Pink-backed	*Pelecanus rufescens*	VU, LC	1		
Secretarybird	*Sagittarius serpentarius*	VU, VU	1	1	1
Pipit, African Rock	*Anthus crenatus*	NT, LC, SLS		1	
Flamingo, Greater	*Phoenicopterus roseus*	NT, LC	1	1	
Roller, European	*Coracias garrulus*	NT, LC	1	1	
Stork, Abdim's	*Ciconia abdimii*	NT, LC	1	1	
Bustard, Kori	*Ardeotis kori*	NT, NT	1	1	
Flamingo, Lesser	*Phoeniconaias minor*	NT, NT	1	1	
Pratincole, Black-winged	*Glareola nordmanni*	NT, NT	1	1	
Plover, Chestnut-banded	*Charadrius pallidus*	NT, NT		1	
Crane, Blue	*Grus paradisea*	NT, VU	1		
Duck, Maccoa	*Oxyura maccoa*	NT, VU	1		
Korhaan, Blue	*Eupodotis caerulescens*	LC, NT, SLS	1	1	
Sandpiper, Curlew	*Calidris ferruginea*	LC, NT	1		
Egret, Slaty	*Egretta vinaceigula*	NA, VU	1	1	
Swallow, South African Cliff	*Petrochelidon spilodera*	*BSLS*	1	1	
Bulbul, Cape	*Pycnonotus capensis*	*E*	1	1	
Buzzard, Jackal	*Buteo rufofuscus*	*NE*	1	1	
Chat, Sickle-winged	*Emarginata sinuata*	*NE*	1	1	
Cisticola, Cloud	*Cisticola textrix*	*NE*	1	1	
Flycatcher, Fairy	*Stenostira scita*	*NE*	1	1	
Flycatcher, Fiscal	*Melaenornis silens*	*NE*	1	1	
Lark, Large-billed	*Galerida magnirostris*	NE	1	1	1

Lark, Melodious	*Mirafra cheniana*	NE	1	1	
Thrush, Karoo	*Turdus smithi*	NE	1	1	
Warbler, Namaqua	*Phragmacia substriata*	NE	1	1	
White-eye, Cape	*Zosterops virens*	NE	1	1	
Canary, Black-headed	*Serinus alario*	NE	1		
Prinia, Karoo	*Prinia maculosa*	NE	1		
Tit-Babbler (Warbler), Layard's	*Sylvia layardi*	NE		1	
Starling, Pied	*Lamprotornis bicolor*	SLS	1	1	1
Lark, Eastern Long-billed	*Certhilauda semitorquata*	SLS	1		
Prinia, Drakensberg	*Prinia hypoxantha*	SLS	1		
Avocet, Pied	*Recurvirostra avosetta*		1	1	
Barbet, Acacia Pied	*Tricholaema leucomelas*		1	1	
Barbet, Crested	*Trachyphonus vaillantii*		1	1	
Batis, Pririt	*Batis pririt*		1	1	
Bee-eater, European	*Merops apiaster*		1	1	
Bee-eater, White-fronted	*Merops bullockoides*		1	1	
Bishop, Southern Red	*Euplectes orix*		1	1	
Bishop, Yellow-crowned	*Euplectes afer*		1	1	
Bokmakierie	*Telophorus zeylonus*		1	1	
Bulbul, African Red-eyed	*Pycnonotus nigricans*		1	1	
Bunting, Cinnamon-breasted	*Emberiza tahapisi*		1	1	
Bunting, Lark-like	*Emberiza impetuani*		1	1	
Buttonquail, Common (Kurrichane)	*Turnix sylvaticus*		1	1	
Buzzard, Common (Steppe)	*Buteo buteo*		1	1	
Canary, Black-throated	*Crithagra atrogularis*		1	1	
Canary, Yellow	*Crithagra flaviventris*		1	1	
Chat, Ant-eating	*Myrmecocichla formicivora*		1	1	1
Chat, Familiar	*Oenathe familiaris*		1	1	
Chat, Karoo	*Emarginata schlegelii*		1	1	
Cisticola, Desert	*Cisticola aridulus*		1	1	1
Cisticola, Levaillant's	*Cisticola tinniens*		1	1	
Cisticola, Zitting	*Cisticola juncidis*		1	1	
Coot, Red-knobbed	*Fulica cristata*		1	1	
Cormorant, Reed	*Microcarbo africanus*		1	1	
Cormorant, White-breasted	*Phalacrocorax lucidus*		1	1	
Courser, Double-banded	*Rhinoptilus africanus*		1	1	1
Courser, Temminck's	*Cursorius temminckii*		1	1	
Crombec, Long-billed	*Sylvietta rufescens*		1	1	
Crow, Pied	*Corvus albus*		1	1	
Cuckoo, Diederik	*Chrysococcyx caprius*		1	1	
Cuckoo, Jacobin	*Clamator jacobinus*		1	1	
Cuckoo, Red-chested	*Cuculus solitarius*		1	1	
Darter, African	*Anhinga rufa*		1	1	
Dove, Cape Turtle (Ring-necked)	*Streptopelia capicola*		1	1	
Dove, Laughing	*Spilopelia senegalensis*		1	1	1
Dove, Namaqua	*Oena capensis*		1	1	
Dove, Red-eyed	*Streptopelia semitorquata*		1	1	1
Dove, Rock	*Columba livia*		1	1	

Drongo, Fork-tailed	*Dicrurus adsimilis*		1	1	
Duck, African Black	*Anas sparsa*		1	1	
Duck, White-faced Whistling	*Dendrocygna viduata*		1	1	
Duck, Yellow-billed	*Anas undulata*		1	1	
Eagle, African Fish	*Haliaeetus vocifer*		1	1	
Egret, Great	*Ardea alba*		1	1	
Egret, Western Cattle	*Bubulcus ibis*		1	1	
Egret, Yellow-billed (Intermediate)	*Ardea intermedia*		1	1	
Eremomela, Yellow-bellied	*Eremomela icteropygialis*		1	1	
Falcon, Amur	*Falco amurensis*		1	1	
Finch, Red-headed	*Amadina erythrocephala*		1	1	
Finch (Weaver), Scaly-feathered	*Sporopipes squamifrons*		1	1	
Firefinch, Red-billed	*Lagonosticta senegala*		1	1	
Fiscal, Southern (Common)	*Lanius collaris*		1	1	1
Flycatcher, Chat	*Melaenornis infuscatus*		1	1	
Flycatcher, Spotted	*Muscicapa striata*		1	1	
Francolin, Orange River	*Scleroptila gutturalis*		1	1	1
Goose, Egyptian	*Alopochen aegyptiaca*		1	1	
Goose, Spur-winged	*Plectropterus gambensis*		1	1	
Goshawk, Gabar	*Micronisus gabar*		1	1	
Goshawk, Pale Chanting	*Melierax canorus*		1	1	
Grebe, Little	*Tachybaptus ruficollis*		1	1	
Greenshank, Common	*Tringa nebularia*		1	1	
Guineafowl, Helmeted	*Numida meleagris*		1	1	
Gull, Grey-headed	*Chroicocephalus cirrocephalus*		1	1	
Hamerkop	*Scopus umbretta*		1	1	
Heron, Black-crowned Night	*Nycticorax nycticorax*		1	1	
Heron, Black-headed	*Ardea melanocephala*		1	1	
Heron, Goliath	*Ardea goliath*		1	1	
Heron, Grey	*Ardea cinerea*		1	1	
Hoopoe, African	*Upupa africana*		1	1	
Ibis, African Sacred	*Threskiornis aethiopicus*		1	1	
Ibis, Glossy	*Plegadis falcinellus*		1	1	
Ibis, Hadeda (Hadada)	*Bostrychia hagedash*		1	1	
Kestrel, Greater	*Falco rupicoloides*		1	1	1
Kestrel, Lesser	*Falco naumanni*		1	1	
Kestrel, Rock	*Falco rupicolus*		1	1	
Kingfisher, Brown-hooded	*Halcyon albiventris*		1	1	
Kingfisher, Malachite	*Corythornis cristatus*		1	1	
Kingfisher, Pied	*Ceryle rudis*		1	1	
Kite, Black-winged	*Elanus caeruleus*		1	1	
Lapwing, Blacksmith	*Vanellus armatus*		1	1	
Lapwing, Crowned	*Vanellus coronatus*		1	1	1
Lark, Chestnut-backed Sparrow-	*Eremopterix leucotis*		1	1	
Lark, Eastern Clapper	*Mirafra fasciolata*		1	1	1
Lark, Fawn-coloured	*Calendulauda africanoides*		1	1	
Lark, Grey-backed Sparrow	*Eremopterix verticalis*		1	1	
Lark, Pink-billed	*Spizocorys conirostris*		1	1	

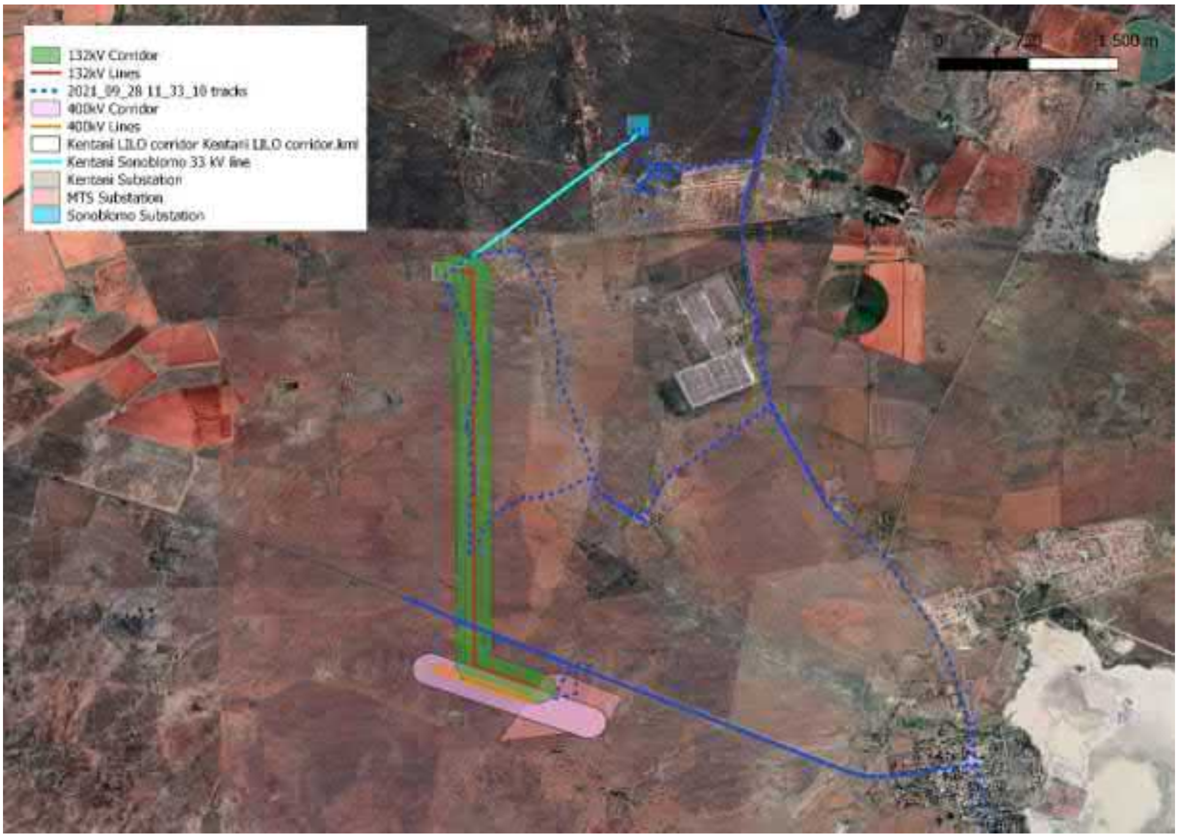
Lark, Red-capped	*Calandrella cinerea*		1	1	
Lark, Rufous-naped	*Mirafra africana*		1	1	
Lark, Sabota	*Calendulauda sabota*		1	1	
Lark, Spike-heeled	*Chersomanes albofasciata*		1	1	1
Longclaw, Cape	*Macronyx capensis*		1	1	
Martin, Brown-throated	*Riparia paludicola*		1	1	
Martin, Rock	*Ptyonoprogne fuligula*		1	1	
Moorhen, Common	*Gallinula chloropus*		1	1	
Mousebird, Red-faced	*Urocolius indicus*		1	1	
Mousebird, Speckled	*Colius striatus*		1	1	
Mousebird, White-backed	*Colius colius*		1	1	
Neddicky	*Cisticola fulvicapilla*		1	1	
Ostrich, Common	*Struthio camelus*		1	1	
Owl, Spotted Eagle-	*Bubo africanus*		1	1	
Owl, Western Barn	*Tyto alba*		1	1	
Pigeon, Speckled	*Columba guinea*		1	1	
Pipit, African	*Anthus cinnamomeus*		1	1	1
Pipit, Buffy	*Anthus vaalensis*		1	1	
Pipit, Plain-backed	*Anthus leucophrys*		1	1	
Plover, Kittlitz's	*Charadrius pecuarius*		1	1	
Plover, Three-banded	*Charadrius tricollaris*		1	1	
Prinia, Black-chested	*Prinia flavicans*		1	1	
Quail-finch, African	*Ortygospiza atricollis*		1	1	
Quail, Common	*Coturnix coturnix*		1	1	
Quelea, Red-billed	*Quelea quelea*		1	1	
Robin-chat, Cape	*Cossypha caffra*		1	1	
Robin, Kalahari Scrub	*Cercotrichas paena*		1	1	
Robin, Karoo Scrub	*Cercotrichas coryphoeus*		1	1	
Sandgrouse, Namaqua	*Pterocles namaqua*		1	1	
Sandpiper, Common	*Actitis hypoleucos*		1	1	
Sandpiper, Marsh	*Tringa stagnatilis*		1	1	
Scimitarbill, Common	*Rhinopomastus cyanomelas*		1	1	
Shelduck, South African	*Tadorna cana*		1	1	
Shoveler, Cape	*Spatula smithii*		1	1	
Shrike, Lesser Grey	*Lanius minor*		1	1	
Shrike, Red-backed	*Lanius collurio*		1	1	
Sparrow-weaver, White-browed	*Plocepasser mahali*		1	1	1
Sparrow, Cape	*Passer melanurus*		1	1	
Sparrow, House	*Passer domesticus*		1	1	
Sparrow, Southern Grey-headed	*Passer diffusus*		1	1	1
Spoonbill, African	*Platalea alba*		1	1	
Spurfowl, Natal	*Pternistis natalensis*		1	1	
Spurfowl, Swainson's	*Pternistis swainsonii*		1	1	
Starling, Cape Glossy (Cape)	*Lamprotornis nitens*		1	1	
Starling, Wattled	*Creatophora cinerea*		1	1	
Stilt, Black-winged	*Himantopus himantopus*		1	1	
Stonechat, African	*Saxicola torquatus*		1	1	
Stork, White	*Ciconia ciconia*		1	1	

Swallow, Barn	*Hirundo rustica*		1	1	
Swallow, Greater Striped	*Cecropis cucullata*		1	1	1
Swallow, Pearl-breasted	*Hirundo dimidiata*		1	1	
Swallow, Red-breasted	*Cecropis semirufa*		1	1	
Swallow, White-throated	*Hirundo albigularis*		1	1	
Swift, Alpine	*Tachymarptis melba*		1	1	
Swift, Common	*Apus apus*		1	1	
Swift, Horus	*Apus horus*		1	1	
Swift, Little	*Apus affinis*		1	1	
Swift, White-rumped	*Apus caffer*		1	1	
Tchagra, Brown-crowned	*Tchagra australis*		1	1	
Teal, Cape	*Anas capensis*		1	1	
Teal, Red-billed	*Anas erythrorhyncha*		1	1	
Tern, Whiskered	*Chlidonias hybrida*		1	1	
Thick-knee, Spotted	*Burhinus capensis*		1	1	
Tit-Babbler (Warbler), Chestnut-vented	*Sylvia subcoerulea*		1	1	
Tit, Ashy	*Melaniparus cinerascens*		1	1	
Wagtail, Cape	*Motacilla capensis*		1	1	
Warbler, African Reed	*Acrocephalus baeticatus*		1	1	
Warbler, Lesser Swamp	*Acrocephalus gracilirostris*		1	1	
Warbler, Rufous-eared	*Malcorus pectoralis*		1	1	
Warbler, Willow	*Phylloscopus trochilus*		1	1	
Waxbill, Black-faced	*Estrilda erythronotos*		1	1	
Waxbill, Common	*Estrilda astrild*		1	1	
Waxbill, Violet-eared	*Uraeginthus granatinus*		1	1	
Weaver, Southern Masked	*Ploceus velatus*		1	1	
Wheatear, Capped	*Oenanthe pileata*		1	1	
Wheatear, Mountain	*Myrmecocichla monticola*		1	1	
White-eye, Orange River	*Zosterops pallidus*		1	1	
Whydah, Pin-tailed	*Vidua macroura*		1	1	
Whydah, Shaft-tailed	*Vidua regia*		1	1	
Widowbird, Long-tailed	*Euplectes progne*		1	1	
Canary, Cape	*Serinus canicollis*		1		
Canary, White-throated	*Crithagra albogularis*		1		
Cisticola, Rattling	*Cisticola chiniana*		1		
Duck, Fulvous Whistling	*Dendrocygna bicolor*		1		
Duck, White-backed	*Thalassornis leuconotus*		1		
Firefinch, African	*Lagonosticta rubricata*		1		
Flycatcher, African Paradise	*Terpsiphone viridis*		1		
Grebe, Black-necked	*Podiceps nigricollis*		1		
Grebe, Great Crested	*Podiceps cristatus*		1		
Gull, Lesser Black-backed	*Larus fuscus*		1		
Heron, Purple	*Ardea purpurea*		1		
Honeyguide, Greater	*Indicator indicator*		1		
Indigobird, Village	*Vidua chalybeata*		1		
Kingfisher, Giant	*Megaceryle maxima*		1		
Lark, Karoo Long-billed	*Certhilauda subcoronata*		1		
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*		1		

Plover, Common Ringed	*Charadrius hiaticula*		1		
Pochard, Southern	*Netta erythrophthalma*		1		
Ruff	*Calidris pugnax*		1		
Sandpiper, Wood	*Tringa glareola*		1		
Snipe, African	*Gallinago nigripennis*		1		
Stint, Little	*Calidris minuta*		1		
Swamphen, African (Purple)	*Porphyrio madagascariensis*		1		
Swift, African Black	*Apus barbatus*		1		
Teal, Hottentot	*Spatula hottentota*		1		
Tern, White-winged	*Chlidonias leucopterus*		1		
Thrush, Olive	*Turdus olivaceus*		1		
Wagtail, Western Yellow	*Motacilla flava*		1		
Warbler, Great Reed	*Acrocephalus arundinaceus*		1		
Waxbill, Blue	*Uraeginthus angolensis*		1		
Weaver, Sociable	*Philetairus socius*		1		
Bee-eater, Swallow-tailed	*Merops hirundineus*			1	
Bittern, Little	*Ixobrychus minutus*			1	
Brubru	*Nilaus afer*			1	
Cisticola, Grey-backed	*Cisticola subruficapilla*			1	
Coucal, Burchell’s	*Centropus burchellii*			1	
Courser, Bronze-winged	*Rhinoptilus chalcopterus*			1	
Eagle, Black-chested Snake	*Circaetus pectoralis*			1	
Eagle, Booted	*Hieraaetus pennatus*			1	
Firefinch, Jameson’s	*Lagonosticta rhodopareia*			1	
Harrier, Montagu’s	*Circus pygargus*			1	
Heron, Green-backed (Striated)	*Butorides striata*			1	
Korhaan, Northern Black	*Afrotis afraoides*			1	1
Korhaan, Red-crested	*Lophotis ruficrista*			1	
Lark, Monotonous	*Mirafra passerina*			1	
Martin, Common House	*Delichon urbicum*			1	
Myna, Common	*Acridotheres tristis*			1	
Nightjar, European	*Caprimulgus europaeus*			1	
Oriole, Eurasian Golden	*Oriolus oriolus*			1	
Owl, Marsh	*Asio capensis*			1	
Penduline-tit, Cape	*Anthoscopus minutus*			1	
Pipit, Nicholson's	*Anthus similis*			1	
Pytilia, Green-winged	*Pytilia melba*			1	
Roller, Lilac-breasted	*Coracias caudatus*			1	
Sunbird, Malachite	*Nectarinia famosa*			1	
Sunbird, White-bellied	*Cinnyris talatala*			1	
Swift, African Palm	*Cypsiurus parvus*			1	
Swift, Bradfield’s	*Apus bradfieldi*			1	
Thrush, Short-toed Rock	*Monticola brevipes*			1	
Warbler, Barred Wren-	*Calamonastes fasciolatus*			1	
Whydah, Long-tailed Paradise	*Vidua paradisaea*			1	
Wood-hoopoe, Green	*Phoeniculus purpureus*			1	
Woodpecker, Cardinal	*Dendropicos fuscescens*			1	

Appendix 3. Photographs of the site.

Appendix 4. GPS tracks from field survey of the site.



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26 August 2022

Att: Liandra Scott-Shaw
SLR Consulting
Unit 14, Braehead Office Park
1 Old Main Road, Kloof
Durban, 3640

Dear Liandra

RE: PROPOSED CONSTRUCTION AND OPERATION OF A RADIO MAST, 132KV POWERLINE AND 400KV LOOP IN LOOP OUT (LILO) POWERLINEs LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Background

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of one (1) Radio Mast, two (2) x 400kV powerlines and one (1) x 132kV powerline that will connect to the authorised 132kV/400kV Main Transmission Substation (MTS) (14/12/16/3/3/1/2460/AM1) as well as to the approved 100MW Kentani Solar Photovoltaic (PV) Energy Facility (14/12/16/3/3/2/724/AM3) respectively.

The Kentani Solar PV Energy Facility is one (1) of eleven (11) solar PV projects collectively known as the Kentani Cluster located near the town of Dealesville, within the Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)].

On 28 October 2021, the Minister of Mineral Resources and Energy announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities, collectively referred to as the "Kentani Cluster", received Preferred Bidder status i.e.:

- Kentani Solar PV (14/12/16/3/3/2/724/AM3)
- Sonoblomo Solar PV (14/12/16/3/3/2/723/AM2)
- Klipfontein Solar PV (14/12/16/3/3/2/722/AM2)
- Klipfontein 2 Solar PV (14/12/16/3/3/2/726/1/AM1)
- Leliehoek Solar PV (14/12/16/3/3/2/728/AM2)
- Braklaagte Solar PV (14/12/16/3/3/2/727/1)

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e., SIPs 8 and 10, which target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

The approved MTS and associated infrastructure will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

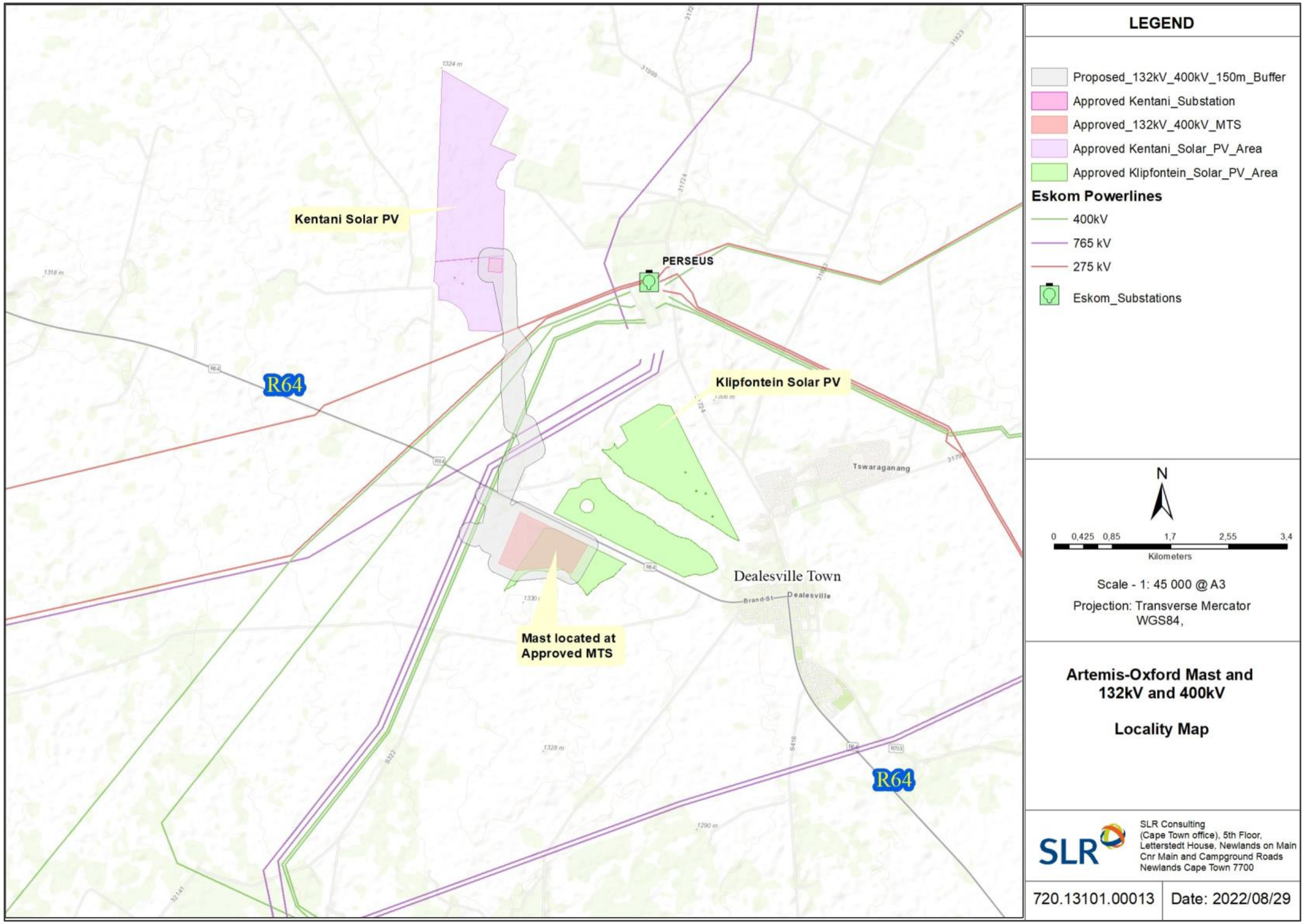

Figure 1: Locality Map of the proposed powerlines (132kv & 400kV) in relation to approved MTS and associated electrical infrastructure (including grid connection corridors) (14/12/16/3/3/1/2460/AM1).

The 132kV/400kV MTS development footprint and the 132kV and 400kV corridors (in which the respective powerlines which form part of this application / BA process would be situated) were granted authorisation by the DFFE in April 2022 (DFFE Reference Number: 14/12/16/3/3/1/2460/AM1). However, due to technical consideration, the approved 132kV and 400kV corridors are not suited to connect the approved MTS to the National grid nor the authorised Kentani Solar PV (DFFE Reference Number: 14/12/16/3/3/2/724/AM3) to the MTS, and as such additional small portions of the corridors are required to be assessed to accommodate the technical changes.

The powerlines are located within the Kimberly Renewable Energy Development Zone (REDZ) (namely REDZ 4) and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The respective powerlines which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 700m in length) are being proposed and will connect the approved MTS (14/12/16/3/3/1/2460/AM1) to the existing Eskom 400kV powerline, located approximately west of the approved MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 5km in length) is being proposed and will connect the approved MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724/AM3), located approx. 4.85km north-west of the approved MTS site.
3. One (1) 90m will be built within the approved MTS footprint (14/12/16/3/3/1/2460/AM1).

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted).

It must be noted that the majority of the proposed powerlines being proposed are located within existing approved powerline corridors and that only small sections will traverse outside of the approved corridors:

- The portion of the 132kV powerline outside of an existing approved corridors and Eskom servitudes is approximately 700m
- The portion of the each of the 400kV powerlines outside of an existing approved corridors and Eskom servitudes is approximately 150m and 250m respectively

Further to the above, the proposed Radio Mast will be located on the approved MTS (14/12/16/3/3/1/2460/AM1).

Considering the above, it is important to note that the location of the corridors for the powerlines being proposed as part of this application have previously been assessed as part of the development footprint for the approved MTS and powerline corridors (14/12/16/3/3/1/2460/AM1) as well as the Kentani Cluster of solar PV developments, each of which received their own EA in 2016[1].

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed powerline development may have an impact on the environment and trigger certain listed activities in Listing Notice 1 of the EIA Regulations, 2014 (as amended) (Government Notice No. 983, as amended). These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended). To inform the assessment, specialist studies are required.

Due to the fact that majority of the proposed powerline corridors have previously been assessed as part of approved developments (14/12/16/3/3/2/724/AM3 & 14/12/16/3/3/1/2460/AM1), the following is of relevance:

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

- The author undertook the original ecological assessments for the Kentani Cluster of projects in which the footprint of the current application is situated. This specialist study complied with current legislation and guidelines regarding specialist studies.
- The methodology included field assessments undertaken within the footprint of the proposed infrastructure under application here.
- The status quo is the same / has or has not changed significantly since the last assessment undertaken between October and November 2021.
- Only two impacts were assessed in this original study, namely loss of natural habitat (Low significance after mitigation) and invasion by alien plants (very low after mitigation).
  - The new portions of the proposed powerline corridor do not result in a change to the impact assessments undertaken as part of the original study / assessment in October / November 2021.
  - The impact assessment remains the same as that compiled in October / November 2021. The impact assessment tables are provided below and apply to the current application.
- No new mitigation measures are required, and the existing Environmental Management Programme (EMPr) is applicable.

Impact: loss of natural vegetation

Issue	Loss of natural vegetation	
Description of Impact		
There will be localised disturbance of natural habitat within the footprint of tower structures during the construction phase.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Probable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is partly reversible by rehabilitation of disturbed areas.	
Degree to which impact may cause irreplaceable loss of resources	Without mitigation of this impact, it is possible that the local footprint of construction around each tower structure will be more extensive than if the impact is controlled. This will lead to a more extensive loss of natural habitat than without mitigation. However, the diversity within the study area is relatively low and includes primarily common and widespread plant species. There would therefore be an insignificant level of irreplaceable loss of resources.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	Restrict activities to footprint areas, use existing maintenance and access roads, rehabilitate disturbed areas after construcion, control alien invasive plant species. The presence of any species of conservation concern within the PV development area as well as along the grid connection should be checked during a preconstruction walk-through of these areas.	

Monitoring	
The following monitoring is recommended:	Annual monitoring for 3 years after construction to evaluate vegetation cover, species composition.

Impact: invasion by alien invasive plant species

Issue	Invasion by alien invasive plant species	
Description of Impact		
There are a variety of alien invasive plant species that occur in the general geographical area. Disturbance will promote the opportunity for invasion by any of these species. Local invasion will degraded habitat and may spread further into surrounding areas. This may lead to more extensive loss of indigenous habitat and biodiversity and long-term control issues.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Long-term	Long-term
Extent	Local	Site
Consequence	High	Low
Probability	Possible / frequent	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	The impact is reversible by implementing control measures.	
Degree to which impact may cause irreplaceable loss of resources	Without mitigation of this impact, it is possible that alien invasive plants will become locally established, develop dense nodes and then spread into surrounding areas. The more established they become, the more difficult it is to get rid of them and the greater the impact they will have on local ecosystems. The effect is exponential, not appearing significant at first, but suddenly becoming excessively difficult to change. At this end point, irreplaceable loss of resources is likely at a local level, and possibly more widely.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	Compile and implement an alien invasive control plan, monitor degree of invasion as well as outcome and effectiveness of control measures.	
Monitoring		
The following monitoring is recommended:	Annual monitoring for the entire operational phase, as per the recommendations of the alien invasive control plan.	

Cumulative impacts

Table 1:Loss of natural vegetation

Issue	Loss of natural vegetation
Description of Impact	

There will be localised disturbance of natural habitat within the footprint of tower structures during the construction phase. This is evaluated only for the areas within the footprint of the proposed power line, on the basis that all other infrastructure will be located within areas where authorisation has already been obtained		
Cumulative impacts		
Nature of cumulative impacts	Existing loss of habitat in the study area is due to cultivation and other infrastructure. Solar PV projects that have been approved will lead to loss of habitat similar in magnitude to existing loss of habitat. Loss of habitat due to power line construction is negligible in comparison to these existing and anticipated future impacts.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Insignificant	Insignificant

Table 2: Invasion by alien invasive plant species

Issue	Invasion by alien invasive plant species	
Description of Impact		
There are a variety of alien invasive plant species that occur in the general geographical area. Disturbance will promote the opportunity for invasion by any of these species. Local invasion will degraded habitat and may spread further into surrounding areas. This may lead to more extensive loss of indigenous habitat and biodiversity and long-term control issues.		
Cumulative impacts		
Nature of cumulative impacts	There is limited degree of invasion within the site and surrounding areas. However, some potentially problematic species occur in the area and can easily become established and problematic. In the absence of control measures, it is possible that combined effects may significantly degraded regional ecosystems.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

In conclusion, the proposed new infrastructure will not change the nature or significance of the assessed potential impacts. No additional impacts will occur. The baseline conditions have also not changed; therefore, the original assessment is valid. The proposed amendments are therefore acceptable from an ecological impact perspective. It is the opinion of the specialist that the proposed infrastructure can be approved.

Yours faithfully,

Dr David Hoare
Director

Site Sensitivity Verification

Kentani MTS and associated infrastructure near Dealesville in the Free State Province

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Site Sensitivity Verification Report for the Kentani MTS and associated infrastructure near Dealesville in the Free State Province.

Location:
Near Dealesville in the Tokologo Local Municipality

For: SLR Consulting (Pty) Ltd (South Africa)

14 November 2021

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SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with Section 13: General Requirements for Environmental Assessment Practitioners (EAPs) and Specialists as well as per Appendix 6 of GNR 982 – Environmental Impact Assessment Regulations and the National Environmental Management Act (NEMA, No. 107 of 1998 as amended 2017) and Government Notice 704 (GN 704). It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows –

Table 1: Details of Specialist

Specialist	Qualification and accreditation	Client	Signature
Dr David Hoare (Pr.Sci.Nat.)	PhD Botany	SLR	Date: 14/11/2021

<u>Details of Author:</u>
Dr David Hoare

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation and general ecology (grasslands, savanna, Albany thicket, fynbos, coastal systems, wetlands).
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Professional Natural Scientist, South African Council for Natural Scientific Professions, Reg. no. 400221/05 (Ecology, Botany)
Member, International Association of Vegetation Scientists (IAVS)
Member, Ecological Society of America (ESA)
Member, International Association for Impact Assessment (IAIA)
Member, Herpetological Association of Africa (HAA)

Employment history

- 1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.
- 1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
- 1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.
- 1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Declaration of independence:

David Hoare Consulting (Pty) Ltd in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by David Hoare Consulting (Pty) Ltd is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

David Hoare Consulting (Pty) Ltd undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to David Hoare Consulting (Pty) Ltd by the client and in addition to information obtained during the course of this study, David Hoare Consulting (Pty) Ltd present the results and conclusion within the associated document to the best of the author's professional judgement and in accordance with best practise.

14 November 2021

Dr David Hoare Date

TERMS OF REFERENCE

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. This states that prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration identified by the national web based environmental screening tool must be confirmed.

1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.
2. The site sensitivity verification must be undertaken through the use of:
    a. a desktop analysis, using satellite imagery;
    b. a preliminary on-site inspection; and
    c. any other available and relevant information.
3. The outcome of the site sensitivity verification must be recorded in the form of a report that:
    a. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
    b. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
    c. is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations (EIA Regulations).

The compliance statement must contain, as a minimum, the following information:

- contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
- a signed statement of independence by the specialist;
- a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- a baseline profile description of biodiversity and ecosystems of the site;
- the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;
- in the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;
- where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;
- a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and
- any conditions to which this statement is subjected.
- A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

INTRODUCTION

Project Background

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, (the 'proposed development') that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor which has been authorised as part of the Kentani Cluster, making provision for this routing in the new proposed MTS (Figure 1).
It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power

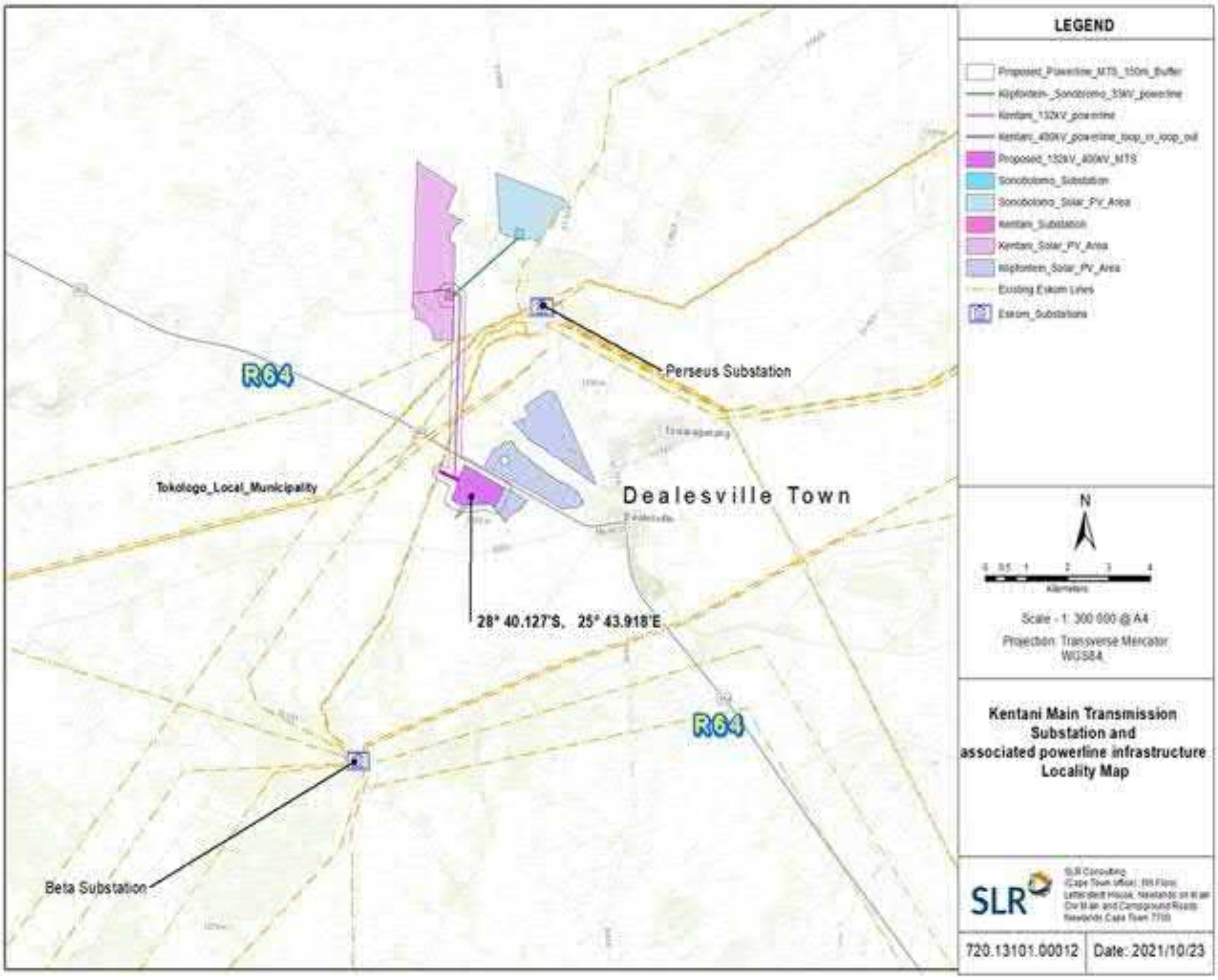

Figure 1: Location of proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors).

Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

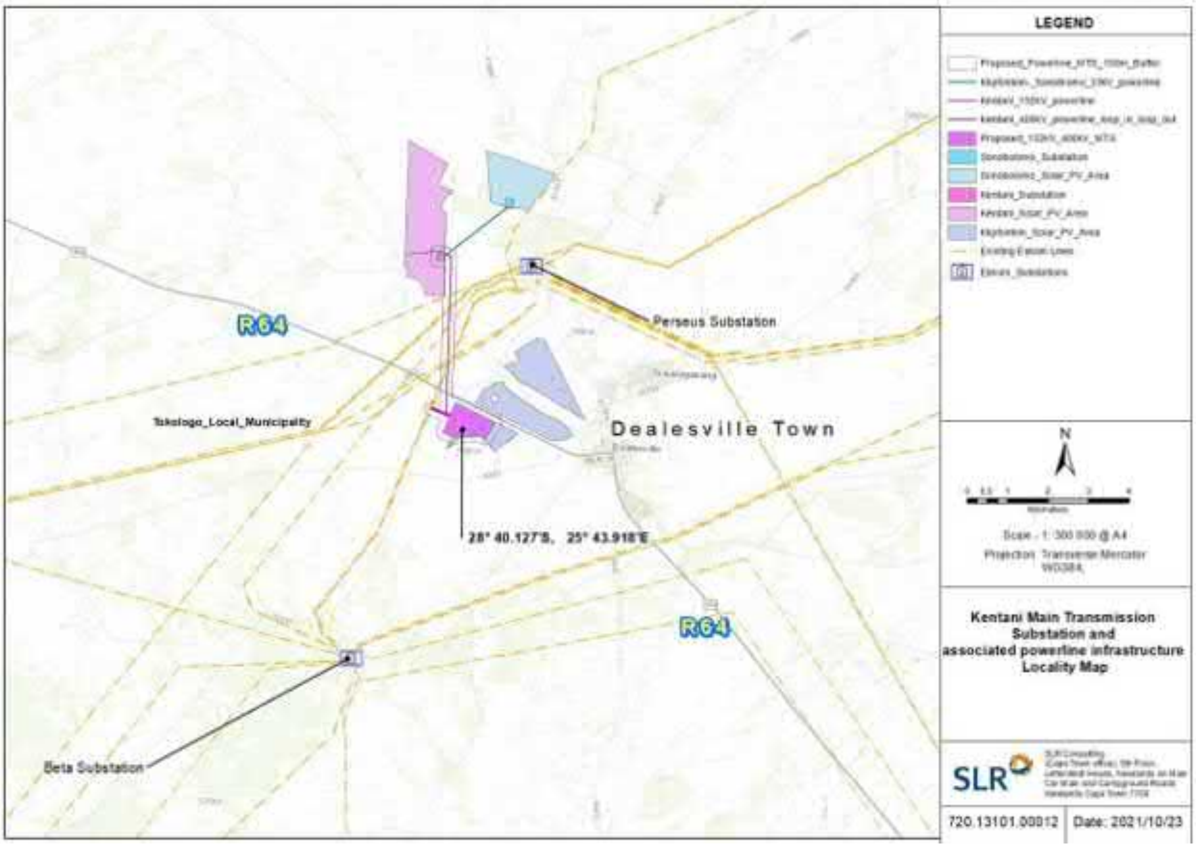

Figure 1: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016 [1].

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 800m in length) are being proposed and will connect the proposed MTS to the existing Eskom 400kV powerline, located approximately 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 4km in length) is being proposed and will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site.
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerlineIn terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended], various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the NEMA EIA Regulations of 2014 (as amended).

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

In accordance with GN 320 and GN 1150 (20 March 2020)[2] of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Mrs Elize Butler, as the Palaeontology Specialist, has been commissioned to verify the sensitivity of the 132kV/400kV Main Transmission Substation (MTS) and Associated Infrastructure project site under these specialist protocols.

Identified Theme Sensitivities

A sensitivity screening report from the DEA Online Screening Tool was requested in the application category: Utilities Infrastructure|Electricity|Generation|Renewable|Solar|PV. The DEA Screening Tool report for the area indicates the following ecological sensitivities:

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Animal Species Theme			X	
Plant Species Theme				X
Terrestrial Biodiversity Theme	X			

Animal Species theme

Sensitivity features are indicates as follows:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Aves- Neotis ludwigii

Plant Species theme

Sensitivity features are indicates as follows:

Sensitivity	Feature(s)
Low	Low Sensitivity

Terrestrial Biodiversity theme

Sensitivity features are indicates as follows:

Sensitivity	Feature(s)
Very High	Critical biodiversity area 1
Very High	Endangered Ecosystem

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[2] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

SITE SENSITIVITY VERIFICATION METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Approach

The study commenced as a desktop-study followed by a site-specific field study on 12 October 2021. The site is within the Grassland Biome with a peak rainfall season in summer, which occurs from November to April. The timing of the survey is therefore sub-optimal in terms of assessing the flora of the site. However, despite this limitation, the overall condition of the vegetation was possible to be determined with a high degree of confidence. In addition, the entire area was previously assessed as part of the environmental authorisation process for the Klipfontein PV facility, for which authorisation has already been obtained (14/12/16/3/3/2/722).

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made. Digital photographs were taken of features and habitats on site, as well as of all plant species that were seen. All plant species recorded were uploaded to the iNaturalist website.

Aerial imagery from Google Earth was used to identify and assess habitats on site. Patterns identified from satellite imagery were verified on the ground. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled. Digital photographs were taken at locations where features of interest were observed.

Species of conservation concern

There are two classes of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

Red List plant species

Determining the conservation status of a species is required to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the International Union for Conservation of Nature (IUCN) Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo *et al*., 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (http://redlist.sanbi.org/). According to the website of the Red List of Southern African Plants (http://redlist.sanbi.org/), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the*

International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: http://www.iucnredlist.org. The South African assessment is used in this study.

The purpose of listing Red List species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.

Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

Other protected species

National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

- National Environmental Management: Biodiversity Act (Act No 10 of 2004); and

This legislation contains lists of species that are protected. These lists were used to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, if it is possible that they could occur on site, this was stated.

Red List animal species

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem *et al*., 2010). The likelihood of any of them occurring was evaluated based on habitat preference and habitats available within the study area. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

Mammal threat status is according to Child et al. (2016), reptile threat status is according to Bates et al. 2014, and amphibian threat status is according to Minter et al. (2004).

Species probability of occurrence

Some species of plants may be cryptic, difficult to find, rare, ephemeral or generally not easy to identify while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected flora that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g. karoo shrubland), but detailed microhabitat requirements (e.g. mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain shrubland on shallow soils overlying sandstone);
- DEFINITE: species found in habitats on site.

Sources of information

Vegetation and plant species

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (http://bgis.sanbi.org).
- The conservation status of the vegetation types were obtained from Mucina and Rutherford (2006) and the National List of Ecosystems that re Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).
- The plant species checklist of species that could potentially occur on site was compiled from a plant species checklist extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grids 2821CA.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, http://redlist.sanbi.org).

Fauna

- Lists of animal species that have a geographical range that includes the study area were obtained from literature sources (Bates et al., 2014 for reptiles, du Preez & Carruthers 2009 for frogs, Mills & Hes 1997 and Friedmann and Daly, 2004 for mammals). This was supplemented with information from the Animal Demography Unit website (adu.uct.ac.za) and literature searches for specific animals, where necessary.

Regional plans

- Information from the National Protected Areas Expansion Strategy (NPAES) was consulted for possible inclusion of the site into a protected area in future (available on http://bgis.sanbi.org).).
- The Free State Biodiversity Area Maps were consulted for inclusion of the site into a Critical Biodiversity Area or Ecological Support Area (biodiversityadvisor.sanbi.org).

OUTCOME OF THE SITE SENSITIVITY VERIFICATION

Broad vegetation patterns

There is one regional vegetation type in the study area, namely Vaal-vet sandy grassland (Figure 3). There are likely to be floristic and vegetation structural influences from any of this vegetation type at any location on site, depending on local ecological conditions. The vegetation type that occurs on site and nearby areas is briefly described below.

Vaal-vet Sandy Grassland (Gh10)

Distribution

North-West and Free State Provinces: South of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. Altitude 1 220–1 560 m, generally 1 260–1 360 m.

Vegetation & Landscape Features

Plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Mainly low-tussock grasslands with an abundant karroid element. Dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T. triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Geology & Soils

Aeolian and colluvial sand overlying sandstone, mudstone and shale of the Karoo Supergroup (mostly the Ecca Group) as well as older Ventersdorp Supergroup andesite and basement gneiss in the north. Soil forms are mostly Avalon, Westleigh and Clovelly. Dominant land type Bd, closely followed by Bc, Ae and Ba.

Climate

Warm-temperate, summer-rainfall climate, with overall MAP of 530 mm. High summer temperatures. Severe frost (37 days per year on average) occurs in winter. See also climate diagram for Gh 12 Vaal-Vet Sandy Grassland (Figure 8.23).

Important Taxa

Graminoids	Anthephora pubescens (d), Aristida congesta (d), Chloris virgata (d), Cymbopogon caesius (d), Cynodon dactylon (d), Digitaria argyrograpta (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. lehmanniana (d), E. plana (d), E. trichophora (d), Heteropogon contortus (d), Panicum gilvum (d), Setaria sphacelata (d), Themeda triandra (d), Tragus berteronianus (d), Brachiaria serrata, Cymbopogon pospischilii, Digitaria eriantha, Eragrostis curvula, E. obtusa, E. superba, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides.
Herbs	Stachys spathulata (d), Barleria macrostegia, Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Geigeria aspera var. aspera, Helichrysum caespititium, Hermannia depressa, Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala.
Geophytic Herbs	Bulbine narcissifolia, Ledebouria marginata.
Succulent Herb	Tripteris aghillana var. integrifolia.

Low Shrubs	Felicia muricata (d), Pentzia globosa (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregeanum, H. paronychioides, Ziziphus zeyheriana.

Endemic Taxa

Herb	Lessertia phillipsiana.

Conservation status of broad vegetation types

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in Table 3, the vegetation type is listed as Endangered.

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

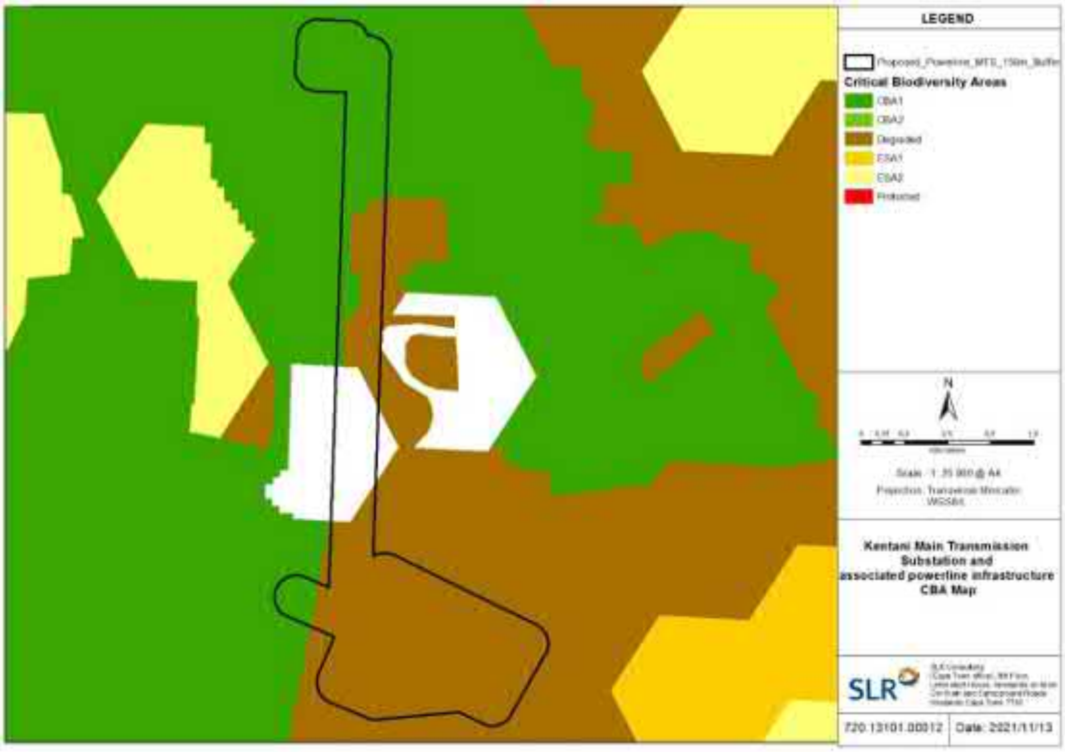

Figure 2: Critical Biodiversity Areas within the broad study area that includes the proposed infrastructure.

The vegetation type is listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

Table 2: Conservation status of different vegetation types occurring in the study area.

Vegetation Type	Conservation status	
	Driver *et al*. 2005; Mucina *et al*., 2006	National Ecosystem List (NEM:BA)
Vaal-vet Sandy Grassland	Endangered	Endangered

It is therefore verified that the site occurs within an Endangered Ecosystem, as listed in The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011) and therefore has VERY HIGH sensitivity from a Terrestrial Biodiversity perspective.

Parts of the site are natural grassland and other parts are secondary grassland in previously cultivated areas. On the basis of historical aerial imagery, confirmed in the field, the previously cultivated areas have a well-established secondary growth that structurally resembles the original grassland, although it is poorer in species composition and diversity. The primary grasslands have higher biodiversity value, but the secondary grasslands are of lower value.

Biodiversity Conservation Plans

The Free State CBA map classifies the natural vegetation of the province according to conservation value in decreasing value, as follows:

1. Protected
2. Critical Biodiversity Area One (Irreplaceable Areas) (RED)
3. Critical Biodiversity Area Two (Important Areas) (ORANGE)
4. Ecological Support Area (GREEN)
5. Other Natural Area (YELLOW)

This shows features within the study area within one of these classes, as follows:

1. CBA1 Areas: The northern parts of the grid corridor (see Figure 2)**.**

This verifies the output from the Online Screening Tool in concept and spatial placement and confirms that parts of the site have VERY HIGH sensitivity from a Terrestrial Biodiversity perspective.

As discussed in the previous section,parts of the study area are previously cultivated. However, the location of these previously cultivated areas has been taken into account in assigning habitats to Critical Biodiversity Areas. Those areas that have been previously cultivated have very little overlap with areas assigned to CBA1 areas (see Figure 3).

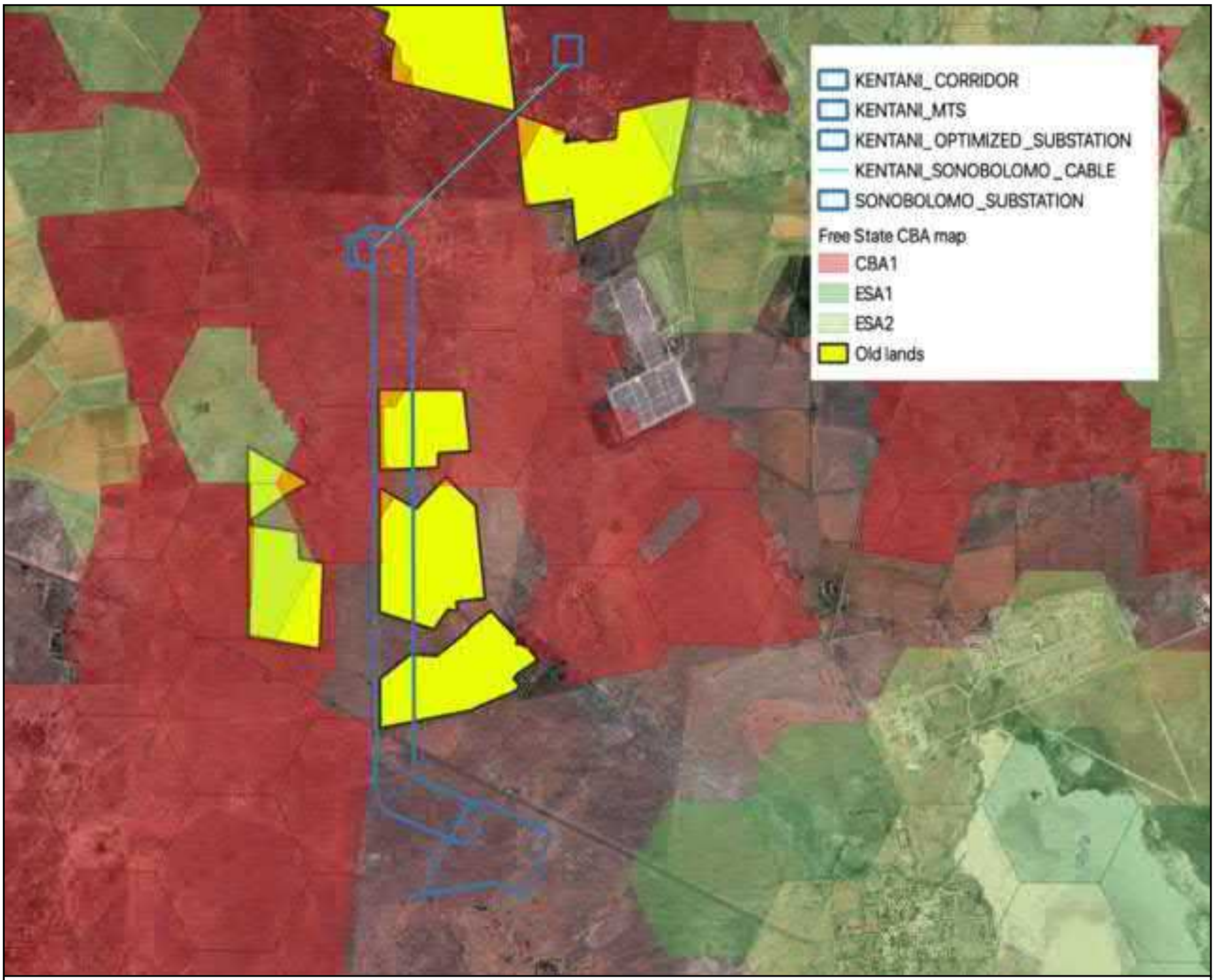

Figure 3: Previously cultivated areas in proximity to Critical Biodiversity Areas within the broad study area that includes the proposed infrastructure.

Red List plant species of the study area

Listsed plant species previously recorded in the Free State were obtained from the South African National Biodiversity Institute (SANBI) website. These are listed in Appendix 2. There are seven threatened species on this list and a total of 35 species of conservation concern that occur in the Free State, but none of them have a geographical distribution that could include the site.

There are therefore no threatened, near threatened or rare species that occur in the study area. It is therefore verified that the Plant Species Theme has LOW sensitivity.

Table 3: Explanation of IUCN Version 3.1 categories (IUCN 2001) and Orange List categories (Victor & Keith 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

Animal species flagged for the study area

According to the National Web-Based Environmental Screening Tool, one animal species has been flagged as of concern for the current project, namely *Neotis ludwigii* (Ludwig's Bustard). This species is listed as Endangered on the basis that the population has undergone a rapid population decline, attributed to collisions with power lines (Birdlife International 2021).

Neotis ludwigii occurs in the flat, open, semi-arid shrublands of the Succulent Karoo, Nama Karoo, and western grasslands of the Free State and Eastern Cape. The site is within a known high density distribution region for the species (Taylor et al. 2015). It may also occur within cultivated fields and pastures. The site has a combination of natural and secondary grassland and is therefore suitable habitat for the species. Although not seen on site during the field survey, the habitat on site is considered to be suitable for the species. It is therefore assumed that it could occur there and that individuals of the species are therefore vulnerable to impacts from the project, especially collisions with overhead power lines.

It is therefore verified that the Animal Species Theme has MEDIUM sensitivity.

CONCLUSION

Desktop information, field data collection and mapping from aerial imagery confirms patterns provided in the DEA Online Screening Tool for various themes.

1. The study area occurs within an Endangered Ecosystem, namely Vaal-Vet Sandy Grassland. This verifies the VERY HIGH sensitivity for the Terrestrial Biodiversity Theme for those parts that are still in a natural state. Those areas that are degraded or secondary are not representative of the listed ecosystem and have LOW sensitivity.
2. Parts of the study area occur within Critical Biodiviersity Area 1 in the Free State Conservation Plan. This verifies the VERY HIGH sensitivity for the Terrestrial Biodiversity Theme for parts of the powerline. Areas outside of the CBA1 area have LOW sensitivity for the Terrestrial Biodiversity Theme.
3. There are no plant species of concern that have a known distribution that includes the study area and none were seen on site. This verifies the LOW sensitivity for the Plant Species Theme.
4. The site has habitat that is suitable for the Endangered Ludwig's Bustard (*Neotis ludwigii*). This verifies the MEDIUM sensitivity for the Animal Species Theme (see Avifauna Report in BA appendices).

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APPENDICES:

Appendix 1: Plant species recorded in the footprint area.

Albuca setosa
Aptosimum procumbens
Argemone ochroleuca
Aristida congesta
Asparagus suaveolens
Berkheya rigida
Chrysocoma ciliata
Cyperus cristatus
Diospyros lycioides
Ehretia rigida
Felicia muricata
Genus Anthospermum
Genus Dimorphotheca
Genus Eragrostis
Genus *Limeum*
Genus *Lycium*
Genus Senecio
Helichrysum argyrosphaerum
Helichrysum luteoalbum
Lasiosiphon polycephalus
Lopholaena coriifolia
Lotononis laxa
Macledium zeyheri
Melolobium candicans
Moraea pallida
Olea europaea
Order Phasmida
Ruschia hamata
Salvia verbenaca
Schoenoplectus muricinux
Searsia lancea
Selago densiflora
Solanum elaeagnifolium
Stigmochelys pardalis
Themeda triandra
Vachellia nilotica
Viscum rotundifolium
Ziziphus mucronata

Appendix 2: Listed plant species of Free State.

Alepidea cordifolia EN
Aloe dominella NT
Anemone fanninii NT
Argyrolobium campicola NT
Brachystelma duplicatum Critically Rare
Brachystelma incanum VU
Calpurnia reflexa Rare
Crassula tuberella VU
Dioscorea sylvatica VU
Disa sankeyi Rare
Drimia sanguinea NT
Eucomis bicolor NT
Gladiolus robertsoniae NT
Helichrysum haygarthii Rare
Kniphofia ensifolia subsp. autumnalis EN
Lithops lesliei subsp. lesliei NT
Lithops salicola NT
Lotononis amajubica Rare
Merwilla plumbea NT
Nerine gracilis VU
Pentzia oppositifolia Rare
Pterygodium alticola Rare
Schizoglossum montanum Rare
Searsia dracomontana NT
Selaginella nubigena Rare
Syncolostemon macranthus NT
Zaluzianskya distans Rare

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Terrestrial Biodiversity Specialist Assessment

Kentani MTS and associated infrastructure near Dealesville in the Free State Province.

Prepared by: Dr David Hoare
Pr.Sci.Nat. (Botany, Ecology) 400221/05

For: SLR Consulting (Pty) Ltd (South Africa)

14 November 2021

EXECUTIVE SUMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The site of the proposed development has been flagged in the Screening Report from the web-based Online Screening Tool as having Very High sensitivity for the Terrestrial Biodiversity Theme, which requires that a specialist assessment be undertaken. The assessment provided here is according to the required protocols.

The site is within a regional vegetation type called Vaal-Vet Sandy Grassland, which is listed as Endangered in the National List of Ecosystems that are Threatened and need of protection. However, not all parts of the site are in a natural state and the threatened categorisation only applies to remaining areas of natural habitat. Other parts of the site are degraded, cultivated, or are secondary grasslands in previously cultivated areas. These areas qualify as having Low sensitivity.

There is a Critical Biodiversity Area (CBA1) in the northern parts of the powerline corridor. These areas having Very High sensitivity. Areas outside of this CBA1 area are degraded or secondary and have Low sensitivity.

Key ecological drivers in dry grasslands are grazing, fire, rainfall, and biological invasions. The project could potentially lead to an increase of the last factor, but is unlikely to affect any of the other ecological drivers. Landscape alteration due to urban areas, cultivation, mining and utilities has led to historical loss of habitat over the geographical distribution range of the ecosystem. At a landscape scale, this can lead to fragmentation and patch isolation, which can disrupt a number of ecological processes. The nature of the project assessed here (primarily powerlines) is of a nature that these processes will not be affected in any significant way. The main anticipated impacts due to the project are therefore localised loss of small amounts of habitat in the footprint of pylons, as well as possible invasion by alien invasive plants. Both of these impacts were assessed as having medium significance before mitigation and low significance after mitigation. Cumulative impacts due to these facots is considered to be negligible.

The report concludes that, on the basis of the assessment undertaken here, which indicates two possible impacts that can be mitigated, it is considred appropriate that they project be given approval.

TABLE OF CONTENTS

SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with Section 13: General Requirements for Environmental Assessment Practitioners (EAPs) and Specialists as well as per Appendix 6 of GNR 982 – Environmental Impact Assessment Regulations and the National Environmental Management Act (NEMA, No. 107 of 1998 as amended 2017) and Government Notice 704 (GN 704). It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows –

Table 1: Details of Specialist

Specialist	Qualification and accreditation	Client	Signature
Dr David Hoare (Pr.Sci.Nat.)	PhD Botany	SLR	Date: 14/11/2021

Details of Author:
Dr David Hoare

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Professional Natural Scientist, South African Council for Natural Scientific Professions, Reg. no. 400221/05 (Ecology, Botany)

Statement of independence:

I, David Hoare, as the appointed plant species specialist, hereby declare/affirm the correctness of the information provided in this compliance statement, and that I:

1. meet the general requirements to be independent and
2. have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
3. am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).

Dr David Hoare

14 November 2021
Date

TERMS OF REFERENCE

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be VERY HIGH, a Terrestrial Biodiversity Specialist Assessment is required, for terrestrial biodiversity features.

The specialist assessment must be prepared by a SACNASP registered specialist with expertise in the field of terrestrial biodiversity.

The assessment must be undertaken on the preferred site and within the proposed development footprint.

The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:

- a description of the ecological drivers or processes of the system and how the proposed development will impact these;
- ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;
- the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;
- the description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;
- a description of terrestrial biodiversity and ecosystems on the preferred site, including:
    - main vegetation types;
    - threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;
    - ecological connectivity, habitat fragmentation, ecological processes and fine- scale habitats; and
    - species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;
- the assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and
- the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:
    - terrestrial critical biodiversity areas (CBAs), including:
        1. the reasons why an area has been identified as a CBA;
        2. an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;
        3. theimpactonspeciescompositionandstructureofvegetationwith an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);
        4. the impact on ecosystem threat status;
        5. the impact on explicit subtypes in the vegetation;
        6. the impact on overall species and ecosystem diversity of the site; and
        7. the impact on any changes to threat status of populations of species of conservation concern in the CBA;
    - terrestrial ecological support areas (ESAs), including:
        1. the impact on the ecological processes that operate within or across the site;

        ii. the extent the proposed development will impact on the functionality of the ESA; and
        iii. loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;
    - protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-
        i. an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;
    - priority areas for protected area expansion, including-
        i. (a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;
    - SWSAsincluding:
        ii. (a) the impact(s) on the terrestrial habitat of a SWSA; and
        iii. (b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);
    - FEPA subcatchments, including-
        i. (a) theimpactsoftheproposeddevelopmentonhabitatconditionand
        ii. species in the FEPA sub catchment;
    - indigenous forests, including:
        i. (a) impact on the ecological integrity of the forest; and
        ii. (b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.

The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report, which must contain, as a minimum, the following information:

- contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
- a signed statement of independence by the specialist;
- a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;
- a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;
- a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);
- additional environmental impacts expected from the proposed development;
- any direct, indirect and cumulative impacts of the proposed development;
- the degree to which impacts and risks can be mitigated;
- the degree to which the impacts and risks can be reversed;
- the degree to which the impacts and risks can cause loss of irreplaceable resources;
- proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);
- a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;

  - a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and
  - any conditions to which this statement is subjected.

The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.

A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

INTRODUCTION

Project Background

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, (the 'proposed development') that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor which has been authorised as part of the Kentani Cluster, making provision for this routing in the new proposed MTS (Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

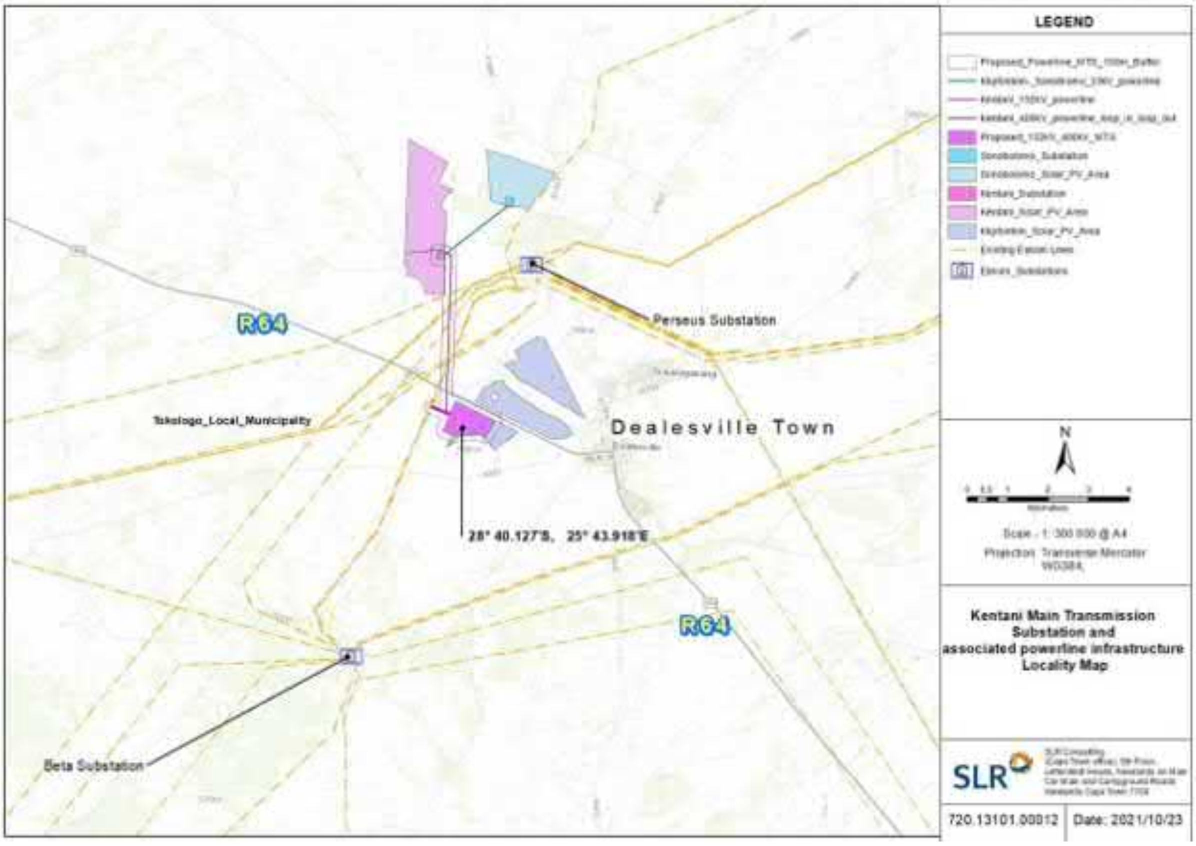

Figure 1: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016 [1].

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 800m in length) are being proposed and will connect the proposed MTS to the existing Eskom 400kV powerline, located approximately 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 4km in length) is being proposed and will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site.
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerlineIn terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended], various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the NEMA EIA Regulations of 2014 (as amended).

In accordance with GN 320 and GN 1150 (20 March 2020)[2] of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Mrs Elize Butler, as the Palaeontology Specialist, has been commissioned to verify the sensitivity of the 132kV/400kV Main Transmission Substation (MTS) and Associated Infrastructure project site under these specialist protocols.

Identified Theme Sensitivity

A sensitivity screening report from the DEA Online Screening Tool was requested in the application category: Utilities Infrastructure|Electricity|Generation|Renewable|Solar|PV. The DEA Screening Tool report for the area indicates the following ecological sensitivities:

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Terrestrial Biodiversity Theme	X			

Terrestrial Biodiversity theme

Sensitivity features are indicates as follows:

Sensitivity	Feature(s)
Very High	Critical biodiversity area 1
Very High	Endangered Ecosystem

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[2] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

PROJECT DESCRIPTION

Project Location

The proposed project is located approximately 2,5km north-west of the town of Dealesville in the Tokologo Local Municipality, within the Lejweleputswa District Municipality of the Free State Province (as shown in Figure 1). The proposed project will be located on the following properties / farm portions (Figure 2):

- Remaining Extent of the Farm Klipfontein No. 305 (F00400000000030500000);
- The Farm Leliehoek No. 748 (F00400000000074800000);
- Remainder of the Farm Oxford No. 1030 (F00400000000103000000);
- Portion 1 of the Farm Walkerville No. 1031 (F00400000000103100001)[3]; and
- Remainder of the Farm Walkerville No. 1031 (F00400000000103100000).
- The Farm Overschot No. 31 (F00400000000003100000)

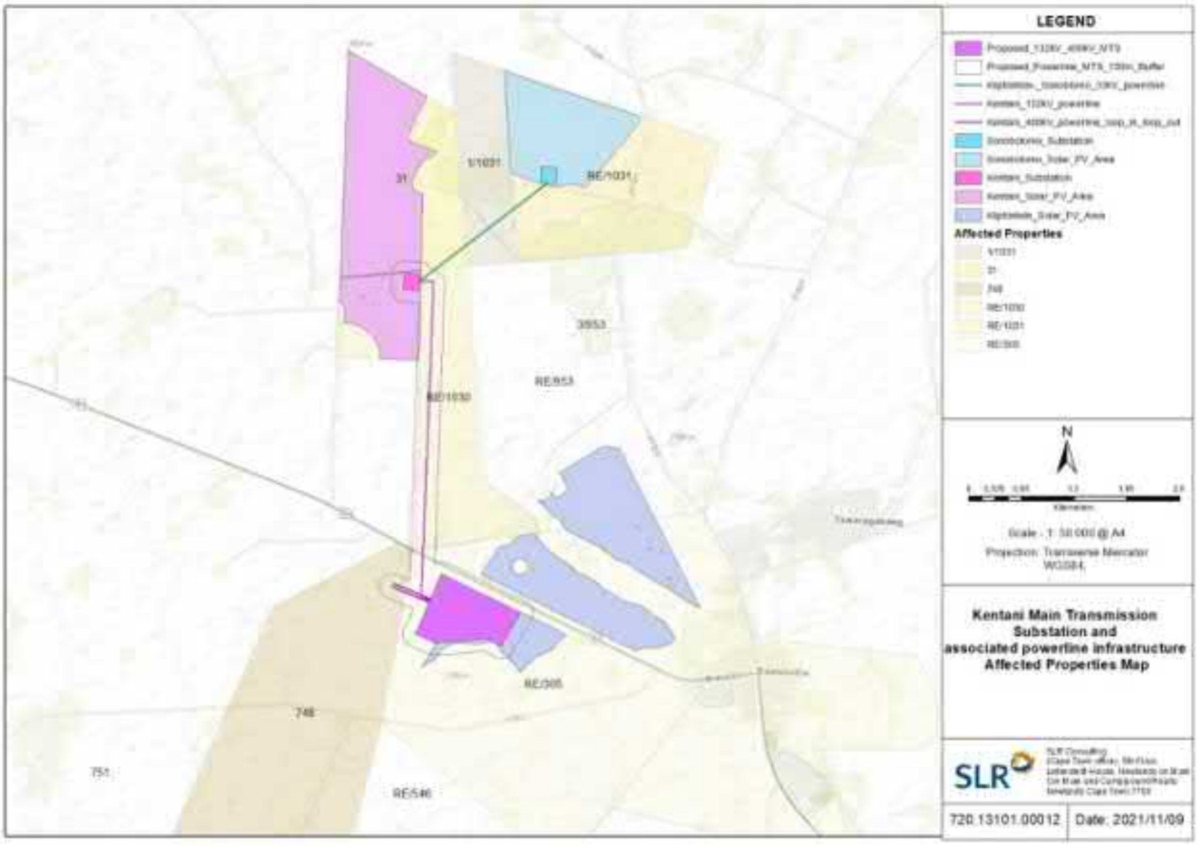

Figure 2: Affected Properties Map

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[3] Property / farm portion traversed by proposed 33kv powerline which will connect to Kentani onsite substation (14/12/16/3/3/2/724). 33kV powerline does however not require authorisation.

The proposed MTS, BESS and powerlines are located within the within the Kimberly Renewable Energy Development Zone (REDZ)[4] as well as the Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

In addition, the proposed MTS and BESS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305. The eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] being proposed and assessed as part of this BA process (i.e., this application) fall outside of the authorised corridor.

Considering the above, it is important to note that the location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

Project components

The proposed development involves the addition of one (1) MTS, Lithium ion BESS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route
- Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS

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[4] GN R 786 of 2020: Notice of Identification in Terms of Section 24(5)(a) and (b) ff The National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance.

associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

The Table below represents these various project components and their specifications. The location of these components in relation to the project site is shown on Figure 3.

Table 1: Summary of the key project components

Project Components	**Location and size / extent (i.e., Farm Names and Areas)**
Location	• Remaining Extent of the Farm Klipfontein No. 305 - F00400000000030500000 • The Farm Leliehoek No. 748 - F00400000000074800000 • Remainder of the Farm Oxford No. 1030 - F00400000000103000000 • Portion 1 of the Farm Walkerville No. 1031 - F00400000000103100001[3] • Remainder of the Farm Walkerville No. 1031 - F00400000000103100000[3] • The Farm Overschot No. 31 - F00400000000003100000
Onsite Main Transmission Substation (MTS)	• One (1) new MTS with capacity of 132kV/400kV • Total footprint of up to approx. 64ha (i.e., 800m x 800m) • Will contain transformers for voltage step up from medium voltage (132kV) to high voltage (400kV) • Direct Current (DC) power from the authorised Kentani Cluster of solar PV developments (each of which received their own EA in 2016[1]) will be converted into Alternating Current (AC) power in the inverters and the voltage will be stepped up to high voltage in the inverter transformers • Will be located within authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on Remaining Extent of the Farm Klipfontein No. 305
Grid Connection (Powerlines)	• Two (2) new 400kV overhead powerlines connecting MTS to existing Eskom 400kV powerline (approx. 1km west of MTS site) via LILO connection; • One (1) new 132kV overhead powerline connecting MTS to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site); • One (1) new 33kV overhead powerline connecting authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723) (approx. 5km north of MTS site) to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site) • Length of 400kV powerlines = approx. 2km • Length of 132kV powerline = approx. 4,5-5km • Length of 33kV powerline = approx. 2km • Area occupied by powerlines unknown at this stage • Powerline corridors with widths of 300m (150m on either side of centre line) being proposed and assessed for 400kV and 132kV powerlines to allow flexibility when routing powerlines within authorised corridor (should EA be granted) • No corridor being considered for 33kV powerline • This will allow for flexibility when routing powerline within the authorised corridor • Eight (8) 132kV powerlines within grid connection corridor authorised as part of Kentani Cluster will also be re-routed and provision will be made for this routing in new proposed MTS
Roads	• One (1) new road in servitude under proposed powerlines • One (1) new access to the R64 provincial route

	• Widths of up to approx. 4-8m
BESS	• Li-Ion Battery Energy Storage System up to 4 ha in extent within the assessed site foot print

Site Layout

The site layout for the proposed project makes provision for one (1) MTS location, (1) BESS location as well as one (1) powerline corridor routing for each of the associated proposed powerlines, as detailed in Table 4-1 above. Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines, no site, layout or powerline corridor alternatives will be assessed.

Additionally, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), while the eight (8) 132kV powerlines which require re-routing are also located within the authorised corridor included as part of the authorised Kentani Cluster. The remaining two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.

The BESS and powerlines associated with the MTS which are being proposed are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

The site layout being proposed is shown in the figure below

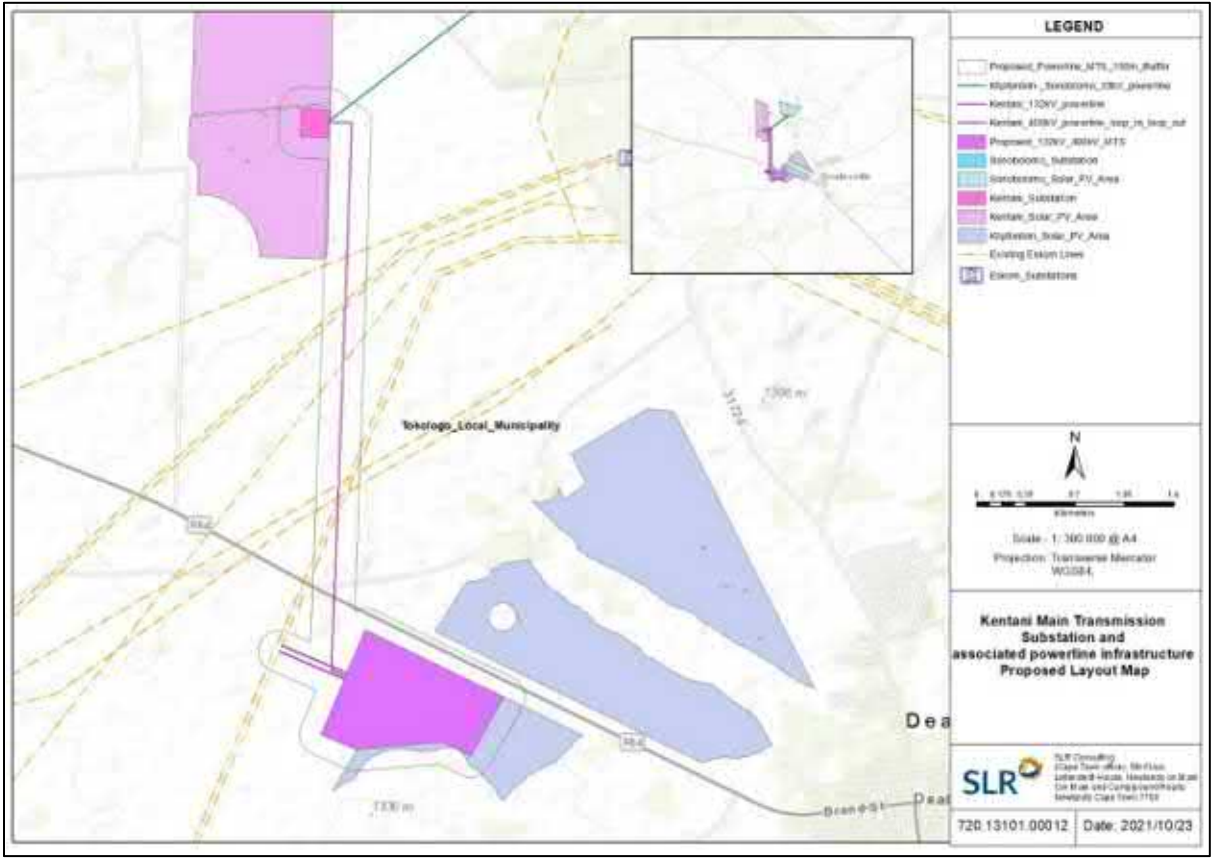

Figure 3: Proposed layout

Alternatives

As mentioned, a comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout BESS technology alternatives or powerline corridor alternatives are therefore being considered and assessed.

With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.

The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor. The site proposed for the MTS and respective powerline corridors will however be assessed against the '**no-go' alternative**. The 'no-go' alternative is the option of not constructing the project, where the *status quo* of the current activities on the project site would prevail.

METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Survey timing

The study commenced as a desktop-study followed by a site-specific field study on 12 October 2021. The site is within the Grassland Biome with a peak rainfall season in summer, which occurs from November to April. The timing of the survey is therefore sub-optimal in terms of assessing the flora of the site, although significant rainfall had fallen prior to the site visit. However, despite this limitation, the overall condition of the vegetation was possible to be determined with a high degree of confidence. In addition, the entire area was previously assessed as part of the environmental authorisation process for the Klipfontein PV facility, for which authorisation has already been obtained (14/12/16/3/3/2/722) and for which the original specialist study was made available.

Field survey approach

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made.

Aerial imagery from Google Earth was used to identify and assess habitats on site. Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground.

Digital photographs were taken of features of interest that were seen on site, as well as of habitat in different parts of the site.

Sources of information

Plant species

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (http://bgis.sanbi.org).
- Information from the National Protected Areas Expansion Strategy (NPAES) was consulted for possible inclusion of the site into a protected area in future (available on http://bgis.sanbi.org).).
- The Free State Biodiversity Area Maps were consulted for inclusion of the site into a Critical Biodiversity Area or Ecological Support Area (biodiversityadvisor.sanbi.org).
- Mapping was done from aerial imagery on Google Earth, which also provides historical imagery for a period up to 15 years ago.

Impact assessment methodology

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Table 3. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). **Part A** provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In **Part B**, a matrix is applied to determine this impact consequence. In **Part C**, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in **Part D**.

Table 3: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE	**Consequence is a function of intensity, spatial extent and duration**	
Determination of SIGNIFICANCE	**Significance is a function of consequence and probability**	
Criteria for ranking of the INTENSITY of environmental impacts	**Very High**	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.
	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.

	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.
Criteria for ranking the DURATION of impacts	**Very Short-term**	The duration of the impact will be < 1 year or may be intermittent.
	Short-term	The duration of the impact will be between 1 - 5 years.
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.
	Long-term	The duration of the impact will be Long-term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity).
	Permanent	The duration of the impact will be permanent
Criteria for ranking the EXTENT of impacts	**Site**	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.
	Local	Impact is confined to within the project site / area and its nearby surroundings.
	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium-term	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short-term	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very Short-term	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
Intensity -Low						
DURATION	Permanent	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium-term	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very Short-term	**Very low**	**Low**	**Low**	**Low**	**Medium**
Intensity- Medium						
DURATION	Permanent	**Medium**	**High**	**High**	**High**	**Very High**
	Long-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**

	Very Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
Intensity -High						
DURATION	Permanent	**High**	**High**	**High**	**Very High**	**Very High**
	Long-term	**Medium**	**High**	**High**	**High**	**Very High**
	Medium-term	**Medium**	**Medium**	**High**	**High**	**High**
	Short-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
Intensity - Very High						
DURATION	Permanent	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long-term	**High**	**High**	**High**	**Very High**	**Very High**
	Medium-term	**Medium**	**High**	**High**	**High**	**Very High**
	Short-term	**Medium**	**Medium**	**High**	**High**	**High**
	Very Short-term	**Low**	**Medium**	**Medium**	**High**	**High**
		Site	Local	Regional	National	International
		EXTENT				

PART C: DETERMINING SIGNIFICANCE

PROBABILITY (of exposure to impacts)	Definite/ Continuous	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
		Very Low	Low	Medium	High	Very High
		CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE

Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.

Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

A comment is provided, as follows, on the degree to which the impact:

1. Can be reversed;
2. May cause irreplaceable loss of resources; and
3. Can be avoided, managed or mitigated.

CUMULATIVE ASSESSMENT

A cumulative impact can be defined as *"the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that itself may not be significant, but may be significant when added to the existing and foreseeable impacts culminating from similar or diverse activities"* (NEMA EIA Reg GN R982 of 2014).

The South African Renewable Energy EIA Application Database (REEA) available at the time (namely "REEA_OR_2021_Q2") shows several renewable energy projects (solar) authorised or being proposed within close proximity to the town of Dealesville, including the Kentani Cluster which consists of eleven (11) authorised solar PV projects and associated electrical infrastructure. According to the information available at the time[5], the following renewable energy applications for EA are either approved (i.e., EA issued) or being proposed within a 30km radius of the proposed project site:

- 100 MW Kentani PV - 14/12/16/3/3/2/724
- 100 MW Klipfontein PV - 14/12/16/3/3/2/722
- 100 MW Braklaagte PV - 14/12/16/3/3/2/727
- 100 MW Meeding PV - 14/12/16/3/3/2/719
- 100 MW Irene PV - 14/12/16/3/3/2/718
- 100 MW Leliehoek PV - 14/12/16/3/3/2/728
- 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
- 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
- 75 MW Braambosch PV - 14/12/16/3/3/2/725
- 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
- 75 MW Eksteen PV - 14/12/16/3/3/2/717
- 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
- Klipbult solar plant - 14/12/16/3/3/2/432
- 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
- 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
- 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
- 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853

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[5] **Information has been based on the latest available version of the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2021_Q2"), the results of the respective online screening tool reports (https://screening.environment.gov.za/screeningtool/#/pages/welcome) and information available on the public domain at the time.**

- 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
- 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
- 100 MW Visserpan solar photovotaic facility project 2 - 14/12/16/3/3/1/2154
- 100 MW Visserpan solar photovotaic facility project 3 - 14/12/16/3/3/1/2155
- 100 MW Visserpan solar photovotaic facility project 4 - 14/12/16/3/3/1/2156

There are therefore a number of renewable energy applications for EA either approved or being proposed within a 30km radius of the proposed project site. In addition, the Jedwater Solar Power Facility (12/12/20/1972/2) and Letsatsi solar power farm (12/12/20/1972/1) are situated just outside of the project site's 30km radius, to the south-east of the project site.

There are however no operational renewable energy developments situated within a 30km radius of the proposed project site to the knowledge of the EAP. The cumulative impact assessed will therefore be the collective impact of the proposed MTS, BESS and powerline application along with the other renewable energy development applications (either approved or being proposed) mentioned above which are located within a 30km radius of the project site.

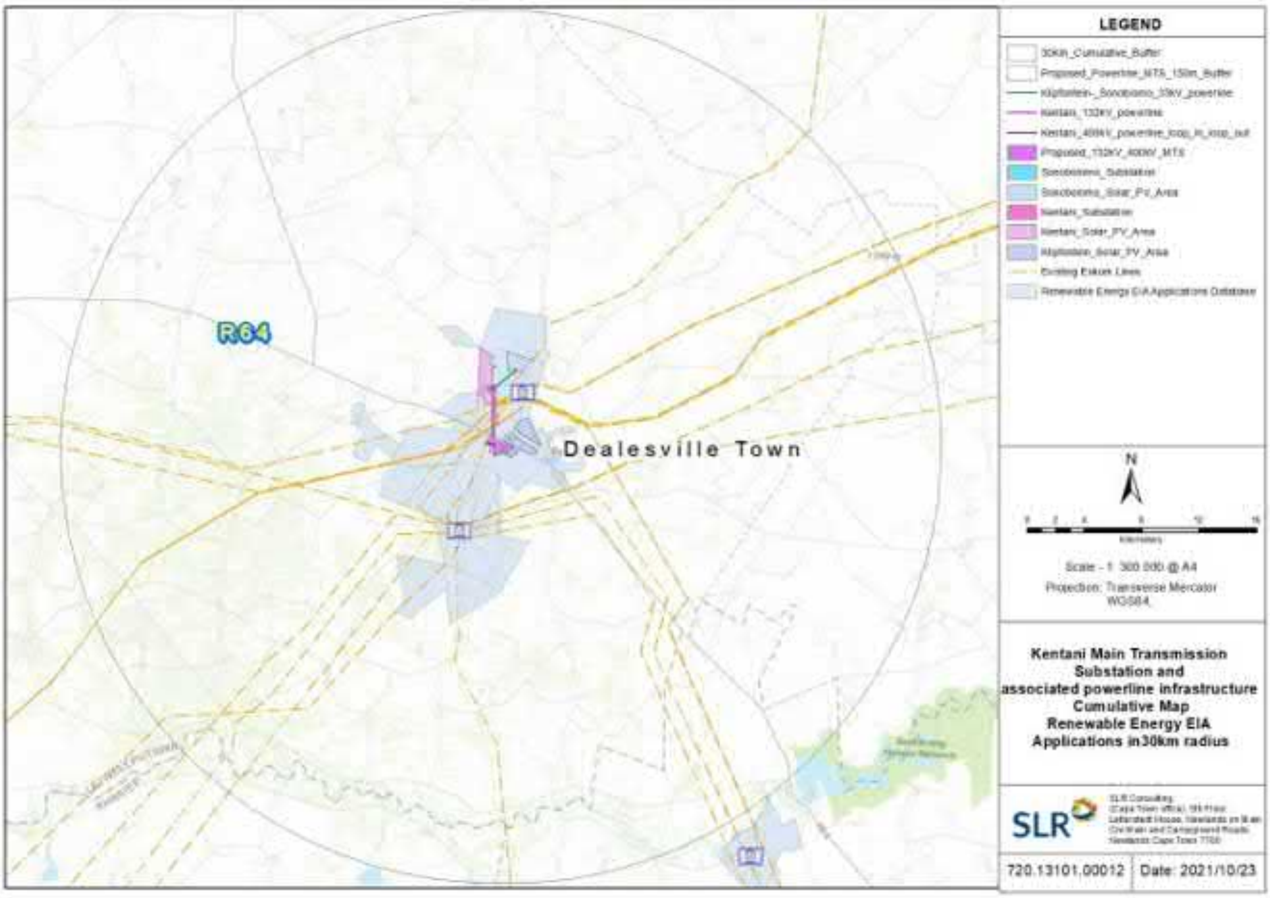

Figure 4: Cumulative Map indicating REFs within the 30km buffer of the proposed MTS and Powerlines (including Powerline Corridors)

Assessment of Alternatives

Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines, no site layout,technology,or powerline corridor alternatives will be assessed.

Aditionally, the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), and as such the location of the proposed MTS has previously been assessed as part of the development footprint for the Klipfontein PV project. Eight (8) 132kV powerlines are also located within the authorised corridor included as part of the authorised Kentani Cluster and thus the location of the corridors being proposed have also previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments.

The site proposed for the MTS,BESS and respective grid connection corridors will however each be assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the Project and where the *status quo* of the current status and/or activities on the site would prevail.

RESULTS

Broad vegetation patterns

There is one regional vegetation type in the study area, namely Vaal-vet sandy grassland, briefly described below, including expected species composition.

Vaal-vet Sandy Grassland (Gh10)

Distribution

North-West and Free State Provinces: South of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. Altitude 1 220–1 560 m, generally 1 260–1 360 m.

Vegetation & Landscape Features

Plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Mainly low-tussock grasslands with an abundant karroid element. Dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T. triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Important Taxa

Graminoids	*Anthephora pubescens (d), Aristida congesta (d), Chloris virgata (d), Cymbopogon caesius (d), Cynodon dactylon (d), Digitaria argyrograpta (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. lehmanniana (d), E. plana (d), E. trichophora (d), Heteropogon contortus (d), Panicum gilvum (d), Setaria sphacelata (d), Themeda triandra (d), Tragus berteronianus (d), Brachiaria serrata, Cymbopogon pospischilii, Digitaria eriantha, Eragrostis curvula, E. obtusa, E. superba, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides.*
Herbs	*Stachys spathulata (d), Barleria macrostegia, Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Geigeria aspera var. aspera, Helichrysum caespititium, Hermannia depressa, Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala.*
Geophytic Herbs	*Bulbine narcissifolia, Ledebouria marginata.*
Succulent Herb	*Tripteris aghillana var. integrifolia.*
Low Shrubs	*Felicia muricata (d), Pentzia globosa (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregeanum, H. paronychioides, Ziziphus zeyheriana.*

Endemic Taxa

Herb	*Lessertia phillipsiana.*

Key ecological drivers

Vaal-Vet Sandy Grassland falls within the Dry Highveld Grassland Bioregion. Key environmental variables / ecosystem drivers in these all grasslands are the amount of rainfall, intensity and type of grazing, frequency and season of fire, soil nutrient status, and soil texture. Key threats are related to fire and grazing mismanagement, cultivation and transformation of grasslands, soil erosion, and invasion by alien invasive plants.

Dry Highveld Grasslands (including Vaal-Vet Sandy Grassland) occupy the central plateau of the country extending over much of the Free State, and into the North West Province, with smaller areas in the Eastern and Northern Cape as well as Gauteng. They occur at mid-altitudes of 1 300 -1 600 masl, where the topography is mostly flat to undulating, broken occasionally by rocky ridges, small outcropping mountains and river valleys (SANBI 2013). They are adapted to a temperate climate with 20 - 50 days of frost a year, and a strongly seasonal summer rainfall of 400 – 550 mm rainfall per annum. The underlying geology is dominated by sandstones and mudstones, giving rise to deep, red soils (). Dolerite sheets are associated with shallower, stony soils. In the west, including within the study area, shallow red sands occur over layers of calcrete (SANBI 2013). The underlying geology is an important determinent of biodiversity, with dolerite areas tending to give rise to ecologically sensitive plant communities with higher levels of local diversity.

The vegetation is dominated by semi-arid sweetveld that is drought-adapted. Plant growth and interactions are driven by environmental limitations (water) rather than competition (Hoare 2009). The plant species show a significant amount of reproduction from seed. Perennial plants persist vegetatively from year to year but new plants establish after droughts from dormant seeds. This dynamic will not be affected by the project.

Grazing is an important ecosystem driver. The unpredictable semi-arid climate, combined with nutrient- rich (unleached) soils, results in nutritious sweetveld (SANBI 2013). Although these grasslands are slow-growing (due to low rainfall), it can support animal production year-round, which means that it is vulnerable to over-grazing. Where over-grazing occurs, it shifts the plant species composition and structure from a forb-rich grassland to a grassy karroid dwarf shrubland. Healthy grassland in these areas has a high cover of palatable grass species, such as *Themeda triandra*, *Digitaria eriantha* and *Anthephora pubescens*, and few or no karroid shrubs. The proposed project will not affect the grazing status and regime of the area - it is expected that untransformed areas will continue to be grazed as currently.

Fire is not as important in these dryer grasslands as in other more moist grassland areas, and is also less of an ecological factor than grazing. Fuel loads take some time to build up and, because of the slower growth rates, the vegetation takes a longer time to recover from fire. The proposed project will not affect the fire regime of the area and it is expected that the land managers will continue to manage in the same way after construction as currently. The vegetation does not reach a stature that would require burning within the servitude in a different manner to the current regime.

Invasion by alien plant species is an important risk factor in these dry grasslands, as with any grassland area in South Africa. No major nodes of invasion were observed on site, but invasive species that could possibly become problematic due to local disturbance include the grasses, *Arundo donax*, *Pennisetum setaceum*, *Sorghum halepense*, the herbaceous species, *Argemone ochroleuca*)seen on site), *Cirsium vulgare*, *Datura ferox*, *Datura stramonium*, *Salsola kali*, *Solanum eleagnifolium*, *Xanthium spinosum*, *Xanthium strumarium*, the succulents, *Agave americana*, *Echinopsis spachiana*, *Opuntia aurantiaca*, *Opuntia ficus-indica*, *Opuntia fulgida*, *Opuntia humifusa*, *Opuntia imbricata*, *Opuntia spinulifera*, *Opuntia stricta*, and the shrubs / woody species, *Tamarix ramosissima*, *Gleditisia triacanthos*, ***Prosopis glandulosa***, *Robinia pseudoacacia*, *Atriplex nummularia*, *Cotoneaster* sp., *Nicotiana glauca*, *Populus x canescens*, *Ailantus altissima*, *Sesbania punicea*, and ***Melia azeradach***, Disturbance associated with construction is alsmost certain to provide opportunity to invasive species to colonise the site.

Loss of habitat and fragmentation of habitat are disruptive to ecological processes and also lead to local loss of biodiversity. This is why the vegetation type is listed as Endangered, due to high rates of transformation across the geographical range of the vegetation type. Locally, the main factors leading to transformation are urbanisation, infrastructure and cultivation. Both cultivation and utilities infrastructure occur within the study area. The current proposal with lead to additional localised loss of habitat.

Conservation status of broad vegetation types

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in Table 3, the vegetation type is listed as Endangered.

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

The vegetation type is listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

Table 3: Conservation status of different vegetation types occurring in the study area.

Vegetation Type	Conservation status	
	Driver *et al*. 2005; Mucina *et al*., 2006	National Ecosystem List (NEM:BA)
Vaal-vet Sandy Grassland	Endangered	Endangered

Parts of the site under the powerline are natural grassland and other parts are secondary grassland in previously cultivated areas. On the basis of historical aerial imagery, confirmed in the field, the previously cultivated areas have a well-established secondary growth that structurally resembles the original grassland, although it is poorer in species composition and diversity. The primary grasslands, which are within the CBA1 areas, have higher biodiversity value, but the secondary and degraded grasslands are of lower value.

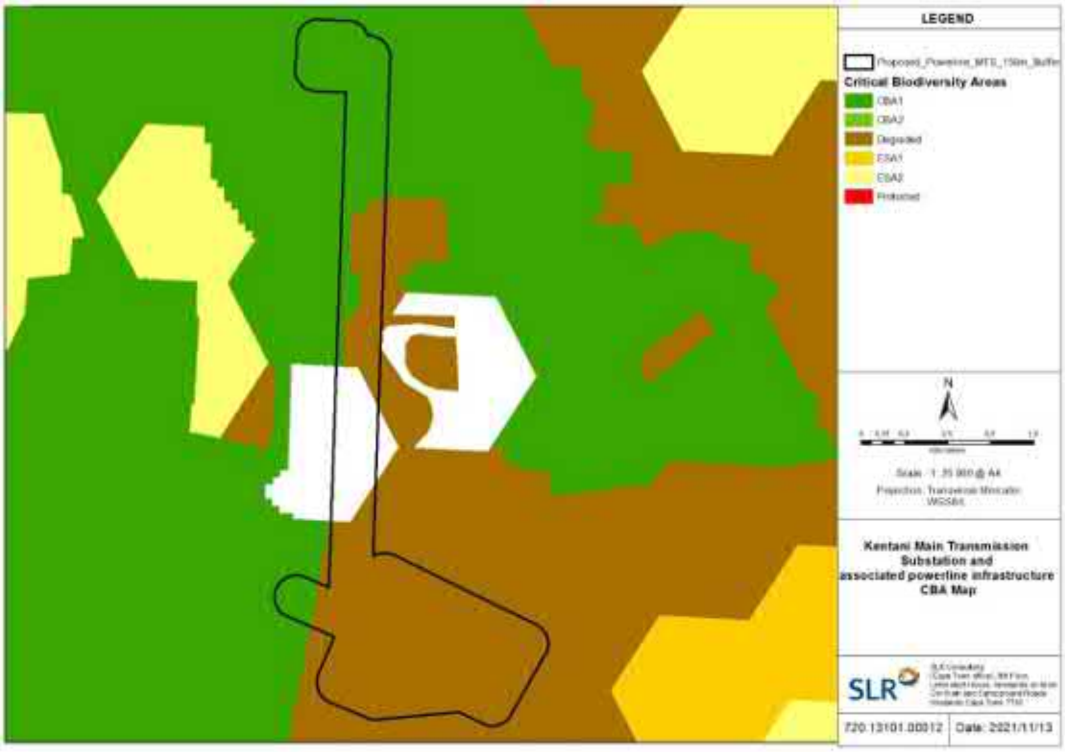

Figure 5: Critical Biodiversity Areas within the broad study area that includes the proposed infrastructure.

Biodiversity Conservation Plans

The Free State CBA map classifies the natural vegetation of the province according to conservation value in decreasing value, as follows:

1. Protected
2. Critical Biodiversity Area One (Irreplaceable Areas) (RED)
3. Critical Biodiversity Area Two (Important Areas) (ORANGE)
4. Ecological Support Area (GREEN)
5. Other Natural Area (YELLOW)

This shows features within the study area within one of these classes, as follows:

1. CBA1 Areas: The northern parts of the grid corridor (see Figure 2).

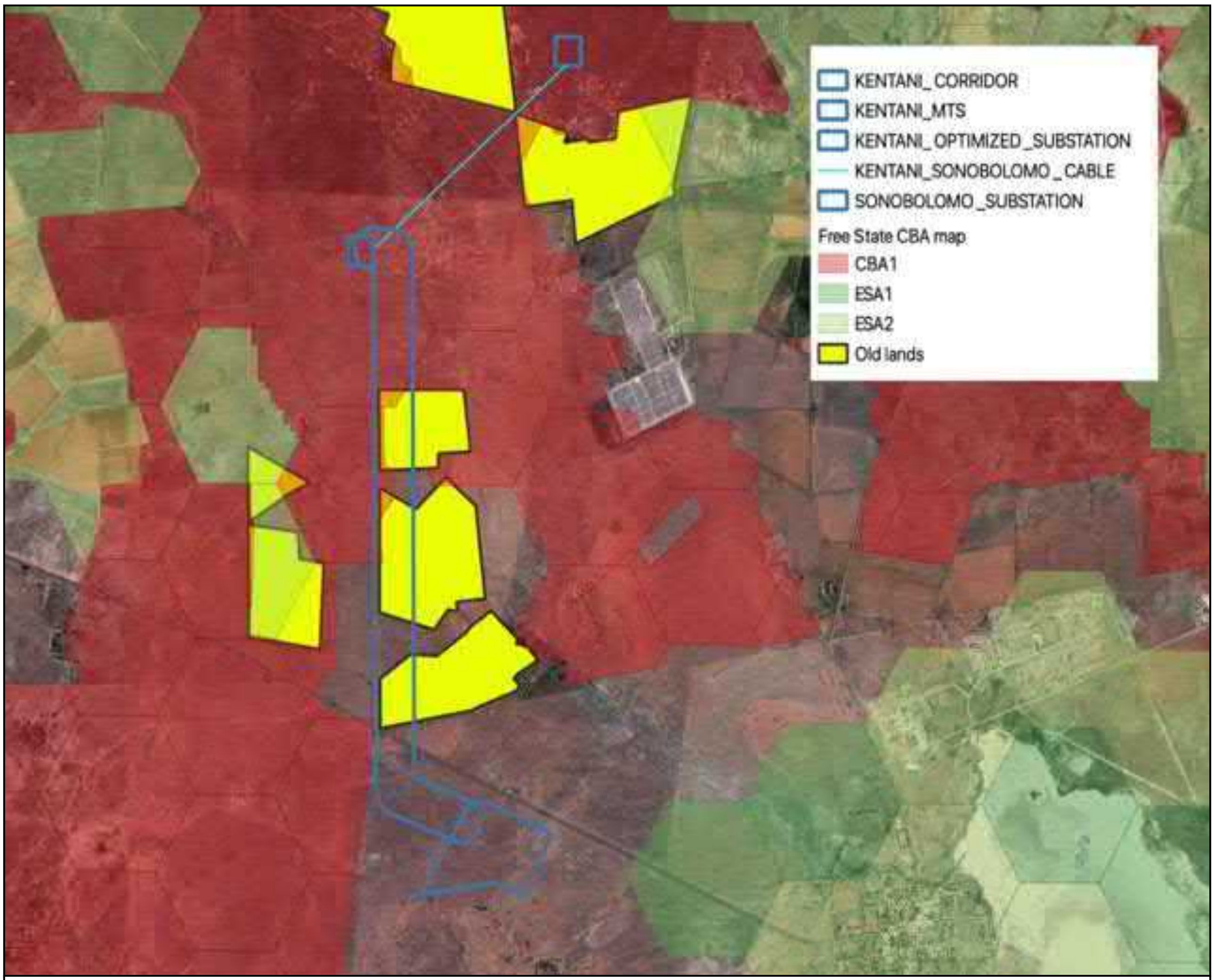

Figure 6: Previously cultivated areas in proximity to Critical Biodiversity Areas within the broad study area that includes the proposed infrastructure.

As discussed in the previous section,parts of the study area are previously cultivated. However, the location of these previously cultivated areas has been taken into account in assigning habitats to Critical Biodiversity Areas. Those areas that have been previously cultivated have very little overlap with areas assigned to CBA1 areas (see Figure 6). However, the CBA1 areas are within the area in which parts of the powerline will be placed, for which an impact of low significance after mitigation has been assessed (see below)

Other important patterns in the study area

The following applies to the study area:

1. No Ecological Support Areas (ESAs) occur within the footprint of the proposed infrastructure.
2. The study area is not within any protected area.
3. According to the National Protected Area Expansion Strategy, the study area is not within any area earmarked for future conservation.
4. There are no indigenous forests within the study area.
5. The site is not within any Freshwater Ecosystem Priority Areas.
6. The site is not within any Strategic Water Source Areas.

Anticipated impacts

There are two main impacts associated with construction of the proposed infrastructure:

1. Direct loss of habitat within the footprint of the proposed pylon and MTS infrastructure.
2. Invasion by alien invasive plant species, leading to degradation of habitat.

The main infrastructure components that will lead to loss of habitat are the Powerline pylons and MTS.

The remaining infrastructure is therefore limited entirely to overhead powerlines. These have a minimal local footprint, restricted to the tower structures and the maintenance roads. The overall loss of habitat due to these infrastructure components is insignificant compared to other approved infrastructure components, and also to existing transformation due to urbanization, utilities and cultivation in the general area.

The main potential remaining impact is therefore due to possible invasion by alien invasive plants within the project area.

Impact: loss of natural vegetation

This is evaluated only for the areas within the footprint of the proposed power line, on the basis that all other infrastructure will be located within areas where authorisation has already been obtained.

Issue	Loss of natural vegetation	
Description of Impact		
There will be localised disturbance of natural habitat within the footprint of tower structures during the construction phase.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low

Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Probable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is partly reversible by rehabilitation of disturbed areas.	
Degree to which impact may cause irreplaceable loss of resources	Without mitigation of this impact, it is possible that the local footprint of construction around each tower structure will be more extensive than if the impact is controlled. This will lead to a more extensive loss of natural habitat than without mitigation. However, the diversity within the study area is relatively low and includes primarily common and widespread plant species. There would therefore be an insignificant level of irreplaceable loss of resources.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	Restrict activities to footprint areas, use existing maintenance and access roads, rehabilitate disturbed areas after construcion, control alien invasive plant species. The presence of any species of conservation concern within the PV development area as well as along the grid connection should be checked during a preconstruction walk-through of these areas.	
Monitoring		
The following monitoring is recommended:	Annual monitoring for 3 years after construction to evaluate vegetation cover, species composition.	

Impact: invasion by alien invasive plant species

Issue	Invasion by alien invasive plant species	
Description of Impact		
There are a variety of alien invasive plant species that occur in the general geographical area. Disturbance will promote the opportunity for invasion by any of these species. Local invasion will degraded habitat and may spread further into surrounding areas. This may lead to more extensive loss of indigenous habitat and biodiversity and long-term control issues.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Long-term	Long-term
Extent	Local	Site
Consequence	High	Low
Probability	Possible / frequent	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	The impact is reversible by implementing control measures.	

Degree to which impact may cause irreplaceable loss of resources	Without mitigation of this impact, it is possible that alien invasive plants will become locally established, develop dense nodes and then spread into surrounding areas. The more established they become, the more difficult it is to get rid of them and the greater the impact they will have on local ecosystems. The effect is exponential, not appearing significant at first, but suddenly becoming excessively difficult to change. At this end point, irreplaceable loss of resources is likely at a local level, and possibly more widely.
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.
Mitigation actions	
The following measures are recommended:	Compile and implement an alien invasive control plan, monitor degree of invasion as well as outcome and effectiveness of control measures.
Monitoring	
The following monitoring is recommended:	Annual monitoring for the entire operational phase, as per the recommendations of the alien invasive control plan.

Cumulative impacts

Table 2:Loss of natural vegetation

Issue	Loss of natural vegetation	
Description of Impact		
There will be localised disturbance of natural habitat within the footprint of tower structures during the construction phase. This is evaluated only for the areas within the footprint of the proposed power line, on the basis that all other infrastructure will be located within areas where authorisation has already been obtained		
Cumulative impacts		
Nature of cumulative impacts	Existing loss of habitat in the study area is due to cultivation and other infrastructure. Solar PV projects that have been approved will lead to loss of habitat similar in magnitude to existing loss of habitat. Loss of habitat due to power line construction is negligible in comparison to these existing and anticipated future impacts.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Insignificant	Insignificant

Table 3: Invasion by alien invasive plant species

Issue	Invasion by alien invasive plant species	
Description of Impact		
There are a variety of alien invasive plant species that occur in the general geographical area. Disturbance will promote the opportunity for invasion by any of these species. Local invasion will degraded habitat and may spread further into surrounding areas. This may lead to more extensive loss of indigenous habitat and biodiversity and long-term control issues.		
Cumulative impacts		
Nature of cumulative impacts	There is limited degree of invasion within the site and surrounding areas. However, some potentially problematic species occur in the area and can easily become established and problematic. In the absence of control measures, it is possible that combined effects may significantly degraded regional ecosystems.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

CONCLUSIONS

- Desktop information, field data collection and mapping from aerial imagery confirms patterns provided in the DEA Online Screening Tool for the Terrestrial Biodiversity theme.

- The study area occurs within an Endangered Ecosystem, namely Vaal-Vet Sandy Grassland. Only the powerline part of the study area is in intact condition - other areas are secondary or degraded This verifies the VERY HIGH sensitivity for the Terrestrial Biodiversity Theme for the CBA1 areas, but other areas should be LOW sensitivity for this theme.

- Parts of the study area occur within Critical Biodiviersity Area 1 in the Free State Conservation Plan. This verifies the VERY HIGH sensitivity for the Terrestrial Biodiversity Theme for the CBA1 areas, but it should be LOW for areas outside the CBA1 area.

- The proposed project consists a MTS, BESS as well as the 132kV and 400kV power lines linking the MTS to Kentani Solar Project and existing Eskom 400kV lines respectively. Other infrastructure components to which these are linked are already approved for development.

- Anticipated impacts due to the power lines are localised loss of habitat below pylon structures, and possible invasion by alien invasive plant species. Both impacts were assessed as having Medium significance before mitigation and Low significance after mitigation.

- On the basis of the assessment undertaken here, which indicates two possible impacts that can be mitigated, it is considred appropriate that they project be given approval.

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Terrestrial Plant Species Compliance Statement

Kentani MTS and associated infrastructure near Dealesville in the Free State Province.

Prepared by: Dr David Hoare
Pr.Sci.Nat. (Botany, Ecology) 400221/05

For: SLR Consulting (Pty) Ltd (South Africa)

12 November 2021

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SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with Section 13: General Requirements for Environmental Assessment Practitioners (EAPs) and Specialists as well as per Appendix 6 of GNR 982 – Environmental Impact Assessment Regulations and the National Environmental Management Act (NEMA, No. 107 of 1998 as amended 2017) and Government Notice 704 (GN 704). It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows –

Table 1: Details of Specialist

Specialist	Qualification and accreditation	Client	Signature
Dr David Hoare (Pr.Sci.Nat.)	PhD Botany	SLR	Date: 12/11/2021

<u>Details of Author:</u>
Dr David Hoare

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Professional Natural Scientist, South African Council for Natural Scientific Professions, Reg. no. 400221/05 (Ecology, Botany)

Statement of independence:

I, David Hoare, as the appointed plant species specialist, hereby declare/affirm the correctness of the information provided in this compliance statement, and that I:

1. meet the general requirements to be independent and
2. have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
3. am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).

	12 November 2021
Dr David Hoare	Date

TERMS OF REFERENCE

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be LOW, a Plant Species Compliance Statement is required, either (1) for areas where no natural habitat remains, or (2) in natural areas where there is no suspected occurrence of SCC.

The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Botanical Science or Ecological Science).

The compliance stement must:

- be applicable within the study area
- confirm that the study area is of "low" sensitivity for terrestrial plant species; and
- indicate whether or not the proposed development will have anyimpact on SCC.

The compliance statement must contain, as a minimum, the following information:

- contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
- a signed statement of independence by the specialist;
- a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- a baseline profile description of biodiversity and ecosystems of the site;
- the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;
- in the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;
- where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;
- a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and
- any conditions to which this statement is subjected.

A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

INTRODUCTION

Project Background

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, (the 'proposed development') that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor which has been authorised as part of the Kentani Cluster, making provision for this routing in the new proposed MTS (Figure 1).

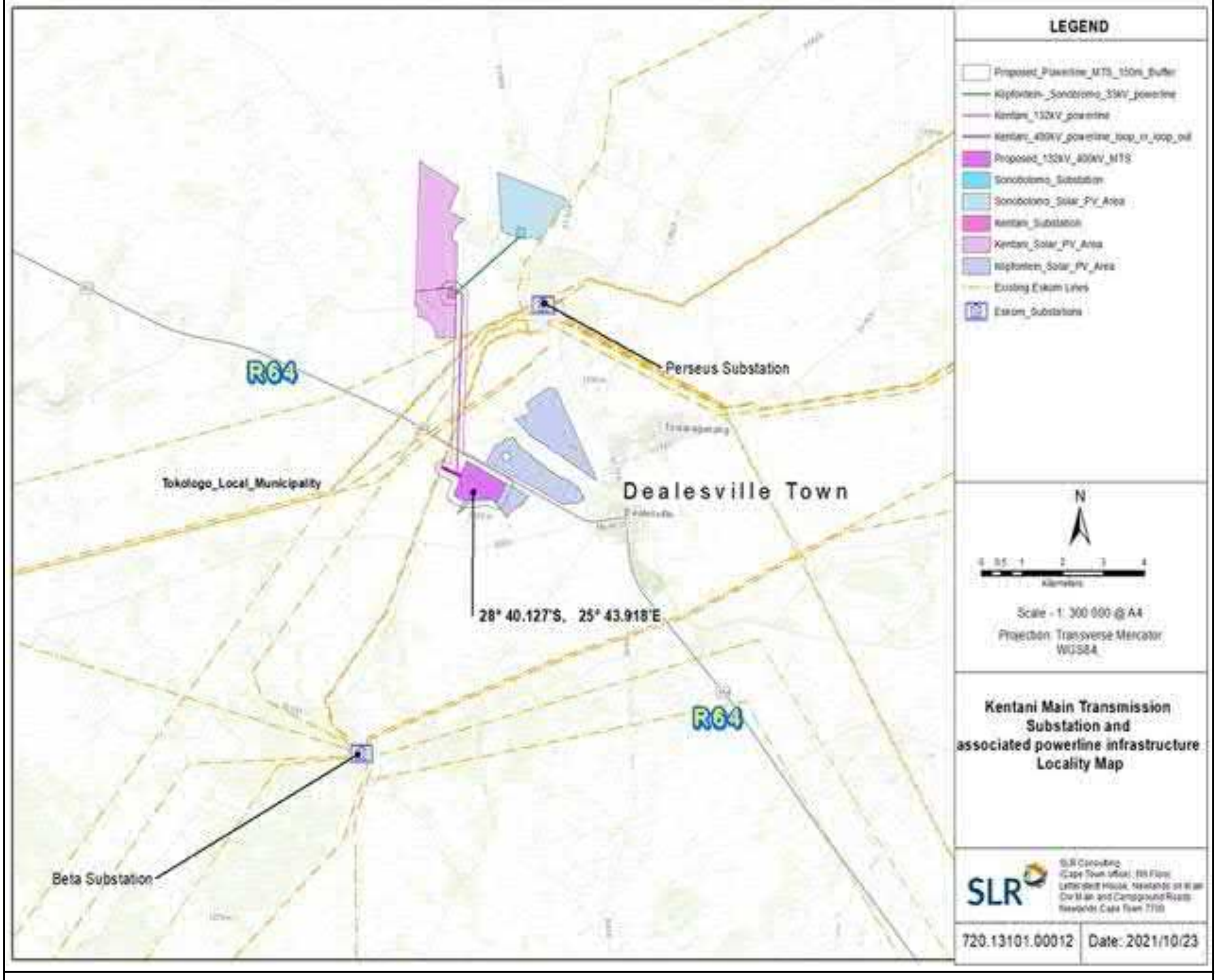

Figure 1: Location of proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016 [1].

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The proposed MTS will occupy a footprint of approximately 64 hectares (ha)

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

(i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 800m in length) are being proposed and will connect the proposed MTS to the existing Eskom 400kV powerline, located approximately 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 4km in length) is being proposed and will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site.
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerlineIn terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended], various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the NEMA EIA Regulations of 2014 (as amended).

In accordance with GN 320 and GN 1150 (20 March 2020)[2] of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Mrs Elize Butler, as the Palaeontology Specialist, has been commissioned to verify the sensitivity of the 132kV/400kV Main Transmission Substation (MTS) and Associated Infrastructure project site under these specialist protocols.

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[2] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

Identified Theme Sensitivity

A sensitivity screening report from the DEA Online Screening Tool was requested in the application category: Utilities Infrastructure|Electricity|Generation|Renewable|Solar|PV. The DEA Screening Tool report for the area indicates the following ecological sensitivities:

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Plant Species Theme				X

Plant Species theme

Sensitivity features are indicates as follows:

Sensitivity	Feature(s)
Low	Low Sensitivity

METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Survey timing

The study commenced as a desktop-study followed by a site-specific field study on 12 October 2021. The site is within the Grassland Biome with a peak rainfall season in summer, which occurs from November to April. The timing of the survey is therefore sub-optimal in terms of assessing the flora of the site. However, despite this limitation, the overall condition of the vegetation was possible to be determined with a high degree of confidence. In addition, the entire area was previously assessed as part of the environmental authorisation process for the Klipfontein PV facility, for which authorisation has already been obtained (14/12/16/3/3/2/722) and for which the original specialist study was made available.

Field survey approach

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made.

Aerial imagery from Google Earth was used to identify and assess habitats on site. Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground during the search for plant species. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled.

Digital photographs were taken of all plant species that were seen on site. All plant species recorded were uploaded to the iNaturalist website.

Sources of information

Plant species

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (http://bgis.sanbi.org). The description of each vegetation type includes a list of plant species that may be expected to occur within the particular vegetation type.
- Plant species that could potentially occur on in the general area was extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grid/s in which the site is located.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, http://redlist.sanbi.org).
- Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated. Habitat information for each species was

obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.

- Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

RESULTS

Broad vegetation patterns

There is one regional vegetation type in the study area, namely Vaal-vet sandy grassland, briefly described below, including expected species composition.

Vaal-vet Sandy Grassland (Gh10)

Distribution

North-West and Free State Provinces: South of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. Altitude 1 220–1 560 m, generally 1 260–1 360 m.

Vegetation & Landscape Features

Plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Mainly low-tussock grasslands with an abundant karroid element. Dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T. triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Important Taxa

Graminoids	Anthephora pubescens (d), **Aristida congesta** (d), Chloris virgata (d), Cymbopogon caesius (d), Cynodon dactylon (d), Digitaria argyrograpta (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. lehmanniana (d), E. plana (d), E. trichophora (d), Heteropogon contortus (d), Panicum gilvum (d), Setaria sphacelata (d), **Themeda triandra** (d), Tragus berteronianus (d), Brachiaria serrata, Cymbopogon pospischilii, Digitaria eriantha, Eragrostis curvula, E. obtusa, E. superba, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides.
Herbs	Stachys spathulata (d), Barleria macrostegia, Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Geigeria aspera var. aspera, Helichrysum caespititium, Hermannia depressa, Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, **Selago densiflora**, Vernonia oligocephala.
Geophytic Herbs	Bulbine narcissifolia, Ledebouria marginata.
Succulent Herb	Tripteris aghillana var. integrifolia.
Low Shrubs	**Felicia muricata** (d), Pentzia globosa (d), **Anthospermum rigidum subsp. pumilum**, Helichrysum dregeanum, H. paronychioides, Ziziphus zeyheriana.

Endemic Taxa

Herb	Lessertia phillipsiana.

Red List plant species of the study area

Listed plant species previously recorded in the Free State were obtained from the South African National Biodiversity Institute (SANBI) website. These are listed in Appendix 2. There are seven threatened species on this list and a total of 35 species of conservation concern that occur in the Free State, but none of them have a geographical distribution that could include the site. **There are therefore no threatened, near threatened or rare species that occur in the study area.**

Plant species recorded in the study area

A total of only 36 plant species were recorded during the field survey (Appendix 1). Some of these are listed for the vegetation type, but they do not represent a typical example of the vegetation type. The diversity of shrubs and low trees, and the presence of species such as *Albuca setosa,* suggest that the vegetation is an intermediate to the Vaalbos Rocky Shrubland vegetation type, which occurs about 6 km to the west, especially in places where there is surface rockiness. The species composition also suggests some similarities with the other main grassland vegetation type in the general area, namely Western Free State Clay Grassland, with the soil properties probably determining the local species composition (sand vs clay).

The number of invasive species was low and included *Argemone ochroleuca* and *Solanum elaegniifolium*, neither of which was widespread. None of the species seen on site are rare or restricted.

CONCLUSIONS

- Desktop information, field data collection and mapping from aerial imagery confirms patterns provided in the DEA Online Screening Tool for the Plant Species theme.
- Due to its geographical location, the study area is not important for any plant SCC.

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APPENDICES:

Appendix 1: Plant species recorded in the footprint area.

Albuca setosa
Aptosimum procumbens
Argemone ochroleuca
Aristida congesta subsp. congesta
Asparagus suaveolens
Berkheya rigida
Chrysocoma ciliata
Cyperus cristatus
Diospyros lycioides
Ehretia rigida
Felicia muricata
Anthospermum rigidum subsp. pumilum
Dimorphotheca sp.
Eragrostis sp.
Limeum sp
Lycium sp.
Senecio sp.
Helichrysum argyrosphaerum
Helichrysum luteoalbum
Lasiosiphon polycephalus
Lopholaena coriifolia
Lotononis laxa
Macledium zeyheri
Melolobium candicans
Moraea pallida
Olea europaea subsp. cuspidata
Ruschia hamata
Salvia verbenaca
Schoenoplectus muricinux
Searsia lancea
Selago densiflora
Solanum elaeagnifolium
Themeda triandra
Vachellia nilotica
Viscum rotundifolium
Ziziphus mucronata

Appendix 2: Listed SCC plant species of Free State.

Alepidea cordifolia EN
Aloe dominella NT
Anemone fanninii NT
Argyrolobium campicola NT
Brachystelma duplicatum Critically Rare
Brachystelma incanum VU
Calpurnia reflexa Rare
Crassula tuberella VU
Dioscorea sylvatica VU
Disa sankeyi Rare
Drimia sanguinea NT
Eucomis bicolor NT
Gladiolus robertsoniae NT
Helichrysum haygarthii Rare
Kniphofia ensifolia subsp. autumnalis EN
Lithops lesliei subsp. lesliei NT
Lithops salicola NT
Lotononis amajubica Rare
Merwilla plumbea NT
Nerine gracilis VU
Pentzia oppositifolia Rare
Pterygodium alticola Rare
Schizoglossum montanum Rare
Searsia dracomontana NT
Selaginella nubigena Rare
Syncolostemon macranthus NT
Zaluzianskya distans Rare

Visual

Project Reference: 720.13101.00013 File Ref. ArtemisOxford_Amendment_VisualComment_25082022

25 August 2022

South Africa Mainstream Renewable Power Developments (Pty) Ltd
PO Box 45063,
CLAREMONT,
7735

ATTENTION: Eugene Marais

Dear Sir,

PROPOSED RADIO MAST, 132kV POWERLINE AND 400kV LOOP-IN LOOP-OUT (LILO) POWERLINES NEAR DEALESVILLE IN THE FREE STATE PROVINCE – ADDENDUM TO VISUAL IMPACT ASSESSMENT

1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development One (1) x Radio Mast, two (2) x 400kV powerlines and one (1) x 132kV powerline that will connect to the authorised 132kV/400kV Main Transmission Substation (MTS) **(14/12/16/3/3/1/2460/AM1)** as well as to the approved 100MW Kentani Solar Photovoltaic (PV) Energy Facility **(14/12/16/3/3/2/724/AM3)** respectively. The Kentani Solar PV Energy Facility is one (1) of eleven (11) solar PV projects collectively known as the Kentani Cluster located near the town of Dealesville, within the Tokologo Local Municipality (Lejweleputswa District) in the Free State Province.

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)]. It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities, collectively referred to as the "Kentani Cluster", received Preferred Bidder status i.e.:

- Kentani Solar PV (14/12/16/3/3/2/724/AM3)
- Sonoblomo Solar PV (14/12/16/3/3/2/723/AM2)
- Klipfontein Solar PV (14/12/16/3/3/2/722/AM2)
- Klipfontein 2 Solar PV (14/12/16/3/3/2/726/1/AM1)
- Leliehoek Solar PV (14/12/16/3/3/2/728/AM2)
- Braklaagte Solar PV (14/12/16/3/3/2/727/1)

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e., SIPs 8 and 10. These SIPs target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

The approved MTS and associated infrastructure will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the 132kV/400kV MTS development footprint and the 132kV and 400kV corridors (in which the respective powerlines which form part of this application / BA process would be situated) were granted authorisation by the DFFE in April 2022 (DFFE Reference Number: **14/12/16/3/3/1/2460/AM1**). However, due to technical consideration, the approved 132kV and 400kV corridors are not suited to connect the approved MTS to the National grid nor the authorised Kentani Solar PV (DFFE Reference Number: **14/12/16/3/3/2/724/AM3**) to the MTS, and as such additional small portions of the corridors are required to be assessed to accommodate the technical changes.

The powerlines are located within the Kimberly Renewable Energy Development Zone (REDZ) (namely REDZ 4) and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The respective powerlines which are being proposed as part of this application and BA process are as follows:

- Two (2) 400kV overhead powerlines (approx. 700m in length) are being proposed and will connect the approved MTS (14/12/16/3/3/1/2460/AM1) to the existing Eskom 400kV powerline, located approximately west of the approved MTS site, via a Loop-In-Loop Out (LILO) connection; and
- One (1) 132kV powerline (approx. 5km in length) is being proposed and will connect the approved MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724/AM3), located approx. 4.85km north-west of the approved MTS site.
- One (1) 90m tapered steel lattice radio mast will be built within the approved MTS footprint (14/12/16/3/3/1/2460/AM1).

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted).

It must be noted that only small sections of the proposed powerlines are outside the approved corridors:

- The portion of the 132kV powerline outside of an existing approved corridors and Eskom servitudes is approximately 700m
- The portion of the each of the 400kV powerlines outside of an existing approved corridors and Eskom servitudes is approximately 150m and 250m respectively

In addition, the proposed Radio Mast will be located on the approved MTS site (14/12/16/3/3/1/2460/AM1).

1.1 TERMS OF REFERENCE

A Visual Impact Assessment (VIA) was originally undertaken in respect of this project by SiVEST SA (Pty) Ltd (SiVEST) in November 2021. The Visual Specialist responsible for that study (Kerry Schwartz), who is now in the employ of SLR Consulting, has been requested to assess the changes to the proposed changes outlined above and provide a motivational letter confirming whether the status quo has or has not changed significantly since the last assessment undertaken between October and November 2021 as well as whether the new portions of the proposed powerline corridor results in a change to the impact assessments undertaken as part of the original study / assessment. The motivational letter must also include any new mitigation and/or EMPr requirements or confirm whether the mitigation and/or EMPr requirements provided in the original assessments are still applicable.

2. BASELINE CHARACTERISTICS

The previous VIA undertaken for the proposed 132kv/400kv On-Site Main Transmission Substation (MTS) and associated infrastructure was based on a desktop-level assessment supported by field-based observation drawn from a two-day site visit undertaken between 12th and 13th October 2021. Desktop assessment using Google Earth imagery has determined that there has been no significant change since October 2021 in the baseline characteristics or the number of sensitive receptors across the remainder of the study area. Accordingly, the findings of the VIA as presented in SiVEST's report dated 9 November 2021 remain unchanged.

3. PROPOSED ADDITIONAL SECTIONS OF POWERLINE CORRIDOR

It has been noted that, although the additional sections of the 132kV and 400kV powerlines are outside the approved corridors, the assessment corridors for these sections are still within the study area assessed for the VIA. The additional sections of corridor as proposed are relatively short in length and are located relatively close to other approved elements of the grid connection infrastructure as well as existing powerline and road infrastructure.

Hence the additional powerline sections, as shown in **Figure 2** will not give rise to additional visual impacts or exacerbate the impacts previously identified in the VIA for this development. Furthermore, no additional recommendations or mitigation measures will be required and all of the mitigation measures set out in the original VIA remain valid.

4. PROPOSED RADIO MAST

The proposed radio mast is a new addition to the proposed project and was not assessed in the VIA undertaken in 2021 in respect of the approved 132kV/400kV on-site main transmission substation (MTS) and associated infrastructure project (**see Figure 1**) positioned within the approved MTS footprint (authorised under: 14/12/16/3/3/1/2460/AM1). The mast will be up to 90m tall with antennae at the top of the mast and will be painted red and white and fitted with aircraft warning lights, in accordance with the Civil Aviation Authority (CAA) regulations.

Figure 1: Examples of a Tapered Steel Lattice Radio Mast

4.1 VISUAL INTRUSION (VISIBILITY)

The general area in the vicinity of the MTS substation site is characterised by relatively flat to slightly undulating terrain. Bearing in mind that the proposed radio mast is potentially 90m high, this structure could potentially be visible from a considerable area around the site. Localised topographic variations may limit views of mast from some parts of the study area, but across the remainder of the study area there would be very little topographic shielding to lessen the visibility of the mast from many of the locally occurring receptor locations.

This factor was confirmed by a GIS based visibility analysis undertaken for the proposed mast, although it should be noted that the visibility analysis is based entirely on topography (relative elevation and aspect) and does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. In addition, detailed topographic data was not available for the broader study area and as such the viewshed analysis does not take into account any localised topographic variations which may constrain views. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.

Furthermore, it should also be noted that viewing distance is a critical factor in the experiencing of visual impacts, as beyond a certain distance, even large developments tend to be much less visible, and difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially as one moves away from the source of impact, with the impact at 1 000m being considerably less than the impact at a distance of 500m. Thus, even though the structure is theoretically visible, the degree of visibility of a single, tapered, steel lattice structure is expected to diminish significantly over distance.

4.2 POTENTIAL ALTERATION OF VISUAL CHARACTER

As the proposed radio mast will be located on the approved MTS site it is within the study area assessed for the VIA. The VIA demonstrated that the study area has a somewhat mixed visual character, transitioning from the heavily transformed landscape associated with Perseus Substation and the town of Dealesville in the east to a more rural / pastoral character across the remainder of the study area. Hence, although the proposed development could potentially alter the visual character and contrast with this rural / pastoral character, the location of the proposed development in relatively close proximity to Dealesville as well as the presence of Perseus Substation and its extensive network of high voltage power lines, will reduce the level of contrast. In addition, considering that the mast will be positioned on the approved MTS site, in amongst the tall structures of the substation and a network of powerlines, it is likely that the mast will be perceived as part of the overall development, thus reducing the level of contrast resulting from the mast.

4.3 RECEPTOR IDENTIFICATION

The identification of visual receptors for the VIA involved a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Where possible, these receptor locations were verified and assessed during a site visit which was undertaken between the 12th and the 13th of October 2021. As the proposed mast is within the study area assessed for the VIA, the receptor database compiled for the VIA formed the basis of this receptor impact assessment for the radio mast.

Given the nature of the receiving environment and the height of the proposed radio mast, the study area or visual assessment zone is assumed to encompass a zone of 5 km from the outer boundary of the substation site. This 5 km limit on the visual assessment zone relates to the importance of distance when assessing visual impacts. Although the proposed development may still be visible beyond 5 km, the degree of visual impact would diminish considerably and as such the need to assess the impact on potential receptor locations beyond this distance would not be warranted.

Only five (5) potentially sensitive visual receptor locations were identified within the 5km visual assessment zone for the proposed radio mast, none of which are considered to be sensitive. All of the identified receptors are believed to be farmsteads that are regarded as *potentially* sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. However, all of these sites are at least 2km from the approved MTS site.

As per the previous VIA, potential visual impacts affecting these five receptors were assessed using a rating matrix based on distance, screening and visual contrast factors. The results show that three (3) of these receptor locations are expected to experience moderate levels of impact as a result of the radio mast, while the remaining two (2) receptors will experience only low levels of visual impact.

Although proposed radio mast is relatively close to the R64 receptor road, motorists travelling along this route are only expected to experience low levels of impact from the proposed development due to the degree of landscape degradation already present along this section of the route.

4.4 NIGHT-TIME IMPACTS

Considering that the tower will be fitted with aircraft warning lights (in accordance with the CAA regulations), it is important to assess whether the introduction of this new light source into the night sky will impact on the visual quality of the area at night.

The VIA determined that the urban areas of Dealesville and Tswaraganang Township, located approximately 3 km east of the approved MTS site are the main sources of light within the study area. These areas are expected to have a significant impact on the night scene in the eastern sector of the study area. Another prominent light source within the study area at night is the security lighting at the existing Perseus Substation which is expected to be visible from relatively far away. Some additional light is expected to emanate from the approved MTS once operational. Accordingly, the visual character of the night environment within the study area is considered to be moderately ‘polluted’ and will therefore not be regarded as pristine.

Although the lighting required on the mast would normally be expected to intrude on the nightscape, night-time impacts of this lighting will be reduced by the existing light spill emanating from Dealesville and Tswaraganang Township as well as Perseus Substation. It should also be noted that the mast will only be constructed if the proposed Kentani PV Cluster is also developed. Light sources for this facility will include operational and security lighting and thus the lighting impacts from the proposed mast would be subsumed by the glare and contrast of the lighting associated with the PV facility as a whole. As such, the mast alone is not expected to result in significant lighting impacts.

4.5 SITE SENSITIVITY

A broad-scale assessment of visual sensitivity that was undertaken for the VIA , based on the physical characteristics of the broader study area, economic activities and land use that predominates, determined that the area would have a low visual sensitivity. It was further established that no areas within the approved MTS site are significantly more visible to the identified receptors than any others.

4.5.1 Sensitivities identified by the National Screening Tool

In assessing visual sensitivity, the proposed development was examined in relation to the Landscape Theme of the National Environmental Screening Tool to determine the relative landscape sensitivity for this type of development. The tool does not however identify any landscape sensitivities in this respect.

4.6 CUMULATIVE IMPACTS

In this instance, the proposed radio mast is an integral part of the MTS development and is therefore likely to be perceived to be part of the overall grid connection infrastructure. In the VIA, the cumulative impact assessment examined the collective impact of the proposed MTS and power line application, along with all the renewable energy applications for EA (approved or proposed) identified within a 30km radius of the project site.

It was determined that there is a relatively large number of renewable energy facilities and associated grid connection infrastructure projects proposed within the surrounding area. These facilities, in conjunction with the extensive electrical infrastructure already present, have the potential for large-scale visual impacts. The concentration of renewable energy facilities as proposed will further change the visual character of the area and alter the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In addition, it is possible that these developments in close proximity to each other could be seen as one large Renewable Energy Facility (REF) rather than several separate developments. Although this will not necessarily reduce impacts on the visual character of the area, it could potentially reduce the cumulative impacts on the landscape.

4.7 ASSESSMENT OF VISUAL IMPACTS

This VIA identified the potential issues / impacts that could result from the proposed development of a substation, power lines and access roads as proposed. Although the radio mast was not included in that assessment, it is believed that the potential issues and impacts identified are relevant to the proposed radio mast. A summary of these issues / impacts is presented below.

Construction Phase

- Potential visual intrusion resulting from large construction vehicles and equipment;
- Potential visual effect of construction activities;
- Potential visual effect of material stockpiles;
- Potential impacts of increased dust emissions from construction activities and related traffic;

- Potential visual scarring of the landscape as a result of surface disturbance during construction; and
- Potential visual pollution resulting from littering on the construction site.

Operational Phase

- Potential alteration of the visual character of the area;
- Potential visual intrusion resulting from the radio mast dominating the skyline in a largely natural / rural area;
- Potential impacts of increased dust emissions from maintenance activities and related traffic;
- Potential visual effect on surrounding farmsteads; and
- Potential alteration of the night time visual environment as a result of aircraft warning lights on the mast.

Decommissioning Phase

- Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;
- Potential impacts of increased dust emissions from decommissioning activities and related traffic; and
- Potential visual intrusion of any remaining infrastructure on the site.

Cumulative Impacts

- Combined visual impacts from proposed renewable energy developments and existing electrical infrastructure in the broader area could further alter the sense of place and visual character of the area;
- Additional electrical infrastructure in the area would increase the visual clutter in the area; and
- Combined visual impacts from proposed renewable energy developments and existing electrical infrastructure in the broader area could potentially exacerbate visual impacts on visual receptors.

4.8 IMPACT RATING

As the radio mast was not considered in the VIA, impact ratings and associated mitigation measures were not provided for this structure. Accordingly, impact matrices for visual impacts associated with the proposed construction, operation and decommissioning of the radio mast are presented below together with recommended mitigation measures.

Please refer to Appendix B of the VIA (Terms of Reference) for an explanation of the impact rating methodology.

4.8.1 Construction Phase

Table 1: Rating of Impacts of Proposed Radio Mast During Construction

Issue: ▪ Potential alteration of the visual character and sense of place ▪ Potential visual impact on receptors in the study area		
Description of Impact		
▪ Large construction vehicles, equipment and construction material stockpiles will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during construction would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment. ▪ Vegetation clearance required for the construction of the proposed substation is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Construction**	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are completely reversible with cessation of construction activity.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
The following measures are recommended:	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: o on all access roads; o in all areas where vegetation clearing has taken place; o on all soil stockpiles.	
The following monitoring is recommended:	▪ Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the siting and management of soil stockpiles, screening and dust suppression.	

	- Regular reporting to an environmental management team must also take place during the construction phase.	
Nature of cumulative impacts	- Combined visual impacts from construction activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could further alter the sense of place and visual character of the area; and - Combined visual impacts from construction activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could potentially exacerbate visual impacts on visual receptors.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

4.8.2 Operation Phase

Table 2: Rating of Impacts of Proposed Radio Mast During Operation

Issue: - Potential alteration of the visual character and sense of place - Potential visual impact on receptors in the study area.		
Description of Impact		
- Potential alteration of the visual character of the area; - Potential visual intrusion resulting from power line and substation infrastructure dominating the skyline in a largely natural / rural area; - Potential impacts of increased dust emissions from maintenance activities and related traffic; - Potential visual effect on surrounding farmsteads; and - Potential alteration of the night time visual environment as a result of operational and security lighting at the proposed substation.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Operation**	
Criteria	Without Mitigation	With Mitigation
Intensity	Very Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are partly reversible with decommissioning of infrastructure.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is limited scope for mitigation as per the recommended mitigation measures below.	
The following measures are recommended:	- Where possible, limit the number of maintenance vehicles using access roads. - Where possible, limit the lighting associated with the mast to aircraft warning lights required in accordance with CAA regulations.	

The following monitoring is recommended:	Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the control of signage, lighting and maintenance vehicles on access roads..	
Nature of cumulative impacts	Additional renewable energy and associated infrastructure developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. Visual intrusion of multiple renewable energy and infrastructure developments may be exacerbated, particularly in more natural undisturbed settings. Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

4.8.3 Decommissioning Phase

Table 3: Impacts During Decommissioning Phase

Issue: Potential alteration of the visual character and sense of place Potential visual impact on receptors in the study area		
Description of Impact		
Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. Decommissioning activities may be perceived as an unwelcome visual intrusion. Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. Surface disturbance during decommissioning would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment. Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Decommissioning**	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are completely reversible with cessation of decommissioning activity.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	

The following measures are recommended:	All infrastructure that is not required post-decommissioning should be removed. Carefully plan to minimize the decommissioning period and avoid delays. Maintain a neat decommissioning site by removing rubble and waste materials regularly. Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. All cleared areas should be rehabilitated as soon as possible. Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	
The following monitoring is recommended:	Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials. In addition, it must be ensured that rehabilitation of the site to a visually acceptable standard is undertaken.	
Nature of cumulative impacts	Combined visual impacts from decommissioning activities associated with multiple renewable energy and grid connection infrastructure projects in the broader area could further alter the sense of place and visual character of the area; and Combined visual impacts from decommissioning activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could potentially exacerbate visual impacts on visual receptors.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

5. CONCLUSION

SLR has assessed the proposed changes to the approved 132kV and 400kV powerline corridors and determined that the additional powerline sections, as shown in **Figure 2** will not give rise to additional visual impacts or exacerbate the impacts previously identified in the VIA for this development. Furthermore, no additional recommendations or mitigation measures will be required and all of the mitigation measures set out in the original VIA remain valid.

Assessment of the proposed addition of a radio mast on the MTS site determined that although the proposed radio mast could potentially alter the visual character and contrast with this rural / pastoral character, the location of the proposed development in relatively close proximity to Dealesville as well as the presence of Perseus Substation and its extensive network of high voltage power lines, will reduce the level of contrast. In addition, considering that the mast will be located on the MTS site, it is likely that the mast will be perceived as part of the overall substation and powerline development, thus reducing the level of contrast associated with the mast.

The area is not typically valued for its tourism significance and no leisure-based tourism facilities or formal protected areas were identified within 5 kms of the proposed development. This factor in conjunction with the high levels of transformation in the east have reduced the overall visual sensitivity of the area.

Only five (5) potentially sensitive visual receptor locations were identified within the 5km visual assessment zone for the proposed radio mast, none of which are considered to be sensitive. All of the identified receptors are believed to be farmsteads and all of these sites are at least 2km from the MTS site. Visual impacts affecting these receptor locations are rated as either moderate or low. Visual impacts affecting the R64 receptor road will be low due to the degree of landscape degradation already present along this section of the route.

An assessment of overall impacts revealed that visual impacts associated with the proposed radio mast are of low significance during construction, operation and decommissioning phases, with limited mitigation measures available.

In light of the above, it is SLR's opinion that the potential visual impacts associated with the approved Main Transmission Substation (MTS) and associated 400 kV, 132 kV and 33kV overhead power lines (including the additional sections), access roads and radio mast are negative and of moderate significance. Given the relatively low number of potentially sensitive receptors and the significant level of human transformation and landscape degradation in areas near the proposed development, the project is deemed acceptable from a visual perspective and the EA should be granted. SLR is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures (as contained the VIA report dated 9th November 2021 and in this addendum thereto) are implemented.

Yours faithfully

Kerry Schwartz
Visual Specialist

Liandra Scott-Shaw
Reviewer

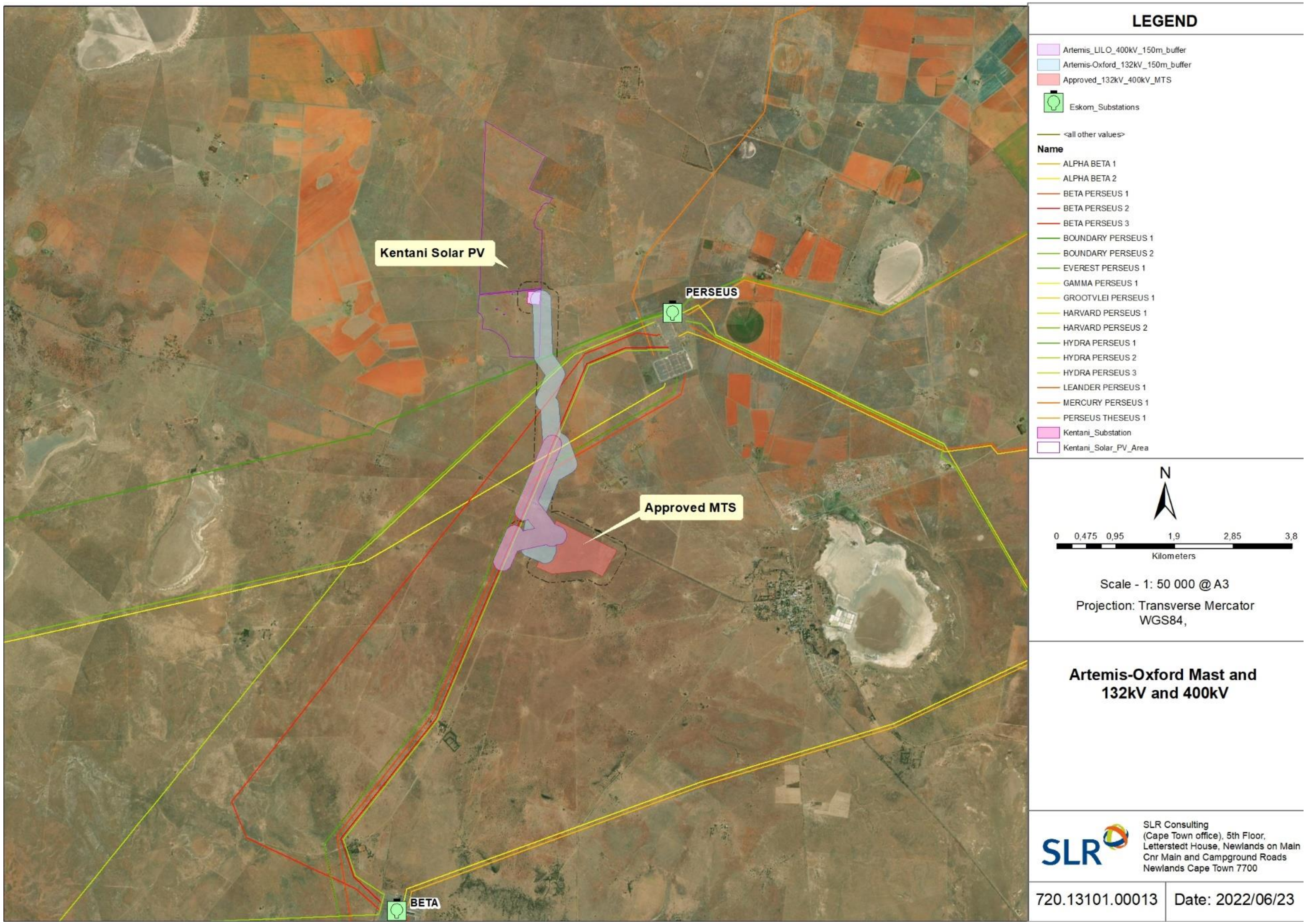

Figure 2: Locality Map of the proposed powerlines (132kv & 400kV) in relation to approved (MTS) and associated electrical infrastructure

CONTENTS

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1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing to add one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and Li-Ion Battery Energy Storage System to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development'). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality. The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality (refer to Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment

(DFFE)][1]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.In terms of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the proposed development, under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report is the 132kV/400kV On-site MTS and Associated Infrastructure near Dealesville application.

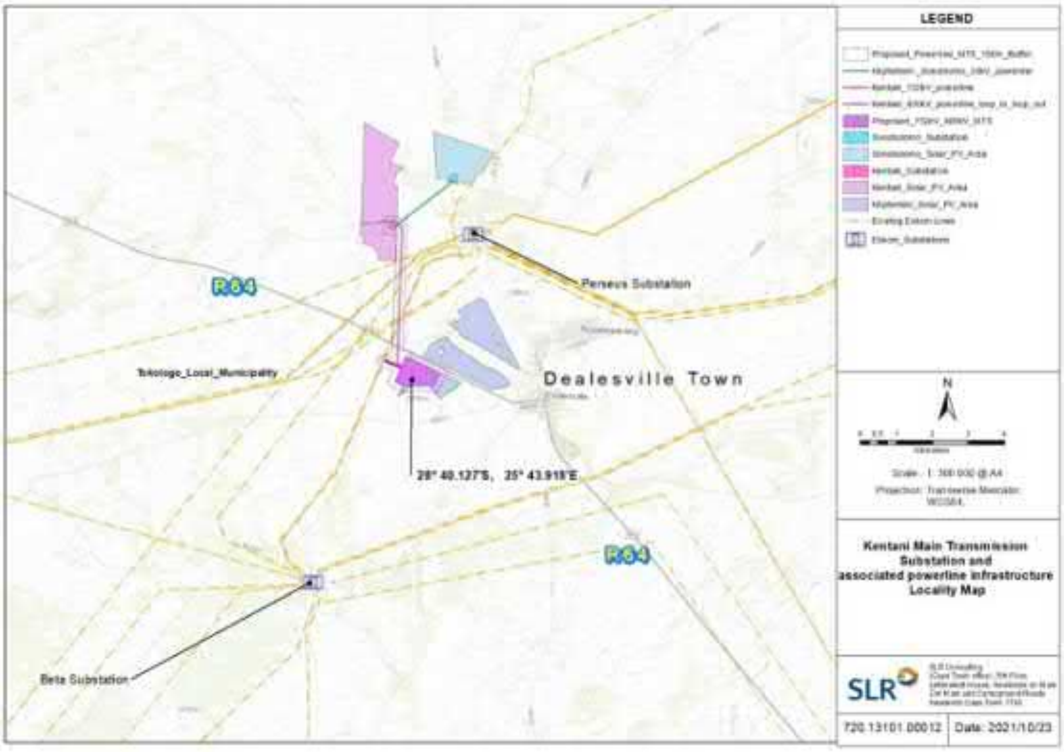

Figure 1: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

The proposed development involves the addition of one (1) MTS, Lithium ion BESS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route
- Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;

2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and

3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

2. SITE SENSITIVITY VERIFICATION METHODOLOGY

A site sensitivity verification has been conducted in support of the Visual Impact Assessment (VIA) for the proposed Main Transmission Substation (MTS), power lines and access roads. The verification exercise is based on a desktop-level assessment supported by field-based observation and involved an assessment of factors as outlined below.

- **Physical landscape characteristics**

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by National Geospatial Information (NGI), the South African National Biodiversity Institute (SANBI) and the South African National Land Cover Dataset (DFFE / Geoterraimage – 2020). The characteristics identified via desktop means were later verified during the site visit.

- **Identification of sensitive receptors**

Visual receptor locations that are sensitive and / or potentially sensitive to the visual intrusion of the proposed development were identified by way of a desktop assessment as well as field-based investigation. Initially Google Earth imagery (2021) was used to identify potential receptors within the study area and where possible, these receptor locations were verified and assessed during the field investigation.

- **Fieldwork and photographic review**

A two (2) day site visit was undertaken on the 12th and 13th of October 2021 (early spring). The aim of the site visit was to:

  - verify the landscape characteristics identified via desktop means;
  - conduct a photographic survey of the proposed study area;
  - verify the sensitivity of visual receptor locations identified via desktop means;
  - eliminate receptor locations that are unlikely to be influenced by the proposed development;
  - identify any additional visually sensitive receptor locations within the study area; and
  - assist with the assessment and rating of receptor impacts.

3. OUTCOME OF SITE SENSITIVITY VERIFICATION

Visual sensitivity of the broader area surrounding the proposed development was found to be **low** largely due to the relatively low number of potentially sensitive receptors in the area and the level of human transformation and landscape degradation in the area.

A screening exercise was undertaken with the aim of indicating any areas that should be precluded from the proposed development footprint. From a visual perspective, these are areas where the establishment of power lines and/or substation infrastructure would result in the greatest probability of visual impacts on sensitive or potentially sensitive visual receptors.

Using GIS-based visibility analysis, it was possible to determine which sectors of the assessment corridors would be visible to the highest numbers of receptors in the study area. However, this analysis found that no areas are significantly more visible than any other area. As such, in terms of visibility, no areas were found to be particularly sensitive.

In determining visual sensitivity, consideration must also be given to the direct visual impact of the proposed development on any nearby farmsteads or receptors. However, investigation determined that there are no farmsteads or potentially sensitive receptors within 500 m of either of any elements of the power line or MTS development. As such, **no** areas of visual sensitivity were identified in relation to any of the power line alignments or the substation site.

In assessing visual sensitivity, the proposed development was examined in relation to the Landscape Theme of the National Environmental Screening Tool to determine the relative landscape sensitivity for this type of development. The tool does not however identify any landscape sensitivities in respect of power line or substation development.

4. CONCLUSION

A site sensitivity verification for the Visual Impact Assessment (VIA) for the proposed Main Transmission Substation (MTS), BESS, power lines and access roads has been conducted, based on a desktop-level assessment supported by field-based observation. As outlined above, it was verified that there are no areas of visual sensitivity in relation to any of the power line alignments or substation site. Furthermore, no landscape sensitivities were identified in terms of the Landscape Theme of the National Environmental Screening Tool.

PROPOSED 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE PROJECT NEAR DEALESVILLE

Visual Impact Assessment Report – Basic Assessment

DFFE Reference:	To be Allocated
Report Prepared by:	**Kerry Schwartz / SiVEST**
Issue Date:	09 November 2-21
Version No.:	1

EXECUTIVE SUMMARY

SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") has been appointed by SLR South Africa Consulting (PTY) Ltd, on behalf of South Africa Mainstream Renewable Power Developments (Pty) Ltd, hereafter referred to as "Mainstream", to undertake a Visual Impact Assessment for the proposed addition of one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and Li-Ion Battery Energy Storage System to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development'). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality.

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, of the eleven (11) power lines, eight (8) are 132kV power lines which are located within the authorised corridor included as part of the authorised solar PV developments and require re-routing within the authorised corridor. The remaining power lines [i.e., two (2) 400kV and one (1) 132kV power lines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

In terms of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof. As part of this EIA process, a Visual Impact Assessment (VIA) is required in order to inform the Basic Assessment Report (BAR) and Application for Environmental Authorisation (EA) under NEMA.

The VIA has determined that the study area has a somewhat mixed visual character, transitioning from the heavily transformed landscape associated with Perseus Substation and the town of Dealesville in the east to a more rural / pastoral character across the remainder of the study area. Hence, although the proposed development would alter the visual character and contrast with this rural / pastoral character, the location of the proposed development in relatively close proximity to Perseus Substation and its extensive network of high voltage power lines, will reduce the level of contrast.

A broad-scale assessment of visual sensitivity, based on the physical characteristics of the study area, economic activities and land use that predominates, determined that the area would have a **low** visual sensitivity. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. The area is not however typically valued for its tourism significance and no leisure-based tourism facilities or formal protected areas were identified within 5 kms of the proposed development. This factor in conjunction with the high levels of transformation in the east have reduced the overall visual sensitivity of the area.

Eighteen (18) potentially sensitive receptors were identified in the study area, none of which was found to be sensitive. All of the identified receptors are believed to be farmsteads that are regarded as *potentially* sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. Three of the receptor locations are outside the viewshed for the proposed power lines and substation site and none of the remaining receptors are expected to experience high levels of visual impact as a result of the proposed development. Ten of the remaining receptor locations are expected to experience moderate levels of impact as a result of the power line and substation development, while five receptors will only experience low levels of visual impact.

Although the R64 receptor road traverses the study area, motorists travelling along this route are only expected to experience low levels of impact from the proposed development due to the degree of landscape degradation already present.

An assessment of overall impacts revealed that visual impacts associated with the proposed power lines, MTS and associated infrastructure are of low significance during construction, operation and decommissioning phases, with a number of mitigation measures available.

Considering the presence of extensive electrical infrastructure and multiple planned renewable energy projects, the introduction of additional electrical infrastructure in the area will result in further change in the visual character of the area and alteration of the inherent sense of place, extending an increasingly industrial character into the broader area and causing significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In light of this, cumulative impacts (with mitigation) have been rated as **low** during construction and decommissioning and **medium** during operation.

From a visual perspective therefore, no fatal flaws were identified in respect of the proposed development and the proposed Main Transmission Substation (MTS) , BESS and associated 400 kV, 132 kV and 33kV overhead power lines and access roads are deemed acceptable and the Environmental Authorization (EA) should be granted. SiVEST is of the opinion that the visual impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of 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;	Appendix A
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix A
c) an indication of the scope of, and the purpose for which, the report was prepared;	Appendix B
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5 Section 7
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.3.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 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;	Section 6
g) an identification of any areas to be avoided, including buffers;	Section 6
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;	Section 6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 5 Section 7
k) any mitigation measures for inclusion in the EMPr;	Section 7 Section 8
l) any conditions for inclusion in the environmental authorisation;	No specific conditions relating to the visual environment need to be included in the

	environmental authorisation (EA)
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
n) a reasoned opinion- i. (as to) 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 should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 2.3.6
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	No feedback has yet been received from the public participation process regarding the visual environment
q) any other information requested by the competent authority.	No information regarding the visual study has been requested from the competent authority to date.
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.	Part A of the Assessment Protocols published in GN 320 on 20 March 2020 is applicable - Site sensitivity verification report is provided Appendix C

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

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

SPECIALIST INFORMATION

Specialist Company Name:	SiVEST SA (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	110
Specialist name:	Kerry Schwartz			
Specialist Qualifications:	BA			
Professional affiliation/registration:	SAGC (GISc Technician)			
Physical address:	12 Autumn St, Rivonia			
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Postal code:	2128	Cell:	082 469 5850	
Telephone:	011 798 0632	Fax:	011 798 0632	
E-mail:	kerrys@sivest.co.za			

DECLARATION BY THE SPECIALIST

I, **Kerry Schwartz**, 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.

KSchwartz

Signature of the Specialist

SiVEST SA (Pty) Ltd

Name of Company:

08 November, 2021

Date:

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GLOSSARY OF TERMS

Anthropogenic feature: An unnatural feature resulting from human activity.

Cultural landscape: A representation of the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee, 1992).

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Scenic route: A linear movement route, usually in the form of a scenic drive, but which could also be a railway, hiking trail, horse-riding trail or 4x4 trail.

Sensitive visual receptors: An individual, group or community that is subject to the visual influence of the proposed development and is adversely impacted by it. They will typically include locations of human habitation and tourism activities.

Slope Aspect: Direction in which a hill or mountain slope faces.

Study area / Visual assessment zone; The study area or visual assessment zone is assumed to encompass a zone of 5km from the outer boundary of the proposed Solar PV Facility application site.

Viewpoint: A point in the landscape from where a particular project or feature can be viewed.

Viewshed / Visual Envelope: The geographical area which is visible from a particular location.

Visual character: The pattern of physical elements, landforms and land use characteristics that occur consistently in the landscape to form a distinctive visual quality or character.

Visual contrast: The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.

Visual exposure: The relative visibility of a project or feature in the landscape.

Visual impact: The effect of an aspect of the proposed development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.

Visual receptors: An individual, group or community that is subject to the visual influence of the proposed development but is not necessarily adversely impacted by it. They will typically include commercial activities, residents and motorists travelling along routes that are not regarded as scenic.

Visual sensitivity: The inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards the new development, which are usually based on the perceived aesthetic appeal of the area.

LIST OF ABBREVIATIONS

BA	Basic Assessment
DBAR	Draft Basic Assessment Report
DM	District Municipality
DoE	Department of Mineral Resources and Energy
DEM	Digital Elevation Model
DFFE`	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Plan
FBAR	Final Basic Assessment Report
GIS	Geographic Information System
HA	Hectares
HIA	Heritage Impact Assessment
I&AP	Interested and/or Affected Party
IPP	Independent Power Producer
LM	Local Municipality
kV	Kilovolt
MW	Megawatt
MTS	Main Transmission Substation
NEMA	National Environmental Management Act
NGI	National Geo-Spatial Information
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
O&M	Operation and Maintenance
OHP	Overhead power line
PV	Photovoltaic
SANBI	South African National Biodiversity Institute

SPEF	Solar Photovoltaic Energy Facility
VIA	Visual Impact Assessment
VR	Visual Receptor
WEF	Wind Energy Facility

1 INTRODUCTION

SiVEST SA (Pty) Ltd (hereafter referred to as “SiVEST”) has been appointed by SLR South Africa Consulting (PTY) Ltd, on behalf of South Africa Mainstream Renewable Power Developments (Pty) Ltd, hereafter referred to as “Mainstream”, to undertake a Visual Impact Assessment for the proposed addition of one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and Li-Ion Battery Energy Storage System to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the ‘proposed development’). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality (refer to Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment (DFFE)][1]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.In terms of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the proposed development, under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report is the 132kV/400kV On-site MTS and Associated Infrastructure near Dealesville application.

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[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

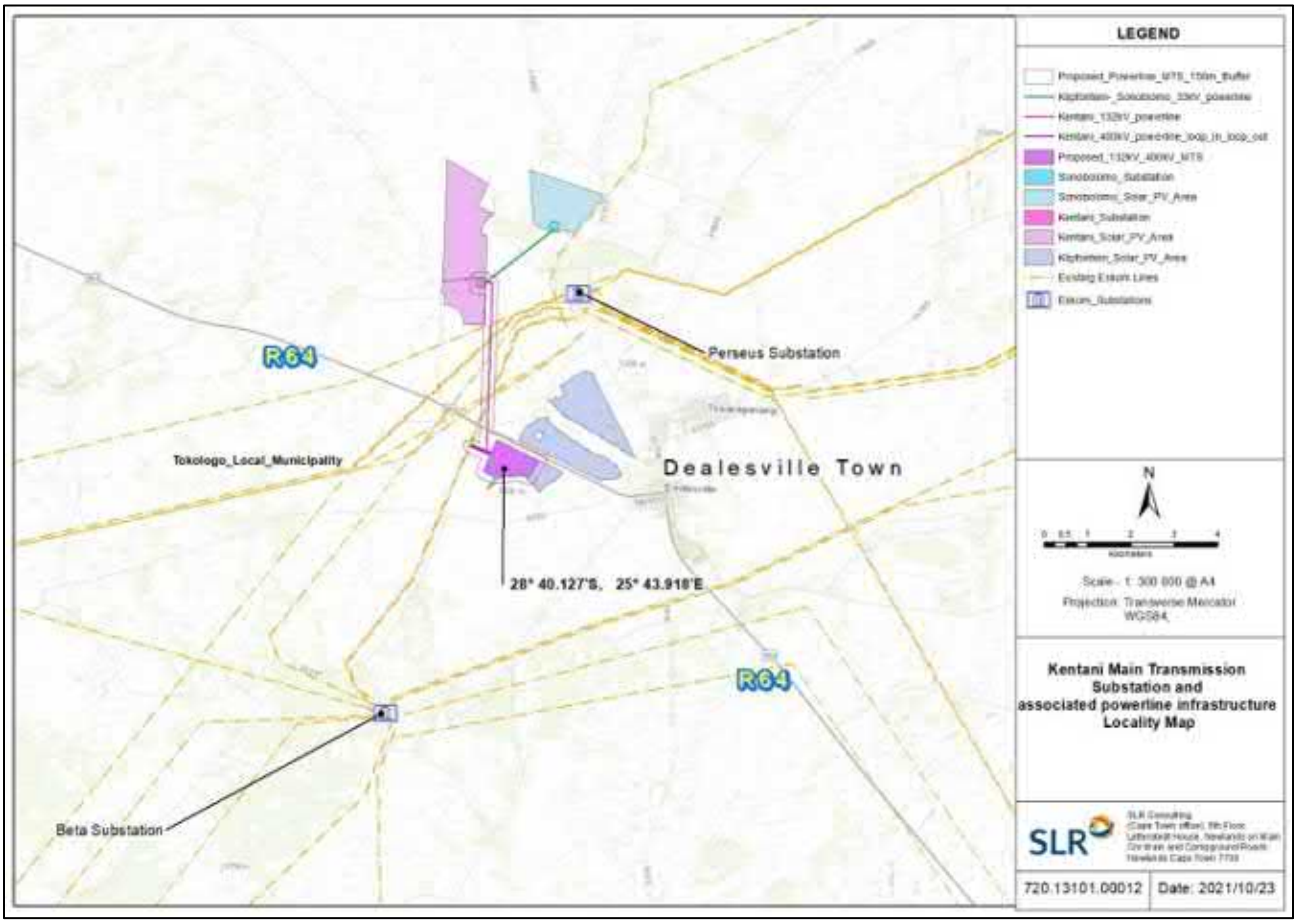

Figure 1: Locality map

2 ASSESSMENT METHODOLOGY

2.1 Specialist Credentials

Please see **Appendix A.**

2.2 Terms of Reference (ToR)

The terms of reference for this VIA are included in **Appendix B**.

2.3 Approach

This VIA has been based on a desktop-level assessment supported by field-based observation drawn from a two-day site visit undertaken between 12th and 13th October 2021. Information has also been drawn from the original VIA for the Kentani PV Cluster undertaken by the CSIR in 2015.

2.3.1 Physical landscape characteristics

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by NGI, the South African National Biodiversity Institute (SANBI) and the South African National Land Cover

Dataset (Geoterraimage – 2020). The characteristics identified via desktop analysis were later verified during the site visit.

2.3.2 Identification of sensitive receptors

Visual receptor locations and routes that are sensitive and/or potentially sensitive to the visual intrusion of the proposed development were assessed in order to determine the impact of the proposed development on each of the identified receptor locations.

2.3.3 Fieldwork and photographic review

A two (2) day site visit was undertaken between the 12th and 13th of October 2021 (early spring). The aim of the site visit was to:

- verify the landscape characteristics identified via desktop means;
- conduct a photographic survey of the study area;
- verify, where possible, the sensitivity of visual receptor locations identified via desktop means;
- eliminate receptor locations that are unlikely to be influenced by the proposed development;
- identify any additional visually sensitive receptor locations within the study area; and
- inform the impact rating assessment of visually sensitive receptor locations (where possible).

2.3.4 Visual / Landscape Sensitivity

GIS technology was used to identify any specific areas of potential visual sensitivity within the study area. These would be areas where the establishment of a power line or substation would result in the greatest probability of visual impacts on potentially sensitive visual receptors.

In addition, the National Environmental Screening Tool[2] was examined to determine any relative landscape sensitivity in respect of the proposed development.

2.3.5 Impact Assessment

A rating matrix was used to provide an objective evaluation of the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) to minimise the visual impact of the proposed development. The rating matrix made use of several different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration and intensity, in order to assign a level of significance to the visual impact of the project.

A separate rating matrix was used to assess the visual impact of the proposed development on each identified visual receptor location. This matrix is based on three (3) parameters, namely the distance of an identified visual receptor from the proposed development, the presence of screening factors and the degree to which the proposed development would contrast with the surrounding environment.

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[2] https://screening.environment.gov.za/screeningtool/

2.3.6 Consultation with I&APs

Continuous consultation with Interested and Affected Parties (I&APs) undertaken during the public participation process will be used (where available) to help establish how the proposed development will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs have not yet provided any feedback in this regard, the report will be updated to include relevant information as and when it becomes available. If no relevant comments are received requiring the report to be updated, the report will automatically inform the final BA report.

2.4 Assumptions and Limitations

- Substations and power lines are very large structures by nature and could impact on receptors that are located relatively far away, particularly in areas of very flat terrain. Given the nature of the receiving environment and the height of the various components of the proposed development, the study area or visual assessment zone is assumed to encompass a zone of 5 km from the outer boundary of the combined power line assessment corridors and substation site. This 5 km limit on the visual assessment zone relates to the importance of distance when assessing visual impacts. Although the proposed development may still be visible beyond 5 km, the degree of visual impact would diminish considerably and as such the need to assess the impact on potential receptor locations beyond this distance would not be warranted.
- The identification of visual receptors involved a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Where possible, these receptor locations were verified and assessed during a site visit which was undertaken between the 12th and the 13th of October 2021.
- Due to the extent of the study area it was not possible to visit or verify every potentially sensitive visual receptor location. As such, several broad assumptions have been made in terms of the likely sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility, the economic dependency of the occupants on the scenic quality of views from the facility and on people's perceptions of the value of "Green Energy". Sensitive receptor locations typically include sites such as tourism facilities and scenic locations within natural settings which are likely to be adversely affected by the visual intrusion of the proposed development. Thus, the presence of a receptor in an area potentially affected by the proposed development does not necessarily mean that any visual impact will be experienced.
- The potential visual impact at each visual receptor location was assessed using a matrix developed for this purpose. The matrix is based on three main parameters relating to visual impact and, although relatively simplistic, it provides a reasonably accurate indicative assessment of the degree of visual impact likely to be experienced at each receptor location as a result of the proposed development. It is however important to note the limitations of quantitatively assessing a largely subjective or qualitative type of impact and as such the matrix should be seen merely as a representation of the likely visual impact at a receptor location.
- As stated above, the exact status of all the receptors could not be verified during the field investigation and as such the receptor impact rating was largely undertaken via desktop means.

- Receptors that were assumed to be farmsteads were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were thus assessed as part of the VIA.
- Based on the project description provided by Mainstream, all analysis undertaken for this VIA is based on a worst-case scenario where the maximum height of power line towers and substation structures is assumed to be 22m.
- Due to the varying scales and sources of information; maps may have minor inaccuracies. Terrain data for the study area derived from the National Geo-Spatial Information (NGI)'s 25m DEM is fairly coarse and somewhat inconsistent and as such, localised topographic variations in the landscape may not be reflected on the Digital Elevation Model (DEM) used to generate the viewsheds and visibility analyses conducted in respect of the proposed development.
- Viewsheds do not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.
- No feedback regarding the visual environment has been received from the public participation process to date. Any feedback from the public during the review period of the Draft Basic Assessment Report (DBAR) will however be incorporated into further drafts of this report, if relevant.
- At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required for the proposed development and therefore the potential impact of lighting at night has not been assessed at a detailed level. It is however assumed that operational and security lighting will be required for the proposed substation and general measures to mitigate the impact of additional light sources on the ambient nightscape have been provided accordingly.
- This study includes an assessment of the potential cumulative impacts of other renewable energy developments on the existing landscape character and on the identified sensitive receptors. This assessment is based on the information available at the time of writing the report and where information has not been available, broad assumptions have been made as to the likely impacts of these developments.
- No visualisation modelling was undertaken for the proposed development as this is not normally required for linear infrastructure. This can however be provided should the Public Participation process identify the need for this exercise.
- It should be noted that the site visits were undertaken during early spring (12th to 13th October 2021), which is characterised by relatively low levels of rainfall and reduced vegetation cover. In these conditions, increased levels of visual impact will be experienced from receptor locations in the surrounding area.
- Clear weather conditions tend to prevail throughout most of the year in this area, and in these clear conditions, power lines and associated infrastructure would present a greater contrast with the surrounding landscape than they would on a cloudy overcast day. Clear weather conditions were experienced during the field investigation and this factor was taken into consideration when undertaking this VIA.

2.5 Source of information

The main sources of information utilized for this VIA included:

- Project description for the proposed power line and substation development provided by Mainstream;
- Elevation data from 25m Digital Elevation model (DEM) from the National Geo-Spatial Information (NGI);
- 1:50 000 topographical maps of South Africa from the NGI;
- Land cover and land use data extracted from the 2020 South African National Land-Cover Dataset provided by GEOTERRAIMAGE;
- Vegetation classification data extracted from the South African National Biodiversity Institute's (SANBI's) VEGMAP 2018 dataset;
- Google Earth Satellite imagery 2021;
- South African Renewable Energy EIA Application Database from Department of Environmental Affairs (incremental release Quarter 2 2021);
- The National Web-Based Environmental Screening Tool, DFFE; and
- VIA for the proposed Kentani Solar PV Cluster, CSIR 2015.

3 LEGAL REQUIREMENT AND GUIDELINES

Key legal requirements pertaining to the proposed development are as follows:

In terms of the NEMA and the EIA Regulations 2014 (as amended), the proposed development includes listed activities which require a BA to be undertaken. As previously stated, the entire extent of the proposed 132kV overhead power line is located within one of the Strategic Transmission Corridors as defined and in terms of the procedures laid out in Government Notice (GN) No. 113, namely the Central Corridor. The proposed overhead power line and substation project irrespective would be subject to a BA process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA is the national Department of Environment, Forestry and Fisheries (DEFF).

As part of this BA process, the need for a VIA to be undertaken has been identified in order to assess the visual impact of the proposed grid connection infrastructure. The VIA must adhere to the requirements for specialist studies as stipulated in Appendix 6 of the NEMA EIA Regulations, 2014, as amended;

There is currently no legislation within South Africa that explicitly pertains to the assessment of visual impacts, however, in addition to the NEMA the following legislation has relevance to the protection of scenic resources:

- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003); and
- National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

Based on these Acts, protected or conservation areas and sites or routes with cultural or symbolic value have been taken into consideration when identifying sensitive and potentially sensitive receptor locations and rating the sensitivity of the study area.

4 PROJECT DESCRIPTION

4.1 Project Location

The proposed project is located approximately 2,5km north-west of the town of Dealesville in the Tokologo Local Municipality, within the Lejweleputswa District Municipality of the Free State Province (as shown in Figure 1). The proposed project will be located on the following properties / farm portions:

- Remaining Extent of the Farm Klipfontein No. 305 (F00400000000030500000);
- The Farm Leliehoek No. 748 (F00400000000074800000);
- Remainder of the Farm Oxford No. 1030 (F00400000000103000000);
- Portion 1 of the Farm Walkerville No. 1031 (F00400000000103100001)[3]; and
- Remainder of the Farm Walkerville No. 1031 (F00400000000103100000).
- The Farm Overschot No. 31 (F00400000000003100000)

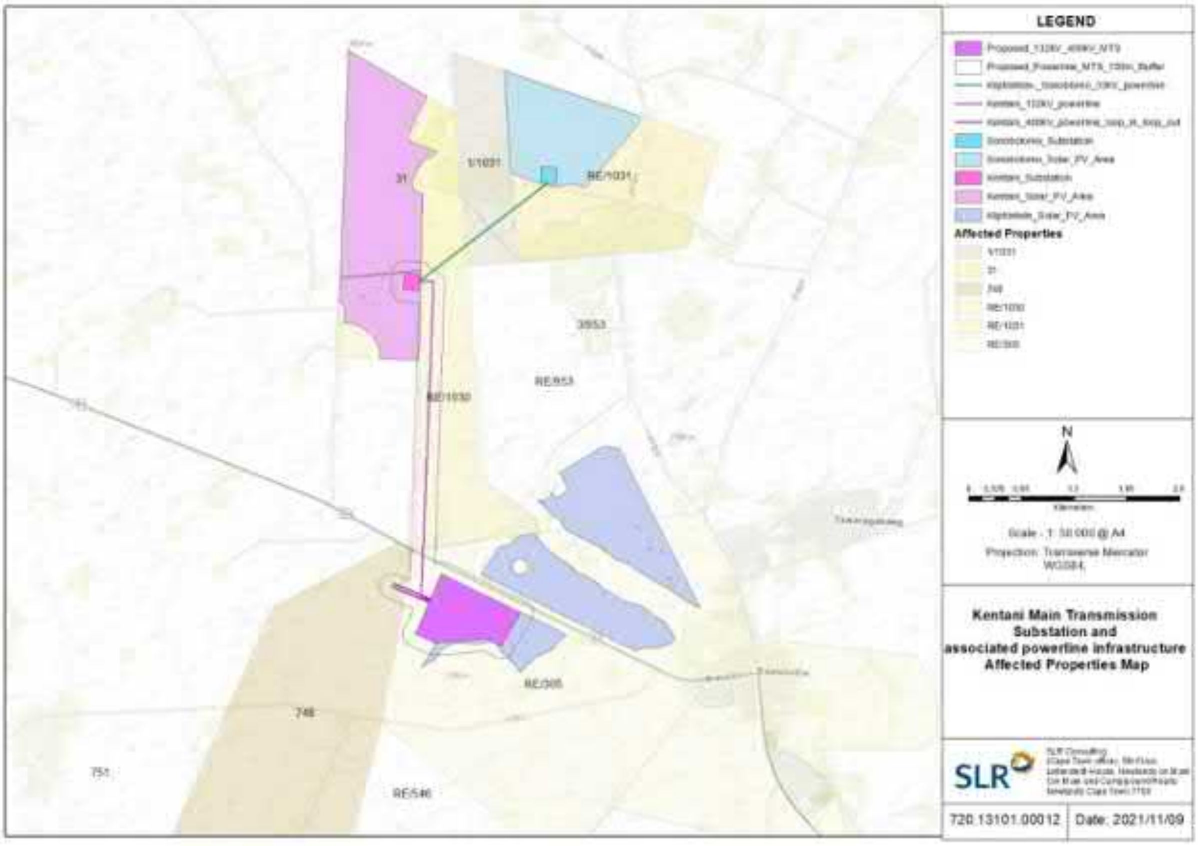

Figure 2: Affected Properties Map

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[3] Property / farm portion traversed by proposed 33kv powerline which will connect to Kentani onsite substation (14/12/16/3/3/2/724). 33kV powerline does however not require authorisation.

The proposed MTS, BESS and powerlines are located within the within the Kimberly Renewable Energy Development Zone (REDZ)[4] as well as the Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notice No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.

In addition, the proposed MTS and BESS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305. The eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] being proposed and assessed as part of this BA process (i.e., this application) fall outside of the authorised corridor.

Considering the above, it is important to note that the location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016[1].

4.2 Project components

The proposed development involves the addition of one (1) MTS, Lithium ion BESS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route
- Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have

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[4] GN R 786 of 2020: Notice of Identification in Terms of Section 24(5)(a) and (b) ff The National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance.

a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

Table 1 below represents these various project components and their specifications. The location of these components in relation to the project site is shown on **Figure 3**.

Table 1: Summary of the key project components

Project Components	Location and size / extent (i.e., Farm Names and Areas)
Location	• Remaining Extent of the Farm Klipfontein No. 305 - F00400000000030500000 • The Farm Leliehoek No. 748 - F00400000000074800000 • Remainder of the Farm Oxford No. 1030 - F00400000000103000000 • Portion 1 of the Farm Walkerville No. 1031 - F00400000000103100001[3] • Remainder of the Farm Walkerville No. 1031 - F00400000000103100000[3] • The Farm Overschot No. 31 - F00400000000003100000
Onsite Main Transmission Substation (MTS)	• One (1) new MTS with capacity of 132kV/400kV • Total footprint of up to approx. 64ha (i.e., 800m x 800m) • Will contain transformers for voltage step up from medium voltage (132kV) to high voltage (400kV) • Direct Current (DC) power from the authorised Kentani Cluster of solar PV developments (each of which received their own EA in 2016[1]) will be converted into Alternating Current (AC) power in the inverters and the voltage will be stepped up to high voltage in the inverter transformers • Will be located within authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on Remaining Extent of the Farm Klipfontein No. 305
Grid Connection (Powerlines)	• Two (2) new 400kV overhead powerlines connecting MTS to existing Eskom 400kV powerline (approx. 1km west of MTS site) via LILO connection; • One (1) new 132kV overhead powerline connecting MTS to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site); • One (1) new 33kV overhead powerline connecting authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723) (approx. 5km north of MTS site) to authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of MTS site) • Length of 400kV powerlines = approx. 2km • Length of 132kV powerline = approx. 4,5-5km • Length of 33kV powerline = approx. 2km • Area occupied by powerlines unknown at this stage • Powerline corridors with widths of 300m (150m on either side of centre line) being proposed and assessed for 400kV and 132kV powerlines to allow flexibility when routing powerlines within authorised corridor (should EA be granted) • No corridor being considered for 33kV powerline • This will allow for flexibility when routing powerline within the authorised corridor • Eight (8) 132kV powerlines within grid connection corridor authorised as part of Kentani Cluster will also be re-routed and provision will be made for this routing in new proposed MTS
Roads	• One (1) new road in servitude under proposed powerlines • One (1) new access to the R64 provincial route

	• Widths of up to approx. 4-8m
BESS	• Li-Ion Battery Energy Storage System up to 4 ha in extent within the assessed site foot print

4.3 Site Layout

The site layout for the proposed project makes provision for one (1) MTS location as well as one (1) power line corridor routing for each of the associated proposed power lines, as detailed in Table 4-1 above. Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated power lines, no site, layout or power line corridor alternatives will be assessed.

Additionally, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), while the eight (8) 132kV power lines which require re-routing are also located within the authorised corridor included as part of the authorised Kentani Cluster. The remaining two (2) 400kV and one (1) 132kV power lines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor.

The powerlines associated with the MTS which are being proposed are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;
2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

The site layout being proposed is shown in the figure below (**Figure 3**).

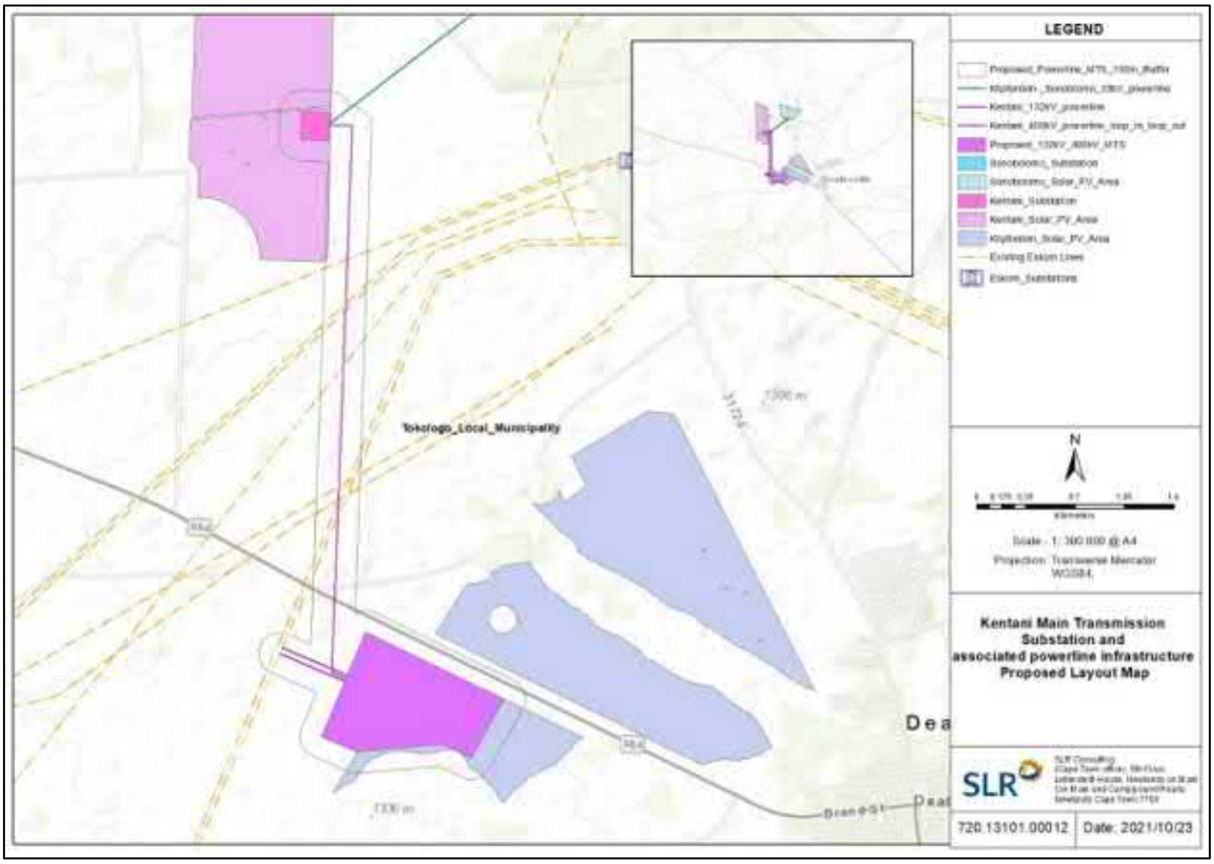

Figure 3: Proposed layout

4.4 Alternatives

As mentioned, a comprehensive design process has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines. No site, layout BESS technology alternatives or powerline corridor alternatives are therefore being considered and assessed.

With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.

The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

One (1) powerline corridor, with a width of 300m (150m on either side of centre line), for each of the 400kV and 132kV powerlines which form part of this BA process (i.e., this application) are however being proposed and assessed. This is to allow flexibility when routing the powerlines within the authorised corridor. No corridor is being considered for the proposed 33kV powerline.

It is important to note that the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722). In addition, the eight (8) 132kV powerlines which require re-routing are located within the authorised corridor included as part of the authorised Kentani Cluster. The location of the proposed MTS as well as the corridor for the eight (8) 132kV powerlines being re-routed have therefore previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments. The two (2) 400kV and one (1) 132kV powerlines being proposed as part of this BA process (i.e., this application) however fall outside of the authorised corridor. The site proposed for the MTS and respective powerline corridors will however be assessed against the ‘no-go’ alternative. The ‘no-go’ alternative is the option of not constructing the project, where the status quo of the current activities on the project site would prevail.

5 BASELINE DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Topography

The general area in the vicinity of the power line and substation assessment corridor is characterised by relatively flat to slightly undulating terrain (**Figure 4: View northwards across the study area** showing relatively flat terrain..

Figure 4: View northwards across the study area showing relatively flat terrain.

The power line and substation assessment corridors are characterised by relatively flat terrain no significant topographic features (**Figure 5** and **Figure 6**).

Maps showing the topography and slopes within and in the immediate vicinity of the combined assessment area are provided in **Figure 7** and **Figure 8** below**.**

Figure 5: View north-west across the power line assessment corridor showing gently undulating terrain.

Figure 6: View south across the proposed substation site from R64.

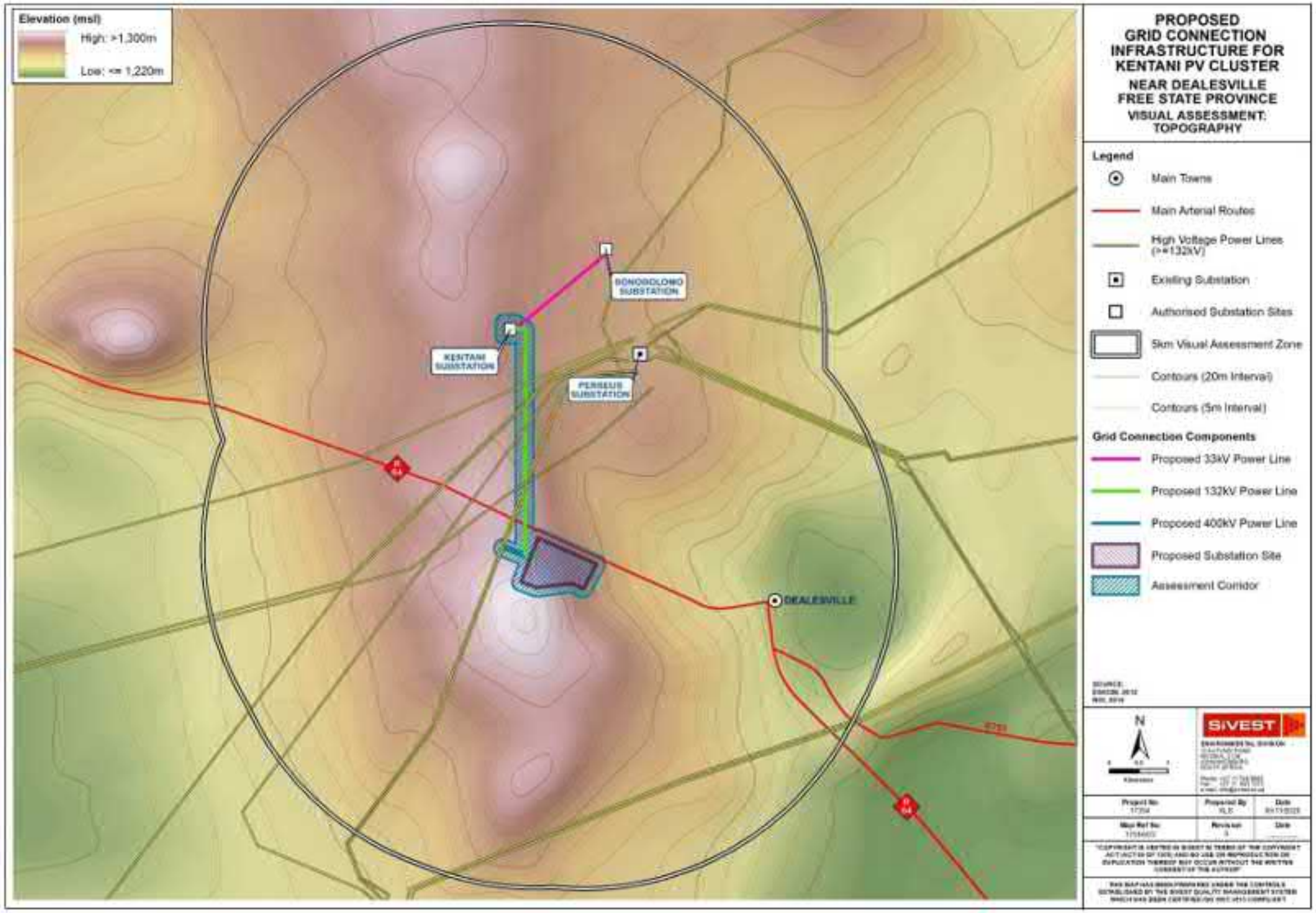

Figure 7: Topography within the study area

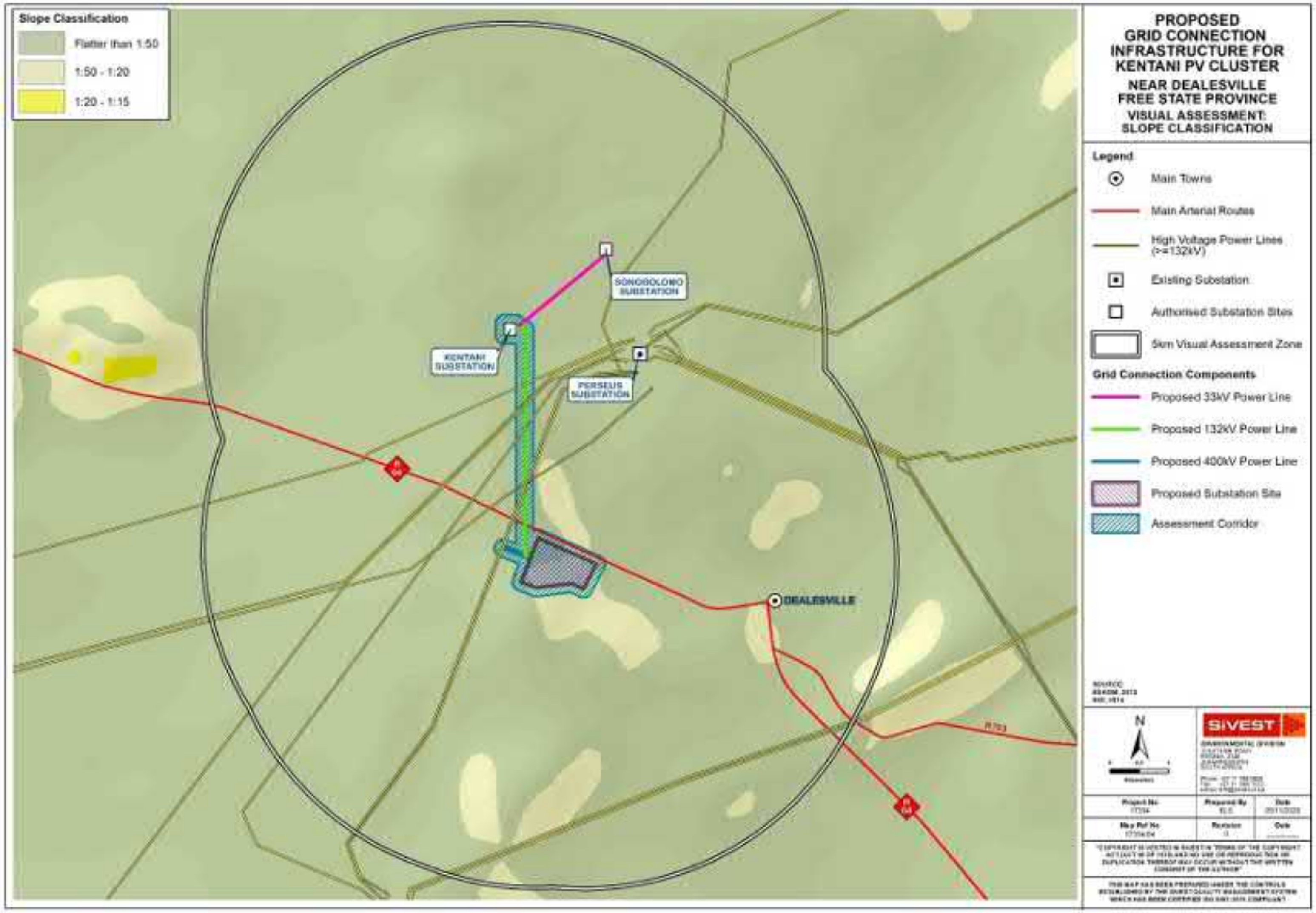

Figure 8: Slope Classification in the study area.

Visual Implications

Areas of flatter relief, including plains and slightly higher-lying plateaus are characterised by wide ranging vistas. Bearing in mind that power lines and substations are very large structures (potentially up to 22m in height), these structures could be visible from a considerable area around the site. Localised topographic variations may limit views of power line from some parts of the study area, but across the remainder of the study area there would be very little topographic shielding to lessen the visibility of the steel structures of the proposed on-site substation from many of the locally occurring receptor locations.

GIS technology was used to undertake a preliminary visibility analysis for the proposed power lines and substation based on the project information provided by Mainstream. This analysis was based on points placed at 250 m intervals along the centre line of the corridor alternatives, and the centre point of the substation site and assumes a tower height of 22 m. The resulting viewshed indicates the geographical area from where the proposed power lines and substation sites would theoretically be visible, i.e. the zone of visual influence or viewshed. This analysis is based entirely on topography (relative elevation and aspect) and does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. In addition, detailed topographic data was not available for the broader study area and as such the viewshed analysis does not take into account any localised topographic variations which may constrain views. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.

The results of this analysis, as per **Figure 9** below, show that elements of the proposed grid connection infrastructure would be highly visible from many parts of the study area, and very few areas are outside the viewshed for the proposed power lines and substation site.

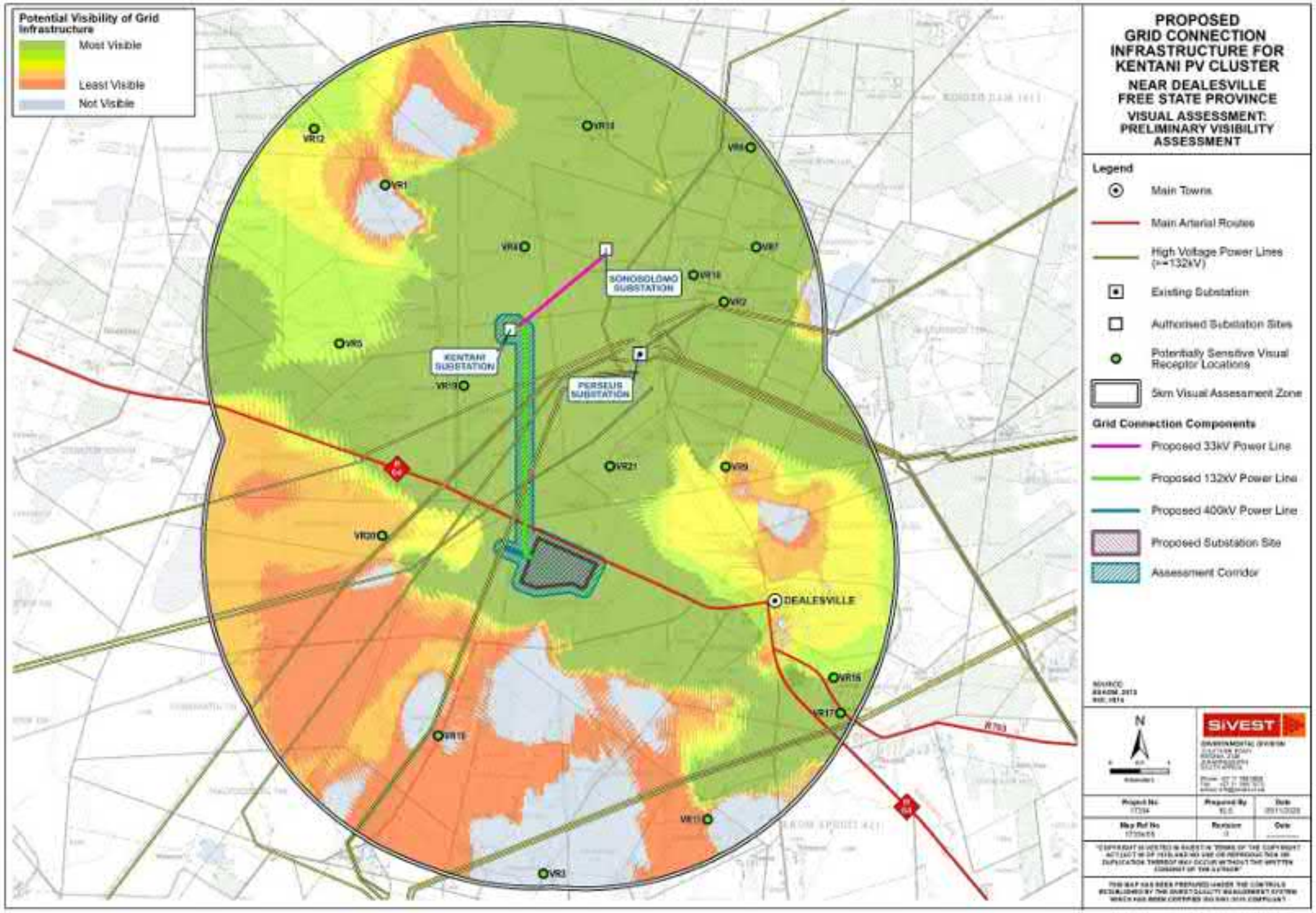

Figure 9: Potential visibility of power lines and substation.

5.2 Vegetation

According to Mucina and Rutherford (2012), much of study area is covered by the Vaal-Vet Sandy Grassland vegetation type, which tends to occur plains-dominated landscapes. This vegetation type largely comprises low tussock grassland (**Figure 10**) with an abundant karroid element. Also present in the south-eastern and south-western sectors of the study area is the Western Free State Clay Grassland vegetation type which is commonly found in flat bottomlands which support dry, species-poor grassland with embedded salt pans (Playas).

Figure 10: Grasslands typical across much of the study area.

Significant areas of the natural vegetation cover have however been partly removed or transformed by cultivation as well as the presence of tall exotic trees scattered in clusters across the study area and around farmsteads (**Figure 11** and **Figure 12**).

Vegetation classifications across the study area are shown below.

Figure 11: Example of scattered trees in the landscape.

Figure 12: Tall trees providing screening around a farm house north-east of the power line assessment corridor.

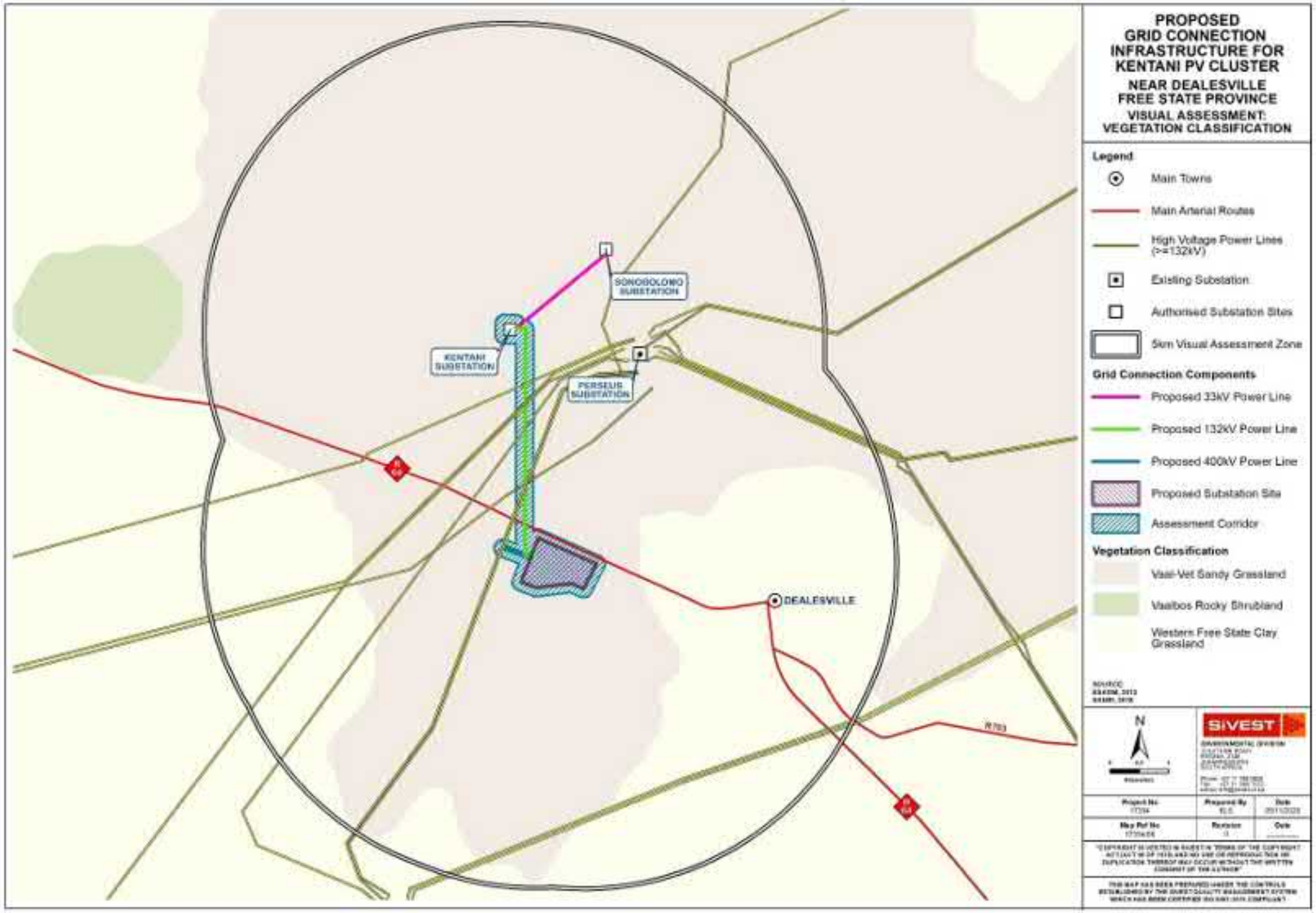

Figure 13: Vegetation Classification in the study area.

Visual Implications

The proposed development will contrast significantly with the predominant vegetative cover in the area, although scattered trees and shrubs will provide some limited degree of screening. However, tall trees planted around farmhouses in the area may restrict views from these receptor locations thus potentially reducing impacts experienced by the potentially sensitive receptors in the area.

5.3 Land Use

According to the South African National Land Cover dataset (Geoterraimage 2020), much of the visual assessment area is classified as “Grassland” interspersed with significant areas of “Cultivation”. Small tracts of forested land and numerous water bodies are scattered throughout the study area (**Figure 14**).

Commercial agriculture is the dominant activity in much of the study area, with the main focus being maize cultivation (**Figure 15**) and livestock grazing. Farm properties in much of the study area are relatively large, resulting in a low density of rural settlement characterised by scattered farmsteads. Built form associated with these areas is limited to farmsteads (**Figure 16**), including farm worker’s dwellings and ancillary farm buildings, gravel access roads, telephone and electricity lines and fences.

High levels of human influence are however visible in the eastern sector of the study area. Perseus Substation (**Figure 17**) located to the east of the assessment corridor is a prominent anthropogenic feature in the landscape. In addition, the extensive network of high voltage power lines associated with this substation and with Beta Substation to the south, forms a major visual component in the landscape (**Figure 18**).

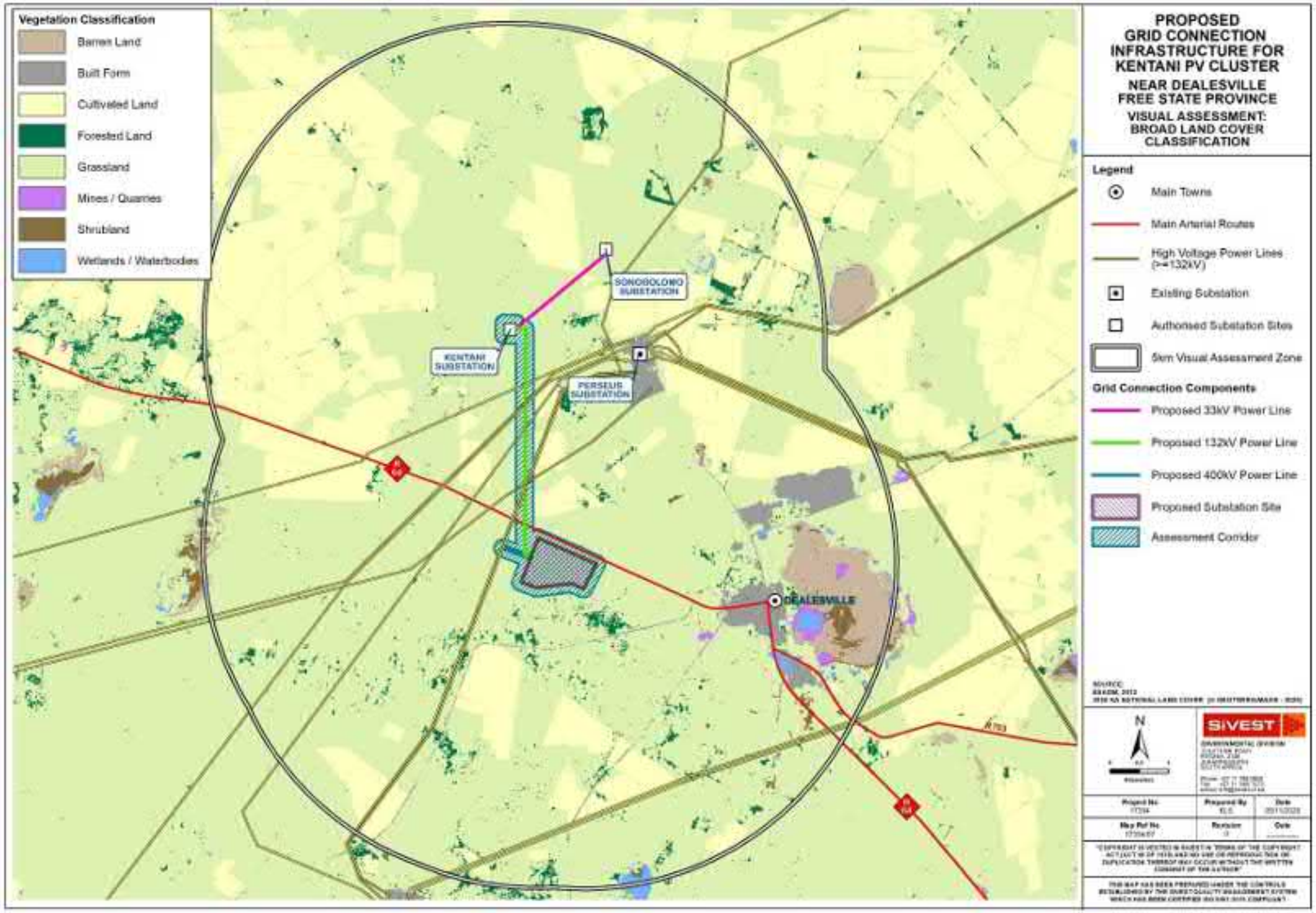

Figure 14: Land Cover Classification in the study area.

Figure 15: Cultivated land north of Perseus Substation.

Figure 16: Typical farmstead located east of the power line assessment corridor.

Figure 17: High voltage power lines feeding into Perseus Substation.

Figure 18: High voltage power lines in the vicinity of the assessment corridor.

The town of Dealesville, located in the south-eastern sector of the study area, is a small agricultural service centre that includes the town of Dealesville (**Figure 19**) with associated road and electricity / telecommunications infrastructure. To the north-east of Dealesville is the Tswaraganang Township with associated residential development and electricity infrastructure (**Figure 20**). The visual character of these urban and peri-urban areas is significantly degraded and the level of degradation has been exacerbated by the presence of a refuse dumping site located on the outskirts the town. The refuse site and the litter around the site (**Figure 21**) contribute to the overall disturbed nature of the area.

Other significant anthropogenic elements in the landscape include the R64 main road which traverses the study area in a north-west / south-east direction. (**Figure 22**).

Figure 19: Centre of Dealesville.

Figure 20: View of Tswaraganang Township to the north-east of Dealesville town centre.

Figure 21: Litter in the vicinity of the Dealesville refuse dump.

Figure 22: R64 Main road heading south-east towards Dealesville.

Visual Implications

The relatively low density of human habitation and presence of natural vegetation cover across large portions of the study area would give the viewer the general impression of a largely natural setting with some pastoral elements resulting from cultivation and livestock farming. High levels of human transformation and visual degradation become evident however in the southern sector of the study area where extensive electrical infrastructure, including Perseus Substation and associated high voltage power lines are prominent features in the landscape. In addition, the urban / peri-urban development in and around Dealesville and Tswaraganang Township have significantly altered the visual character in this sector of the study area and resulted in a general degradation of the landscape, extending into the urban periphery.

Hence, the visual impacts associated with the proposed development are expected to be relatively insignificant in these areas as they have already undergone significant transformation and degradation.

The influence of the level of human transformation on the visual character of the area is described in more detail below.

5.4 Visual Character and Cultural Value

The physical and land use-related characteristics of the study area as described above contribute to its overall visual character. Visual character largely depends on the level of change or transformation from a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural, undisturbed landscape. Visual character is also influenced by the presence of built infrastructure including buildings, roads and other objects such as telephone or electrical infrastructure. The visual character of an area largely determines the **sense of place** relevant to the area. This is the unique quality or character of a place, whether natural, rural or urban which results in a uniqueness, distinctiveness or strong identity.

As mentioned above, much of the study area is characterised by rural areas with natural unimproved vegetation. Agriculture in the form of cultivation and livestock rearing is the dominant land use, which has transformed the natural vegetation in many areas. However, significant portions of the study area have retained a natural appearance due to the presence of grasslands and as such the introduction of electrical infrastructure into this environment could be considered to be a degrading factor.

In this instance however, much of the landscape has already been transformed by the presence of Perseus Substation and the associated power line network. This infrastructure, in conjunction with the urban infrastructure of Dealesville, has resulted in an increasingly industrial landscape character and a high degree of visual degradation. The more industrial character of the landscape is an important factor in this context, as the introduction of the proposed power line would result in less visual contrast where other anthropogenic elements are already present, especially where the scale of those elements is similar to that of the proposed development.

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of ‘cultural landscape’ is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). In this instance, the rural / pastoral landscape represents how the environment has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small towns, such as Dealesville, engulfed by an otherwise rural / pastoral environment, form an integral part of the wider landscape.

In light of this, it is important to assess whether the introduction of a new power line and substation into the study area would be a degrading factor in the context of the prevailing character of the cultural landscape. Broadly speaking, visual impacts on the cultural landscape in this area would be greatly reduced by the presence of Perseus Substation and an extensive network of high voltage power lines in the area.

5.5 Visual Absorption Capacity

Visual absorption capacity is the ability of the landscape to absorb a new development without any significant change in the visual character and quality of the landscape. The level of absorption capacity is largely based on the physical characteristics of the landscape (topography and vegetation cover) and the level of transformation present in the landscape.

Although the relatively flat topography in the study area and the predominant grassland would reduce the visual absorption capacity, this would be offset to a considerable degree by the extensive electrical infrastructure already present in the landscape as well as the urban and peri-urban development in the south-east of the study area.

Visual absorption capacity in the study area is therefore rated as **high**.

5.6 Sensitive Visual Receptors

A sensitive visual receptor location is defined as a location from where receptors would potentially be impacted by a proposed development. Adverse impacts often arise where a new development is seen as an intrusion which alters the visual character of the area and affects the 'sense of place'. The degree of visual impact experienced will however vary from one receptor to another, as it is largely based on the viewer's perception.

A distinction must be made between a receptor location and a sensitive receptor location. A receptor location is a site from where the proposed development may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Less sensitive receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. More sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include tourism facilities, scenic sites and residential dwellings in natural settings.

The identification of sensitive receptors is typically based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- the presence of leisure-based (especially nature-based) tourism in an area;
- the presence of sites or routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in a largely natural setting where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the BA study.

Viewing distance is also a critical factor in the experiencing of visual impacts. As the visibility of the development would diminish exponentially over distance, receptor locations which are closer to the proposed development would experience greater adverse visual impacts than those located further away.

The degree of visual impact experienced will however vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical landscape character of the surrounding area.

5.6.1 Receptor Identification

Preliminary desktop assessment of the study area identified eighteen (18) potentially sensitive visual receptor locations within a five km radius of the power line / substation assessment corridor, most of which appear to be existing farmsteads. Although the findings of the desktop assessment were largely confirmed during the field investigation, it was not possible to confirm the presence of receptors at all the identified locations due to access restrictions. Notwithstanding this limitation, all the identified receptor locations were assessed as part of the VIA as they are still regarded as being potentially sensitive to the visual impacts associated with the proposed development.

Although the identfied receptor locations are all believed to be farmsteads, they are regarded *as potentially sensitive* visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. At this stage however, local sentiments towards the proposed development are not known. Three of these farmsteads were found to be outside the preliminary viewshed for the proposed power line and substation and none of the remaining receptors was identified as being sensitive.

Although the residences in Dealesville and Tswaraganang Township could be considered to be receptors, they are not considered to be sensitive due to their location within built-up, heavily transformed areas. As such, they are not expected to perceive the proposed development in a negative light and this would reduce the level of visual impact experienced at these locations.

In many cases, roads along which people travel are regarded as sensitive receptors. The primary thoroughfare in the study area is the R64 Main road which traverses the study area in a north-west / south-east direction, linking Bloemfontein in the east with Kimberley to the west. The section of the road traversing the study area is not considered part of a designated scenic route, although the route is an important link and is likely to be utilised, to some extent, by tourists en route to the Northern Cape. As a result, the road is considered to be a potentially sensitive receptor road – i.e. a road being used by motorists who may object to the potential visual intrusion of the proposed power line and substation development.

The R703 Main Road and other thoroughfares in the study area are primarily used as local access roads and do not form part of any scenic tourist routes. These roads are not specifically valued or utilised for their scenic or tourism potential and are therefore not regarded as visually sensitive.

No protected areas were identified within 5kms of the power line / substation assessment corridor.

The potentially sensitive visual receptor locations identified within the study area for the proposed power line and substation are indicated in **Figure 23.**

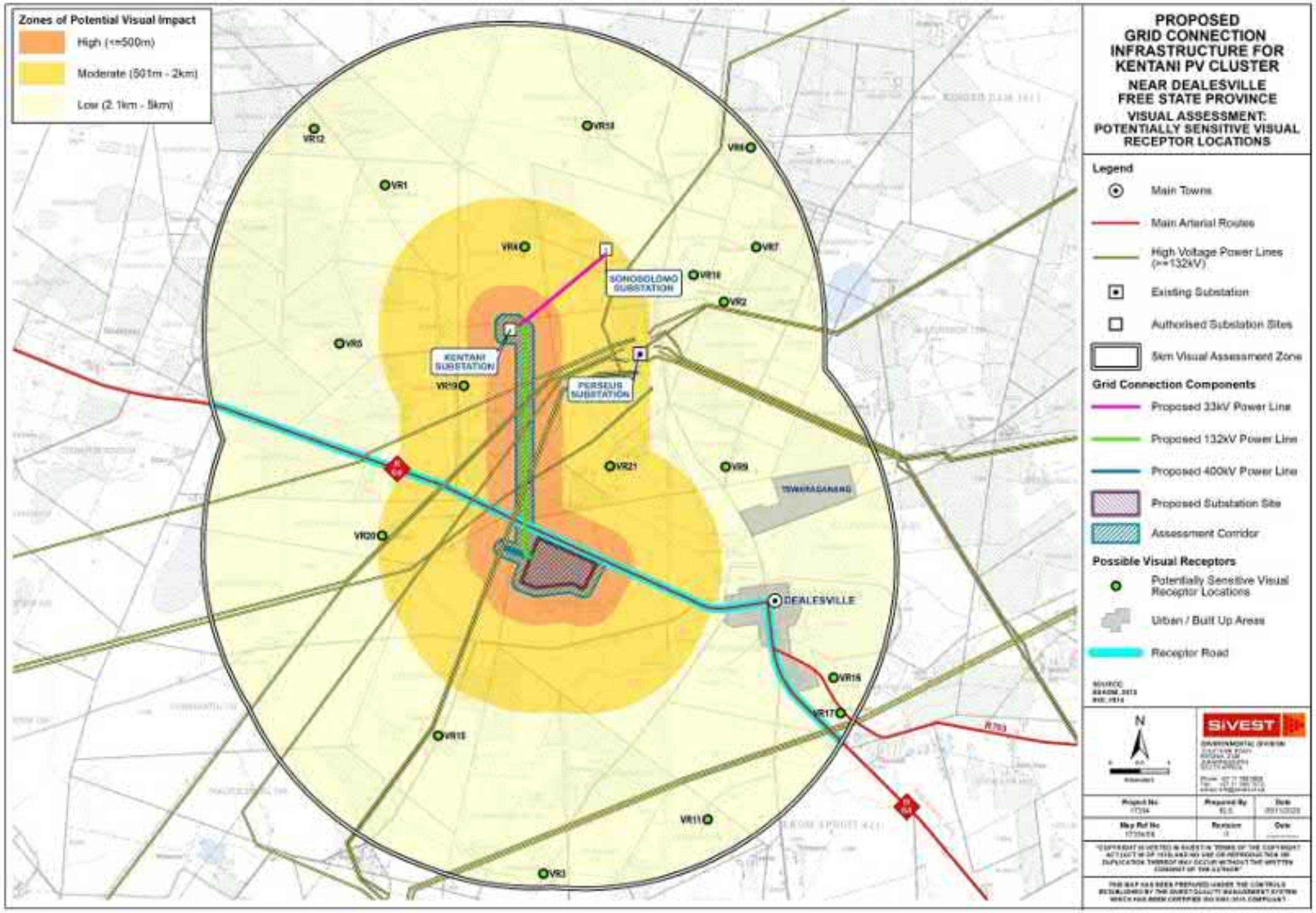

Figure 23: Potentially sensitive visual receptor locations.

5.6.2 Receptor Impact Rating

In order to assess the impact of the proposed development on the identified potentially sensitive receptor locations, a matrix that takes into account a number of factors has been developed and is applied to each receptor location.

The matrix is based on the factors listed below:

- Distance of a receptor location away from the proposed development (zones of visual impact)
- Presence of screening elements (topography, vegetation etc.)
- Visual contrast of the development with the landscape pattern and form.

These are considered to be the most important factors when assessing the visual impact of a proposed development on a potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way of assigning a likely representative visual impact, which allows a number of factors to be considered. Experiencing visual impacts is however a complex and qualitative phenomenon, and is thus difficult to quantify accurately. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

As described above, the distance of the viewer / receptor location from the development is an important factor in the context of experiencing visual impacts which will have a strong bearing on mitigating the potential visual impact. A high impact rating has been assigned to receptor locations that are located within 500m of the elements of the proposed development. The visual impact of the proposed development beyond 5km would be negligible as the development would appear to merge with the elements on the horizon. Any visual receptor locations beyond these distance limits have therefore not been assessed as they fall outside the study area and would not be visually influenced by the proposed development.

At this stage of the process, zones of visual impact for the proposed development have been delineated according to distance from the power line / substation assessment corridor. Based on the assumed height and scale of the development, the distance intervals chosen for the zones of visual impact, as shown in **Figure** 23, are as follows:

- 0 – 500m (high impact zone);
- 500m –2km (moderate impact zone);
- 2km - 5km (low impact zone).

The presence of screening elements is an equally important factor in this context. Screening elements can be vegetation, buildings and topographic features. For example, a grove of trees or a series of low hills located between a receptor location and an object could completely shield the object from the receptor.

The visual contrast of a development refers to the degree to which the development would be congruent with the surrounding environment. This is based on whether or not the development would conform to the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. Visual compatibility is an important factor to be considered when assessing the impact of the development on receptors within a specific context. A development that is incongruent with the surrounding area could change the visual character of the landscape and have a significant visual impact on sensitive receptors.

In order to determine the likely visual compatibility of the proposed development, the study area was classified into the following zones of visual contrast:

- **High –** undeveloped / natural / rural areas.
- **Moderate –**
    - areas within 500m of existing power lines (>=88kV);
    - areas within 250m of main roads;
    - cultivated areas and plantations.
- **Low –**
    - areas within 500m of urban / built-up areas;
    - areas within 500m of Perseus Substation;

These zones are depicted in **Figure 24** below.

Based on the above criteria, the receptor impact rating matrix returns a score which in turn determines the visual impact rating assigned to each receptor location (**Table 2**) below.

Table 2: Rating Scores

Rating	**Overall Score**
High Visual Impact	8-9
Moderate Visual Impact	5-7
Low Visual Impact	3-4
Negligible Visual Impact	(overriding factor)

An explanation of the matrix is provided in **Table 3** below.

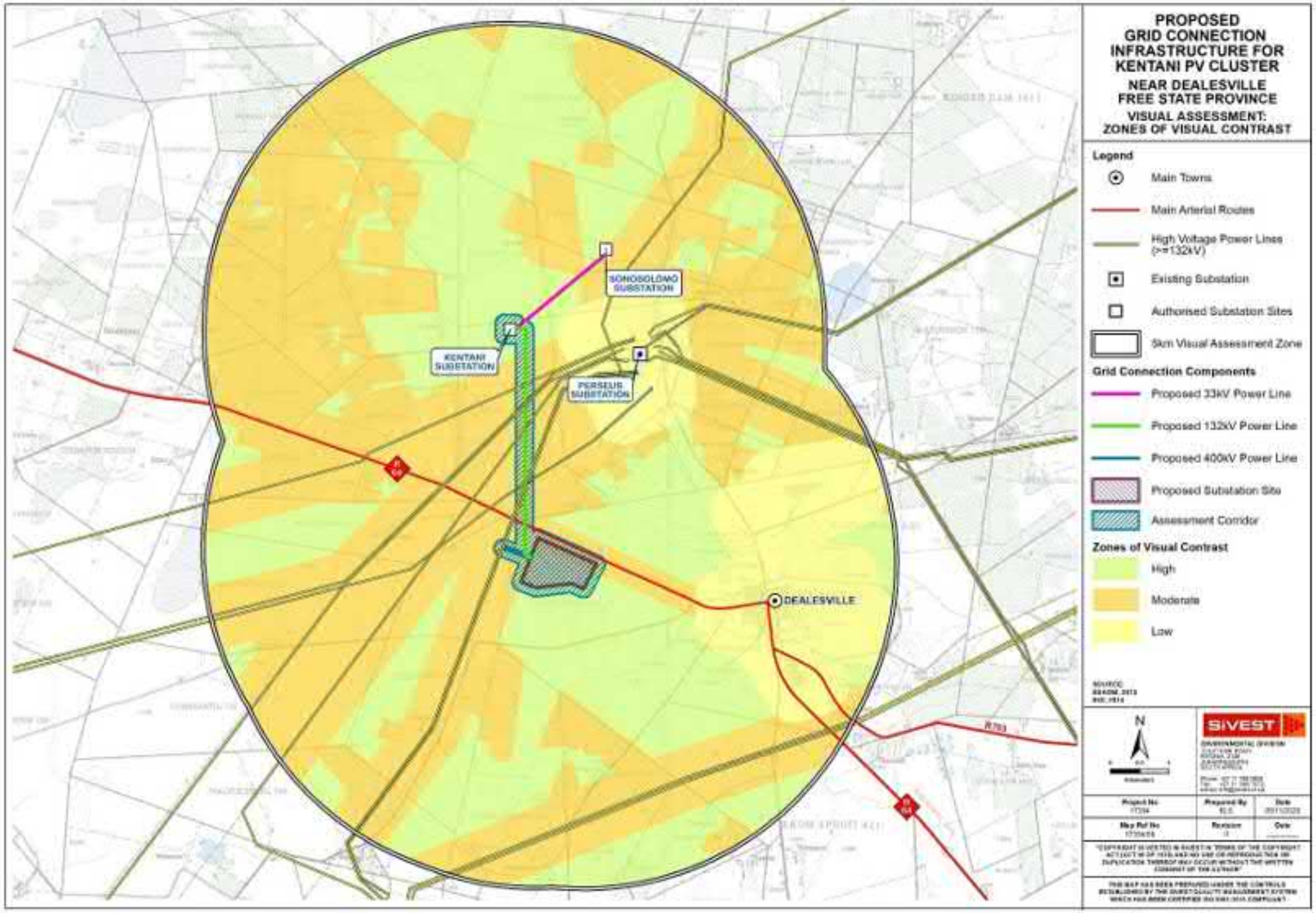

Figure 24: Zones of visual contrast.

Table 3: Visual assessment matrix used to rate the impact of the proposed development on potentially sensitive receptors

VISUAL IMPACT RATING				
VISUAL FACTOR	**HIGH**	**MODERATE**	**LOW**	**<u>OVERRIDING FACTOR</u>: NEGLIGIBLE**
Distance of receptor away from proposed development	<= 500m **Score 3**	500m - 2km **Score 2**	2km - 5km **Score 1**	>5km
Presence of screening factors	No / almost no screening factors – development highly visible **Score 3**	Screening factors partially obscure the development **Score 2**	Screening factors obscure most of the development **Score 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Visual Contrast	**High contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 3**	**Moderate contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 2**	**Corresponds** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score 1**	

Table 4 below presents a summary of the overall visual impact of the proposed 132kV power line and substation on each of the potentially sensitive visual receptor locations identified within 5kms of the proposed development.

Table 4: Receptor impact rating for the proposed power lines and substation

Receptor Location	**Distance to Corridor**			**Screening**		**Contrast**		**OVERALL IMPACT RATING**	
	KM	**Rating**		**Rating**		**Rating**		**Rating**	
*VR1 - Farmstead **	*NIL*								
VR2 - Farmstead	2.2	Low	1	Low	1	Mod	2	LOW	4
*VR3 - Farmstead **	*NIL*								
VR4 - Farmstead	0.9	Mod	2	Mod	2	Mod	2	MODERATE	6
VR5 - Farmstead	2.9	Low	1	Mod	2	Mod	2	MODERATE	5
VR6 - Farmstead	3.2	Low	1	Low	1	High	3	MODERATE	5
VR7 - Farmstead	2.6	Low	1	Low	1	High	3	MODERATE	5
VR9 - Farmstead	3.2	Low	1	Low	1	Mod	2	LOW	4
VR10 - Farmstead	1.5	Mod	2	Low	1	Mod	2	MODERATE	5
*VR11 – Farmstead**	*NIL*								
VR12 - Farmstead	4.7	Low	1	Mod	2	Mod	2	MODERATE	5
VR15 - Farmstead	2.2	Low	1	Low	1	Low	1	LOW	3
VR16 - Farmstead	5.0	Low	1	Low	1	Low	1	LOW	3
VR17 - Farmstead	5.4	Low	1	Low	1	Mod	2	LOW	4
VR18 - Farmstead	3.5	Low	1	Low	1	High	3	MODERATE	5
VR19 - Farmstead	0.9	Mod	2	High	3	Mod	2	MODERATE	7
VR20 - Farmstead	1.9	Mod	2	Mod	2	Mod	2	MODERATE	6
VR21 - Farmstead	3.5	Low	1	Mod	2	Mod	2	MODERATE	5

[*] *Receptor is outside the preliminary viewshed and as such the overall impact rating is “**NIL***

The table above shows that three of the identified receptors are outside the viewshed for the development and none of the remaining receptors is expected to experience high levels of visual impact as a result of the proposed development. Ten of the remaining receptor locations are expected to experience moderate levels of impact as a result of the power line and substation development, while five receptors will only experience low levels of visual impact.

As stated above, the R64 main road could be considered as a potentially sensitive receptor road. Elements of the power line / substation development are expected to be visible to motorists travelling along the R64, but the likely visual impacts of the proposed development on motorists would be reduced by the level of transformation and landscape degradation already visible from this route. In light of this, visual impacts affecting the R64 are rated as **low**.

5.7 Night Time Impacts

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely to have a significant impact on the nightscape. In contrast, introducing new light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed wind farm at night.

The urban areas of Dealesville and Tswaraganang Township, located approximately 3 km east of the proposed MTS site is the main source of light within the study area. These areas are expected to have a significant impact on the night scene in the eastern sector of the study area. Another prominent light source within the study area at night is the security lighting at the existing Perseus Substation which is expected to be visible from relatively far away.

Power lines and associated towers or pylons are not generally lit up at night and, thus light spill associated with the proposed electrical infrastructure project is only likely to emanate from the proposed MTS. Although the lighting required at the substation site would normally be expected to intrude on the nightscape, night time impacts of this lighting will be reduced by the existing light spill emanating from Dealesville and Tswaraganang Township as well as Perseus Substation. It should also be noted that the power line and substation will only be constructed if the proposed Kentani PV Cluster is also developed. Light sources for this facility will include operational and security lighting and thus the lighting impacts from the proposed substation would be subsumed by the glare and contrast of the lighting associated with the facility as a whole. As such, the substation alone is not expected to result in significant lighting impacts.

6 SENSITIVITY MAPPING

Visual sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer’s perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational or nature-based tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the broader area, SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be ‘key issues’ (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 5**), the visual sensitivity of the area is broken up into a number of categories, as described below:

i) **High** - The introduction of a new development such as a power line and/or substation would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors.

ii) **Moderate** – Receptors are present, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low -** The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 5: Environmental factors used to define visual sensitivity of the study area

FACTORS	DESCRIPTION	RATING									
		1	2	3	4	5	6	7	8	9	10
Pristine / natural / scenic character of the environment	Study area is largely natural with areas of scenic value and some pastoral elements.	🟨	🟨	🟨	🟨						
Presence of sensitive visual receptors	Relatively few sensitive receptors have been identified in the study area.	🟨	🟨	🟨	🟨						
Aesthetic sense of place / visual character	Visual character is typical of a rural / pastoral landscape.	🟨	🟨	🟨	🟨	🟨					
Irreplaceability / uniqueness / scarcity value	Few areas of scenic value within the study area.	🟨	🟨	🟨	🟨						
Cultural or symbolic meaning	Much of the area is typical of a rural / pastoral landscape.	🟨	🟨	🟨	🟨	🟨					
Protected / conservation areas in the study area	No protected or conservation areas were identified in the study area.	🟨	🟨	🟨							
Sites of special interest present in the study area	No sites of special interest were identified in the study area.	🟨									
Economic dependency on scenic quality	No tourism/leisure based facilities in the area	🟨									
International / regional / local status of the environment	-	🟨									
**Scenic quality under threat / at risk of change	Introduction of a power line and MTS infrastructure will alter the visual character and sense of place, increasing the level of transformation in the area and giving rise to significant cumulative impacts	🟨	🟨	🟨	🟨	🟨					

***Any rating above ‘5’ for this specific aspect will trigger the need to undertake an assessment of cumulative visual impacts.*

Low			**Moderate**				**High**		
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**

Based on the above factors, the total score for the study area is 33, which according to the scale above, would result in the area being rated as having a **low** level of visual sensitivity. It should be stressed however that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of whether the landscape is likely to be sensitive to visual impacts, and is based on the physical characteristics of the study area, economic activities and land use that predominates. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs and this has been factored into the sensitivity rating above.

As part of the visual sensitivity assessment, a screening exercise was undertaken with the aim of indicating any areas that should be precluded from the proposed development footprint. From a visual perspective, these are areas where the establishment of power lines and/or substation infrastructure would result in the greatest probability of visual impacts on sensitive or potentially sensitive visual receptors.

Using GIS-based visibility analysis, it was possible to determine which sectors of the assessment corridors would be visible to the highest numbers of receptors in the study area. However, this analysis found that no areas on the substation site or along the proposed route alignment are *significantly* more visible than any other area. As such, in terms of visibility, no areas were found to be particularly sensitive.

In determining visual sensitivity, consideration must also be given to the direct visual impact of the proposed development on any nearby farmsteads or receptors. However, investigation determined that there are no farmsteads or potentially sensitive receptors within 500 m of any elements of the power line or MTS development. As such, no areas of visual sensitivity were identified in relation to any of the power line alignments or the substation site.

6.1 Sensitivities identified by the National Screening Tool

In assessing visual sensitivity, the proposed development was examined in relation to the Landscape Theme of the National Environmental Screening Tool to determine the relative landscape sensitivity for this type of development. The tool does not however identify any landscape sensitivities in this respect.

7 SPECIALIST FINDINGS ASSESSMENT OF IMPACTS

This VIA has identified the potential issues / impacts that could result from the proposed development of a substation, power lines and access roads as proposed. It should be noted however that the visual impacts of the proposed access roads are generally not regarded as a significant factor when compared to the visual impact associated with the power lines and MTS. A summary of these issues / impacts is presented below.

Construction Phase

- Potential visual intrusion resulting from large construction vehicles and equipment;
- Potential visual effect of construction activities;
- Potential visual effect of material stockpiles;
- Potential impacts of increased dust emissions from construction activities and related traffic;

- Potential visual scarring of the landscape as a result of surface disturbance during construction; and
- Potential visual pollution resulting from littering on the construction site.

Operational Phase

- Potential alteration of the visual character of the area;
- Potential visual intrusion resulting from power line and substation infrastructure dominating the skyline in a largely natural / rural area;
- Potential impacts of increased dust emissions from maintenance activities and related traffic;
- Potential visual effect on surrounding farmsteads; and
- Potential alteration of the night time visual environment as a result of operational and security lighting at the proposed substation.

Decommissioning Phase

- Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;
- Potential impacts of increased dust emissions from decommissioning activities and related traffic; and
- Potential visual intrusion of any remaining infrastructure on the site.

Cumulative Impacts

- Combined visual impacts from proposed renewable energy developments and existing electrical infrastructure in the broader area could further alter the sense of place and visual character of the area;
- Additional electrical infrastructure in the area would increase the visual clutter in the area; and
- Combined visual impacts from proposed renewable energy developments and existing electrical infrastructure in the broader area could potentially exacerbate visual impacts on visual receptors.

7.1 Impact assessment

The EIA Regulations, 2014 (as amended) require that an overall rating for visual impact be provided to allow the visual impact to be assessed alongside other environmental parameters. The impact matrices for visual impacts associated with the proposed construction, operation and decommissioning of the proposed power lines and substation are presented below together with recommended mitigation measures. The mitigation measures have been determined based on best practice and literature reviews.

Please refer to **Appendix B (Terms of Reference)** for an explanation of the impact rating methodology.

7.1.1 Impacts during Construction Phase

Table 6: Rating of Impacts of Proposed Power Line, MTS, BESS and Access Roads During Construction

Issue: ▪ Potential alteration of the visual character and sense of place ▪ Potential visual impact on receptors in the study area
Description of Impact
▪ Large construction vehicles, equipment and construction material stockpiles will alter the natural character of the study area and expose visual receptors to impacts associated with construction. ▪ Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. ▪ Dust emissions and dust plumes from increased traffic on gravel roads serving the construction site may evoke negative sentiments from surrounding viewers.

▪ Surface disturbance during construction would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment. ▪ Vegetation clearance required for the construction of the proposed substation is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact. ▪ Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Construction**	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are completely reversible with cessation of construction activity.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
The following measures are recommended:	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Unless there are water shortages, ensure that dust suppression techniques are implemented: o on all access roads; o in all areas where vegetation clearing has taken place; o on all soil stockpiles.	
The following monitoring is recommended:	▪ Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the siting and management of soil stockpiles, screening and dust suppression. ▪ Regular reporting to an environmental management team must also take place during the construction phase.	
Nature of cumulative impacts	▪ Combined visual impacts from construction activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could further alter the sense of place and visual character of the area; and ▪ Combined visual impacts from construction activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could potentially exacerbate visual impacts on visual receptors.	

	Without Mitigation	With Mitigation
Rating of cumulative impacts	Medium -	Low -

7.1.2 Impacts during Operation Phase

Table 7: Rating of Impacts of Proposed Power Line, MTS, BESS and Access Roads During Operation

Issue: ▪ Potential alteration of the visual character and sense of place ▪ Potential visual impact on receptors in the study area.		
Description of Impact		
▪ Potential alteration of the visual character of the area; ▪ Potential visual intrusion resulting from power line and substation infrastructure dominating the skyline in a largely natural / rural area; ▪ Potential impacts of increased dust emissions from maintenance activities and related traffic; ▪ Potential visual effect on surrounding farmsteads; and ▪ Potential alteration of the night time visual environment as a result of operational and security lighting at the proposed substation.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Operation**	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are partly reversible with decommissioning of infrastructure.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is limited scope for mitigation as per the recommended mitigation measures below.	
The following measures are recommended:	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Buildings on the substation site should be painted with natural tones that fit with the surrounding environment. ▪ Non-reflective surfaces should be utilised where possible.	
The following monitoring is recommended:	▪ Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the control of signage, lighting and maintenance vehicles on access roads..	

Nature of cumulative impacts	▪ Additional renewable energy and associated infrastructure developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. ▪ Visual intrusion of multiple renewable energy and infrastructure developments may be exacerbated, particularly in more natural undisturbed settings. ▪ Additional renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. ▪ The night time visual environment could be altered as a result of operational and security lighting at multiple renewable energy facilities in the broader area.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

7.1.3 Impacts during Decommissioning Phase

Table 8: Rating of Impacts of Proposed Power Line, MTS, BESS and Access Roads During Decommissioning

Issue: ▪ Potential alteration of the visual character and sense of place ▪ Potential visual impact on receptors in the study area		
Description of Impact		
▪ Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts. ▪ Decommissioning activities may be perceived as an unwelcome visual intrusion. ▪ Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers. ▪ Surface disturbance during decommissioning would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment. ▪ Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.		
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Phases	**Decommissioning**	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Impacts are completely reversible with cessation of decommissioning activity.	
Degree to which impact may cause irreplaceable loss of resources	Marginal loss of visual resources without mitigation measures.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	

The following measures are recommended:	▪ All infrastructure that is not required post-decommissioning should be removed. ▪ Carefully plan to minimize the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required.	
The following monitoring is recommended:	▪ Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials. ▪ In addition, it must be ensured that rehabilitation of the site to a visually acceptable standard is undertaken.	
Nature of cumulative impacts	▪ Combined visual impacts from decommissioning activities associated with multiple renewable energy and grid connection infrastructure projects in the broader area could further alter the sense of place and visual character of the area; and ▪ Combined visual impacts from decommissioning activities associated with the development of multiple renewable energy and grid connection infrastructure projects in the broader area could potentially exacerbate visual impacts on visual receptors.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.2 Alternatives

As mentioned in **Section 4.4**, no site, layout, technology[5] or power line corridor alternatives are being considered and assessed as part of the BA process. A power line corridor with a width of 300m (150m on either side of centre line) is however being proposed and assessed for each of the 400kV and 132kV power lines which form part of the BA process. This is to allow flexibility when routing the power lines within the authorised corridor. No corridor is being considered for the proposed 33kV power line.

The site proposed for the MTS and respective power line corridors will however be assessed against the '**no-go' alternative**. The 'no-go' alternative is the option of not constructing the project, where the *status quo* of the current farming activities on the site would prevail. In the event that the proposed power lines, MTS and associated infrastructure are not developed, the area would retain its visual character and sense of place and no visual impacts would be experienced by any locally occurring receptors.

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[5] With regards to the BESS, three (3) technology types were however considered for the proposed BESS, namely Lithium Ion (Li-Ion), Vanadium Redox Flow and Zinc-hybrid (Zinc-Bromine - ZNBR) Flow.
The Solid-State Li-ion battery technology was chosen as the preferred technology for the BESS, based on the risk assessment undertaken by Mainstream in the design phase of the project. A concise Risk Assessment of both technologies (Solid State and Flow Batteries) over three (3) battery types (Lithium-Ion, Vanadium Redox Flow and Zinc Hybrid Flow) is included in Appendix 9 of the BAR.

7.3 Cumulative Impacts

In relation to an activity, cumulative impact means "*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (NEMA EIA Reg GN R982 of 2014).

The South African Renewable Energy EIA Application Database (REEA) (namely "REEA_OR_2021_Q2") and other information available at the time[6] shows that there are no operational renewable energy developments situated within a 30km radius of the proposed project site. There are however several renewable energy projects (solar) authorised or being proposed within close proximity to the town of Dealesville, including the Kentani Cluster which consists of eleven (11) authorised solar PV projects and associated electrical infrastructure. According to the information available at the time[6], the following renewable energy applications for EA are either approved (i.e., EA issued) or being proposed within a 30km radius of the proposed project site:

- 100 MW Kentani PV - 14/12/16/3/3/2/724
- 100 MW Klipfontein PV - 14/12/16/3/3/2/722
- 100 MW Braklaagte PV - 14/12/16/3/3/2/727
- 100 MW Meeding PV - 14/12/16/3/3/2/719
- 100 MW Irene PV - 14/12/16/3/3/2/718
- 100 MW Leliehoek PV - 14/12/16/3/3/2/728
- 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
- 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
- 75 MW Braambosch PV - 14/12/16/3/3/2/725
- 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
- 75 MW Eksteen PV - 14/12/16/3/3/2/717
- 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
- Klipbult solar plant - 14/12/16/3/3/2/432
- 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
- 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
- 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
- 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853
- 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
- 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
- 100 MW Visserpan solar photovoltaic facility project 2 - 14/12/16/3/3/1/2154
- 100 MW Visserpan solar photovoltaic facility project 3 - 14/12/16/3/3/1/2155
- 100 MW Visserpan solar photovoltaic facility project 4 - 14/12/16/3/3/1/2156

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[6] Information has been based on the latest available version of the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2021_Q2"), the results of the respective online screening tool reports (https://screening.environment.gov.za/screeningtool/#/pages/welcome) and information available on the public domain at the time.

In addition, the Jedwater Solar Power Facility (12/12/20/1972/2) and Letsatsi solar power farm (12/12/20/1972/1) are situated just outside of the project site's 30km radius, to the south-east of the project site.

The cumulative impact assessed will therefore be the collective impact of the proposed MTS, BESS and power line application, along with the above-mentioned renewable energy applications for EA which are either approved or being proposed within a 30km radius of the proposed project site.

The relatively large number of renewable energy facilities and associated grid connection infrastructure, in conjunction the extensive electrical infrastructure already present within the surrounding area and their potential for large-scale visual impacts could significantly alter the sense of place and visual character in the broader region, as well as exacerbate the visual impacts on surrounding visual receptors, once constructed. From a visual perspective, the concentration of renewable energy facilities as proposed will further change the visual character of the area and alter the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In addition, it is possible that these developments in close proximity to each other could be seen as one large Renewable Energy Facility (REF) rather than several separate developments. Although this will not necessarily reduce impacts on the visual character of the area, it could potentially reduce the cumulative impacts on the landscape.

An examination of the literature available for the environmental assessments undertaken for many of these renewable energy applications showed that the visual impacts identified and the recommendations and mitigation measures provided are largely consistent with those identified in this report.

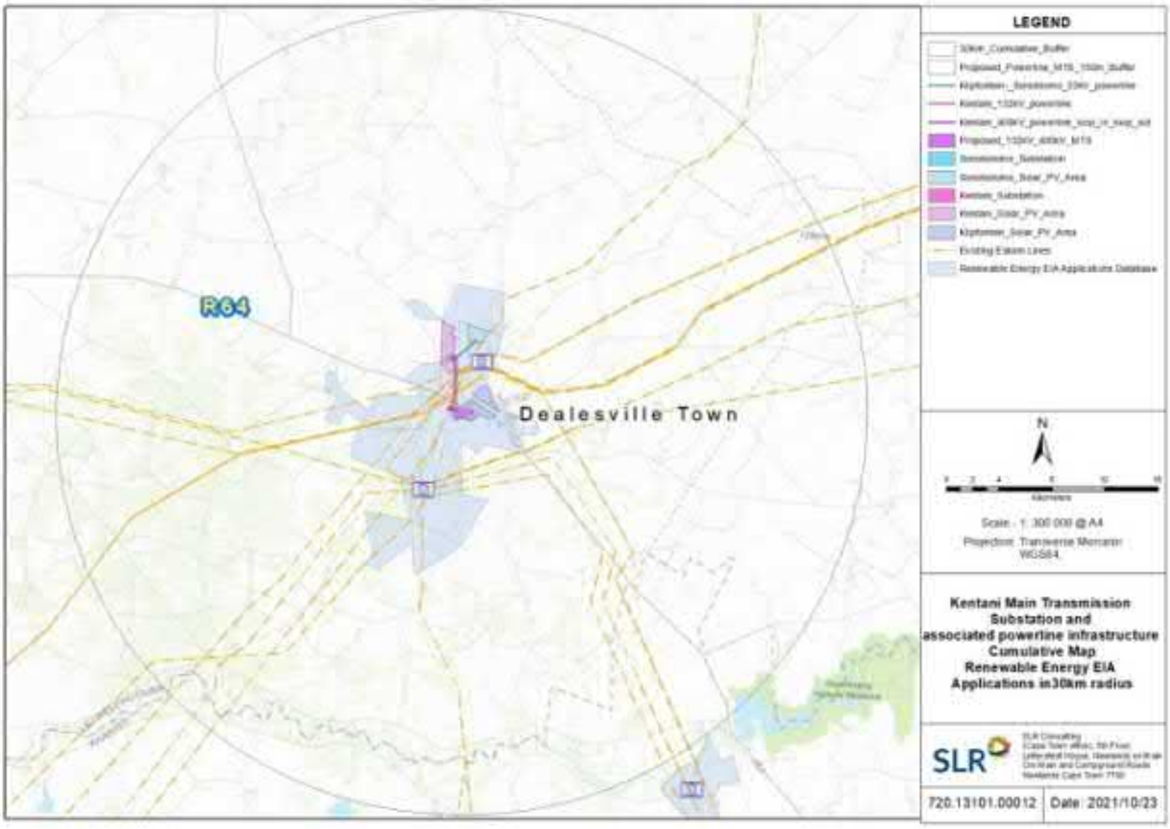

Figure 25: Cumulative Map indicating REFs within the 30km buffer of the proposed MTS and Powerlines (including Powerline Corridors)

8 MITIGATION AND EMPR REQUIREMENTS

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. CONSTRUCTION PHASE					
B.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed power line and substation.	Avoid or minimize construction impacts on existing visual resources and potentially sensitive receptor locations in the surrounding area. .	▪ Carefully plan to mimimise the construction period and avoid construction delays. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the construction site, where possible. ▪ Ensure that dust suppression techniques are implemented: o on all access roads; o in all areas where vegetation clearing has taken place; o on all soil stockpiles.	Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the siting and management of soil stockpiles, screening and dust suppression. Regular reporting to an environmental management team must also take place during the construction phase.	Ongoing during construction	▪ Main Contractor (MC), Environ-mental Officer (EO) and ECO
B. OPERATION PHASE					

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
C.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed grid connection infrastructure.	Avoid or minimize operational impacts on existing visual resources and potentially sensitive receptor locations in the surrounding area.	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation.. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Buildings on the SS sites should be painted with natural tones that fit with the surrounding environment. ▪ Non-reflective surfaces should be utilised where possible.	Ensure that visual mitigation measures are monitored by the management team on an on-going basis. This will include monitoring activities associated with visual impacts such as the control of signage, lighting and maintenance vehicles on access roads.	Ongoing during operation	▪ ESKOM
C. DECOMISSIONING PHASE					
D.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed grid connection infrastructure.	Avoid or minimize impacts of decommissioning activities on existing visual resources and potentially sensitive receptor locations in the surrounding area.	▪ All infrastructure that is not required post-decommissioning should be removed. ▪ Carefully plan to reduce the decommissioning period and avoid delays. ▪ Maintain a neat decommissioning site by removing rubble and waste materials regularly. ▪ Position storage / stockpile areas in unobtrusive positions	Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials. In addition, it must be ensured that rehabilitation of the site to a visually acceptable standard is undertaken.	During decommissioning	▪ MC, EO and ECO

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		in the landscape, where possible. ▪ Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. ▪ All cleared areas should be rehabilitated as soon as possible. ▪ Rehabilitated areas must be monitored post-decommissioning and remedial actions implemented as required.			

9 CONCLUSION AND SUMMARY

9.1 Summary of Findings

A VIA has been conducted to assess the magnitude and significance of the potential visual impacts associated with the construction of the proposed Main Transmission Substation (MTS), BESS and associated 400 kV, 132 kV and 33kV overhead power lines and access roads. The VIA has demonstrated that the study area has a somewhat mixed visual character, transitioning from the heavily transformed landscape associated with Perseus Substation and the town of Dealesville in the east to a more rural / pastoral character across the remainder of the study area.. Hence, although the proposed development would alter the visual character and contrast with this rural / pastoral character, the location of the proposed development in relatively close proximity to Perseus Substation and its extensive network of high voltage power lines, will reduce the level of contrast.

A broad-scale assessment of visual sensitivity, based on the physical characteristics of the study area, economic activities and land use that predominates, determined that the area would have a **low** visual sensitivity. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. The area is not however typically valued for its tourism significance and no leisure-based tourism facilities or formal protected areas were identified within 5 kms of the proposed development. This factor in conjunction with the high levels of transformation in the east have reduced the overall visual sensitivity of the area.

A total of eighteen (18) potentially sensitive receptors were identified in the study area, none of which was found to be sensitive. All of the identified receptors are believed to be farmsteads that are regarded as *potentially* sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. Three of the receptor locations are outside the viewshed for the proposed power lines and substation site and none of the remaining receptors are expected to experience high levels of visual impact as a result of the proposed development. Ten of the remaining receptor locations are expected to experience moderate levels of impact as a result of the power line and substation development, while five receptors will only experience low levels of visual impact.

Although the R64 receptor road traverses the study area, motorists travelling along this route are only expected to experience low levels of impact from the proposed development due to the degree of landscape degradation already present.

An assessment of overall impacts revealed that visual impacts associated with the proposed power lines, BESS and MTS are of low significance during construction, operation and decommissioning phases, with a number of mitigation measures available.

Considering the presence of extensive electrical infrastructure and multiple planned renewable energy projects, the introduction of additional electrical infrastructure in the area will result in further change in the visual character of the area and alteration of the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In light of this, cumulative impacts (with mitigation) have been rated as low during construction and decommissioning and medium during operation.

From a visual perspective, no fatal flaws were identified in respect of the proposed development.

9.2 Conclusion and Impact Statement

It is SiVEST’s opinion that the potential visual impacts associated with the proposed Main Transmission Substation (MTS), Battery Energy Storage System and associated 400 kV, 132 kV and 33kV overhead power lines and access roads are negative and of moderate significance. Given the relatively low number of potentially sensitive receptors and the significant level of human transformation and landscape degradation in areas near the proposed development, the project is deemed acceptable from a visual perspective and the EA should be granted. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

10 REFERENCES

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Appendix A

SPECIALIST CV AND DECLARATION

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

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	SiVEST SA (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	110
Specialist name:	Kerry Schwartz			
Specialist Qualifications:	BA			
Professional affiliation/registration:	SAGC (GISc Technician)			
Physical address:	12 Autumn St, Rivonia			
Postal address:	PO Box 2921, Rivonia			
Postal code:	2128	Cell:	082 469 5850	
Telephone:	011 798 0632	Fax:	011 8037272	
E-mail:	kerrys@sivest.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Kerry Schwartz**, 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.

K Schwartz

Signature of the Specialist

SiVEST SA (PTY) Ltd

Name of Company:

08 November 202

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Kerry Schwartz**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

KSchwartz

Signature of the Specialist

SiVEST SA (Pty) Ltd

Name of Company

08 November 2021

Date

Signature of the Commissioner of Oaths

08 November 2021

Date

Hlengiwe Innocentia Ntuli
COMMISSIONER OF OATHS
Signature:
PPP Administrator
RO-02/11/2020 ZA-GT-10/11/2020
Date 08/11/2021 Place Rivonia
Business Address: 12 Autumn Street, Rivonia 2128

CURRICULUM VITAE

Name	Kerry Lianne Schwartz
Profession	GIS Specialist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior GIS Consultant: Environmental Division
Years with Firm	32 Years
Date of Birth	21 October 1960
ID No.	6010210231083
Nationality	South African

Professional Qualifications

BA (Geography), University of Leeds 1982

Membership to Professional Societies

South African Geomatics Council – GTc GISc 1187

Employment Record

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1994 – Present	SiVEST SA (Pty) Ltd - Environmental Division: GIS/Database Specialist.
1988 - 1994	SiVEST (formerly Scott Wilson Kirkpatrick): Town Planning Technician.
1984 – 1988	Development and Services Board, Pietermaritzburg: Town Planning Technician.

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent

Key Experience

Kerry is a GIS specialist with more than 25 years' experience in the application of GIS technology in various environmental, regional planning and infrastructural projects undertaken by SiVEST.

Kerry's GIS skills have been extensively utilised in projects throughout South Africa in other Southern African Countries. These projects have involved a range of GIS work, including:

- Design, compilation and management of a spatial databases in support of projects.
- Collection, collation and integration of data from a variety of sources for use on specific projects.
- Manipulation and interpretation of both spatial and alphanumeric data to provide meaningful inputs for a variety of projects.
- Production of thematic maps and graphics.
- Spatial analysis and 3D modelling.

Kerry further specialises in visual impact assessments (VIAs) and landscape assessments for various projects, including renewable energy facilities, power lines and mixed use developments.

Projects Experience

STRATEGIC PLANNING PROJECTS

Provision of database, analysis and GIS mapping support for the following:

- Database development for socio-economic and health indicators arising from Social Impact Assessments conducted for the Lesotho Highlands Development Association – Lesotho.
- Development Plans for the adjacent towns of Kasane and Kazungula and for the rural village of Hukuntsi in Botswana.
- Integrated Development Plans for various District and Local Municipalities in KwaZulu-Natal Province.
- Rural Development Initiative and Rural Roads Identification for uMhlathuze Local Municipality (KwaZulu-Natal).
- Tourism Initiatives and Master Plans for areas such as the Mapungubwe Cultural Landscape (Limpopo Province) and the Northern Cape Province.
- Spatial Development Frameworks for various Local and District Municipalities in KwaZulu-Natal and Mpumalanga and Free State Provinces.
- Land Use Management Plans/Systems (LUMS) for various Local Municipalities in KwaZulu-Natal.
- Land use study for the Johannesburg Inner City Summit and Charter.
- Port of Richards Bay Due Diligence Investigation.

BUILT INFRASTRUCTURE

- EIA and EMP for a 9km railway line and water pipeline for manganese mine – Kalagadi Manganese (Northern Cape Province).
- EIA and EMP for 5x 440kV Transmission Lines between Thyspunt (proposed nuclear power station site) and several substations in the Port Elizabeth area – Eskom (Eastern Cape Province).
- Initial Scoping for the proposed 750km multi petroleum products pipeline from Durban to Gauteng/Mpumalanga – Transnet Pipelines.
- Detailed EIA for multi petroleum products pipeline from Kendall Waltloo, and from Jameson Park to Langlaagte Tanks farms –Transnet Pipelines.
- Environmental Management Plan for copper and cobalt mine (Democratic Republic of Congo).
- EIA and Agricultural Feasibility study for Miwani Sugar Mill (Kenya).
- EIAs for Concentrated Solar and Photovoltaic power plants and associated infrastructure (Northern Cape, Free State, Limpopo and North West Province).
- EIAs for Wind Farms and associated infrastructure (Northern Cape and Western Cape).
- Basic Assessments for 132kV Distribution Lines (Free State, KwaZulu-Natal, Mpumalanga and North West Province).
- Environmental Assessment for the proposed Moloto Development Corridor (Limpopo).
- Environmental Advisory Services for the Gauteng Rapid Rail Extensions Feasibility Project.
- Environmental Screening for the Strategic Logistics and Industrial Corridor Plan for Strategic Infrastructure Project 2, Durban-Free State-Gauteng Development Region.

STATE OF THE ENVIRONMENT REPORTING

- 2008 State of the Environment Report for City of Johannesburg.
- Biodiversity Assessment – City of Johannesburg.

STRATEGIC ENVIRONMENTAL ASSESSMENTS AND ENVIRONMENTAL MANAGEMENT FRAMEWORKS

- SEA for Greater Clarens – Maloti-Drakensberg Transfrontier Park (Free State).
- SEA for the Marula Region of the Kruger National Park, SANParks.
- SEA for Thanda Private Game Reserve (KwaZulu-Natal).
- SEA for KwaDukuza Local Municipality (KwaZulu-Natal).
- EMF for proposed Renishaw Estate (KwaZulu-Natal).
- EMF for Mogale City Local Municipality, Mogale City Local Municipality (Gauteng).
- SEA for Molemole Local Municipality, Capricorn District Municipality (Limpopo).
- SEA for Blouberg Local Municipality, Capricorn District Municipality (Limpopo).
- SEA for the Bishopstowe study area in the Msunduzi Local Municipality (KwaZulu-Natal).

VISUAL IMPACT ASSESSMENTS

- VIAs for various Solar Power Plants and associated grid connection infrastructure (Northern Cape, Free State, Limpopo and North West Province) the most recent project being:
    - Mooi Plaats, Wonderheuvel and Paarde Valley Solar PV facilities near Nouport (Northern Cape).
    - Oya Energy Facility, near Touws River (Western Cape).
- VIAs for various Wind Farms and associated grid connection infrastructure (Northern Cape and Western Cape), the most recent projects including:
    - Paulputs WEF near Pofadder (Northern Cape)
    - Kudusberg WEF near Matjiesfontein (Western Cape);
    - Tooverberg WEF, near Touws River (Western Cape);
    - Rondekop WEF, near Sutherland (Northern Cape).
    - Gromis and Komas WEFs, near Kleinzee (Northerrn Cape).
- VIAs for various 132kV Distribution Lines (Free State, KwaZulu-Natal, Mpumalanga and North West Province).
- VIA for the proposed Rorqual Estate Development near Park Rynie on the South-Coast of KwaZulu-Natal Province.
- VIAs for the proposed Assagay Valley and Kassier Road North Mixed Use Development (KwaZulu-Natal).
- VIA for the proposed Tinley Manor South Banks Development (KwaZulu-Natal).
- VIA for the proposed Tinley Manor South Banks Beach Enhancement Solution, (KwaZulu-Natal).
- VIAs for the proposed Mlonzi Hotel and Golf Estate Development (Eastern Cape Province).

Appendix A

TERMS OF REFERENCE

PROPOSED CONSTRUCTION AND OPERATION OF THE 132KV/400KV ON-SITE MAIN TRANSMISSION SUBSTATION (MTS) AND ASSOCIATED INFRASTRUCTURE LOCATED NEAR DEALESVILLE IN THE TOKOLOGO LOCAL MUNICIPALITY, LEJWELEPUTSWA DISTRICT IN THE FREE STATE PROVINCE

TERMS OF REFERENCE (ToR) FOR SPECIALIST STUDIES

CONTENTS

1 INTRODUCTION[1]

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the development of (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines), Li-Ion Battery Energy Storage System, the associated electrical infrastructure, (the 'proposed development') that will connect to the authorised Solar Energy Facilities i.e. Kentani, Klipfontein, Klipfontein 2, Leliehoek, Sonoblomo, Braklaagte, Boschrand 2, Meeding, Irene and Braambosch, collectively known as the Kentani Cluster located near the town of Dealesville, Tokologo Local Municipality (Lejweleputswa District) in the Free State Province. The proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor which has been authorised as part of the Kentani Cluster, making provision for this routing in the new proposed MTS (Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment

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[1] Important definitions:

1) **Project Site** = Total extent of the land parcel(s)
2) **Development Area** = Identified area (located within the project site) where the MTS and powerlines are planned to be located. This area has been selected as a practical option for the project, considering technical preference and constraints
3) **Development Envelope** = Area identified considering and avoiding identified environmental constraints present within the development area
4) **Development Footprint** = Any evidence of physical alteration as a result of the undertaking of any activity

(DFFE)]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016 [2].

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively. The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 800m in length) are being proposed and will connect the proposed MTS to the existing Eskom 400kV powerline, located approximately 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection; and
2. One (1) 132kV powerline (approx. 4km in length) is being proposed and will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site.
3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

As part of the BA process, powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the 400kV and 132kV powerlines. This is to allow flexibility when routing the

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[2] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended). To inform the assessment, specialist studies are required.

The purpose of this Terms of Reference (ToR) is to provide the specialist team with a consistent approach to the respective specialist studies. The specialist deliverables are twofold and include the following:

(1) Site Sensitivity Verification Report; and
(2a) Specialist Assessment Report / Compliance Statement (as applicable in terms of GN 320 of 20 March 2020 and GN 1150 of 30 October 2020); **OR**
(2b) Appendix 6 of the EIA Regulations, 2014 (as amended) (should no protocols apply to the discipline).

The specialist reports which are required as part of this BA process are detailed in Section 2.1.

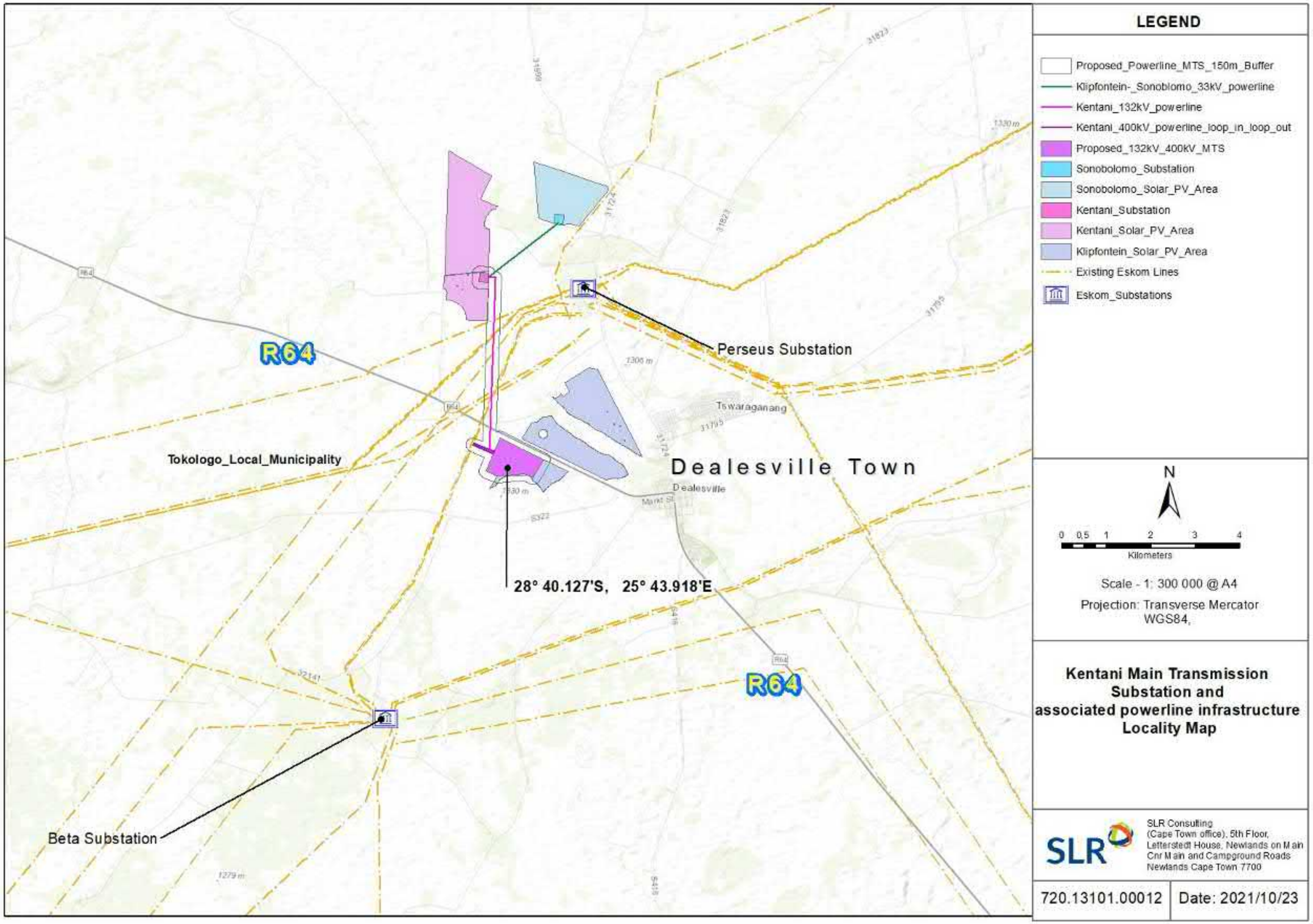

Figure 1: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

2 SPECIALIST REPORTING REQUIREMENTS

2.1 Compilation of Specialist Reports

The specialists are requested to compile the following reports, in line with Appendix 6 of the EIA Regulations, 2014 (as amended), as well as any specific Gazetted specialist protocols[3] (if required / applicable):

1. Site Sensitivity Verification Report (SSVR); and
2. Specialist Impact Assessment Report (including management measures and recommendations)

Table 2-1: Reports required and applicable NEMA process

Specialist Report	Project	Process
Site Sensitivity Verification Report (SSVR)	132kV/400kV On-site Main Transmission Substation (MTS) and associated infrastructure near Dealesville in the Free State Province	BA Process
Specialist Impact Assessment Report		

2.2 Site Sensitivity Verification Report (SSVR) and Specialist Assessment Report Templates

The main deliverables have associated templates to ensure all components of the reports are included in your submission, as follows:

1. Site Sensitivity Verification Report (SSVR) – (Separate document on OneDrive which will be made available to specialists)
2. Specialist Assessment Report – (Separate document on OneDrive which will be made available to specialists)
3. Compliance Statement (if applicable) – see Section 2.2.3 below

It is not mandatory to use the specific specialist report template(s), as long as the same content is included in your own template.

2.2.1 SSVR Template

Note: It is mandatory that all specialists submit a SSVR, according to GN 320 of March 2020 (Separate document on OneDrive which will be made available to specialists)

2.2.2 Specialist Assessment Report Template

The template includes generic project information for all reports and if used, the content for the other respective reports should be deleted as applicable. Alternatively, generic project information can be copied and pasted into your own template, as required by GN.320 and GN 1150 (2020). (Separate document on OneDrive which will be made available to specialists)

In summary, the key content is as follows:

1. If relevant, a table cross referencing how the requirements for specialist reports have been adhered to according to Appendix 6 of the EIA Regs, 2014 (as amended)
2. Executive summary
3. Project description
4. Relevant legislation and guidelines, including the requirement for any permits

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[3] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation.

5. Methodology, including details of field work; consultations; gaps and uncertainties
6. Baseline environment
7. Sensitivity mapping [overlain with the layout(s)]
8. Impact assessment, including the ‘no-go’ assessment
9. Mitigation and Environmental Management Programme (EMPr) requirements
10. Cumulative impact assessment
11. Conclusion / impact statement on the acceptability of the project

2.2.3 Compliance Statement

As specified in the respective protocols, in summary the compliance statement must:

1. be applicable to the preferred site and proposed development footprint (project description can be found in Separate document on OneDrive which will be made available to specialists);
2. confirm the sensitivity of the site for your discipline; and
3. indicate whether or not the proposed development will have any impact / an unacceptable impact on the resource.

The compliance statement must contain, as a minimum, the following information:

1. the contact details of the specialist, their South African Council for Natural Scientific Professions (SACNASP) registration number, their field of expertise and a curriculum vitae (CV);
2. a signed statement of independence by the specialist (template can be found in separate document on OneDrive which will be made available to specialists);
3. Baseline profile or sensitivity mapping, as required by the applicable protocol;
4. Methodology, including details of site inspection, any modelling or calculations required by the protocol or any associated design recommendations that have applied to reduce impacts;
5. a substantiated statement from the specialist on the acceptability (or not) of the proposed development and a recommendation on the approval (or not) of the proposed development;
6. any conditions to which this statement is subjected;
7. in the case of a linear activity, confirmation from the specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two (2) years of completion of the construction phase;
8. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and
9. a description of the assumptions made and any uncertainties or gaps in knowledge or data.

2.3 Project description

The project description for the proposed development is set out in the Assessment Report template (Separate document on OneDrive which will be made available to specialists) which has been compiled, to ensure that all available technical information is available for assessment and for the compilation of the specialist report. This same project description can then be used for the SSV Report and Impact Assessment / Compliance Report (as required), although not repeated in these templates.

Please take note of the following important definitions:

1) **Project Site** = Total extent of the land parcel(s)
2) **Development Area** = Identified area (located within the project site) where the MTS and powerlines are planned to be located. This area has been selected as a practical option for the project, considering technical preference and constraints
3) **Development Envelope** = Area identified considering and avoiding identified environmental constraints present within the development area

4) **Development Footprint** = Any evidence of physical alteration as a result of the undertaking of any activity

2.4 Impact Rating Methodology

The impacts of the proposed development (during the Pre-Construction, Construction, Operation and Decommissioning phases) are to be assessed and rated according to the methodology described below, which was developed by SLR to align with the requirements of the EIA Regulations, 2014 (as amended).

Specialists will be required to make use of the impact rating matrix provided (in Excel format) for this purpose.

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Table 2. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). **Part A** provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In **Part B**, a matrix is applied to determine this impact consequence. In **Part C**, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in **Part D**.

Table 2: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE	**Consequence is a function of intensity, spatial extent and duration**	
Determination of SIGNIFICANCE	**Significance is a function of consequence and probability**	
Criteria for ranking of the INTENSITY of environmental impacts	**Very High**	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.
	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.
	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.
Criteria for ranking the DURATION of impacts	**Very Short-term**	The duration of the impact will be < 1 year or may be intermittent.
	Short-term	The duration of the impact will be between 1 - 5 years.
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.
	Long-term	The duration of the impact will be Long-term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity).
	Permanent	The duration of the impact will be permanent
Criteria for ranking the	**Site**	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.

EXTENT of impacts	**Local**	Impact is confined to within the project site / area and its nearby surroundings.
	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium-term	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short-term	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very Short-term	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
Intensity -Low						
DURATION	Permanent	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium-term	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very Short-term	**Very low**	**Low**	**Low**	**Low**	**Medium**
Intensity- Medium						
DURATION	Permanent	**Medium**	**High**	**High**	**High**	**Very High**
	Long-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Very Short-term	**Low**	**Low**	**Low**	**Medium**	**Medium**
Intensity -High						
DURATION	Permanent	**High**	**High**	**High**	**Very High**	**Very High**
	Long-term	**Medium**	**High**	**High**	**High**	**Very High**
	Medium-term	**Medium**	**Medium**	**High**	**High**	**High**
	Short-term	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very Short-term	**Low**	**Medium**	**Medium**	**Medium**	**High**
Intensity - Very High						
DURATION	Permanent	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long-term	**High**	**High**	**High**	**Very High**	**Very High**
	Medium-term	**Medium**	**High**	**High**	**High**	**Very High**

	Short-term	Medium	Medium	High	High	High
	Very Short-term	**Low**	Medium	Medium	High	High
		Site	Local	Regional	National	International
		EXTENT				

PART C: DETERMINING SIGNIFICANCE						
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
		Very Low	Low	Medium	High	Very High
		CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE		
Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.
Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

The specialists are also required to include a comment, as follows, on the degree to which the impact:

1. Can be reversed;
2. May cause irreplaceable loss of resources; and
3. Can be avoided, managed or mitigated.

3 CUMULATIVE ASSESSMENT

A cumulative impact can be defined as *"the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that itself may not be significant,* *but may be significant when added to the existing and foreseeable impacts culminating from similar or diverse activities"* (NEMA EIA Reg GN R982 of 2014).

The South African Renewable Energy EIA Application Database (REEA) available at the time (namely "REEA_OR_2021_Q2") shows several renewable energy projects (solar) authorised or being proposed within close proximity to the town of Dealesville, including the Kentani Cluster which consists of eleven (11) authorised solar PV projects and associated electrical infrastructure. According to the information available at the time[4], the following renewable energy applications for EA are either approved (i.e., EA issued) or being proposed within a 30km radius of the proposed project site:

- 100 MW Kentani PV - 14/12/16/3/3/2/724
- 100 MW Klipfontein PV - 14/12/16/3/3/2/722
- 100 MW Braklaagte PV - 14/12/16/3/3/2/727
- 100 MW Meeding PV - 14/12/16/3/3/2/719
- 100 MW Irene PV - 14/12/16/3/3/2/718
- 100 MW Leliehoek PV - 14/12/16/3/3/2/728
- 75 MW Sonoblomo PV - 14/12/16/3/3/2/723
- 75 MW Klipfontein PV 2 - 14/12/16/3/3/2/726
- 75 MW Braambosch PV - 14/12/16/3/3/2/725
- 75 MW Boschrand PV 2 - 14/12/16/3/3/2/720
- 75 MW Eksteen PV - 14/12/16/3/3/2/717
- 75 MW solar PV facility which forms part of Kentani Photovoltaic solar Energy Facilities and Supporting Electrical Infrastructure - 14/12/16/3/3/2/721
- Klipbult solar plant - 14/12/16/3/3/2/432
- 75 MW Sebina Letsatsi Solar PV Facility - 14/12/16/3/3/2/755
- 100 MW Edison PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/851
- 100 MW Maxwell PV Solar Facility and shared electricity Infrastructure - 14/12/16/3/3/2/852
- 100 MW Marconi PV solar projects and associated infrastructure - 14/12/16/3/3/2/853
- 100 MW Watt PV solar projects and associated infrastructure - 14/12/16/3/3/2/854
- 100 MW Farday PV solar projects and associated infrastructure - 14/12/16/3/3/2/855
- 100 MW Visserpan solar photovotaic facility project 2 - 14/12/16/3/3/1/2154
- 100 MW Visserpan solar photovotaic facility project 3 - 14/12/16/3/3/1/2155
- 100 MW Visserpan solar photovotaic facility project 4 - 14/12/16/3/3/1/2156

There are therefore a number of renewable energy applications for EA either approved or being proposed within a 30km radius of the proposed project site. In addition, the Jedwater Solar Power Facility (12/12/20/1972/2) and Letsatsi solar power farm (12/12/20/1972/1) are situated just outside of the project site's 30km radius, to the south-east of the project site.

There are however no operational renewable energy developments situated within a 30km radius of the proposed project site to the knowledge of the EAP. Should more information regarding renewable energy applications for EA within a 30km radius of the proposed project site becomes available, this will be disseminated to the specialists (should SLR be able to obtain information regarding these applications.

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[4] Information has been based on the latest available version of the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2021_Q2"), the results of the respective online screening tool reports (https://screening.environment.gov.za/screeningtool/#/pages/welcome) and information available on the public domain at the time.

The cumulative impact assessed will therefore be the collective impact of the proposed MTS and powerline application along with the other renewable energy development applications (either approved or being proposed) mentioned above which are located within a 30km radius of the project site.

A map showing the other renewable energy development applications located within a 30km radius of the proposed project site will be provided to the specialists once it becomes available.

3.1 Assessment of Alternatives

Due to the comprehensive design process that has been undertaken to inform the site proposed for the MTS as well as the corridors being proposed for the associated powerlines, no site, layout or powerline corridor alternatives will be assessed.

Aditionally, as mentioned, the proposed MTS will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), and as such the location of the proposed MTS has previously been assessed as part of the development footprint for the Klipfontein PV project. Eight (8) 132kV powerlines are also located within the authorised corridor included as part of the authorised Kentani Cluster and thus the location of the corridors being proposed have also previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments.

The site proposed for the MTS and respective grid connection corridors will however each be assessed against the ‘no-go’ alternative. The ‘no-go’ alternative is the option of not constructing the Project and where the *status quo* of the current status and/or activities on the site would prevail.

4 SPECIALIST SPECIFIC DELIVERABLES

Each specialist may have a different set of deliverables for the MTS and Powerline reports, based on the EIA Regulations (and associated Specialist Theme Protocols) and the nature of the sensitivity / activities. These are twofold and may include the following:

1. **Site Sensitivity Verification Report,** in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020;
2. **Impact Assessment Report:**
    a. **Specialist Assessment Report / Compliance Statement** (as applicable), in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020 (where applicable, the Species Environmental Assessment Guideline may apply[5]); or
    b. Compliance with **Appendix 6 of the EIA Regulations, 2014 (as amended)**, should no protocols apply to the discipline.

Refer to the Section 4.1 below for specifics for each specialist. A template for the SSV Report and Impact Assessment Report is provided (Separate documents on OneDrive).

---

[5] Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 2.1 2021.

4.1 Specialist Deliverables

Report	**Site Sensitivity Verification Report**	**Level of impact assessment and relevant legislation**		
	SSV Report in terms of GN 320 of 20 March 2020	**Compliance Statement in terms of GN 320 / GN 1150 of 20 March 2020**	**Specialist Assessment Report in terms of GN 320 March 2020 / GN 1150 of Oct 2020**	**Appendix 6 of NEMA 2014**
Terrestrial				
MTS	x		x	
POWERLINES (400kV & 132kV)	x		x	
Plant theme				
MTS	x	x		
POWERLINES (400kV & 132kV)	x	x		
Aquatic				
MTS	x	x		
POWERLINES (400kV & 132kV)	x	x		
Animal theme				
MTS	X		x	
POWERLINES (400kV & 132kV)	x		x	
Birds				
MTS	x			x
POWERLINES (400kV & 132kV)	x		x	
Agriculture				
MTS	x		x	
POWERLINES (400kV & 132kV)	x	x		
Heritage (incl. Palaeo)				
MTS	x			x
POWERLINES (400kV & 132kV)	x			x
Palaeo				
MTS	x			x
POWERLINES (400kV & 132kV)	x			x

Report	**Site Sensitivity Verification Report**	**Level of impact assessment and relevant legislation**		
	SSV Report in terms of GN 320 of 20 March 2020	**Compliance Statement in terms of GN 320 / GN 1150 of 20 March 2020**	**Specialist Assessment Report in terms of GN 320 March 2020 / GN 1150 of Oct 2020**	**Appendix 6 of NEMA 2014**
Visual				
MTS	x			x
POWERLINES (400kV & 132kV)	x			x

5 DELIVERABLES AND SUBMISSION REQUIREMENTS

5.1 Deliverables

Please ensure that your submission includes the following:

1. The Site Verification Report and Compliance Statement / Specialist Report (as required) must be in line with the DFFF Screening Tool[6] Specialist Theme Protocols (as gazetted on 20 March 2020 and 30 October 2020) and where relevant, the Species Environmental Assessment Guideline5 (should they apply). Should they not apply, the report must be written in accordance with Appendix 6 of the EIA Regulations, 2014 (as amended);
2. Data for the refined sensitivity layers;
3. Excel spreadsheet of impact ratings; and
4. A copy of the specialist's CV.

5.2 Deadlines

1. Draft Site Verification Report and Compliance Statement / Specialist Report (as required) no later than **22 October 2021**.
2. All spatial information for the reports (where required) to be submitted no later than **22 October 2021**.
3. Mainstream and SLR intends for all reports to be finalised **by 31 October 2021**.

5.3 Report / data formats

1. All specialist reports must be provided in MS Word format;
2. Where maps have been inserted into the report, SLR will require a separate map set in PDF format for inclusion in our submission;
3. Where figures and/or photos have been inserted into the report, SLR will require the original graphic in .jpg format for inclusion in our submission; and
4. Delineated areas of sensitivity must be provided in either ESRI shape file format or Google Earth KML format. **Sensitivity classes must be included in the attribute tables with a clear indication of which areas are 'No-Go' areas.**

---

[6] https://screening.environment.gov.za/screeningtool/#/pages/welcome

Appendix C

Site Sensitivity Verification (in terms of Part A of the Assessment Protocols published in GN 320 on 20 March 2020)

CONTENTS

:

1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing to add one (1) Main Transmission Substation (MTS) and three (3) powerlines (namely 1 x 132kV powerline and 2 x 400kV powerlines) and Li-Ion Battery Energy Storage System to their authorised Kentani Cluster of solar photovoltaic (PV) developments near the town of Dealesville in the Free State Province (the 'proposed development'). The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality. The proposed development will also involve the re-routing of eight (8) 132 kilovolt (kV) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The proposed development area falls within the Tokologo Local Municipality, within the Lejweleputswa District Municipality (refer to Figure 1).

It should be noted that on 28 October 2021, the Minister of Mineral Resources and Energy, Gwede Mantashe announced the Preferred Bidders of the Round 5 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and six (6) of the aforementioned Solar Energy Facilities received Preferred Bidder status i.e.:

- Kentani Solar PV
- Klipfontein Solar PV
- Klipfontein 2 Solar PV
- Leliehoek Solar PV
- Sonoblomo Solar PV
- Braklaagte Solar PV

These Solar Energy Facilities have now become Strategic Infrastructure Projects i.e. SIPs 8 and 10. SIPs 8 and 10 target the development of green energy in support of the South African economy and the provision of electricity transmission and distribution respectively.

- SIP 8 supports sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities.
- SIP 10 Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

The Kentani Cluster consists of eleven (11) solar PV projects and associated electrical infrastructure (including a powerline), each of which received their own Environmental Authorisation (EA) in 2016 from the Department of Environmental Affairs (DEA) [now referred to as the Department of Forestry, Fisheries and the Environment

(DFFE)][1]. The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

It should be noted that the proposed MTS and associated infrastructure will be located within the authorised Klipfontein PV facility (14/12/16/3/3/2/722), which is proposed on the Remaining Extent of the Farm Klipfontein No. 305 (SG Code: F00400000000030500000). Of the eleven (11) powerlines, eight (8) are 132kV powerlines which are located within the authorised corridor, and which have been included as part of the authorised solar PV developments. The remaining powerlines [i.e., two (2) 400kV and one (1) 132kV powerlines] fall outside of the authorised corridor and therefore will be assessed as part of the Basic Assessment (BA) process for the MTS (i.e., this application).

Considering the above, it is important to note that the location of the proposed MTS as well as the corridors being proposed for the powerlines have previously been assessed as part of the development footprint for the Kentani Cluster of solar PV developments, each of which received their own EA in 2016.

Moreover, the proposed MTS and powerlines are located within the Kimberly Renewable Energy Development Zone and Central Strategic Transmission Corridor, as defined and in terms of the procedures laid out in Government Notices No. 113 and No. 145 which were formally gazetted on 16 February 2018 and 26 February 2021 respectively.In terms of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the proposed development, under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report is the 132kV/400kV On-site MTS and Associated Infrastructure near Dealesville application.

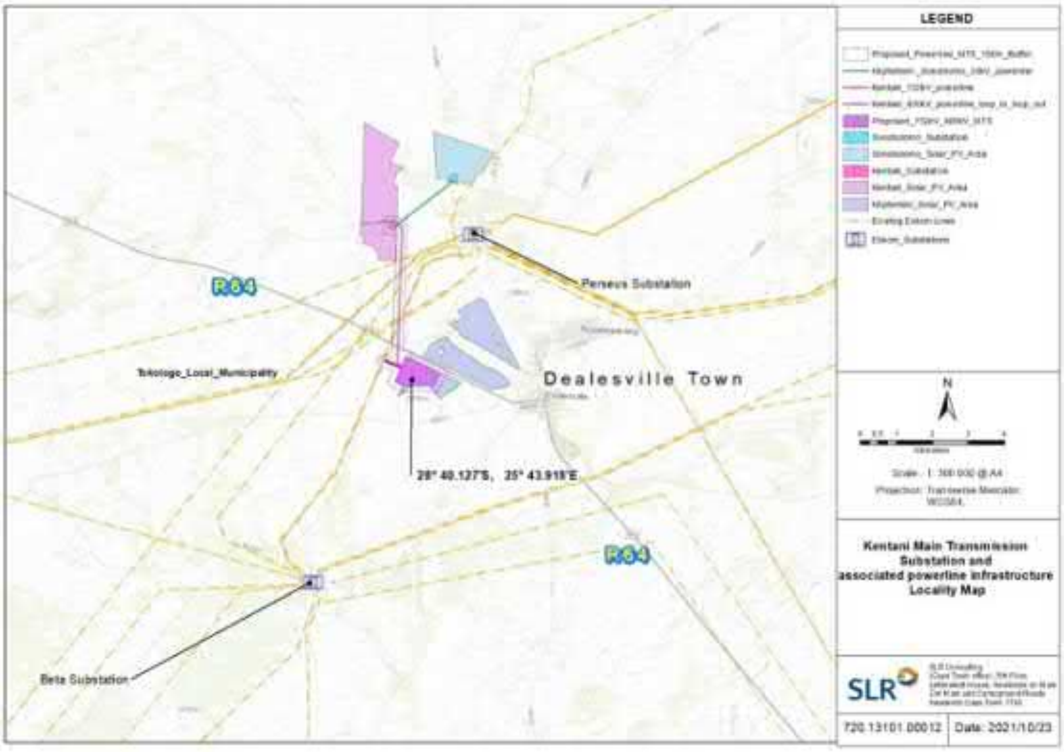


Figure 1: Locality Map of the proposed Main Transmission Substation (MTS) and associated electrical infrastructure (including grid connection corridors)

---

[1] It should be noted that the validity period of the EA issued for the Klipfontein Solar PV Energy Facility in 2016 was extended by the Holder of the EA in April 2021 (14/12/16/3/3/2/722/AM1). The EA issued in 2016 is now valid until 06 June 2026 (i.e., EA lapses on 06 June 2026).

The proposed development involves the addition of one (1) MTS, Lithium ion BESS and three (3) powerlines to Mainstream's authorised Kentani Cluster of solar PV developments, as well as the re-routing of eight (8) powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS.

The proposed MTS and associated infrastructure [i.e., eleven (11) powerlines] will service eleven (11) of Mainstream's solar PV projects authorised as part of the Kentani Cluster.

The proposed development requires several key components to facilitate the transmission and distribution of electricity at a large scale. This includes:

- One (1) new 132kV/400kV Main Transmission Substation (MTS);
- One (1) new 132kV overhead powerline;
- Two (2) new 400kV overhead powerlines;
- One (1) new 33kV overhead powerline;
- A road in the servitude under the proposed powerlines; and
- An access road (approx. 4-8m wide) to the R64 provincial route
- Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

The proposed MTS will occupy a footprint of approximately 64 hectares (ha) (i.e., 800m x 800m) and the proposed Lithium-Ion Battery Energy Storage System (BESS) with occupy up to 4 ha. The area occupied by the proposed power lines is unknown at this stage. In addition, the proposed MTS will have a capacity of 132/400 kilovolt (kV), while the associated powerlines will have capacities of up to 400kV, 132kV and 33kV respectively. The powerlines and BESS associated with the MTS and which are being proposed as part of this application and BA process are as follows:

1. Two (2) 400kV overhead powerlines (approx. 2km in length) that will connect the proposed MTS to the existing Eskom 400kV powerline, located approx. 1km west of the proposed MTS site, via a Loop-In-Loop Out (LILO) connection;

2. One (1) 132kV powerline (approx. 4.5km in length) that will connect the proposed MTS to the authorised Kentani on-site substation (14/12/16/3/3/2/724), located approx. 4km north-west of the proposed MTS site; and

3. Li-Ion Battery Energy Storage System (BESS) up to 4 ha in extent within the assessed site footprint

Additionally, there is one (1) 33kv powerline (approx. 2km in length) being proposed and will connect the authorised 75MW Sonoblomo PV facility (14/12/16/3/3/2/723), which is located approximately 5km north of the proposed MTS site, to the authorised Kentani on-site substation (14/12/16/3/3/2/724) (approx. 4km north-west of proposed MTS site). This powerline is not subject to the Basic Assessment study as it does trigger the need for an Application for Environmental Authorisation, however, the powerline has been considered by the specialist team.

As mentioned above, the proposed development will also involve the re-routing of eight (8) 132kV powerlines within the grid connection corridor authorised as part of the Kentani Cluster and making provision for this routing in the new proposed MTS. The remaining two (2) 400kV powerlines and one (1) 132kV powerline fall outside of the authorised corridor and will be assessed as part of the BA process for the MTS (i.e., this application).

Powerline corridors with widths of 300m (150m on either side of centre line) are being proposed and assessed for the proposed 400kV and 132kV powerlines which form part of this BA process (i.e., this application). This is to allow flexibility when routing the powerlines within the authorised corridor (should the EA be granted). No corridor is however being considered for the proposed 33kV powerline.

A road in the servitude under the proposed powerlines as well as an access road (approx. 4-8m wide) to the R64 provincial route will also be required.

2. SITE SENSITIVITY VERIFICATION METHODOLOGY

A site sensitivity verification has been conducted in support of the Visual Impact Assessment (VIA) for the proposed Main Transmission Substation (MTS), power lines and access roads. The verification exercise is based on a desktop-level assessment supported by field-based observation and involved an assessment of factors as outlined below.

- **Physical landscape characteristics**

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by National Geospatial Information (NGI), the South African National Biodiversity Institute (SANBI) and the South African National Land Cover Dataset (DFFE / Geoterraimage – 2020). The characteristics identified via desktop means were later verified during the site visit.

- **Identification of sensitive receptors**

Visual receptor locations that are sensitive and / or potentially sensitive to the visual intrusion of the proposed development were identified by way of a desktop assessment as well as field-based investigation. Initially Google Earth imagery (2021) was used to identify potential receptors within the study area and where possible, these receptor locations were verified and assessed during the field investigation.

- **Fieldwork and photographic review**

A two (2) day site visit was undertaken on the 12th and 13th of October 2021 (early spring). The aim of the site visit was to:

  - verify the landscape characteristics identified via desktop means;
  - conduct a photographic survey of the proposed study area;
  - verify the sensitivity of visual receptor locations identified via desktop means;
  - eliminate receptor locations that are unlikely to be influenced by the proposed development;
  - identify any additional visually sensitive receptor locations within the study area; and
  - assist with the assessment and rating of receptor impacts.

3. OUTCOME OF SITE SENSITIVITY VERIFICATION

Visual sensitivity of the broader area surrounding the proposed development was found to be **low** largely due to the relatively low number of potentially sensitive receptors in the area and the level of human transformation and landscape degradation in the area.

A screening exercise was undertaken with the aim of indicating any areas that should be precluded from the proposed development footprint. From a visual perspective, these are areas where the establishment of power lines and/or substation infrastructure would result in the greatest probability of visual impacts on sensitive or potentially sensitive visual receptors.

Using GIS-based visibility analysis, it was possible to determine which sectors of the assessment corridors would be visible to the highest numbers of receptors in the study area. However, this analysis found that no areas are significantly more visible than any other area. As such, in terms of visibility, no areas were found to be particularly sensitive.

In determining visual sensitivity, consideration must also be given to the direct visual impact of the proposed development on any nearby farmsteads or receptors. However, investigation determined that there are no farmsteads or potentially sensitive receptors within 500 m of either of any elements of the power line or MTS development. As such, **no** areas of visual sensitivity were identified in relation to any of the power line alignments or the substation site.

In assessing visual sensitivity, the proposed development was examined in relation to the Landscape Theme of the National Environmental Screening Tool to determine the relative landscape sensitivity for this type of development. The tool does not however identify any landscape sensitivities in respect of power line or substation development.

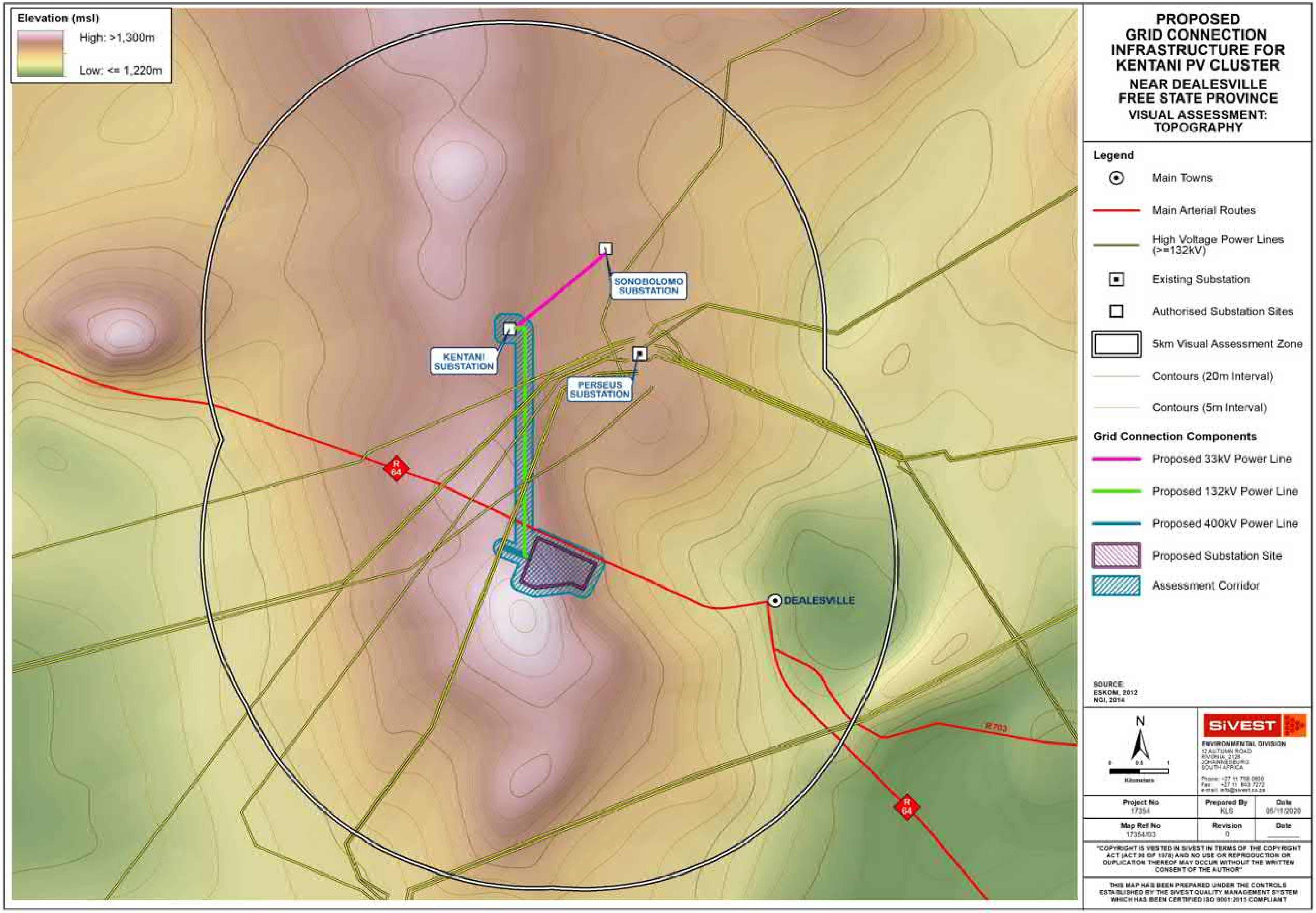
4. CONCLUSION

A site sensitivity verification for the Visual Impact Assessment (VIA) for the proposed Main Transmission Substation (MTS), BESS, power lines and access roads has been conducted, based on a desktop-level assessment supported by field-based observation. As outlined above, it was verified that there are no areas of visual sensitivity in relation to any of the power line alignments or substation site. Furthermore, no landscape sensitivities were identified in terms of the Landscape Theme of the National Environmental Screening Tool.

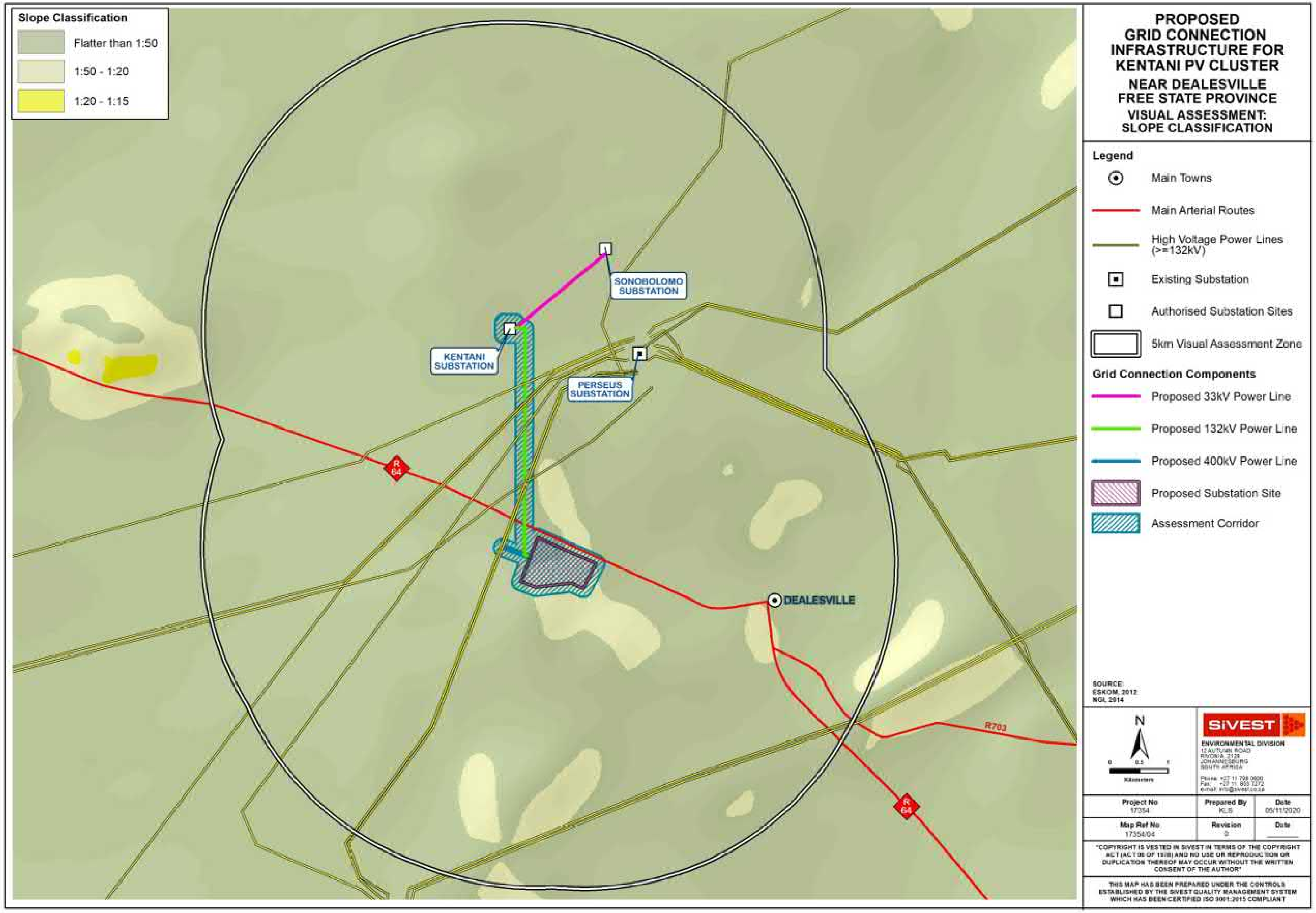
Appendix D

Maps

MAP 1: Topography



MAP 2: Slope


Slope Classification
Flatter than 1:50
1:50 - 1:20
1:20 - 1:15
SONOBOLOMO SUBSTATION
KENTANI SUBSTATION
PERSEUS SUBSTATION
R 64
DEALESVILLE
R703
R 64
PROPOSED GRID CONNECTION INFRASTRUCTURE FOR KENTANI PV CLUSTER
NEAR DEALESVILLE FREE STATE PROVINCE
VISUAL ASSESSMENT: SLOPE CLASSIFICATION
Legend
Main Towns
Main Arterial Routes
High Voltage Power Lines (>=132kV)
Existing Substation
Authorised Substation Sites
5km Visual Assessment Zone
Grid Connection Components
Proposed 33kV Power Line
Proposed 132kV Power Line
Proposed 400kV Power Line
Proposed Substation Site
Assessment Corridor
SOURCE: ESKOM, 2012 NGI, 2014
N
0
0.5
1
Kilometers
SIVEST
ENVIRONMENTAL DIVISION
12 AUTUMN ROAD
RIVONIA, 2128
JOHANNESBURG
SOUTH AFRICA
Phone: +27 11 798 0600
Fax: +27 11 803 7272
email: info@sivest.co.za
Project No 17354
Prepared By KLS
Date 05/11/2020
Map Ref No 17354/04
Revision 0
Date
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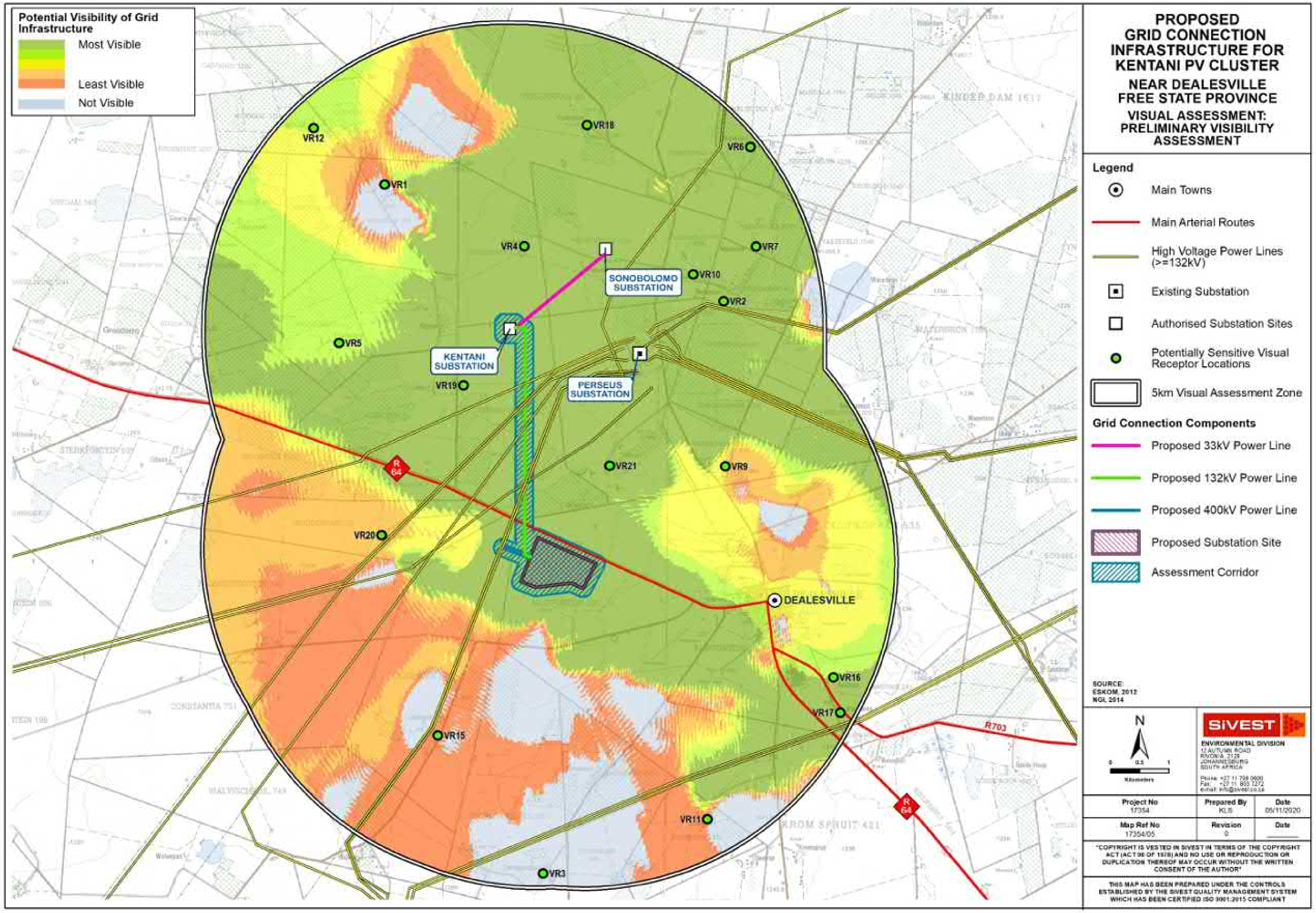
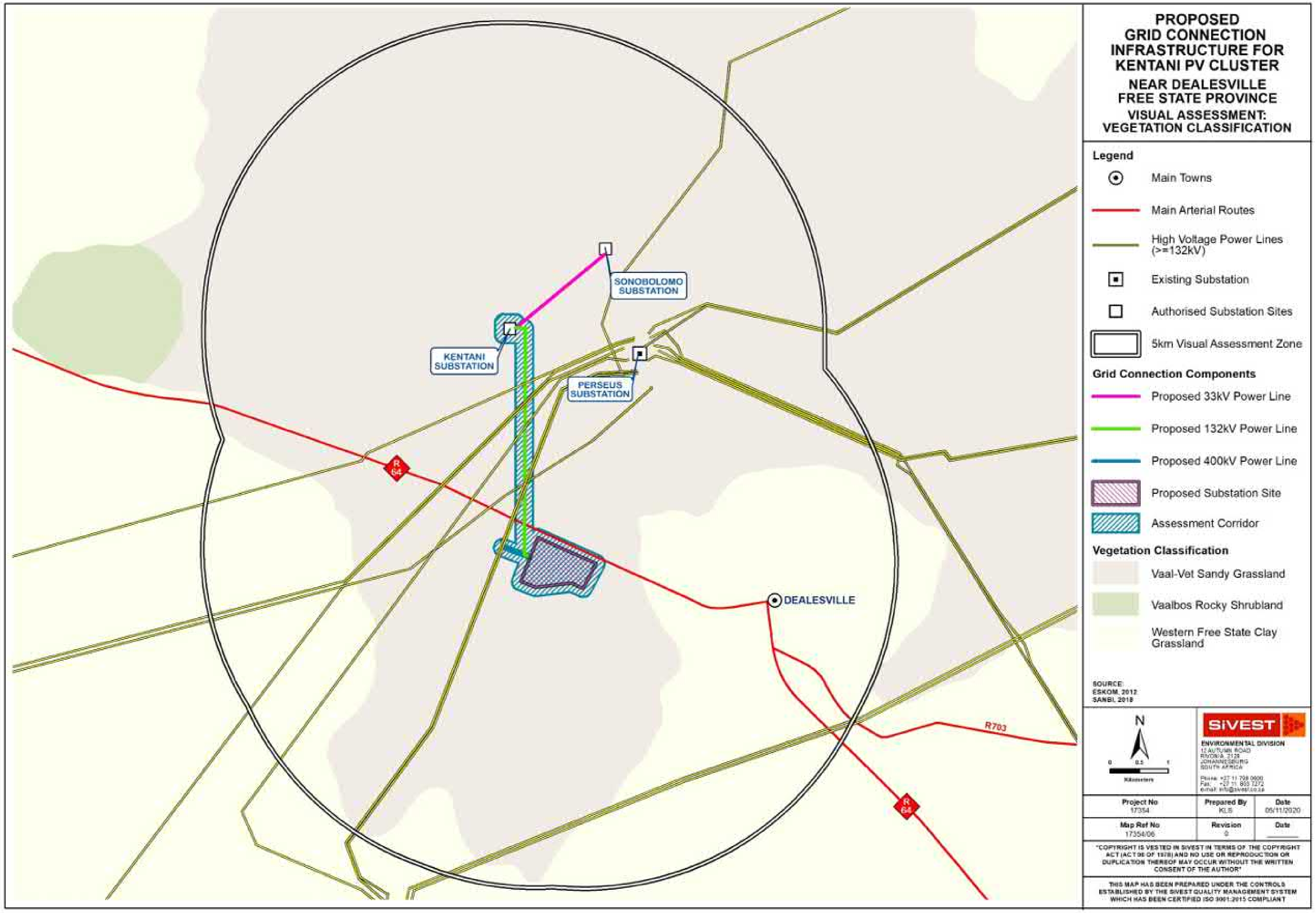
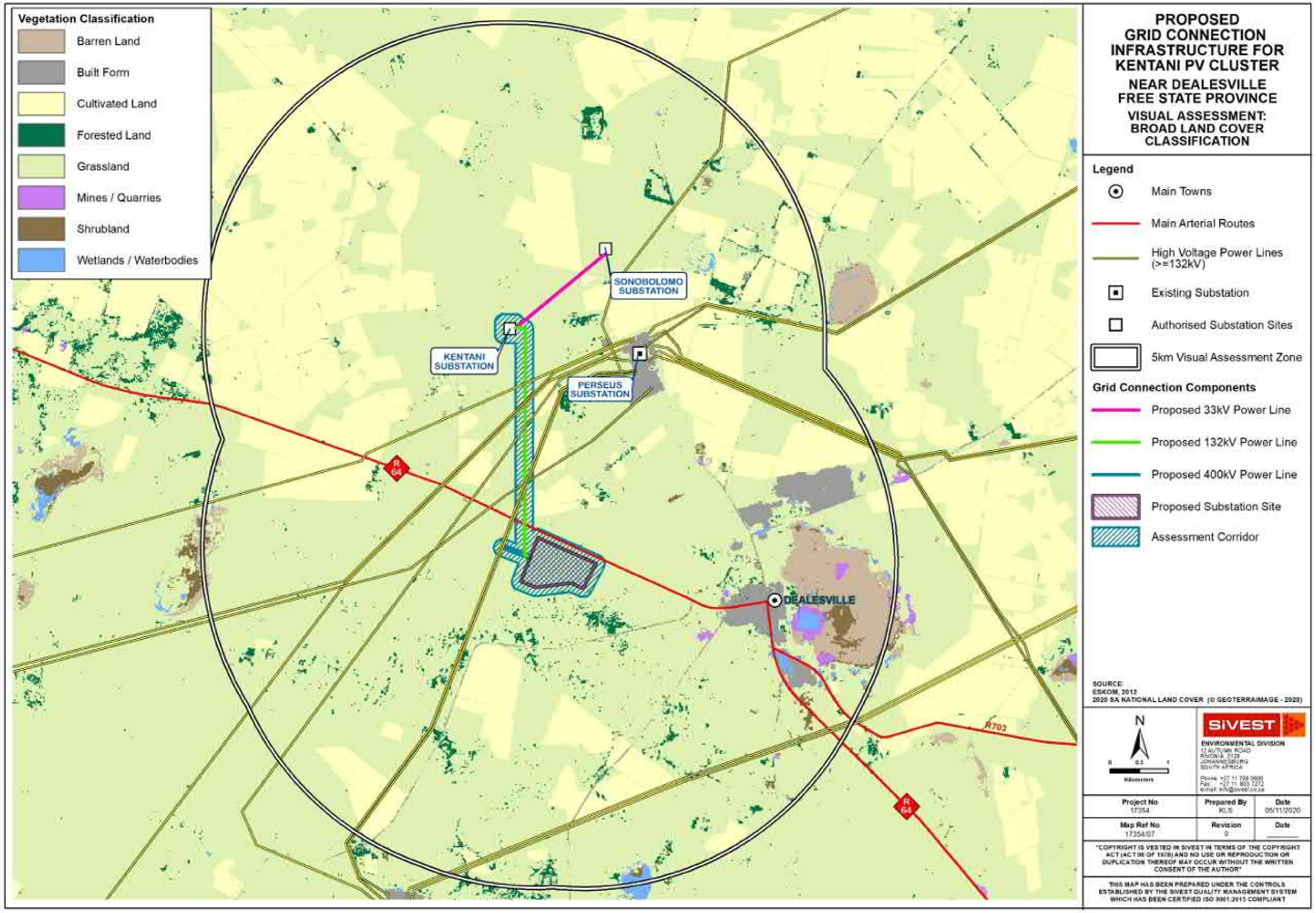
MAP 3: Potential Visibility of Power Lines and Substation



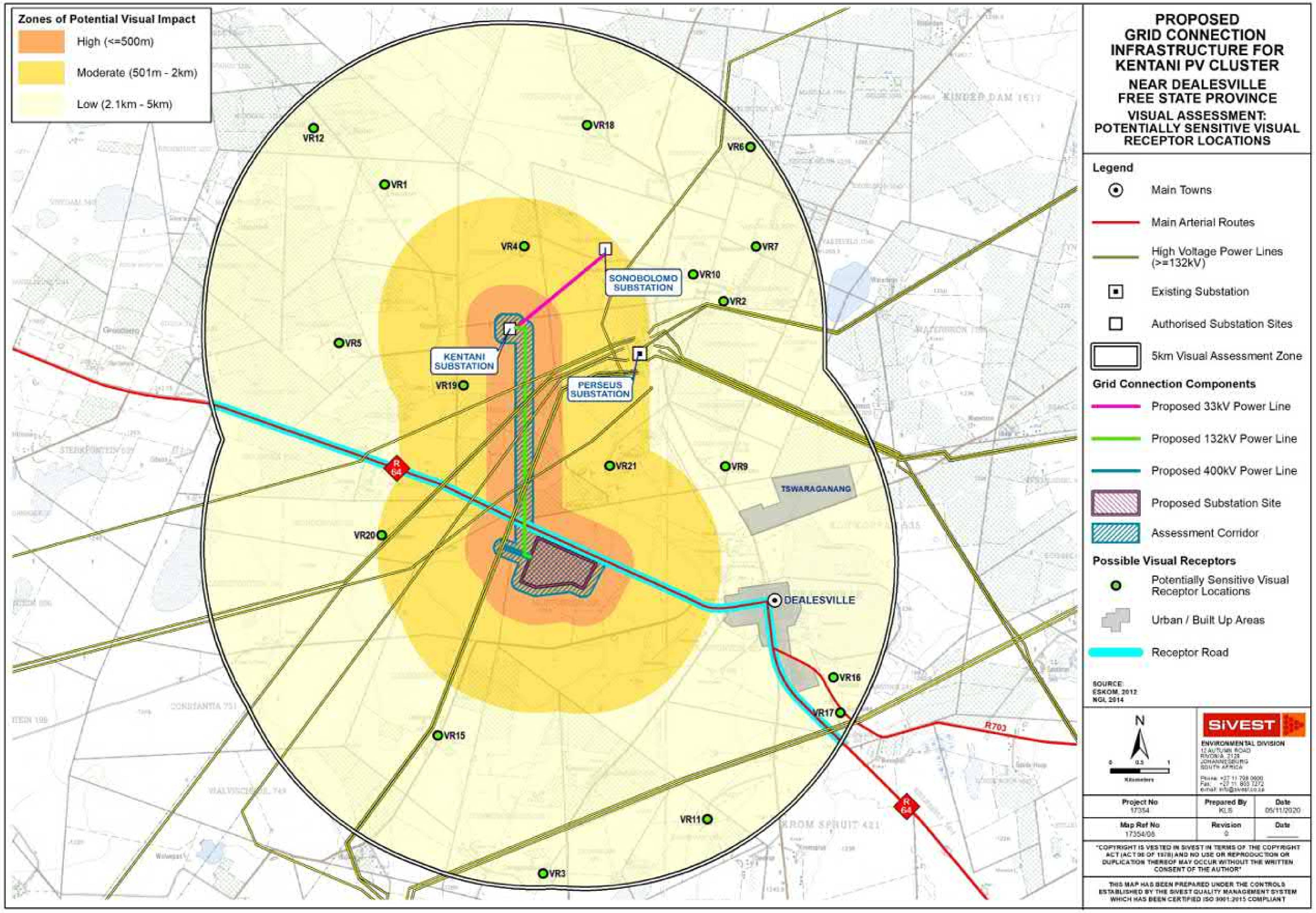
MAP 4: Vegetation Classification



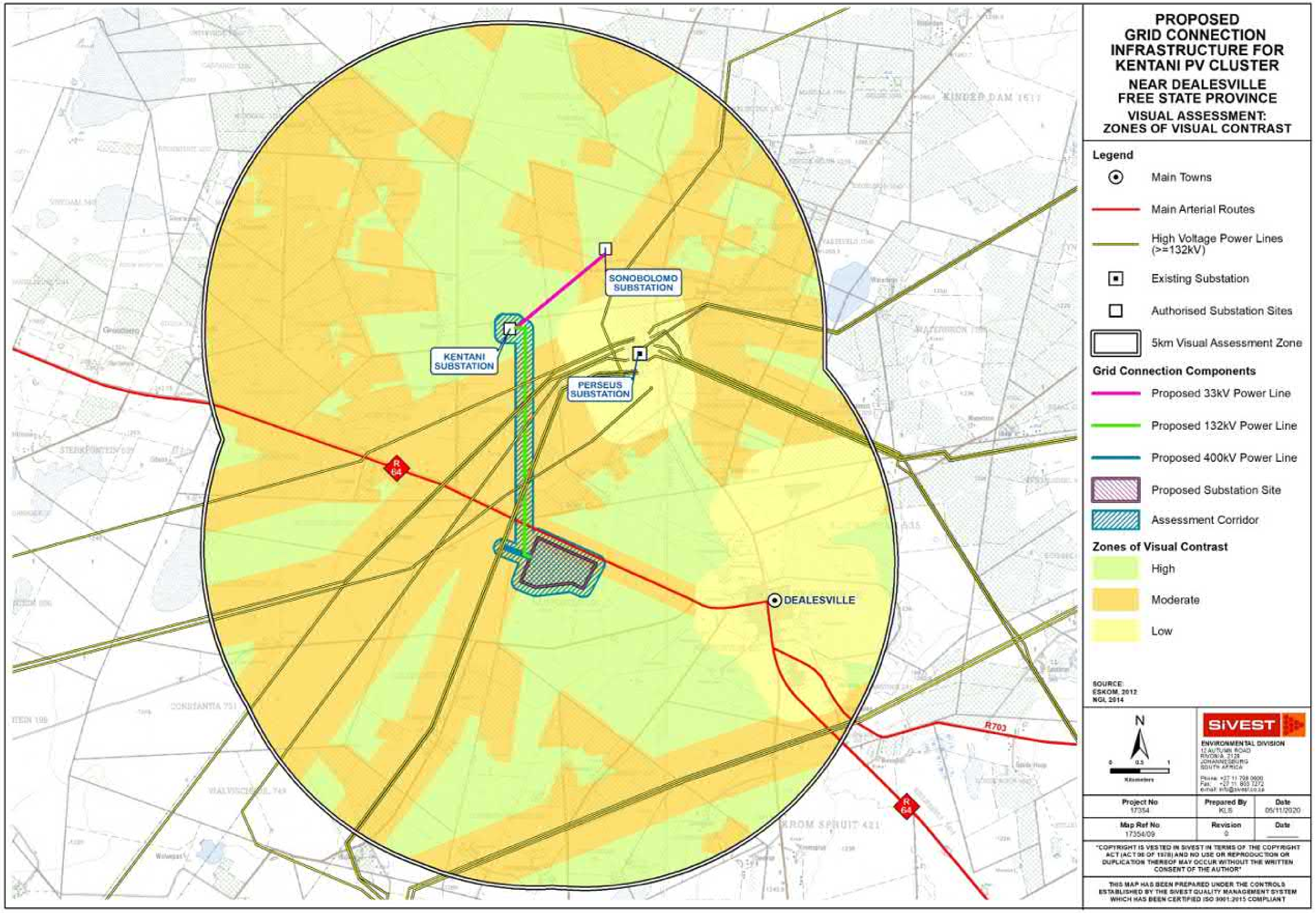
MAP 5: Land Cover Classification



MAP 6: Potentially Sensitive Receptor Locations



MAP 7: Zones of Visual Contrast



Geotechnical[1]

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[1] PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR KENTANI SOLAR PV POWER PROJECT DEALESVILLE, FREE STATE PROVINCE

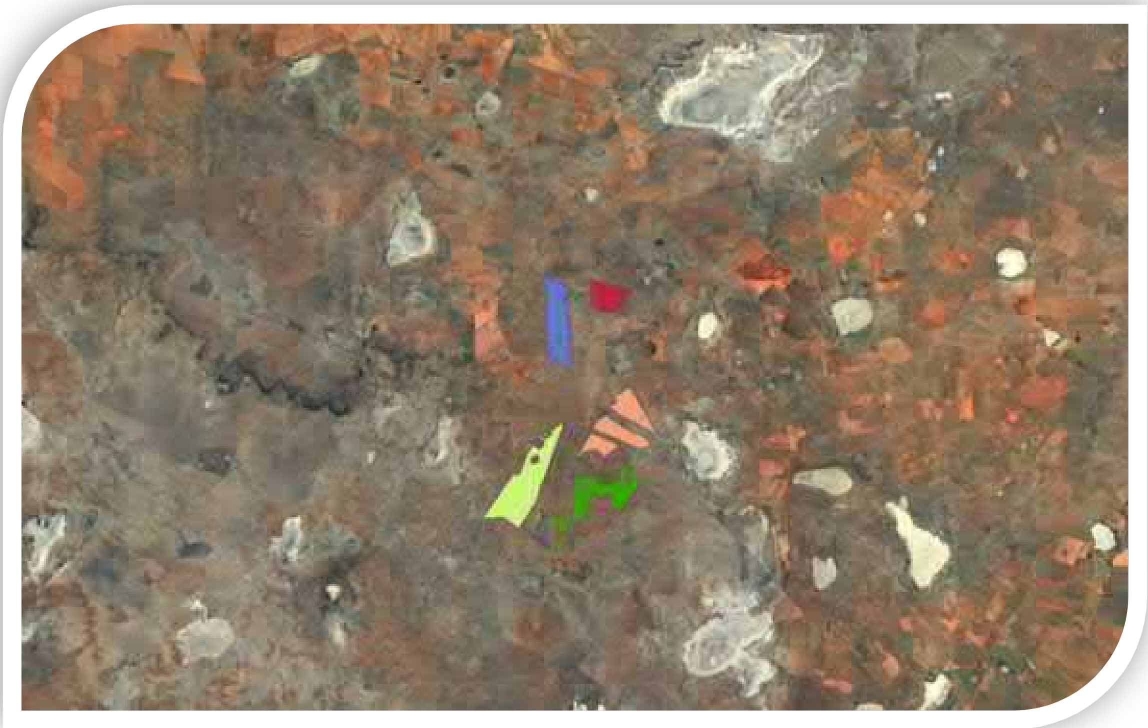
PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR

Kentani Solar PV Power Project

DEALESVILLE, FREE STATE PROVINCE

October 2020

Ref. C1801/30/2020/10/2836



Project Name:	Kentani Solar PV Power Project
Report Number:	C1801/30/2020/10/2836
Report for:	Mainstream Renewable Power South Africa

REVISIONS

Revision #	Date	Change Overview	Prepared by	Reviewed by
0	29/09/2020	Draft	R. Roberts	A. Lodenkemper
1	06/10/2020	Draft	R. Roberts	A. Lodenkemper
A		Draft		
AA		Final		

QUALITY

Compiled by:	Richard Roberts	**Reviewed by:**	A. Lodenkemper
Position Held:	Geotechnical Engineer	**Position Held:**	Professional Geologist
Signature:		**Signature:**	ALodenkemper
Date:	08/10/2020	**Date:**	08/10/2020

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SMEC COMPANY DETAILS

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APPENDICES

1. INTRODUCTION

1.1 Background and Project Description

SMEC South Africa (Pty) Ltd. ("SMEC") were appointed by Mainstream Renewable Power South Africa ("Mainstream") to conduct preliminary geotechnical investigations for 24no. renewable power projects around South Africa. The renewable power projects comprise 10no. solar photo-voltaic (PV) projects and 14no. wind projects, which are under consideration for project development and thus submission for round 5 of the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) bid window.

This report presents the field data acquired from preliminary geotechnical investigations and laboratory testing for the proposed Kentani Cluster Solar photo-voltaic (PV) power plants located around Dealesville, Free State Province. The cluster is split into 5no. separate proposed development sites:

(i) Kentani;

(ii) Klipfontein;

(iii) Klipfontein 2;

(iv) Leliehoek, and;

(v) Sonoblomo.

The fieldwork data is interpreted further to provide Mainstream with conceptual site development recommendations for the solar power project and highlights geotechnical constraints towards their development.

1.2 Terms of Reference

SMEC South Africa (Pty) Ltd. responded to a request for quotation from Mainstream Renewable Power South Africa received on 13 November 2019 for the provision of geotechnical services for 24no. renewable power projects. SMEC's proposal for preliminary geotechnical investigations at all 24no. projects, reference number 1907EB, and dated 30 January 2020, was accepted by Mainstream on 24 February 2020 subsequently appointing SMEC to conduct the investigations.

The 24no. projects have been subdivided into nine clusters each to be treated separately. The order number to proceed with investigations for the Kentani cluster is ZA01PO-000754.

1.3 Geotechnical Objective

The objective of the investigation is to establish the geotechnical aspects and boundary conditions of the site(s) earmarked for the envisaged solar plant infrastructure with a reasonable level of confidence commensurate with the current stage of the project.

To fulfil this objective the investigation was designed to provide provisional data on:

(i) Geological sequence and geotechnical zonations underlying the proposed PV panels and associated infrastructure;

(ii) Thickness and variability of in-situ soils;

(iii) Depth to and rock mass lithology;

(iv) In-situ soil and rock index parameters;

(v) Mechanical properties of in-situ soil and rock;

(vi) Excavatability of surface material;

(vii) Suitability of in-situ material for use in the construction process;

(viii) Location of potential construction material sources on or near the site;

(ix) Potential ground related risk, mitigation methods and appropriate construction methodology, and;

(x) Conceptual foundation solutions.

1.4 Investigation Approach

The investigation approach adopted in realising the objective comprised four stages as follows: viz.:

(i) Desktop study;

(ii) Walkover assessment and field mapping;

(iii) Site investigations with field tests, and;

(iv) Laboratory testing on sample material retrieved from site.

The desktop study was essential in identifying the geology to be anticipated on site and the subsequent soils derived from the mechanical degradation and chemical decomposition of the parent rock mass. The desktop study formed the basis for the geotechnical proposal and essentially established the geotechnical objectives for the investigation. The desktop study included the review and interpretation of the following information sources available/ applicable to the Kentani Cluster:

(i) Aerial imagery (Google Earth®) and 1: 50 000 scale topographic sheets;

(ii) Council for Geoscience geological map series (1:250 000 scale) and explanation booklets for Kimberley (2824);

(iii) SMEC geotechnical data base of past geotechnical/ geological projects completed near the site or within similar geological profiles/ geotechnical zonations, and;

(iv) Literature review of applicable geological and geotechnical engineering information sources.

After completion of the desktop study and formulation of the geotechnical objectives a preliminary field investigation was undertaken. The field investigations were necessary to qualify the assumptions made during the desktop study and verify geological and geotechnical conditions on site. Field investigations involved the following tasks to better understand the subsurface conditions of the site:

(i) Walkover assessment and geological mapping of the site where notable rock outcrops or geological features were observed. This included setting out trial pit localities utilising a handheld GPS as well as visually assessing existing and greenfield borrow pit sites;

(ii) Mechanical excavation of 96no. trial pits across the cluster utilising a CAT 428E tractor-loader backhoe (TLB), split between the individual sites as follows; Kentani 20 no., Klipfontein 26no., Klipfontein 2 17no., Leliehoek 19no. and Sonoblomo 14no. Trial pits were excavated within supplied buildable areas to establish the suitable foundation depth for different structures that may be located in these areas. The trial pits were excavated to a maximum depth of 3.0 m or earlier refusal on weathered rock mass;

(iii) Profiling of all trial pits by a Geotechnical Engineer utilising the latest profiling standards (AEG, 2002). Soil profiles were recorded digitally utilising WinLog (GAEA, 2005) and via photographs;

(iv) Where possible soil profiles were qualified further by in-situ density testing utilising a dynamic probe light (DPL);

(v) Electrical resistance and seismic tomography geophysical surveys to supplement the trial pit and DPSH profiles, and to provide information for corrosion resistance and earth mat design;

(vi) In-situ falling head permeability testing at substation/ collector station localities to establish the permeability of shallow (0.3 m) surface soils, and;

(vii) Representative soil and rock specimens were removed from trial pits and tested by accredited (SANAS) geotechnical laboratories: Simlab (Bloemfontein) and Soillab (Pty) Ltd. (Pretoria).

1.5 Codes of Practices and Standards

SMEC implemented the preliminary geotechnical investigation according to the following documents:

(i) Site Investigation Code of Practice. SAICE Geotechnical Division (2010);

(ii) Guidelines for Soil and Rock Logging of South Africa. AEG/SAIEG/SAICE (2002), and;

(iii) SANS 10160-5: 2011 Basis of Structural Design and Actions for Buildings and Industrial Structures: Part 5: Basis of Geotechnical Design and Actions (2011).

1.6 Limitations of Assessment

The services performed by SMEC were conducted in a manner consistent with the level of care, skill and detail required for Geotechnical Category 1 and 2 structures (SANS 10160-5, 2011). The level of information provided in this report, and by association the recommendations derived from the geotechnical data provided herein, is thus limited to the design of Geotechnical Category 1 or 2 structures. The quantity of investigative positions for the Kentani Cluster was guided by Mainstream supplied scope of work packages. Furthermore, SMEC took guidance from the requirements of both feasibility and detailed design stages as per the Geotechnical Site Investigation Code of Practice (SAICE, 2010) to render sufficient information upon which preliminary engineering design and project economic decisions may be taken.

Although best practice measures were taken during field investigations it is noted that the nature of geotechnical engineering is such that variations in soil conditions may occur even where sites seem to be consistent. Variations in what is reported here may become evident during construction and it is thus imperative that a geotechnical practitioner conducts a detailed geotechnical investigation, requisite with the same level of engineering design, prior to construction of the solar power projects. This will ensure that conditions at variance with those predicted are not left unaddressed in the final designs (SANS 10160-5, 2011).

No groundwater was intersected during the time of geotechnical investigations. It is however possible that certain indications of groundwater levels were latent or otherwise not visible in shallow excavations. Our assessment is based on what was visible at the time the investigation was conducted and therefore it is advised that groundwater levels be reassessed and verified prior to construction and preferably during the wet season. It is the responsibility of the design engineer to ensure that the impact of fluctuating and/or perched groundwater tables, which cannot be readily observed during a short duration investigation, are considered in the final design. Furthermore, the design engineer must also consider the impact of the development on existing surface and subsurface drainage pathways.

It must be noted that the founding recommendation(s) provided herein do not comprise a geotechnical design report and thus this report does not present a design for the proposed foundation support solution(s). Referral to a design solution is conceptual and the design process, as per the latest version of SANS 10160 in general and specifically SANS 10160-5, must be completed as part of another phase of the project.

This report has been prepared for the exclusive use of the client, with specific application to the proposed project.

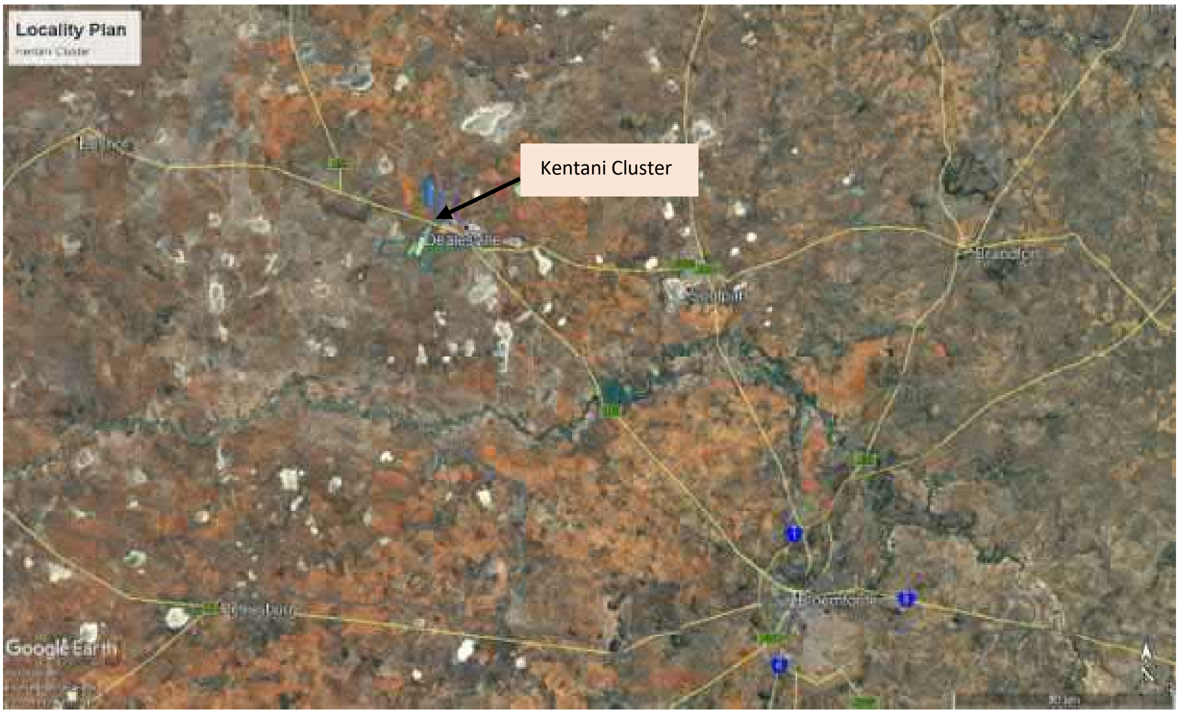
2. SITE CHARACTERISATION

2.1 Site Location and Description

The Kentani Cluster is spread over several properties around Dealesville, approximately 70 km north west of Bloemfontein, Free State Province. The individual sites are accessed either from the R64 or from other provincial gravel roads.

The cluster location is depicted in **Figure 2.1**.

Figure 2.1. Kentani Cluster Locality Plan



The individual properties that comprise the 5no. sites within the cluster are detailed hereunder:

(i) Kentani – located on farms Overschot 31, landowner Christiaan van der Watt, and Remainder of Oxford 1030, landowner Ronelle van Zyl;

(ii) Klipfontein – located on farms Klipfontein 305, landowner Tokologo Municipality, and Kentani 953, landowner Christiaan van der Watt;

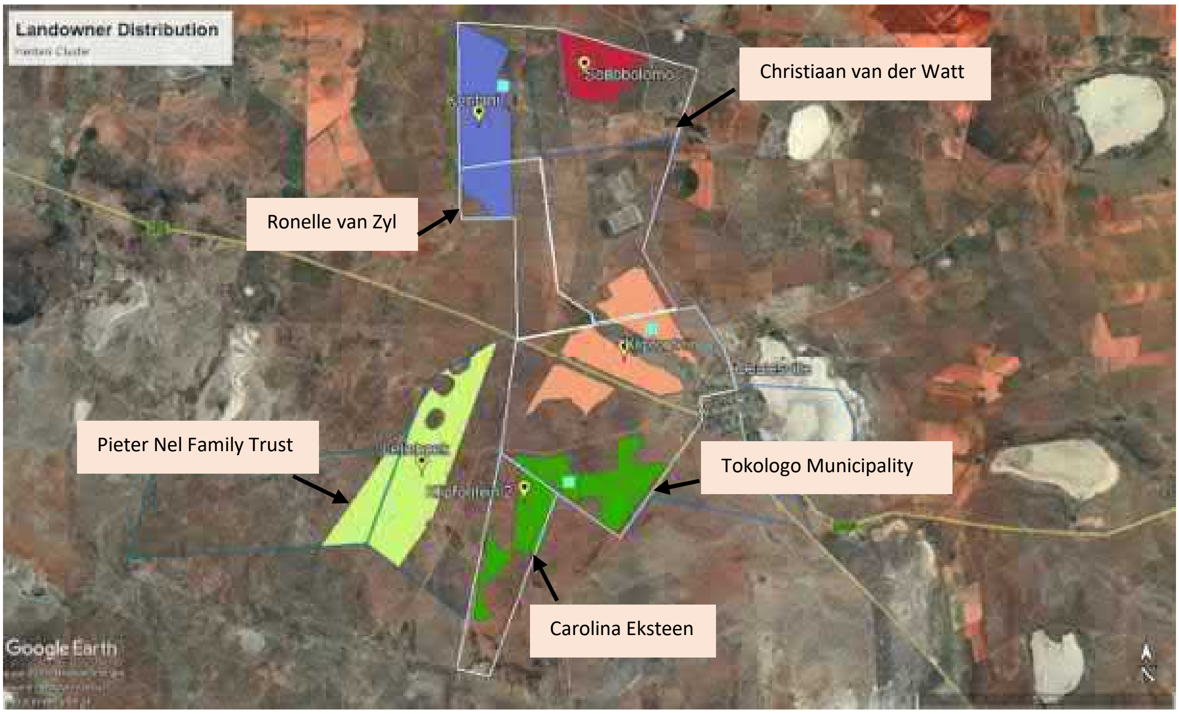
(iii) Klipfontein 2 – located on farms Klipfontein 305, landowner Tokologo Municipality, and Doornranndjes, landowner Carolina Eksteen;

(iv) Leliehoek – located on farm Leliehoek 748, landowner Pieter Nel Family Trust;

(v) Sonoblomo – located on Portion 1 and Remainder of farm Walkerville 1031, landowner Christiaan van der Watt.

The distribution of the individual sites in relation with landowners' properties is presented in **Figure 2.2**.

Figure 2.2. Kentani Cluster Landowner Distribution



2.2 Existing Conditions

The cluster is generally undeveloped and used primarily for grazing. The cluster sites are generally covered by grass with occasional small trees. Outcropping rock, associated with a ridge and a regional high point, is present to the immediate north of the Klipfontein 2 site.

A single drainage channel, which delineates the two portions of the Klipfontein site to the north of the R64, is present on site running in an approximately north west to south east alignment towards a large dam. Water was not observed within the channel or dam so it could not be determined whether this was operational infrastructure. No other drainage channels were observed on site and drainage is assumed to be sheetwash and follows the site topography.

The topographical maps which cover the cluster (2825DA and DB) and Google Earth® imagery indicates the site to slope gently from a high point on farm Klipfontein 305, at the approximate cluster centre, at 1319 mAMSL to 1270 mAMSL at the southern extremity and 1290 mAMSL at the northern extremity of the cluster.

2.3 Site Development

In each project power will be generated by PV solar panel arrays. At the time of investigation, the exact layout and design of the panels was not known, however indicative substation locations were provided. **Figure 2.3** provides an overview of the proposed development areas for the project, highlighting localities of the planned new infrastructure (substations) available at the time of investigation.

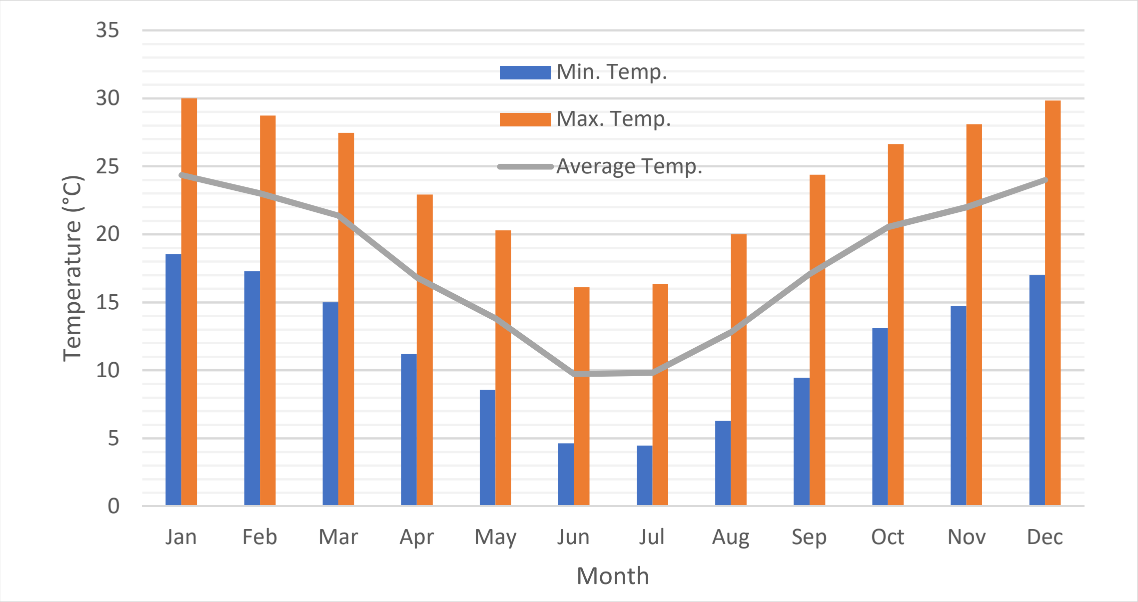
Figure 2.3. Site Development Plan

2.4 Climate

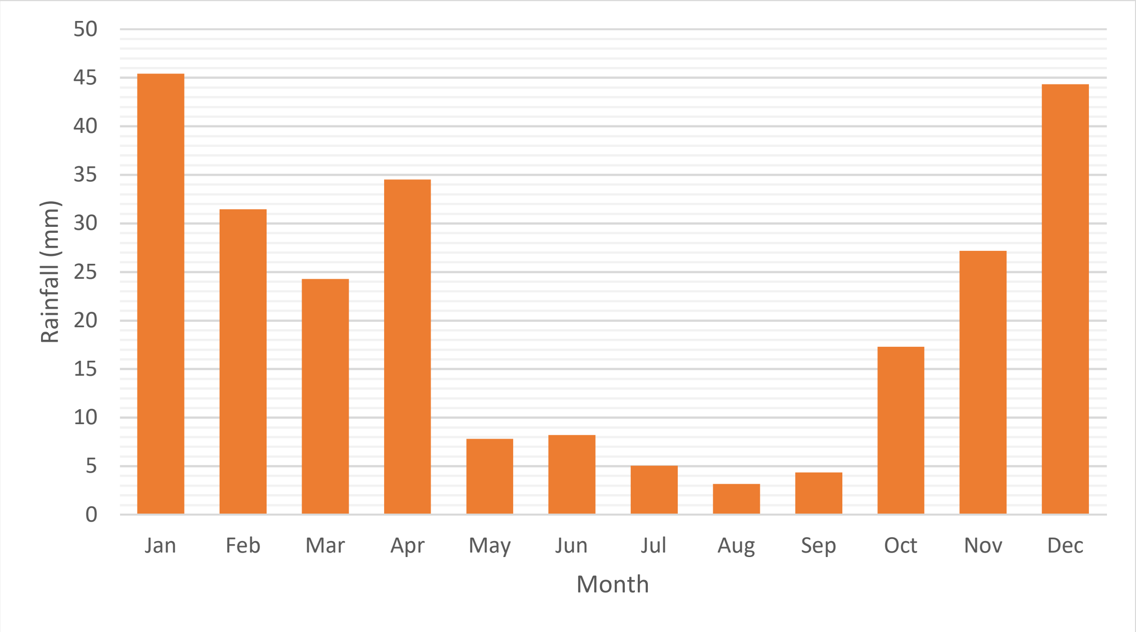
Climatic data available for Dealesville indicates that the locality experiences a semi-arid climate, comprising hot, wet summers and cool, dry winters. Climatic data available from January 2009 to December 2019 indicates that the average maximum daily temperatures vary from 30ºC in December and January to 16ºC in June and July (World Weather Online, 2020). Corresponding minimum temperatures for these months are 17ºC and 4ºC, respectively **(Figure 2.4 [a])**. The mean annual precipitation over this eleven-year period is approximately 253 mm per annum, falling mainly during the summer months **(Figure 2.4 [b]).**

Climate determines the mode and rate of weathering. The effect of climate on the weathering process (i.e. soil formation) can be empirically derived from the climatic N-value as defined by Weinert (1970). The approximate N-value for the area is approximately 5, which indicates that neither physical disintegration nor chemical weathering predominates. This indicates that, both chemical decomposition and mechanical disintegration of rock masses occur in relatively similar ratios in the region resulting in potentially thick soil development across the sites.

Figure 2.4. Summary of Site Climatic Data



(a) Annual Average Monthly Temperatures



(b) Annual Average Monthly Rainfall

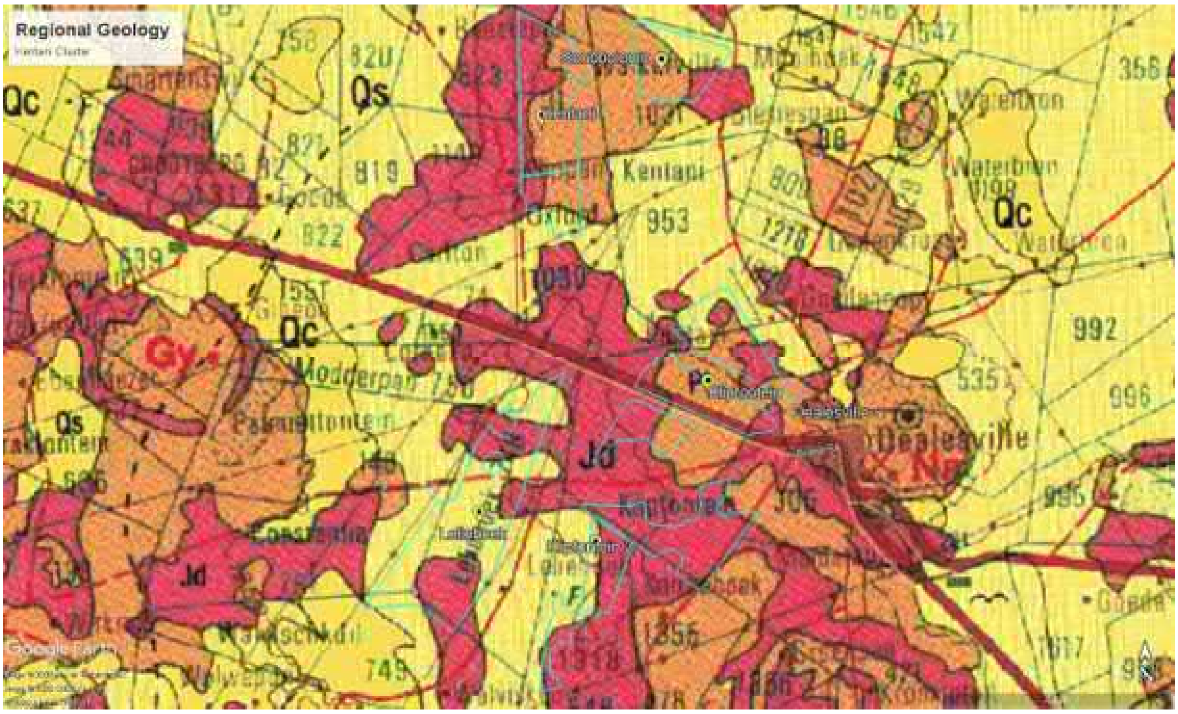
2.5 Geological Setting

The geological map of Kimberley (sheet no. 2824, scale 1:250 000) shows the cluster to be underlain by Quaternary deposits, comprising red and grey aeolian dune sand and shale, siltstone and sandstone of the Tierberg Formation, Ecca Group, Karoo Sequence, which have been intruded into by large expanses of dolerite in the form of dykes and sills. It is likely that the Tierberg Formation and dolerite rock mass underlies the Quaternary sand at depth.

Residual soils originating from the underling geology may display compressible or potentially expansive attributes. Furthermore, the transported Quaternary sand deposits are well documented to display a potentially collapsible soil structure.

An extract of the geological map, indicating the site, is shown in **Figure 2.5**.

Figure 2.5. Extract from Kimberley (2824) Geological Map



Symbol	Stratigraphy	Lithology
Qs	Quaternary deposits	Red and grey aeolian dune sand
Qc	Quaternary deposits	Calcrete
Jd	Intrusive	Dolerite
Pt	Tierberg Group	Shale, siltstone and sandstone

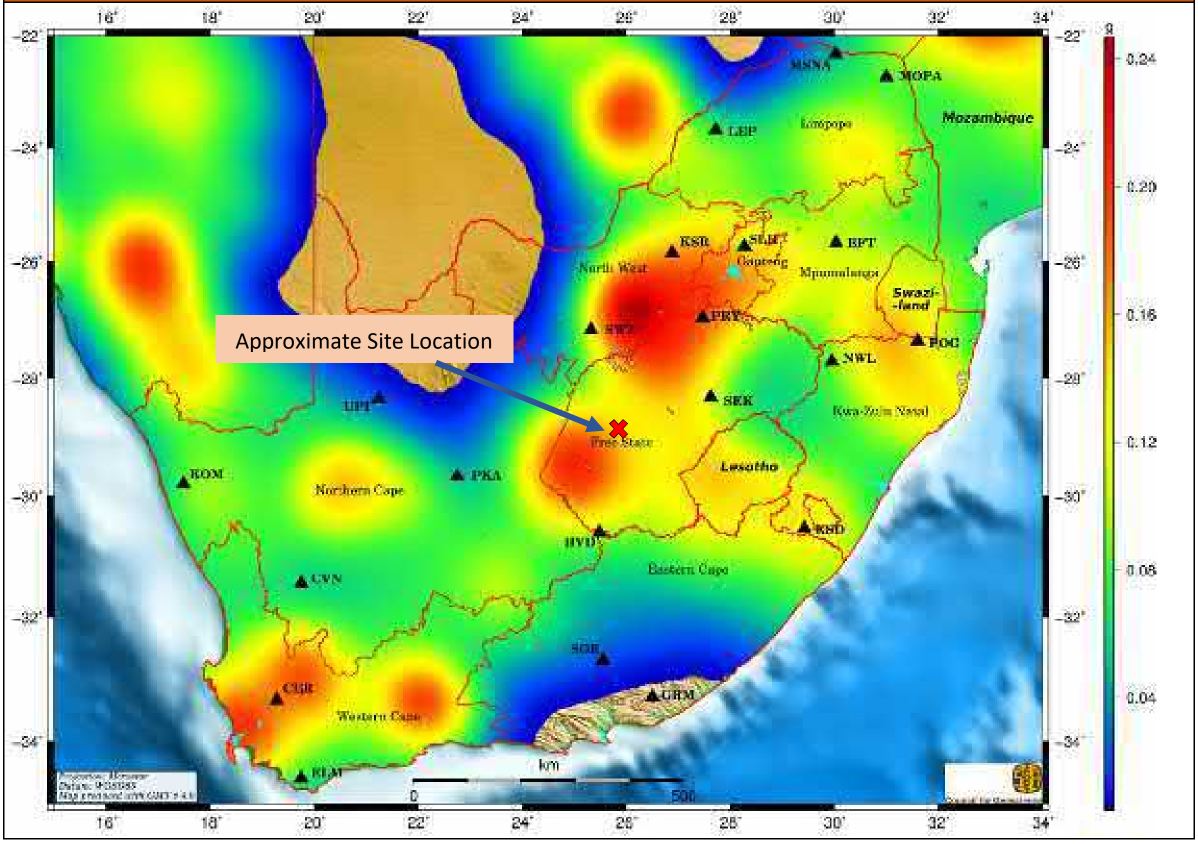
2.6 Seismicity

South Africa is located on the African Tectonic Plate which, in comparison to other tectonic plates, is fairly stable with low degrees of movement. Much of the African Plate – except the East African Rift Zone and localities of intensive underground mining – can be considered to be a zone of low tectonic activity. This does not suggest that no seismic activity occurs but rather that the probability of activity is much lower. Seismic hazard is represented by the peak horizontal ground acceleration (PGA) of any particular area: the greater the PGA the more severe the potential seismic activity at the given site.

Figure 2.6 provides indicative seismic risk across South Africa and the corresponding peak ground accelerations with a 10% probability of exceedance within a 50 year period. For preliminary design purposes a baseline PGA of 0.18g is thus considered applicable, which equates to a VII degree classification on the Modified Mercalli Scale. The South African Loading Code SANS 10160 (Part 4 Seismic Actions for Buildings) requires "ordinary buildings" to be designed for seismic or mining induced seismic activity where PGA exceeds 0.1g.

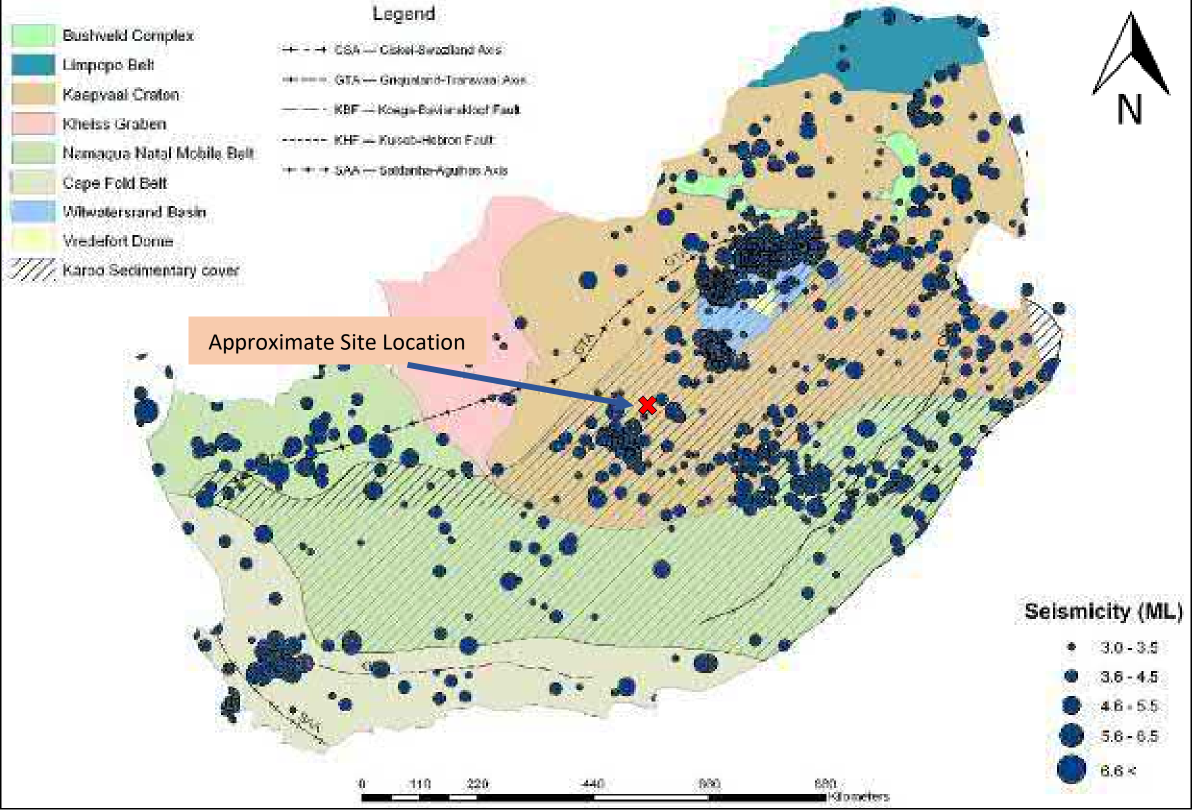
The regional seismicity in the Koffiefontein area, which extends towards Dealesville, is generally higher than one would expect when compared to the general norm across South Africa, outside of the Ceres-Kango-Baviansskloof-Coega (CKBC) fault system and Cape Fold Belt, and localities of intense deep underground mining. This anomalous area is discussed in the paper "Seismotectonics and seismic history of the Koffiefontein region" (T. Mulabisana, E. Chirenje, V. Midzi) in an attempt to understand the geological origins of the relatively high instance of seismic events concentrated in this area. The study uncovered, below the relatively shallow sedimentary rock cover, a high density of deep-seated lineaments are present at multiple orientations. It was concluded that, due to the concentration and orientation of the lineaments, it was difficult to specify which specific orientations influence the seismic activity, but that the seismic events were concentrated on lineament intersections. These intersections represent areas of major crustal deformation and weakness and are usually linked to increased seismicity.

Figure 2.6. Seismic Hazard Map of South Africa by SANSN



In addition to this rating, the South African National Seismic Network (SANSN), a division of the Council for Geoscience, has recorded seismic events across South Africa. For completeness, and to give a complete overview of the seismic setting of the site, this is presented in **Figure 2.7**.

Figure 2.7. Seismic Activity Recorded by SANSN (from Bejaichund et al, 2009)



2.7 Previous Investigations

SMEC has not undertaken geotechnical investigations in the vicinity of the cluster, with the closest located in Bloemfontein, approximately 65 km from Dealesville. Whilst the geology in the area is documented to be relatively consistent, as shown on the geological map, the distance from the site makes information generated by these investigations of little relevance above what has been documented in literature studies.

3. PRELIMINARY GEOTECHNICAL INVESTIGATION

3.1 Overview

Geotechnical investigations were undertaken during 22 June – 3 July 2020. SMEC deployed a Geotechnical Engineer to undertake field investigations as detailed in **Section 1.4**.

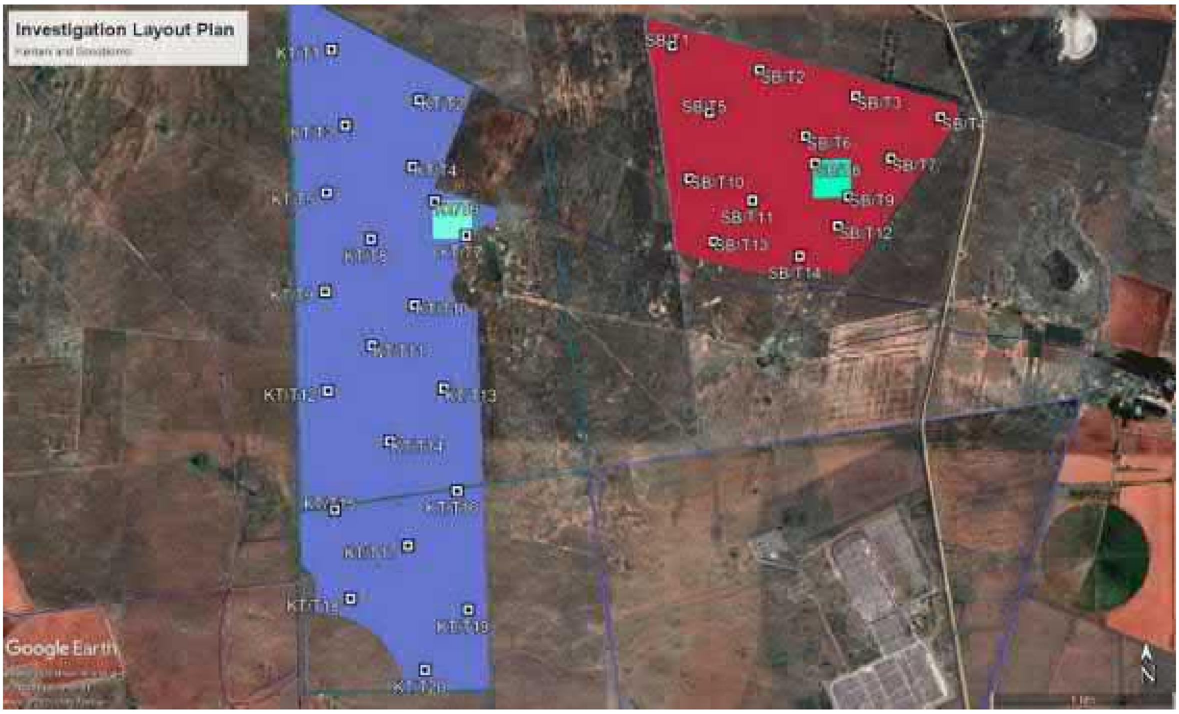
The primary intrusive technique utilised was trial pitting, excavated within the proposed development areas and at key supporting infrastructure (substations). In total 96no. trial pits were excavated.

Dynamic probe light (DPL) tests were conducted within selected trial pits where subsoil conditions were considered suitable (soil cover >0.5 m thick). In total 12no. DPL tests were undertaken.

3no. potential borrow pits were also identified; 2no. small calcrete borrow pits, near Klipfontein and Leliehoek, and a large dolerite quarry/ borrow pit, near Klipfontein 2.

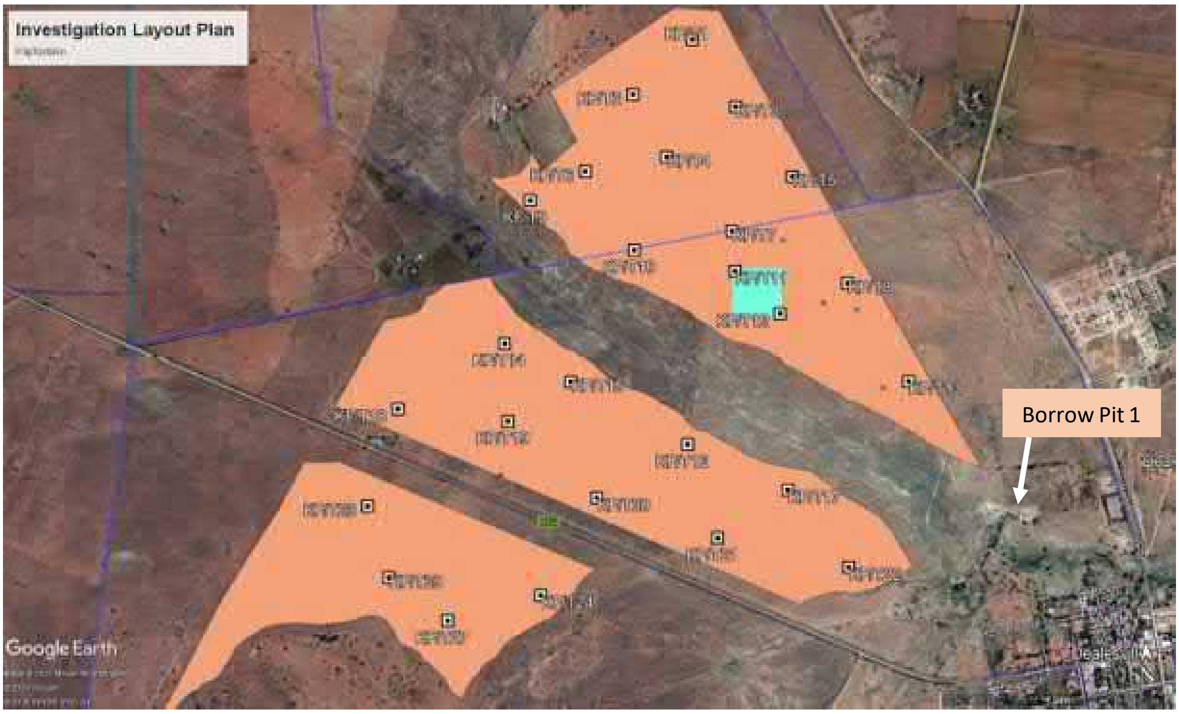
Figures 3.1 (a-d) indicate trial pit positions and potential borrow pits relative to the proposed cluster development areas.

Figure 3.1. Investigation Point Locality Plans

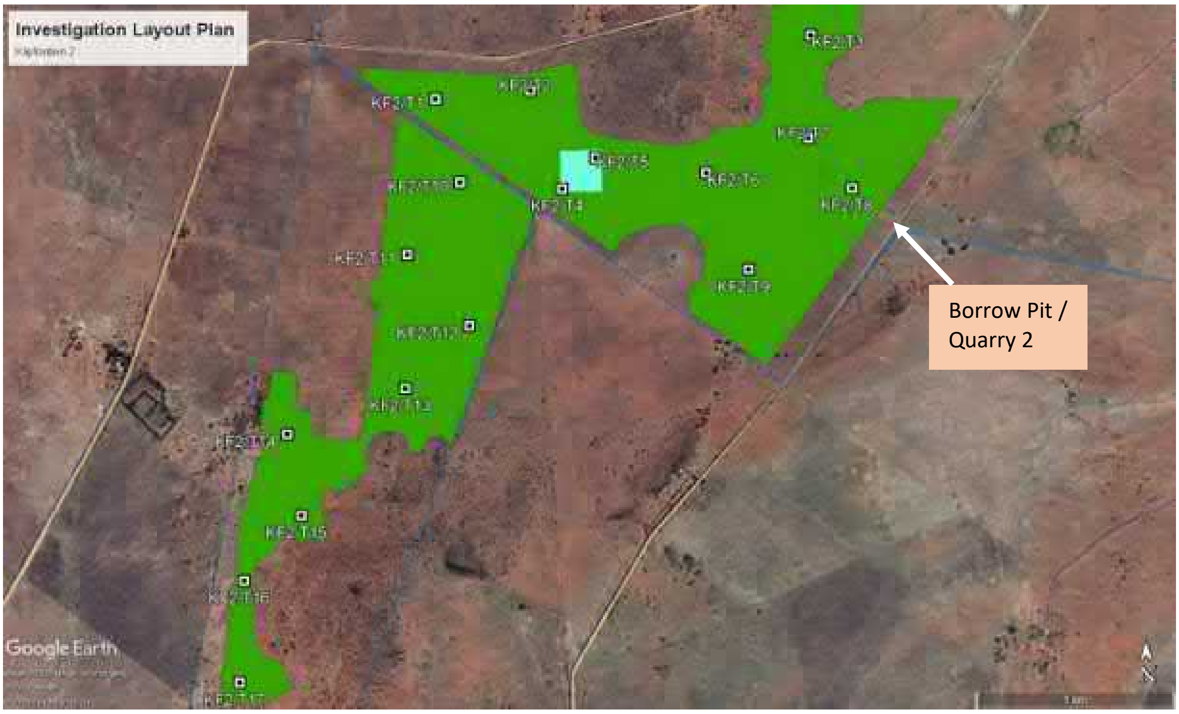


(a) Kentani and Sonoblomo

Figure 3.1. Investigation Point Locality Plans

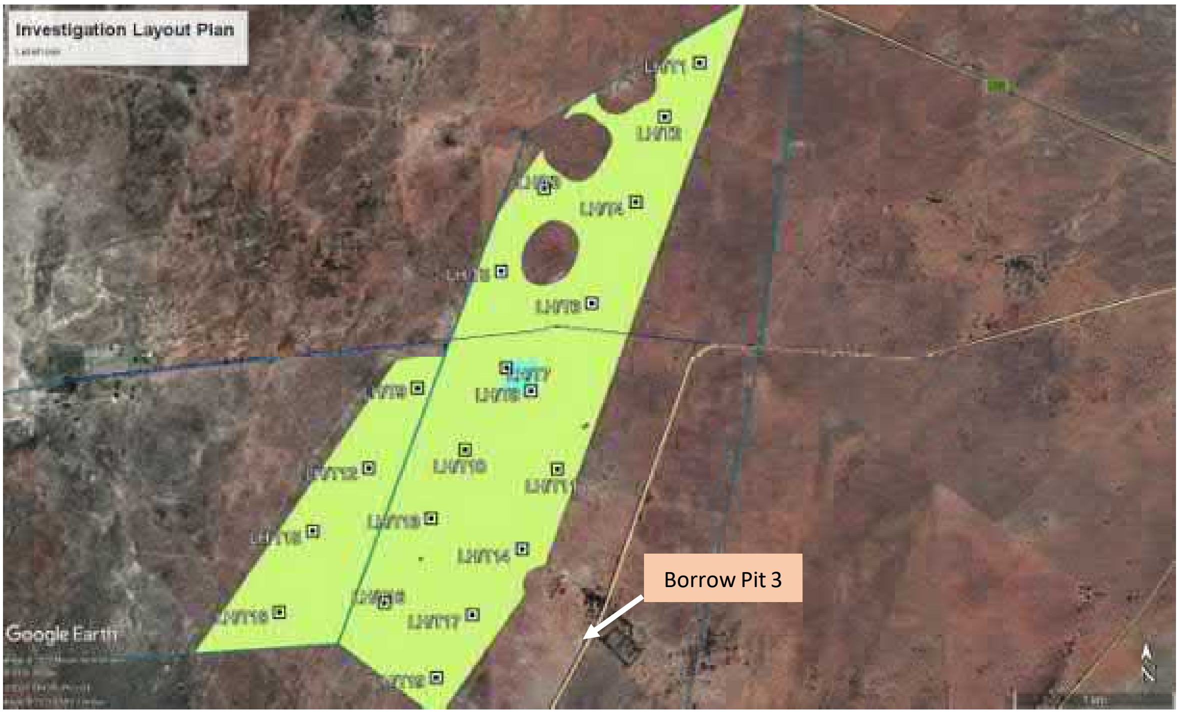


(b) Klipfontein



(c) Klipfontein 2

Figure 3.1. Investigation Point Locality Plans



(d) Leliehoek

3.2 Trial Pit Observations

Trial pits were excavated by CAT 428E TLB across the cluster to depths of between 0.3 m and 3.0 m below existing ground level (EGL). No groundwater was intersected in any trial pits.

The detailed trial pit profiles, accompanied by photographs, are provided as **Appendix A** and the logging and profiling parameters as **Appendix C**.

The generalised profiles observed within the trial pits was comparable over the entire cluster and generally comprised a relatively thin layer (generally 0.5 m thick) of clayey sand (topsoil and transported soils) overlying shallow rock mass; either soft to medium hard rock shale or soft to hard rock dolerite, generally correlating with the documented geology. However, within several trial pits close to indicated contacts, other rock masses were observed, i.e. dolerite where shale is documented. This may be due to limitations in the accuracy of the geological map or small undocumented dolerite intrusions.

Within several trial pits, generally concentrated on Klipfontein and Leliehoek but intermittently present across the cluster, a cemented to strongly cemented calcrete layer was observed between the topsoil/ sand and rock mass, which extended to depths of approximately 1 m below EGL.

Furthermore, very intermittent and relatively thin gravel and clay residual soils were observed overlying the rock mass but did not extend to beyond 1 m below EGL. The highest instance of occurrence was observed on Kentani and Sonoblomo as residual shale, but also within trial pits on Leliehoek (residual dolerite) and Klipfontein (residual shale).

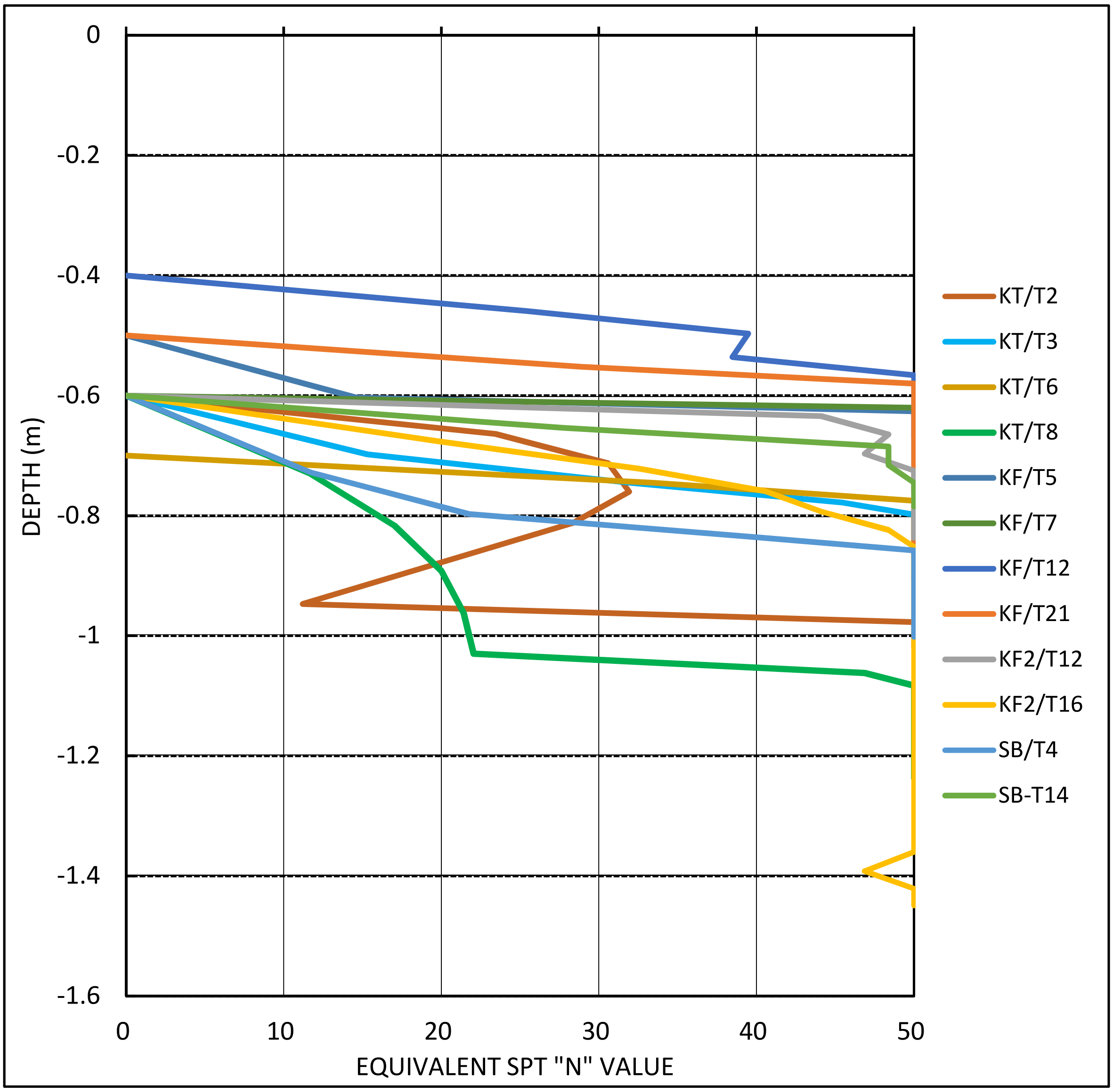
Excavation was possible with the TLB into the soft rock masses but soon either refused on medium hard to hard rock or further progress became uneconomical. On occasion, refusal also occurred on the strongly cemented calcrete.

3.3 DPL Test Results

DPL tests were conducted at 12 no. selected trial pits where a covering of greater than 0.5 m of transported soil was encountered. DPL test results confirmed that the in-situ density of the soils across the cluster is generally loose to medium dense rapidly becoming dense and refusing where rock mass was encountered. At the selected positions, very dense ground / refusal of the DPL occurred between approximately 0.55 m and 1.1 m.

Individual DPL profiles accompany trial pit profiles in **Appendix A**. The consolidated results of the DPLs are given in **Figure 3.2**, which illustrates the relative consistency of ground conditions across the cluster.

Figure 3.2. Consolidated DPL Sounding Profiles for Kentani Cluster



It is important to note that the DPL test provides only a point source of information on the day of testing and it must be anticipated that these will differ both vertically and laterally across the extent of the envisioned infrastructure and even more so during wet conditions. For this reasoning the DPL test is primarily utilised to qualify and calibrate observations made during test pit profiling.

Furthermore, the reader is directed to the detailed trial pit logs for the prevailing site conditions, as the DPLs undertaken within this cluster represent a small minority of locations where shallow rock mass (<0.5 m below EGL) was not encountered.

3.4 In-Situ Soil Permeability

Two in-situ falling head permeability tests were conducted per project site and were undertaken within the upper 300 mm and 300 – 600 mm of the sandy soils.

Individual tests were conducted by excavating a small pit in the surface soils with approximate dimensions 250 mm x 250 mm x 300 mm deep. The pit was then filled with water and the water left to soak into the soils to attempt to simulate saturated conditions. Once the water had been absorbed into the soil, it was filled with water again and the drawdown of water was measured over 100 mm intervals. Using Darcy's empirical law, the hydraulic gradient of water flowing through the soil was determined and from this the approximate permeability of the soil can be determined.

Darcy's empirical law:

$$q = vA = Aki$$

Where:

q = volume of water flowing per unit time (flow rate)

v = discharge velocity

A = cross sectional area inside pit

k = coefficient of permeability (m/s)

i = hydraulic gradient

A summary of the permeability test data and results is provided in **Table 3.1**. Note that the test method has the following limitations:

(i) Tests were conducted in pre-soaked soil whereas Darcy's empirical law is based on water flow through saturated soils;

(ii) Water drawdown rate was assumed to be constant over the assessed depth;

(iii) Tests were terminated after ~30 minutes.

Table 3.1. Summary of In-Situ Falling Head Permeability Test Data

Test	Depth Interval (m)	Cumulative Time Interval (s)	Coefficient of Permeability (m/s)	Drainage Potential*
Kentani (KT/T7)				
1	0.0 – 0.1	2400	8.3×10^{-5}	Good
	0.1 – 0.13	3600	2.1×10^{-4}	Good
2	0.0 – 0.1	2700	7.4×10^{-5}	Good
Klipfontein (KF/T13)				
1	0.0 – 0.09	1800	1.1×10^{-4}	Good
2	0.0 – 0.08	1800	1.1×10^{-4}	Good
Klipfontein 2 (KF2/T5)				
1	0.0 – 0.1	600	3.3×10^{-4}	Good
	0.1 – 0.2	1380	3.8×10^{-4}	Good

Table 3.1. Summary of In-Situ Falling Head Permeability Test Data

Test	Depth Interval (m)	Cumulative Time Interval (s)	Coefficient of Permeability (m/s)	Drainage Potential*
Kentani (KT/T7)				
	0.2 – 0.25	1800	5.4x10^{-4}	Good
2	0.0 – 0.1	720	2.8x10^{-4}	Good
	0.1 – 0.2	1800	2.7x10^{-4}	Good
Leliehoek (LH/T7)				
1	0.0 – 0.1	840	2.4x10^{-4}	Good
	0.1 – 0.18	1800	2.9x10^{-4}	Good
2	0.0 – 0.1	900	2.2x10^{-4}	Good
	0.1 – 0.15	1800	3.1x10^{-4}	Good
Sonoblomo (SB/T9)				
1	0.0 – 0.1	1440	1.4x10^{-4}	Good
	0.1 – 0.12	1800	6.9x10^{-4}	Good
2	0.0 – 0.1	1800	1.1x10^{-4}	Good

Notes:
*B. Look (2007)

3.5 Groundwater

During field investigations no groundwater was intersected in any of the trial pits excavated. A detailed geohydrological assessment was not part of SMEC's appointment, however a brief review of the aquifer classification and groundwater quality maps of South Africa (Conrad et al, 1999) indicate the following:

(i) The cluster is underlain by a minor aquifer region of moderate yielding and variable quality water, and;

(ii) The groundwater generally has low to moderate dissolved salt contents (low to moderate electrical conductivity).

As the rock mass is relatively shallow across the site, it is anticipated that seasonal groundwater levels between soil and rock mass will have a negligible effect on foundation design however it will need to be considered in stormwater flow and drainage designs. For the purpose of groundwater utilisation for construction a detailed geohydrological assessment of the site will need to be conducted to determine water depth, quality and yields.

3.6 Borrow Pits

All 3 no. borrow pits have been identified in the vicinity of the cluster. 2no. borrow pits are small calcrete sources and 1no. borrow pit / quarry comprises weathered dolerite. The borrow pits have been labelled borrow pit 1 to borrow pit 3 and their distribution across the cluster is shown in **Figure 3.1**. A summary of the borrow pits is provided in **Table 3.2** hereunder. More detailed borrow pit assessment sheets with photographs are provided as **Appendix B**.

A discussion on borrow pit material quality and quantity is provided in **Section 6.3.4**.

Table 3.2. Summary of Identified Borrow Pits

BP	Geology	Material Potential (Visual Assessment)	Potential Reserves	Excavatability
1	Calcrete	Selected layerworks (G5 to G7)	~2 000 m³**	Soft to Intermediate Excavation
2*	Dolerite	Selected layerworks (G5 to G7) with additional development via blasting for better than G4 material	~50 000 m³	Soft to Intermediate Excavation
3	Calcrete	Selected layerworks (G5 to G7)	~2 500 m³**	Soft to Intermediate Excavation

Notes:
* Current extents of the source overlaps with proposed Klipfontein 2 development site.
** Potential for expansion of these sources.

It is noted that SMEC was not appointed to undertake a detailed borrow pit prospecting campaign. As such details provided in **Table 3.2** and supporting borrow pit assessment sheets (**Appendix B**) are based on field observations and limited laboratory testing done on samples taken from test pits in a similar profile. No trial pits have been excavated and no laboratory samples have been taken directly from potential borrow pits. Reserve potentials have been estimated from anticipated profile thicknesses (as observed in outcrops) and linear extent as observed on site exposures and Google Earth® imagery.

3.7 Geophysical Surveys

35no. Electrical Resistivity and 30no. Seismic Refraction geophysical surveys were undertaken by Geofocus (Pty) Ltd at locations across the cluster during August 2020. The survey sites are all 100 m in length.

A single resistivity survey site was undertaken in both north-south and east-west alignments at the proposed substation locations. The majority of the other surveys are single 100 m long lines in either north-south or east-west alignments, with selected sites at oblique angles, perpendicular to geological features (contacts, faults, etc.) indicated on the geological map.

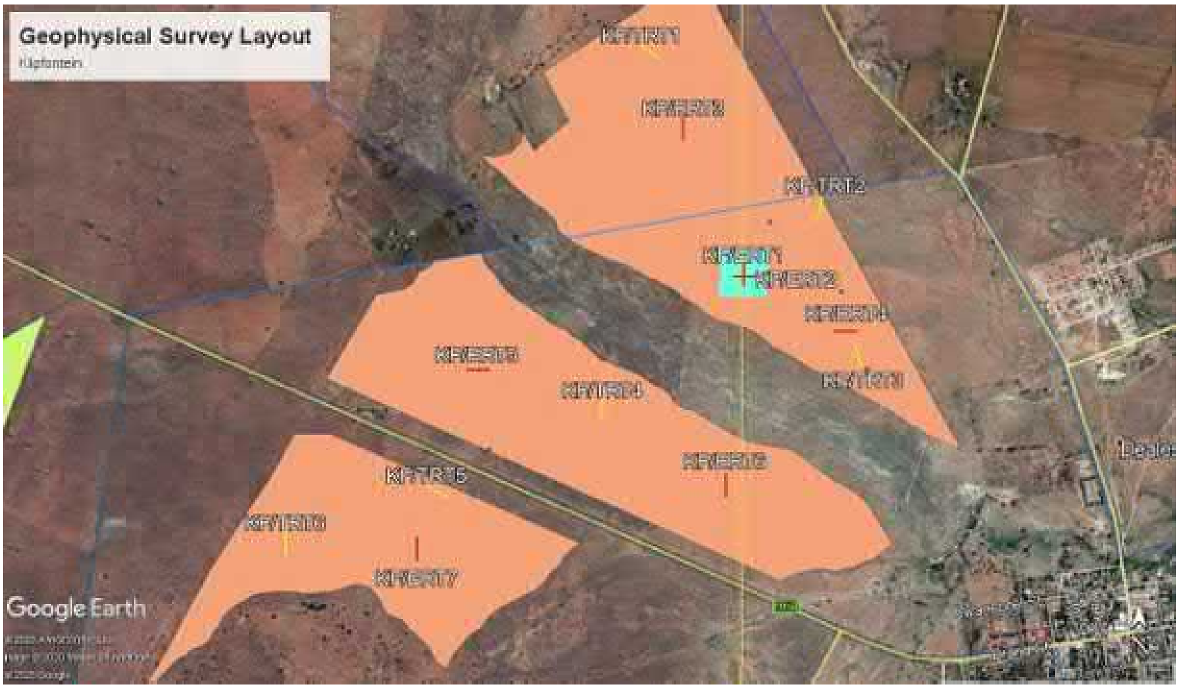
The objective of these surveys was to supply information about ground resistance, corrosivity, and geological competence and layering with depth, such that this information can be used to aid the grounding and design of the solar PV panels and other infrastructure. A fourth objective was to provide information on the water table where possible, but with 100m long survey profiles the depth of penetration is considered too low in almost all cases.

The detailed report supplied by the geophysical subconsultant is provided in **Appendix D**, and the findings summarised in the following sub-sections.

The layout of the geophysical surveys is given in **Figure 3.4 (a)** to **(d)**.

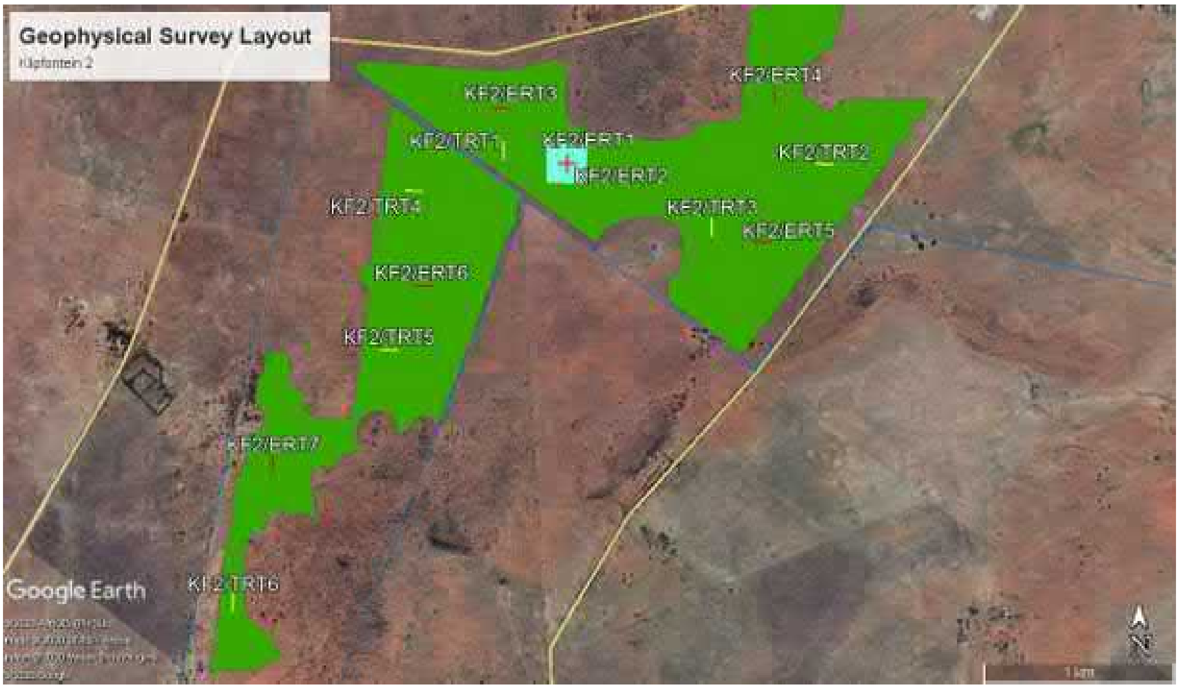
Figure 3.3. Geophysical Survey Layout Plan

(a) Kentani and Sonoblomo

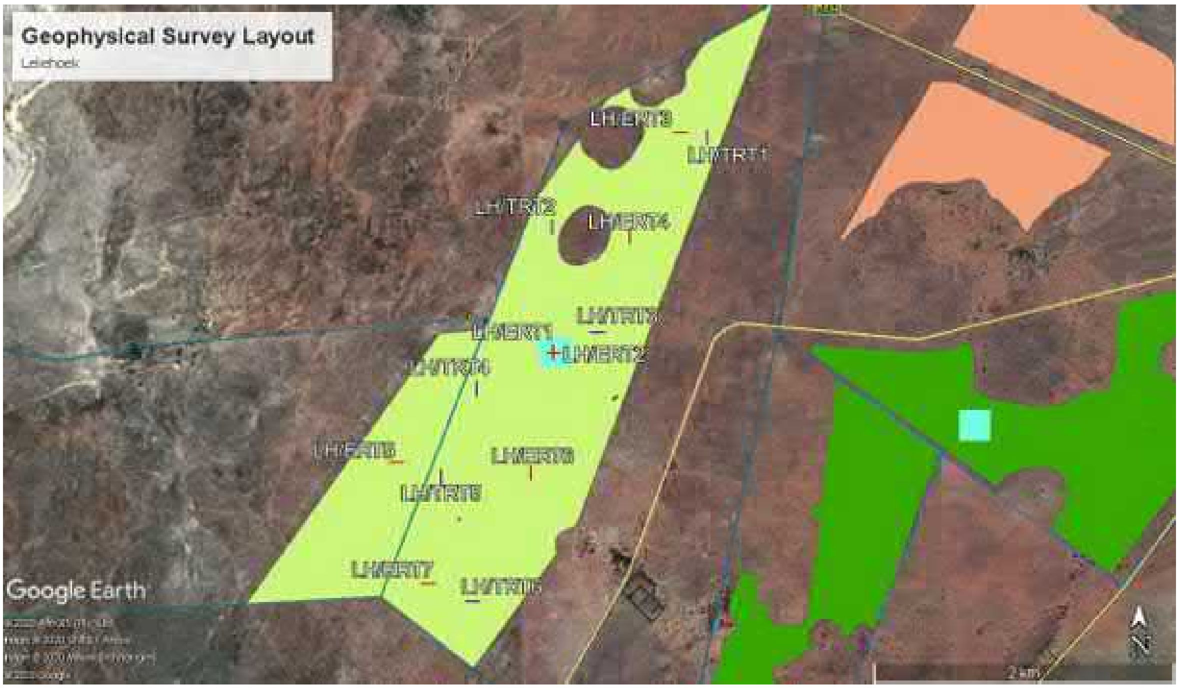


(b) Klipfontein

Figure 3.3. Geophysical Survey Layout Plan



(c) Klipfontein 2



(d) Leliehoek

3.7.1 Electrical Resistivity Survey

An ABEM LS Terrameter resistivity instrument was used to measure ground resistance at each 100 m long resistivity profile, as shown in red in **Figure 3.4**. For each electrode spacing along the traverse, the resistivity was measured by recording the current sent to the outer electrodes, and the voltage measured across the two inner electrodes (Wenner method). Note that with the Wenner array method, the spacings between electrodes are always equal and the array is simply expanded from a 1 m spacing to a 24 m spacing.

(a) Kentani

The first five resistivity traverses KT/ERT1-5 show the same type of section, being the classic deep blue, usually interpreted as a sand profile, although in this case highly weathered rock mass is probable, correlating with the observed weathered shale and dolerite rock mass profiles, with thin calcretised surface layer. KT/ERT6 is very different, showing highly resistive rock mass up to 3000 ohm.m as shallow as 3 m deep, probably as a result of shallow dolerite, as observed within trial pits KT/T12 and LT/T15 in the locality. KT/ERT7 appears to show a thick sand/ weathered soft rock layer with hard rock mass starting to appear at around 8 m depth.

(b) Klipfontein

The resistivity sections for this site are the classic deep blue interpreted sand/ clay rich weathered lithology sections (with calcretised layer at surface) except for traverse KF/ERT3 which shows moderately resistive rock mass at a depth of 2.5 – 8 m, correlating with shallow dolerite rock mass, observed in trial pits KF/T3 and KF/T4. There is no sign of hard rock mass on the other profiles except for a hint on traverse KF/ERT4 at 15 m depth. The geological map shows considerable dolerite on this site, so this is an enigma. It is likely that the interpreted sand profiles actually represent highly weathered, clay-rich weathered rock mass material.

(c) Klipfontein 2

This site is different in as much as KT2/ERT1 – 6 resistivity sections are dominated by resistive rock mass and not the usual deep blue sand/ clay-rich weathered lithology profiles prevalent elsewhere. KF2/ERT1 and KF2/ERT2 are classic examples, showing shallow, highly resistive rock at depths of 2.5 m to 4 m, with only a thin layer of low resistivity material above this. KF2/ERT4-6 are similar except the resistive rock mass is deeper, varying from 5 m to 8 m deep. The interpretation here would lean towards dolerite, being close to surface or covered by varying thicknesses of sand, which correlates well with the observed outcropping dolerite and shallow dolerite rock mass observed within the trial pits. KF2/ERT7 is the only classic deep blue interpreted highly weathered shale rock mass profile showing no hard rock mass up to 12.5 m, again correlating with the weathered shale rock mass observed within the trial pits in that locality.

(d) Leliehoek

In terms of resistivity, Leliehoek is a mixture of low, moderate and highly resistive sites. Traverse LH/ERT3 shows very resistive rock mass at a shallow depth of 2-4 m, which may result in softer dolerite outcrop/ very shallow rock mass. By contrast, traverses LH/ERT1, 2 and 5 all show very low resistivity material (presumably highly weathered shale rock mass, as observed within the trial pits) below a thin resistive surface layer (presumably calcrete). There is no sign of hard rock mass at depth on these traverses. LH/ERT4, 6 and 7 all show moderate resistivities most likely associated with shallow, weathered Karoo shales and siltstones, or, more likely, shallow weathered dolerite as observed within the trial pits in that locality. LH/ERT6 shows an 8 m wide low resistivity zone which is likely the contact between the dolerite and Tierberg Formation sedimentary rock masses, as indicated on the geological map.

(e) Sonoblomo

At Sonoblomo there are two general types of resistivity profiles; those observed at SB/ERT1, 2 and 5, show moderate resistivity values in green throughout (200 – 600 ohm.m), whilst the other type at SB/ERT3, 4, 6 and 7 show very low resistivities, less than 50 ohm.m, in deep blue colours. The latter usually have a thin resistive surface layer potentially representing well developed calcrete, up to 4 m thick on SB/ERT7. This layer probably overlies highly weathered shale. None of these show any more resistive hard rock mass up to 15 m depth. In contrast, the former 3 traverses have a thin high resistivity layer near surface, likely corresponding to shallow hard rock mass, which was identified in several trial pits in that area. Both ERT1 and 2 show sharp sub-vertical structures which could represent geological contacts between the dolerite and Tierberg Formation rock mass, documented in close proximity by the geological map.

3.7.2 Seismic Survey

A Geometrics Geode instrument (24-channel seismograph) was used for the seismic refraction measurements. A generalised array (essentially a line of geophones) was laid out, in this case 5 m apart, and their positions and elevations recorded. A seismic source was then activated some distance away from the end of the array, or along the array as the survey progresses. A sledge hammer and metal plate were used as a source in this case. As the hammer strikes the plate it sends a pulse of energy into the ground, which is then received at different times by the various geophones. Usually the plate is struck several times, stacking the signal on the seismograph until an acceptable record is obtained.

For P-wave measurements, the exploration depth when using a hammer and plate as the energy source, is typically of the order of 20 m. By moving the shot points and calculating the velocity at each geophone location, a profile of the subsurface velocities can be created in 2D section. Processing requires the selection of first-arrival times, which are compiled into travel-time curves. The first-arrival times are then assigned to layers with different acoustic velocities. Once this is complete a layered model can be produced. The interpretation package SeisImager is used in this process, with the output being a three-layer model or multilayer model as appropriate. The interpreted outcome is a cross section from which the degree of weathering and/or thickness of overburden soils and rock may be inferred.

For the seismic analysis at the cluster it was assumed that the transition between weathered and fresh rock mass can be taken at 2 500 m/s which is generally considered the standard, although competent weathered rock may be considered as low in velocity as 2 000 m/s depending on the rock type. Measurements >3 000 m/s can be assumed to be fresh rock mass. The results of the seismic survey are summarised per project site hereunder.

(a) Kentani

KT/TRT5 and KT/TRT6 display high velocities in red at depth with very shallow, competent rock mass, correlating with hard rock shale that was observed in the trial pits in that locality. The other 4 sections all show moderate velocities in the orange colours (3000 – 3500 m/s), more consistent with softer shales. Hard rock mass varies in depth from 1 m (KT/TRT5, essentially outcrop) to 16 m (KT/TRT1, from 60-110 m laterally within the traverse). Mostly hard rock mass is of the order of 6-8 m depth.

(b) Klipfontein

Only KF/TRT5 and KF/TRT6 show the shallow, high velocity rock mass one would associate with dolerite. Rock mass is similarly shallow on KF/TRT4, but this may be shale as its velocities are low, around 3000 m/s, correlating well with the soft shale observed within the trial pits in that locality. At KF/TRT3 the same rock type occurs, but the weathering profile is thicker and the gradation to fresher rock is slow. Hard rock mass is deep, at 15-20 m at KF/TRT1 and is likely overlain by weathered rock mass (shale). KF/TRT2 shows only yellow, low velocity material typical of weathered rock and in fact, hard rock mass is not encountered even as deep as 20 m. The assumption is that a localised, deep highly weathered rock mass is present at this site, which potentially may be a result of a documented contact between the dolerite and Tierberg Formation (shale) at that location.

(c) Klipfontein 2

The seismic refraction datasets show high velocity fresh rock mass at around 5-10 m on all sections except for KF2/TRT6, which is very different, correlating well with the documented geology and trial pit observations. The latter shows a thickly developed weathered profile (in yellow) down to 20 m or more, and in fact high velocity rock mass is not seen. The rock mass at KF2/TRT4 may well be different in nature, because although it is shallow is does not reach the high velocity red colours of KF2/TRT1, 2, 3 and 5 but remains in the orange at 3000 – 3500 m/s. It is possible the rock mass at KF2/TRT4 is shale or siltstone, and dolerite at the other four sites.

(d) Leliehoek

All the seismic refraction profiles at Leliehoek are similar, varying only in the depth to high velocity (3000 m/s) rock mass, from 5 m to 20 m deep. LH/TRT1 shows relatively shallow hard rock mass, as shallow as 4 m, whilst at LH/TRT6 rock mass is the deepest at around 20 m. Varying thicknesses of sand cover can explain this, as can variable depth-of-weathering, and, given the trial pit profiles, is highly likely to be weathered profiles. High values are seen for all traverses, well into the red colours being 4000 – 4500 m/s, except for LH/TRT4. One would expect this to be a very competent rock, most likely dolerite. LH/TRT4 may be located on a lower velocity rock type such as shale, which correlates with the trial pit observations in that locality.

(e) Sonoblomo

At all six of the seismic sections at Sonoblomo lower velocities were recorded throughout and none of the traverses have the strong red colours towards the base that are seen in five of the Leliehoek traverses. In general, only orange colours representing 3000 – 3500 m/s are seen at Sonoblomo. Normally this would indicate different rock mass, most likely shale. Depth to fresh rock mass for all traverses varies between 8 m (SB/TRT6) and 20 m (SB/TRT2). SB/TRT3 also shows substantial weathering, down to 15 m in places.

4. LABORATORY TEST RESULTS

Laboratory tests were scheduled to confirm the observations made during on-site investigations, establish preliminary engineering properties and identify any problem soils. Bulk soil samples were taken from the trial pits and sent to SANAS accredited laboratories for testing. The main objective for the cluster was to:

(i) Establish the material utilisation potential of the soils;

(ii) Identify any potential problematic soils;

(iii) Establish soil geomechanical properties, and;

(iv) Establish the materials aggressivity towards buried infrastructure.

Tests conducted on material from site include:

(i) Index testing (foundation indicator) to determine particle size distribution and activity;

(ii) Moisture Content tests to assess moisture content range for thermal resistivity analyses and in-situ density evaluation;

(iii) Proctor moisture density relationships to assess optimum moisture content and compaction requirements for thermal resistivity analyses;

(iv) Modified AASTHO, CBR and Compactability tests to evaluate on-site material compaction and density potential;

(v) Shearbox tests on granular soil samples to approximate soil shear characteristics;

(vi) Chemical tests including pH, electrical conductivity, sulphate, chloride and organic matter content to determine in-situ soil aggressivity towards buried services and foundations;

(vii) Thermal Resistivity tests on remoulded samples to approximate design parameters for buried electrical cables.

Tables 4.1 – 4.5 provide a summary of the laboratory test results. For detailed test results refer to **Appendix E**.

Table 4.1. Summary of Soil Index Properties

Trial Pit	Depth (m)	Description*	Particle %				GM	Equiv. PI	LL	LS	In-situ Moisture (%)	Chemical Analysis		USCS Classification & Activity
			Clay	Silt	Sand	Gravel						pH	EC (S/m)	
Kentani														
KT/T2	0.8-2.5	Sandy GRAVEL	1	5	21	73	2.58	1	36	5.0	10.9	8.42	0.0690	SP-SM, Low, Class B.
KT/T3[3]	0.2-0.6	Sandy CLAY	33	12	54	1	0.51	16	36	7.0	15.6	7.39	0.0688	CL, Medium, Class D.
KT/T4	0.8-1.9	Gravelly SAND	2	9	48	41	1.77	6	42	5.0	9.3	8.36	0.0845	SM, Low, Class A.
KT/T6	0.5-1.8	Sandy GRAVEL	3	11	22	64	2.30	4	45	8.5	10.0	-	-	SM, Low, Class A.
KT/T7	0.8-2.0	Sandy GRAVEL	3	10	21	66	2.35	3	44	9.0	9.4	8.48	0.0625	SC, Low, Class A.
KT/T8[3]	0.2-1.0	Clayey SAND	23	20	55	2	0.65	11	32	6.0	14.8	-	-	SC, Low, Class D.
KT/T8[3]	0.2-1.0	Sandy CLAY	34	8	58	0	0.54	17	36	7.0	11.8	-	-	SC, Medium, Class D.
KT/T11	0.3-2.2	Sandy GRAVEL	8	5	23	64	2.33	4	44	9.5	10.9	8.53	0.0542	SC, Low, Class A.
KT/T13[3]	0.3-0.9	Sandy CLAY	34	18	48	0	0.50	28	63	14.0	14.4	8.24	0.3400	MH, High, Class D.
KT/T14[3]	0.2-0.7	Sandy GRAVEL	1	1	14	84	2.71	1	44	8.0	7.3	-	-	GW, Low, Class B.
KT/T16	0.7-1.6	Sandy GRAVEL	1	2	17	80	2.66	2	59	8.5	8.7	8.57	0.0599	GP, Low, Class B.
Klipfontein														
KF/T1[1]	0.4-1.5	Gravelly SAND	1	3	79	18	1.84	SP	-	1.0	2.7			SP, Low, Class B.
KF/T5[1]	0.3-0.9	Gravelly SAND	1	6	71	22	1.75	SP	-	1.0	3.0			SP, Low, Class B.
KF/T6[1]	0.3-1.5	Gravelly SAND	1	7	54	38	2.16	NP	-	0.0	3.3	7.74	0.0649	SP-SM, Low, Class B.
KF/T7[1]	0.3-1.4	Gravelly SAND	1	3	82	15	1.81	SP	-	1.0	3.3			SP, Low, Class B.
KF/T9[3]	0.3-0.7	Sandy CLAY	52	10	38	0	0.34	25	52	10.5	11.1			CH, Med, Class D.

Table 4.1. Summary of Soil Index Properties

Trial Pit	Depth (m)	Description*	Particle %				GM	Equiv. PI	LL	LS	In-situ Moisture (%)	Chemical Analysis		USCS Classification & Activity
			Clay	Silt	Sand	Gravel						pH	EC (S/m)	
KF/T11[2]	0.6-1.9	Gravelly SAND	6	12	60	22	1.46	9	58	7.0	13.2			SM, Low, Class D.
KF/T12	0.8-2.4	Sandy GRAVEL	5	5	34	56	2.27	4	55	11.5	5.9	-	-	SW-SM, Low, Class A.
KF/T16	0.2-2.2	Sandy GRAVEL	3	0	23	74	2.59	2	45	9.5	5.6	7.72	0.0527	GP, Low, Class A.
KF/T18[2]	0.4-0.8	Gravelly SAND	3	8	64	25	1.68	2	31	2.5	8.8			SM, Low, Class B.
KF/T22	0.3-2.2	Sandy GRAVEL	1	6	20	73	2.52	3	45	8.5	6.6	-	-	GP-GM, Low, Class A.
KF/T27[2]	0.4-0.8	Gravelly SAND	2	12	51	35	1.82	NP	-	0.0	4.4	7.78	0.0243	SM, Low, Class B.
Klipfontein 2														
KF2/T1[1]	0.5-1.4	Sandy GRAVEL	1	3	46	50	2.21	2	34	3.0	4.3	8.06	0.0264	SW-SM, Low, Class B.
KF2/T3[1]	0.3-0.9	Gravelly SAND	1	3	55	41	2.14	1	26	2.0	3.4	-	-	SW-SM, Low, Class B.
KF2/T4[1]	0.8-1.7	Sandy GRAVEL	2	10	38	50	2.10	2	25	2.5	3.0	7.55	0.0407	SW-SM, Low, Class B.
KF2/T5[1]	0.4-1.0	Gravelly SAND	1	4	49	46	2.15	1	31	3.5	3.1	7.72	0.0184	SW-SM, Low, Class B.
KF2/T8[1]	0.4-1.1	Gravelly SAND	1	4	58	37	2.02	1	23	2.0	2.5	-	-	SW-SM, Low, Class B.
KF2/T9[1]	0.4-1.2	Sandy GRAVEL	1	5	29	65	2.45	1	34	4.5	2.9	7.48	0.0514	SP-SM, Low, Class B.
KF2/T12[1]	0.6-1.7	Sandy GRAVEL	1	10	43	46	2.14	2	32	4.0	3.2	4.51	0.0356	SW-SM, Low, Class B.
KF2/T14[1]	1.1-1.8	Gravelly SAND	26	11	35	28	1.37	12	45	10.0	9.0	8.14	0.3060	SC, Low, Class D.
KF2/T16	1.0-3.0	Sandy GRAVEL	1	9	35	55	2.24	2	33	5.5	3.1	7.52	0.0527	SW-SM, Low, Class A.
KF2/T16	1.0-3.0	Sandy GRAVEL	10	5	25	60	2.26	4	52	10.0	9.4	-	-	SM, Low, Class D.
KF2/T17[2]	0.5-1.3	Gravelly SAND	1	7	77	15	1.29	NP	-	0.0	6.6	8.31	0.0516	SM, Low, Class B.

Table 4.1. Summary of Soil Index Properties

Trial Pit	Depth (m)	Description*	Particle %				GM	Equiv. PI	LL	LS	In-situ Moisture (%)	Chemical Analysis		USCS Classification & Activity
			Clay	Silt	Sand	Gravel						pH	EC (S/m)	
Leliehoek														
LH/T2[1]	0.4-0.8	Gravelly SAND	5	6	45	44	1.96	3	33	4.5	6.3	7.52	0.0269	SC, Low, Class A.
LH/T3[1]	0.4-0.8	Gravelly SAND	3	3	52	42	2.09	2	30	5.0	4.6	7.28	0.0229	SW-SC, Low, Class A.
LH/T5	0.3-2.7	Sandy GRAVEL	1	4	18	77	2.64	1	40	6.0	9.7	7.85	0.0578	SW-SM, Low, Class B.
LH/T7[2]	0.4-1.2	Sandy GRAVEL	5	7	32	56	2.17	3	34	4.0	8.1	8.39	0.0497	SM, Low, Class B.
LH/T9	0.8-2.5	Gravelly SAND	9	18	48	25	1.55	8	45	9.0	9.7	8.64	0.0534	SM, Low, Class A.
LH/T14[1]	0.3-0.8	Sandy GRAVEL	1	6	23	70	2.46	1	27	2.5	8.6	8.10	0.0667	GP-GC, Low, Class B.
Sonoblomo														
SB/T1	0.5-1.4	Sandy GRAVEL	1	8	23	68	2.44	1	23	2.0	10.3	8.18	0.0534	GP-GC, Low, Class B.
SB/T3[1]	0.6-1.1	Sandy GRAVEL	2	12	40	46	2.15	2	38	5.5	1.6	-	-	SM, Low, Class B.
SB/T4[3]	0.4-0.5	Clayey SAND	28	14	57	1	0.57	13	36	6.0	-	8.05	0.0688	SC, Medium, Class D.
SB/T7	0.3-3.0	Sandy GRAVEL	1	5	22	72	2.54	1	47	6.5	9.2	8.01	0.0652	GP-GM, Low, Class B.
SB/T8	0.3-2.1	Sandy GRAVEL	5	5	17	73	2.47	1	31	4.0	7.6	-	-	GP-GM, Low, Class B.
SB/T9	0.3-0.6	Sandy GRAVEL	5	8	34	53	1.99	3	39	2.5	10.4	8.23	0.0629	GM, Low, Class A.
SB/T10	0.3-2.1	Gravelly SAND	7	22	39	32	1.58	7	48	7.0	11.9	8.21	0.0578	SM, Low, Class A.
SB/T10	0.3-2.1	Sandy GRAVEL	9	8	41	42	1.84	8	56	9.5	9.8	-	-	SM, Low, Class A.
SB/T13	0.5-1.8	Sandy GRAVEL	2	4	17	77	2.55	2	38	5.0	2.3	8.14	0.0651	GP-GM, Low, Class B.
SB/T14[1]	0.6-1.1	Sandy GRAVEL	1	7	41	51	2.26	1	29	3.5	4.7	-	-	SP-SC, Low, Class B.
Notes:														

Table 4.1. Summary of Soil Index Properties

Trial Pit	Depth (m)	Description*	Particle %				GM	Equiv. PI	LL	LS	In-situ Moisture (%)	Chemical Analysis		USCS Classification & Activity
			Clay	Silt	Sand	Gravel						pH	EC (S/m)	

GM =	Grading Modulus	SM=	Silty sands/ sand-silt mixtures	Classification in terms of TRH20	
PI=	Equivalent Plasticity Index (whole sample)	SC=	Clayey sands/ sand-clay mixtures	Class A =	Erodible gravel wearing course
LL=	Liquid Limit	SW/ SP=	Well/ poorly graded sands	Class B =	Ravels and Corrugates gravel wearing course
LS=	Linear Shrinkage	CL=	Inorganic/ gravelly/ silty/ sandy clays of low to medium plasticity	Class C =	Ravels
EC=	Electrical Conductivity	GC=	Clayey gravels/ gravel-sand-clay mixtures	Class D =	Slippery
USCS =	Unified Soil Classification System	GM =	Silty gravels/ gravel-sand-silt mixtures	Class E =	Good Material
		GW/ GP=	Well/ poorly graded gravels		
		Low/Medium/High =	Degree of clay/silt activity (heave and shrinkage)		

All samples are excavated shale except: 1 – dolerite; 2 – calcrete; 3 – transported/ residual soils

*It should be noted that the material type and depth refer to the horizon from which the corresponding sample was retrieved. The material type is based on the logged soil profiles, according to AEG (2002). Due to the natural variability of soils (particularly transported horizons) laboratory test results may diverge slightly from the logged material type e.g. in a variable horizon of clayey sand, a small proportion (e.g. 1 in 10) of the laboratory test results may indicate sandy clay. Despite these small-scale variations in laboratory test results, the material type is assessed to be more distinctive of horizon conditions on a large-scale.

Table 4.2. Summary of Modified AASTHO CBR Test Results

Trial Pit	**Depth (m)**	**Density**		**CBR Values (%)**				**Swell (%)**	**COLTO**
		MDD kg/m^3	**OMC (%)**	**90**	**93**	**95**	**98**		
Kentani									
KT/T2	0.8-2.5	1897	15.5	14	19	23	30	0.0	G7
KT/T6	0.5-1.8	1897	13.7	15	17	20	23	0.2	>G9
KT/T7	0.8-2.0	1882	15.8	14	19	24	34	0.1	>G9
KT/T8	0.2-1.0	1872	13.2	-	-	-	-	-	-
KT/T11	0.3-2.2	1942	11.0	9	12	14	19	2.4	>G9
Klipfontein									
KF/T6[1]	0.3-1.5	2123	10.9	22	31	29	54	0.0	G6
KF/T12	0.8-2.4	1920	15.1	10	12	13	15	0.5	G8
KF/T16	0.2-2.2	2013	12.6	21	28	34	45	0.1	G7
KF/T22	0.3-2.2	2021	12.6	18	25	31	43	0.0	G7
KF/T27[2]	0.4-0.8	1843	14.0	14	27	43	84	0.1	G6
Klipfontein 2									
KF2/T4[1]	0.8-1.7	2290	2.0	18	25	31	42	0.0	G6
KF2/T9[1]	0.4-1.2	2314	8.3	30	37	43	53	0.0	G6
KF2/T12[1]	0.6-1.7	2253	7.5	24	34	44	63	0.0	G6
KF2/T16	1.0-3.0	2280	7.8	19	32	41	53	0.0	G6
Leliehoek									
LH/T5	0.3-2.7	1810	11.0	10	12	14	17	0.1	G8
LH/T9	0.8-2.5	1912	14.0	3	5	7	10	0.7	>G9
LH/T14[1]	0.3-0.8	2080	10.5	42	60	76	108	0.0	G5
Sonoblomo									
SB/T1	0.5-1.4	1872	14.7	41	53	63	82	0.0	G5
SB/T3[1]	0.6-1.1	2195	8.4	30	40	48	64	0.0	G5
SB/T7	0.3-3.0	1963	12.0	19	25	29	38	0.1	G6
SB/T8	0.3-2.1	1907	14.1	21	29	36	49	0.2	G6
SB/T10	0.3-1.7	1752	16.5	5	6	8	10	2.5	>G9
SB/T14[1]	0.6-1.1	2032	9.7	22	32	41	59	0.0	G6

Notes: **As per COLTO**

MDD= Maximum Dry Density

CBR= California Bearing Ratio

OMC= Optimum Moisture Content

All samples are excavated shale except: 1 – dolerite; 2 – calcrete

Table 4.3. Summary of Shearbox and Triaxial Test Results

Trial Pit	**Depth (m)**	**Material**	**Peak Angle of Friction (°)**	**Cohesion (kPa)**
KT/T8	0.2-1.0	Sandy CLAY / Clayey SAND	40.8	3.1
SB/T10	0.3-2.1	Very soft rock SHALE	31.0	0.0

Notes: Shear box test drained; Triaxial test consolidated, undrained

1 Samples remoulded to 93% MDD

Table 4.4. Summary of Thermal Conductivity Test Results

Trial Pit	**Depth (m)**	**Material**	**Parameter**	**Test**			
				1	**2**	**3**	**4**
Kentani							
KT/T3[3]	0.2-0.6	Sandy CLAY	**Moisture Content**	0	4	6	15.6
			Thermal Conductivity	0.338	0.467	0.678	1.586
KT/T13[3]	0.3-0.9	Sandy CLAY	**Moisture Content**	0	4	6	14.4
			Thermal Conductivity	0.242	0.343	0.391	0.695
KT/T16	0.7-1.6	Sandy GRAVEL	**Moisture Content**	0	4	6	8.7
			Thermal Conductivity	0.177	0.347	0.412	0.777
Klipfontein							
KF/T1[1]	0.4-1.5	Gravelly SAND	**Moisture Content**	0	2.7	5	
			Thermal Conductivity	0.211	0.308	0.842	
KF/T7[1]	0.3-1.4	Gravelly SAND	**Moisture Content**	0	2	3.3	5
			Thermal Conductivity	0.237	0.360	0.546	0.837
KF/T9[3]	0.3-0.7	Sandy CLAY	**Moisture Content**	0	2	5	11.1
			Thermal Conductivity	0.349	0.389	0.536	0.752
KF/T18[2]	0.4-0.8	Gravelly SAND	**Moisture Content**	0	2	5	8.8
			Thermal Conductivity	0.255	0.318	0.456	1.353
Klipfontein 2							
KF2/T3[1]	0.3-0.9	Gravelly SAND	**Moisture Content**	0	2	4.3	5
			Thermal Conductivity	0.273	0.282	0.617	0.637
KF2/T5[1]	0.4-1.0	Gravelly SAND	**Moisture Content**	0	2	3.1	5
			Thermal Conductivity	0.274	0.371	0.541	0.956
KF2/T14[1]	1.1-1.8	Gravelly SAND	**Moisture Content**	0	2	5	9
			Thermal Conductivity	0.192	0.428	0.700	1.101
KF2/T17[2]	0.5-1.3	Gravelly SAND	**Moisture Content**	0	2	5	6.6
			Thermal Conductivity	0.317	0.377	0.716	1.101
Leliehoek							
LH/T2[1]	0.4-0.8	Gravelly SAND	**Moisture Content**	0	2	5	6.3
			Thermal Conductivity	0.266	0.374	0.868	0.915
LH/T3[1]	0.4-0.8	Gravelly SAND	**Moisture Content**	0	2	4.6	5
			Thermal Conductivity	0.254	0.382	0.821	0.893
LH/T7[2]	0.4-1.2	Sandy GRAVEL	**Moisture Content**	0	2	5	8.1
			Thermal Conductivity	0.235	0.364	0.483	0.827
Sonoblomo							
SB/T4[3]	0.4-0.5	Clayey SAND	**Moisture Content**	0	2	5	7
			Thermal Conductivity	0.300	0.433	0.538	0.644
SB/T9	0.3-0.6	Sandy GRAVEL	**Moisture Content**	0	4	6	11
			Thermal Conductivity	0.225	0.324	0.324	0.772
SB/T13	0.5-1.8	Sandy GRAVEL	**Moisture Content**	0	2.4	4	6
			Thermal Conductivity	0.209	0.228	0.271	0.593

Notes:	**As per SANS 10198**
Moisture Content	Compacted Moisture Content
Thermal Conductivity	(W/m.k)

All samples are excavated shale except: 1 – dolerite; 2 – calcrete; 3 – transported/ residual soils

All samples compacted to 90% Mod. AASHTO

Table 4.5. Summary of Chemical Test Results

Trial Pit	Depth (m)	Material	pH	Resistivity (Ω.m)	Sulphate (mg/kg)	Chloride (mg/kg)	Carbon (%)	Agressivity*
Kentani								
KT/T3[3]	0.2-0.6	Clayey SAND	7.39	14.53	116	74	3.87	Severely Corrosive
KT/T4	0.8-1.9	Gravelly SAND	8.36	11.83	352	64	3.72	Severely Corrosive
KT/T13[3]	0.3-0.9	Clayey SAND	8.24	2.94	589	401	4.20	Very Severely Corrosive
KT/T16	0.7-1.6	Sandy GRAVEL	8.57	16.69	137	85	2.93	Severely Corrosive
Klipfontein								
KF/T1[1]	0.4-1.5	Gravelly SAND	8.14	51.28	55	50	5.06	Mildly Corrosive
KF/T7[1]	0.3-1.4	Gravelly SAND	7.37	74.63	41	46	5.15	Mildly Corrosive
KF/T9[3]	0.3-0.7	Sandy CLAY	8.33	12.00	75	67	6.19	Severely Corrosive
KF/T18[2]	0.4-0.8	Gravelly SAND	8.58	41.49	82	71	3.90	Moderately Corrosive
Klipfontein 2								
KF2/T1[1]	0.5-1.4	Sandy GRAVEL	8.06	37.88	96	67	4.27	Moderately Corrosive
KF2/T5[1]	0.4-1.0	Gravelly SAND	7.72	54.35	75	71	3.62	Mildly Corrosive
KF2/T14[1]	1.1-1.8	Gravelly SAND	8.14	3.27	319	92	3.67	Very Severely Corrosive
KF2/T17[2]	0.5-1.3	Gravelly SAND	8.31	19.38	140	67	2.88	Severely Corrosive
Leliehoek								
LH/T2[1]	0.4-0.8	Gravelly SAND	7.52	37.17	72	53	3.87	Moderately Corrosive
LH/T3[1]	0.4-0.8	Gravelly SAND	7.28	43.67	89	64	4.03	Moderately Corrosive
LH/T7[2]	0.4-1.2	Sandy GRAVEL	8.39	20.12	120	71	3.87	Moderately Corrosive
Sonoblomo								
SB/T4[3]	0.4-0.5	Clayey SAND	8.05	14.97	82	67	4.13	Severely Corrosive
SB/T9	0.3-0.6	Sandy GRAVEL	8.23	15.90	120	78	5.55	Severely Corrosive
SB/T13	0.5-1.8	Sandy GRAVEL	8.14	15.36	137	74	3.77	Severely Corrosive

Notes:
*Corrosion Institute of Southern Africa (2004)
All samples are excavated shale except: 1 – dolerite; 2 – calcrete; 3 – transported/ residual soils

5. GEOTECHNICAL EVALUATION

5.1 Ground Conditions

As discussed above, the ground conditions across the cluster generally comprise a relatively thin cover of topsoil and transported sand overlying shale and dolerite rock mass, with intermittent cemented to strongly cemented calcrete and residual clay and clayey gravel. Refusal generally occurred within the rock masses at depths of between 1 m and 2 m below EGL, although where harder rock mass or strongly cemented calcrete was present refusal could occur as shallow as ~0.5 m below EGL. A site-specific summary is given in the proceeding sub-sections.

5.1.1 Kentani

The ground conditions at Kentani are a thin cover of topsoil generally underlain by a relatively thin residual layer comprising clayey gravel or sandy clay, with occasional, equally thin transported clayey sand where the residual soils were not present. The soils generally overlie very soft to medium hard rock shale at depths of between 0.3 m to 1.0 m. At trial pits KT/T12 and KT/T15 soft to medium hard rock dolerite was observed at 0.3 m below EGL. Cemented to strongly cemented calcrete was observed overlying the shale rock mass in KT/T16.

5.1.2 Klipfontein

The ground conditions at Klipfontein generally comprised topsoil overlying either very soft to medium hard rock dolerite (trial pits KF/T1 – KF/T7), cemented to strongly cemented calcrete or very soft to medium hard rock shale. In several locations where the calcrete was penetrated it was observed overlying the shale. There are also intermittent, relatively thin deposits of transported clayey sand/ sandy clay.

5.1.3 Klipfontein 2

The majority of the profiles observed on Klipfontein 2 comprised topsoil overlying very soft to medium hard rock dolerite, with occasional relatively thin transported sand layers overlying the rock mass. In trial pits KF2/T13 and KF2/T14 the dolerite is overlain by weakly to strongly cemented calcrete. In trial pits KF2/T16 and KF2/T17 the profile comprised topsoil overlying weakly to strongly cemented calcrete, which was underlain by soft to medium hard rock shale.

5.1.4 Leliehoek

Leliehoek was generally underlain by medium hard to hard rock dolerite, with refusal in most trial pits occurring at approximately 0.5 m below EGL. Within approximately one third of the trial pits the profile underlying the topsoil comprised either strongly cemented calcrete, weakly cemented to cemented calcrete overlying very soft to medium hard rock shale or very soft to medium hard rock shale.

5.1.5 Sonoblomo

The proximity of Sonoblomo to Kentani equates to very similar ground conditions, with the majority of the profiles comprising relatively thin transported/ residual clayey soils overlying very soft to medium hard rock shale. Trial pits SB/T2, SB/T3 and SB/T14 encountered soft to medium hard rock dolerite underlying the topsoil and a thin sandy clay layer in SB/T3.

5.2 Excavatability

The ease with which the TLB (model CAT 428E) was able to excavate through the profiles observed across the site was the main measurement for excavatability. All test pits generally reached refusal or effective refusal (slow progress) within shale or dolerite at depths of between 1 m and 2 m.

Based on these field observations it is envisioned that the majority of the cluster may be classed as "Intermediate" generally grading to "Hard Excavation" conditions from relatively shallow depth (SABS 1200 DM), with "Soft Excavation" conditions generally in the upper 0.5 – 1 m.

Occasional "Boulder Class Excavation" may also be applicable within the dolerite geological zones, as indicated on the geological maps and trial pit localities.

5.3 Problem Soils/ Rocks

Whilst there are no explicit and widespread problem soils across the cluster, the abundance of shale at shallow depth may require some construction mitigation.

The shale is largely classified as good quality rock however, as observed in surface exposures on site, has a tendency to disintegrate into small angular gravels (friable) when exposed to the atmosphere. It is believed (Brink, 1983) that this disintegration occurs in shales due to the development of micro-cracks in the rock mass as a result of stress relief and moisture loss. When shale is exposed to constant wetting and drying cycles the rock mass swells and shrinks and subsequently breaks along these micro-cracks. As the process is repeated the rock mass gradually disintegrates into gravel-sized particles subsequently lowering the quality and strength of the rock mass. Furthermore, left uncontrolled over time these particles will eventually develop clayey coatings and eventually will decompose entirely into potentially expansive clay.

The rate of disintegration is largely unquantified but nevertheless any excavations in the shale rock mass will require shotcrete or blinding to limit exposure of fresh rock to the elements and as such limit the effects of disintegration.

5.4 Slope Stability

No notable or significant slopes warranting slope stability concerns were noted during investigations. The majority of the site is observed to comprise flat to slightly undulating terrain with very gently sloping ridges, and the shale rock mass generally has a near horizontal bedding plane. The only notable slope feature was the dolerite ridges adjacent to the Klipfontein 2 site.

The need for slope stabilisation should thus be assessed on a case by case basis during the design of each structure. Foundation stability, taking into account rock mass properties and discontinuity orientations should be assessed in detail during foundation design.

5.5 Soil Corrosivity

The results of chemical analyses conducted on soils obtained from the cluster indicate that these are generally neutral to mildly alkaline. This indicates that acid attack on concrete is unlikely to be a problem.

The sulphur, chloride and organic content found over the cluster range from low to high, with consistently high results obtained on Kentani and it is anticipated that these contents may cause durability issues to concrete buried in these soils (BRE Special Digest 1, 2005).

Electrical Resistivity surveys indicate that all the sites within the cluster are in the moderate-unlikely corrosivity potential range (i.e. the resistivity range 20 - >300 ohm.m) except for Klipfontein 2 traverse KF2/ERT7 which has values in the severe range (<20 ohm.m). Traverses KF/ERT1 and KF/ERT2, but especially KF/ERT1, on Klipfontein have values on the cusp of ‘severe’, being around the 21 ohm.m mark, as have two deep readings for Leliefontein LH/ERT1.

Electrical conductivity test results conducted on soil samples removed from trial pits indicate that the soils across the cluster generally range from severely corrosive to very severely corrosive, with the exception of Leliehoek samples, which were moderately corrosive. As per guidelines offered by the Corrosion Institute of Southern Africa (2004) these electrical resistivity results indicate that buried ferrous services and steel in foundations will need corrosion protection.

Although the electrical resistivity results generally indicate mildly corrosive conditions, the laboratory results suggest severely corrosive conditions, particularly on Kentani and Sonoblomo. On this basis corrosion protection measures must be factored into the design of buried ferrous services and the steel in foundations. The laboratory tests are most likely the most reliable indicator for in-situ ground conditions and give specific point readings, which are not “averaged out” over a traverse section. Furthermore, anecdotal evidence from a land owner indicated the propensity of buried ferrous metals to rust rapidly. This may be linked to the “salt” crystals observed within some trial pits on Kentani and Sonoblomo.

5.6 Thermal Conductivity

The thermal conductivity of a soil is its ability to conduct heat. For the purpose of the solar PV farms accurate measurement of this parameter is critical for the determination and design of the electrical cabling system. There are five main factors that increase a soils capacity to conduct heat; namely:

(i) Mineralogy. Quartz sand with low mica content;

(ii) Maximum dry density (MDD). High density after compaction;

(iii) Grading. Well-graded soils with high degree of grain interlock;

(iv) Compaction moisture content. Compaction relative to optimum moisture content (OMC) without detriment to point (ii), and;

(v) Time. More specifically the soils ability to maintain a constant moisture content over time.

Following site preparation, the shale and dolerite rock mass are likely to be the main shallow geological horizons on the cluster in which service trenches will be excavated, and thus has been assessed according to these five factors. Based on the trial pit profiles, there is only minor amounts of sand across the cluster for selected bedding and backfill material, and the bulk of this will likely be imported from commercial sources.

Furthermore, it is noted from **Table 4.2** that the MDD for shale, dolerite and calcrete samples generally fell into two distinct ranges; 1800 – 2000 kg/m^3 for shale and 2100 – 2300 kg/m^3 for dolerite and calcrete. On this basis, the thermal resistivity for each rock mass type has been assessed separately. Similarly, the average OMC for shale is 13.3% and for dolerite 8.2%. The natural moisture content for the shale ranges between 2.3 – 15.6% and 2.7 – 9.0% for the dolerite and calcrete, giving averages of 9.0% for the shale and 5.3% for the dolerite.

It is observed that the thermal conductivity increases with increased moisture content. For comparative purposes the “ideal” (SANS 10198-5, 2004) thermal conductivity of electrical cable bedding of 0.85 W/m.K (or a thermal resistivity of 1.2 K.m/ W) is indicated in Figure 5.1 relative to the laboratory results.

When the results are assessed as separate material types the following observations are made:

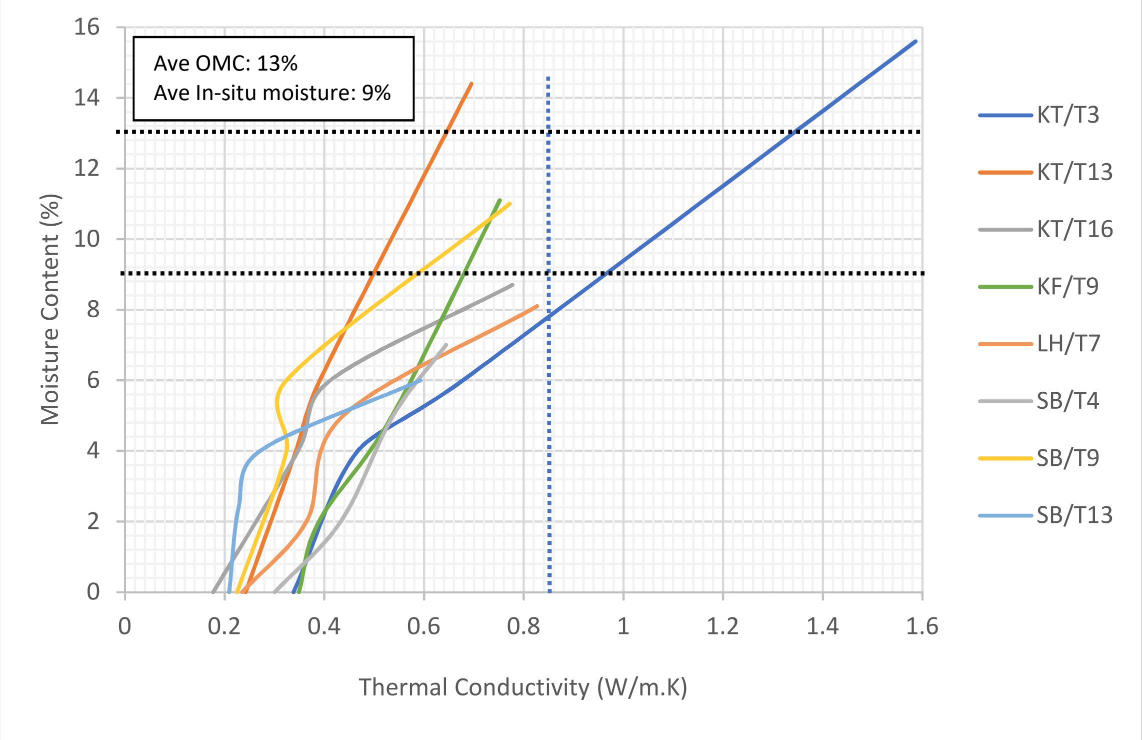
(i) In general, the shale samples fail to achieve the “ideal” value of 0.85 W/m.K within the tested range and, more, importantly, natural moisture content. Extrapolation of the shale moisture content to thermal conductivity relationship indicates that it will likely reach the desired “ideal” value prior to OMC;

(ii) In general, the dolerite and calcrete samples exceed the “ideal” value within natural moisture content range and will all exceed this value at OMC;

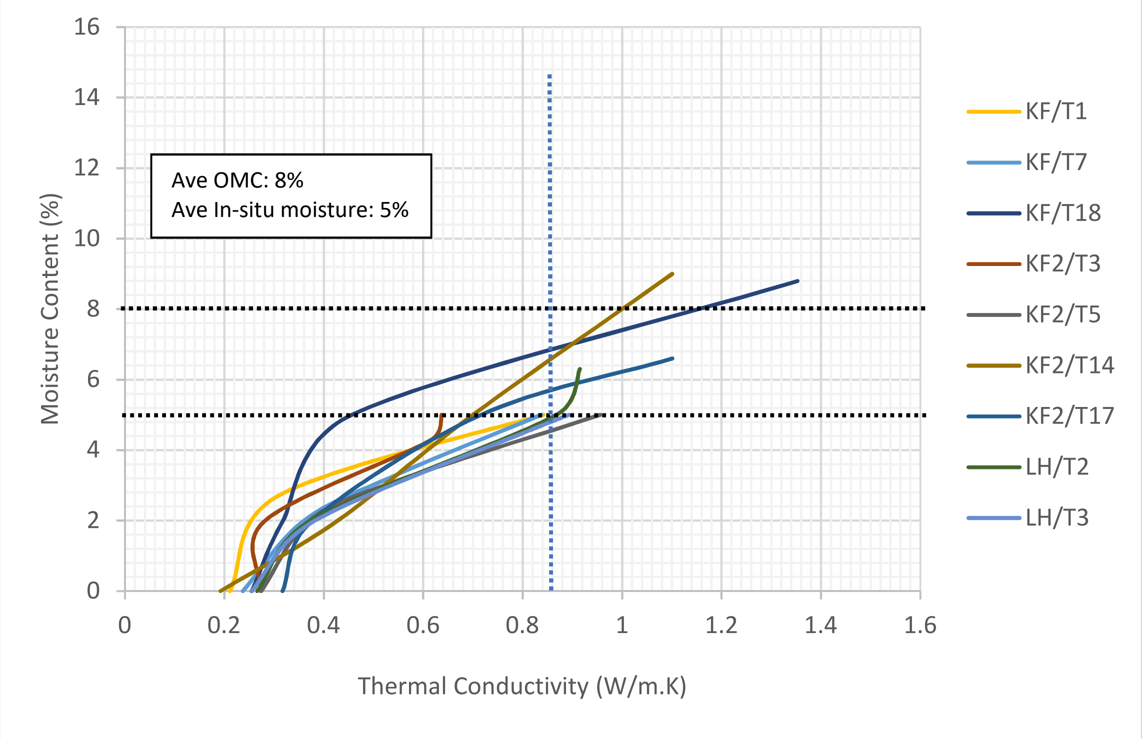
(iii) However, all tested material types will not qualify as bedding or selected backfill for the cables, due to their grading (gravel content). However, highly weathered dolerite or crusher dust from the dolerite quarry operations (if adopted as part of the materials sources) may be utilised and will likely display similar thermal conductivity properties.

Figure 5.1(a) and **(b)** analyses the effects of moisture content on the thermal conductivity of the shale/clay and dolerite/calcrete.

Figure 5.1. Thermal Conductivity – Moisture Content Relationship



(a) Shale and Clay



(b) Dolerite and Calcrete

5.7 Soil Permeability

The results of in-situ falling-head permeability test results were relatively consistent across the cluster. The on-site permeability test results (average $k = 2.6 \times 10^{-4}$ m/s) indicate that the upper, relatively shallow soils have good drainage potential. However, when coupled with the shallow rock mass across the cluster, this suggests that during heavy/ sustained rainfall events soils are likely to saturate quickly and facilitate sheet wash drainage, and potential scour of soils, on surface. Hydrological modelling should be conducted to model these effects and the results incorporated into the stormwater management plan for the cluster and individual infrastructure.

5.8 Geotechnical Constraints to Development

The consistency between trial pits across the cluster (i.e. relatively shallow hard strata) suggests that no significant variance in what has been observed during this investigation is anticipated. However, the following are considered geotechnical constraints towards the development of the site and should be noted for detailed geotechnical investigations, preliminary and detailed design, as well as construction:

(i) Undefined rock mass competence laterally and with depth;

(ii) Lack of suitable service/ cable bedding and backfill material on/ near the site;

(iii) Undefined depth to permanent groundwater table and whether this is suitable for use during construction.

6. RECOMMENDATIONS

6.1 Foundations

6.1.1 PV Panel Foundations

It is critical for the PV panels to maintain the optimal angle to the sun in order for the energy production of the power plant to remain at maximum efficiency. Therefore, any deviation of the panels from this optimal angle following installation will affect the power output of the plant and deviate from the proposed energy production rates. This deviation may occur in two major ways; settlement (both total and differential) of the foundations due to the loading forces and pull-out forces acting on the panels from wind loads causing the panel to effectively act as a sail, thus translating horizontal loads into vertical loads.

On this basis, it is understood that the hierarchy for the preferred founding method for the PV panels is the following:

(i) Driven piles, acting in friction in both vertical directions. This method is simple and effective to install and thus the most economic.

(ii) Predrilled piles, where the depth of soil cover, into which driven piles are installed, is not sufficient to resist the pull-out forces. This method requires predrilling the pile positions, inserting the pile and grouting the hole, effectively anchoring the structure to the underlying hard strata. This method may also be considered for sites where obstructions are present within the soil horizon. In this case, the concrete grout will act in friction with the soils.

(iii) Concrete bases are installed where there are instances of deep loose soils, which provide insufficient resistance to pull-out forces and the depth precludes economic pile lengths, or where deep expansive soils are present, which would affect the alignment of the panels by expansion / shrinkage of the soils with changes in moisture content. These are typically substantial bases as their self-weight will be the factor resisting uplift. This is the most expensive option, as, if ground conditions preclude the piled options, additional site preparation will be required.

From the trial pits profiles, it would appear that the preferred driven pile founding method is not achievable and the PV foundations over all the site in the cluster are suitable for predrilled piles, anchored in the rock mass, which will provide sufficient pull-out resistance.

Concrete bases bearing at nominal depth may also be suitable for this cluster, however site preparation may make this solution uneconomical. Construction of suitable soil rafts should comprise the excavation of the in-situ material to approximately 1 m below foundation underside or to the soft rock strata, whichever is the shallower, and 1 m laterally beyond the foundation base on all sides. The excavated material should then be laid in 200 mm thick compacted layers to 95% Mod. AASHTO and ±2% OMC. It is possible that boulders may be intermittently present within the excavated depth, will have to be removed and the volume made up with imported material or cut from other parts of the site.

6.1.2 Substation Foundations

(a) Kentani

At the location of the Kentani substation (trial pits KT/T6 and KT/T7) medium dense clayey sand and gravel was observed to depths of between 0.8 m and 0.9 m, at which depth very soft to soft rock shale was encountered.

Therefore, normal strip footings may be adopted for this substation, bearing either on the medium dense sand and gravel at nominal depth or on the very soft rock shale at about 0.8 m below EGL. Allowable bearing pressures of 50 kPa and 150 kPa may be used for foundation design for the sand and gravel and very soft rock shale respectively.

(b) Klipfontein

At the location of the Klipfontein substation (trial pits KF/T11 and KF/T12) firm to stiff sandy clay was observed to approximately 0.5 m below EGL, at which depth cemented calcrete and very soft to soft rock shale were encountered.

Therefore, normal strip footings may be adopted for this substation, bearing on the calcrete and very soft rock shale at about 0.5 m below EGL. To prevent differential settlement between the two different strata, allowable bearing pressures should be limited to 100 kPa for foundation design.

(c) Klipfontein 2

At the location of the Klipfontein 2 substation (trial pits KF2/T4 and KF2/T5) loose to medium dense clayey sand was observed to between 0.3 m and 0.8 m below EGL, at which depth very soft to medium hard rock dolerite was encountered.

Therefore, normal strip footings may be adopted for this substation. However, to prevent differential settlement between the sand and rock mass horizons, foundations should bear wholly on the very soft to soft rock dolerite at depths of between 0.3 m and 0.8 m below EGL. Allowable bearing pressures of 150 kPa may be used for foundation design.

(d) Leliehoek

At the location of the Leliehoek substation (trial pits LH/T7 and LH/T8) loose to medium dense clayey sand was observed to depths of up to 0.4 m below EGL, at which depth weakly cemented to cemented calcrete and hard rock dolerite were encountered. The TLB refused on the hard rock dolerite at 0.4 m below EGL, whereas penetration through the calcrete was possible into underlying soft to medium hard rock shale at 1.2 m below EGL.

Therefore, normal strip footings may be adopted for this substation, bearing on the calcrete and hard rock dolerite at nominal depth. To prevent differential settlement between the two different strata, allowable bearing pressures should be limited to 100 kPa for foundation design.

(e) Sonoblomo

The location of the Sonoblomo substation differs to that shown in **Figure 3.1(a)**, due to a revision in location, and is located in the south eastern corner of the site. Therefore, at the location of the Sonoblomo substation (trial pits SB/T12 and SB/T14) loose to medium dense clayey sand was observed to depths of up to 0.6 m below EGL, after which soft to medium hard rock shale and dolerite were encountered.

Therefore, normal strip footings may be adopted for this substation, bearing on the soft rock shale and dolerite depths of between 0.3 m and 0.6 m below EGL. An allowable bearing pressure of 150 kPa may be used for foundation design.

Notwithstanding the recommendations given in the above sub-sections, a suitably qualified Competent Person (geotechnical) must inspect the foundation excavations prior to construction to ensure that suitable founding conditions have been achieved.

6.1.3 Laydown Areas and Hardstands

These prepared surfaces will be utilised to store construction materials and heavy plant equipment. The shale may find use as subgrade and selected layerworks for the design of these platforms, however the dolerite should be the preferred material. All paved surfaces will be required to undergo a detailed pavement design by a suitably qualified Professional Engineer. Where layerworks design specifications require G1 – G4 quality material these will need to be commercially sourced and imported to site, alternatively the dolerite quarry may offer suitable material once proven.

6.2 Excavations

"Intermediate Excavation" is anticipated from shallow depth (within 0.5-1 m of surface) over the majority of the cluster, as penetration into the weathered rock masses was only possible to some degree with a TLB. A 30-tonne excavator with rock-pecker attachment will be suitable plant for excavations into medium hard and blasting for hard rock, where deep excavation (say >2 m) is required. Minimal "Soft" and majority "Intermediate Excavation" will be applicable to services, support infrastructure foundations and new paved areas (roads and laydowns).

Excavations in soils exceeding 1.2 m in depth are considered stable where excavations are in the flat recesses of the site however are classified as unstable where these are located on slopes. It is recommended that all excavations in soils exceeding 1.2 m be battered to a stable slope of 1V:1.5H. Where excavations exceed 3 m, the excavation stability must be assessed by a Professional Geotechnical Engineer who is responsible for the design of any temporary or permanent lateral support required.

6.3 Material Utilisation

6.3.1 Service Bedding

Minimal soils were observed on site, with the majority of the profiles comprising weathered shale or dolerite rock masses. These horizons were generally excavated as gravelly materials with frequent cobble inclusions, which are unsuitable for service bedding in the current state. Therefore, no suitable selected fill for the bedding of services of any size will be sourced from in-situ materials without significant preparation (sorting and/ or crushing) to meet the grading and compactibility requirements of selected granular fill (SABS 1200 LB). The laying of services should follow the recommendations offered by SABS 1200 LB and DB.

6.3.2 Cable Bedding

As stated in **Sub-Section 6.3.1** above, there are no suitable sources of soils for service or cable bedding unless sorting and/ or crushing of rock masses is undertaken. However, as there is a possibility that this may occur as part of the site development, particularly if the identified dolerite quarry is developed, thermal conductivity testing and assessments were undertaken. Furthermore, the generated values represent the general highly weathered rock masses that the cables trenches are likely to be excavated into.

In general the findings indicate that the dolerite and calcrete displayed better thermal conductivity characteristics than the shale samples. Once a potential bedding source is identified additional confirmatory testing should be undertaken. In order for the bedding to have the best chance of maintaining a consistent range of moisture content it is recommended that cables be buried no shallower than 1.2 m below EGL.

6.3.3 Earthworks

The excavatable shale is generally a poorer material and will only find use as general fill for the layerworks in pavements, rafts and bulk earthworks. Laboratory testing indicates the shale to classify as G7-G9 material.

Whereas the dolerite, and to a lesser extent the calcrete, generally classifies as G5-G6 material. Therefore, the dolerite and calcrete may find use across the site for bulk earthworks requirements such as in fill, rafts, selected pavement layerworks/ subgrade and stabilised pavement layerworks.

6.3.4 Borrow Pits

The small calcrete borrow pit sites may potentially be exploited to supply the project with materials for service bedding and/or construction activities (G5 – G7 materials), although service bedding material will require additional processing. The potential reserves of the existing calcrete from the identified borrow sites is in the order of 4 500 m^3, although potential expansion of these sources may yield up to 100 000 m^3.

However, the dolerite source may potentially be exploited supplying the project with materials for service bedding and/or construction activities (G5 – G7 materials). Certainly, the highly weathered dolerite near surface may be utilised as service bedding with minimal additional processing. In total, 50 000 m^3 of borrow material is estimated to be available from this source in its current state. Furthermore, development of the source by blasting may also yield better than G4 materials (potentially even G1/ G2 and aggregate materials). It must be noted that this source currently overlaps the proposed Klipfontein 2 development area and is also constrained by a gravel road, thus should extension of this source be required to supply additional quantities, consideration of slight reduction in the Klipfontein 2 development area may be necessary.

Prior to exploiting the identified borrow sources, detailed geotechnical assessments must be undertaken in the form of excavation, drilling and sampling to prove reserves as well as suitability (durability, strength, etc.) as construction material. Environmental authorisation will also be necessary, particularly for extensions to the existing small calcrete sources, if required.

6.3.5 Due Diligence

Any material removed from site anticipated for use as construction material must first be tested by a civil engineering laboratory for its intended usage and approved by a duly appointed material technician/ engineer. The use of material other than those removed from construction activities, i.e. borrow pits, will require environmental authorisation, mining permits and water use licences at the very least before being removed. The exploitation of a materials source must include relevant appropriate quality control measures, consisting of frequent and regular laboratory testing to ensure the material meets the required specifications.

6.4 Access Roads

The cluster is readily accessible from the local paved and gravel roads, with some immediately adjacent to existing access gates. Thereafter, all roads within the cluster are farm tracks and Eskom access tracks beneath overhead power lines, with no pavement design. It is envisioned that these will need to be upgraded and maintained in order to accommodate construction vehicles and post-construction access.

The in-situ subgrade is good material upon which selected layerworks for new road networks may be constructed. Selected layerworks will require granular material meeting the specifications for at least haul road classification as per TRH 20 (1990) guidelines. In general, the dolerite and calcrete are the better materials for suitable subgrade and selected layerworks, whilst the shale, which is the dominant subgrade, is of lower quality. It is noted that the gravel roads in the area are of dolerite construction, likely sourced from the identified quarry adjacent to Klipfontein 2.

Whilst these materials do not meet the selected layerworks requirements (G1 – G4) for haul and paved roads, the proximity of the sites to maintained municipal/ provincial tarred and gravel roads indicate relatively low trafficking and short distances for internal access roads. Therefore, the in-situ materials may be utilised for access roads, subject to more frequent maintenance. Alternatively, better quality materials may be imported from commercial sources or following development of the dolerite quarry site.

New roads must be designed by a suitably qualified Professional Engineer.

6.5 Additional Geotechnical Investigations

In order to quantify the shortcomings of the preliminary investigation, as detailed in **Section 5**, and assign key geomechanical design parameters, the following scope of work (SAICE, 2010) is considered applicable for detailed design:

(i) Additional trial pit excavations within the proposed development area. The increased frequency of investigation positions will facilitate additional in-situ and laboratory testing and further refine variations in depth to hard strata and provide greater accuracy for pile installation depths;

(ii) On site supervision of geotechnical contractors for quality control purposes;

(iii) Additional bulk sampling of soil and rock for determination of geomechanical design parameters by laboratory testing;

(iv) Proving (exploratory trial pits, boreholes and laboratory testing) of viable borrow pits/ quarry for construction materials (viz. pavement layerworks, service bedding, etc.);

(v) Profiling of soil and rock horizons by a registered professional Engineering Geologist or Geotechnical Engineer;

(vi) Geohydrological investigation to assess groundwater potential for utilisation as potable, PV panel cleaning and construction water use.

Following the detailed investigations, supplementary “pull out” tests should also be undertaken to confirm design parameters and final design.

7. CONCLUSIONS

This report contains the results of a preliminary geotechnical investigation conducted by SMEC South Africa (Pty) Ltd. on behalf of Mainstream Renewable Power South Africa (Pty) Ltd. for the Kentani Cluster PV Solar Power project. Geotechnical investigations comprised trial pitting, field mapping and geophysical surveys within the supplied buildable area designations as well as at supporting infrastructure (substations). All fieldwork data was substantiated further by off-site laboratory testing.

The ground conditions across the site generally comprise shallow soils underlain predominantly by shale, but also dolerite and intermittent calcrete.

It is recommended that predrilled piles (socketed into the shale or dolerite rock mass) are adopted for the PV panel foundations over the cluster, as the shallow hard strata will preclude driven pile installation to depths that would provide sufficient “pull-out” (i.e. uplift and moment) resistance.

Alternatively, concrete bases may be adopted, however this solution may be uneconomical due to the required site preparation (soil rafts) that will be required to provide a uniform founding horizon.

All the substation sites will utilise relatively shallow strip foundations bearing on shallow rock mass, or medium dense sand and gravel in the case of Kentani. Allowable bearing pressures of 50 kPa to 150 kPa are recommended for the sites.

The in-situ excavatable shale, dolerite or calcrete generally classify as G5 to G9 materials, with the dolerite and calcrete averaging as the better material (G5 to G6). No suitable bedding or granular backfill material was identified on site for services >150 mm diameter and may have to be imported from a commercial source or development and processing of on-site sources. The near surface, highly weathered dolerite rock mass from the quarry source may be sufficiently granular to be considered, but confirmation of suitability and quantities should be undertaken as part of a materials investigation.

As there was no identified service bedding/ backfill material, only thermal conductivity properties of the shale, dolerite and calcrete were undertaken as the materials into which the cable trenches will be excavated and thus general background conditions. The dolerite and calcrete proved to be more suitable, in terms of thermal resistivity, and may indicate potential for the highly weathered granular dolerite rock mass to be utilised, subject to suitability and quantities. Additional thermal resistivity testing should be undertaken on materials sources proposed for this use.

2no. small (~2 000 m^3) calcrete borrow pits have been identified, along with a large (~50 000 m^3) dolerite borrow/ quarry source. All the identified sources should be able to provide G5/ G6 quality materials and the dolerite source shows potential to be deepened by blasting and may generate G1/ G2 quality material following crushing. The calcrete borrow pits have potential to be significantly enlarged to provide additional materials of similar quality, however the dolerite source is restricted by a gravel road and proposed development area of Klipfontein 2.

It is imperative that a Competent Person inspects all excavations to ensure that conditions at variance with those predicted are exposed and accommodated in the structural design and to undertake reinterpretation of the facts supplied in this report where necessary.

It must be noted that the information and recommendations given in this report are based on point data distributed across the buildable area designation. It is therefore likely that inconsistencies from what has been reported here will be observed during construction where positions were not explicitly investigated. It is imperative that a detailed geotechnical investigation be undertaken for the requisite degree of engineering design for the project as well as the access roads and where all possible cut and fill operations will need to be assessed in greater detail.

Furthermore, all recommendations made in this report serve merely as guidelines for the consideration of the Client. This report does not serve as a foundation design report but provides the design engineer with the preliminary design parameters to fulfil the same degree of engineering design.

We trust that this report will be found to be complete and adequate for your consideration. Should further elaboration be required for any portion of this project, we would be pleased to provide assistance.

SMEC South Africa (Pty) Ltd appreciates the opportunity of providing geotechnical investigation services on this project and look forward to future collaborations.

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Appendix A

Trial Pit Logs and Photographs

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T1
X COORD: 3 166 190
Y COORD: Lo25 -69 921
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, silty SAND** Slightly moist, red/brown, topsoil.	
		0.30		
		0.40	**Loose to medium dense, clayey, silty SAND** Moist, yellow/brown, residual.	
			Refusal on medium hard rock dolerite	
			End of Log	
1.0				
2.0				
3.0				

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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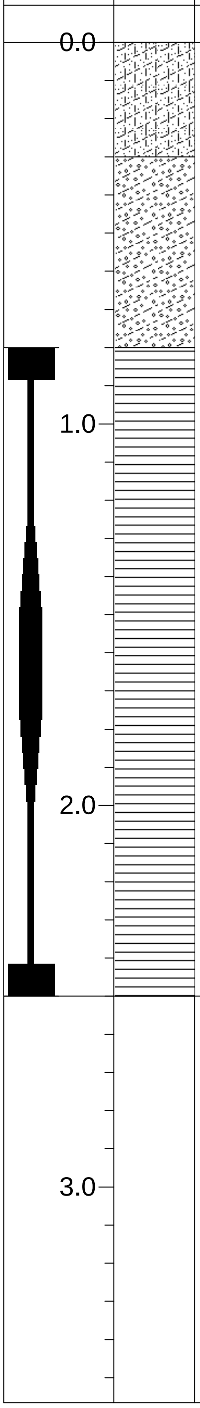
TRIAL PIT LOG

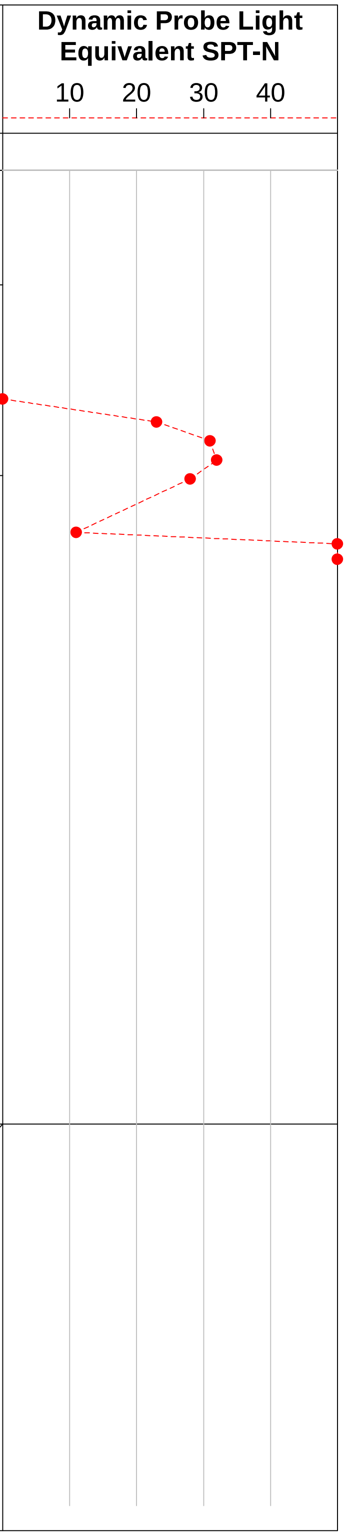
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T2
X COORD: 3 166 470
Y COORD: Lo25 -70 338
ELEVATION:
PAGE 1 of 1



Depth	Description
0.00	Ground Surface
0.00–0.30	**Medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
0.30–0.80	**Medium dense to dense, clayey, silty, sandy GRAVEL** Moist, grey, residual.
0.80–2.50	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.
2.50	**Trial pit stopped - slow progress**

End of Log



NOTES
1: Trial pit dry
2: Sample KT/T2/1 at 0.8-2.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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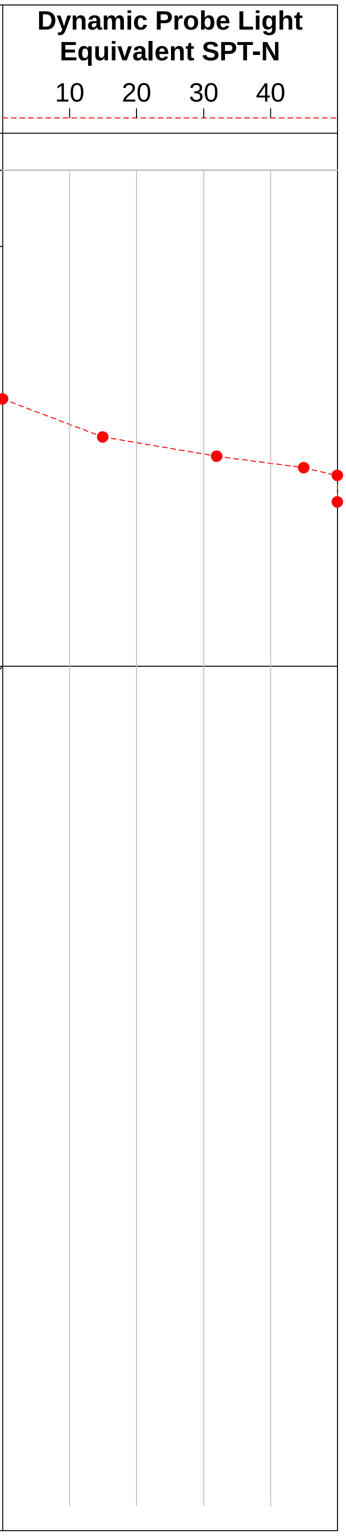
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T3
X COORD: 3 166 598
Y COORD: Lo25 -69 985
ELEVATION:
PAGE 1 of 1

Depth		Description
0.00		Ground Surface
0.0	0.20	**Loose, silty SAND** Slightly moist, orange/brown, topsoil.
	0.60	**Firm, silty, very sandy CLAY** Moist, brown, residual.
1.0	1.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.
2.0		**Refusal on medium hard rock**
3.0		End of Log



NOTES
1: Trial pit dry
2: Sample KT/T3/1 at 0.2-0.6m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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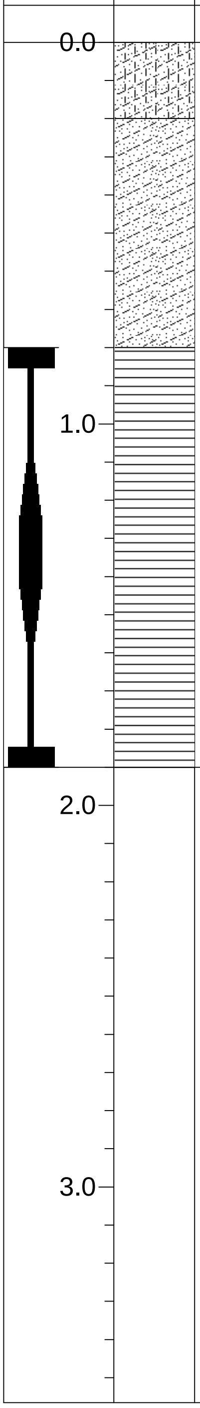
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T4
X COORD: 3 166 827
Y COORD: Lo25 -70 343
ELEVATION:
PAGE 1 of 1



Depth	Description
0.00	Ground Surface
0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, dark brown, topsoil.
0.80	**Medium dense to dense, very clayey, silty SAND** Slightly moist, light brown, residual.
1.90	**Very soft to soft rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Becoming grey and more competent from 1.4m. Recovered as gravel.
	Trial pit stopped - slow progress
	End of Log

Dynamic Probe Light Equivalent SPT-N
10 20 30 40

NOTES 1: Trial pit dry
2: Sample KT/T4/1 at 0.8-1.9m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T5

X COORD: 3 166 956
Y COORD: Lo25 -69 875
ELEVATION:
PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0	0.00	Ground Surface	
		Loose to medium dense, clayey, silty SAND Slightly moist, dark brown, topsoil.	
	0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel and cobbles.	
1.0	1.20	**Refusal on medium hard rock**	
2.0		End of Log	
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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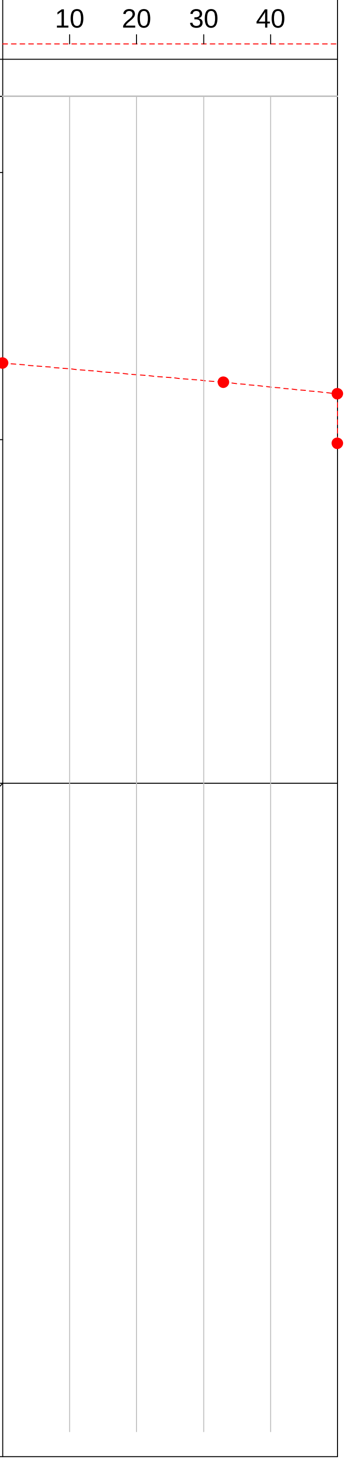
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T6
X COORD: 3 167 017
Y COORD: Lo25 -70 458
ELEVATION:
PAGE 1 of 1

Depth		**Description**
0.0	0.00	Ground Surface
	0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
	0.90	**Medium dense, very clayey, sity SAND** Slightly moist to moist, dark brown, transported.
1.0	1.80	**Very soft to soft rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.
2.0		**Refusal on medium hard rock** End of Log
3.0		

Dynamic Probe Light Equivalent SPT-N



NOTES
1: Trial pit dry
2: Sample KT/T6/1 at 0.9-1.8m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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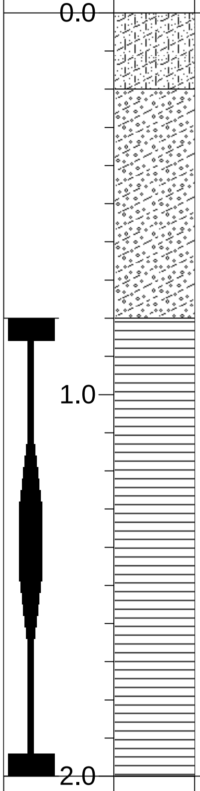
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T7
X COORD: 3 167 202
Y COORD: Lo25 -70 624
ELEVATION:
PAGE 1 of 1



Depth	Description
0.00	Ground Surface
0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, dark brown, topsoil.
0.80	**Medium dense to dense, clayey, sity, sandy GRAVEL** Slightly moist, light brown, sub-angular, fine, medium and coarse, residual.
2.00	**Very soft to soft rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.
	Trial pit stopped - slow progress
	End of Log

Dynamic Probe Light Equivalent SPT-N
10 20 30 40

NOTES 1: Trial pit dry
2: Sample KT/T7/1 at 0.8-2.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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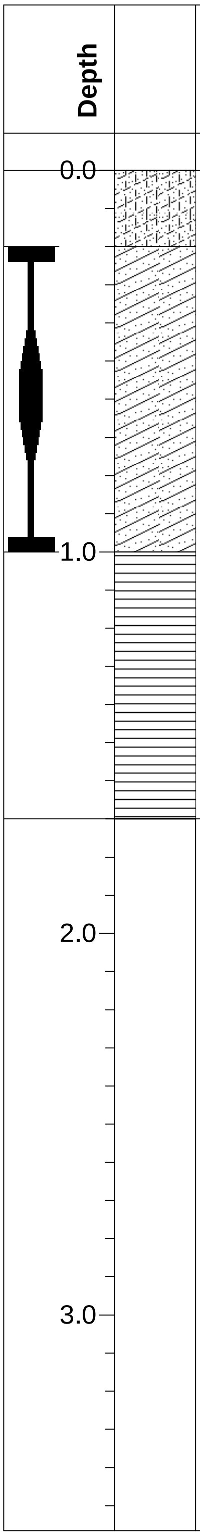
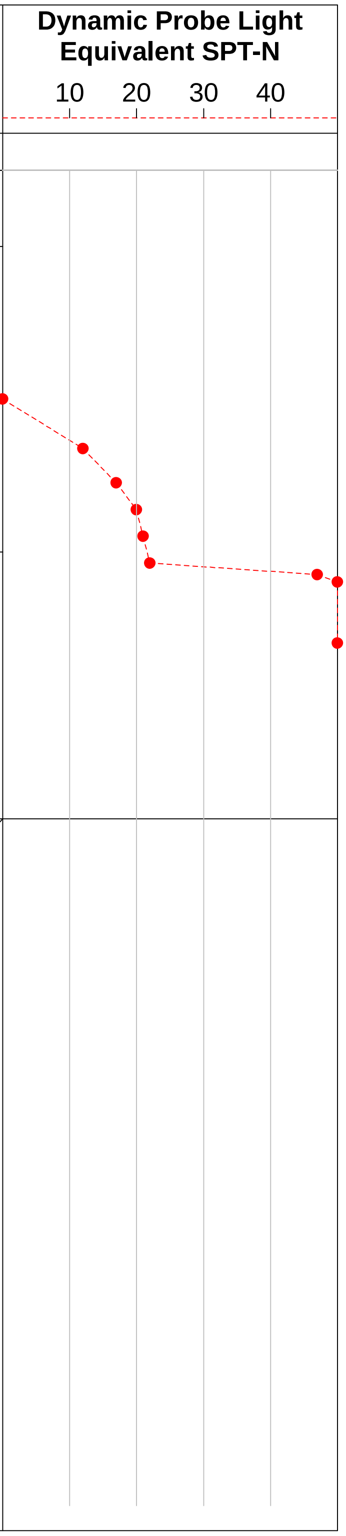
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T8
X COORD: 3 167 210
Y COORD: Lo25 -70 110
ELEVATION:
PAGE 1 of 1



Depth	**Description**
0.00	Ground Surface
0.20	**Loose, clayey, silty SAND** Slightly moist to moist, brown, topsoil.
1.00	**Firm to stiff, silty, very sandy CLAY** Moist, yellow/brown becoming dark grey, residual.
1.70	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.
	Trial pit stopped - slow progress
	End of Log



NOTES 1: Trial pit dry
2: Sample KT/T8/1 at 0.2-1.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T9
X COORD: 3 167 485
Y COORD: Lo25 -69 856
ELEVATION:
PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0	0.00	Ground Surface	
	0.20	**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
	0.60	**Loose to medium dense, very clayey, silty SAND** Moist, orange/brown transported.	
1.0	1.20	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
		Refusal on medium hard rock	
2.0		End of Log	
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T10
X COORD: 3 167 569
Y COORD: Lo25 -70 338
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0		0.00	Ground Surface	
		0.20	**Medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
		0.70	**Medium dense to dense, clayey, silty SAND** Slightly moist, brown transported.	
1.0		1.60	**Very soft to soft rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
2.0			**Refusal on medium hard rock** End of Log	
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 22 June 2020
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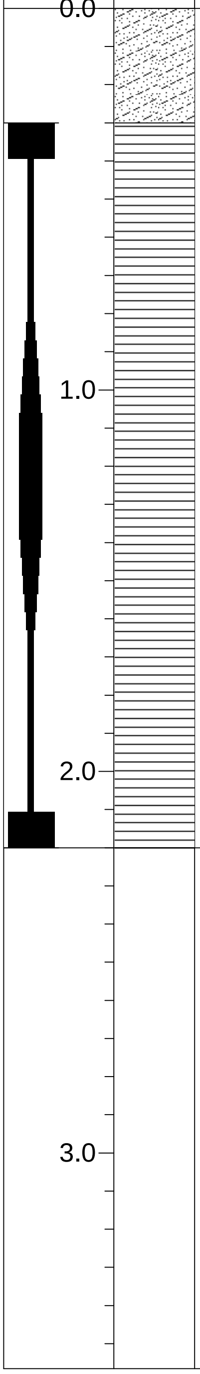
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T11

X COORD: 3 167 781
Y COORD: Lo25 -70 101
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.00–0.30	**Medium dense, very clayey, silty SAND** Moist, brown, topsoil.	
0.30–2.20	**Very soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
2.20	**Trial pit stopped - slow progress** End of Log	

NOTES 1: Trial pit dry
2: Sample KT/T11/1 at 0.3-2.2m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 22 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T12
X COORD: 3 168 022
Y COORD: Lo25 -69 858
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		0.30	**Soft to medium hard rock DOLERITE** Moderately weathered, grey, very highly fractured, fine grained.	
		0.70	**Refusal on hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T13
X COORD: 3 168 023
Y COORD: Lo25 -70 484
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.0	0.00	Ground Surface	
	0.30	**Medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
	0.90	**Medium dense, clayey, silty SAND** Slightly moist, brown, transported.	
1.0	1.80	**Very soft to medium hard rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
2.0		**Trial pit stopped - slow progress** End of Log	
3.0			

NOTES 1: Trial pit dry
2: Sample KT/T13/1 at 0.3-0.9m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T14
X COORD: 3 168 300
Y COORD: Lo25 -70 186
ELEVATION:
PAGE 1 of 1

Depth	Description
0.00	Ground Surface
0.00–0.20	**Loose, clayey, silty SAND** Slightly moist, orange/brown, topsoil.
0.20–0.70	**Firm, silty, very sandy CLAY** Moist, orange/brown, transported.
0.70–2.00	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained.
2.00	**Trial pit stopped - slow progress**
	End of Log

Dynamic Probe Light Equivalent SPT-N: 10 20 30 40

NOTES 1: Trial pit dry
2: Sample KT/T14/1 at 0.2-0.7m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 22 June 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T15
X COORD: 3 168 661
Y COORD: Lo25 -69 881
ELEVATION:
PAGE 1 of 1

Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.00–0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
0.30–1.10	**Soft to medium hard rock DOLERITE** Highly weathered, brown, very highly fractured, fine to medium grained.	
1.10	**Refusal on medium hard rock**	
	End of Log	

Depth scale: 0.0, 1.0, 2.0, 3.0

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 3 July 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T16

X COORD: 3 168 577
Y COORD: Lo25 -70 545
ELEVATION:
PAGE 1 of 1

Depth	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.00	Ground Surface	
0.00 – 0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, brown, topsoil.	
0.30 – 0.70	**Cemented to strongly cemented CALCRETE**	
0.70 – 1.60	**Soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
1.60	**Trial pit stopped - slow progress**	
	End of Log	

Depth scale: 0.0, 1.0, 2.0, 3.0

NOTES 1: Trial pit dry
2: Sample KT/T16/1 at 0.7-1.6m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 3 July 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T17
X COORD: 3 168 865
Y COORD: Lo25 -70 272
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose to medium dense, slightly clayey, silty SAND** Slightly moist, red/brown, topsoil.	
		0.40	**Medium hard rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
			Refusal on medium hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 3 July 2020
PROFILED BY: R Roberts
CHECKED BY:

Prof Reg:
Prof Reg:

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T18

X COORD: 3 169 142
Y COORD: Lo25 -69 956
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, slightly clayey, silty SAND** Slightly moist, red/brown, topsoil.	
		0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
		0.50	**Refusal on hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 3 July 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T19
X COORD: 3 169 218
Y COORD: Lo25 -70 590
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
		0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
		0.70	**Refusal on medium hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Kentani

HOLE NO: KT/T20
X COORD: 3 169 536
Y COORD: Lo25 -70 348
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
		0.20	**Soft rock SHALE** Highly weathered, grey, very thinly bedded, very highly fractured, very fine grained. Calcrete at surface.	
1.0				
		1.30	**Trial pit stopped - slow progress** End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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KT/T1

KT/T2

KT/T3

KT/T4

KT/T5

KT/T6

KT/T7

KT/T8

KT/T9

KT/T10

KT/T12

KT/T13

KT/T14

KT/T15

KT/T16

KT/T17

KT/T18

KT/T19

KT/T20

TRIAL PIT LOG

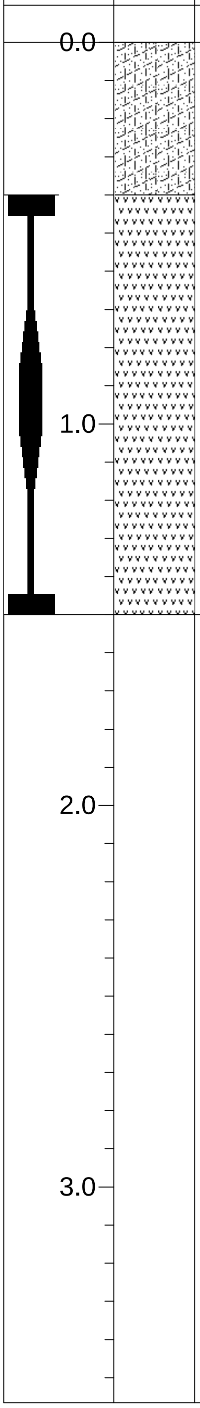
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T1

X COORD:	3 170 836
Y COORD: Lo25	-73 131
ELEVATION:	

PAGE 1 of 1

Dynamic Probe Light Equivalent SPT-N: 10 20 30 40



Depth	Description
0.00	Ground Surface
0.00 – 0.40	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.
0.40 – 1.50	**Very soft to soft rock DOLERITE** Completely to highly weathered, yellow/brown, very highly fractured, fine to medium grained.
1.50	**Trial pit stopped - slow progress** End of Log

NOTES
1: Trial pit dry
2: Sample KF/T1/1 at 0.4-1.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T2

X COORD: 3 170 991
Y COORD: Lo25 -72 826
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		0.40	**Very soft to soft rock DOLERITE** Completely to highly weathered, yellow/brown, very highly fractured, fine to medium grained.	
1.0		1.20		
			Trial pit stopped - slow progress End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 24 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T3
X COORD: 3 171 052
Y COORD: Lo25 -73 255
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.30	**Very soft to medium hard rock DOLERITE** Completely to moderately weathered, yellow/brown, very highly fractured, fine to medium grained.	
		0.50	**Refusal on medium hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T4
X COORD: 3 171 255
Y COORD: Lo25 -72 962
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.0		0.00	Ground Surface	
			Loose, clayey, silty SAND Slightly moist to moist, orange/brown, topsoil.	
		0.40	**Very soft to medium hard rock DOLERITE** Completely to highly weathered, yellow/brown, very highly fractured, fine to medium grained.	
		0.70	**Refusal on medium hard rock**	
1.0			End of Log	
2.0				
3.0				

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

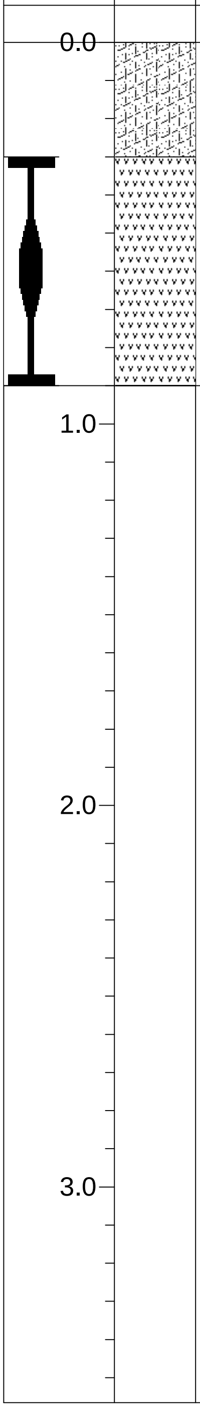
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

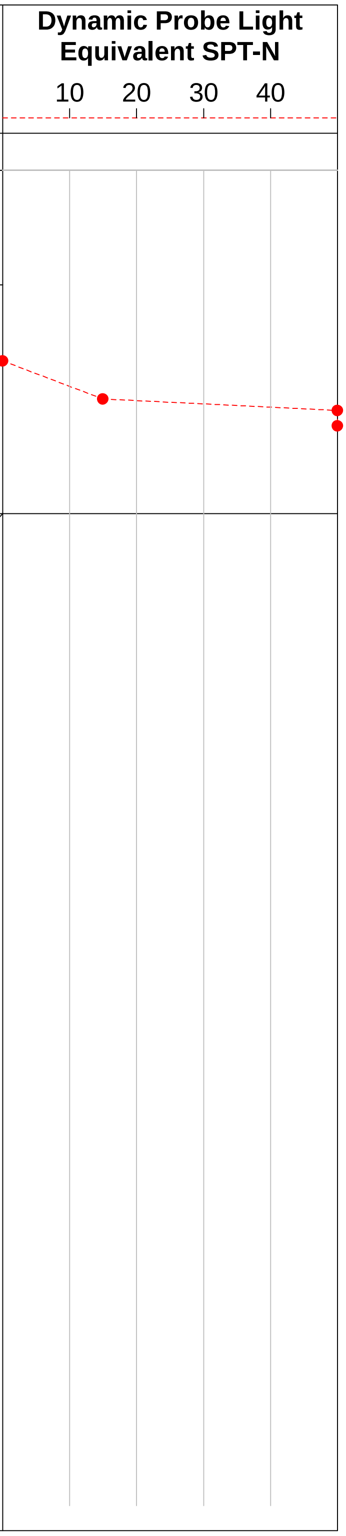
HOLE NO: KF/T5

X COORD:	3 171 347
Y COORD: Lo25	-73 488
ELEVATION:	

PAGE 1 of 1

Depth			Description
		0.00	Ground Surface
0.0		0.30	**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.
		0.90	**Very soft to soft rock DOLERITE** Completely to highly weathered, yellow/brown, very highly fractured, fine to medium grained.
1.0			**Refusal on medium hard rock**
			End of Log





NOTES 1: Trial pit dry
2: Sample KF/T5/1 at 0.3-0.9m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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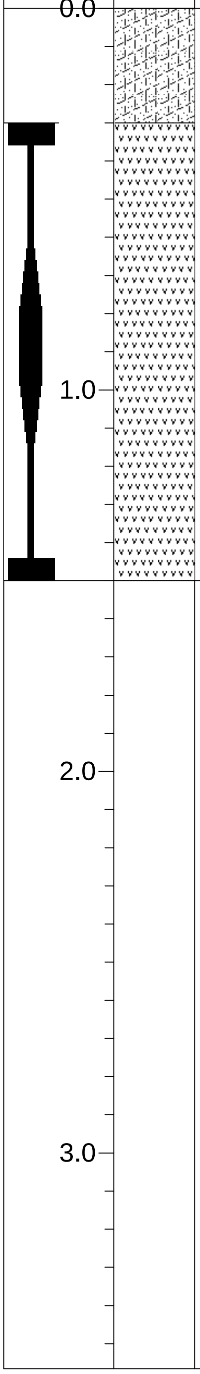
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T6

X COORD: 3 171 306
Y COORD: Lo25 -72 618
ELEVATION:
PAGE 1 of 1

Depth	Description
0.00	Ground Surface
0.30	**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.
1.50	**Very soft to soft rock DOLERITE** Completely to highly weathered, yellow/brown to grey, very highly fractured, fine to medium grained.
	Trial pit stopped - slow progress
	End of Log

Dynamic Probe Light
Equivalent SPT-N
10 20 30 40



NOTES 1: Trial pit dry
2: Sample KF/T6/1 at 0.3-1.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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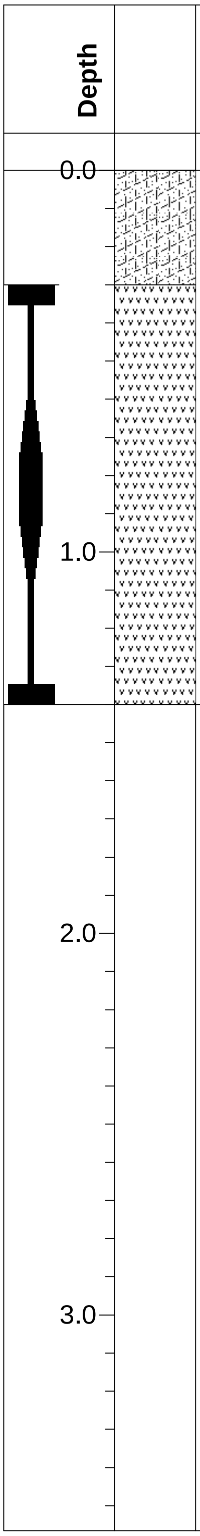
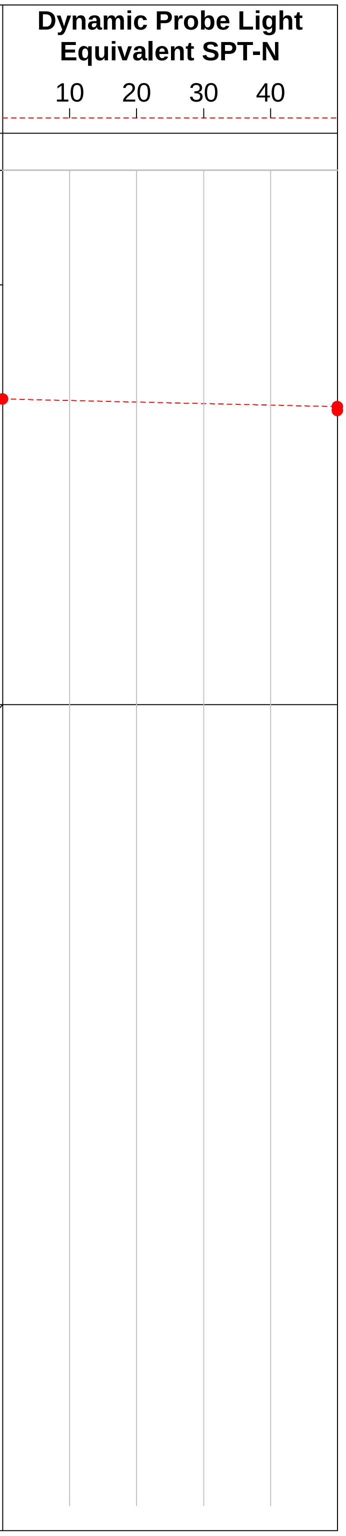
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T7
X COORD: 3 171 569
Y COORD: Lo25 -73 230
ELEVATION:
PAGE 1 of 1



	Description
0.00	Ground Surface
0.30	**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.
1.40	**Very soft to soft rock DOLERITE** Completely to highly weathered, brown, very highly fractured, fine to medium grained.
	Trial pit stopped - slow progress
	End of Log



NOTES 1: Trial pit dry
2: Sample KF/T7/1 at 0.3-1.4m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T8
X COORD: 3 171 797
Y COORD: Lo25 -73 711
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		2.00	**Soft to medium hard rock SHALE** Highly weathered, grey, very thinly bedded, very highly fractured, very fine grained. Very soft rock to 0.6m.	
1.0				
2.0			**Trial pit stopped - slow progress** End of Log	
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 30 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T9
X COORD: 3 171 422
Y COORD: Lo25 -72 384
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0		0.30	**Firm to stiff, silty, sandy CLAY** Slightly moist to moist, dark grey, topsoil.	
		0.70	**Firm to stiff, silty, sandy CLAY** Slightly moist to moist, dark brown, transported.	
1.0 2.0		2.40	**Very soft to soft rock SHALE** Highly weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
3.0			**Trial pit stopped - slow progress** End of Log	

NOTES
1: Trial pit dry
2: Sample KF/T9/1 at 0.3-0.7m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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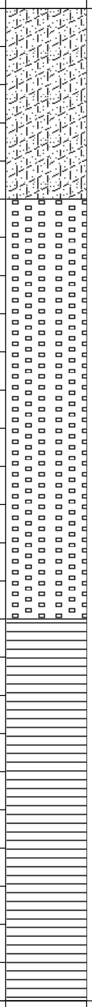
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T10
X COORD: 3 171 639
Y COORD: Lo25 -72 817
ELEVATION:
PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
	0.00	Ground Surface	
0.0		**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
	0.50	**Cemented CALCRETE**	
1.0	1.60	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
2.0	2.60	**Trial pit stopped - slow progress**	
3.0		End of Log	



NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T11
X COORD: 3 171 736
Y COORD: Lo25 -73 239
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.0	0.00	Ground Surface	
	0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
	0.60	**Firm to stiff, silty, sandy CLAY** Slightly moist, dark brown, transported.	
1.0	1.90	**Cemented CALCRETE**	
2.0	2.40	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
		Trial pit stopped - slow progress	
		End of Log	
3.0			

NOTES 1: Trial pit dry
2: Sample KF/T11/1 at 0.6-1.9m
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 30 June 2020
DIAM: Trench
PROFILED BY: R Roberts
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FILE REF: C1801/3 Working/30 Kentani
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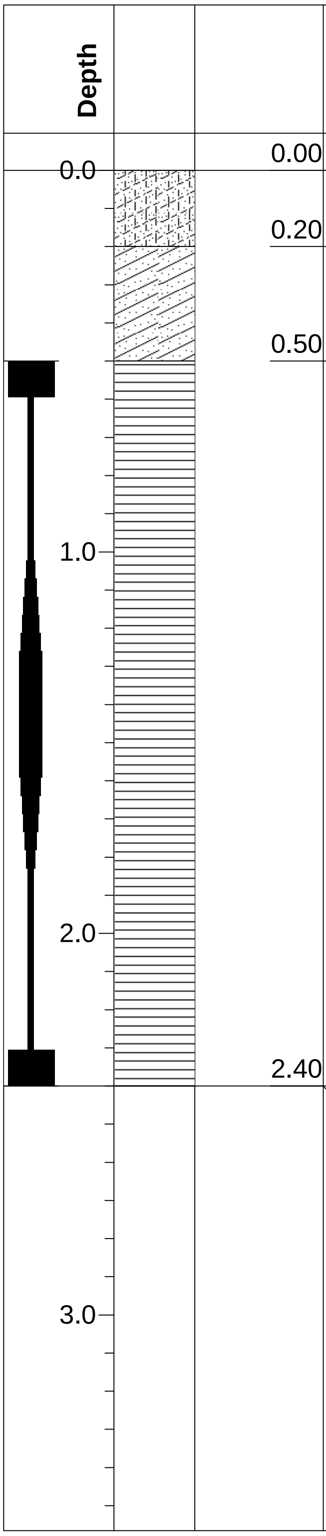
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T12
X COORD: 3 171 918
Y COORD: Lo25 -73 426
ELEVATION:
PAGE 1 of 1

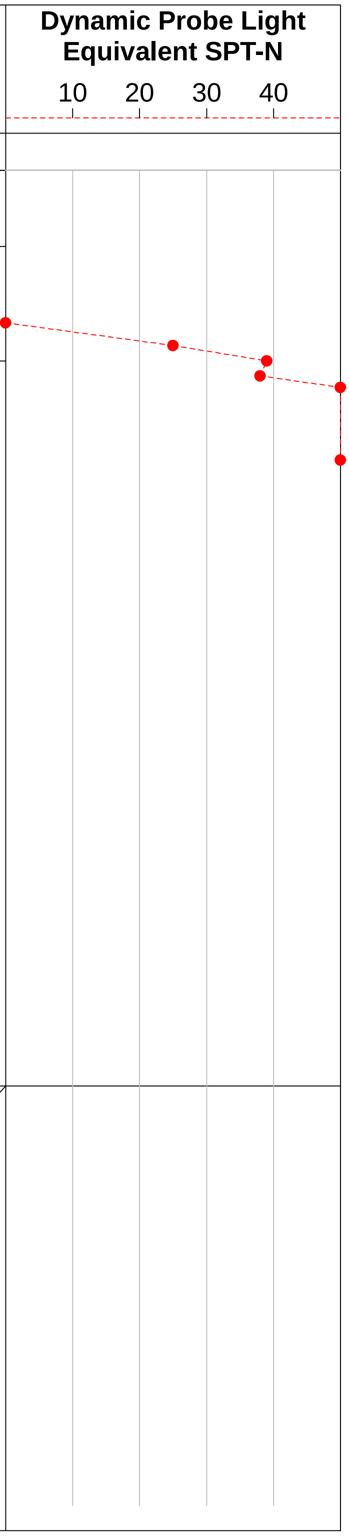


Description

Depth	Description
0.00	Ground Surface
0.00–0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
0.20–0.50	**Firm to stiff, silty, sandy CLAY** Slightly moist, dark brown, transported.
0.50–2.40	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.

Trial pit stopped - slow progress

End of Log



NOTES 1: Trial pit dry
2: Sample KF/T12/1 at 0.5-2.4m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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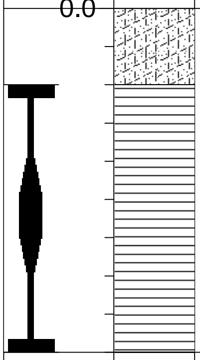
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T13
X COORD: 3 172 215
Y COORD: Lo25 -73 962
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
0.90	**Soft to medium hard rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
	Refusal on medium hard rock	
	End of Log	

NOTES
1: Trial pit dry
2: Sample KF/T13/1 at 0.2-0.9m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T14
X COORD: 3 172 018
Y COORD: Lo25 -72 263
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.50		
			Refusal on strongly cemented calcrete	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 1 July 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T15
X COORD: 3 172 186
Y COORD: Lo25 -72 538
ELEVATION:
PAGE 1 of 1

Depth	Depth (m)	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0	0.00	Ground Surface	
		Loose, clayey, silty SAND Slightly moist to moist, dark brown, topsoil.	
	0.40	**Cemented CALCRETE**	
1.0	1.20	**Very soft to soft rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
2.0	2.00	**Trial pit stopped - slow progress** End of Log	
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 30 June 2020
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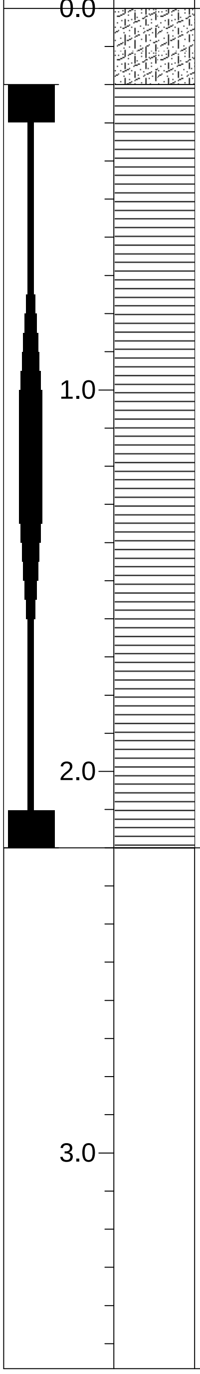
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T16
X COORD: 3 172 459
Y COORD: Lo25 -73 024
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
	0.00	Ground Surface	
0.0	0.20	**Loose, clayey, silty SAND** Slightly moist to moist, dark brown, topsoil.	
	2.20	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Very soft rock to 0.7m.	
		Trial pit stopped - slow progress	
		End of Log	



NOTES 1: Trial pit dry
2: Sample KF/T16/1 at 0.2-2.2m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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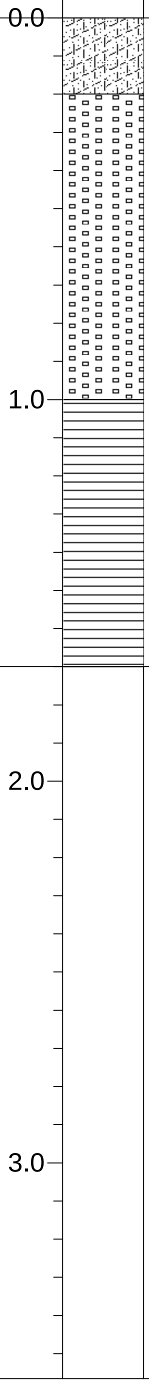
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T17
X COORD: 3 172 660
Y COORD: Lo25 -73 443
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.00	Ground Surface	
0.20	**Loose, clayey, silty SAND** Slightly moist to moist, dark brown, topsoil.	
1.00	**Weakly cemented to cemented CALCRETE**	
1.70	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Very soft rock to 0.7m.	
	Trial pit stopped - slow progress	
	End of Log	

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T18
X COORD: 3 172 282
Y COORD: Lo25 -71 811
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Cemented to strongly cemented CALCRETE**	
		0.80	**Refusal on strongly cemented calcrete**	
1.0			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: Sample KF/T18/1 at 0.4-0.8m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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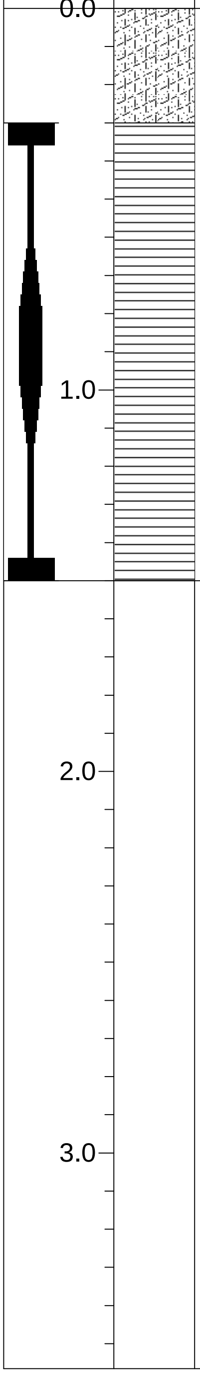
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T19
X COORD: 3 172 345
Y COORD: Lo25 -72 270
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist, orange/brown, topsoil.	
		0.30	**Very soft to medium hard rock SHALE** Highly to moderately weathered, grey to orange, very thinly bedded, very highly fractured, very fine grained. Medium hard rock from 0.9m.	
		1.50	**Trial pit stopped - slow progress** End of Log	



NOTES
1: Trial pit dry
2: Sample KF/T19/1 at 0.3-1.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T20
X COORD: 3 172 674
Y COORD: Lo25 -72 636
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, very clayey, silty SAND** Slightly moist, dark brown, topsoil.	
		0.30	**Medium dense, very clayey, silty SAND** Moist, brown, transported.	
		0.70	**Medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
1.0				
		1.70	**Trial pit stopped - slow progress**	
			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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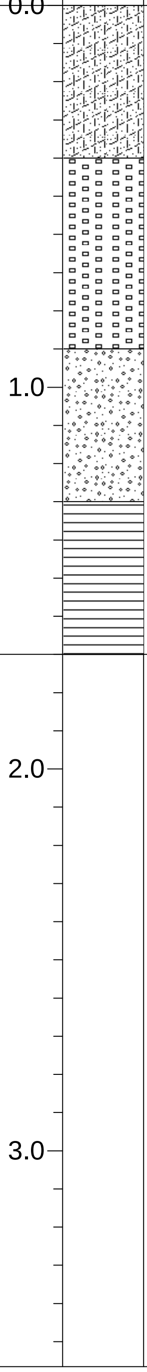
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T21

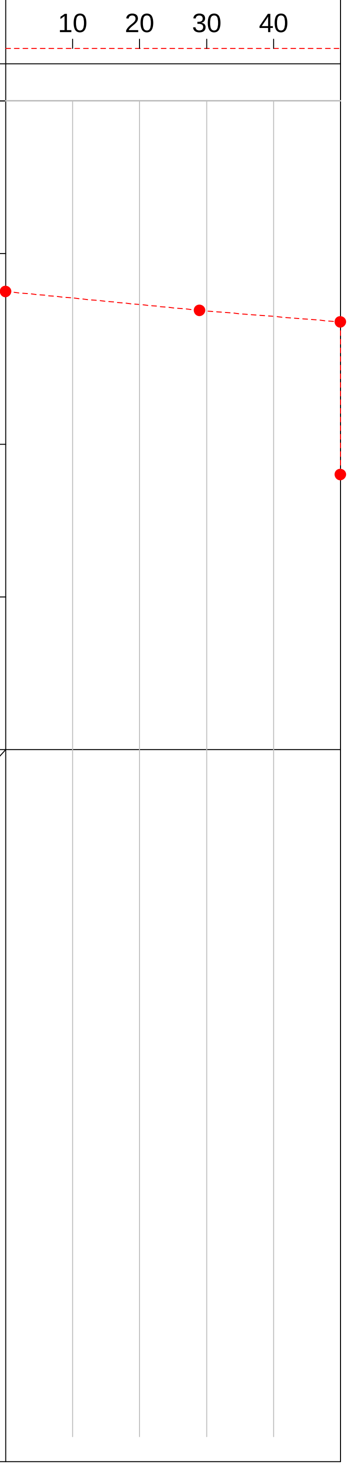
X COORD:	3 172 853
Y COORD: Lo25	-73 142
ELEVATION:	

PAGE 1 of 1



Depth	Description
0.00	Ground Surface
0.40	**Medium dense, clayey, silty SAND** Slightly moist, dark brown, topsoil.
0.90	**Weakly cemented to cemented CALCRETE**
1.30	**Medium dense, silty, sandy GRAVEL** Slightly moist to moist, brown, sub-angular, fine, residual.
1.70	**Medium hard rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.
	Refusal on medium hard rock
	End of Log

Dynamic Probe Light Equivalent SPT-N



NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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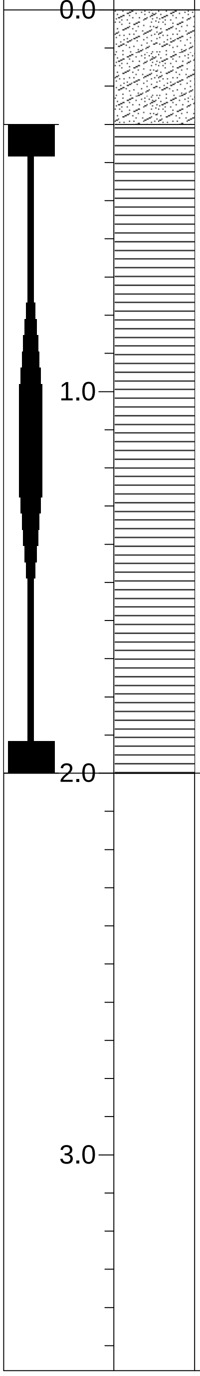
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T22

X COORD: 3 172 989
Y COORD: Lo25 -73 692
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, very clayey, silty SAND** Slightly moist to moist, dark brown, topsoil.	
		0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
2.0		2.00	**Trial pit stopped - slow progress** End of Log	



NOTES
1: Trial pit dry
2: Sample KF/T22/1 at 0.3-2.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T23
X COORD: 3 172 730
Y COORD: Lo25 -71 781
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
		0.70	**Refusal on medium hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T24

X COORD: 3 173 074
Y COORD: Lo25 -72 391
ELEVATION:
PAGE 1 of 1

Depth	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.00	Ground Surface	
0.00–0.60	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
0.60–1.00	**Cemented CALCRETE**	
1.00–1.70	**Soft to medium hard rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
1.70	**Trial pit stopped - slow progress** End of Log	

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T25
X COORD: 3 172 984
Y COORD: Lo25 -71 758
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose, clayey, silty SAND** Slightly moist, red/brown, topsoil.	
		0.50	**Cemented to strongly cemented CALCRETE**	
			Refusal on strongly cemented calcrete	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 29 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein

HOLE NO: KF/T27
X COORD: 3 173 169
Y COORD: Lo25 -71 999
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Cemented to strongly cemented CALCRETE**	
		0.80	**Trial pit stopped - slow progress**	
1.0			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: Sample KF/T27/1 at 0.4-0.8m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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KF/T1

KF/T2

KF/T3

KF/T4

KF/T5

KF/T6

KF/T7

KF/T8

KF/T9

KF/T10

KF/T11

KF/T12

KF/T13

KF/T14

KF/T15

KF/T16

KF/T17

KF/T18

KF/T19

KF/T20

KF/T21

KF/T22

KF/T23

KF/T24

KF/T25

KF/T27

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T1
X COORD: 3 174 388
Y COORD: Lo25 -70 963
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.50	**Medium dense, slightly clayey, silty SAND** Slightly moist to moist, red/brown, transported.	
1.0		1.40	**Very soft to soft rock DOLERITE** Completely to highly weathered, light brown, very highly fractured, fine grained.	
			Refusal on medium hard rock	
			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: Sample KF2/T1/1 at 0.5-1.4m
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 29 June 2020
DIAM: Trench
PROFILED BY: R Roberts
Prof Reg:
FILE REF: C1801/3 Working/30 Kentani
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Prof Reg:

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T2
X COORD: 3 174 357
Y COORD: Lo25 -71 436
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		0.40		
		0.50	**Soft to medium hard rock DOLERITE** Highly to moderately weathered, light brown, very highly fractured, fine grained. Calcrete at surface.	
			Refusal on medium hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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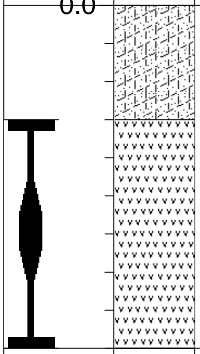
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T3

X COORD: 3 174 105
Y COORD: Lo25 -72 846
ELEVATION:
PAGE 1 of 1



Depth		Description
	0.00	Ground Surface
0.0		**Loose to medium dense, clayey, silty SAND** Slightly moist, red/brown, topsoil.
	0.30	**Soft to medium hard rock DOLERITE** Highly weathered, light brown to orange, very highly fractured, fine grained.
	0.90	**Trial pit stopped - very slow progress** End of Log
1.0		
2.0		
3.0		

Dynamic Probe Light Equivalent SPT-N

10	20	30	40

NOTES
1: Trial pit dry
2: Sample KF2/T3/1 at 0.3-0.9m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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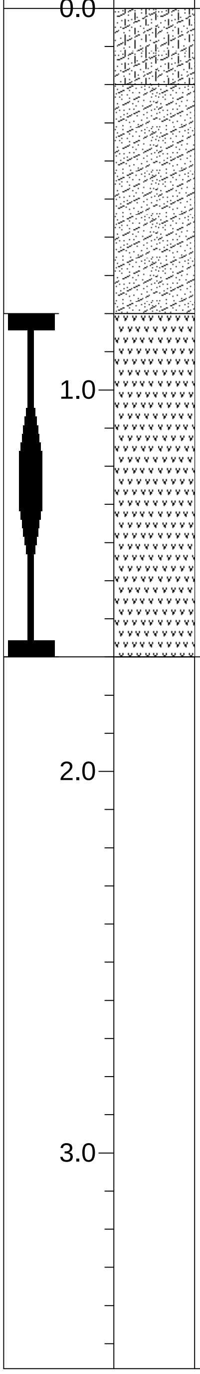
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T4
X COORD: 3 174 845
Y COORD: Lo25 -71 584
ELEVATION:
PAGE 1 of 1



Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
		0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist, red/brown, topsoil.	
		0.80	**Loose to medium dense, very clayey, silty SAND** Moist, red/brown, transported.	
		1.70	**Very soft to soft rock DOLERITE** Highly weathered, brown, very highly fractured, fine grained.	
			Trial pit stopped - slow progress	
			End of Log	

NOTES 1: Trial pit dry
2: Sample KF2/T4/1 at 0.8-1.7m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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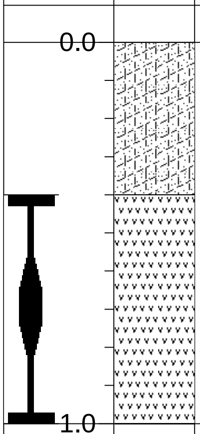
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T5
X COORD: 3 174 696
Y COORD: Lo25 -71 754
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.00	Ground Surface	
0.00–0.40	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
0.40–1.00	**Soft rock DOLERITE** Highly weathered, light brown, very highly fractured, fine grained.	
1.00	**Refusal on medium hard rock**	

End of Log

2.0

3.0

NOTES 1: Trial pit dry
2: Sample KF2/T5/1 at 0.4-1.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T6
X COORD: 3 174 781
Y COORD: Lo25 -72 305
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Soft rock DOLERITE** Highly weathered, brown to orange, very highly fractured, fine grained.	
1.0		1.10		
			Trial pit stopped - slow progress	
			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 29 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T7
X COORD: 3 174 619
Y COORD: Lo25 -72 821
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.60	**Soft to medium hard rock DOLERITE** Highly weathered, light brown to orange, very highly fractured, fine grained. Calcretised.	
			Refusal on medium hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T8
X COORD: 3 174 871
Y COORD: Lo25 -73 035
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Soft to medium hard rock DOLERITE** Highly weathered, light brown to orange, very highly fractured, fine grained. With hard rock boulder sized corestones.	
1.0		1.10	**Trial pit stopped - very slow progress**	
			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: Sample KF2/T8/1 at 0.4-1.1m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 29 June 2020
PROFILED BY: R Roberts Prof Reg:
CHECKED BY: Prof Reg:

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TRIAL PIT LOG

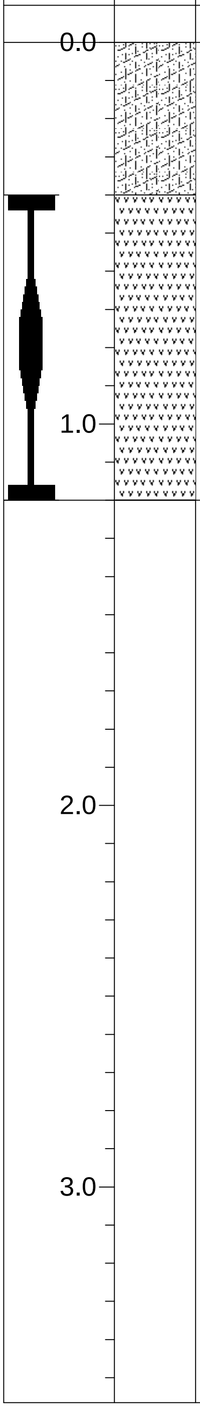
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T9

X COORD:	3 175 265
Y COORD: Lo25	-72 507
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
		0.40	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		1.20	**Soft to medium hard rock DOLERITE** Highly weathered, brown, very highly fractured, fine grained. With hard rock boulder sized corestones.	
			Refusal on medium hard rock	
			End of Log	



NOTES 1: Trial pit dry
2: Sample KF2/T9/1 at 0.4-1.2m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T10
X COORD: 3 174 803
Y COORD: Lo25 -71 076
ELEVATION:
PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0	0.00	Ground Surface	
	0.20	**Loose to medium dense, silty SAND** Slightly moist to moist, red/brown, topsoil.	
1.0	1.10	**Medium dense, silty SAND** Moist, red/brown, transported. With some sub-rounded, dolerite boulders up to 500mm.	
		Refusal on boulders	
		End of Log	
2.0			
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 2 July 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T11
X COORD: 3 175 154
Y COORD: Lo25 -70 804
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.50	**Soft to medium hard rock DOLERITE** Highly weathered, brown, very highly fractured, fine to medium grained.	
			Refusal on medium hard rock End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 2 July 2020
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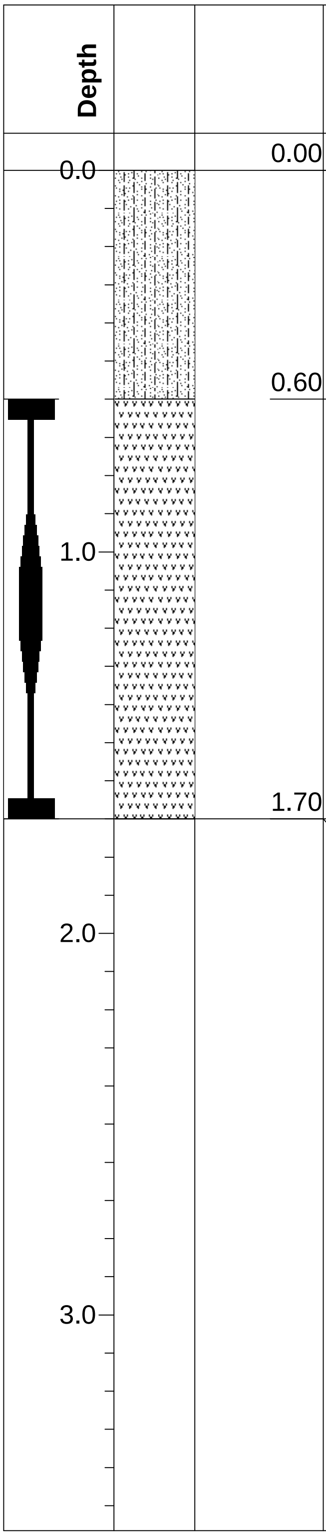
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T12
X COORD: 3 175 514
Y COORD: Lo25 -71 107
ELEVATION:
PAGE 1 of 1



Description

0.00 Ground Surface

0.60

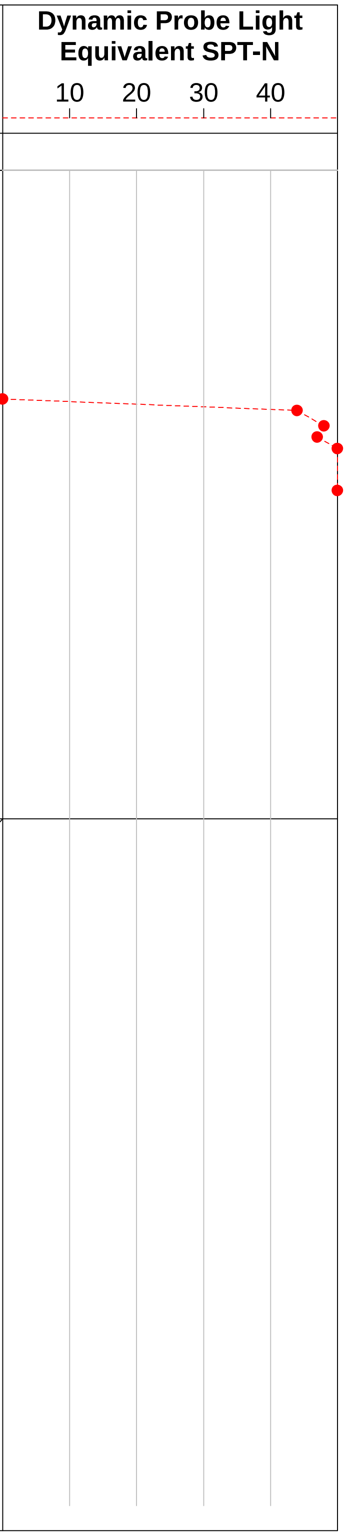
Loose, silty SAND
Slightly moist to moist, red/brown, topsoil.

1.70

Very soft to soft rock DOLERITE
Completely to highly weathered, brown, very highly fractured, fine to medium grained. Recovered as sandy gravel.

Trial pit stopped - slow progress

End of Log



NOTES 1: Trial pit dry
2: Sample KF2/T12/1 at 0.6-1.7m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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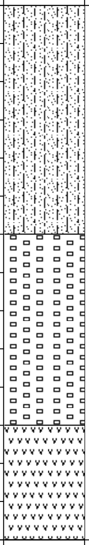
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T13
X COORD: 3 175 821
Y COORD: Lo25 -70 779
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, slightly clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.60	**Cemented to strongly cemented CALCRETE** With some very soft rock dolerite.	
1.0		1.10	**Very soft to soft rock DOLERITE** Completely to highly weathered, light brown, very highly fractured, fine to medium grained.	
		1.40	**Trial pit stopped - slow progress**	
			End of Log	
2.0				
3.0				



NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T14
X COORD: 3 176 045
Y COORD: Lo25 -70 202
ELEVATION:
PAGE 1 of 1

Dynamic Probe Light Equivalent SPT-N
10 20 30 40

Depth			**Description**
		0.00	Ground Surface
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist, dark brown, topsoil.
		0.40	**Very weakly to weakly cemented CALCRETE**
1.0		1.10	**Very soft to soft rock DOLERITE** Completely to highly weathered, grey, very highly fractured, fine to medium grained. Recovered as clayey gravel.
		1.80	**Trial pit stopped - slow progress**
2.0			End of Log
3.0			

NOTES 1: Trial pit dry
2: Sample KF2/T14/1 at 1.1-1.8m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 2 July 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T15

X COORD: 3 176 440
Y COORD: Lo25 -70 245
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose, slightly clayey, silty SAND** Slightly moist, red/brown, topsoil.	
		0.60	**Soft to medium hard rock DOLERITE** Highly weathered, brown, very highly fractured, fine grained. Calcretised.	
			Refusal on medium hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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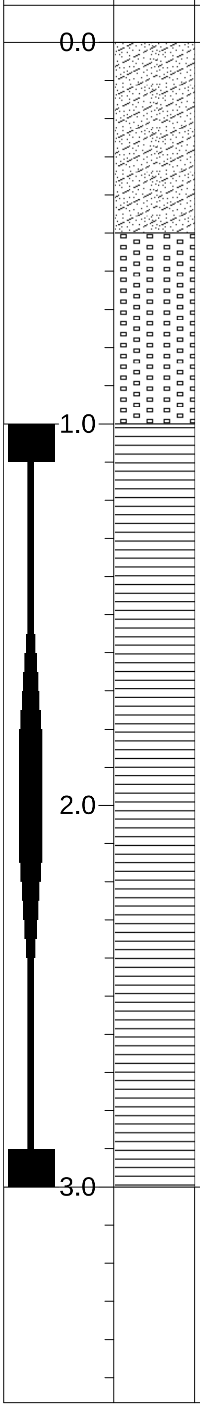
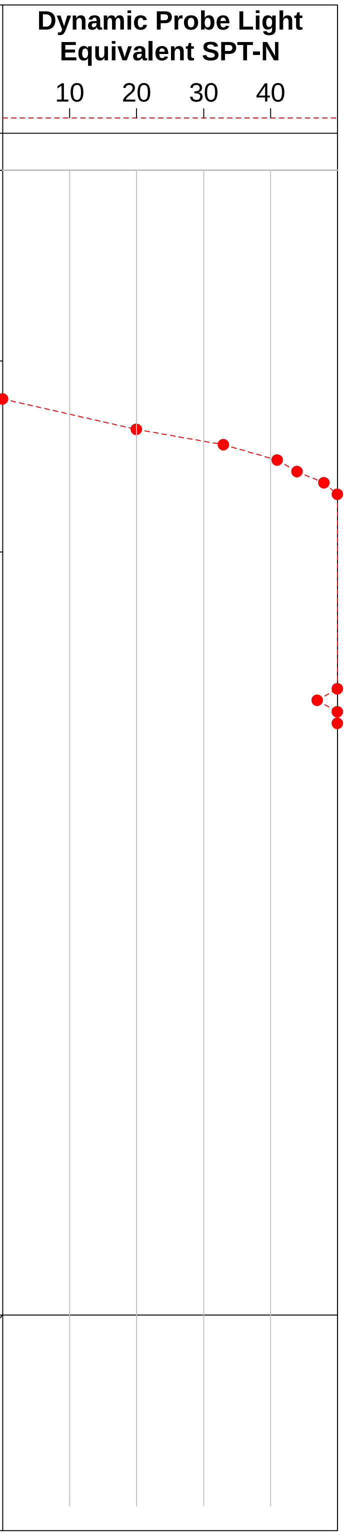
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T16
X COORD: 3 176 760
Y COORD: Lo25 -69 948
ELEVATION:
PAGE 1 of 1

Depth		Description
0.00		Ground Surface
0.00 – 0.50		**Loose to medium dense, very clayey, silty SAND** Slightly moist, brown, topsoil.
0.50 – 1.00		**Very weakly to weakly cemented CALCRETE**
1.00 – 3.00		**Very soft to soft rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.
3.00		**Trial pit stopped at required depth**
		End of Log





NOTES
1: Trial pit dry
2: Sample KF2/T16/1 at 1.0-3.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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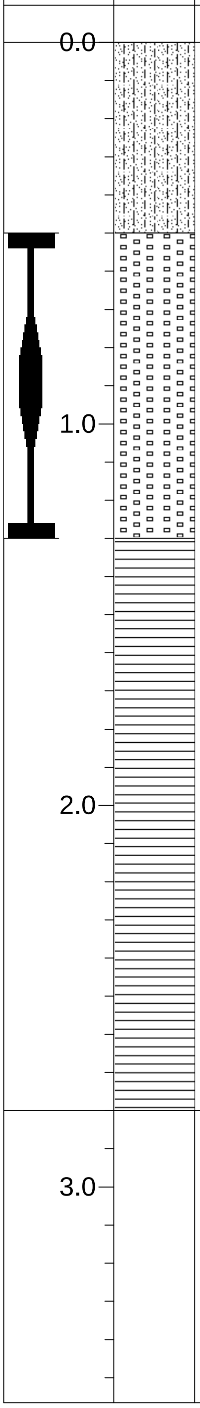
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Klipfontein 2

HOLE NO: KF2/T17
X COORD: 3 177 267
Y COORD: Lo25 -69 913
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.50	**Loose, slightly clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
1.30	**Cemented to strongly cemented CALCRETE**	
2.80	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
	Trial pit stopped at required depth End of Log	

NOTES
1: Trial pit dry
2: Sample KF2/T17/1 at 0.5-1.3m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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KF2/T1

KF2/T2

KF2/T3

KF2/T4

KF2/T5

KF2/T6

KF2/T7

KF2/T8

KF2/T9

KF2/T10

KF2/T11

KF2/T12

KF2/T13

KF2/T14

KF2/T15

KF2/T16

KF2/T17

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T1
X COORD: 3 172 351
Y COORD: Lo25 -70 063
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0		0.00	Ground Surface	
	▨	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
	▨	0.50	**Cemented to strongly cemented CALCRETE**	
			Refusal on strongly cemented calcrete	
1.0			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 25 June 2020
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TRIAL PIT LOG

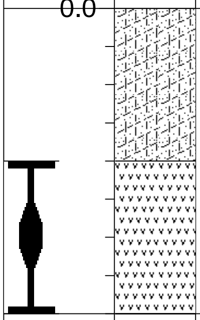
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T2

X COORD:	3 172 678
Y COORD: Lo25	-69 841
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil. With some sub-angular to sub-rounded, dolerite boulders up to 800mm.	
		0.40	**Soft rock DOLERITE** Completely to highly weathered, brown, very highly fractured, fine grained.	
		0.80	**Refusal on hard rock dolerite / boulders**	
1.0			End of Log	
2.0				
3.0				



NOTES 1: Trial pit dry
2: Sample LH/T2/1 at 0.4-0.8m
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 25 June 2020
DIAM: Trench
PROFILED BY: R Roberts
Prof Reg:
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T3
X COORD: 3 173 099
Y COORD: Lo25 -69 089
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
	0.00	Ground Surface	
0.0	0.40	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
	0.80	**Very soft to soft rock DOLERITE** Highly weathered, brown, very highly fractured, fine grained.	
		Refusal on medium hard rock dolerite	
1.0		End of Log	
2.0			
3.0			

NOTES 1: Trial pit dry
2: Sample LH/T3/1 at 0.4-0.8m
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 25 June 2020
DIAM: Trench
PROFILED BY: R Roberts
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FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T4

X COORD:	3 173 195
Y COORD: Lo25	-69 651
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0	▨	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
			Refusal on hard rock dolerite	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 25 June 2020
PROFILED BY: R Roberts Prof Reg:
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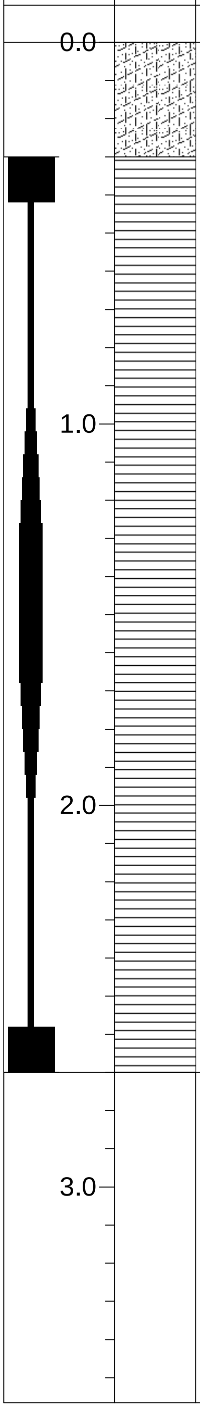
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T5

X COORD:	3 173 599
Y COORD: Lo25	-68 811
ELEVATION:	

PAGE 1 of 1



Depth (m)	Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.00	Ground Surface	
0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
2.70	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
	Trial pit stopped - slow progress	
	End of Log	

NOTES
1: Trial pit dry
2: Sample LH/T5/1 at 0.3-2.7m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T6

X COORD: 3 173 809
Y COORD: Lo25 -69 366
ELEVATION:
PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
	0.00	Ground Surface	
0.0		**Loose to medium dense, clayey, silty SAND** Slightly moist, red/brown, topsoil.	
	0.30		
	0.40	**Strongly cemented CALCRETE**	
		Refusal on strongly cemented calcrete	
		End of Log	
1.0			
2.0			
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 25 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T7
X COORD: 3 174 196
Y COORD: Lo25 -68 831
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, brown, topsoil.	
		0.40	**Weakly cemented to cemented CALCRETE** With some very soft rock shale.	
1.0		1.20	**Soft to medium hard rock SHALE** Moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
2.0		2.30	**Trial pit stopped - slow progress** End of Log	
3.0				

NOTES 1: Trial pit dry
2: Sample LH/T7/1 at 0.4-1.2m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T8
X COORD: 3 174 341
Y COORD: Lo25 -68 978
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0	▨	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
			Refusal on hard rock dolerite	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 25 June 2020
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TRIAL PIT LOG

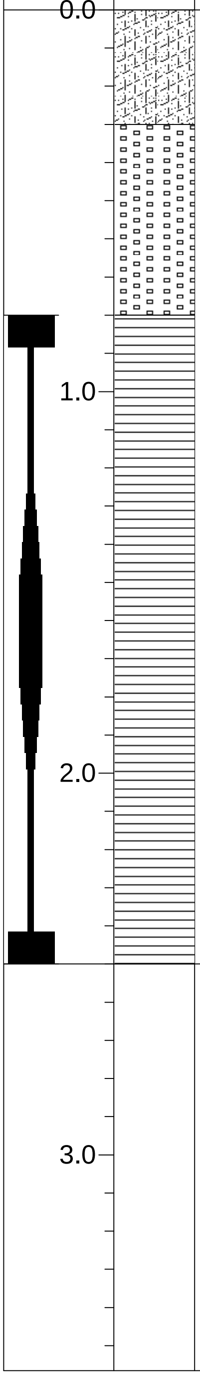
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T9

X COORD:	3 174 308
Y COORD: Lo25	-68 276
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
		0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
		0.80	**Weakly cemented to cemented CALCRETE**	
		2.50	**Very soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
			Trial pit stopped - slow progress	
			End of Log	



NOTES 1: Trial pit dry
2: Sample LH/T9/1 at 0.8-2.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T10
X COORD: 3 174 694
Y COORD: Lo25 -68 563
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, brown, topsoil.	
		0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
1.0		1.10	**Trial pit stopped - slow progress**	
			End of Log	
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 25 June 2020
DIAM: Trench
PROFILED BY: R Roberts
Prof Reg:
FILE REF: C1801/3 Working/30 Kentani
CHECKED BY:
Prof Reg:

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T11
X COORD: 3 174 824
Y COORD: Lo25 -69 131
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.0	0.00	Ground Surface	
		Firm to stiff, silty, sandy CLAY Slightly moist, dark grey, topsoil.	
	0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey to grey, very thinly bedded, very highly fractured, very fine grained. Medium hard rock from 1.2m.	
1.0			
2.0	2.00	**Trial pit stopped - slow progress**	
		End of Log	
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 25 June 2020
PROFILED BY: R Roberts Prof Reg:
CHECKED BY: Prof Reg:

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T12
X COORD: 3 174 794
Y COORD: Lo25 -67 964
ELEVATION:
PAGE 1 of 1

Depth	Depth (m)	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.0	0.00	Ground Surface	
	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
	0.60	**Firm to stiff, silty, sandy CLAY** Slightly moist, dark grey, residual.	
	0.70	**Hard rock DOLERITE** Moderately weathered, grey/brown, very highly fractured, fine grained.	
1.0		**Refusal on hard rock**	
		End of Log	
2.0			
3.0			

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 26 June 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T13
X COORD: 3 175 110
Y COORD: Lo25 -68 344
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0	▨		**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
	▨	0.60		
			Refusal on medium hard rock dolerite	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T14
X COORD: 3 175 311
Y COORD: Lo25 -68 902
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		0.80	**Soft to medium hard rock DOLERITE** Highly to moderately weathered, light brown to grey, very highly fractured, fine grained. Calcretised.	
			Trial pit stopped - slow progress End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: Sample LH/T14/1 at 0.3-0.8m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 25 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T15
X COORD: 3 175 173
Y COORD: Lo25 -67 607
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, brown, topsoil.	
		0.40	**Medium hard rock DOLERITE** Moderately weathered, dark grey, very highly fractured, fine grained.	
			Refusal on hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 26 June 2020
PROFILED BY: R Roberts Prof Reg:
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T16

X COORD: 3 175 624
Y COORD: Lo25 -68 040
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Refusal on medium hard rock dolerite**	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 26 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T17
X COORD: 3 175 708
Y COORD: Lo25 -68 585
ELEVATION:
PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0		0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
		0.40	**Medium hard rock DOLERITE** Highly to moderately weathered, brown/blue, very highly fractured, fine grained.	
			Refusal on medium hard rock	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 26 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T18
X COORD: 3 175 668
Y COORD: Lo25 -67 388
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0	▨	0.40	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
			Refusal on medium hard rock dolerite and calcrete End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Leliehoek

HOLE NO: LH/T19

X COORD:	3 176 092
Y COORD: Lo25	-68 353
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
		0.00	Ground Surface	
0.0	▨	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, red/brown, topsoil.	
			Refusal on medium hard rock dolerite	
			End of Log	
1.0				
2.0				
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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LH/T1

LH/T2

LH/T3

LH/T4

LH/T5

LH/T6

LH/T8

LH/T9

LH/T10

LH/T11

LH/T12

LH/T13

LH/T14

LH/T15

LH/T16

LH/T17

LH/T18

LH/T19

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T1
X COORD: 3 166 206
Y COORD: Lo25 -71 763
ELEVATION:
PAGE 1 of 1

Depth	**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.00	Ground Surface	
0.0 – 0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
0.30 – 0.50	**Firm, silty, very sandy CLAY** Moist, grey, residual.	
0.50 – 1.40	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained.	
1.40	**Trial pit stopped - slow progress** End of Log	

Depth scale: 0.0, 1.0, 2.0, 3.0

NOTES 1: Trial pit dry
2: Sample SB/T1/1 at 0.5-1.4m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T2
X COORD: 3 166 344
Y COORD: Lo25 -72 232
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0	▨		**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
		0.30		
	▨		**Soft to medium hard rock DOLERITE** Highly to moderately weathered, brown, very highly fractured, fine to medium grained.	
		0.50	**Refusal on medium hard rock**	
			End of Log	
1.0				
2.0				
3.0				

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 23 June 2020
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T3
X COORD: 3 166 496
Y COORD: Lo25 -72 752
ELEVATION:
PAGE 1 of 1

Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
0.60	**Firm, silty, very sandy CLAY** Moist, red/brown, transported.	
1.10	**Very soft to soft rock DOLERITE** Highly to moderately weathered, olive/brown to grey/brown, very highly fractured, fine to medium grained.	
	Refusal on medium hard rock	
	End of Log	

Depth scale: 0.0, 1.0, 2.0, 3.0

NOTES 1: Trial pit dry
2: Sample SB/T3/1 at 0.6-1.1m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 23 June 2020
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CHECKED BY: Prof Reg:

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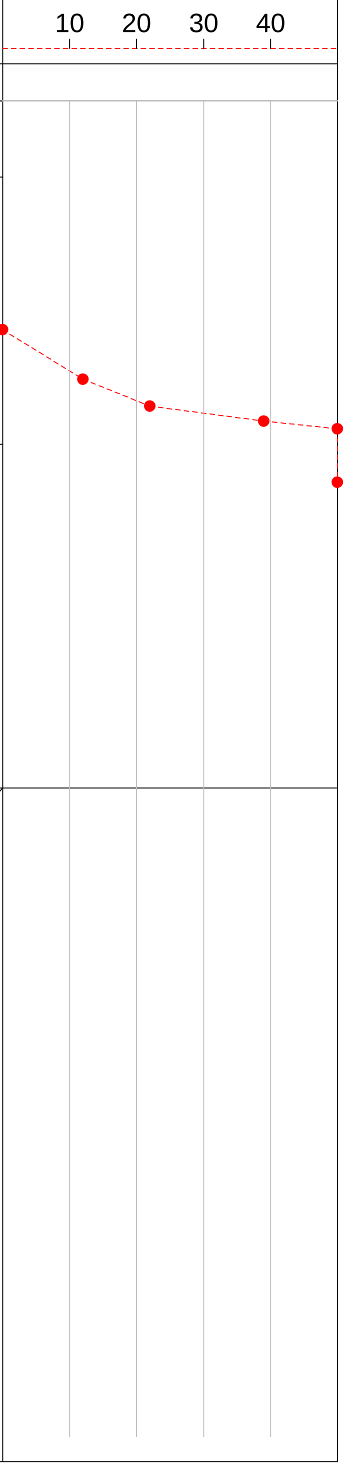
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T4
X COORD: 3 166 621
Y COORD: Lo25 -73 209
ELEVATION:
PAGE 1 of 1

Depth	Description
0.00	Ground Surface
0.00–0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.
0.20–0.60	**Firm, silty, very sandy CLAY** Moist, red/brown, transported.
0.60–0.90	**Medium dense, very clayey, silty SAND** Moist, light brown, residual.
0.90–1.80	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained.
1.80	**Refusal on medium hard rock**
	End of Log

Dynamic Probe Light Equivalent SPT-N



NOTES
1: Trial pit dry
2: Sample SB/T4/1U at 0.4-0.5m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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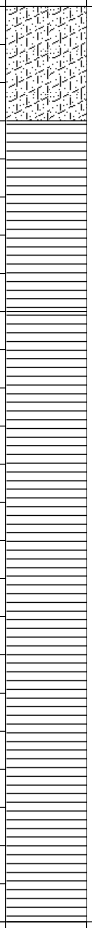
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T5
X COORD: 3 166 568
Y COORD: Lo25 -71 955
ELEVATION:
PAGE 1 of 1

Depth	Description
0.00	Ground Surface
0.00 – 0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
0.30 – 0.80	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.
0.80 – 2.40	**Medium hard rock SHALE** Highly weathered, orange/grey, very thinly bedded, very highly fractured, very fine grained.
2.40	**Trial pit stopped - slow progress**
	End of Log



Dynamic Probe Light Equivalent SPT-N: 10 20 30 40

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T6
X COORD: 3 166 706
Y COORD: Lo25 -72 475
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0	▨		**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
	▤	0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel and cobbles.	
1.0	▤			
2.0		2.00	**Refusal on medium hard rock**	
			End of Log	
3.0				

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

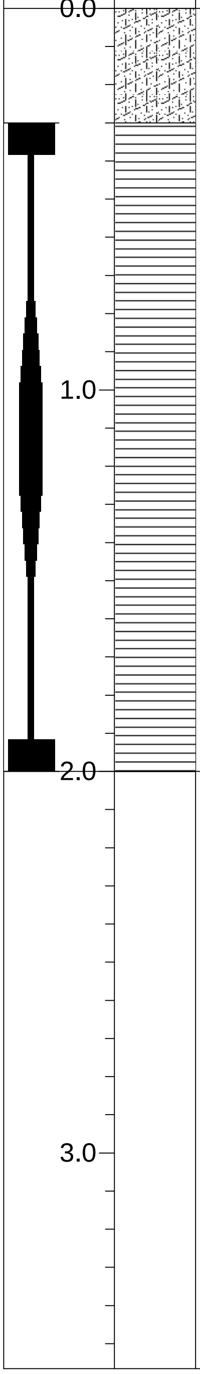
CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T7

X COORD:	3 166 835
Y COORD: Lo25	-72 936
ELEVATION:	

PAGE 1 of 1

Depth			Description	Dynamic Probe Light Equivalent SPT-N
				10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
		0.30	**Soft to medium hard rock SHALE** Highly to moderately weathered, grey/brown, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
2.0		2.00	**Trial pit stopped - slow progress** End of Log	



NOTES 1: Trial pit dry
2: Sample SB/T7/1 at 0.3-2.0m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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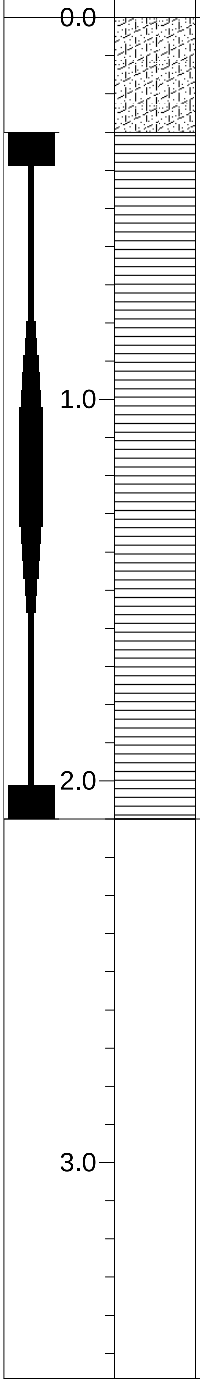
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T8
X COORD: 3 166 855
Y COORD: Lo25 -72 522
ELEVATION:
PAGE 1 of 1



Depth	Description	Dynamic Probe Light Equivalent SPT-N (10 20 30 40)
0.00	Ground Surface	
0.00–0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.	
0.30–2.10	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey occasionally orange, very thinly bedded, very highly fractured, very fine grained. Recovered as gravel.	
2.10	**Trial pit stopped - slow progress**	
	End of Log	

NOTES 1: Trial pit dry
2: Sample SB/T8/1 at 0.3-2.1m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T9
X COORD: 3 167 036
Y COORD: Lo25 -72 700
ELEVATION:
PAGE 1 of 1

Dynamic Probe Light Equivalent SPT-N
10 20 30 40

Depth		**Description**
0.0	0.00	Ground Surface
	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
	0.60	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey occasionally orange, very thinly bedded, very highly fractured, very fine grained.
		Refusal on hard rock
		End of Log
1.0		
2.0		
3.0		

NOTES 1: Trial pit dry
2: Sample SB/T9/1 at 0.3-0.6m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 23 June 2020
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CHECKED BY:
Prof Reg:

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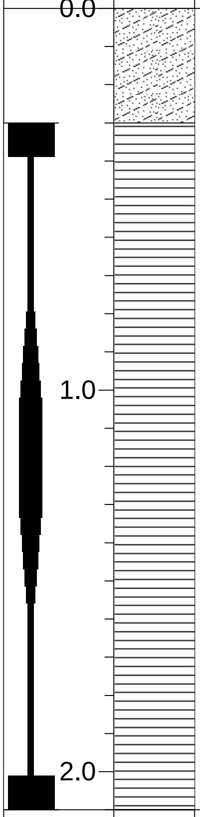
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T10
X COORD: 3 166 922
Y COORD: Lo25 -71 839
ELEVATION:
PAGE 1 of 1

Depth			**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
		0.00	Ground Surface	
0.0			**Loose to medium dense, very clayey, silty SAND** Slightly moist, dark brown, topsoil.	
		0.30	**Very soft to soft rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained. Becoming medium hard from 1.7m.	
1.0				
2.0		2.10	**Trial pit stopped - slow progress** End of Log	
3.0				



NOTES
1: Trial pit dry
2: Sample SB/T10/1 at 0.3-2.1m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

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TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T11
X COORD: 3 167 047
Y COORD: Lo25 -72 178
ELEVATION:
PAGE 1 of 1

Depth		**Description**	**Dynamic Probe Light Equivalent SPT-N** 10 20 30 40
0.0	0.00	Ground Surface	
		Loose to medium dense, clayey, silty SAND Slightly moist, brown, topsoil.	
	0.30	**Medium hard rock SHALE** Highly to moderately weathered, grey occasionally orange, very thinly bedded, very highly fractured, very fine grained.	
	0.50	**Refusal on medium hard rock**	
		End of Log	
1.0			
2.0			
3.0			

NOTES
1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 23 June 2020
PROFILED BY: R Roberts Prof Reg:
CHECKED BY: Prof Reg:

SMEC South Africa
Consulting Engineers
+27 (0)11 369 0600
www.smec.com

Template: SMEC TP04

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T12

X COORD:	3 167 194
Y COORD: Lo25	-72 638
ELEVATION:	

PAGE 1 of 1

Depth		Description	Dynamic Probe Light Equivalent SPT-N 10 20 30 40
0.0	0.00	Ground Surface	
	0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.	
	0.60	**Soft to medium hard rock SHALE** Highly to moderately weathered, light grey, very thinly bedded, very highly fractured, very fine grained.	
		Refusal on hard rock	
		End of Log	
1.0			
2.0			
3.0			

NOTES 1: Trial pit dry
2: No sample
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani

DATE PROFILED: 23 June 2020
PROFILED BY: R Roberts Prof Reg:
CHECKED BY: Prof Reg:

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Consulting Engineers
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www.smec.com

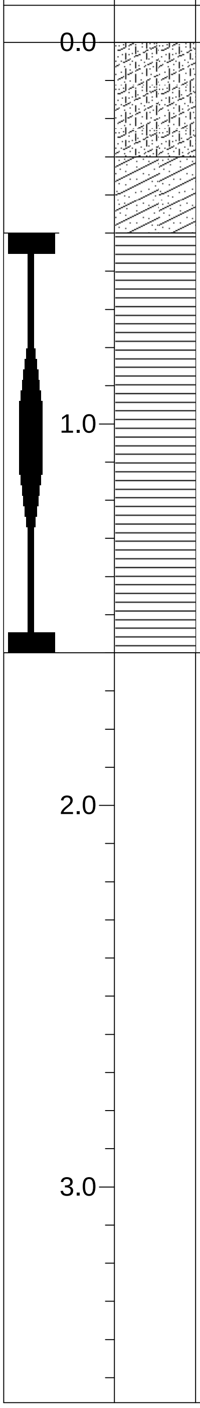
Template: SMEC TP04

TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T13

X COORD: 3 167 261
Y COORD: Lo25 -71 963
ELEVATION:
PAGE 1 of 1



Depth	Description
0.00	Ground Surface
0.30	**Loose to medium dense, clayey, silty SAND** Slightly moist, brown, topsoil.
0.50	**Firm, silty, very sandy CLAY** Moist, grey, residual.
1.60	**Very soft to medium hard rock SHALE** Highly weathered, light grey, very thinly bedded, very highly fractured, very fine grained.
	Trial pit stopped - slow progress
	End of Log

Dynamic Probe Light Equivalent SPT-N

10 20 30 40

NOTES
1: Trial pit dry
2: Sample SB/T13/1 at 0.5-1.6m
3:
4:

MACHINE: CAT 428E
DATE PROFILED: 23 June 2020
DIAM: Trench
PROFILED BY: R Roberts
Prof Reg:
FILE REF: C1801/3 Working/30 Kentani
CHECKED BY:
Prof Reg:

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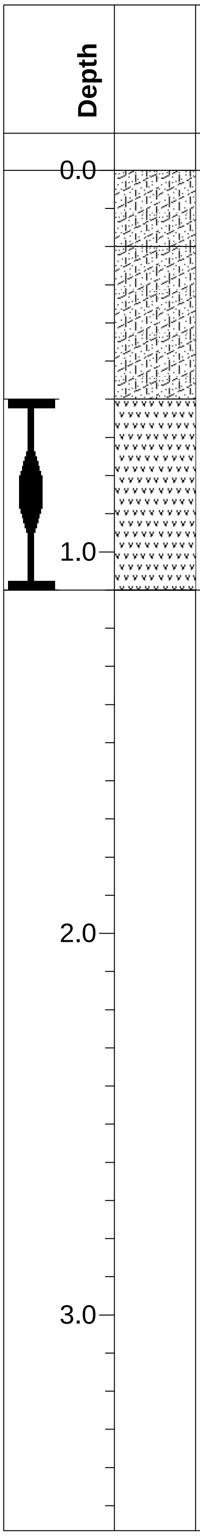
Template: SMEC TP04

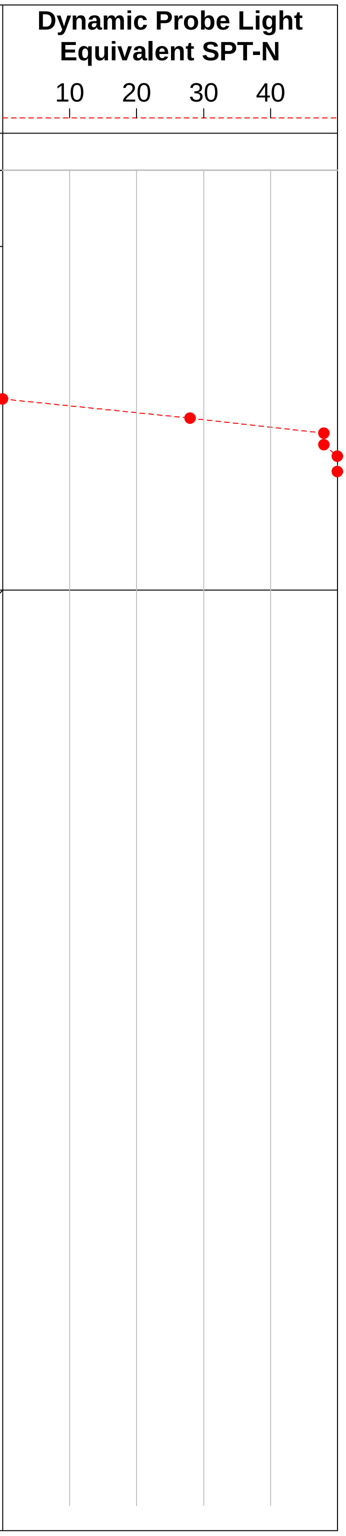
TRIAL PIT LOG

CLIENT: Mainstream Renewable Power
PROJECT: Kentani Solar Development
PROJECT NO: C1801/40
SITE: Sonoblomo

HOLE NO: SB/T14
X COORD: 3 167 351
Y COORD: Lo25 -72 428
ELEVATION:
PAGE 1 of 1



Depth (m)	Description
0.00	Ground Surface
0.20	**Loose to medium dense, clayey, silty SAND** Slightly moist to moist, orange/brown, topsoil.
0.60	**Medium dense, clayey, silty SAND** Moist, orange/brown, transported.
1.10	**Soft to medium hard rock DOLERITE** Highly weathered, light grey/brown, very highly fractured, fine to medium grained.
	Refusal on medium hard rock
	End of Log



NOTES
1: Trial pit dry
2: Sample SB/T14/1 at 0.6-1.1m
3:
4:

MACHINE: CAT 428E
DIAM: Trench
FILE REF: C1801/3 Working/30 Kentani
DATE PROFILED: 23 June 2020
PROFILED BY: R Roberts
CHECKED BY:
Prof Reg:
Prof Reg:

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Template: SMEC TP04

SB/T1

SB/T2

SB/T3

SB/T4

SB/T5

SB/T6

SB/T7

SB/T8

SB/T9

SB/T10

SB/T11

SB/T12

SB/T13

SB/T14

Appendix B

Borrow Pit Assessment Sheets and Photographs

Borrow Pit Assessment Sheet

Project: C1801_Phase 30: Kentani Cluster

Date: 30 June 2020

Borrow Pit Number	1	Co-ordinates	28°40'7.79"S	25°45'42.03"E
Geology	Calcrete	Potential Reserves	~2 000 m^3 (potentially up to ~50 000 m^3 with additional development)	
Material Potential	Selected fill for earthworks and pavements of estimated G5-G7 quality.			

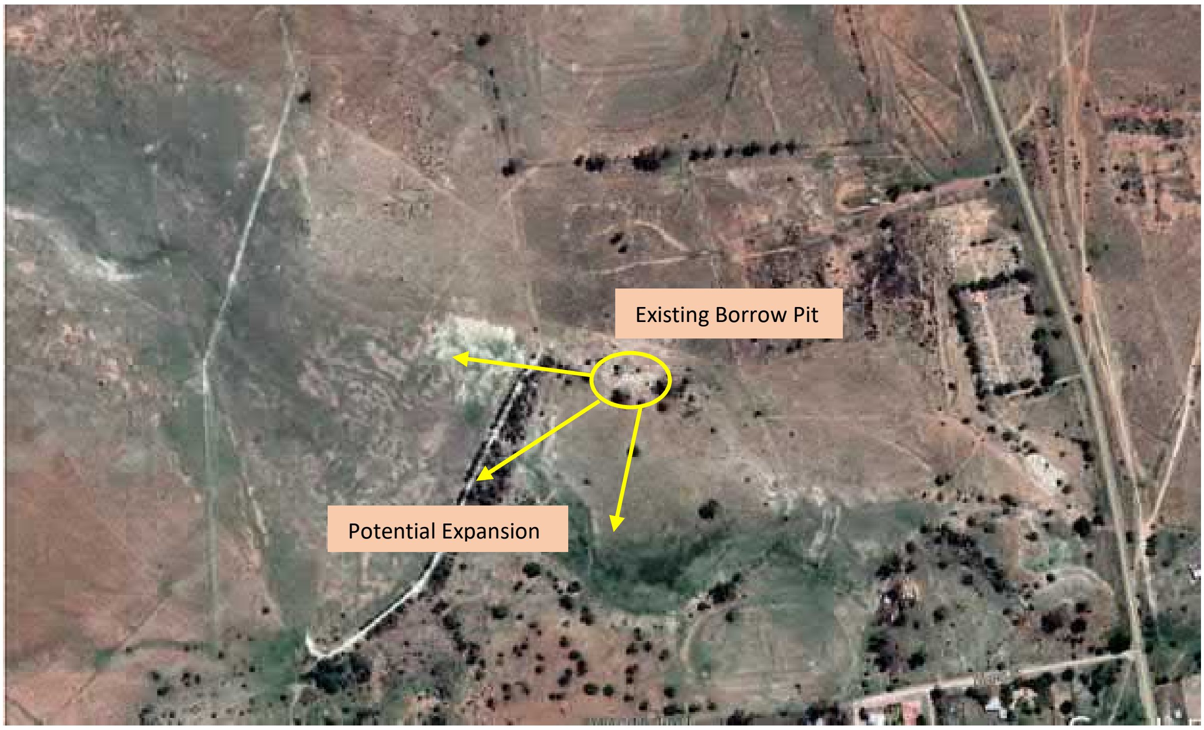
Description:

1. Small calcrete borrow pit.
2. Located adjacent to Klipfontein project close to gravel road giving access to Kentani and Sonoblomo.

Potential Flaws to Exploitation:

1. Relatively small initial size will need to be expanded to be viable. Potential expansion areas to the west and south.

Photos and Layout:



Borrow Pit Assessment Sheet

Project: C1801_Phase 30: Kentani Cluster

Date: 29 June 2020

Borrow Pit Number	2	Co-ordinates	28°41'19.20"S	25°44'57.11"E
Geology	Dolerite (quarry)	Potential Reserves	~50 000 m^3 borrow material plus additional via blasting	
Material Potential	Highly weathered: Selected fill for earthworks and pavements of estimated G5-G7 quality.			
	Moderately to unweathered: Selected fill for earthworks and pavements of estimated G4 or better quality (will require blasting for development).			

Description:

1. Highly weathered grading to unweathered dolerite.
2. Friable at surface (1-2 m) with rockmass having undergone mechanical breakdown into sand and gravel.
3. Already a developed quarry with stockpiles of both borrowed and blasted materials evident
4. Existing access to gravel road.

Potential Flaws to Exploitation:

1. Will require blasting to exploit better quality materials.
2. Very close/potential overlap to proposed Klipfontein 2 development area. Further development or this source may impact on final design.

Photos and Layout:

Borrow Pit Assessment Sheet

Project: C1801_Phase 30: Kentani Cluster

Existing Borrow Pit / Quarry overlapping with Klipfontein 2 development area

Borrow Pit Assessment Sheet

Project: C1801_Phase 30: Kentani Cluster

Date: 25 June 2020

Borrow Pit Number	3	Co-ordinates	28°41'49.51"S	25°42'30.92"E
Geology	Calcrete	Potential Reserves	~2 500 m^3 (potentially up to ~50 000 m^3 with additional development)	
Material Potential	Selected fill for earthworks and pavements of estimated G5-G7 quality.			

Description:

1. Small calcrete borrow pit.
2. Located adjacent to Leliehoek project close to gravel road.

Potential Flaws to Exploitation:

1. Relatively small initial size will need to be expanded to be viable. Potential expansion areas to the west and south.

Photos and Layout:

Appendix C

Logging and Profiling Parameters

1. SOIL DESCRIPTIVE TERMS

DESCRIPTIVE ORDER:
1. CONSISTENCY 2. SOIL TYPE 3. MOISTURE CONDITION 4. COLOUR 5. SOIL STRUCTURE 6. ORIGIN

1.(a) CONSISTENCY: GRANULAR SOILS

S P T "N"	GRAVELS & SANDS Generally free draining soils		TYPICAL DRY DENSITY (kg/m^3)
< 4	VERY LOOSE	Crumbles very easily when scraped with geological pick	< 1450
4-10	LOOSE	Small resistance to penetration by sharp pick point	1450-1600
10-30	MEDIUM DENSE	Considerable resistance to penetration by sharp pick point	1600-1750
30-50	DENSE	Very high resistance to penetration by sharp pick point. Requires many blows of pick for excavation	1750-1925
> 50	VERY DENSE	High resistance to repeated blows of geological pick. Requires power tools for excavation	> 1925

1(b) CONSISTENCY: COHESIVE SOILS

S P T "N"	SILTS & CLAYS and combination with SANDS Generally slow draining soils		UCS (kPa)
< 2	VERY SOFT	Pick point easily pushed in 100mm. Easily moulded by fingers	< 50
2-4	SOFT	Pick point easily pushed in 30-40mm. Moulded by fingers with some pressure. Easily penetrated by thumb.	50-125
4-8	FIRM	Pick point penetrates up to 10mm. Very difficult to mould with fingers. Indented by thumb with effort. Spade just penetrates.	125-500
8-15	STIFF	Slight indentation by pushing in pick point. Cannot be moulded by fingers. Penetrated by thumbnail. Pick necessary to excavate.	250-500
15-30	VERY STIFF	Slight indentation by blow of pick point.. Requires power tools for excavation.	500-1000

2. SOIL TYPE

SOIL TYPE	PARTICLE SIZE (mm)
CLAY	< 0,002
SILT	0,002 – 0,06
SAND	0,06 – 2
GRAVEL	2 – 60*
COBBLES	60 – 200*
BOULDERS	> 200*

* Specify aver/max sizes, hardness, shape and proportion

3. MOISTURE CONDITION

DRY	No water detectable
SLIGHTLY MOIST	Water just discernable
MOIST	Water easily discernable
VERY MOIST	Water can be squeezed out
WET	Generally below the water table

4. COLOUR

Described at natural moisture content, as seen in profile (unless otherwise specified).

SPECKLED	Very small patches of colour < 2 mm
MOTTLED	Irregular patches of colour 2 – 6 mm
BLOTCHED	Large irregular patches 6 – 20 mm
BANDED	Approximately parallel bands of varying colour
STREAKED	Randomly orientated streaks of colour
STAINED	Local colour variations: associated with discontinuity surfaces
Described using bedding thickness criteria. (e.g. thickly banded, thinly streaked, etc.)	

5. SOIL STRUCTURE

INTACT	No structure present
FISSURED	Presence of discontinuities, possibly cemented
SLICKENSIDED	Very smooth, glossy, often striated discontinuity planes
SHATTERED	Presence of open fissures. Soil breaks into gravel size blocks
MICRO-SHATTERED	Small scale shattering, very closely spaced open fissures. Soil breaks into sand size crumbs
RESIDUAL STRUCTURES	Relict bedding, lamination, foliation, etc.

6. ORIGIN

TRANSPORTED	Alluvium, hillwash, talus, etc.
RESIDUAL	Weathered from parent rock e.g. residual granite
PEDOCRETES	Ferricrete, laterite, silcrete, calcrete, etc.

DEGREE OF CEMENTATION OF PEDOCRETES		UCS (MPa)
VERY WEAKLY CEMENTED	Some material can be crumbled between finger and thumb. Disintegrates under knife blade to a friable state.	0,1 – 0,5
WEAKLY CEMENTED	Cannot be crumbled between strong fingers. Some material can be crumbled by strong pressure between thumb and hard surface. Under light hammer blows disintegrates to friable state.	0,5 – 2
CEMENTED	Material crumbles under firm blows of sharp pick point. Grains can be dislodged with some difficulty by a knife blade.	2 – 5
STRONGLY CEMENTED	Firm blows of sharp pick point on hand-held specimen show 1-3mm indentations. Grains cannot be dislodged by knife blade.	5 – 10
VERY STRONGLY CEMENTED	Hand-held specimen can be broken by single firm blow of hammerhead. Similar appearance to concrete.	10 - 25

REFERENCE: Guidelines for Soil and Rock Logging (SAIEG – AEG – SAICE) (1990)

2. ROCK DESCRIPTIVE TERMS

DESCRIPTIVE ORDER: 1. HARDNESS 2. ROCK TYPE 3. WEATHERING 4. COLOUR 5. FRACTURE SPACING 6. DISCONTINUITY SURFACE DESCRIPTION 7. GRAIN SIZE 8. ROCK FORMATION NAME

1. ROCK HARDNESS

HARDNESS	DESCRIPTION	UCS (MPa)
VERY SOFT	Material crumbles under firm blows of pick point. Can be peeled with a knife. SPT refusal. Too hard to cut triaxial sample by hand	1 – 3
SOFT ROCK	Firm blows with pick point: 2-4mm indents. Can just be scraped with a knife	3 - 10
MEDIUM HARD ROCK	Firm blows of pick head will break hand-held specimen. Cannot be scraped or peeled with a knife.	10 - 25

HARDNESS	DESCRIPTION	UCS (MPa)
HARD ROCK	Breaks with difficulty, rings when struck Point load or laboratory test results necessary to distinguish between categories	25 – 70
VERY HARD ROCK		70 – 200
VERY VERY HARD ROCK		> 200

2. ROCK TYPE

Quartzite, sandstone, granite, limestone, etc.

4. COLOUR

Described in the dry state unless otherwise indicated

3. WEATHERING

DEGREE OF WEATHERING	EXTENT OF DISCOLOURATION	FRACTURE CONDITION	SURFACE CHARACTERISTICS	ORIGINAL FABRIC	GRAIN BOUNDARY CONDITION
UNWEATHERED	None	Closed or stained	Unchanged	Preserved	Tight
SLIGHTLY WEATHERED	< 20% of fracture spacing on both sides of fracture	Discoloured, may contain thin filling	Partial discolouration. Often unweathered rock colour	Preserved	Tight
MODERATELY WEATHERED	>20% of fracture spacing on both side of fracture	Discoloured, may contain thick filling	Partial to complete discolouration. Not friable except poorly cemented rocks	Preserved	Partial opening
HIGHLY WEATHERED	Throughout	-	Friable, possibly pitted	Mainly preserved	Partial separation. Not easily indented with knife. Does not slake
COMPLETELY WEATHERED	Throughout	-	Resembles a soil	Partially preserved	Complete separation. Easily indented with knife. Slakes

5. DISCONTINUITY SPACING

SEPARATION (mm)	SPACING (foliation, cleavage, bedding, etc.)	SPACING (fractures, joints, etc.)
< 6	very intensely	very highly
6 – 20	intensely	
20 – 60	very thinly	highly
60 – 200	thinly	
200 – 600	medium	moderately
600 – 2000	thickly	slightly
> 2000	very thickly	very slightly

6.3 ROUGHNESS OF DISCONTINUITY PLANES

CLASSIFICATION	DESCRIPTION
SMOOTH	Appears smooth and is essentially smooth to the touch. May be slickensided *
SLIGHTLY ROUGH	Asperities on the fracture surface are visible and can be distinctly felt
MEDIUM ROUGH	Asperities are clearly visible and fracture surface feels abrasive
ROUGH	Large angular asperities can be seen. Some ridge and high side angle steps evident
VERY ROUGH	Near vertical steps and ridges occur on the fracture surface

* Where slickensides occur the direction of the slickensides should be recorded

6. DISCONTINUITY SURFACE DESCRIPTION

6.1 JOINT FILLING

JOINT FILL TYPE	DEFINITION (wall separation specified in mm)
CLEAN	No fracture filling
STAINED	Colouration of rock only. No recognisable filling material
FILLED	Fracture filled with finite thickness filling material

6.2 DISCONTINUITY ORIENTATION

Discontinuity inclinations (i.e. of joints, bedding, faults

7. GRAIN SIZE

CLASSIFICATION	SIZE (mm)	RECOGNITION
VERY FINE GRAINED	< 0.2	Individual grains cannot be seen with a hand lens
FINE GRAINED	0.2 – 0.6	Just visible as individual grains under hand lens
MEDIUM GRAINED	0.6 – 2	Grains clearly visible under hand lens, just visible to the naked eye
COARSE GRAINED	2 – 6	Grains clearly visible to the naked eye
VERY COARSE GRAINED	> 6	Grains measurable

8. ROCK FORMATION

Brixton Formation, Halfway House Granite Dome etc.

REFERENCE: Guidelines for Soil and Rock Logging (SAIEG – AEG – SAICE) (1990)

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Appendix D

Geophysical Survey Report

GeoFocus
Geophysical Services
Reg: 2016 / 324488 / 07

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Limpopo
RSA

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bjorn@geofocus.co.za (072 086 9829)

2 Sept, 2020

SMEC South Africa
65 Riebeeck Street
Cape Town
8001
South Africa

Attention Mr Richard Roberts

Tel +27 72 495-0920
Email Richard.Roberts@smec.com

Kentani Area Solar Power Plant - Resistivity and Seismic Survey Report

1. General

The results are given here of 35 soil resistivity surveys and 30 refraction seismic surveys carried out at five different sites at the proposed locations of the Kentani area solar power plant, some 70km NW of Bloemfontein in the Free State, next to the town of Dealesville. The three different sites are known as Leliehoek, Sonobolomo, Klipfontein, Klipfontein 2, and Kentani and are located as shown in Figure 1. The survey profiles were in all cases 100m long, and were located by SMEC. The seismic surveys are in all cases separate from the resistivity surveys. The objective of these surveys was to supply information about ground resistance, corrosivity, and geological competence and layering with depth, such that this information can be used to aid the grounding and design of the solar panels and plant. A fourth objective was to be information on the water table where possible, but with 100m long survey profiles the depth of penetration is considered too low in almost all cases.

The sites are all relatively flat and covered in low scrub, although the latter did not impede the surveys much. At all sites soil appears somewhat poorly developed and there is calcrete and rock outcrop close to surface in some areas. The geology map of the area shows areas of Kalahari sand as well as outcropping dolerite sills, Ecca shale and siltstone (Karoo).

Fieldwork was performed during August 2020. The profile coordinates for the relevant survey positions are shown in the tables below. The coordinates are given in Lat/Long WGS84. Each resistivity survey was 100m in length, and a cross of two surveys was done at one sub-station site at each location, to measure any anisotropy in the resistivity values. The seismic surveys were also 100m long, but were done as individual lines, not crosses.

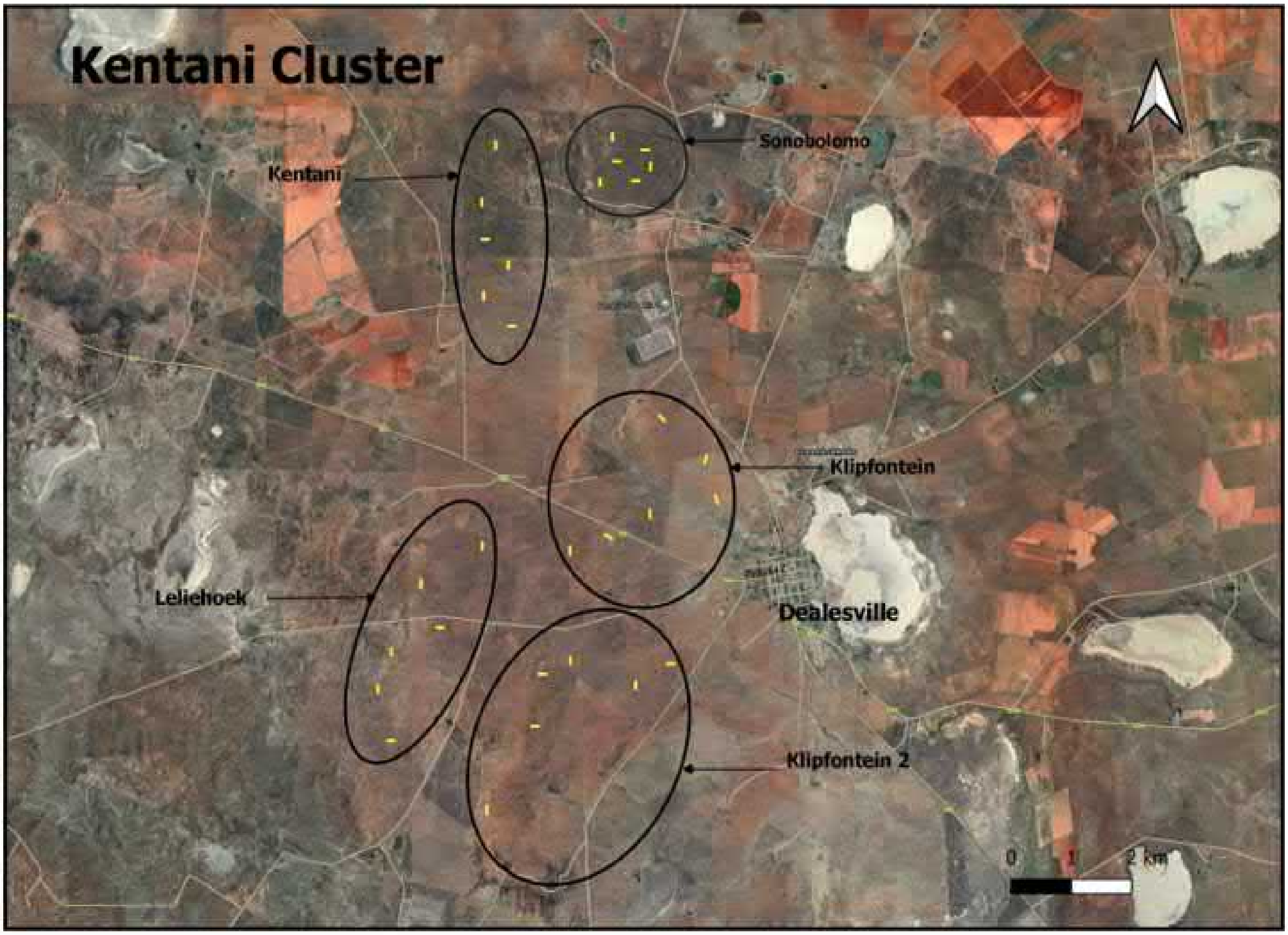


Figure 1 – General location of Kentani sites.

Kentani

Seismic Refraction

	Start		End	
TRT1	-28.61222	25.71830	-28.61313	25.71829
TRT2	-28.62031	25.71584	-28.62123	25.71581
TRT3	-28.62602	25.71687	-28.62602	25.71583
TRT4	-28.62922	25.72026	-28.63013	25.72022
TRT5	-28.63352	25.71599	-28.63443	25.71599
TRT6	-28.63842	25.72126	-28.63842	25.72022

Electrical Resistivity

ERT1	-28.61718	25.72133	-28.61809	25.72133
ERT2	-28.61773	25.72187	-28.61773	25.72086
ERT3	-28.61081	25.71473	-28.61172	25.71475
ERT4	-28.61658	25.71751	-28.61660	25.71647
ERT5	-28.62390	25.71965	-28.62482	25.71965
ERT6	-28.62992	25.71586	-28.62992	25.71483
ERT7	-28.63624	25.71918	-28.63715	25.71914

Klipfontein

Seismic Refraction

	Start		End	
TRT1	-28.65197	25.74643	-28.65142	25.74561
TRT2	-28.65721	25.75355	-28.65819	25.75329
TRT3	-28.66288	25.75499	-28.66376	25.75532
TRT4	-28.66485	25.74393	-28.66575	25.74393
TRT5	-28.66876	25.73730	-28.66831	25.73636
TRT6	-28.66993	25.73015	-28.67085	25.73016

Electrical Resistivity

ERT1	-28.65974	25.75010	-28.66064	25.75010
ERT2	-28.66024	25.75067	-28.66024	25.74964
ERT3	-28.65410	25.74743	-28.65503	25.74743
ERT4	-28.66237	25.75510	-28.66235	25.75407
ERT5	-28.66382	25.73900	-28.66382	25.73798
ERT6	-28.66784	25.74933	-28.66877	25.74933
ERT7	-28.67025	25.73583	-28.67115	25.73583

Klipfontein 2

Seismic Refraction

	Start		End	
TRT1	-28.68564	25.73007	-28.68655	25.73007
TRT2	-28.68669	25.74764	-28.68664	25.74662
TRT3	-28.68922	25.74114	-28.69012	25.74109
TRT4	-28.68795	25.72583	-28.68794	25.72480
TRT5	-28.69536	25.72449	-28.69536	25.72346
TRT6	-28.70671	25.71560	-28.70762	25.71560

Electrical Resistivity

ERT1	-28.68623	25.73342	-28.68714	25.73342
ERT2	-28.68668	25.73400	-28.68668	25.73297
ERT3	-28.68410	25.73037	-28.68410	25.72934
ERT4	-28.68303	25.74450	-28.68394	25.74450
ERT5	-28.69034	25.74430	-28.69033	25.74328
ERT6	-28.69238	25.72637	-28.69238	25.72533
ERT7	-28.70019	25.71778	-28.70110	25.71778

Leliehoek

Seismic Refraction

	Start		End	
TRT1	-28.66918	25.71534	-28.67009	25.71533
TRT2	-28.67445	25.70486	-28.67536	25.70482
TRT3	-28.68115	25.70847	-28.68115	25.70739
TRT4	-28.68407	25.69971	-28.68498	25.69971
TRT5	-28.68931	25.69732	-28.69022	25.69732
TRT6	-28.69718	25.69997	-28.69718	25.69893

Electrical Resistivity

ERT1	-28.68194	25.70493	-28.68283	25.70493
ERT2	-28.68241	25.70551	-28.68241	25.70448
ERT3	-28.66933	25.71410	-28.66930	25.71307
ERT4	-28.67498	25.71008	-28.67589	25.71008
ERT5	-28.68887	25.69483	-28.68887	25.69378
ERT6	-28.68907	25.70339	-28.68998	25.70339
ERT7	-28.69610	25.69699	-28.69611	25.69594

Sonobolomo

Seismic Refraction

	Start		End	
TRT1	-28.61121	25.73813	-28.61213	25.73811
TRT2	-28.61356	25.74416	-28.61354	25.74312
TRT3	-28.61514	25.73933	-28.61514	25.73831
TRT4	-28.61546	25.74455	-28.61638	25.74453
TRT5	-28.61765	25.73590	-28.61856	25.73590
TRT6	-28.61791	25.74259	-28.61791	25.74156

Electrical Resistivity

ERT1	-28.61941	25.74255	-28.62031	25.74255
ERT2	-28.61987	25.74307	-28.61988	25.74203
ERT3	-28.61079	25.73509	-28.61170	25.73507
ERT4	-28.61283	25.74083	-28.61281	25.73978
ERT5	-28.61325	25.74615	-28.61415	25.74613
ERT6	-28.61568	25.73729	-28.61571	25.73625
ERT7	-28.61828	25.73968	-28.61920	25.73970

2. Methodology

For the resistivity surveys, an ABEM LS Terrameter resistivity instrument was used to measure ground resistance whilst a handheld GPS was used to locate each point. 100m long resistivity profiles were conducted as shown in red in Figures 2-4 below. For each electrode spacing along the traverse, the resistivity was measured by recording the current sent to the outer electrodes, and the voltage measured across the two inner electrodes. Note that with the Wenner array, shown in Figure 5, the spacings between electrodes are always equal. The array is simply expanded from a 1m a-spacing to a 24m a-spacing. The whole array is then moved along line, 1m at a time. The idea of doing two surveys at each sub-station site, in a cross, is to be able to compare the results from each traverse. Depending on the geology, ground resistance can be anisotropic. However, if the results are very similar, it doubles the confidence level in the measurements.

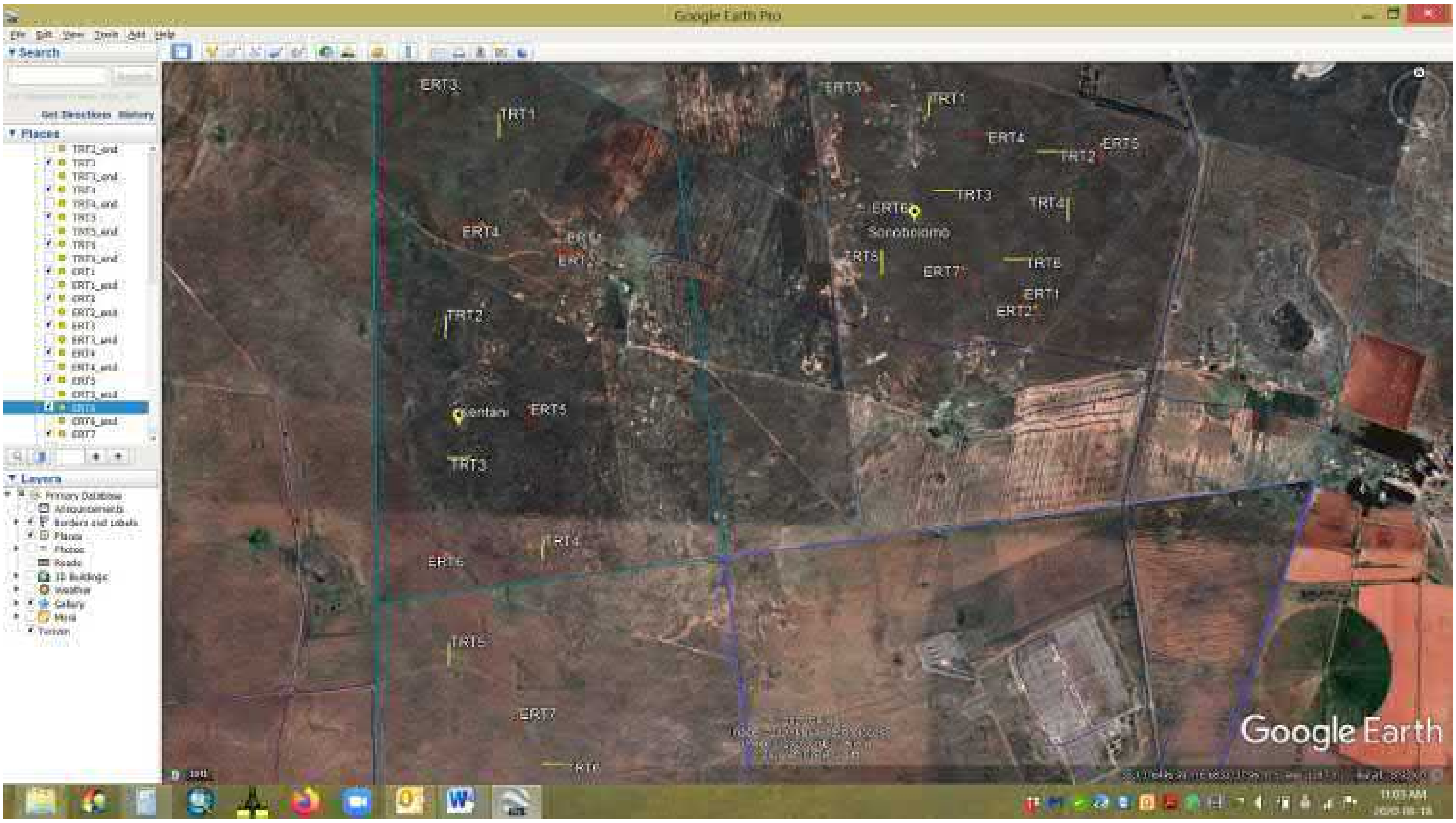


Figure 2 – Location of resistivity profile lines in red (ERT), and seismic lines (TRT) in yellow, for the Kentani and Sonobolomo sites. The site outlines are shown in blue. These two sites lie just to the NW of Dealesville.

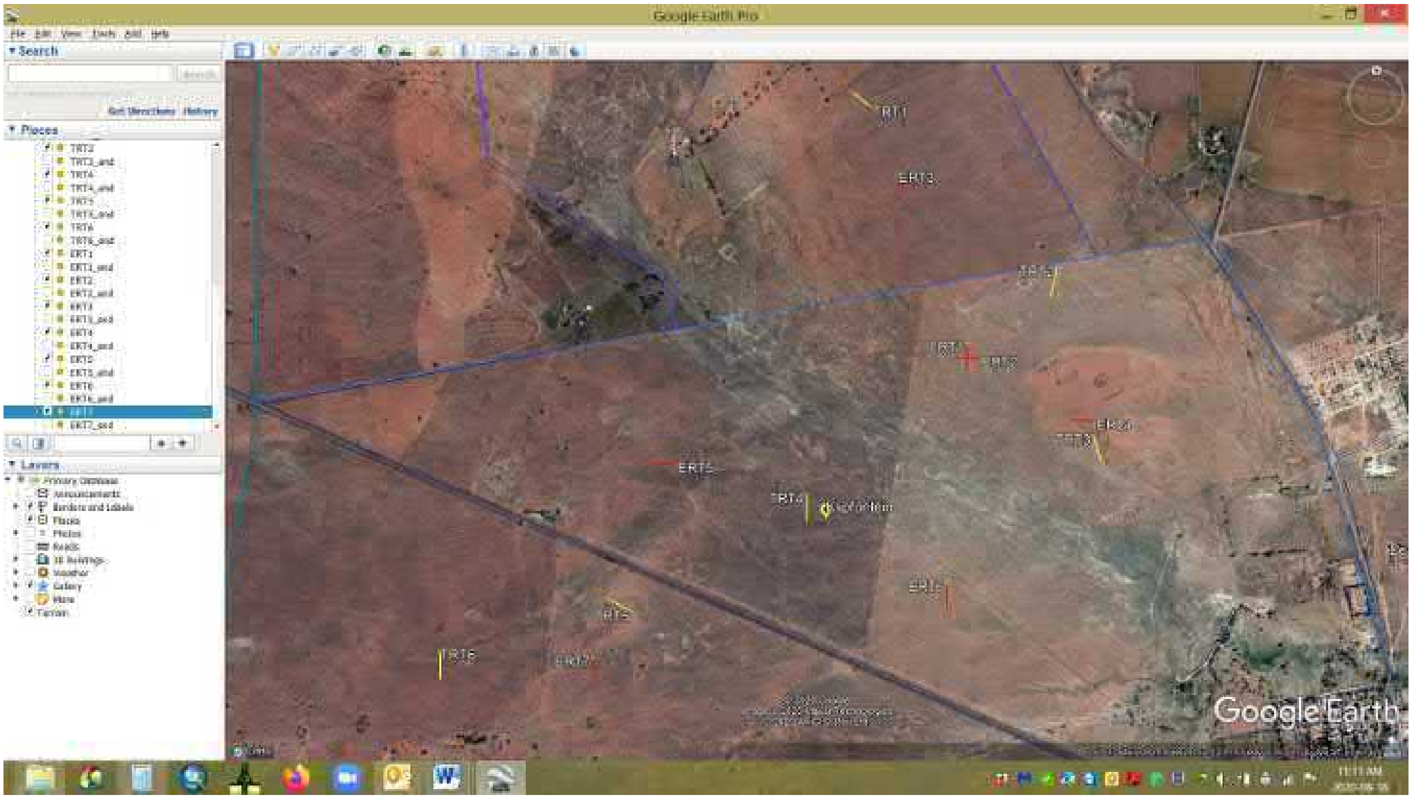


Figure 3 – Location of resistivity profiles lines as red lines (ERT), and seismic lines as yellow lines (TRT), for Klipfontein. The site outline is shown in blue. The NW corner of the town of Dealesville is visible bottom right.

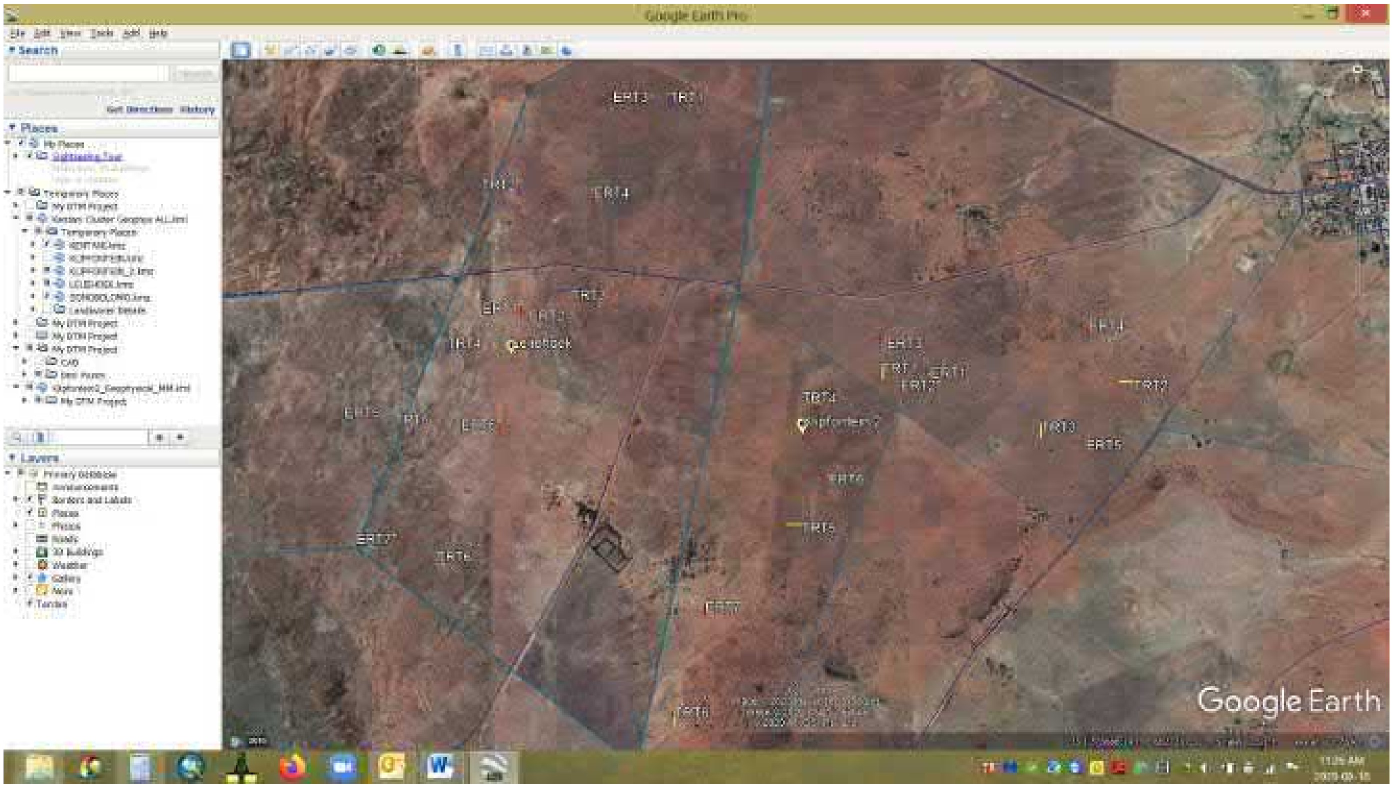


Figure 4 – Location of resistivity profiles lines as red lines (ERT), and seismic lines as blue or yellow lines (TRT), for Leliehoek and Klipfontein 2 respectively. The site outlines are shown in blue. Dealesville is visible in the top right corner.

The Wenner resistivity array was used, which has equal electrode spacings in an expanding array as shown in Figure 5 below.

To reiterate, readings were taken with a=1m initially, and the array then expanded in increments up to 24m separation. This was done over the full 100m profile. Readings were taken at different electrode spacings, at multiple locations, resulting in a dataset consisting of multiple readings for each spacing. This allows for good averaging of the values for each spacing, and thus a reliable measurement is obtained. In general, the larger the electrode spacing the deeper into the ground the array is 'seeing'. The a-spacing is broadly equivalent to 1.5 times the depth of penetration in this case although, depending on the ground resistance, this can vary.

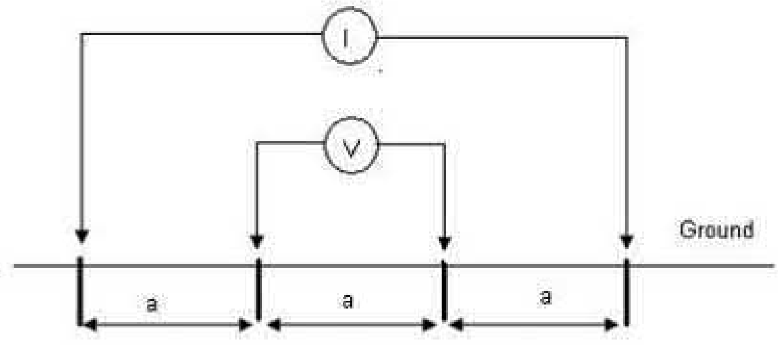


Figure 5 – The Wenner electrode array.

In terms of the refraction seismics, a Geometrics Geode instrument, being a 24-channel seismograph, was used. A generalised array is shown in Figure 6 below. Essentially a line of geophones is laid out, in this case 5m apart, and their positions recorded with a GPS. Elevations are recorded with a dumpy level and staff. A seismic source is then activated some distance away from the end of the array, or along the array as the survey progresses. A sledge hammer and metal plate were used as a source in this case. The hammer strikes the plate and sends a pulse of energy into the ground, which is then received at different times by the various geophones. Usually the plate is struck several times, stacking the signal on the seismograph until an acceptable record is obtained. For P-wave measurements, the exploration depth when using a hammer and plate as the energy source is typically of the order of 20 metres, depending on background noise, although only information to the depth of hard rock will be gained. By moving the shot points and calculating the velocity at each geophone location, a profile of the subsurface velocities can be created in 2D section. Processing requires the picking of first-arrival times; these are compiled into travel-time curves. The first-arrival times are then assigned to layers with different acoustic velocities. Once this is complete a layered model can be produced. The interpretation package SeisImager is used in this process, with the output being a three layer model or multilayer model as appropriate. The interpreted outcome will be a cross section from which the degree of weathering and/or thickness of overburden can be inferred.

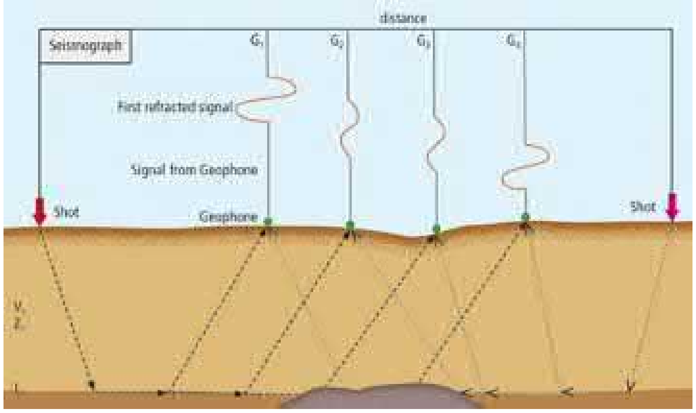


Figure 6 – A generalised seismic refraction array.

The locations of the seismic lines are shown in yellow or blue in Figures 2-4 above. And also in Figure 1 in yellow.

3. Results

3.1 Resistivity Results

In terms of resistivity, the data for each site are summarised according to electrode separation in a series of tables below, listed by their profile number for each area. The resistivity values shown are the mean value. The number of readings over which the mean is taken is given in column 2 (Count) along with the mean apparent resistivity (Ohm.m) and resistance (Ohm) values of those readings. A is the Wenner electrode spacing (A=a) shown in Figure 2, as per Eskom earthing specifications. The data should be read in conjunction with the legend. From the tables it can be seen that all of the sites are in the moderate-unlikely corrosivity potential range (i.e. the resistivity range 20 - >300 ohm.m) **except for Klipfontein 2 Traverse ERT7 which has values in the severe range** (< 20 ohm.m). These are highlighted in red. As these results are averaged over many individual readings this result is considered highly reliable. Traverses ERT1 and ERT2, but especially ERT1, on Klipfontein have values on the cusp of 'severe', being around the 21 ohm.m mark. These have been highlighted in orange, as have two deep readings for Leliefontein ERT1.

The data are discussed in more detail, and compared to the seismics, in the discussion section below.

Resistivity Vs Corrosivity Legend

Apparent Resistivity (Ohm.m)	Corrosivity Potential
0-20	Severe
20-100	Moderate
100-300	Mild
> 300	Unlikely

The inverted (modelled) resistivity colour images are shown for each traverse in Appendix 1. In these, the modelled depths of penetration are shown on the Y-axis. This is considered a more realistic depth than the A-spacing, and can be used for the purposes of this study. On each of these, any relevant geological changes have been indicated.

Leliehoek Traverses 1 and 2

Leliehoek L1				**Leliehoek L2**			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	54	180.86	28.79	1	57	158.28	25.19
2	72	134.76	10.72	2	72	146.77	11.68
3	44	109.56	5.81	3	45	118.42	6.28
4	41	96.71	3.85	4	42	126.36	5.03
6	38	72.13	1.91	6	42	91.94	2.44
8	39	48.06	0.96	8	39	71.36	1.42
10	35	33.26	0.53	10	36	58.81	0.94
12	32	26.22	0.35	12	33	49.99	0.66
14	29	24.11	0.27	14	30	44.08	0.50
16	25	22.38	0.22	16	26	38.85	0.39
18	22	21.13	0.19	18	23	34.82	0.31
20	20	21.40	0.17	20	21	31.55	0.25
22	15	20.91	0.15	22	16	29.69	0.21
24	9	19.68	0.13	24	10	28.81	0.19

A few high corrosivity risk numbers are recorded at depth for Traverse 1.

Leliehoek Traverses 3 and 4

Leliehoek L3				**Leliehoek L4**			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	47	210.21	33.46	1	54	572.77	91.16
2	65	315.06	25.07	2	75	467.36	37.19
3	45	362.89	19.25	3	49	411.63	21.84
4	45	446.51	17.77	4	44	315.10	12.54
6	42	576.05	15.28	6	36	213.44	5.66
8	39	712.28	14.17	8	39	189.24	3.76
10	36	847.62	13.49	10	36	177.06	2.82
12	33	974.32	12.92	12	32	183.21	2.43
14	30	1097.83	12.48	14	29	202.99	2.31
16	27	1221.25	12.15	16	26	227.01	2.26
18	23	1314.16	11.62	18	24	251.61	2.22
20	21	1396.56	11.11	20	21	277.52	2.21
22	16	1479.16	10.70	22	15	305.17	2.21
24	10	1559.21	10.34	24	10	331.91	2.20

Leliehoek Traverses 5 and 6

Leliehoek L5				Leliehoek L6			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	52	227.56	36.22	1	51	129.31	20.58
2	68	270.28	21.51	2	71	163.93	13.05
3	43	251.99	13.37	3	48	188.54	10.00
4	43	220.05	8.76	4	45	220.14	8.76
6	42	137.36	3.64	6	42	254.54	6.75
8	39	82.24	1.64	8	39	281.16	5.59
10	36	56.03	0.89	10	36	302.57	4.82
12	33	43.27	0.57	12	33	319.76	4.24
14	30	38.01	0.43	14	30	332.02	3.77
16	27	36.89	0.37	16	26	341.35	3.40
18	24	37.53	0.33	18	23	346.71	3.07
20	20	39.38	0.31	20	20	350.24	2.79
22	16	41.71	0.30	22	16	346.72	2.51
24	10	44.76	0.30	24	10	347.03	2.30

Leliehoek Traverse 7

Leliehoek L7			
A	Count	App.Res.	Resistance
1	57	203.79	32.44
2	72	300.95	23.95
3	52	344.75	18.29
4	45	367.62	14.63
6	42	384.05	10.19
8	39	389.98	7.76
10	36	388.64	6.19
12	33	379.92	5.04
14	30	366.62	4.17
16	27	351.20	3.49
18	24	330.87	2.93
20	21	310.67	2.47
22	16	289.47	2.09
24	10	271.06	1.80

Sonobolomo Traverses 1 and 2

Sonobolomo L1				Sonobolomo L2			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	52	85.48	13.60	1	51	75.59	12.03
2	71	142.41	11.33	2	71	129.64	10.32
3	50	180.16	9.56	3	48	167.40	8.88
4	44	212.49	8.45	4	45	178.21	7.09
6	42	248.86	6.60	6	42	203.10	5.39
8	38	274.87	5.47	8	39	224.28	4.46
10	37	287.21	4.57	10	36	243.85	3.88
12	33	305.01	4.05	12	33	260.21	3.45
14	30	316.24	3.60	14	30	275.76	3.13
16	27	326.85	3.25	16	27	289.97	2.88
18	24	336.02	2.97	18	24	303.95	2.69
20	21	342.58	2.73	20	21	316.74	2.52
22	16	350.62	2.54	22	16	327.77	2.37
24	10	354.99	2.35	24	10	338.43	2.24

Sonobolomo Traverses 3 and 4

Sonobolomo L3				Sonobolomo L4			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	52	58.60	9.33	1	51	40.04	6.37
2	72	62.29	4.96	2	59	45.23	3.60
3	46	57.99	3.08	3	39	46.39	2.46
4	43	47.77	1.90	4	40	43.60	1.73
6	38	37.10	0.98	6	42	39.45	1.05
8	39	32.77	0.65	8	39	36.59	0.73
10	36	30.21	0.48	10	36	35.19	0.56
12	33	29.24	0.39	12	33	34.97	0.46
14	30	29.18	0.33	14	30	33.92	0.39
16	27	29.38	0.29	16	27	33.84	0.34
18	24	29.75	0.26	18	24	34.16	0.30
20	21	30.07	0.24	20	21	34.35	0.27
22	16	30.76	0.22	22	16	34.87	0.25
24	10	31.56	0.21	24	10	35.38	0.23

Sonobolomo Traverses 5 and 6

Sonobolomo L5				Sonobolomo L6			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	55	72.98	11.62	1	50	42.60	6.78
2	75	107.49	8.55	2	66	57.38	4.57
3	50	113.56	6.02	3	47	57.36	3.04
4	45	149.95	5.97	4	44	52.41	2.09
6	41	170.58	4.52	6	41	40.84	1.08
8	39	187.85	3.74	8	39	35.03	0.70
10	36	202.42	3.22	10	36	32.36	0.52
12	33	212.41	2.82	12	33	30.84	0.41
14	30	219.94	2.50	14	30	29.79	0.34
16	27	224.35	2.23	16	27	29.33	0.29
18	24	225.03	1.99	18	24	29.18	0.26
20	21	223.54	1.78	20	21	29.27	0.23
22	16	218.67	1.58	22	16	29.61	0.21
24	10	209.81	1.39	24	10	30.00	0.20

Sonobolomo Traverse 7

Sonobolomo L7			
A	Count	App.Res.	Resistance
1	52	59.30	9.44
2	71	88.66	7.06
3	44	113.17	6.00
4	45	103.16	4.10
6	40	104.46	2.77
8	39	102.01	2.03
10	36	97.32	1.55
12	33	92.31	1.22
14	30	87.01	0.99
16	27	82.42	0.82
18	24	78.31	0.69
20	21	74.21	0.59
22	16	71.36	0.52
24	10	69.55	0.46

Kentani Traverses 1 and 2

Kentani L1				Kentani L2			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	41	61.17	9.74	1	53	64.81	10.32
2	68	70.62	5.62	2	70	76.58	6.09
3	45	67.89	3.60	3	47	68.73	3.65
4	41	60.67	2.41	4	41	65.76	2.62
6	40	46.95	1.25	6	42	50.47	1.34
8	39	38.87	0.77	8	39	40.99	0.82
10	36	34.20	0.54	10	36	36.15	0.58
12	33	31.39	0.42	12	33	33.41	0.44
14	30	30.22	0.34	14	30	31.99	0.36
16	27	30.67	0.31	16	27	31.59	0.31
18	24	30.94	0.27	18	24	31.23	0.28
20	21	31.38	0.25	20	21	31.69	0.25
22	16	32.42	0.23	22	16	32.65	0.24
24	10	33.80	0.22	24	10	33.86	0.22

Kentani Traverses 3 and 4

Kentani L3				Kentani L4			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	51	52.21	8.31	1	51	105.68	16.82
2	73	50.79	4.04	2	72	108.42	8.63
3	46	46.16	2.45	3	49	90.63	4.81
4	43	40.85	1.63	4	45	76.39	3.04
6	38	33.08	0.88	6	38	46.95	1.25
8	39	29.27	0.58	8	39	34.88	0.69
10	36	28.25	0.45	10	36	29.15	0.46
12	33	28.62	0.38	12	33	27.15	0.36
14	30	29.92	0.34	14	30	26.63	0.30
16	27	31.58	0.31	16	27	26.74	0.27
18	24	33.48	0.30	18	24	26.95	0.24
20	21	35.48	0.28	20	21	27.74	0.22
22	16	38.02	0.28	22	16	28.99	0.21
24	10	41.31	0.27	24	10	30.46	0.20

Kentani Traverses 5 and 6

Kentani L5				Kentani L6			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	50	44.95	7.15	1	52	154.51	24.59
2	64	52.37	4.17	2	71	200.86	15.98
3	47	47.93	2.54	3	46	227.82	12.09
4	39	53.16	2.12	4	43	309.33	12.31
6	42	49.40	1.31	6	42	410.69	10.89
8	39	42.10	0.84	8	39	500.98	9.97
10	36	37.86	0.60	10	36	602.46	9.59
12	33	34.86	0.46	12	33	704.23	9.34
14	30	32.93	0.37	14	30	803.23	9.13
16	27	31.85	0.32	16	27	894.72	8.90
18	24	31.20	0.28	18	24	981.41	8.68
20	21	31.06	0.25	20	20	1074.26	8.55
22	16	31.41	0.23	22	16	1135.27	8.21
24	10	31.84	0.21	24	10	1183.63	7.85

Kentani Traverse 7

Kentani L7			
A	Count	App.Res.	Resistance
1	52	99.41	15.82
2	69	97.73	7.78
3	47	94.79	5.03
4	43	103.69	4.13
6	42	113.61	3.01
8	39	127.91	2.54
10	36	144.85	2.31
12	33	162.36	2.15
14	30	180.88	2.06
16	27	199.99	1.99
18	24	220.11	1.95
20	21	241.20	1.92
22	16	263.61	1.91
24	10	285.32	1.89

Klipfontein 2 Traverses 1 and 2

Klipfontein 2 L1				Klipfontein 2 L2			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	50	170.68	27.17	1	50	163.03	25.95
2	72	262.06	20.85	2	70	269.06	21.41
3	48	334.34	17.74	3	50	343.34	18.22
4	43	432.07	17.19	4	43	413.81	16.47
6	42	600.42	15.93	6	42	572.78	15.19
8	39	755.86	15.04	8	39	724.69	14.42
10	36	911.84	14.51	10	36	876.04	13.94
12	33	1062.47	14.09	12	33	1013.89	13.45
14	30	1209.71	13.75	14	30	1155.18	13.13
16	27	1346.41	13.39	16	27	1295.49	12.89
18	24	1472.40	13.02	18	24	1430.89	12.65
20	21	1599.31	12.73	20	21	1546.95	12.31
22	16	1718.91	12.44	22	16	1668.94	12.07
24	10	1828.58	12.13	24	10	1775.41	11.77

Klipfontein 2 Traverses 3 and 4

Klipfontein 2 L3				Klipfontein 2 L4			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	52	261.11	41.56	1	50	265.96	42.33
2	69	304.02	24.19	2	70	365.26	29.07
3	45	334.68	17.76	3	40	432.67	22.95
4	43	402.94	16.03	4	45	520.40	20.71
6	42	487.13	12.92	6	42	684.87	18.17
8	39	544.00	10.82	8	39	824.42	16.40
10	36	597.69	9.51	10	36	978.17	15.57
12	33	640.11	8.49	12	33	1123.99	14.91
14	30	676.86	7.69	14	30	1263.64	14.37
16	27	704.73	7.01	16	27	1400.97	13.94
18	24	724.05	6.40	18	24	1533.77	13.56
20	21	731.90	5.82	20	21	1648.29	13.12
22	16	732.01	5.30	22	16	1756.88	12.71
24	10	728.31	4.83	24	10	1871.08	12.41

Klipfontein 2 Traverses 5 and 6

Klipfontein 2 L5				Klipfontein 2 L6			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	53	143.00	22.76	1	55	129.34	20.59
2	67	195.01	15.52	2	73	175.53	13.97
3	46	231.29	12.27	3	46	205.41	10.90
4	43	288.75	11.49	4	45	250.07	9.95
6	42	367.28	9.74	6	42	318.01	8.44
8	39	443.54	8.82	8	39	380.84	7.58
10	36	533.63	8.49	10	36	445.99	7.10
12	33	619.42	8.22	12	33	509.88	6.76
14	30	710.62	8.08	14	30	576.72	6.56
16	27	814.51	8.10	16	27	645.77	6.42
18	23	900.34	7.96	18	24	709.79	6.28
20	21	991.16	7.89	20	21	769.89	6.13
22	16	1072.07	7.76	22	16	834.80	6.04
24	10	1154.31	7.65	24	10	895.57	5.94

Klipfontein 2 Traverse 7

Klipfontein 2 L7			
A	Count	App.Res.	Resistance
1	52	173.94	27.68
2	73	106.20	8.45
3	48	64.78	3.44
4	45	46.33	1.84
6	42	26.36	0.70
8	39	19.16	0.38
10	36	16.80	0.27
12	33	15.57	0.21
14	30	15.26	0.17
16	27	15.39	0.15
18	24	15.37	0.14
20	20	15.38	0.12
22	16	16.03	0.12
24	10	16.63	0.11

Note the numbers in red. High corrosivity risk from A=8 onwards.

Klipfontein Traverses 1 and 2

Klipfontein L1				Klipfontein L2			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	55	195.65	31.14	1	55	203.61	32.41
2	71	146.76	11.68	2	72	151.49	12.06
3	40	111.41	5.91	3	44	100.82	5.35
4	45	76.64	3.05	4	43	67.27	2.68
6	38	44.83	1.19	6	41	38.23	1.01
8	39	30.56	0.61	8	39	26.99	0.54
10	36	24.28	0.39	10	36	23.63	0.38
12	33	22.11	0.29	12	33	22.32	0.30
14	30	21.48	0.24	14	30	21.97	0.25
16	27	21.43	0.21	16	27	22.02	0.22
18	24	21.50	0.19	18	24	22.27	0.20
20	21	21.68	0.17	20	21	22.74	0.18
22	16	22.30	0.16	22	16	23.60	0.17
24	10	23.15	0.15	24	10	24.30	0.16

Note the orange value at the low end of the moderate corrosivity threat, and right on the border with severe.

Klipfontein Traverses 3 and 4

Klipfontein L3				Klipfontein L4			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	53	139.32	22.17	1	53	86.56	13.78
2	69	196.92	15.67	2	65	90.09	7.17
3	42	244.48	12.97	3	47	89.83	4.77
4	43	279.53	11.12	4	42	76.35	3.04
6	42	348.20	9.24	6	40	54.82	1.45
8	39	402.65	8.01	8	39	37.90	0.75
10	36	453.68	7.22	10	34	31.08	0.49
12	33	496.46	6.58	12	32	27.12	0.36
14	30	533.64	6.07	14	28	25.52	0.29
16	27	565.46	5.62	16	25	22.48	0.22
18	24	590.59	5.22	18	21	24.40	0.22
20	21	608.71	4.84	20	18	25.45	0.20
22	16	624.06	4.51	22	14	26.75	0.19
24	9	634.84	4.21	24	10	27.72	0.18

Klipfontein Traverses 5 and 6

Klipfontein L5				Klipfontein L6			
A	Count	App.Res.	Resistance	A	Count	App.Res.	Resistance
1	55	57.88	9.21	1	55	133.99	21.33
2	67	59.95	4.77	2	72	117.07	9.32
3	46	56.68	3.01	3	45	109.04	5.78
4	40	57.05	2.27	4	43	87.95	3.50
6	40	52.81	1.40	6	38	68.03	1.80
8	39	50.07	1.00	8	37	59.08	1.18
10	34	49.73	0.79	10	35	55.18	0.88
12	32	50.78	0.67	12	32	53.93	0.72
14	28	51.68	0.59	14	29	54.45	0.62
16	25	53.23	0.53	16	26	55.31	0.55
18	22	55.65	0.49	18	22	56.30	0.50
20	19	57.93	0.46	20	19	57.19	0.46
22	14	60.24	0.44	22	14	57.98	0.42
24	10	64.90	0.43	24	10	60.43	0.40

Klipfontein Traverse 7

Klipfontein L7			
A	Count	App.Res.	Resistance
1	45	70.24	11.18
2	62	86.60	6.89
3	44	75.67	4.01
4	40	74.31	2.96
6	38	56.62	1.50
8	37	44.46	0.88
10	34	38.02	0.61
12	32	34.12	0.45
14	29	32.81	0.37
16	24	30.85	0.31
18	23	30.91	0.27
20	19	31.65	0.25
22	13	32.16	0.23
24	10	33.63	0.22

3.2 Seismic Results

In the following images, displayed in the discussion section below for ease of reference, the transition between weathered and fresh bedrock can be taken at 2,500 m/s which is generally considered the standard, although competent weathered rock may be considered as low in velocity as 2,000 m/s depending on the rock type. The 2,500 m/s contour is shown on each image, and colour-wise has been made at the eye-catching yellow transition zone between green and orange. Anything in the orange and red colours (> 3,000 m/s) can be assumed to be fresh bedrock. However, this scheme can of course be further calibrated depending on test pit and drilling results in the field. It will be noticed that the lowest velocities are all near surface, within the top resistive layer seen in many of the resistivity profiles in Appendix 1.

4. Discussion of Combined Results

4.1 Leliehoek

In terms of resistivity, Leliehoek is a mixture of low, moderate and highly resistive sites. Traverse ERT3 shows very resistive bedrock at the shallow depth of 2-4m, which is essentially outcrop, possibly of dolerite.. By contrast, Traverses ERT1, 2 and 5 all show very low resistivity material (presumably sand cover, although it may be clay–rich weathered rock) below a thin resistive surface layer (presumably calcrete). There is no sign of bedrock at depth on these traverses. ERT4, 6 and 7 all show moderate resistivities most likely associated with shallow, weathered Karoo shales and siltstones. ERT6 shows an 8m wide low resistivity zone which could be a dyke, or a faulted zone.

In terms of the refraction seismics, all profiles are similar, varying only in the depth to high velocity (3000 m/s) bedrock, from 5m to 20m deep. TRT1 shows very shallow bedrock, as shallow as 4m, whilst at TRT6 bedrock is the deepest at around 20m deep. Varying thicknesses of sand cover can explain this, as can variable depth-of-weathering. High values are seen for all traverses, well into the red colours being 4000 m/s -4500 m/s, except for TRT4. One would expect this to be a very competent rock such as sandstone, or dolerite.TRT4 may be located on a lower velocity rock type such as shale.

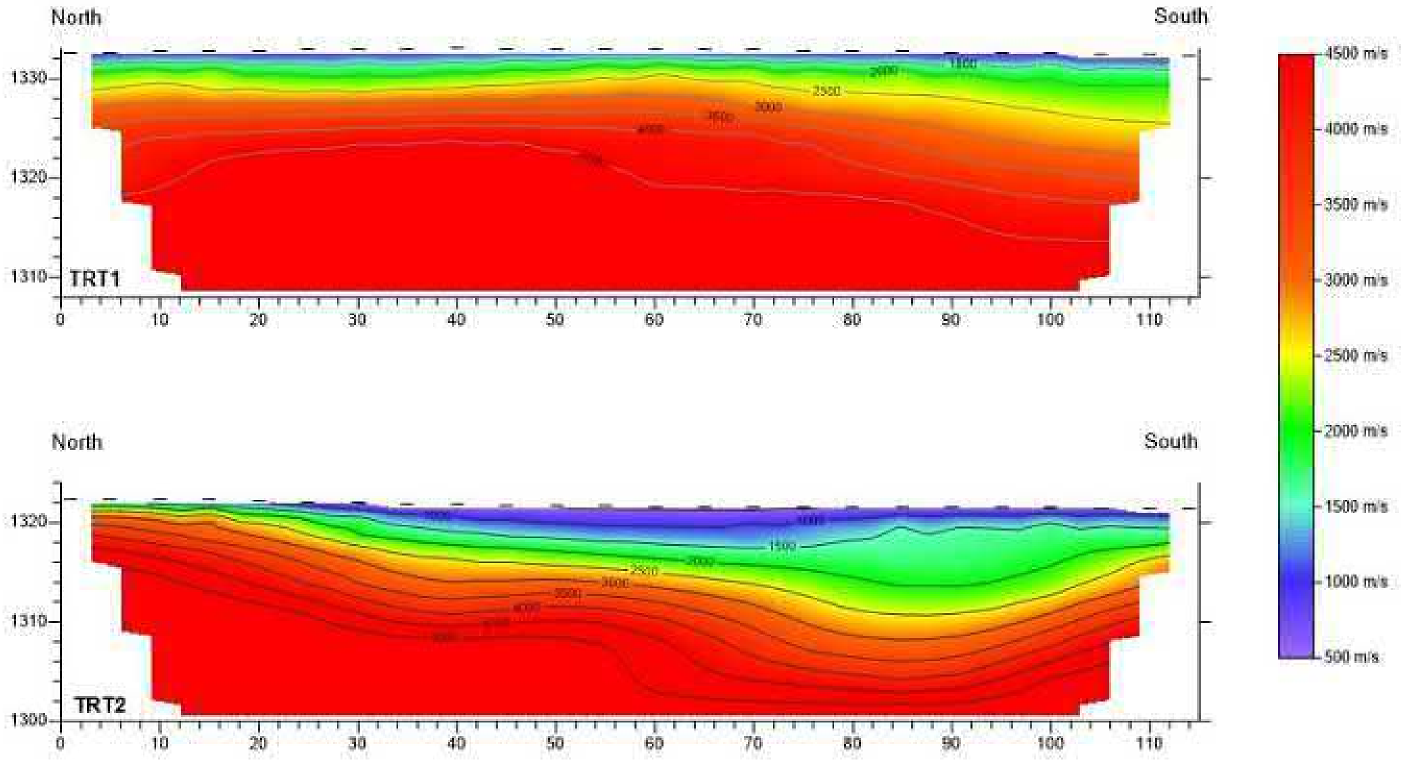


Figure 7 – Seismic refraction sections for LH TRT1 and TRT2. Very shallow bedrock occurs on TRT1.

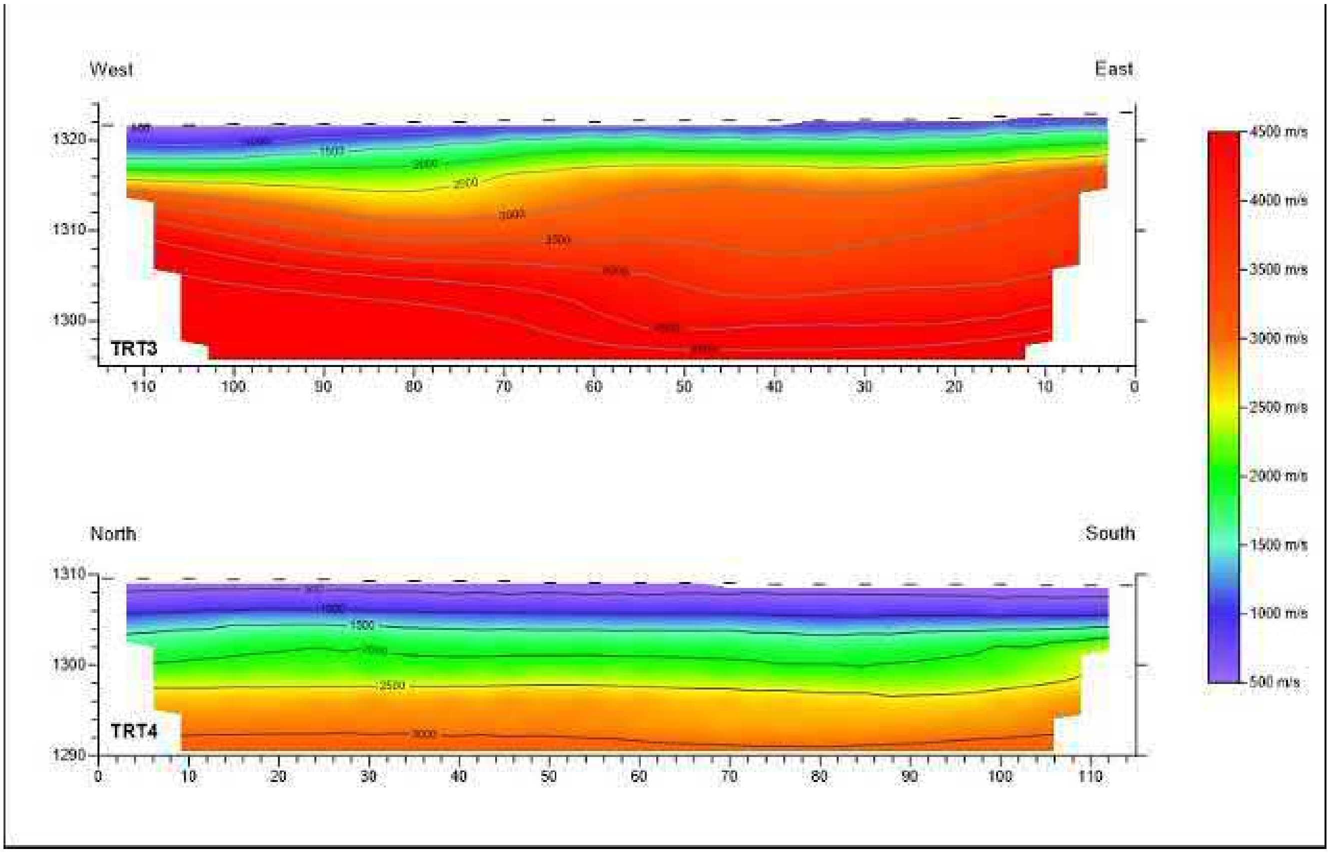


Figure 8 – Seismic refraction sections for LH TRT3 and TRT4. TRT4 shows deep bedrock at around 20m deep.

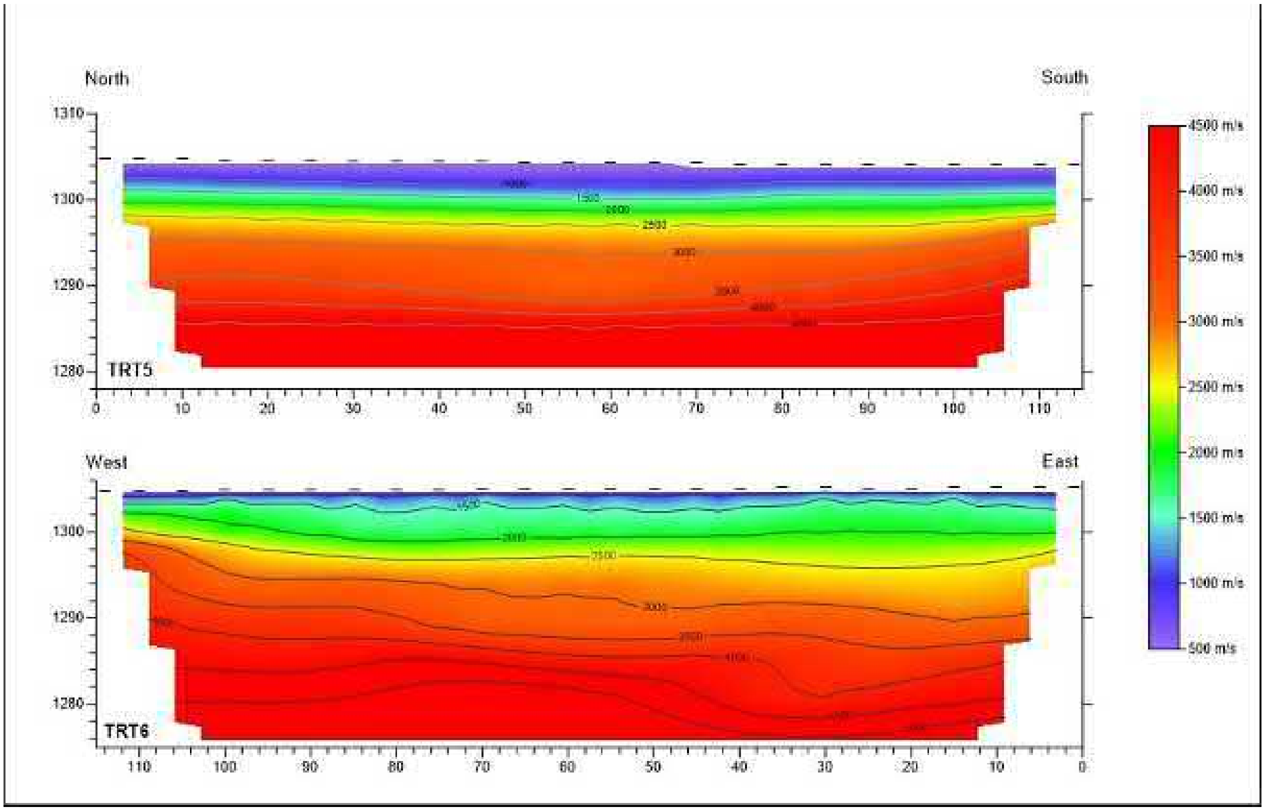


Figure 9 – Seismic refraction sections for LH TRT5 and TRT6.

4.2 Sonobolomo

A general comment about all six of these seismic sections is the lower velocities recorded throughout. A quick glance at the images below confirms that none of the traverses have the strong red colours towards the base that are seen in five of the Leliehoek traverses. In general, only orange colours representing 3000 m/s - 3500 m/s are seen at Sonobolomo. Normally this would indicate different bedrock, more similar to that of TRT4 at Leliehoek, perhaps Karoo shale. Depth to fresh bedrock for all traverses varies between 8m (TRT6) and 20m (TRT2). TRT3 also shows substantial weathering, down to 15m in places.

In terms of the resistivity profiles, there are two types of section. One type, being ERT1, 2 and 5, shows moderate resistivity values in green throughout (200 – 600 ohm.m), whilst the other type, being ERT3, 4, 6 and 7 shows very low resistivities, less than 50 ohm.m, in deep blue colours. The latter usually have a thin resistive surface layer representing calcrete, although this is well developed and up to 4m thick on SB ERT7. This layer probably overlies sand, or highly weathered clay-rich lithology. None of these show any hint of resistive bedrock at depth. In contrast, the former 3 traverses have a thin low resistivity layer near surface. Both ERT1 and 2 show sharp sub-vertical structures which could represent geological contacts. The moderate resistivity bedrock here could be shale.

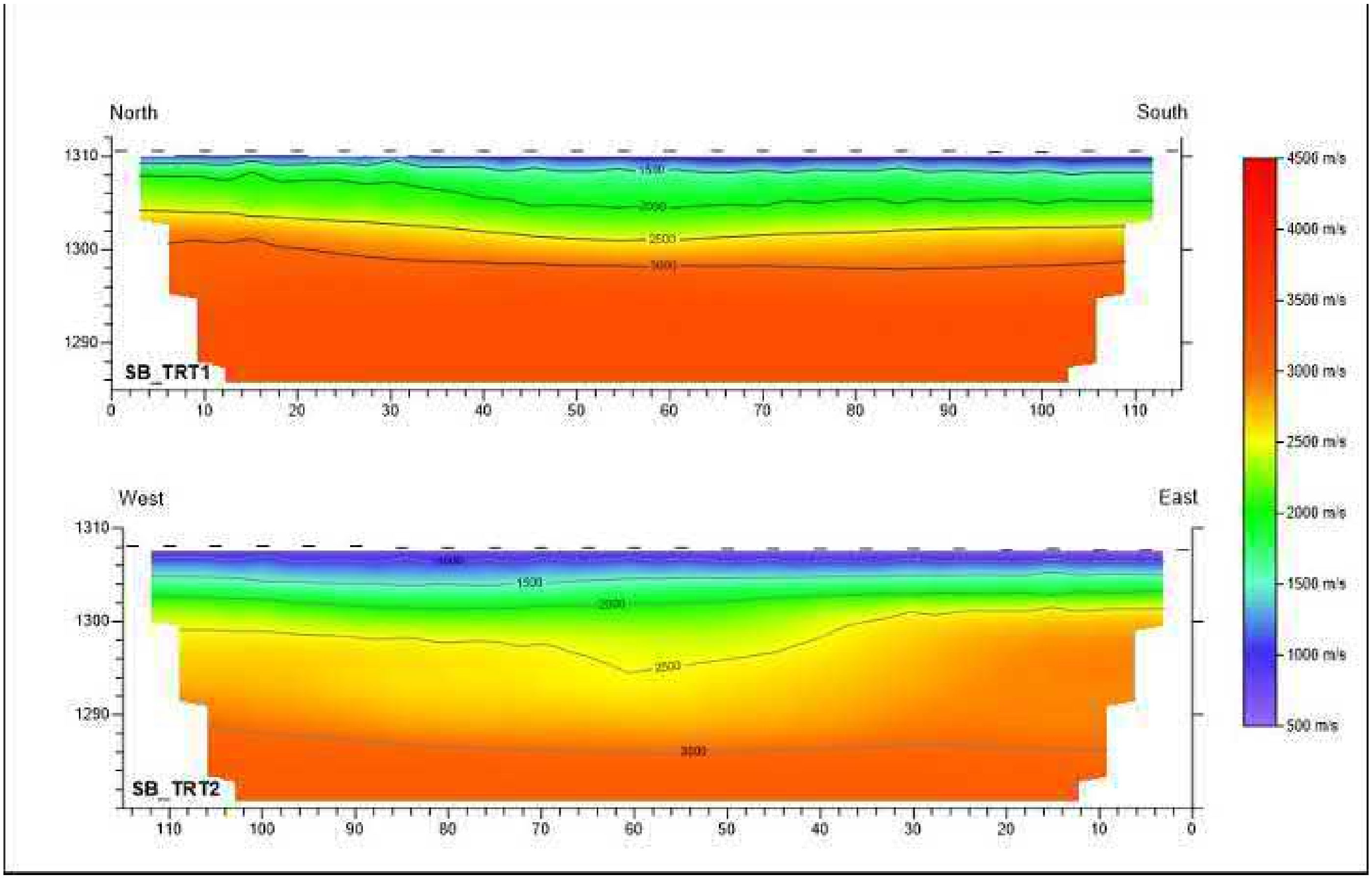


Figure 10 – Seismic refraction sections for SB TRT1 and TRT2. TRT2 shows an exceptionally thick weathering zone in yellow, all the way down to 20m depth.

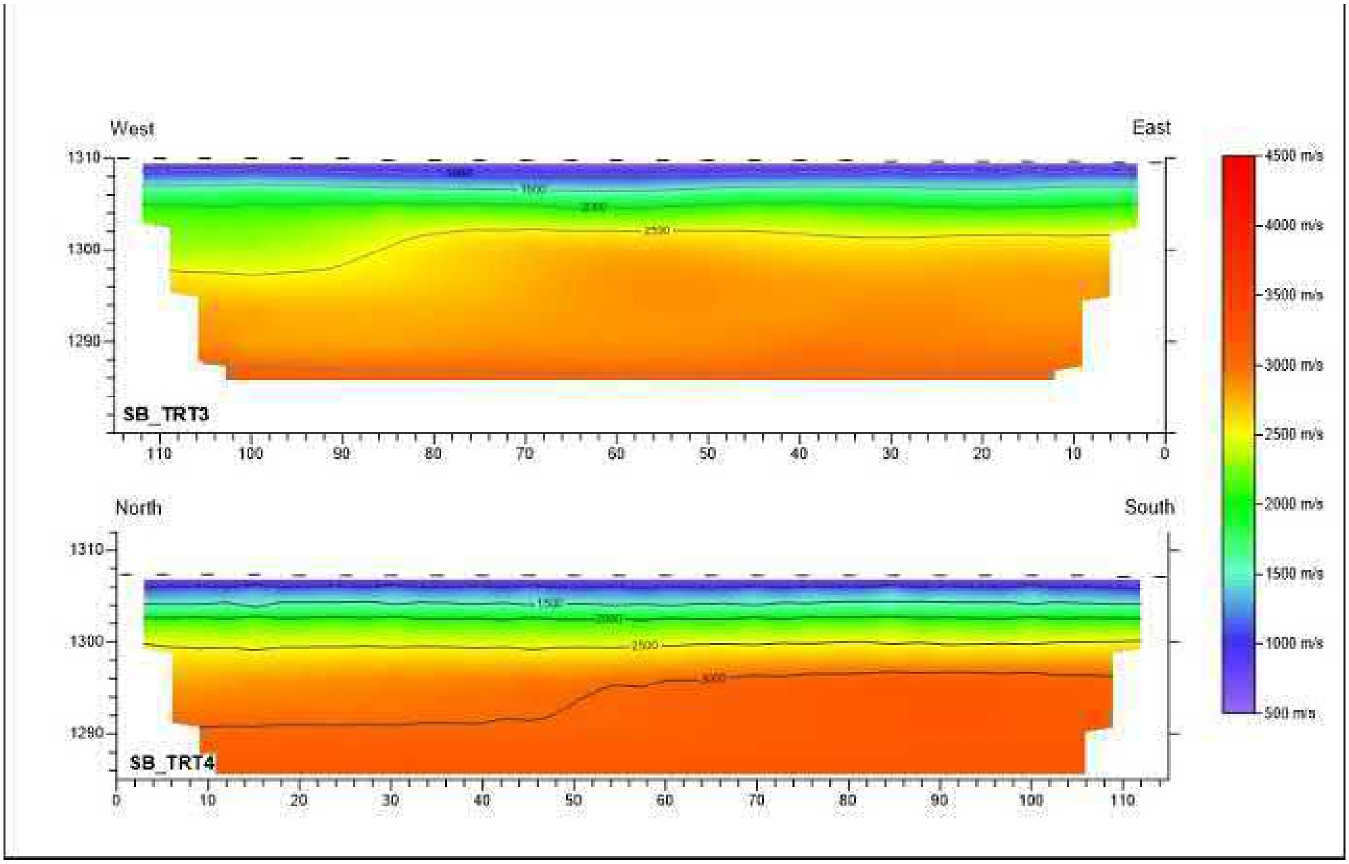


Figure 11 – Seismic refraction sections for SB TRT3 and TRT4. TRT3 shows a thick weathered zone down to 15m in places.

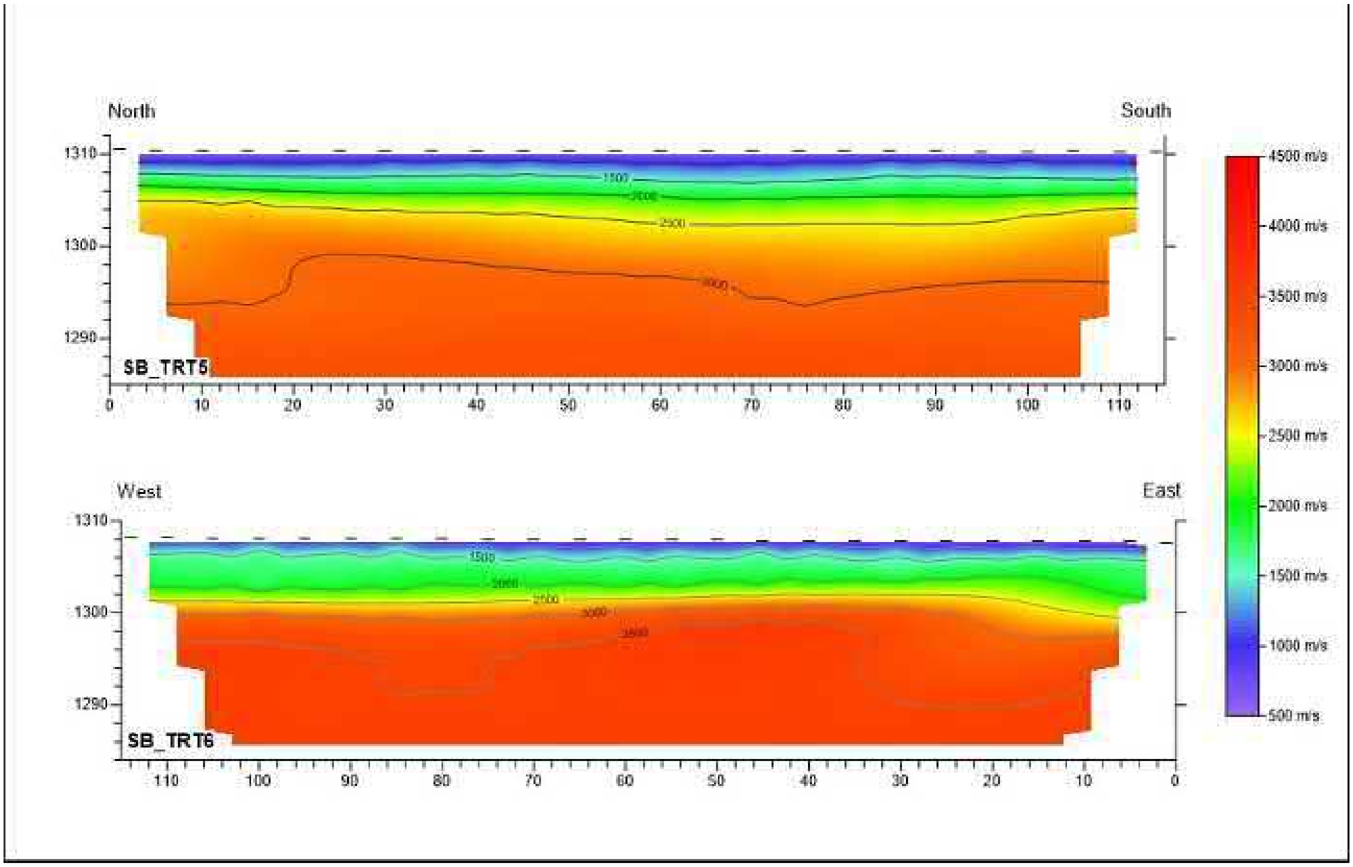


Figure 12 – Seismic refraction traverse for SB TRT5 and TRT6. TRT6 has a very narrow weathered zone in yellow with fresh bedrock being relatively shallow, around 8m deep.

4.3 Kentani

The first five resistivity traverses KT ERT1-ERT5 show the same type of section, being the classic deep blue interpreted sand profile (although it may be a clay-rich weathered lithology), with thin calcrete surface layer. KT ERT6 is very different, showing highly resistive bedrock up to 3000 ohm.m as shallow as 3m deep. KT ERT7 appears to show a thick sand layer with bedrock starting to appear at around 8m depth.

In terms of the seismic data, KT TRT5 and TRT6 display high velocities in red at depth with very shallow, competent bedrock. One would assume this to be dolerite, although it could be sandstone. The other 4 sections all show moderate velocities in the orange colours (3000 – 3500 m/s), more consistent with shales or siltstones. Bedrock varies in depth from 1m (TRT5, essentially outcrop) to 16m (TRT1, from 60-110m). Mostly it is of the order of 6-8m deep.

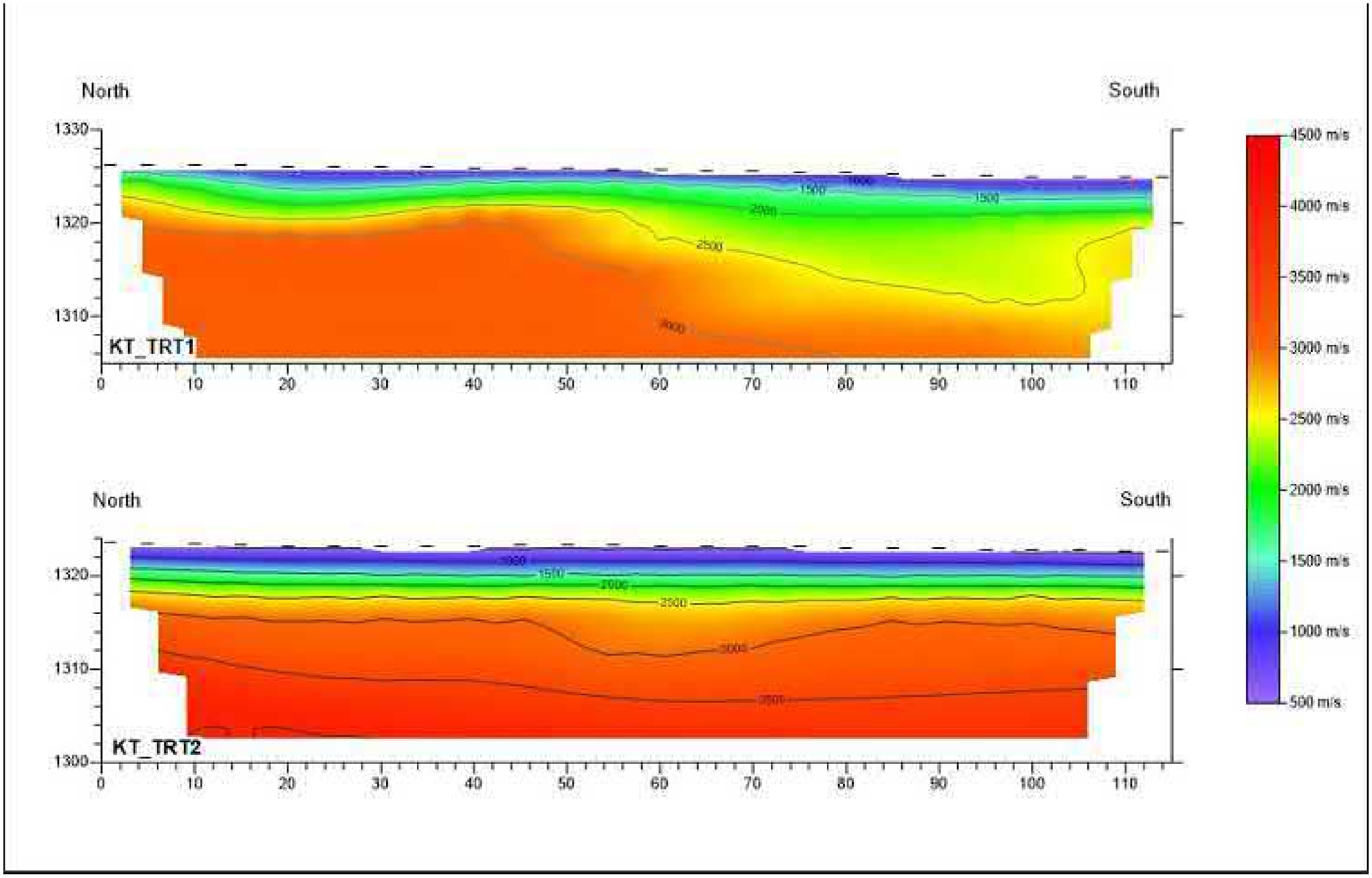


Figure 13 – Seismic refraction sections for KT TRT1 and TRT2. KT TRT1 shows thickly developed weathering from 60-110m.

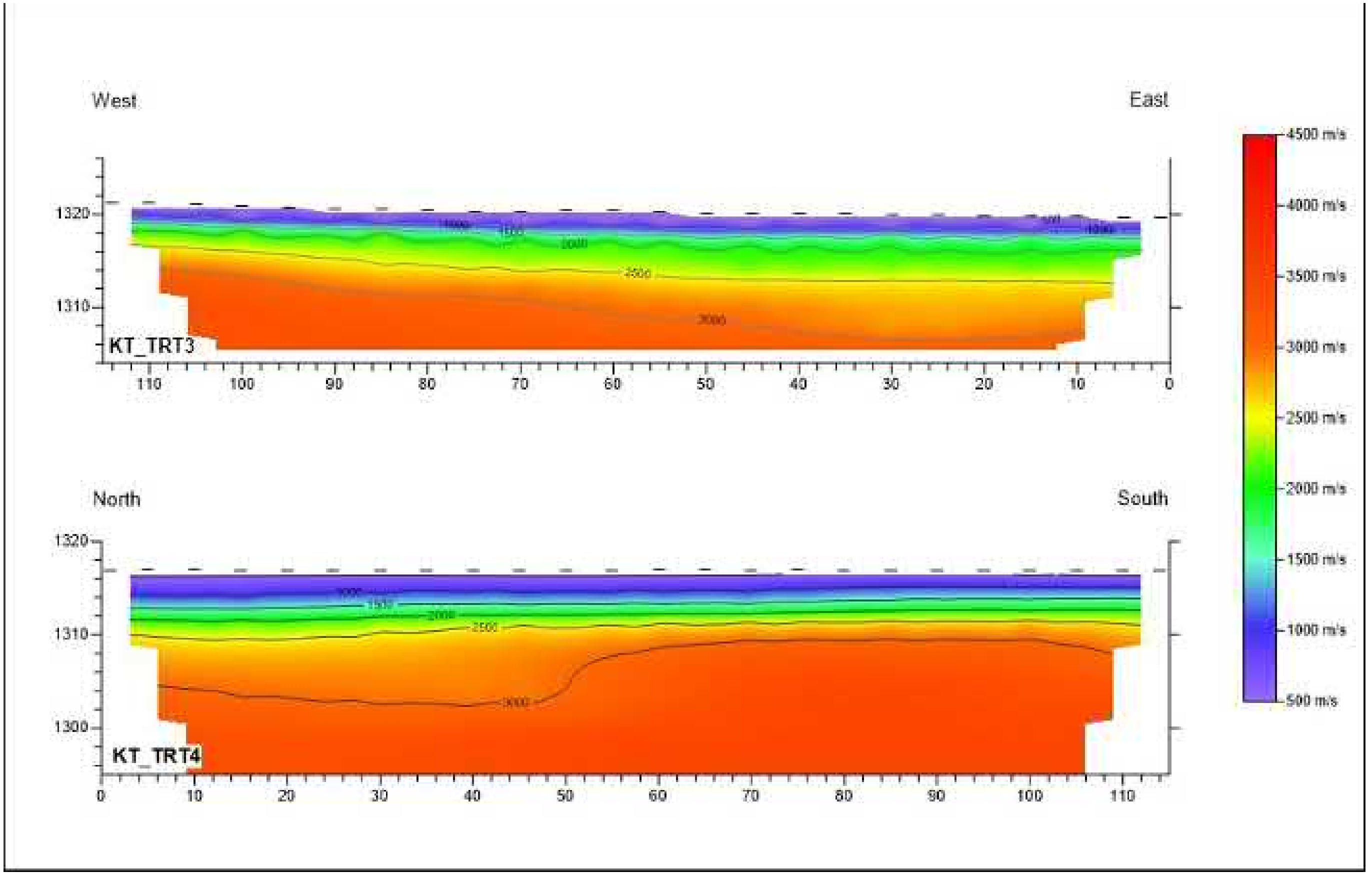


Figure 14 – Seismic refraction sections for KT TRT3 and TRT4. Bedrock lies at 6-8m depth on both.

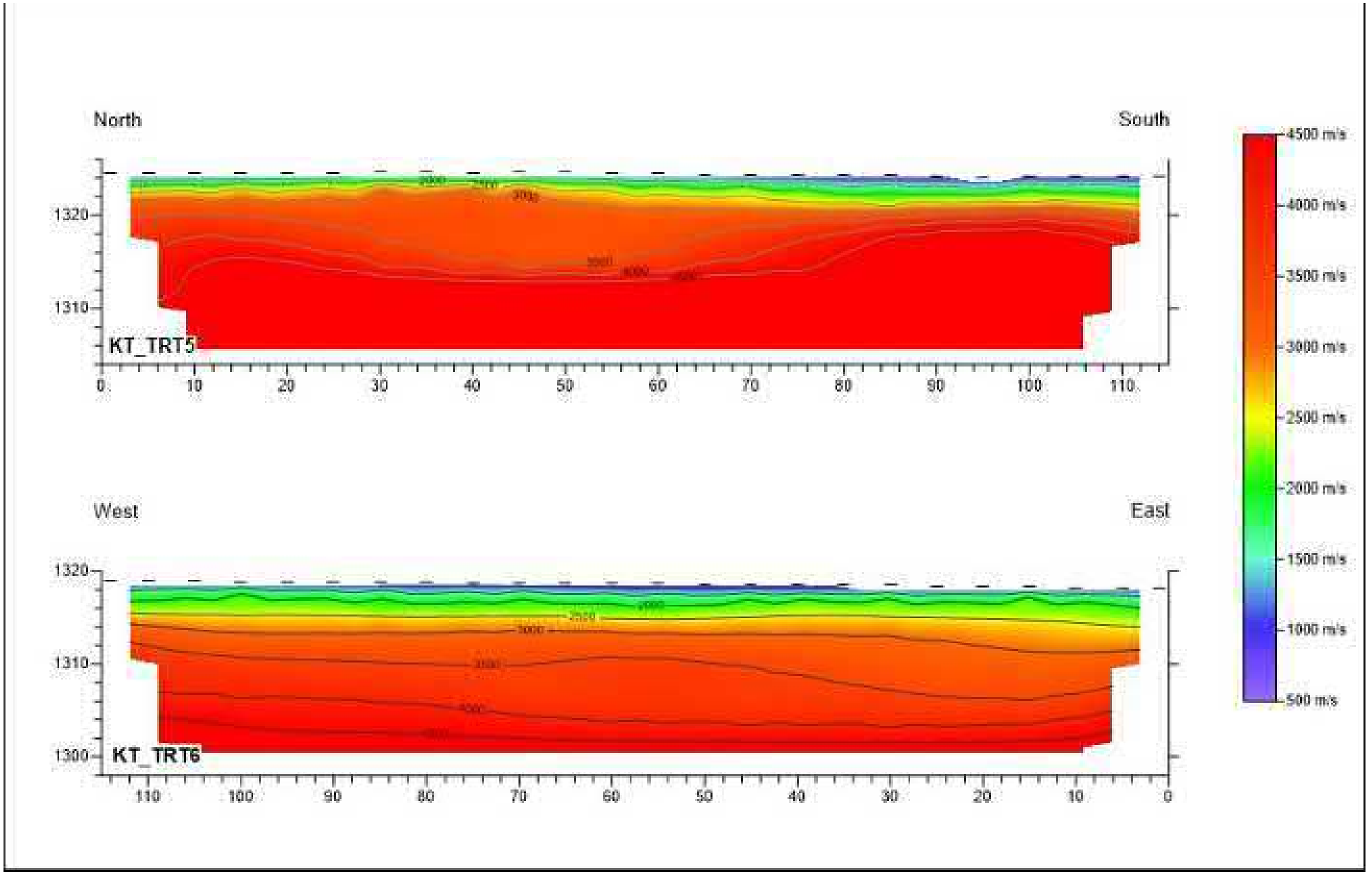


Figure 15 – Seismic refraction section for KT TRT5 and TRT6. TRT5 is essentially on outcrop. TRT6 bedrock is very shallow.

4.4 Klipfontein 2

This site is different inasmuch as the first six of the resistivity sections are dominated by resistive bedrock and not the usual deep blue sand profiles prevalent elsewhere. KF2 ERT1 and ERT2 are classic examples, showing shallow, highly resistive rock at depths of 2.5m to 4m, with only a thin layer of low resistivity material above this. ERT 4-6 are similar except the resistive bedrock is deeper, varying from 5m to 8m deep. The interpretation here would lean towards dolerite, being close to surface or covered by varying thicknesses of sand. ERT7 is the only classic deep blue interpreted sand profile showing no bedrock at all.

The seismic refraction datasets below show high velocity fresh bedrock at around 5-10m on all sections except for TRT6, which is very different. The latter shows a thickly developed weathered profile (in yellow) down to 20m or more, and in fact high velocity bedrock is not seen. The bedrock at TRT4 may well be different in nature, because although it is shallow is does not reach the high velocity red colours of TRT1, 2, 3 and 5 but remains in the orange at 3000 – 3500 m/s. It is possible the bedrock at RT4 is shale or siltstone, and dolerite at the other four sites.

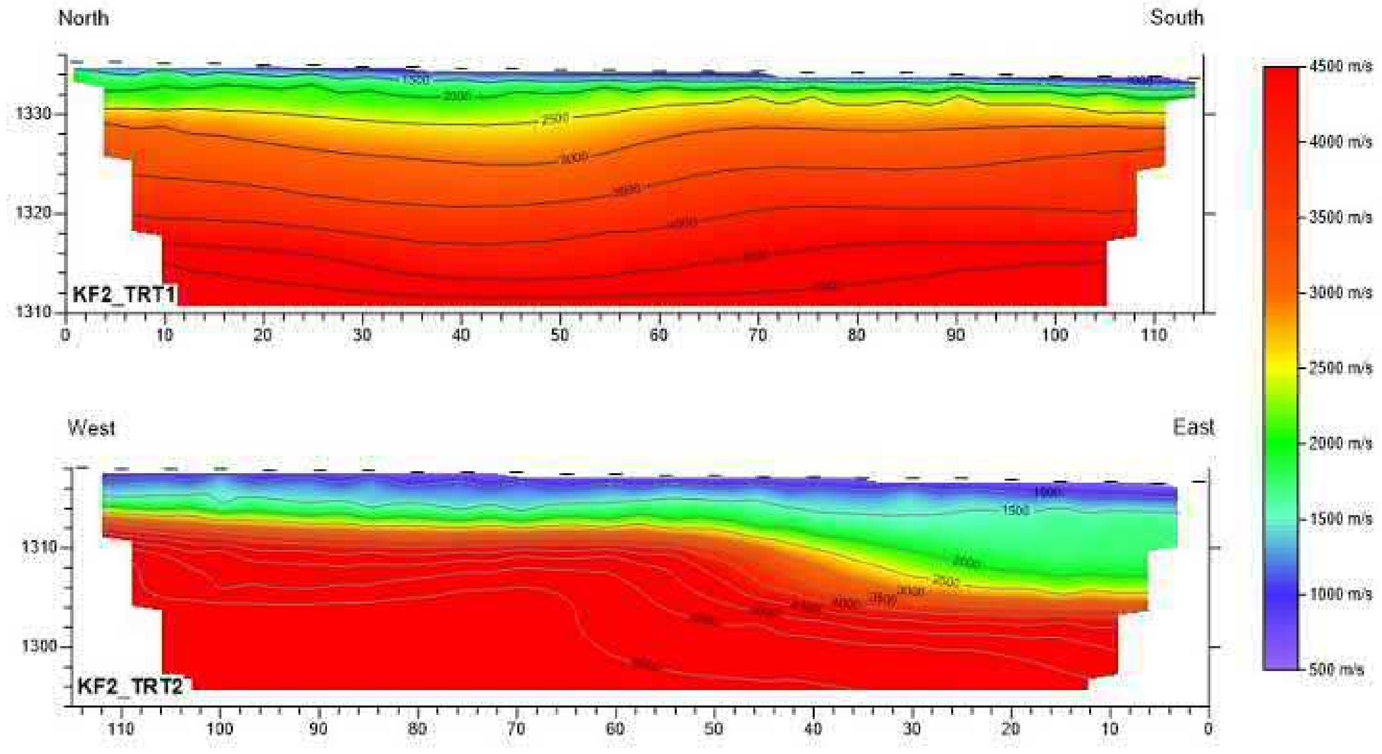


Figure 16 – Seismic refraction sections for KF2 TRT1 and TRT2. Shallow, high-velocity bedrock occurs at 5-7m on both.

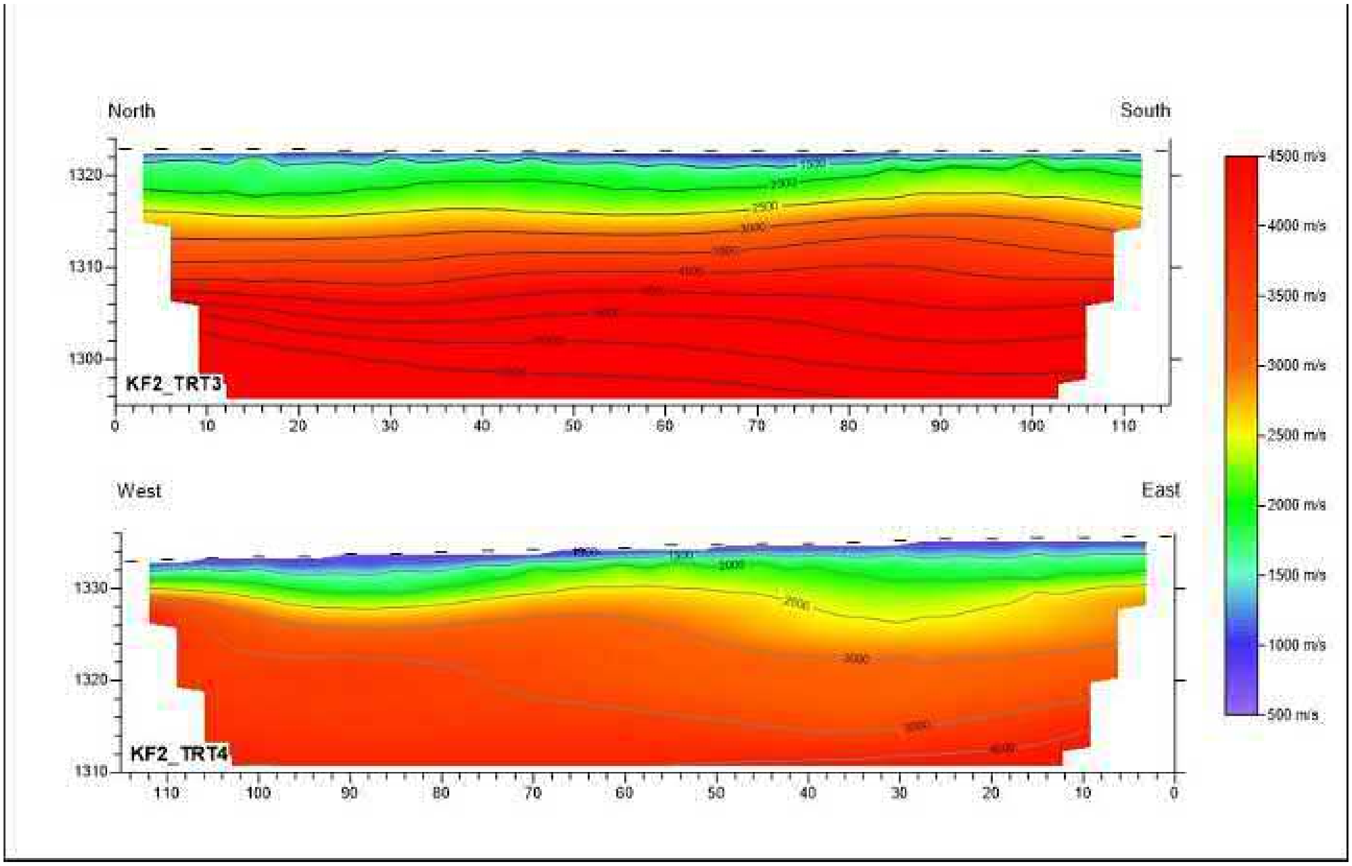


Figure 17 – Seismic refraction sections for KF2 TRT3 and TRT4. Bedrock lies at 6-10m depth on both.

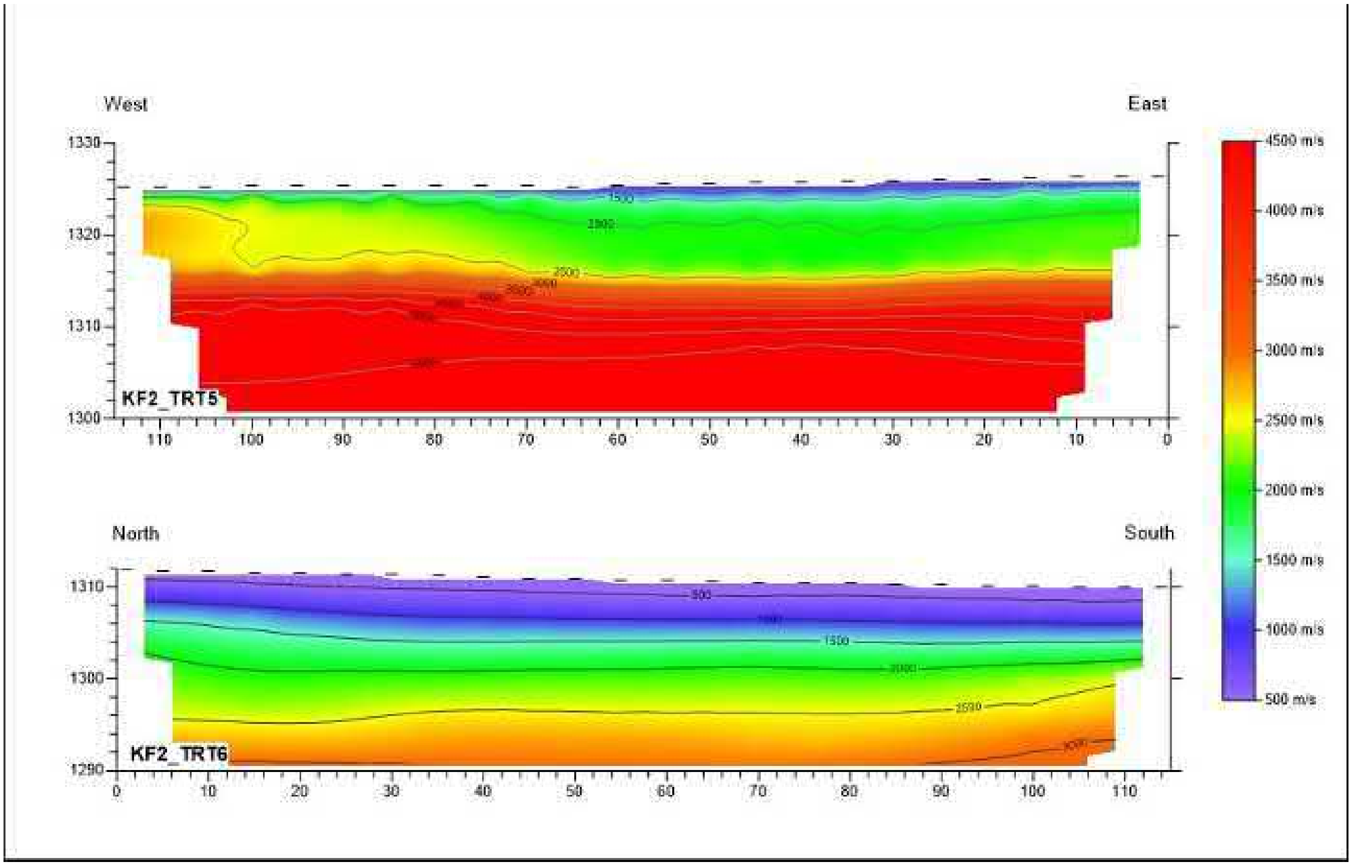


Figure 18 – Seismic refraction sections for KF2 TRT5 and TRT6. Bedrock is very deep on TRT6, around 20m.

4.5 Klipfontein

In contrast to Klipfontein 2, at this site all of the resistivity sections are the classic deep blue interpreted sand sections (with calcrete layer on top) except for Traverse 3 which shows moderately resistive bedrock at a depth of 2.5 -8m. There is no sign of bedrock on the other profiles except for a hint on Traverse 4 at 15m depth. The geology map shows considerable dolerite on this farm, so this is an enigma. It is possible that the interpreted sand profiles actually represent highly weathered, clay-rich doleritic material. This needs confirmation from the trenching results on site.

In terms of the refraction seismic images shown below, only KF TRT5 and TRT6 show the shallow, high velocity bedrock we would associate with dolerite (or sandstone). Bedrock is similarly shallow on TRT4, but this may be shale as its velocities are low, around 3000 m/s. On TRT3 the same rock type occurs, but the weathering profile is thicker and the gradation to fresher rock is slow. Bedrock is deep at 15-20m deep on TRT1. TRT2 shows only yellow, low velocity material typical of weathered rock and in fact, fresh bedrock is not encountered even as deep as 20m. The assumption is that a thick sand layer is present at this site.

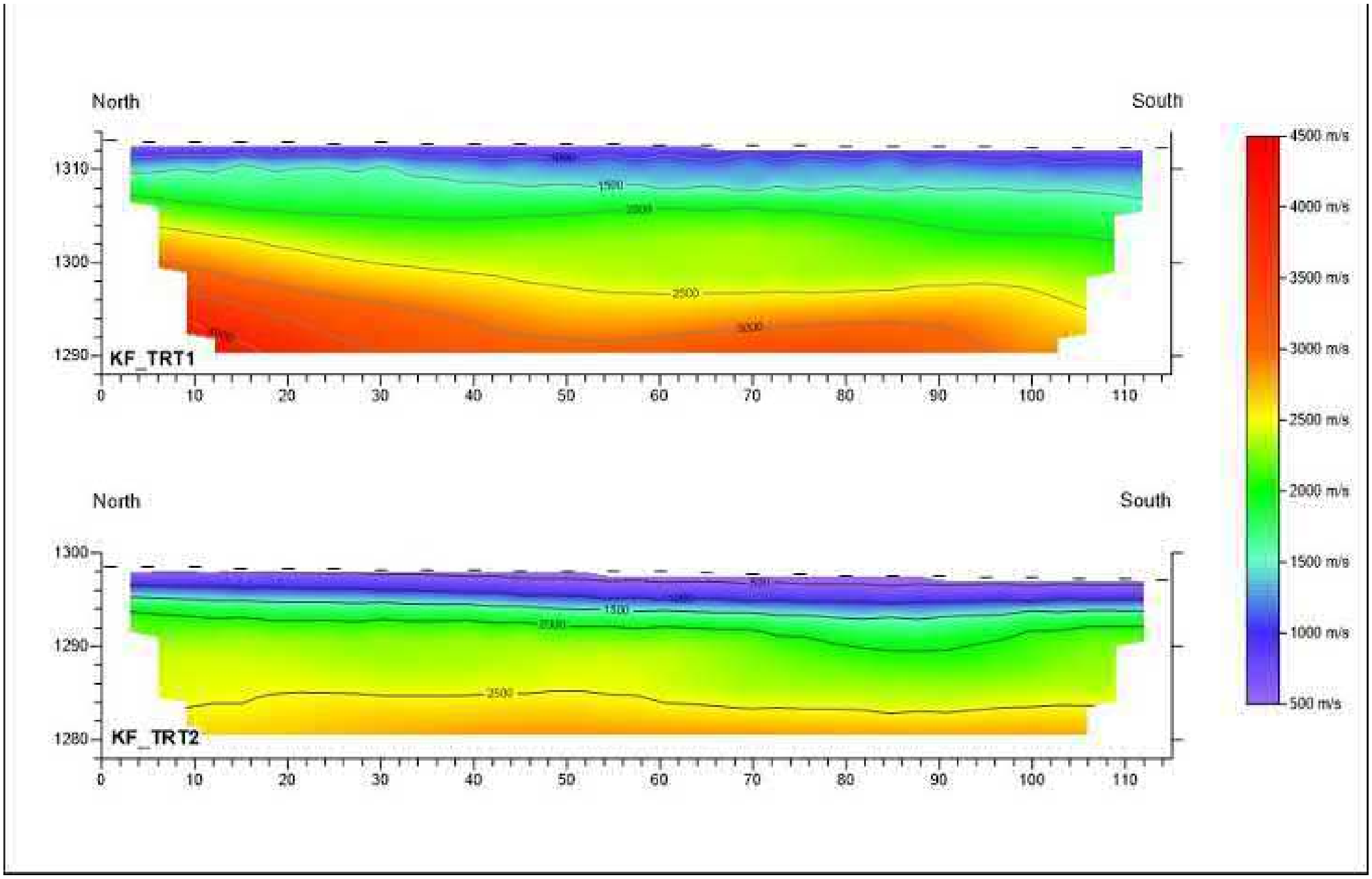


Figure 19 – Seismic refraction sections for KF TRT1 and TRT2. Fresh bedrock is around 15-20m on TRT1, and is essentially not encountered on TRT2.

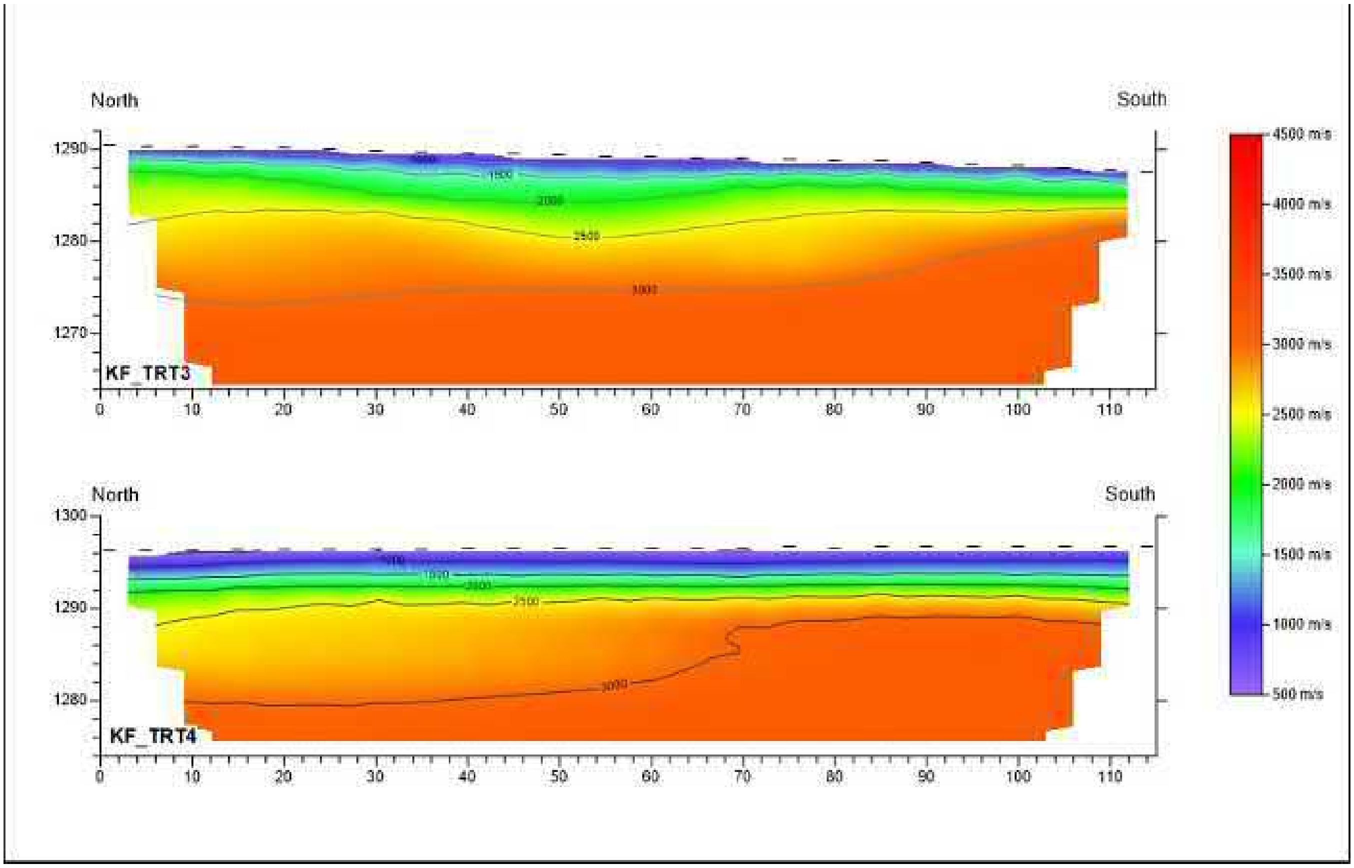


Figure 20 – Seismic refraction sections for KF TRT3 and TRT4. These profiles appear typical of weathered shale.

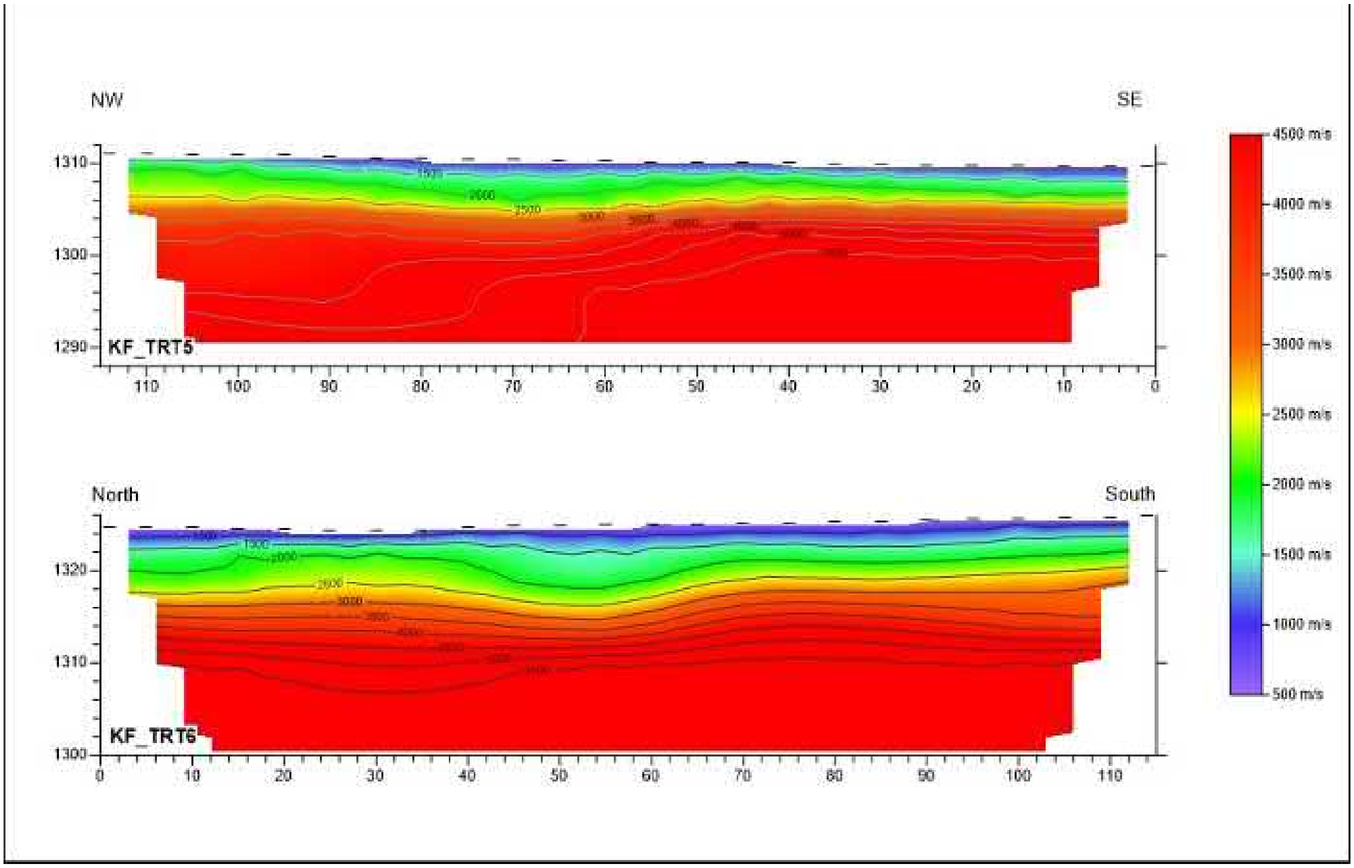


Figure 21 – Seismic refraction sections for KF TRT5 and TRT6. Competent bedrock occurs at 7-10m on both.

5. Conclusions

Combined resistivity and seismic refraction surveys at five main sites in the Free State near Dealesville have yielded varied results in terms of geology and bedrock depth. There are clear geological differences between the sites, with Klipfontein 2 showing fresh bedrock on six out of seven resistivity surveys, and the Klipfontein site showing thick interpreted sand with little evidence of bedrock on six out of seven surveys. Depth to fresh bedrock is as low as 2.5m in some areas, and as deep as 20m or more at other sites. Most sites show a mix of results with shale, siltstone, dolerite and sand cover being encountered.

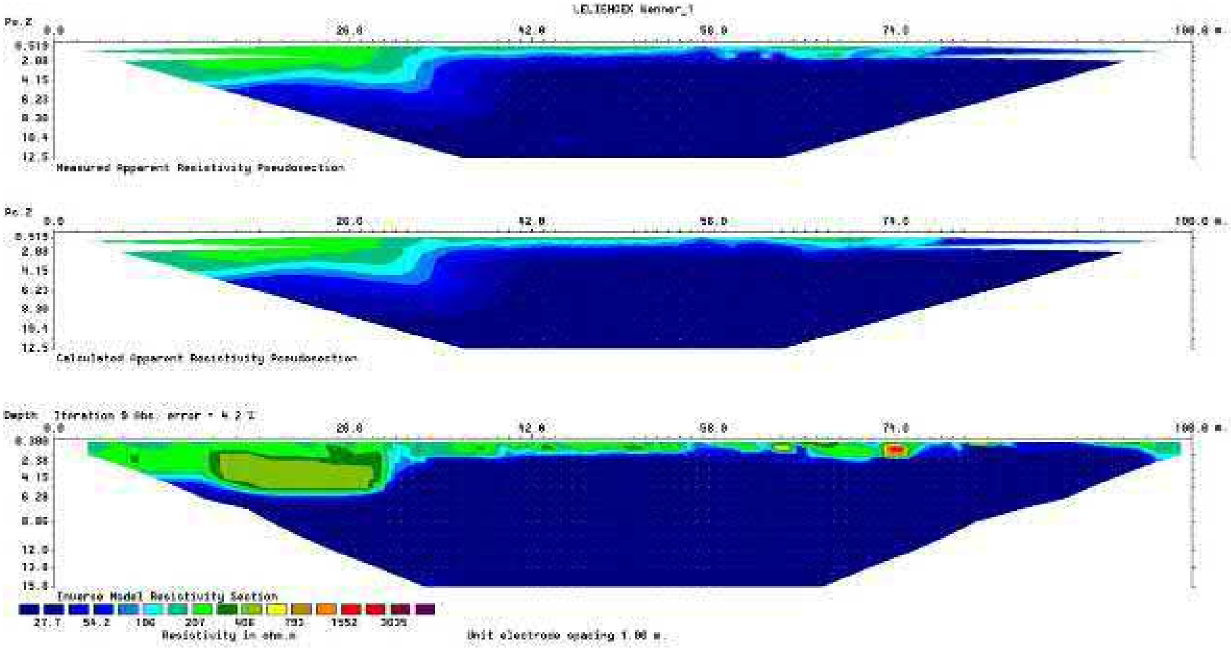
In terms of corrosivity, the tables show that the only severe problem is at Klipfontein 2 Traverse ERT7. Traverse ERT1 on Klipfontein has values very close to the severe risk category, being right on the margin. All of the other resistivity surveys show moderate to unlikely corrosivity risk.

In terms of the water table no information could be gleaned from these surveys, as in all cases the survey depth-of-penetration is considered too shallow for this purpose.

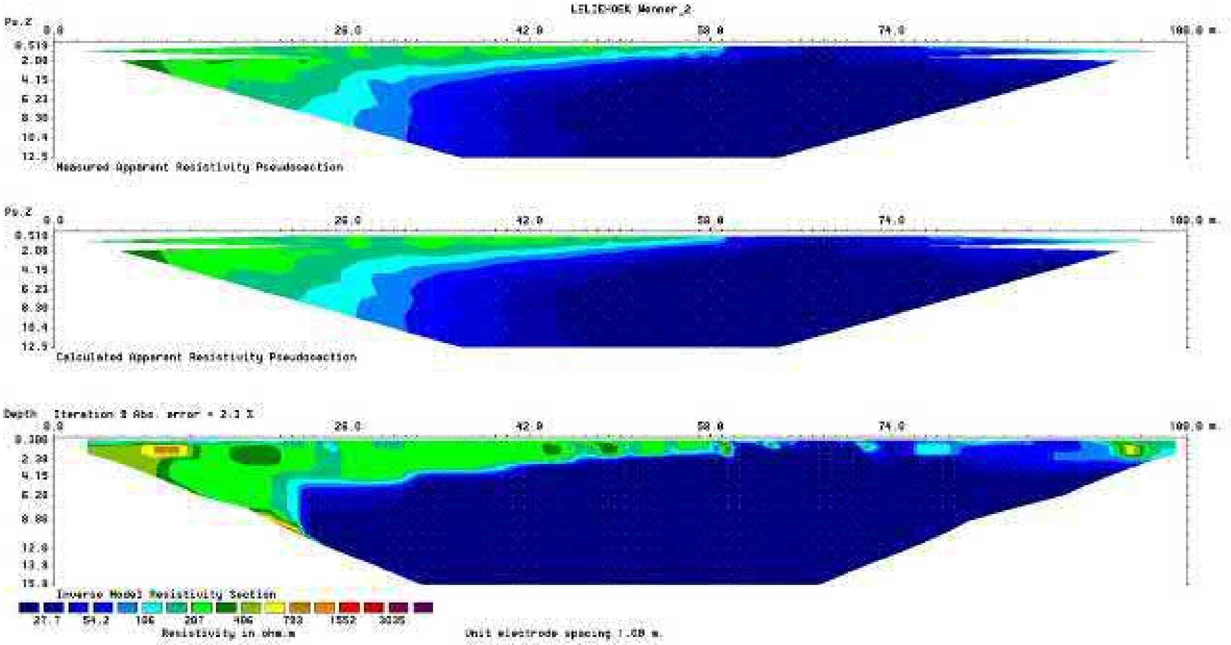
APPENDIX 1 – Kentani Cluster Solar Site

In the following images, the top image is the actual measured data, and the middle image shows the model data fit. The middle image should therefore look similar to the top image, if the modelled data in the bottom image is good. The bottom image reflects the modelled earth resistivity in section. Any geological changes can be identified on the bottom image, with their correct geometry.

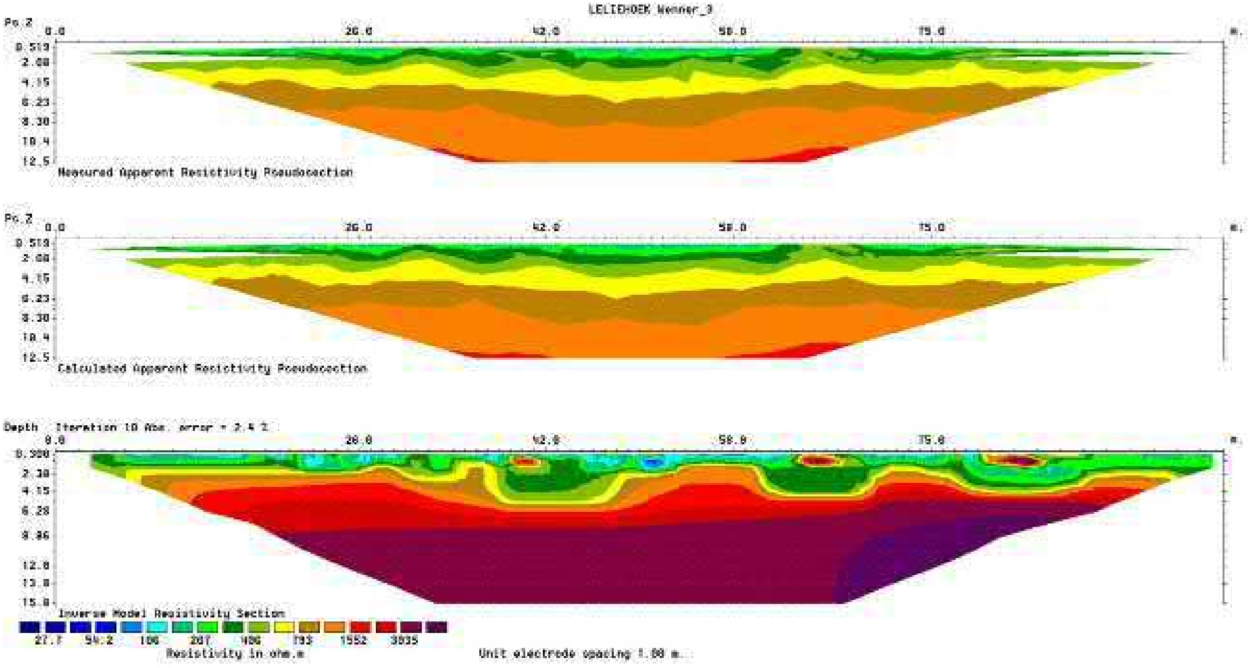
Traverse Leliehoek 1



Traverse Leliehoek 2

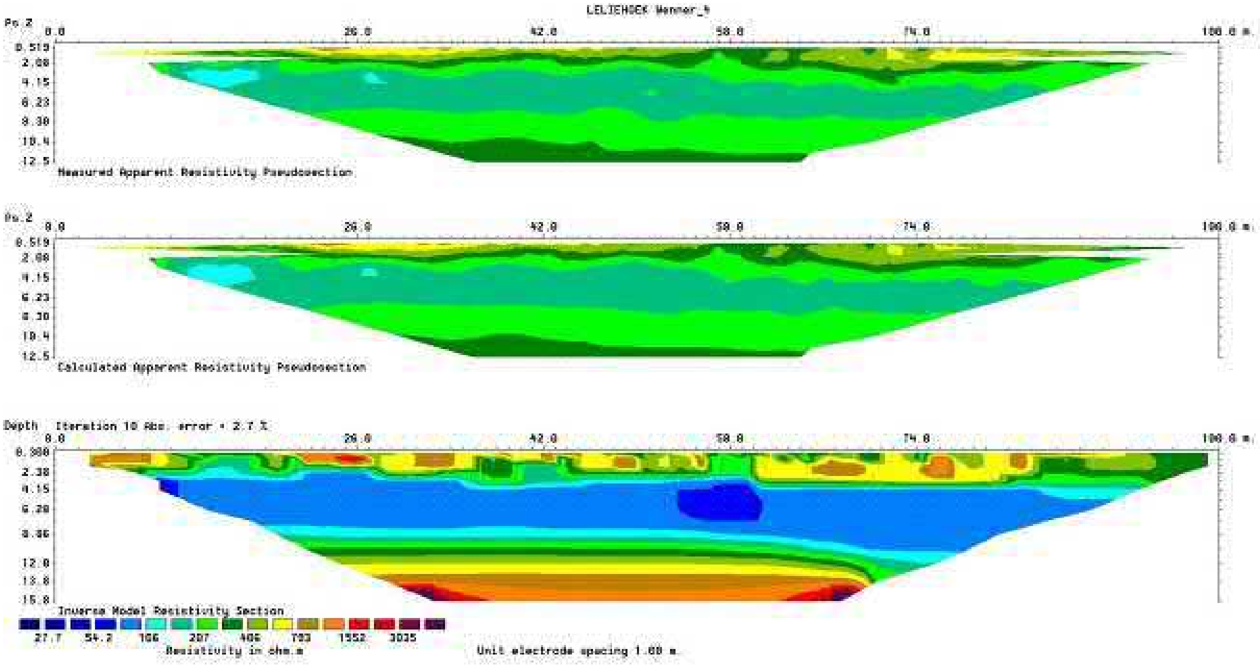


Traverse Leliehoek 3

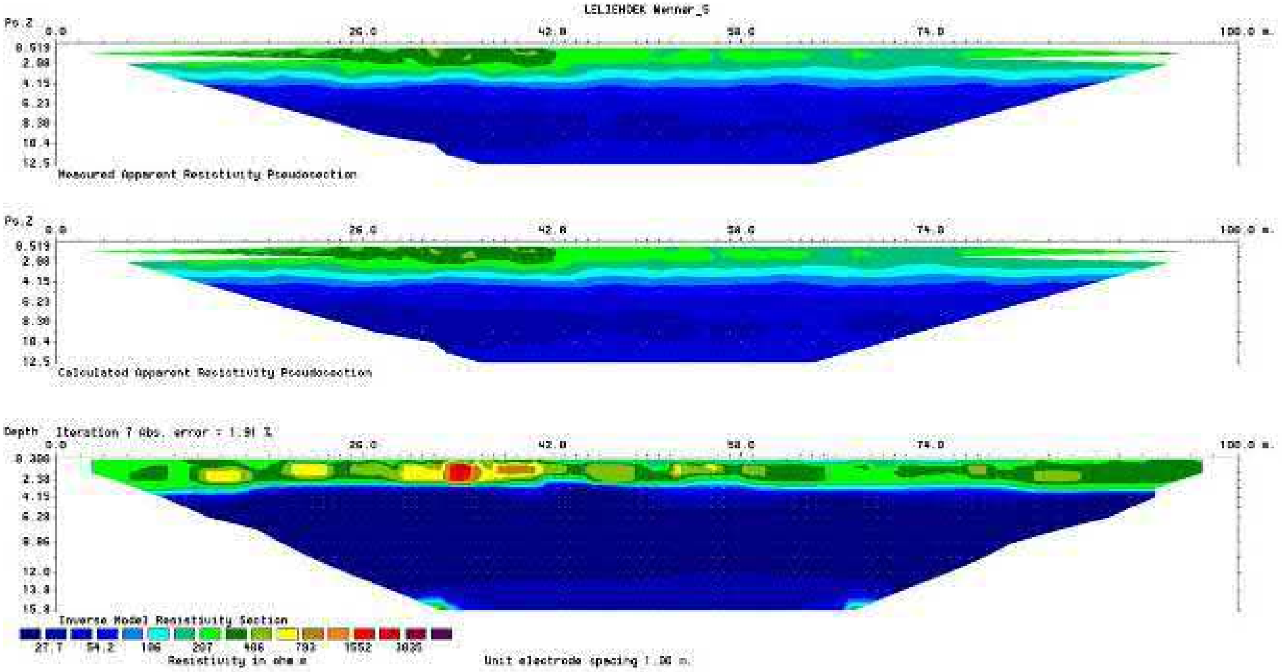


{Traverse 3 shows very resistive bedrock at shallow depths. This is possibly fresh dolerite. Traverse 4 shows moderate resistivities throughout, possibly Ecca shale}.

Traverse Leliehoek 4

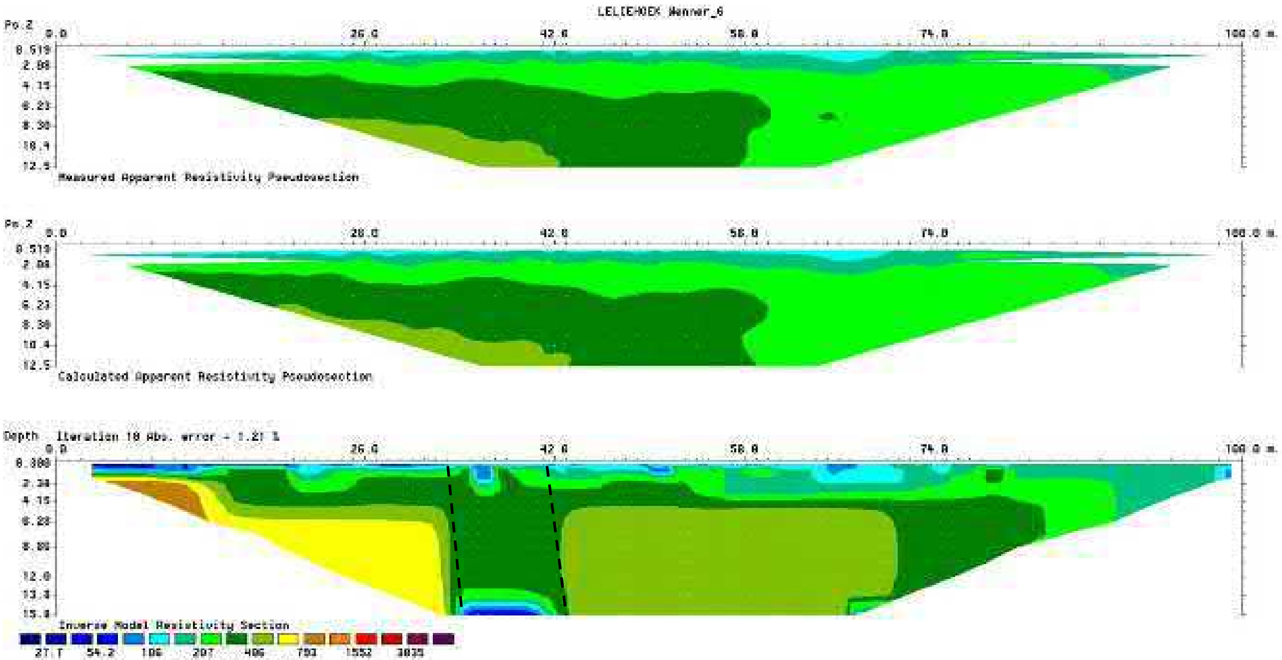


Traverse Leliehoek 5



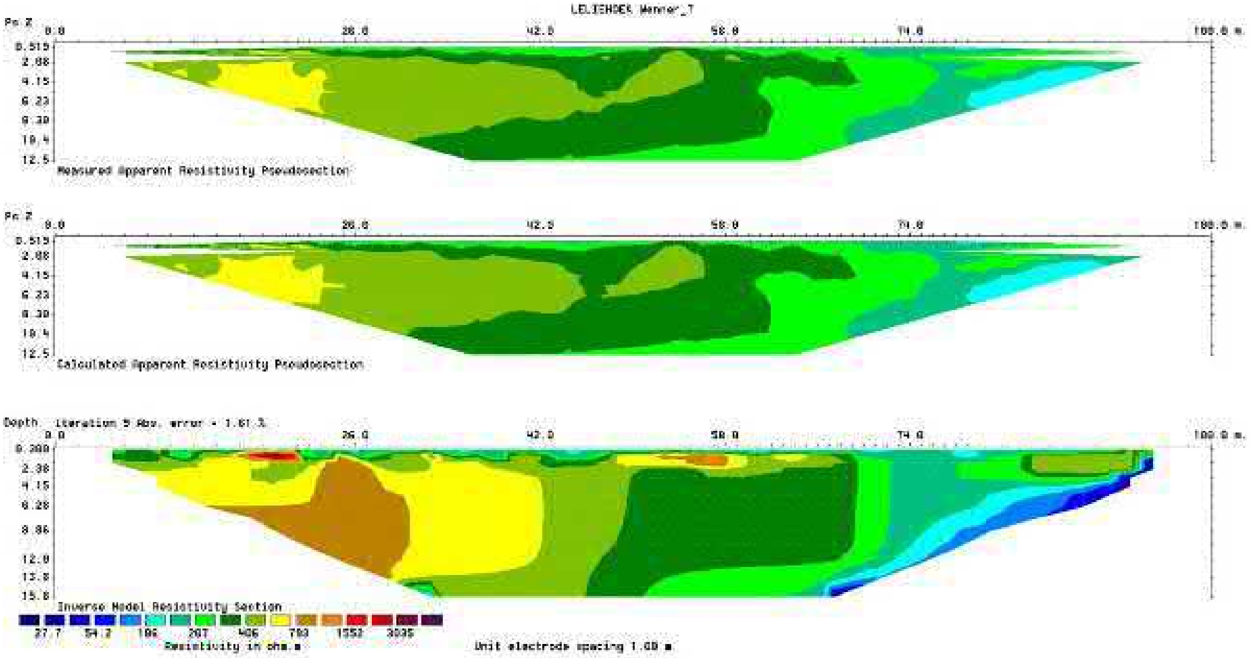
{Traverse 5 shows the classic calcrete surface layer overlying thick interpreted sand. Traverse 6 shows moderate resistivities throughout, which may represent Karoo shale or siltstone}

Traverse Leliehoek 6



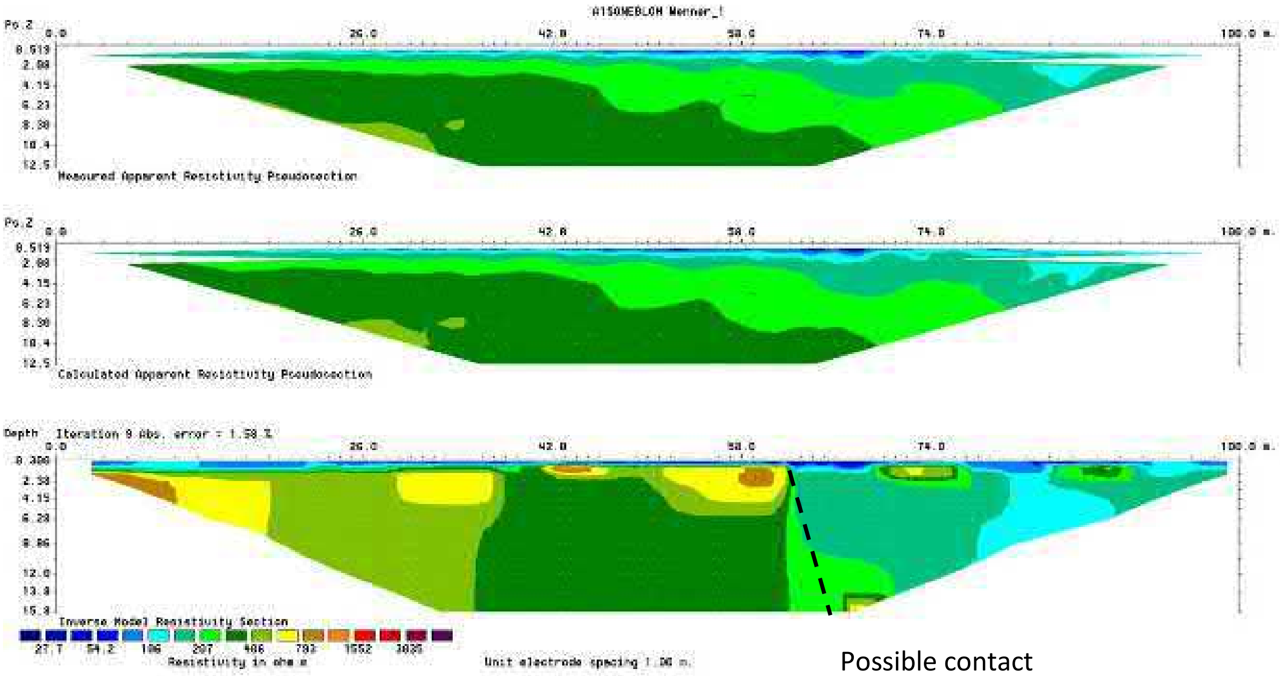
Possible dyke or fault

Traverse Leliehoek 7



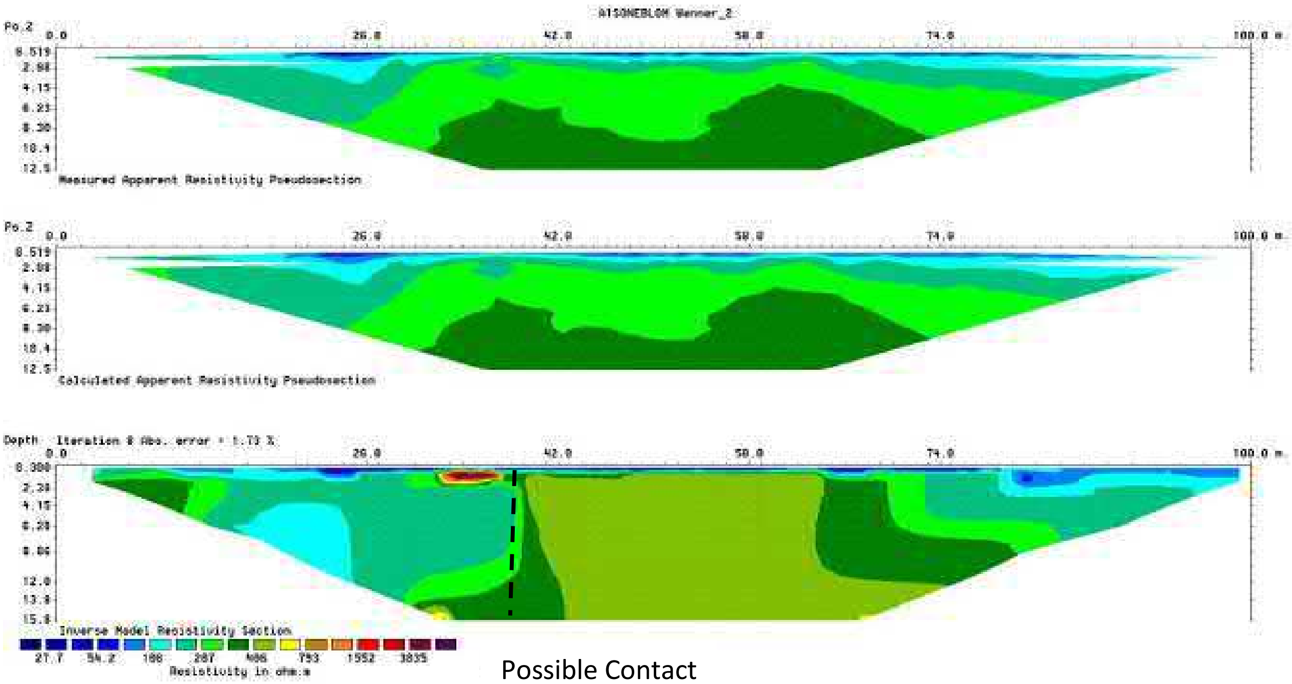
{Both images on this page possibly represent weathered Karoo shales}

Traverse Sonobolomo 1



Possible contact

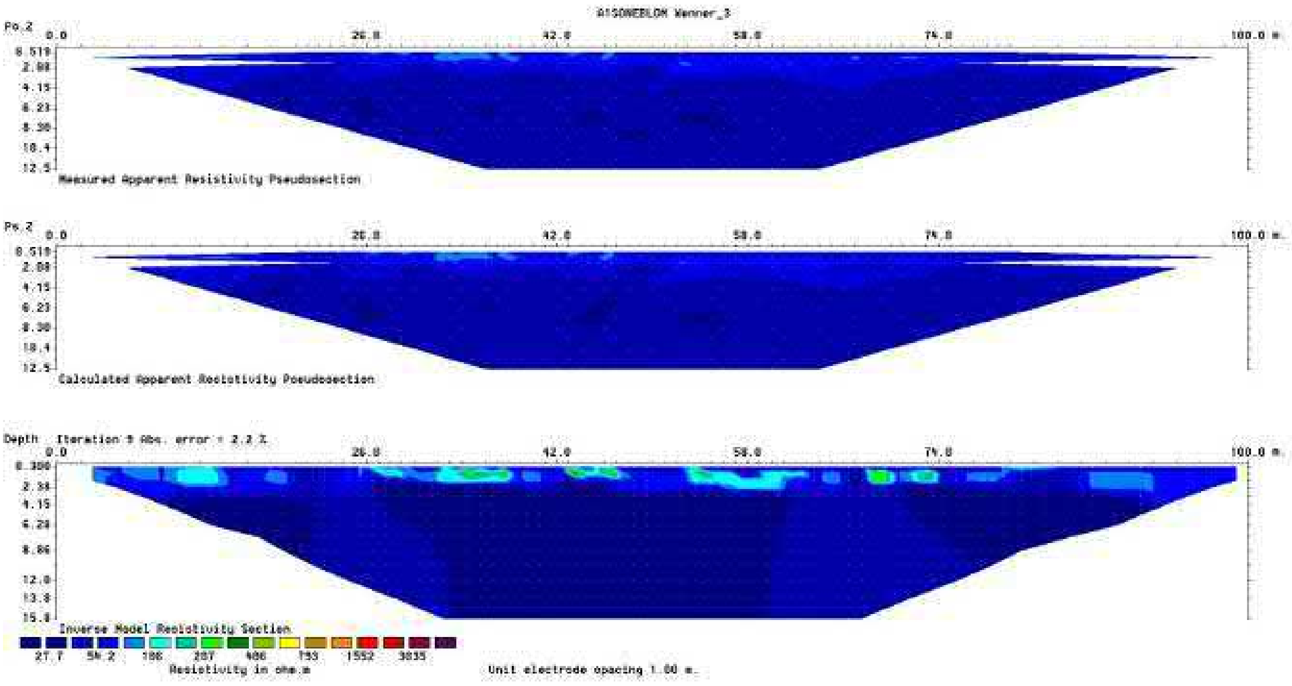
Traverse Sonobolomo 2



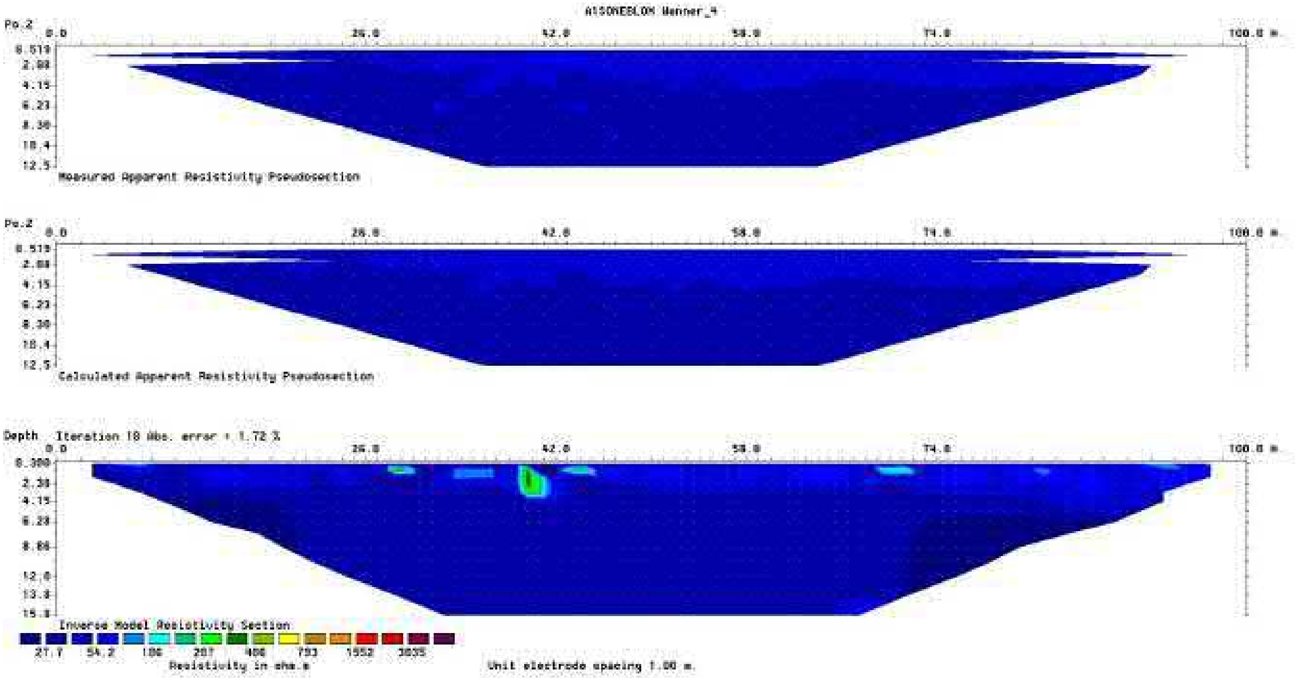
Possible Contact

{Traverse 2 possibly represent weathered Karoo shales, whilst Traverse 3 more likely is thick interpreted sand}

Traverse Sonobolomo 3

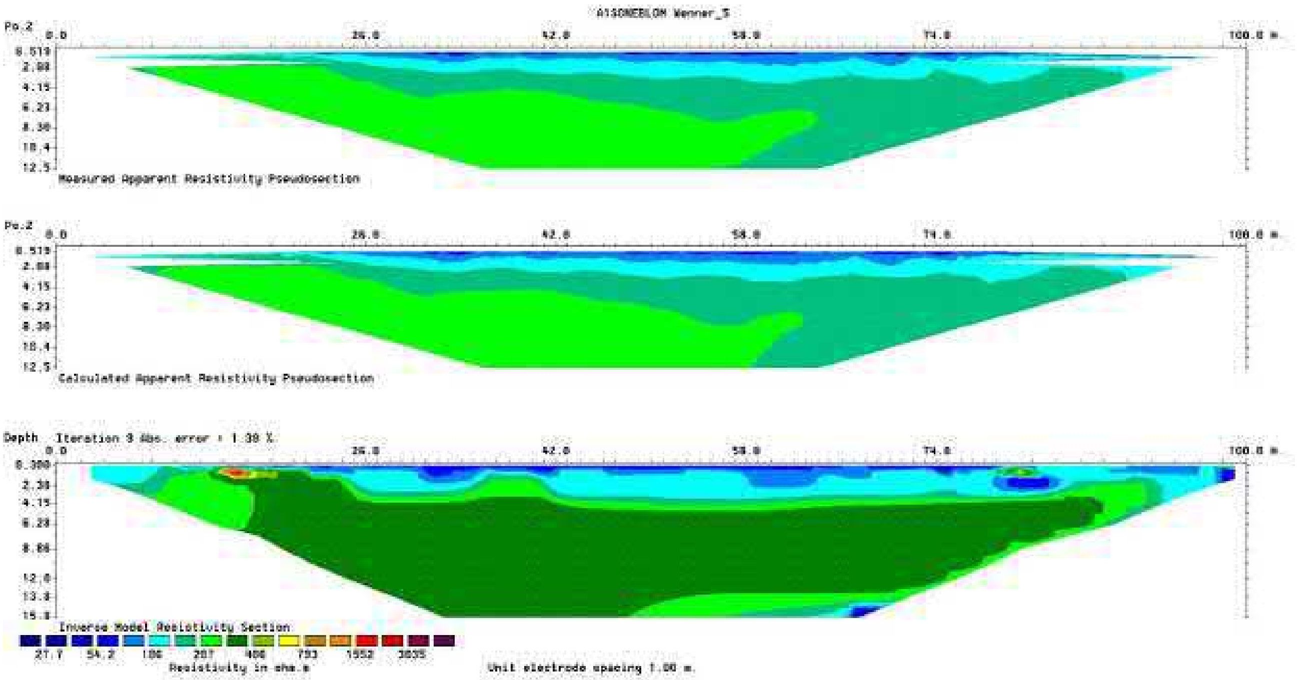


Traverse Sonobolomo 4

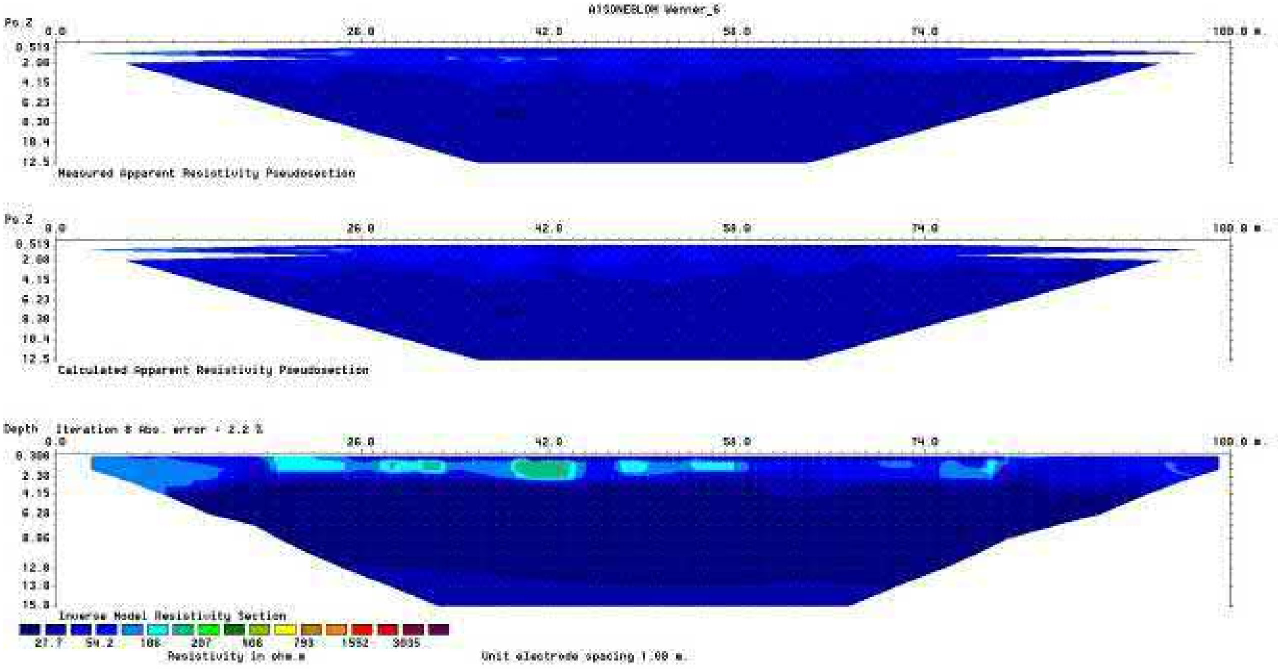


{Traverse 5 possibly represent weathered Karoo shales, whilst Traverse 4 more likely represents thick interpreted sand}

Traverse Sonobolomo 5

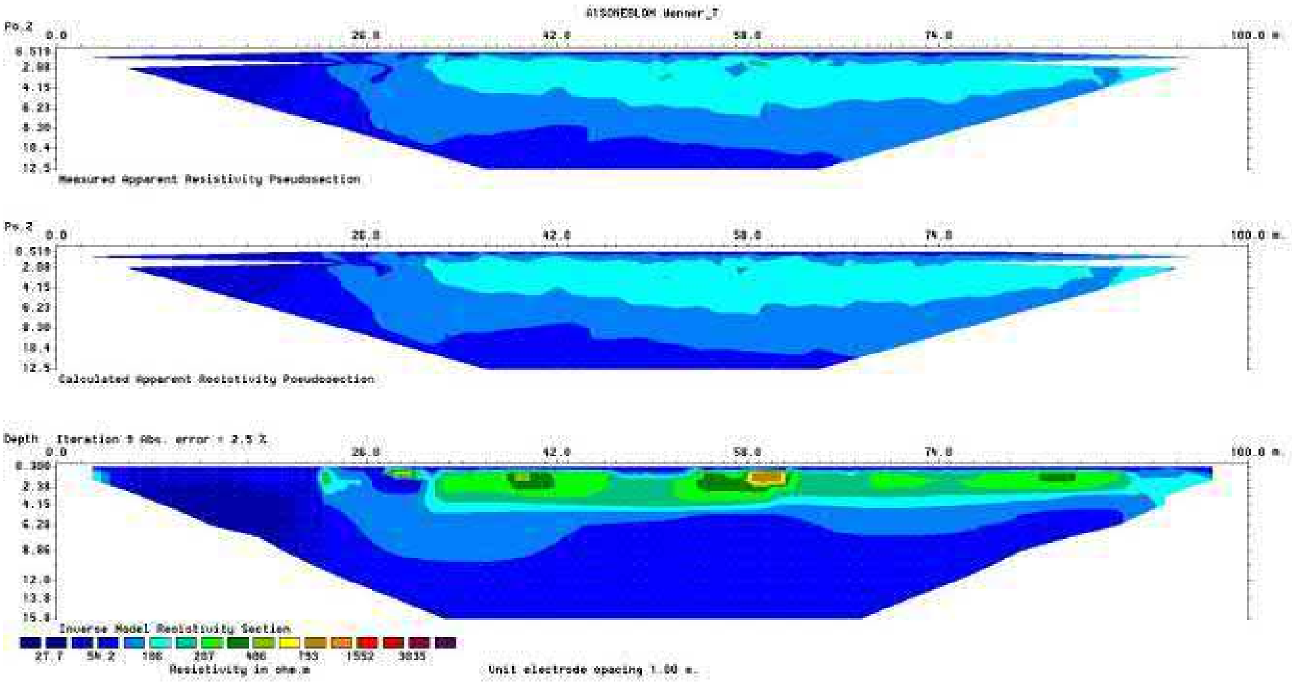


Traverse Sonobolomo 6

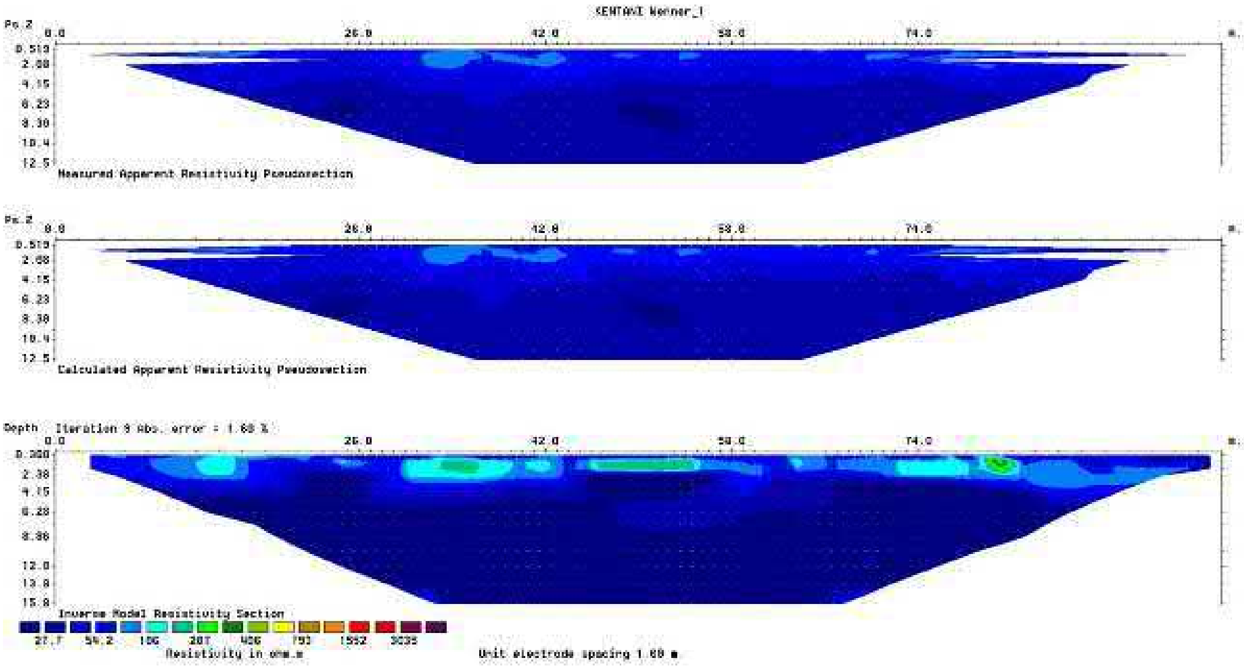


{Both images represent thick interpreted sand, with a thick surface calcrete layer on Traverse 7}

Traverse Sonobolomo 7

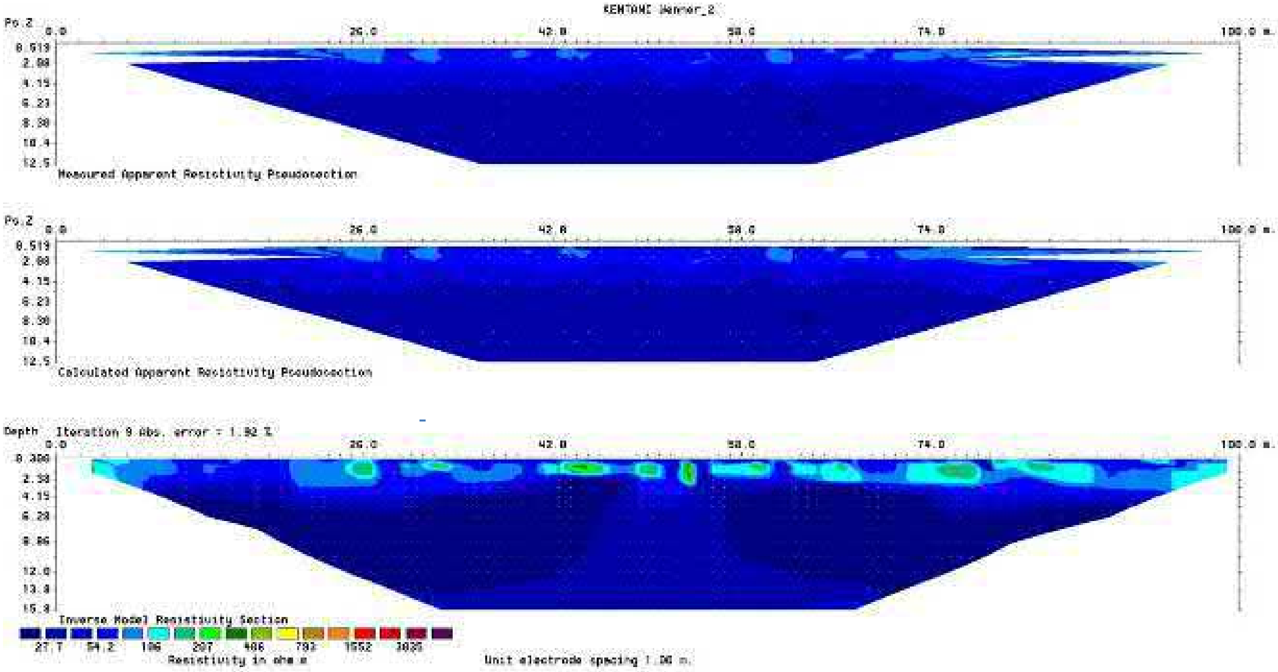


Traverse Kentani 1

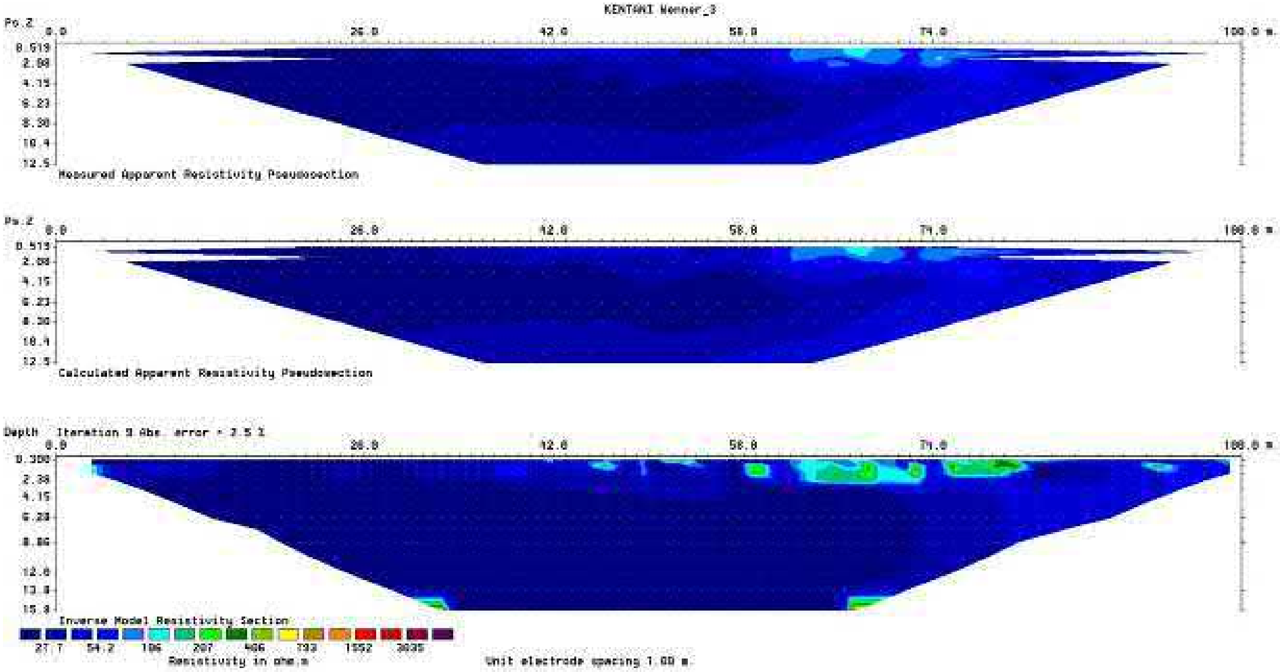


{Both sections show only thin surface calcrete overlying thick, low resistivity interpreted sand}

Traverse Kentani 2

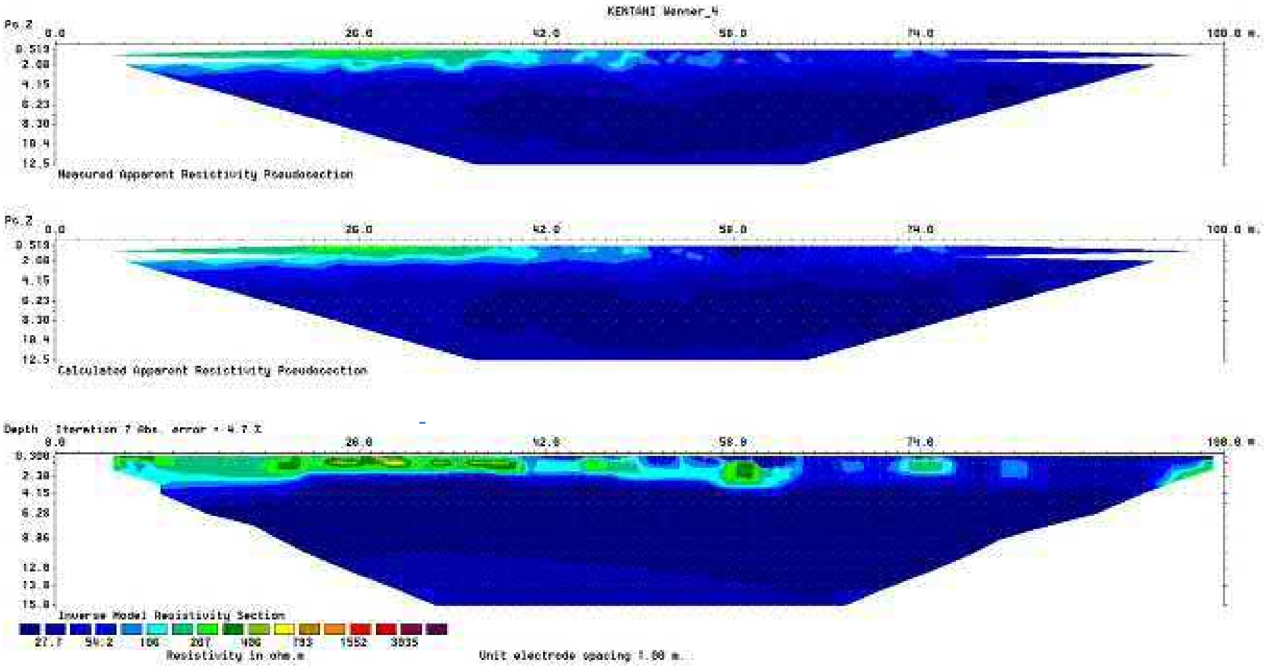


Traverse Kentani 3

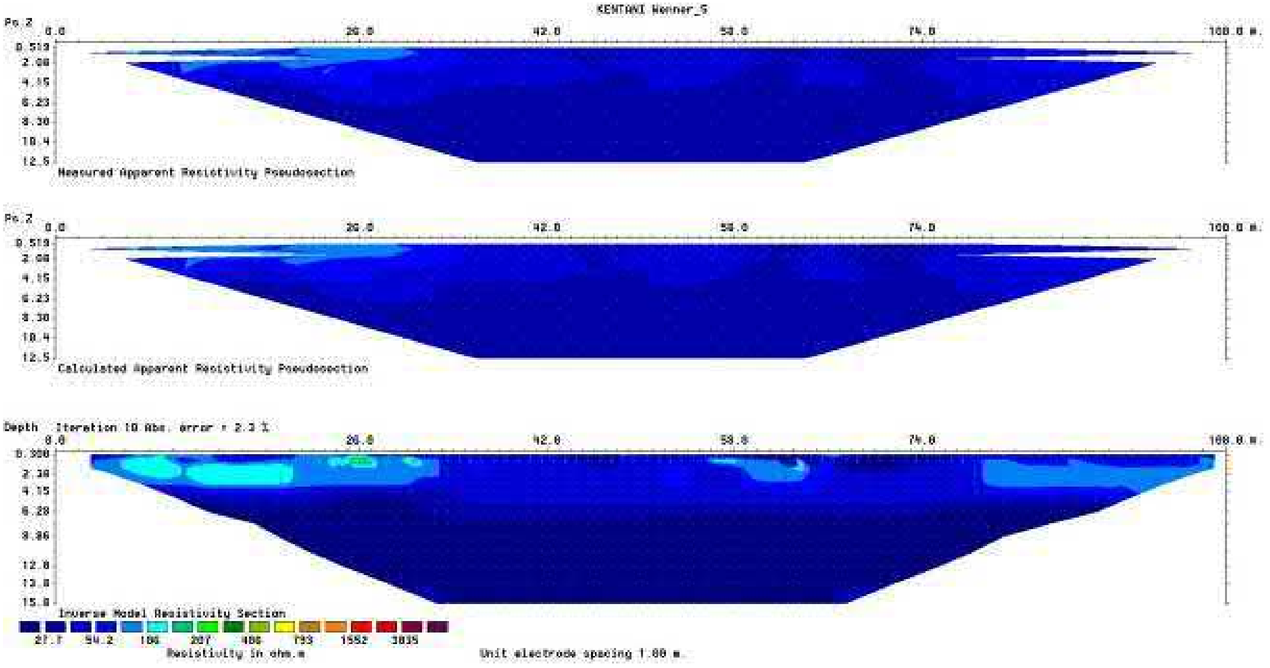


{Both sections show only thin surface calcrete overlying thick, low resistivity interpreted sand}

Traverse Kentani 4

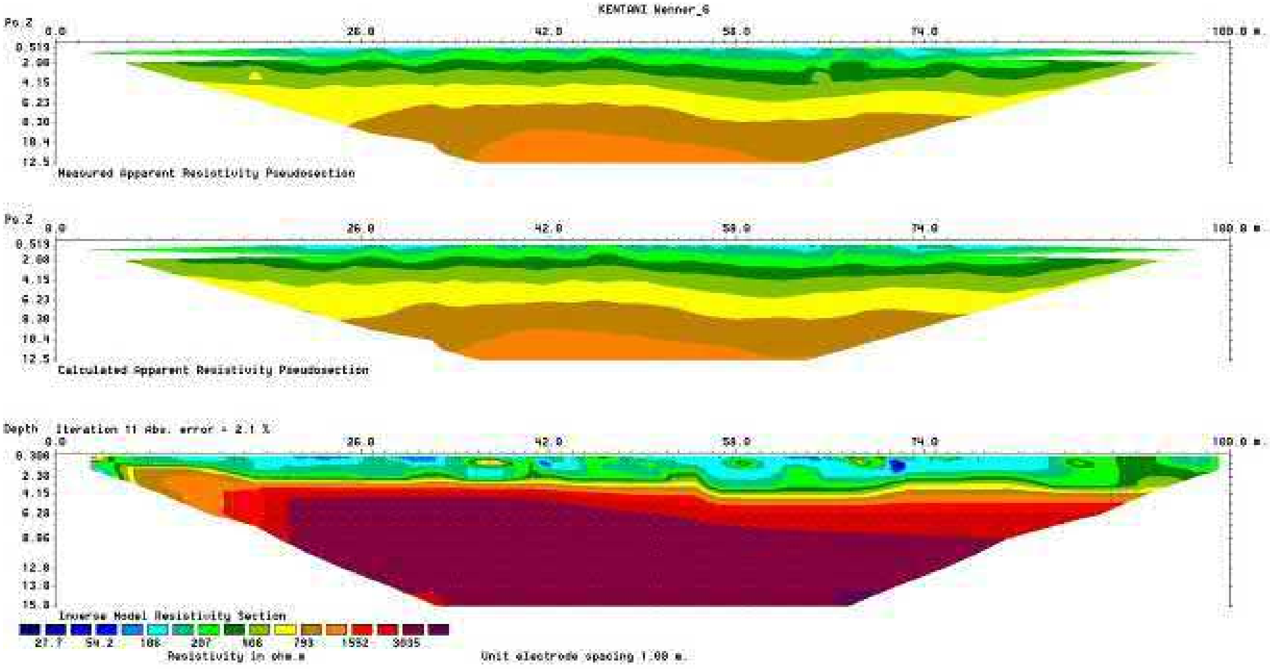


Traverse Kentani 5

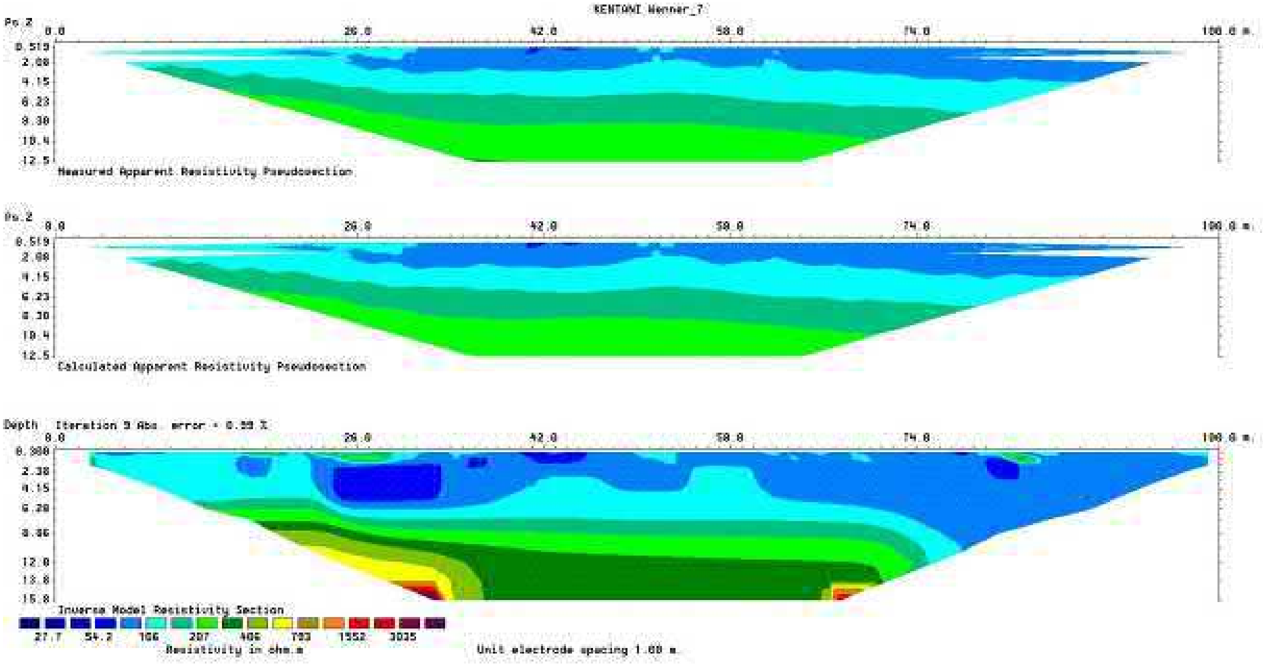


{Traverse 5 shows the classic thin calcrete surface layer with thick interpreted sand beneath. Traverse 6 shows highly resistive bedrock (possibly dolerite) at a very shallow depth of 2.5m}

Traverse Kentani 6

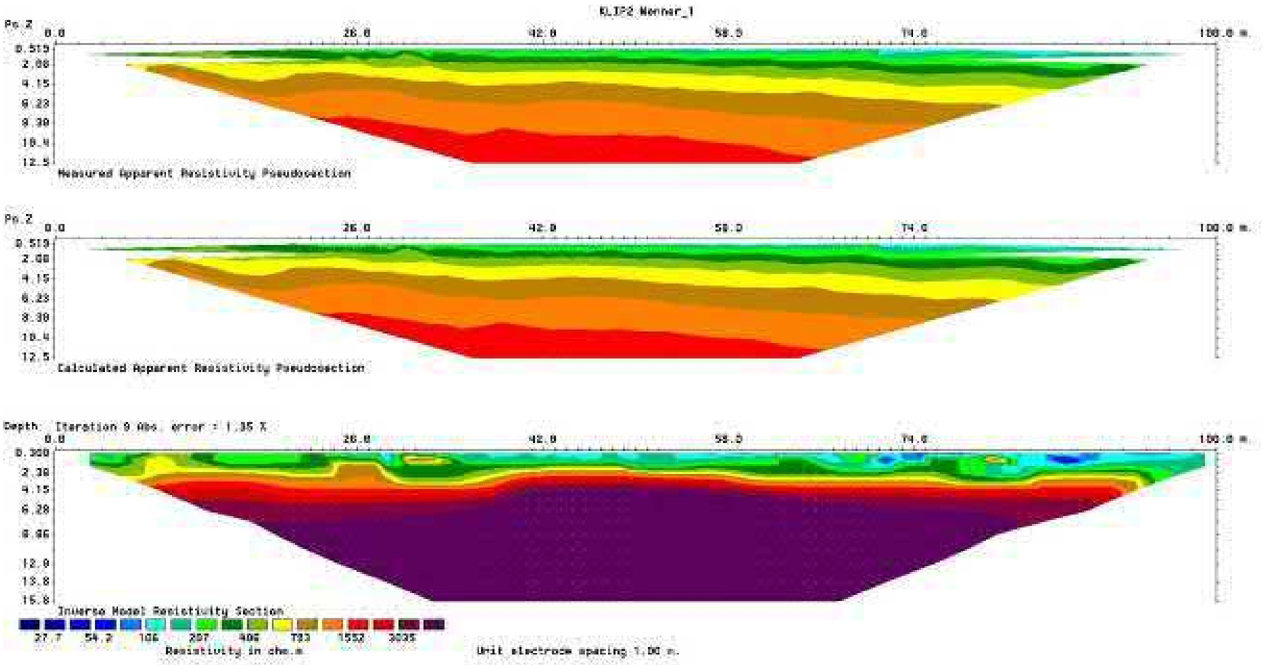


Traverse Kentani 7

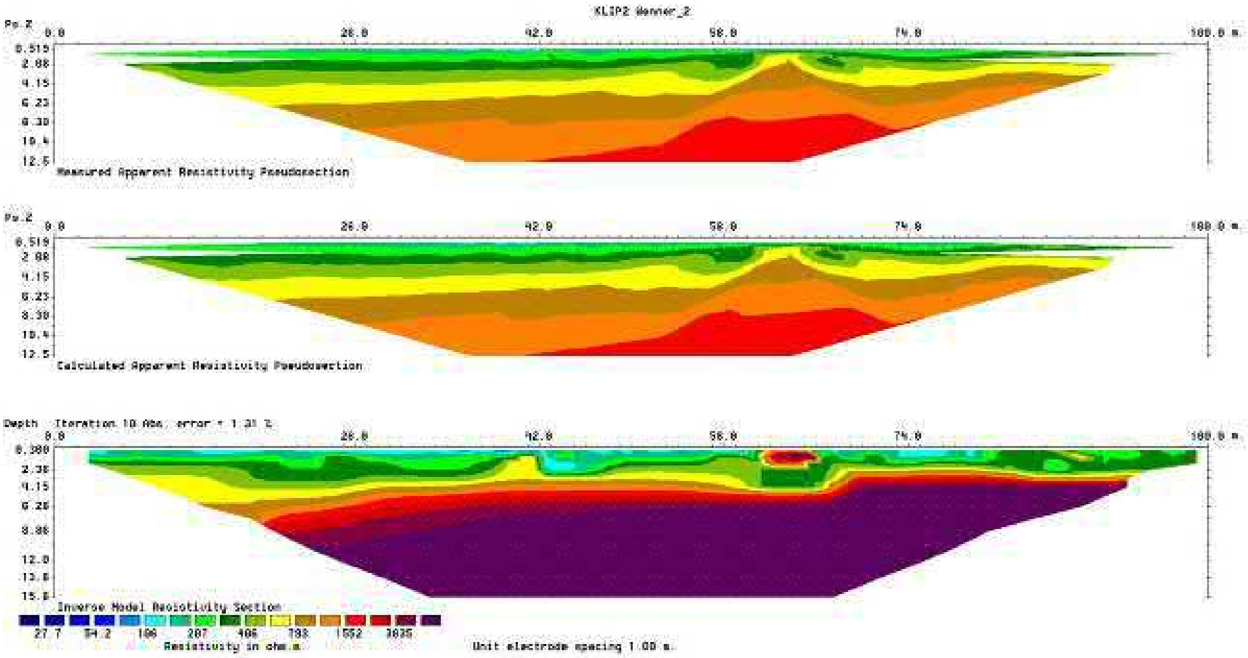


{Kentani 7 shows bedrock coming in at around 8-10 m depth, with sand overlying this. Klipfontein 2 Traverse 1 below shows extremely resistive bedrock as shallow as 2.5m}

Traverse 1 Klipfontein 2

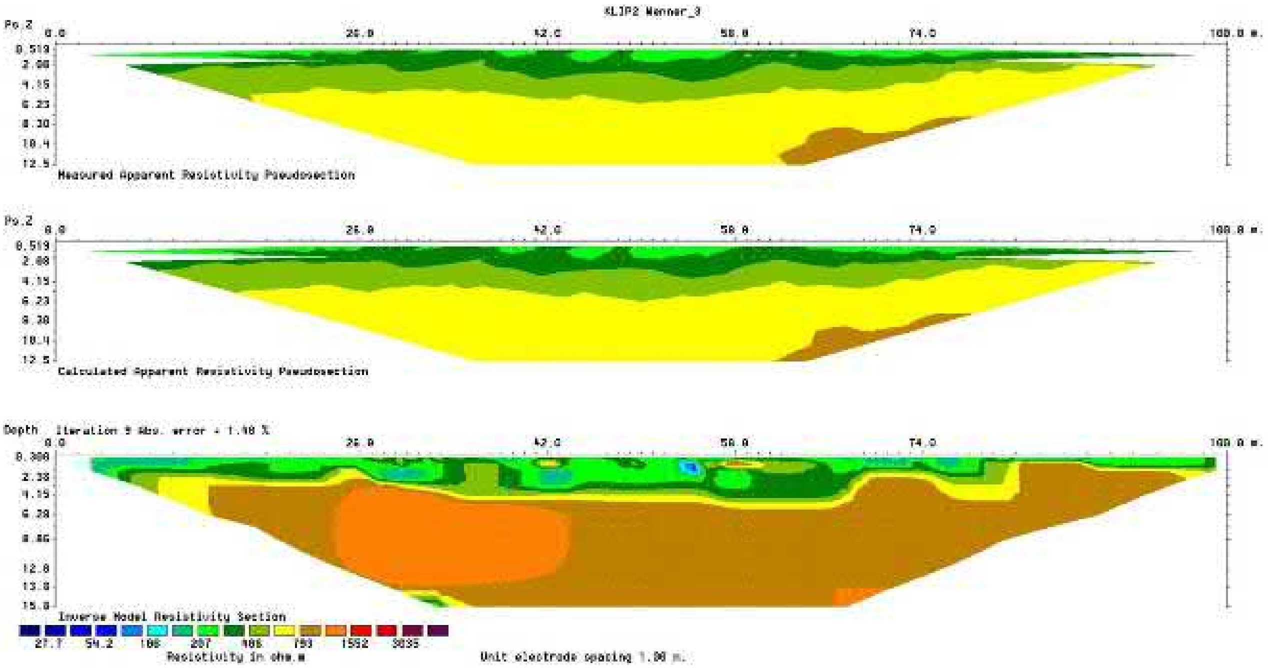


Traverse 2 Klipfontein 2

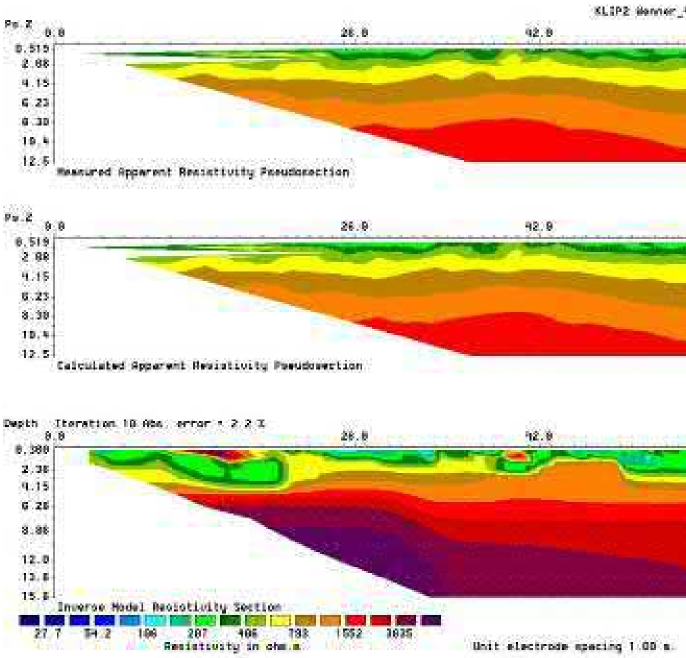


{Traverse 2 shows shallow, highly resistive bedrock at 4m depth. Traverse 3 shows less resistive bedrock at 4m depth; this could be shale or siltstone}

Traverse 3 Klipfontein 2

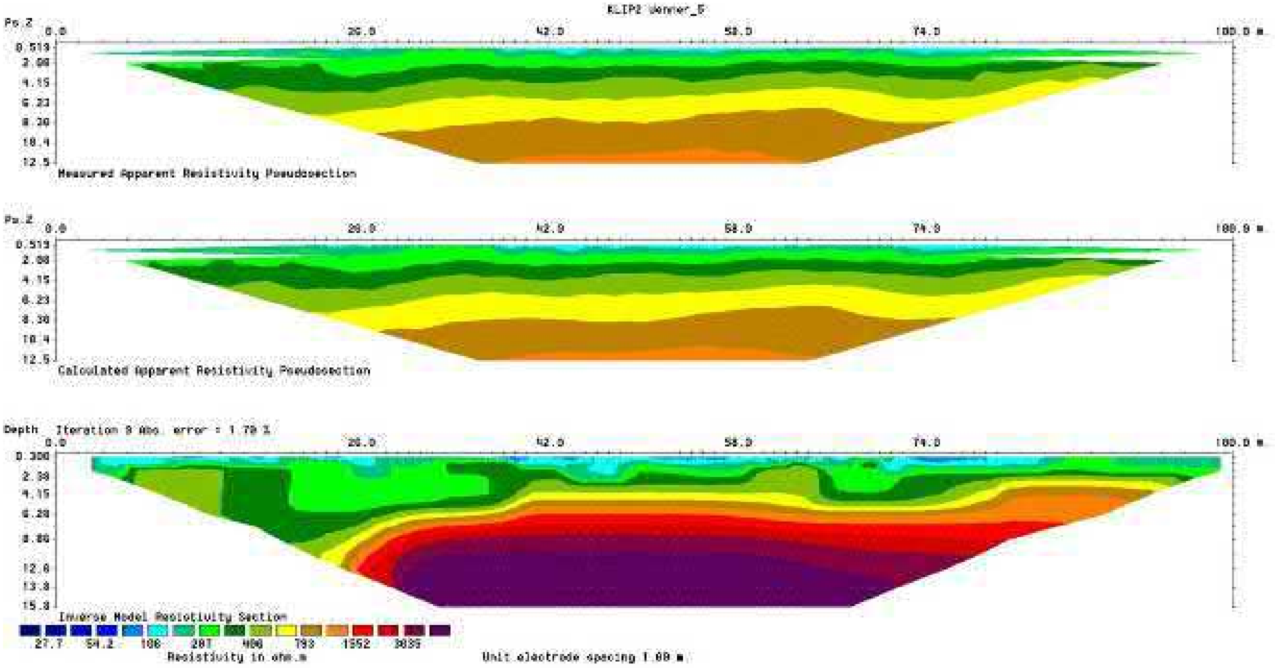


Traverse 4 Klipfontein 2

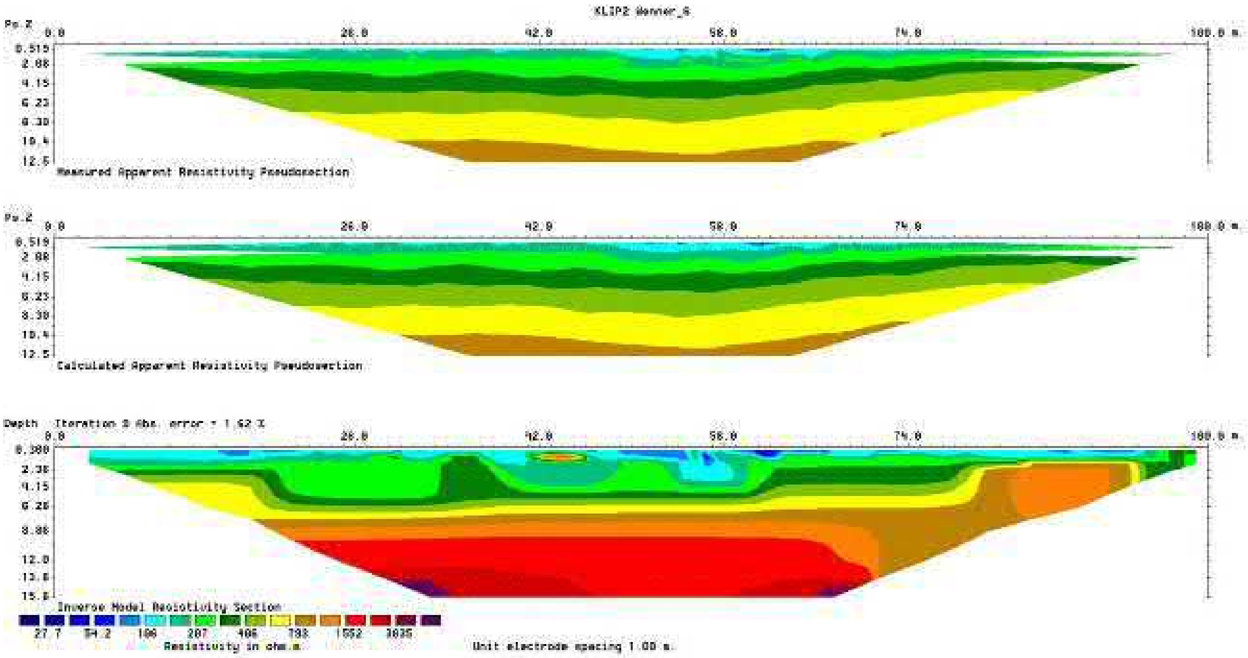


{Both traverses show highly resistive bedrock coming in at around 5m - 7m depth}

Traverse 5 Klipfontein 2

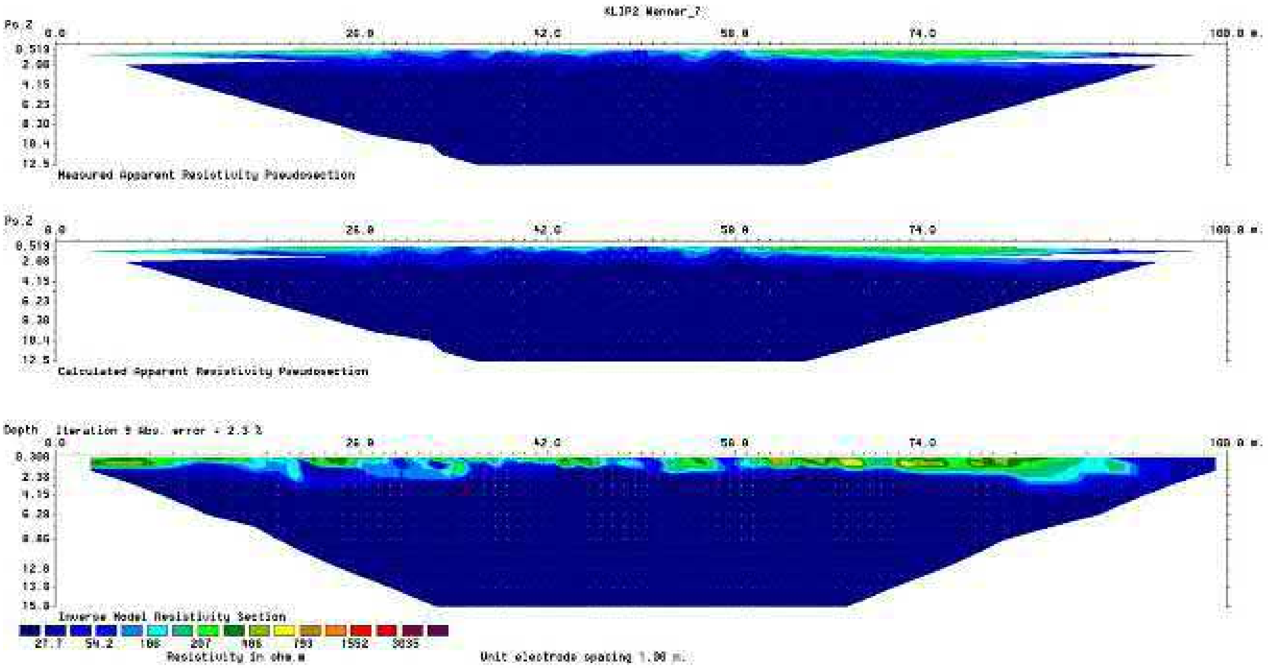


Traverse 6 Klipfontein 2

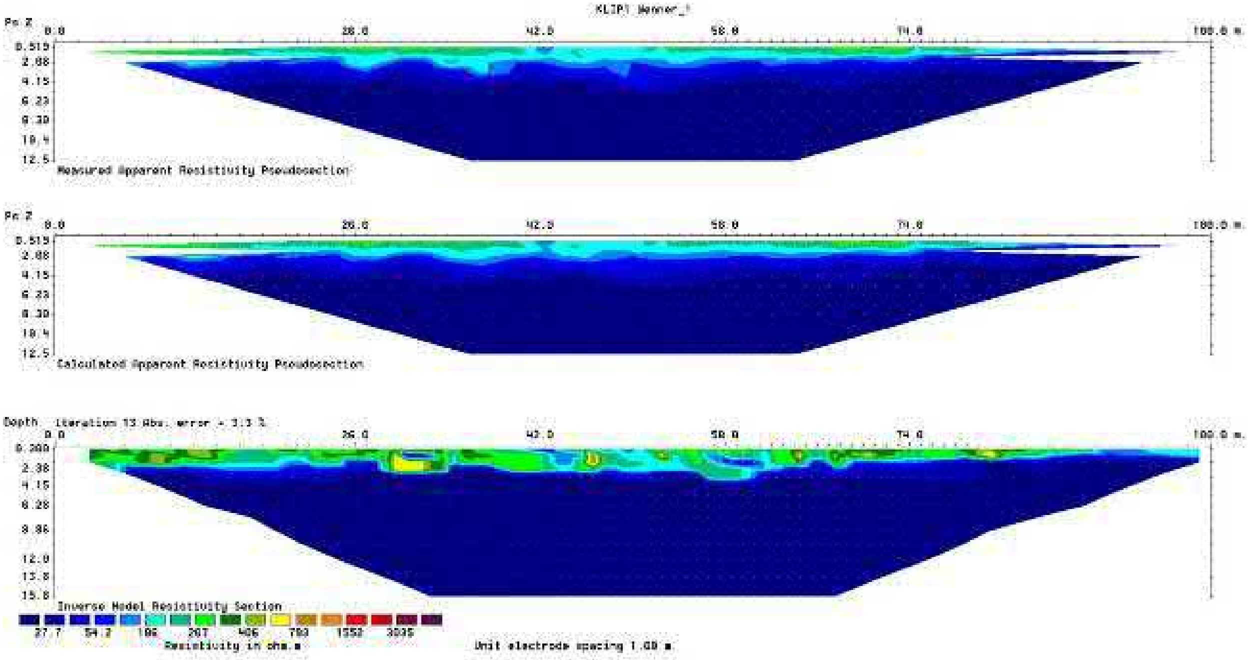


{Traverse 7 shows the only classic interpreted sand profile at Klipfontein 2. Traverse 6 shows resistive bedrock at 8m depth}

Traverse 7 Klipfontein 2

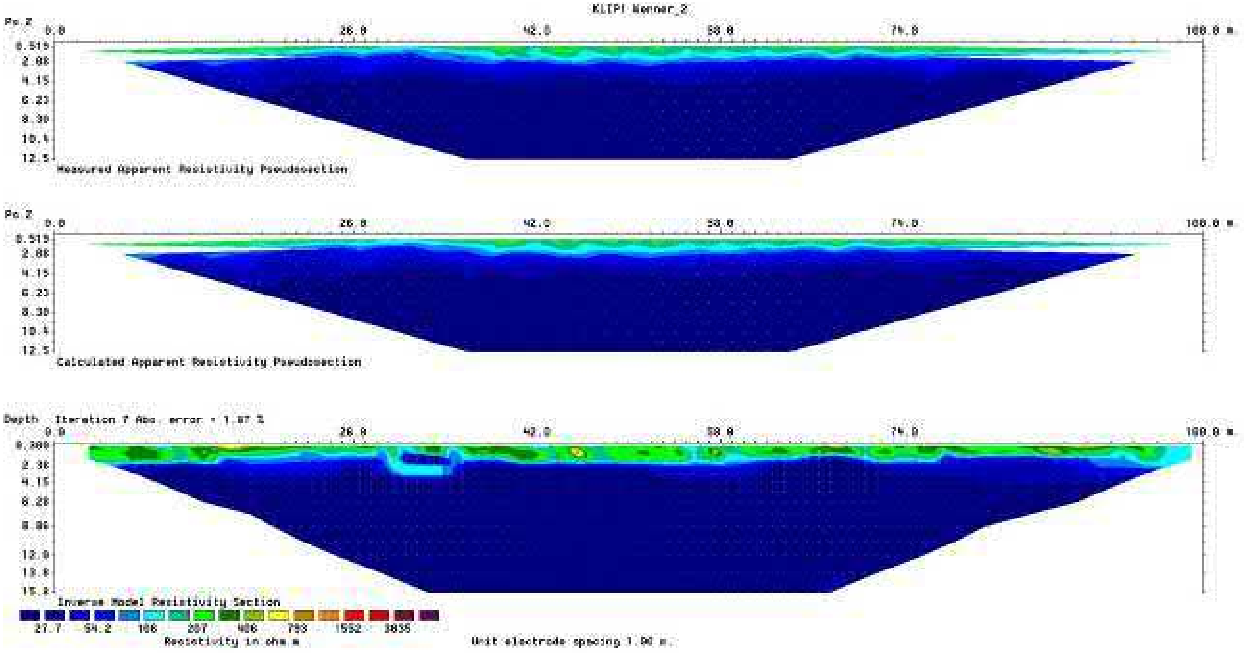


Traverse 1 Klipfontein

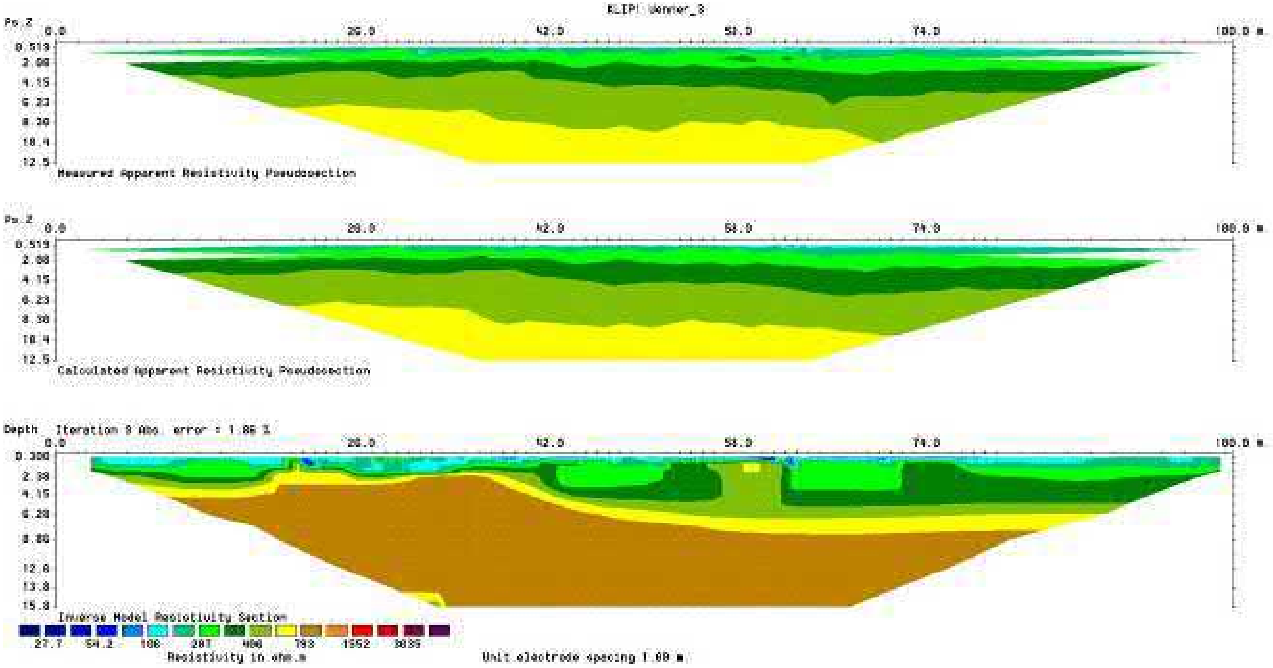


{Both resistivity sections show a thin calcrete layer at surface, with thick interpreted sand to depth}

Traverse 2 Klipfontein

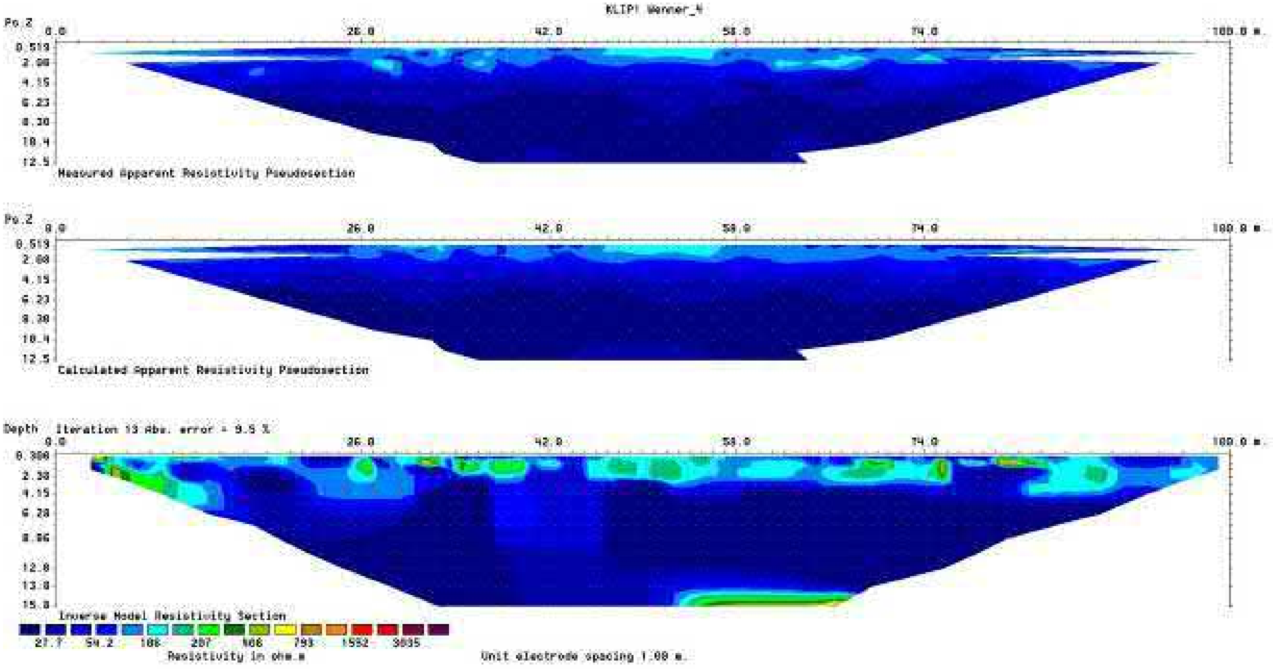


Traverse 3 Klipfontein

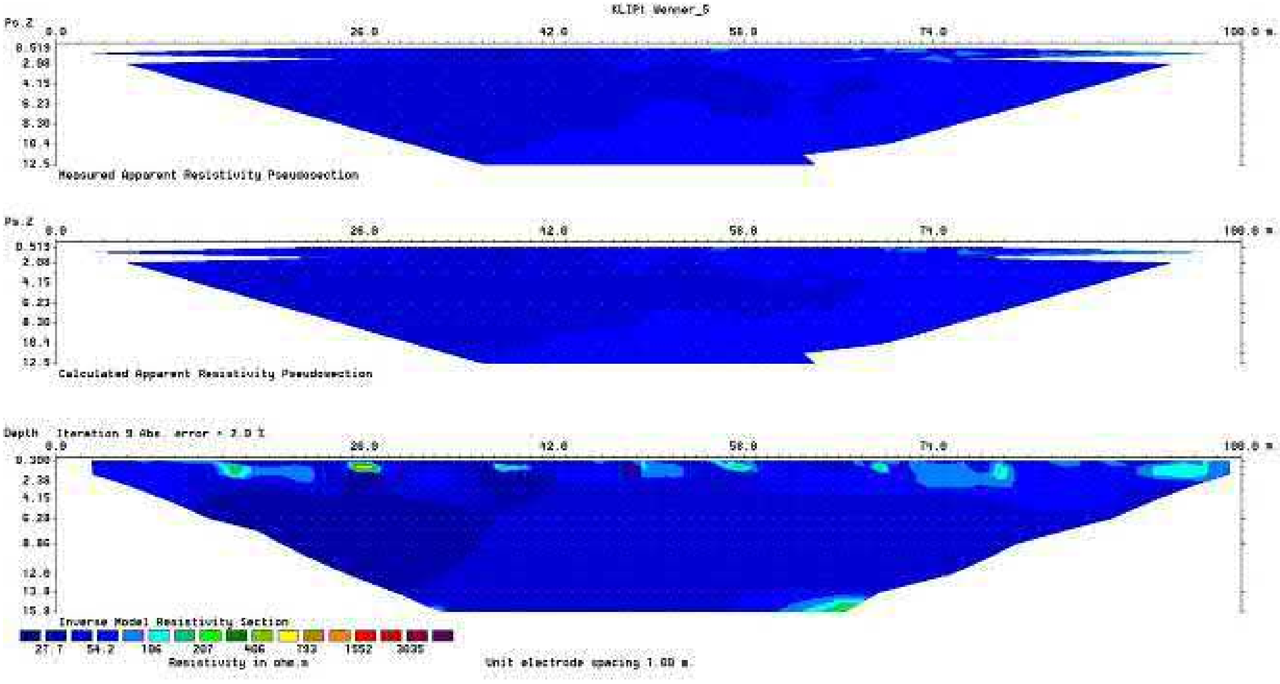


{Traverse 3 shows moderately resistive bedrock at 2.5m – 8m depth. This may be shale. Traverse 4 shows the typical interpreted sand profile with a hint of bedrock starting to form at 15m depth}

Traverse 4 Klipfontein

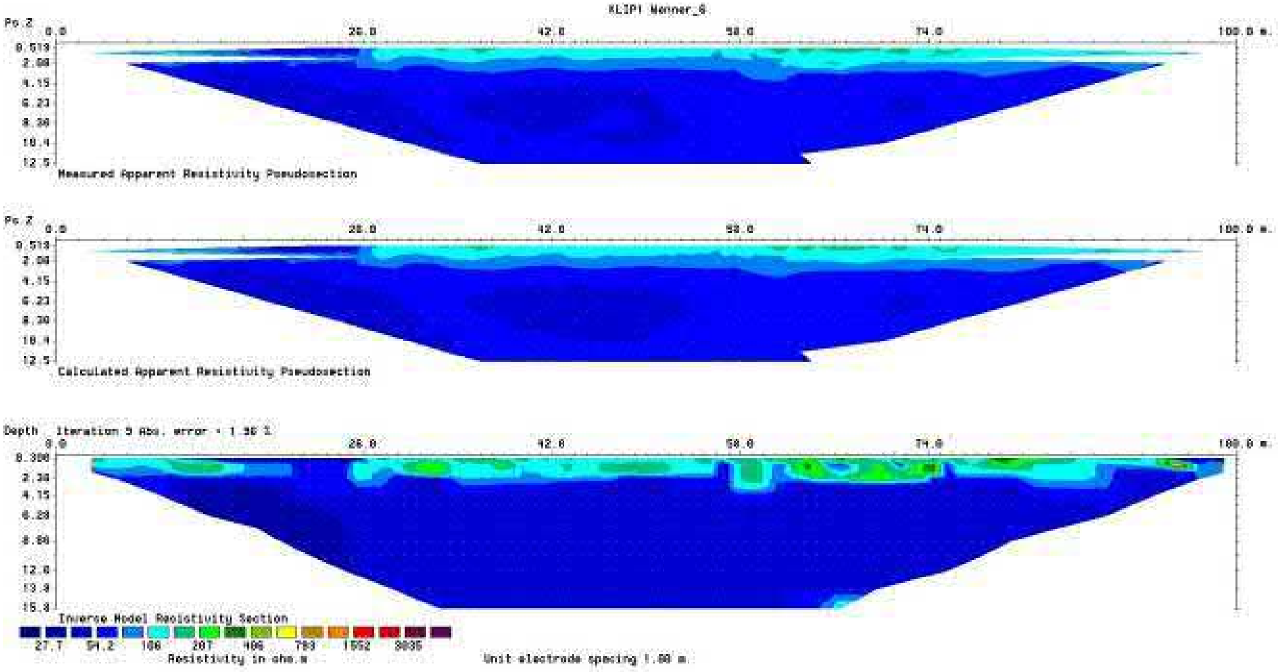


Traverse 5 Klipfontein

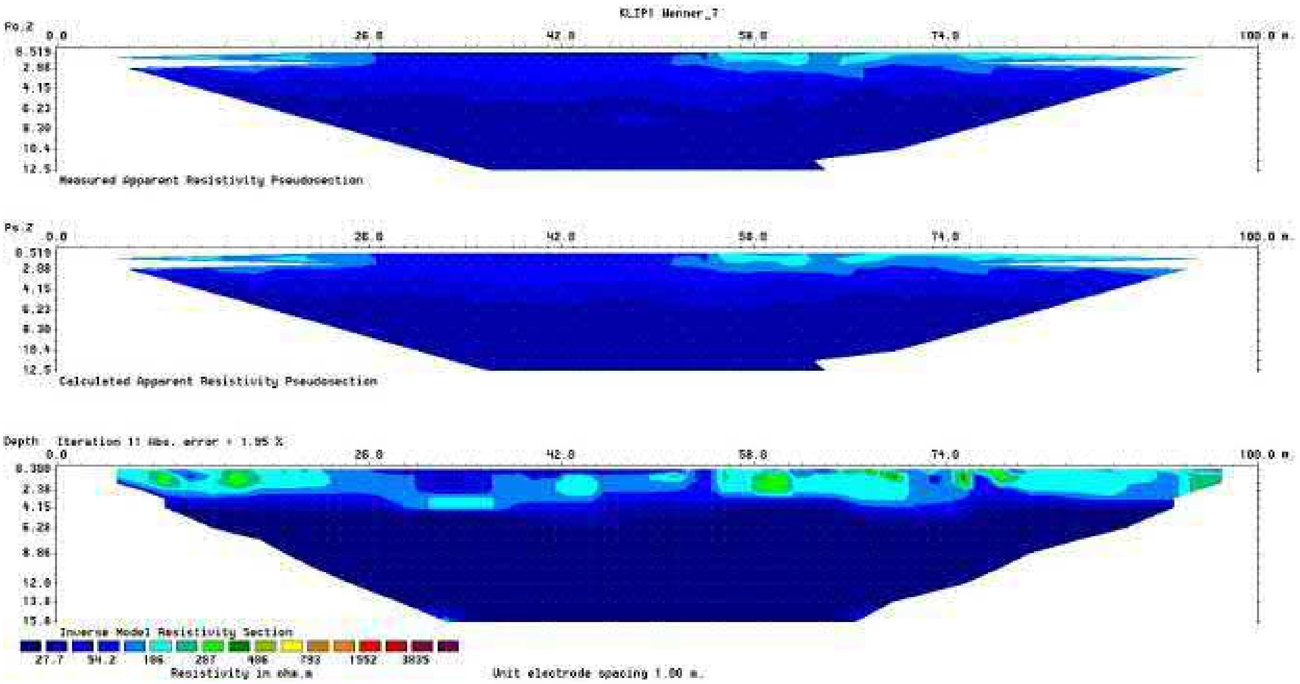


{Both resistivity sections show a thin calcrete layer at surface, with thick interpreted sand to depth}

Traverse 6 Klipfontein



Traverse 7 Klipfontein



{Classic interpreted sand section, with thickly developed calcrete on surface}

Appendix E

Laboratory Test Results

Simlab
(EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
sanas Testing Laboratory
T0455
REG. No: 1987/004282/07
NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA, Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

Enquiries : Bloemfontein
Our ref. : SL / 3092
Your ref. : Soil Classification for Project C1801/30 – Kentani Solar Farm, Dealsville, Free State
File ref. : 020/900(a)
Date : 24/07/2020

ATTENTION: MR. RICHARD ROBERTS

SMEC SOUTH AFRICA (PTY) LIMITED (RANDBURG)
267 Kent Avenue
RANDBURG
2194

Tel. / Cell.: 011 369 0789 / 072 495 0920
E-mail: richard.roberts@smec.com

Sir,

SOIL CLASSIFICATION FOR PROJECT C1801/30, KENTANI SOLAR FARM, DEALSVILLE, FREE STATE.

1.) Terms of reference

SMEC SOUTH AFRICA (PTY) LTD (Randburg), Mr Richard Roberts appointed SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) for the soil testing of Project C1801/30 – Kentani Solar Farm, Dealsville, Free State, as sampled by client, SMEC SOUTH AFRICA (PTY) LTD, Mr Richard Roberts.

The results for the materials tested by SIMLAB (Pty) Limited (Bloemfontein), can be found in APPENDIX A of this report.

2.) Disclaimer

The opinions expressed, interpretations and recommendations in this Report have been based on the information supplied to SIMLAB (Pty) Limited – Geotechnical Services. (Bloemfontein).

SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this Report apply to the site conditions and features as they existed at the time of SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) site inspection / investigation.

SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) does not accept any liability or responsibility whatsoever from any third parties for the use, reliance or interpretation of this Report.

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3.) Test Methods used

SIMLAB (Pty) Limited (Bloemfontein)) (a SANAS Accredited Testing Laboratory – T0455) was instructed to test the following on various samples received: *In Situ* Moisture Content (MC), Foundation Indicator (FI), Maximum Dry Density (MDD), California Bearing Ratio (CBR), pH-Value (pH) and Electrical Conductivity (EC). These tests are used to determine the Engineering Properties of the materials. These tests were conducted from the 10th of July 2020 to the 23rd of July 2020.

Please visit the SIMLAB or SANAS website for more information regarding SANAS Accreditation. www.simlab.co.za or www.sanas.co.za

Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples).
- * TMH1 : 1986, A20 – The electronic determination of the ph value of a soil suspension
- * TMH1 : 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of SIMLAB (Pty) Limited – Geotechnical Services.

4.) Appendices

APPENDIX A – LABORATORY TEST RESULTS

We trust this meets with your requirements. Should you require further information in this regard, please do not hesitate to contact us.

WT HITGE (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

APPENDIX A

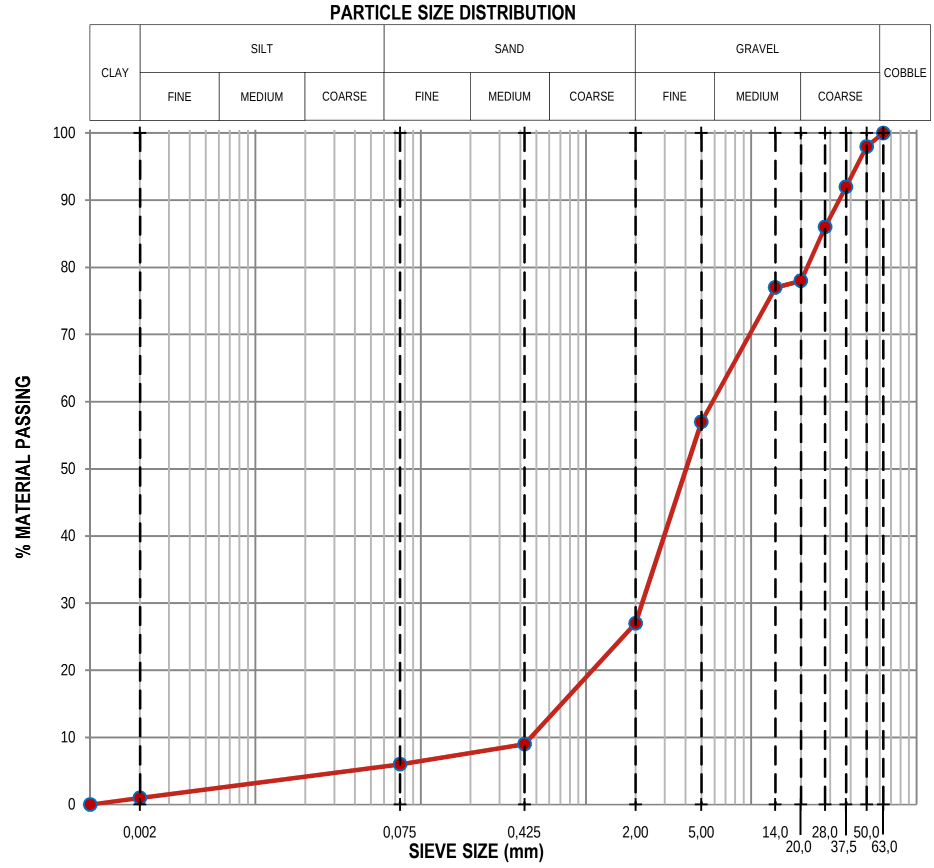
LABORATORY TEST RESULTS

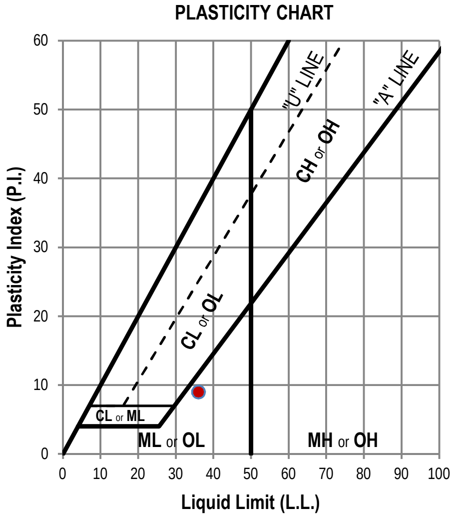
(Particle Size Distribution) (Material Classification)

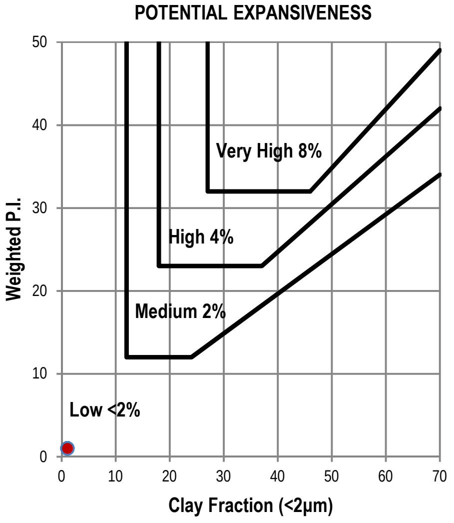
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Kenani Solar Farm	**MATERIAL DEPTH** (mm) :	800 - 2500	**SAMPLE No / LABORATORY No.:**	KT/T2/1 / 020/900
MATERIAL DESCRIPTION :	Poorly graded SAND with silt and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		10,9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	98
	37,5 mm	92
	28,0 mm	86
	20,0 mm	78
	14,0 mm	77
	5,00 mm	57
	2,00 mm	27
	0,425 mm	9
	0,075 mm	6
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,58
SOIL MORTAR	**COARSE SAND**	67
	FINE SAND (Course)	4
	FINE SAND (Medium)	4
	FINE SAND (Fine)	2
	SILT AND CLAY (<0.075mm)	23
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	36
	P.I. (%)	9
	L.S. (%)	5,0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	3,3
	C_C (ASTM D2487)	6,7
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	21
	% Gravel (>2.0mm)	73
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1897
	OPTIMUM MOISTURE (%)	15,5
	SWELL (%)	0,0
	CBR @ 100% (%)	37
	CBR @ 98% (%)	30
	CBR @ 95% (%)	23
	CBR @ 93% (%)	19
	CBR @ 90% (%)	14
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0690
pH VALUE (TMH1: Method A21)		8,42
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		SP-SM
COLTO CLASSIFCATION		G7







REMARKS.:

* Tests marked "Not SANAS Accredited" in this report are not in the SANAS Schedule of Accreditation for this laboratory.

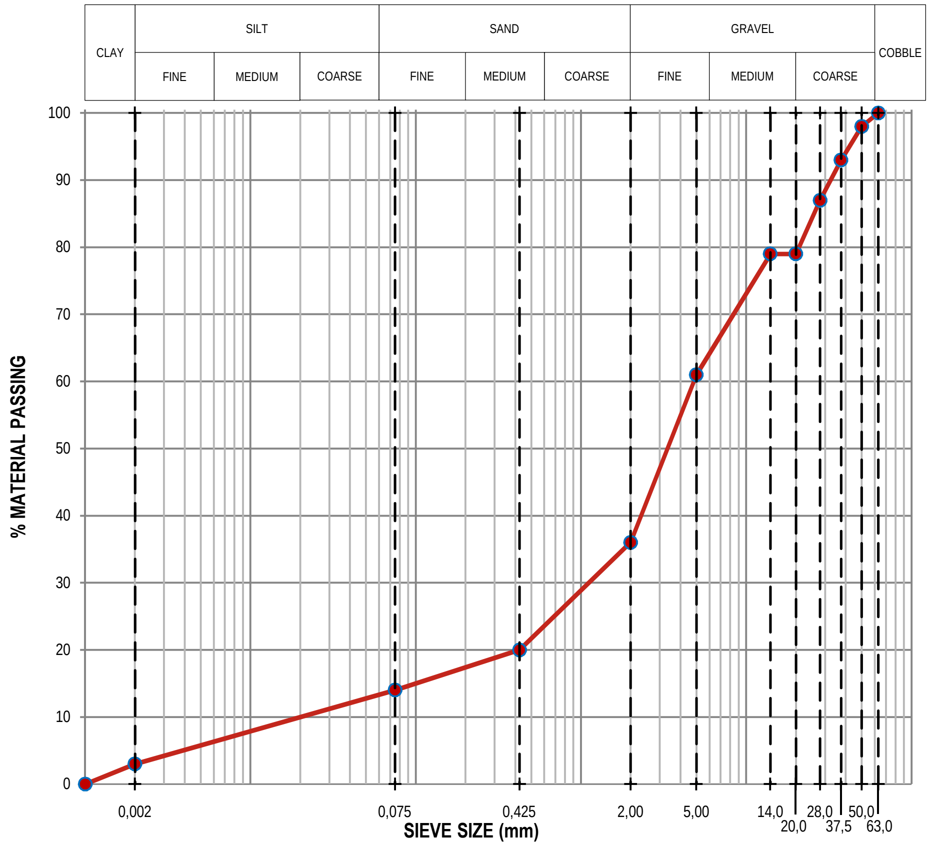
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

MATERIAL CLASSIFICATION TEST RESULTS

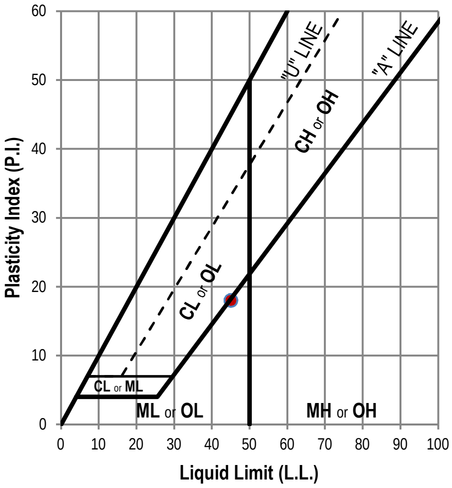
TEST PIT / HOLE No.:	Kenani Solar Farm	**MATERIAL DEPTH** (mm) **:**	500 - 1800	**SAMPLE No / LABORATORY No.:**	KT/T6/1 / 020/901
MATERIAL DESCRIPTION :	Silty SAND with GRAVEL.				

	IN SITU MOISTURE CONTENT (GR20) (%)	10,0
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	98
	37,5 mm	93
	28,0 mm	87
	20,0 mm	79
	14,0 mm	79
	5,00 mm	61
	2,00 mm	36
	0,425 mm	20
	0,075 mm	14
TMH1: METHOD A6	**0,002 mm**	3
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,30
SOIL MORTAR	**COARSE SAND**	45
	FINE SAND (Course)	8
	FINE SAND (Medium)	6
	FINE SAND (Fine)	3
	SILT AND CLAY (<0.075mm)	38
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	45
	P.I. (%)	18
	L.S. (%)	8,5
*** MEASURES OF GRADATIONS**	**C_U** (ASTM D2487)	647,6
	C_C (ASTM D2487)	4,8
	% Clay (>0.002mm)	3
	% Silt (0.075 - 0.002mm)	11
	% Sand (0.075 - 2.0mm)	22
	% Gravel (>2.0mm)	64
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	197
	OPTIMUM MOISTURE (%)	13,7
	SWELL (%)	0,2
	CBR @ 100% (%)	26
	CBR @ 98% (%)	23
	CBR @ 95% (%)	20
	CBR @ 93% (%)	17
	CBR @ 90% (%)	15
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		SM
COLTO CLASSIFCATION		No Classification

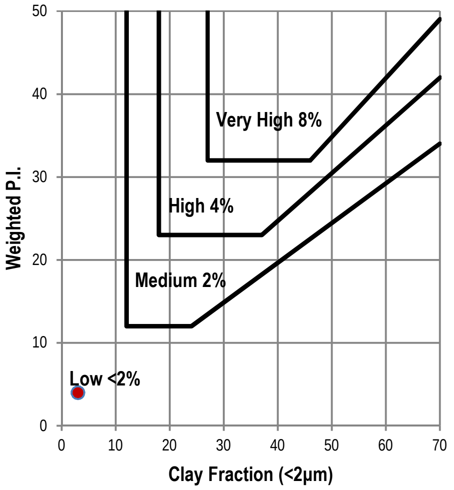
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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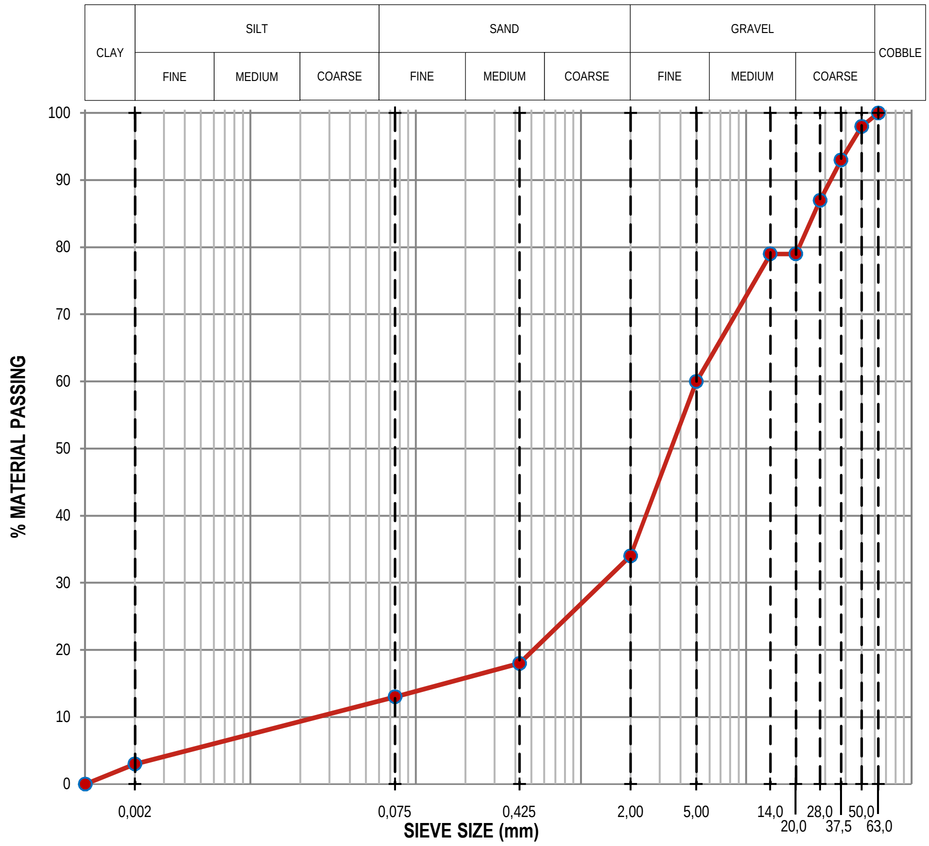
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

MATERIAL CLASSIFICATION TEST RESULTS

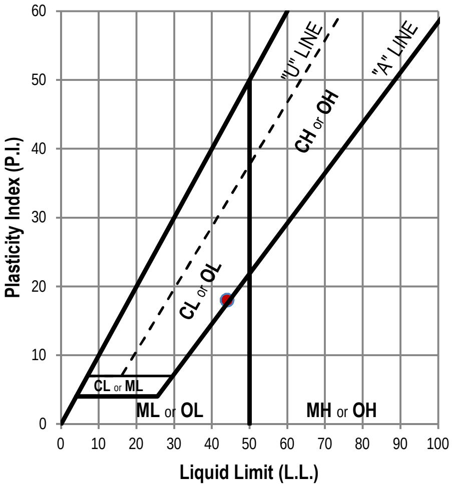
TEST PIT / HOLE No.:	Kenani Solar Farm	**MATERIAL DEPTH** (mm) **:**	800 - 2000	**SAMPLE No / LABORATORY No.:**	KT/T7/1 / 020/902
MATERIAL DESCRIPTION :	Clayey SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		9,4
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	98
	37,5 mm	93
	28,0 mm	87
	20,0 mm	79
	14,0 mm	79
	5,00 mm	60
	2,00 mm	34
	0,425 mm	18
	0,075 mm	13
TMH1: METHOD A6	**0,002 mm**	3
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,35
SOIL MORTAR	**COARSE SAND**	46
	FINE SAND (Course)	7
	FINE SAND (Medium)	6
	FINE SAND (Fine)	3
	SILT AND CLAY (<0.075mm)	38
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	44
	P.I. (%)	18
	L.S. (%)	9,0
*** MEASURES OF GRADATIONS**	**C_U** (ASTM D2487)	200,0
	C_C (ASTM D2487)	14,8
	% Clay (>0.002mm)	3
	% Silt (0.075 - 0.002mm)	10
	% Sand (0.075 - 2.0mm)	21
	% Gravel (>2.0mm)	66
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1882
	OPTIMUM MOISTURE (%)	15,8
	SWELL (%)	0,1
	CBR @ 100% (%)	43
	CBR @ 98% (%)	34
	CBR @ 95% (%)	24
	CBR @ 93% (%)	19
	CBR @ 90% (%)	14
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0625
pH VALUE (TMH1: Method A21)		8,48
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		SC
COLTO CLASSIFCATION		No Classification

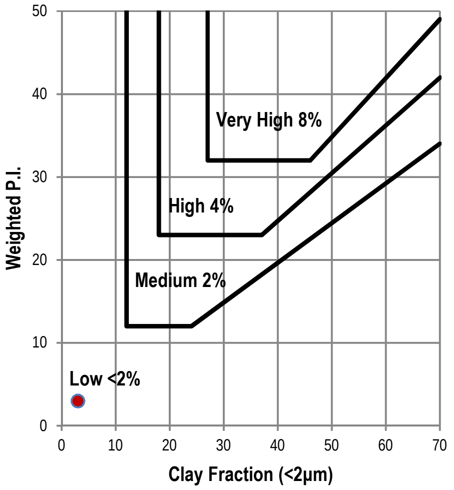
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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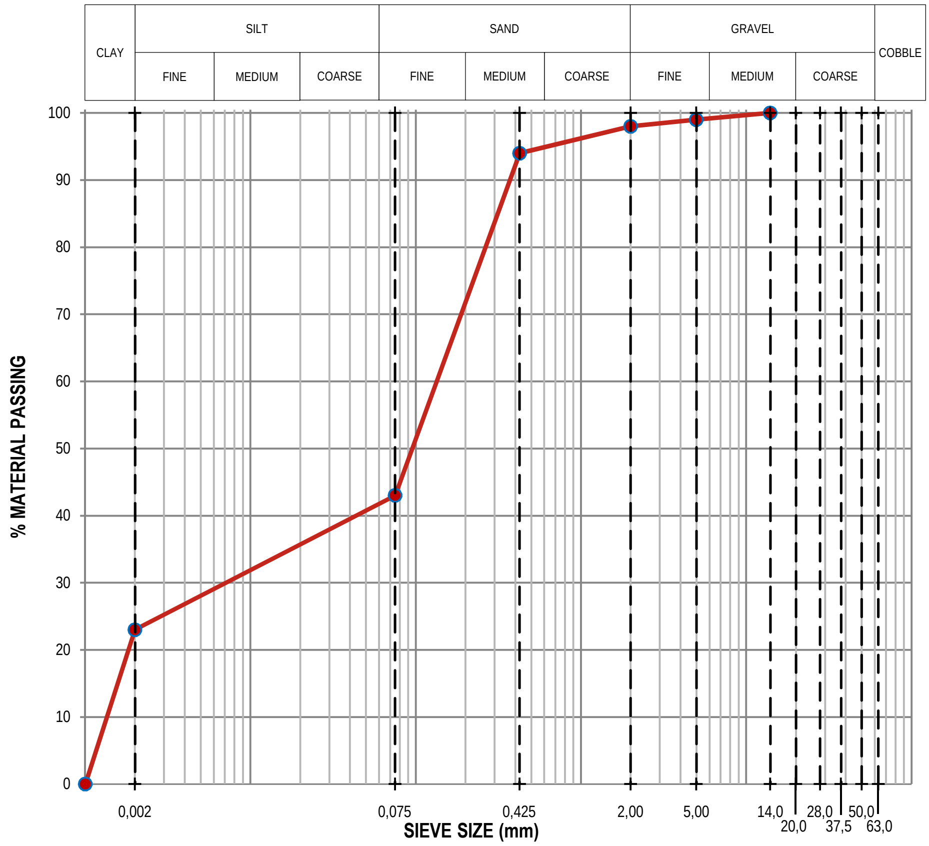
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

MATERIAL CLASSIFICATION TEST RESULTS

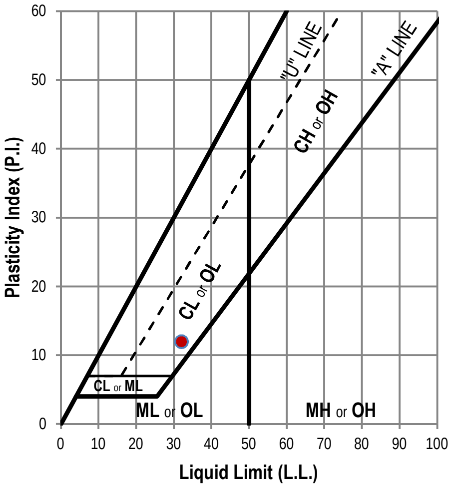
TEST PIT / HOLE No.:	Kenani Solar Farm	**MATERIAL DEPTH** (mm) **:**	200 - 1000	**SAMPLE No / LABORATORY No.:**	KT/T8/1 / 020/903
MATERIAL DESCRIPTION :	Clayey SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		14,8
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	
	14,0 mm	100
	5,00 mm	99
	2,00 mm	98
	0,425 mm	94
	0,075 mm	43
TMH1: METHOD A6	**0,002 mm**	23
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	0,65
SOIL MORTAR	**COARSE SAND**	4
	FINE SAND (Course)	10
	FINE SAND (Medium)	19
	FINE SAND (Fine)	22
	SILT AND CLAY (<0.075mm)	44
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	32
	P.I. (%)	12
	L.S. (%)	6,0
*** MEASURES OF GRADATIONS**	**C_U** (ASTM D2487)	224,0
	C_C (ASTM D2487)	0,2
	% Clay (>0.002mm)	23
	% Silt (0.075 - 0.002mm)	20
	% Sand (0.075 - 2.0mm)	55
	% Gravel (>2.0mm)	2
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1872
	OPTIMUM MOISTURE (%)	13,2
	SWELL (%)	
	CBR @ 100% (%)	
	CBR @ 98% (%)	
	CBR @ 95% (%)	
	CBR @ 93% (%)	
	CBR @ 90% (%)	
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-6a (2)
UNIFIED SOIL CLASSIFICATION		SC
COLTO CLASSIFCATION		

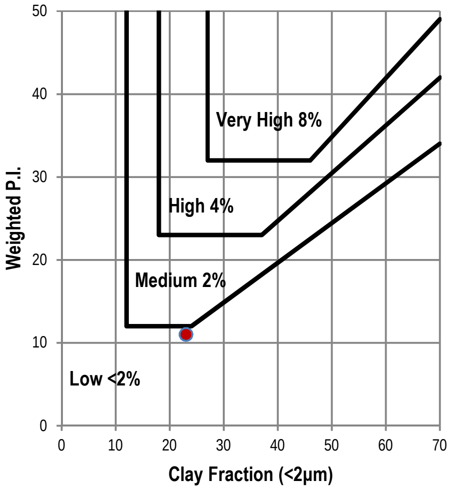
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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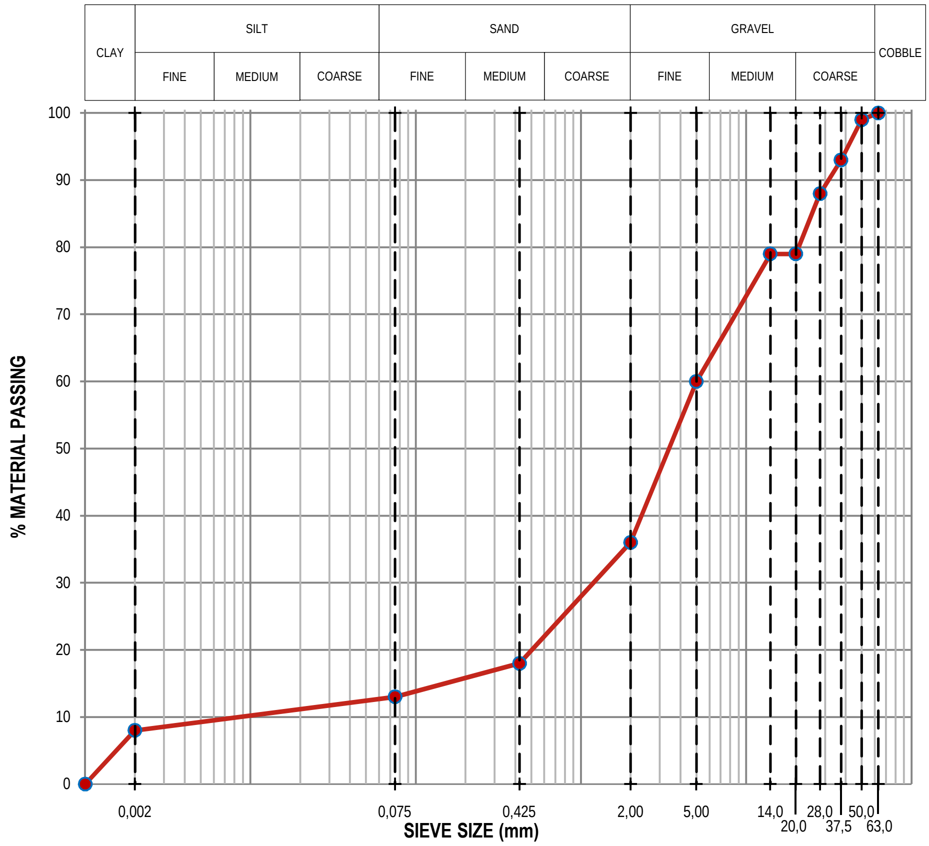
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

MATERIAL CLASSIFICATION TEST RESULTS

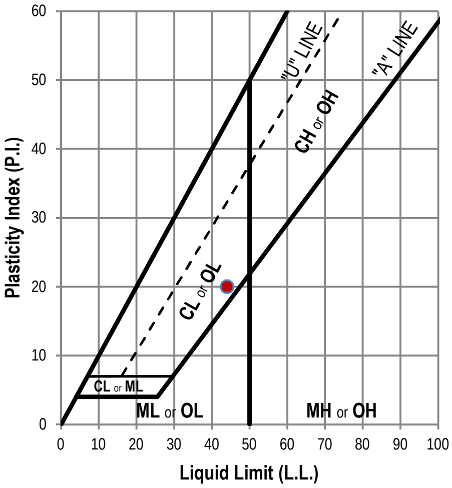
TEST PIT / HOLE No.:	Kenani Solar Farm	**MATERIAL DEPTH** (mm) **:**	300 - 2200	**SAMPLE No / LABORATORY No.:**	KT/T11/1 / 020/904
MATERIAL DESCRIPTION :	Clayey SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		10,9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	99
	37,5 mm	93
	28,0 mm	88
	20,0 mm	79
	14,0 mm	79
	5,00 mm	60
	2,00 mm	36
	0,425 mm	18
	0,075 mm	13
TMH1: METHOD A6	**0,002 mm**	8
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,33
SOIL MORTAR	**COARSE SAND**	50
	FINE SAND (Course)	7
	FINE SAND (Medium)	5
	FINE SAND (Fine)	2
	SILT AND CLAY (<0.075mm)	35
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	44
	P.I. (%)	20
	L.S. (%)	9,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	555,6
	C_C (ASTM D2487)	31,6
	% Clay (>0.002mm)	8
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	23
	% Gravel (>2.0mm)	64
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1942
	OPTIMUM MOISTURE (%)	11,0
	SWELL (%)	2,4
	CBR @ 100% (%)	23
	CBR @ 98% (%)	19
	CBR @ 95% (%)	14
	CBR @ 93% (%)	12
	CBR @ 90% (%)	9
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0542
pH VALUE (TMH1: Method A21)		8,53
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		SC
COLTO CLASSIFCATION		No Classification

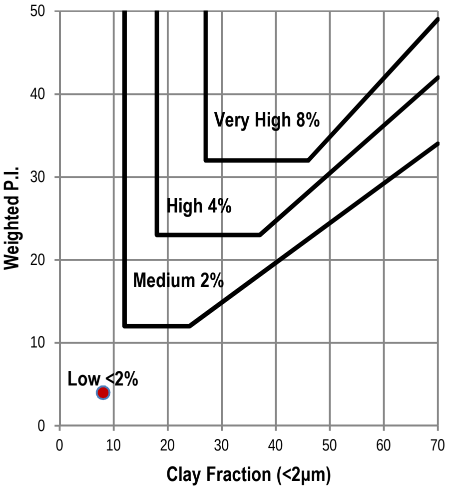
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



REMARKS.:

* Tests marked "Not SANAS Accredited" in this report are not in the SANAS Schedule of Accreditation for this laboratory.

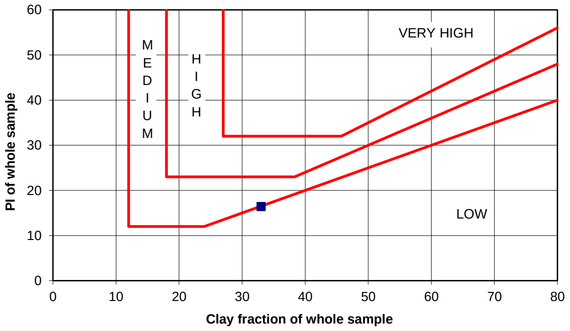
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

PARTICLE SIZE ANALYSIS

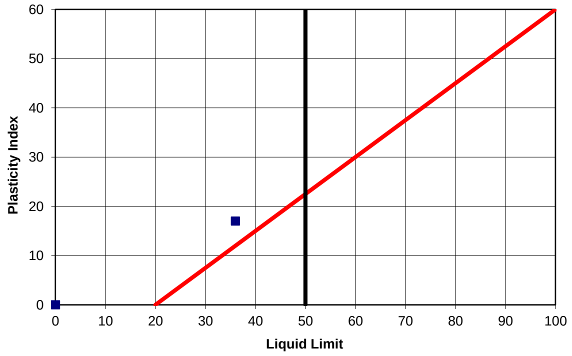
PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

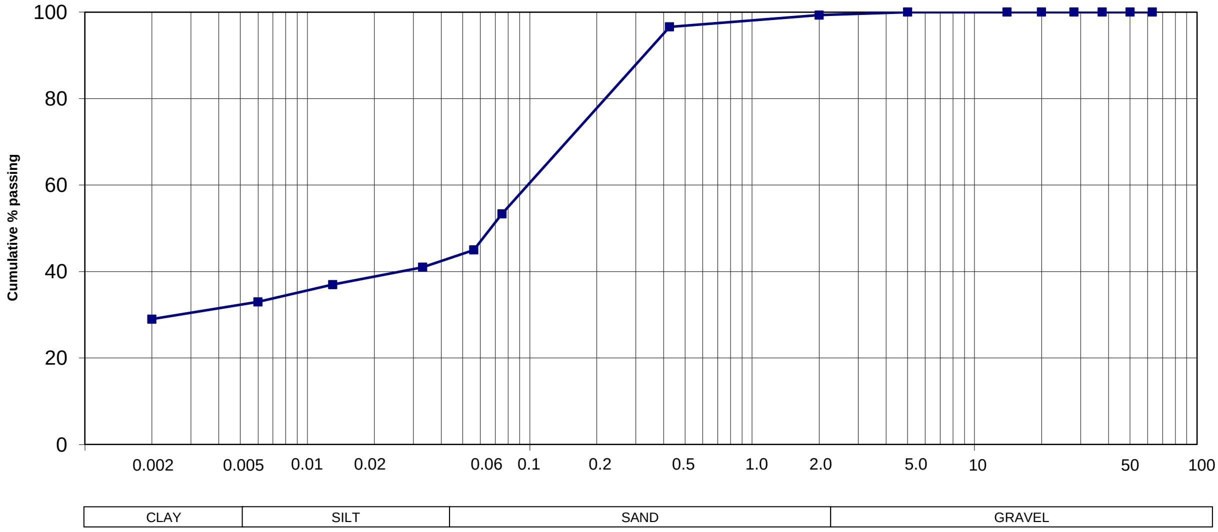
Sample No.	1
Soillab Sample No.	S20-0886-01
Depth (m)	0,2 - 0,6
Position	KT/T3/1
Material Description	DARK REDDISH BROWN CLAYEY SAND
Relative density on < 2 mm **(SANS 5844)**	2.544
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	99
0.425 mm	97
0.075 mm	53
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
56 µm	45
33 µm	41
13 µm	37
6 µm	33
2 µm	29
% Clay	33
% Silt	12
% Sand	54
% Gravel	1
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	36
Plasticity Index	17
Linear Shrinkage (%)	7.0
Grading Modulus	0.51
Classification	A-6 (6)
Unified Classification	CL
Chart Reference	■

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



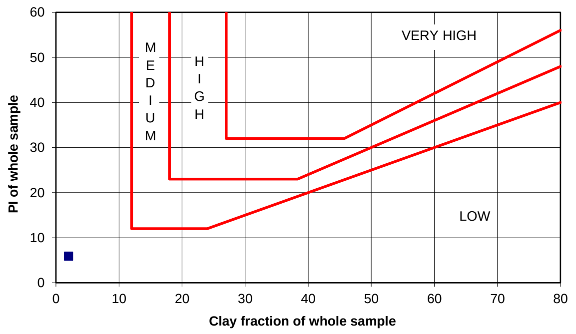


PARTICLE SIZE ANALYSIS

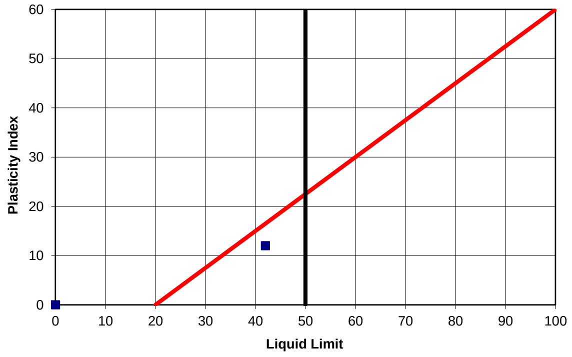
PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

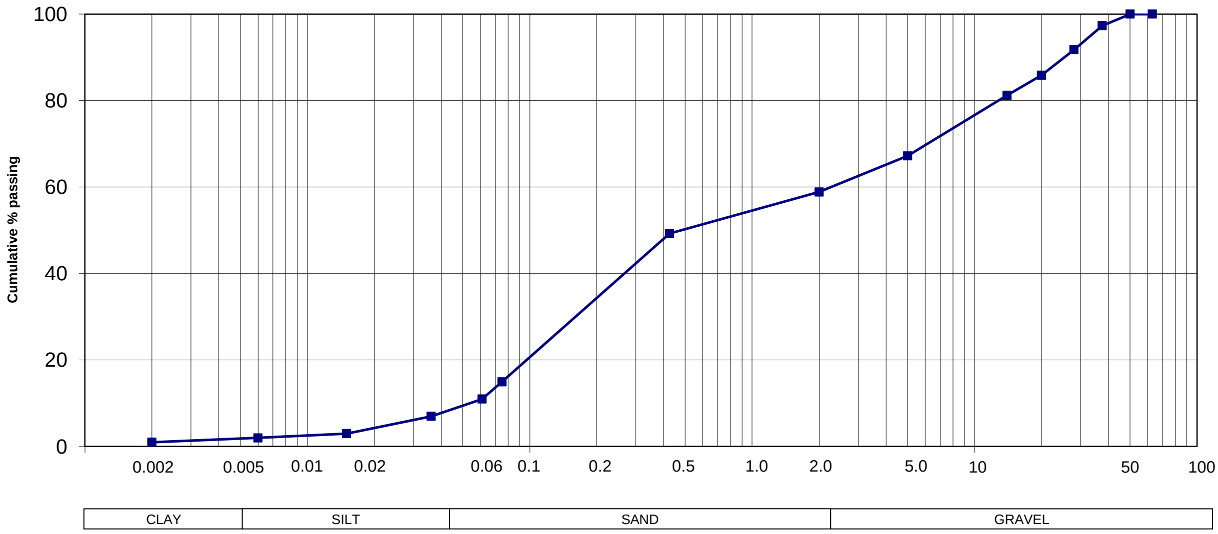
Sample No.	2
Soillab Sample No.	S20-0886-02
Depth (m)	0,8 - 1,9
Position	KT/T4/1
Material Description	LIGHT REDDISH BROWN GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.607
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	97
28.0 mm	92
20.0 mm	86
14.0 mm	81
5.0 mm	67
2.00 mm	59
0.425 mm	49
0.075 mm	15
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
61 µm	11
36 µm	7
15 µm	3
6 µm	2
2 µm	1
% Clay	2
% Silt	9
% Sand	48
% Gravel	41
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	42
Plasticity Index	12
Linear Shrinkage (%)	5.0
Grading Modulus	1.77
Classification	A-2-7 (0)
Unified Classification	SM
Chart Reference	

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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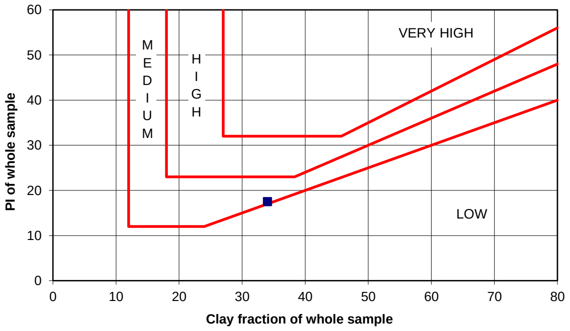
PARTICLE SIZE ANALYSIS

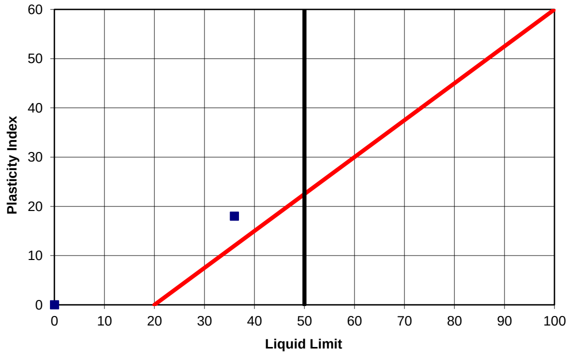
Sample No.	3
Soillab Sample No.	S20-0886-03
Depth (m)	0,2 - 1,0
Position	KT/T8/1
Material Description	LIGHT REDDISH BROWN CLAYEY SAND
Relative density on < 2 mm **(SANS 5844)**	2.552
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	100
0.425 mm	97
0.075 mm	49
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
59 µm	42
34 µm	38
14 µm	36
6 µm	34
2 µm	32
% Clay	34
% Silt	8
% Sand	58
% Gravel	0
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	36
Plasticity Index	18
Linear Shrinkage (%)	7.0
Grading Modulus	0.54
Classification	A-6 (5)
Unified Classification	SC
Chart Reference	■

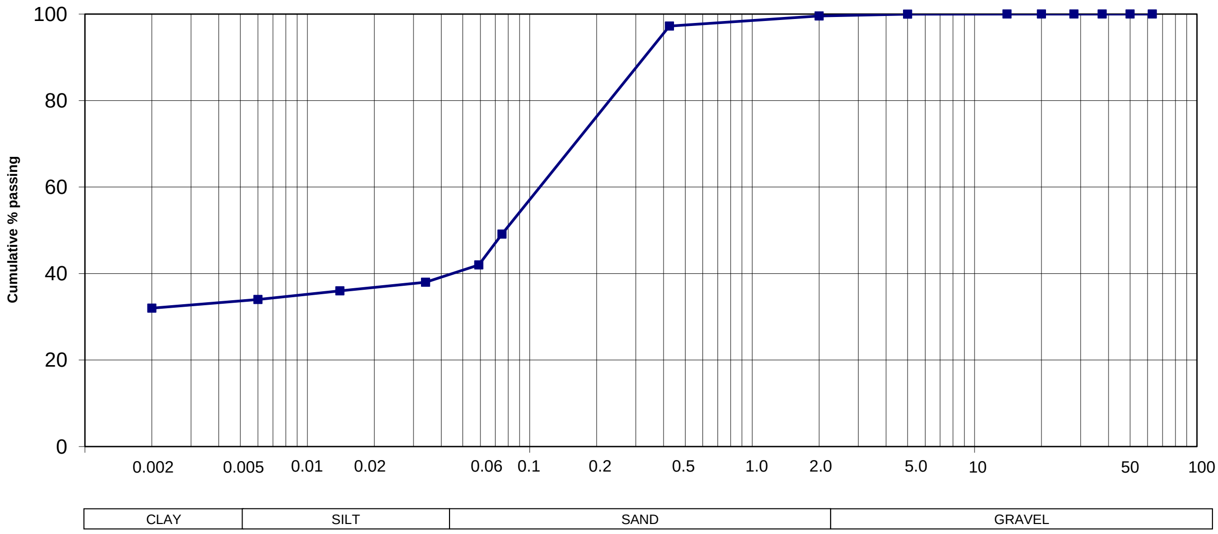
PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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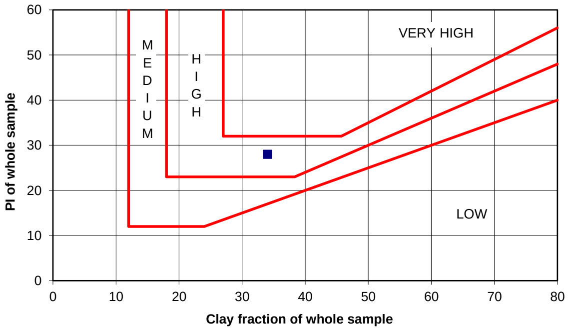
PARTICLE SIZE ANALYSIS

Sample No.	4
Soillab Sample No.	S20-0886-04
Depth (m)	0,3 - 0,9
Position	KT/T13/1
Material Description	LIGHT REDDISH BROWN CLAYEY SAND
Relative density on < 2 mm **(SANS 5844)**	2.45
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	100
0.425 mm	97
0.075 mm	53
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
59 µm	52
34 µm	46
14 µm	38
6 µm	34
2 µm	26
% Clay	34
% Silt	18
% Sand	48
% Gravel	0
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	63
Plasticity Index	29
Linear Shrinkage (%)	14.0
Grading Modulus	0.50
Classification	A-7-5 (13)
Unified Classification	MH
Chart Reference	■

PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

POTENTIAL EXPANSIVENESS



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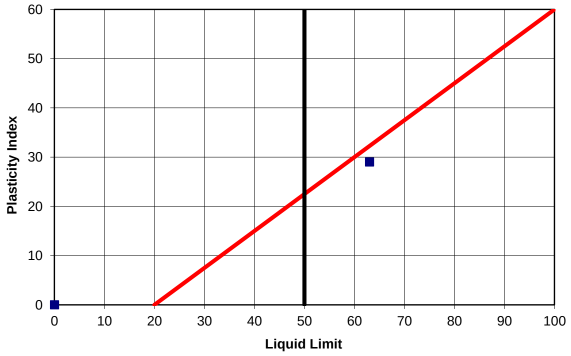

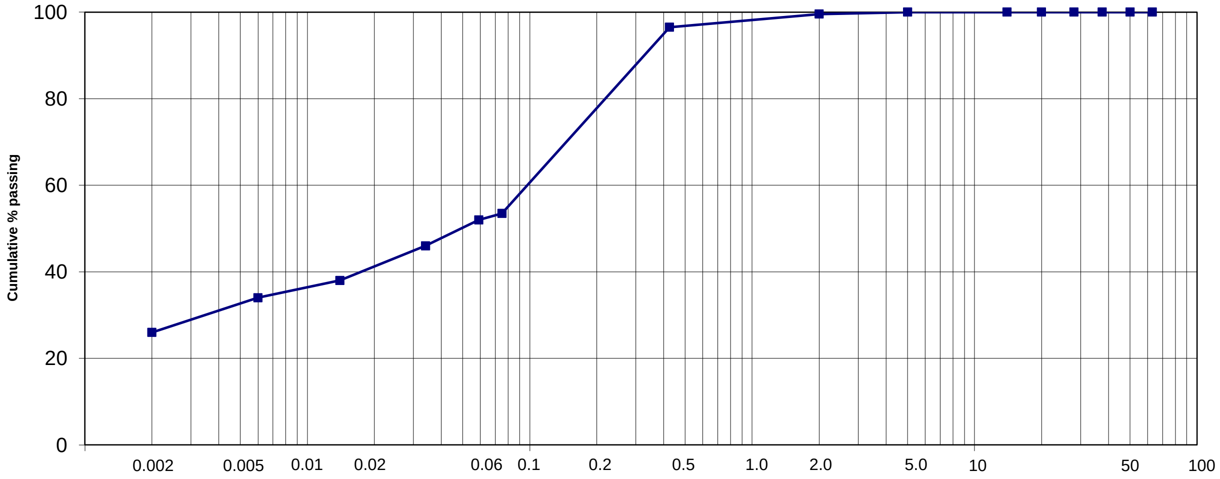

CLAY	SILT	SAND	GRAVEL

HIDROMETER/S20-0886-04 FI

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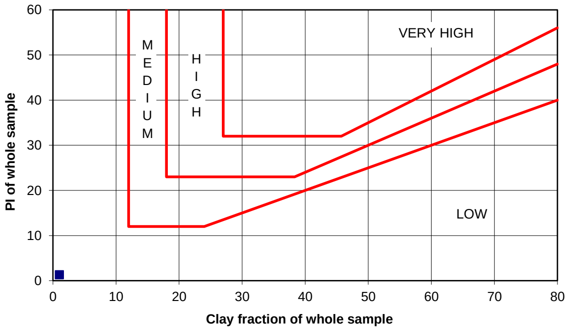
PARTICLE SIZE ANALYSIS

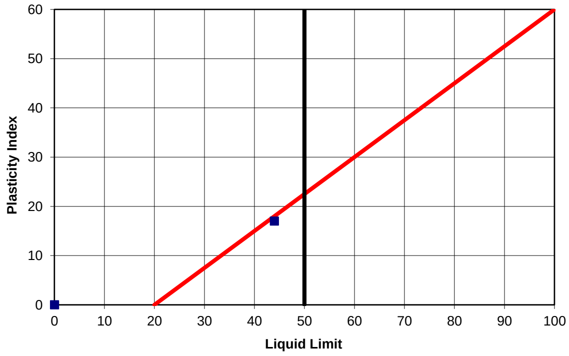
PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

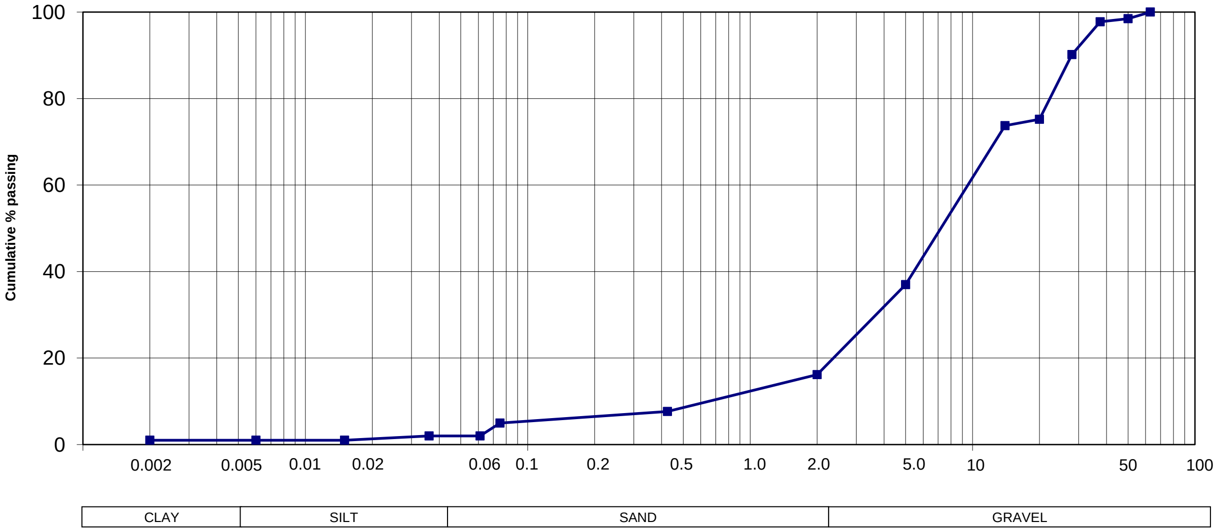
Sample No.	5
Soillab Sample No.	S20-0886-05
Depth (m)	0,2 - 0,7
Position	KT/T14/1
Material Description	LIGHT REDDISH BROWN SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.506
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	98
37.5 mm	98
28.0 mm	90
20.0 mm	75
14.0 mm	74
5.0 mm	37
2.00 mm	16
0.425 mm	8
0.075 mm	5
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
61 µm	2
36 µm	2
15 µm	1
6 µm	1
2 µm	1
% Clay	1
% Silt	1
% Sand	14
% Gravel	84
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	44
Plasticity Index	17
Linear Shrinkage (%)	8.0
Grading Modulus	2.71
Classification	A-2-7 (0)
Unified Classification	GW
Chart Reference	■

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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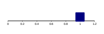
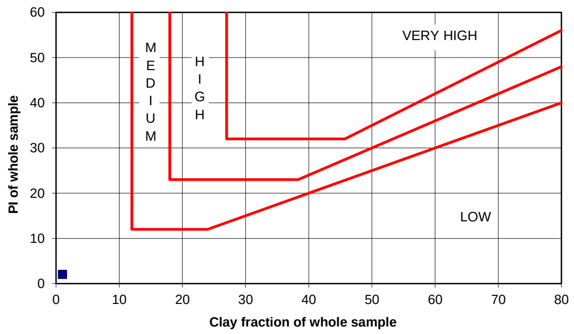
PARTICLE SIZE ANALYSIS

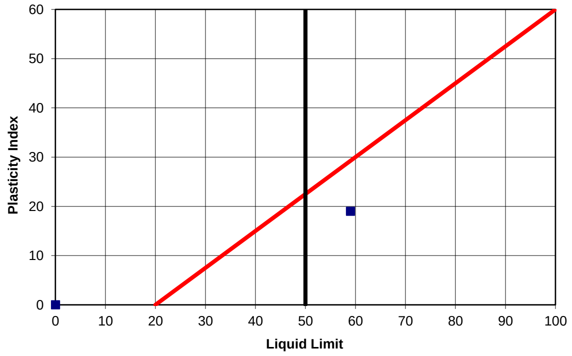
Sample No.	6
Soillab Sample No.	S20-0886-06
Depth (m)	0,7 - 1,6
Position	KT/T16/1
Material Description	LIGHT REDDISH BROWN SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.604
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	91
28.0 mm	78
20.0 mm	62
14.0 mm	57
5.0 mm	31
2.00 mm	20
0.425 mm	11
0.075 mm	4
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
60 µm	3
35 µm	2
15 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	2
% Sand	17
% Gravel	80
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	59
Plasticity Index	19
Linear Shrinkage (%)	8.5
Grading Modulus	2.66
Classification	A-2-7 (0)
Unified Classification	GP
Chart Reference	

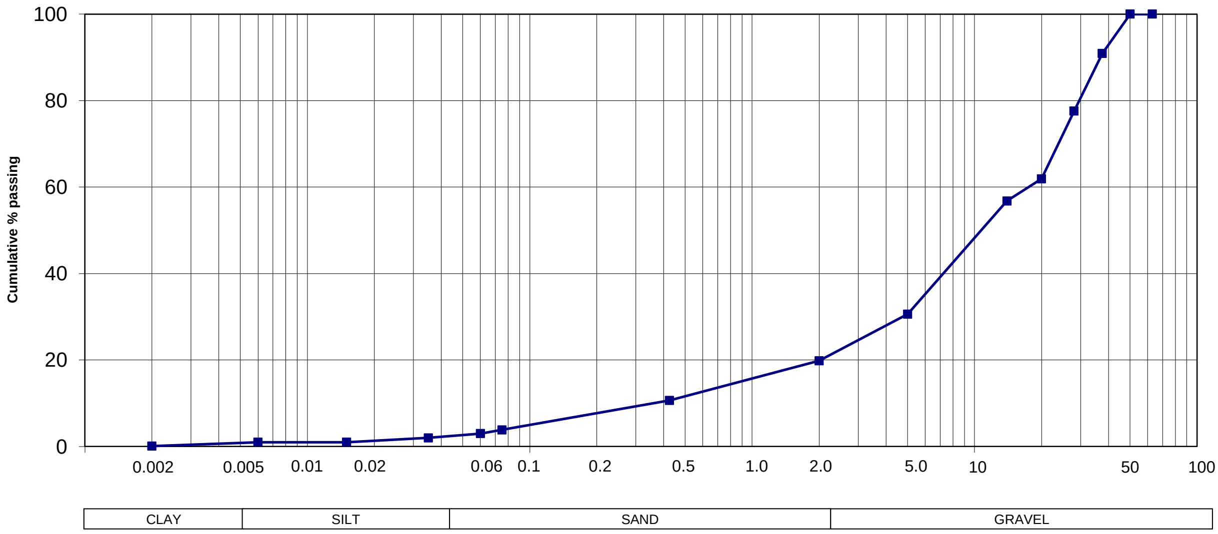
PROJECT : KENTANI SOLAR FARM
JOB No. : S20-0886
DATE : 2020-08-13

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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South Africa, 0040

Client:	SMEC
Project:	KENTANI SOLAR FARM
Project No.:	S20-0886
Date:	2020-08-13

MOISTURE CONTENT - SANS 3001-GR20

Sample No.:	Description:	Depth (m)	Moisture Content (%)
S20-0886-01	KT/T3/1	0,2 - 0,6	15.6
S20-0886-02	KT/T4/1	0,8 - 1,9	9.3
S20-0886-03	KT/T8/1	0,2 - 1,0	11.8
S20-0886-04	KT/T13/1	0,3 - 0,9	14.4
S20-0886-05	KT/T14/1	0,2 - 0,7	7.3
S20-0886-06	KT/T16/1	0,7 - 1,6	8.7

Note: Items marked with a star (*) is Not Accredited

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South Africa, 0040

Client: SMEC
Project: KENTANI SOLAR FARM - C1801/30
Project No.: S20-0886
Date: 2020-07-29

TEST RESULTS: CHEMICAL

Soillab No	Sample No	Depth (m)	pH (TMH 1 A20)	Electrical Conductivity (TMH 1 A21T)	Cl content (%) *SANS 202	Org. Content (%) BS 1377-3: 1990	Soluble SO_3 (%) *SANS 5850
S20-0886-01	KT/T3/1	0.2-0.6	7.39	0.0688	0.0074	3.87	0.0116
S20-0886-02	KT/T4/1	0.8-1.9	8.36	0.0845	0.0064	3.72	0.0352
S20-0886-04	KT/T13/1	0.3-0.9	8.24	0.3400	0.0401	4.20	0.0589
S20-0886-06	KT/T16/1	0.7-1.6	8.57	0.0599	0.0085	2.93	0.0137

Note: Items marked with a star (*) is Not Accredited

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Client:	SMEC SA(C01400)
Project:	KENTANI SOLAR FARM
Project No.:	S20-0886
Date:	2020-07-14

THERMAL CONDUCTIVITY (SANS 10198*)

Sample No.	Moisture Content	Thermal Conductivity (K) W/m.K	Thermal Resistivity (g) K.m/W
S20-0886-01 SAMPLE NO: 01 KT/T3/1 0.2 – 0.6	**0 %**	0.338	2.955
	4%	0.467	2.157
	6%	0.678	1.475
	15.6% (AS RECEIVED)	1.586	0.630
S20-0886-02 SAMPLE NO: 02 KT/T13/1 0.3 – 0.9	**0 %**	0.242	4.125
	4%	0.343	2.917
	6%	0.391	2.524
	14.4% (AS RECEIVED)	0.695	1.439
S20-0886-03 SAMPLE NO: 03 KT/T16/1 0.7 – 1.6	**0 %**	0.177	5.658
	4 %	0.347	2.894
	6%	0.412	2.426
	8.7 %(AS RECEIVED)	0.777	1.287

Consolidated Undrained Triaxial

Results Summary

Project:	SMEC
Client:	Kentani Solar Farm
Geolab Job Nr:	S20-0886
Test Method:	BS1377-8:1990

Sample Nr:	KT/T8/1
Sample Depth:	0.2-1.0_CU
Date:	11/08/2020

Results		
ϕ' =	**40.8**	**o**
c' =	**3.1**	**kPa**

Sampling Method:	Shelby Tube
Disturbed/Undist:	Disturbed
Remoulded To:	-

Initial Sample Details	**1**	**2**	**3**	
Sample Length:	100	100	100	mm
Sample Diameter:	50	50	50	mm
Sample Mass:	324.4	342.4	324.3	g
Dry Density:	1478	1560	1477	kg/m³
Bulk Density:	1652	1744	1652	kg/m³
Void Ratio:	0.724	0.634	0.725	
Moisture Content:	11.8	11.8	11.8	%
Specific Gravity:		2.548		Mg/m³

Flush Stage	**1**	**2**	**3**	
Volume Change:	N/A	N/A	N/A	ml
% Volume Change:	N/A	N/A	N/A	%

Saturation Stage	**1**	**2**	**3**	
Final B Value	0.98	0.96	0.99	
Final Back Pressure	400	400	399	kPa

Consolidation Stage	**1**	**2**	**3**	
Effective Stress:	20	30	50	kPa
Volume Change:	-2.271	-3.91	-9.159	ml
Height After Consolidation:	99.61	99.34	98.45	mm
Diameter After Consolidation:	49.81	49.66	49.20	mm
Void Ratio Before Consolidation:	0.724	0.634	0.725	
Void Ratio After Consolidation:	0.705	0.601	0.645	
Coef Of Volume Comp (m_{vi}):	0.997	1.084	1.609	m²/MN

Shear Stage	**1**	**2**	**3**	
Rate of Shear:	0.01686	0.01691	0.01707	mm/min
Failure Criteria:	MSR	MSR	MSR	
Deviator Stress at Failure:	19.2	41.5	52.2	kPa
Stress Ratio at Failure:	10.6	7.9	5.7	
Strain at Failure:	6.3	13.6	9.7	%

Final Sample Details	**1**	**2**	**3**	
Dry Density:	1495	1591	1549	kg/m³
Density:	1911	2016	1969	kg/m³
Void Ratio:	0.705	0.601	0.645	
Moisture Content:	27.82	26.72	27.06	%

Consolidated Undrained Triaxial

Consolidation Stage

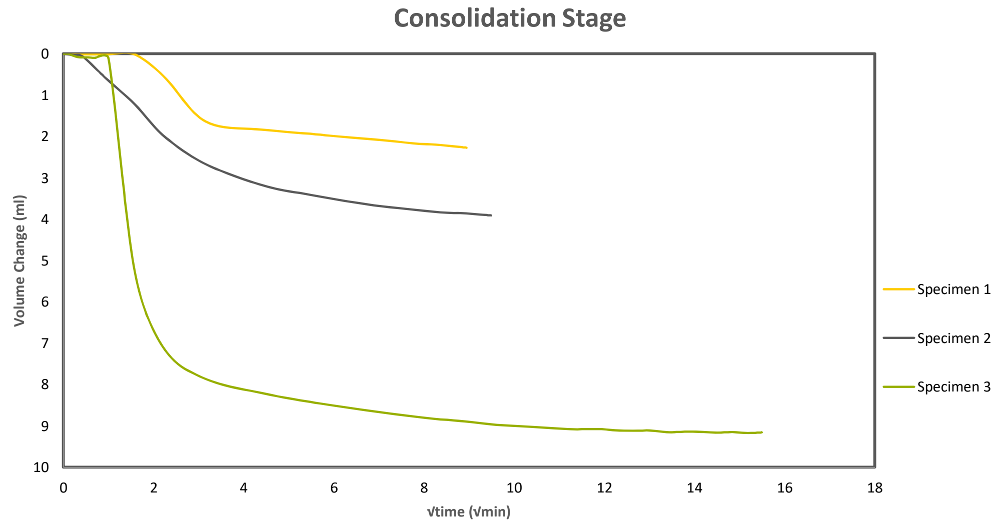
Project:	SMEC
Client:	Kentani Solar Farm
Geolab Job Nr:	S20-0886

Sample Nr:	KT/T8/1
Sample Depth:	0.2-1.0_CU
Date:	11/08/2020

Initial Conditions	1	2	3	
Cell Pressure:	419	430	449	kPa
Back Pressure:	399	400	399	kPa
Void Ratio:	0.724	0.634	0.725	
Side Drain Used:	y	y	y	

Final Conditions	1	2	3	
Volume Change:	-2.3	-3.9	-9.2	ml
Volumetric Strain:	-1.16	-1.99	-4.66	%
Corrected Length:	99.61	99.34	98.45	mm
Corrected Diameter:	49.81	49.66	49.20	mm
Void Ratio:	0.705	0.601	0.645	

Calculations and Parameters	1	2	3	
Calculated Shear Speed:	0.0167	0.0167	0.0167	mm/min
Coeff of Volume Comp (m_{vi}):	0.997	1.084	1.609	m^2/MN



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www.soillab.co.za

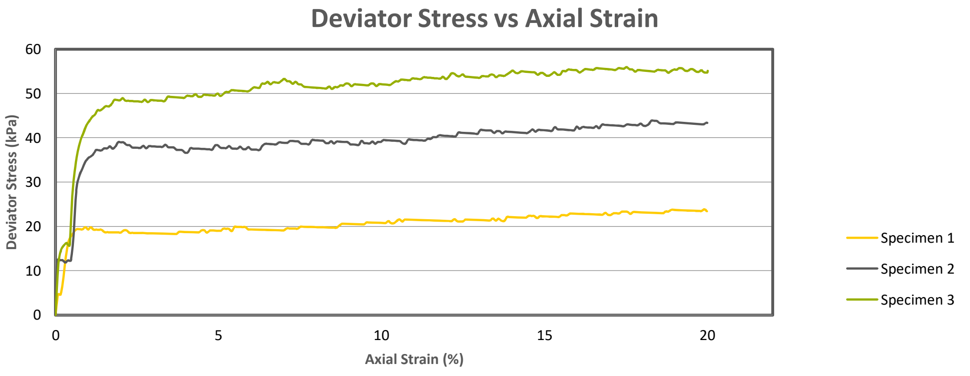
Consolidated Undrained Triaxial

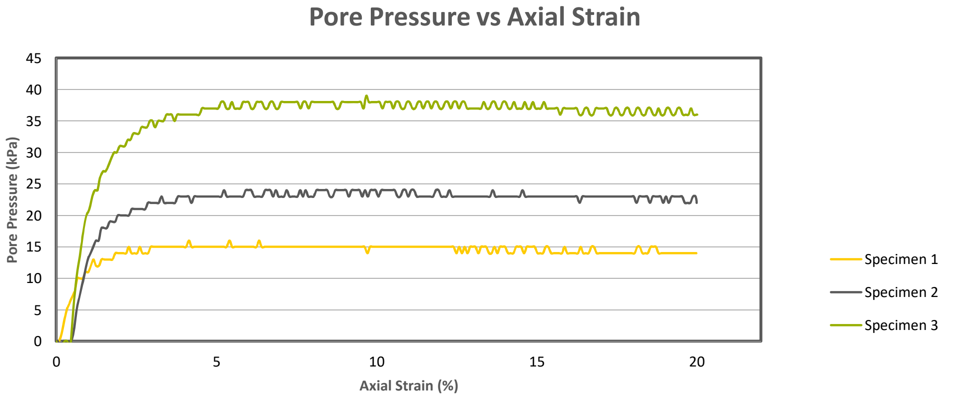
Shear Stage

Project:	SMEC
Client:	Kentani Solar Farm
Geolab Job Nr:	S20-0886

Sample Nr:	KT/T8/1
Sample Depth:	0.2-1.0_CU
Date:	11/08/2020

Shear	**1**	**2**	**3**	
σ_1' at Failure:	21.2	47.5	63.2	kPa
σ_3' at Failure:	2.0	6.0	11.0	kPa
Failure Criteria:	MSR	MSR	MSR	
Deviator Stress at Failure:	19.2	41.5	52.2	kPa
Stress Ratio at Failure:	10.6	7.9	5.7	
Strain at Failure:	6.3	13.6	9.7	%
Calculated Shear Speed:	0.0167	0.0167	0.0167	mm/min
Actual Shear Speed:	0.0169	0.0169	0.0171	mm/min





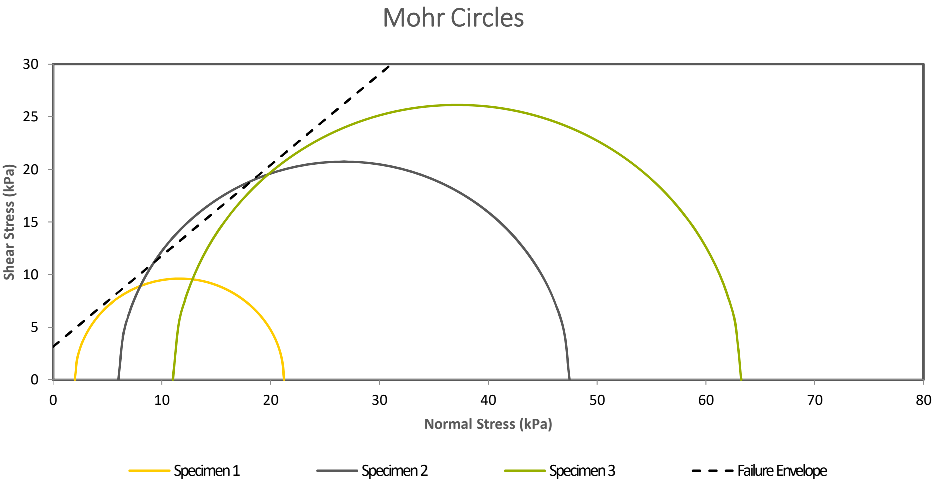
Consolidated Undrained Triaxial

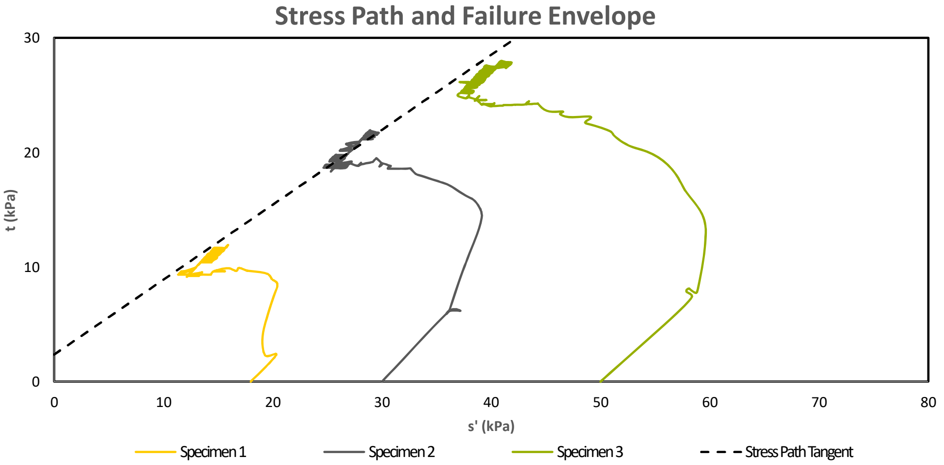
Shear Stage

Project:	SMEC
Client:	Kentani Solar Farm
Geolab Job Nr:	S20-0886

Sample Nr:	KT/T8/1
Sample Depth:	0.2-1.0_CU
Date:	11/08/2020

Results			
θ=	**33.2**	°	*Stress Path Tangent*
t_0=	**2.4**	**kPa**	
ϕ' =	**40.8**	°	*Mohr-Coulomb Failure Envelope*
c' =	**3.1**	**kPa**	





GEOLAB
Part of the SMEC Group

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
sanas Testing Laboratory T0455
REG. No. 1987/004282/07 NLA No. 2012/187
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☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

Enquiries : Bloemfontein
Our ref. : SL / 3092
Your ref. : Soil Classification for Project C1801/30 – Klipfontein 1 Solar Farm, Dealesville, Free State.
File ref. : 020/938(a)
Date : 30/07/2020

ATTENTION: MR. RICHARD ROBERTS

SMEC SOUTH AFRICA (PTY) LIMITED (RANDBURG)
267 Kent Avenue
RANDBURG
2194

Tel. / Cell.: 011 369 0789 / 072 495 0920
E-mail: richard.roberts@smec.com

Sir,

SOIL CLASSIFICATION FOR PROJECT C1801/30, KLIPFONTEIN 1 SOLAR FARM, DEALESVILLE, FREE STATE.

1.) Terms of reference

SMEC SOUTH AFRICA (PTY) LTD (Randburg), Mr Richard Roberts appointed SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) for the soil testing of Project C1801/30 – Klipfontein 1 Solar Farm, Dealesville, Free State, as sampled by client, SMEC SOUTH AFRICA (PTY) LTD, Mr Richard Roberts.

The results for the materials tested by SIMLAB (Pty) Limited (Bloemfontein), can be found in APPENDIX A of this report.

2.) Disclaimer

The opinions expressed, interpretations and recommendations in this Report have been based on the information supplied to SIMLAB (Pty) Limited – Geotechnical Services. (Bloemfontein).

SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this Report apply to the site conditions and features as they existed at the time of SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) site inspection / investigation.

SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) does not accept any liability or responsibility whatsoever from any third parties for the use, reliance or interpretation of this Report.

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3.) Test Methods used

SIMLAB (Pty) Limited (Bloemfontein)) (a SANAS Accredited Testing Laboratory – T0455) was instructed to test the following on various samples received: *In Situ* Moisture Content (MC), Foundation Indicator (FI), Maximum Dry Density (MDD), California Bearing Ratio (CBR), pH-Value (pH) and Electrical Conductivity (EC). These tests are used to determine the Engineering Properties of the materials. These tests were conducted from the 20th of July 2020 to the 27th of July 2020.

Please visit the SIMLAB or SANAS website for more information regarding SANAS Accreditation. www.simlab.co.za or www.sanas.co.za

Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples).
- * TMH1 : 1986, A20 – The electronic determination of the ph value of a soil suspension
- * TMH1 : 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of SIMLAB (Pty) Limited – Geotechnical Services.

4.) Appendices

APPENDIX A – LABORATORY TEST RESULTS

We trust this meets with your requirements. Should you require further information in this regard, please do not hesitate to contact us.

WT HITGE (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

APPENDIX A

LABORATORY TEST RESULTS

(Particle Size Distribution) (Material Classification)

Simlab
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(PTY) LIMITED GEOTECHNICAL SERVICES
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T0455
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NLA No. 2012/187
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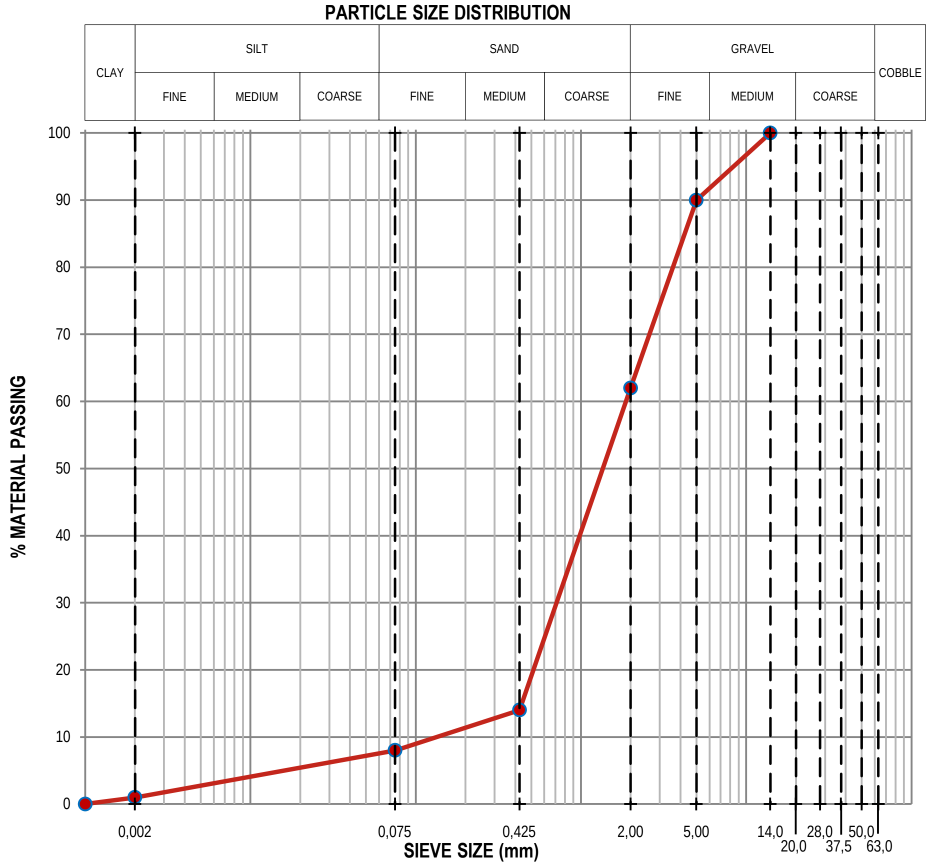
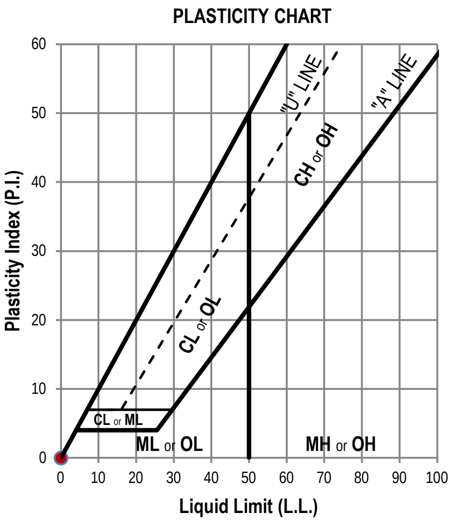
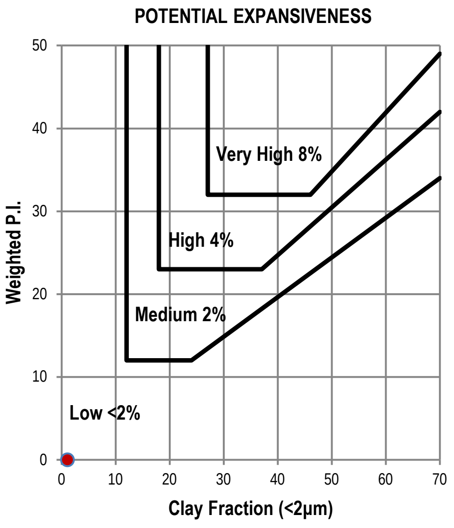
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Klipfontein 1	**MATERIAL DEPTH** (mm) :	300 - 1500	**SAMPLE No / LABORATORY No.:**	KF/T6/1 / 020/938
MATERIAL DESCRIPTION :	Poorly graded SAND with clay and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		3,3
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	
	14,0 mm	100
	5,00 mm	90
	2,00 mm	62
	0,425 mm	14
	0,075 mm	8
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,16
SOIL MORTAR	**COARSE SAND**	78
	FINE SAND (Course)	3
	FINE SAND (Medium)	2
	FINE SAND (Fine)	3
	SILT AND CLAY (<0.075mm)	14
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	-
	P.I. (%)	Non Plastic
	L.S. (%)	0,0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	33,7
	C_C (ASTM D2487)	0,8
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	7
	% Sand (0.075 - 2.0mm)	54
	% Gravel (>2.0mm)	38
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2123
	OPTIMUM MOISTURE (%)	10,9
	SWELL (%)	0,0
	CBR @ 100% (%)	68
	CBR @ 98% (%)	54
	CBR @ 95% (%)	39
	CBR @ 93% (%)	31
	CBR @ 90% (%)	22
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0649
pH VALUE (TMH1: Method A21)		7,74
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-1-b (1)
UNIFIED SOIL CLASSIFICATION		SP-SC
COLTO CLASSIFCATION		G6


PARTICLE SIZE DISTRIBUTION


PLASTICITY CHART


POTENTIAL EXPANSIVENESS

REMARKS.:

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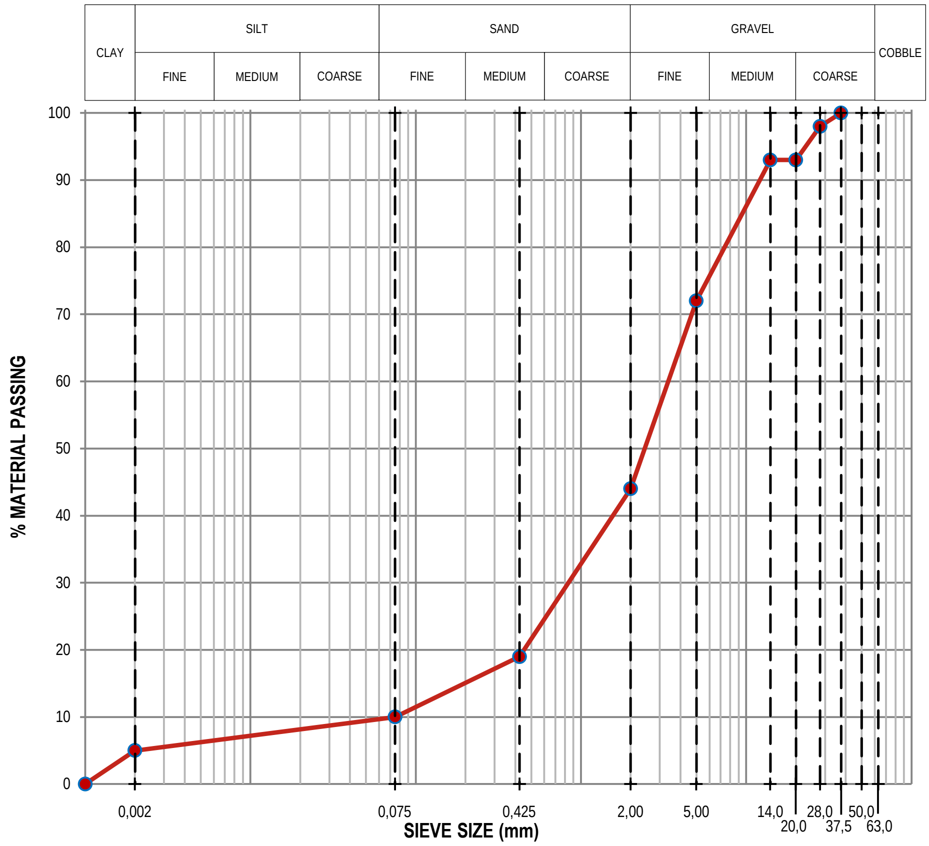
MATERIAL CLASSIFICATION TEST RESULTS

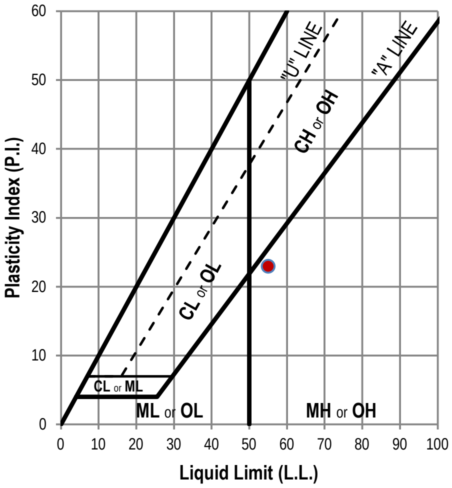
TEST PIT / HOLE No.:	Farm Klipfontein 1	**MATERIAL DEPTH** (mm) **:**	800 - 2400	**SAMPLE No / LABORATORY No.:**	KF/T12/1 / 020/939
MATERIAL DESCRIPTION :	Well-graded SAND with silt and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		5,9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	100
	28,0 mm	98
	20,0 mm	93
	14,0 mm	93
	5,00 mm	72
	2,00 mm	44
	0,425 mm	19
	0,075 mm	10
TMH1: METHOD A6	**0,002 mm**	5
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,27
SOIL MORTAR	**COARSE SAND**	55
	FINE SAND (Course)	9
	FINE SAND (Medium)	7
	FINE SAND (Fine)	6
	SILT AND CLAY (<0.075mm)	23
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	55
	P.I. (%)	23
	L.S. (%)	11,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	81,1
	C_C (ASTM D2487)	1,5
	% Clay (>0.002mm)	5
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	34
	% Gravel (>2.0mm)	56
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1920
	OPTIMUM MOISTURE (%)	15,1
	SWELL (%)	0,5
	CBR @ 100% (%)	17
	CBR @ 98% (%)	15
	CBR @ 95% (%)	13
	CBR @ 93% (%)	12
	CBR @ 90% (%)	10
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		SW-SM
COLTO CLASSIFCATION		G8

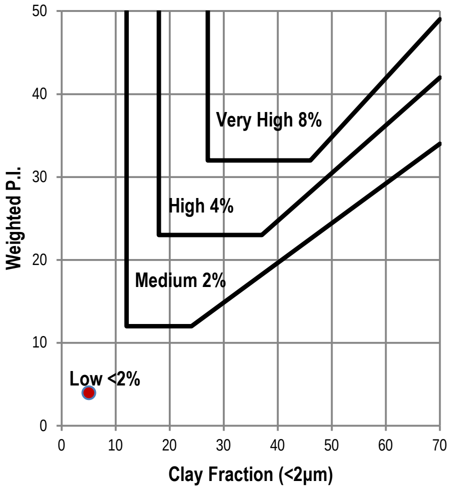
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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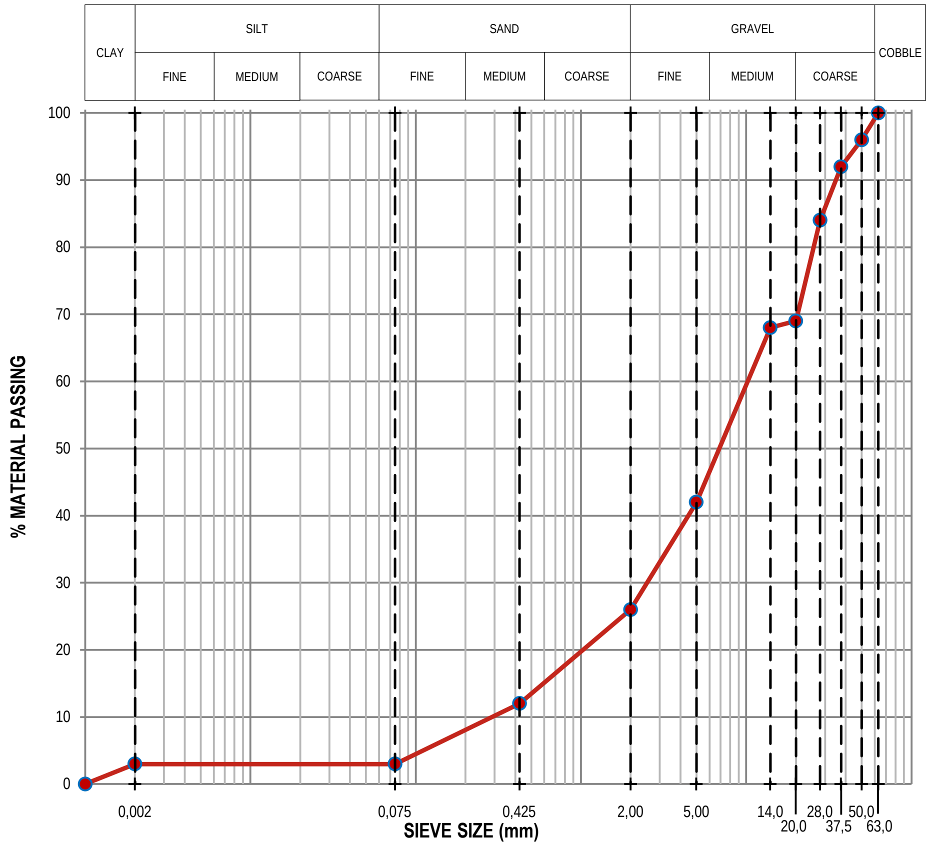
MATERIAL CLASSIFICATION TEST RESULTS

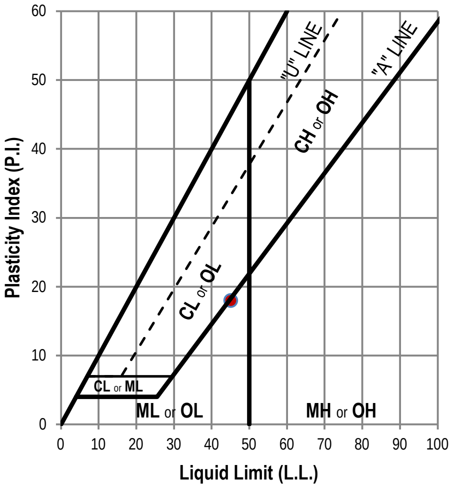
TEST PIT / HOLE No.:	Farm Klipfontein 1	**MATERIAL DEPTH** (mm) **:**	200 - 2200	**SAMPLE No / LABORATORY No.:**	KF/T16/1 / 020/940
MATERIAL DESCRIPTION :	Poorly graded GRAVEL with SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		5,6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	96
	37,5 mm	92
	28,0 mm	84
	20,0 mm	69
	14,0 mm	68
	5,00 mm	42
	2,00 mm	26
	0,425 mm	12
	0,075 mm	3
TMH1: METHOD A6	**0,002 mm**	3
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,59
SOIL MORTAR	**COARSE SAND**	53
	FINE SAND (Course)	14
	FINE SAND (Medium)	10
	FINE SAND (Fine)	11
	SILT AND CLAY (<0.075mm)	12
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	45
	P.I. (%)	18
	L.S. (%)	9,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,1
	C_C (ASTM D2487)	994,8
	% Clay (>0.002mm)	3
	% Silt (0.075 - 0.002mm)	0
	% Sand (0.075 - 2.0mm)	23
	% Gravel (>2.0mm)	74
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m^3)	2013
	OPTIMUM MOISTURE (%)	12,6
	SWELL (%)	0,1
	CBR @ 100% (%)	55
	CBR @ 98% (%)	45
	CBR @ 95% (%)	34
	CBR @ 93% (%)	28
	CBR @ 90% (%)	21
PROCTOR MAX. DRY DENSITY (kg/m^3)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm^{-1}) (TMH1: Method A20)		0,0527
pH VALUE (TMH1: Method A21)		7,72
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		GP
COLTO CLASSIFCATION		G7

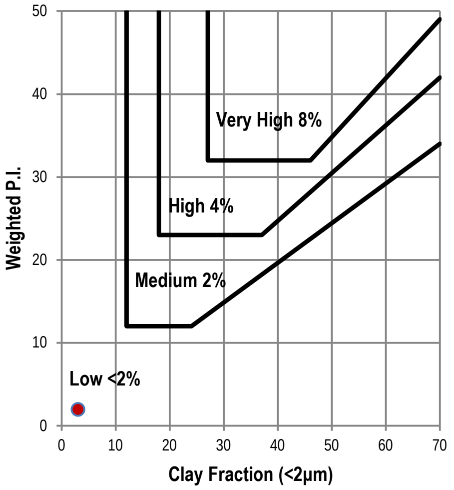
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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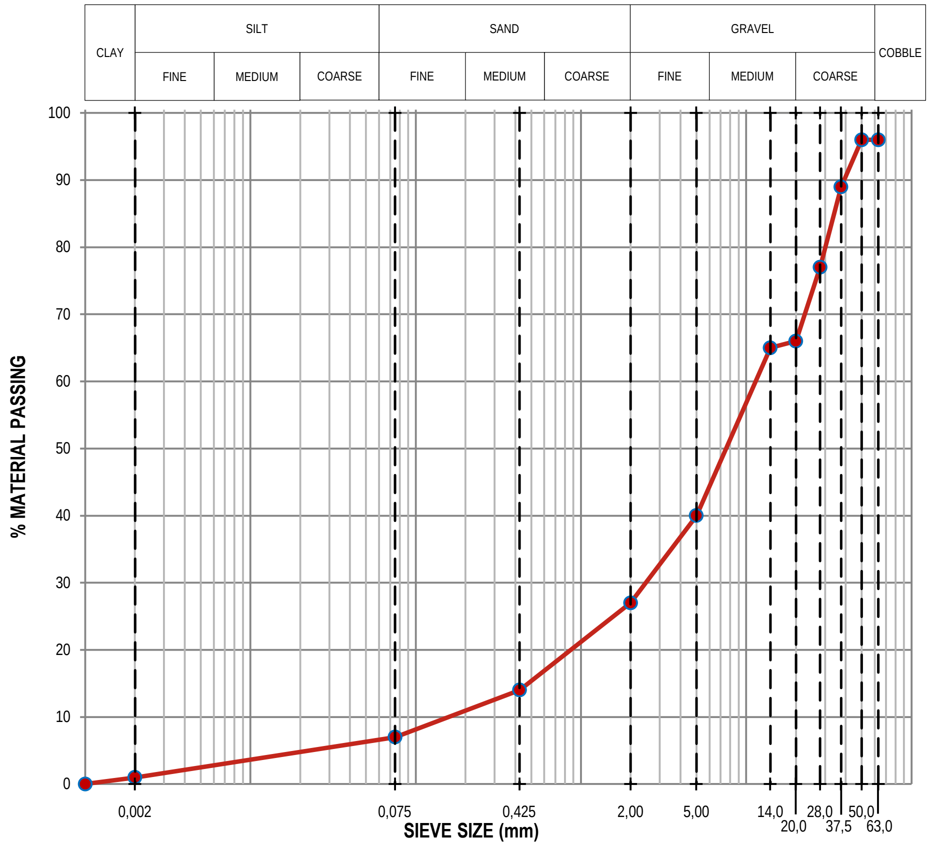
MATERIAL CLASSIFICATION TEST RESULTS

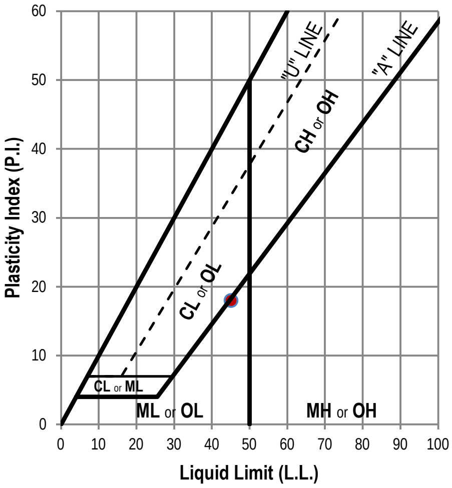
TEST PIT / HOLE No.:	Farm Klipfontein 1	**MATERIAL DEPTH** (mm) **:**	300 - 2000	**SAMPLE No / LABORATORY No.:**	KF/T22/1 / 020/941
MATERIAL DESCRIPTION :	Poorly graded GRAVEL wit silt and SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		6,6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	96
	50,0 mm	96
	37,5 mm	89
	28,0 mm	77
	20,0 mm	66
	14,0 mm	65
	5,00 mm	40
	2,00 mm	27
	0,425 mm	14
	0,075 mm	7
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,52
SOIL MORTAR	**COARSE SAND**	47
	FINE SAND (Course)	11
	FINE SAND (Medium)	8
	FINE SAND (Fine)	7
	SILT AND CLAY (<0.075mm)	27
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	45
	P.I. (%)	18
	L.S. (%)	8,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,1
	C_C (ASTM D2487)	3864,5
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	6
	% Sand (0.075 - 2.0mm)	20
	% Gravel (>2.0mm)	73
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2021
	OPTIMUM MOISTURE (%)	12,6
	SWELL (%)	0,0
	CBR @ 100% (%)	53
	CBR @ 98% (%)	43
	CBR @ 95% (%)	31
	CBR @ 93% (%)	25
	CBR @ 90% (%)	18
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		GP-GM
COLTO CLASSIFCATION		G7

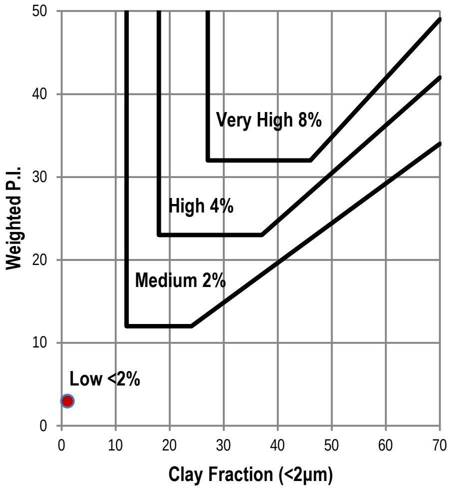
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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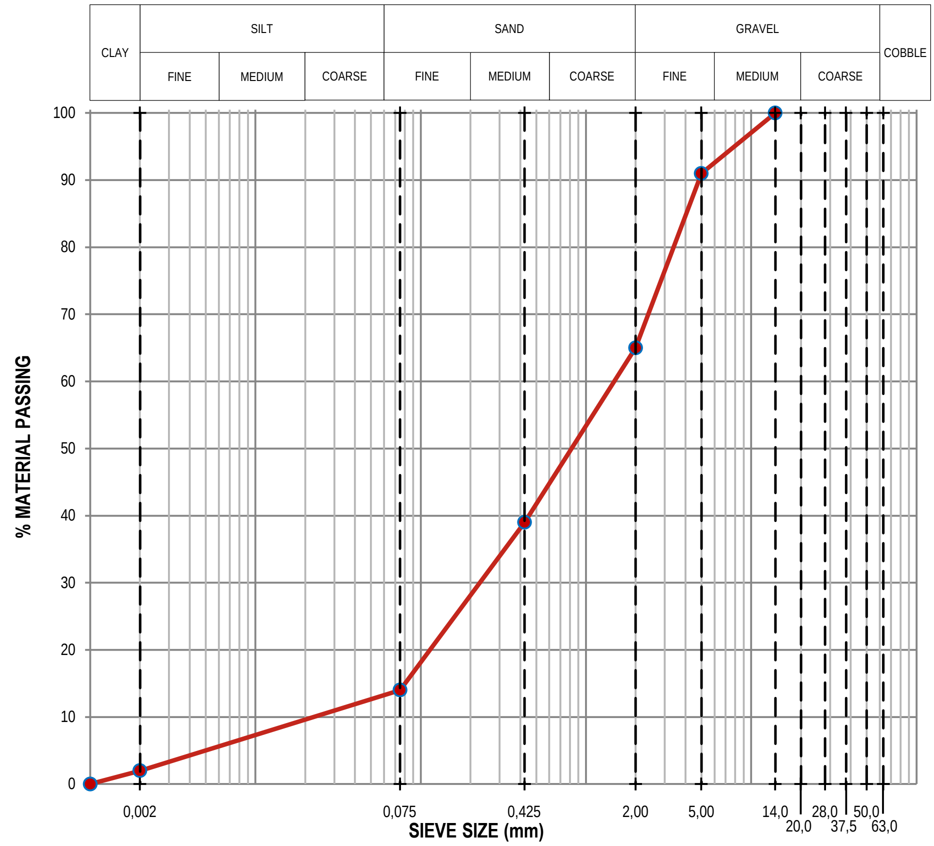
MATERIAL CLASSIFICATION TEST RESULTS

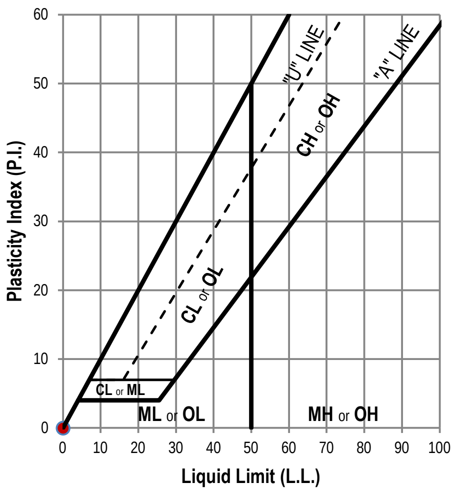
TEST PIT / HOLE No.:	Farm Klipfontein 1	**MATERIAL DEPTH** (mm) **:**	400 - 800	**SAMPLE No / LABORATORY No.:**	KF/T27/1 / 020/942
MATERIAL DESCRIPTION :	Silty SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		4,4
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	
	14,0 mm	100
	5,00 mm	91
	2,00 mm	65
	0,425 mm	39
	0,075 mm	14
TMH1: METHOD A6	**0,002 mm**	2
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	1,82
SOIL MORTAR	**COARSE SAND**	40
	FINE SAND (Course)	13
	FINE SAND (Medium)	14
	FINE SAND (Fine)	11
	SILT AND CLAY (<0.075mm)	22
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	-
	P.I. (%)	Non Plastic
	L.S. (%)	0,0
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	141,5
	C_C (ASTM D2487)	0,8
	% Clay (>0.002mm)	2
	% Silt (0.075 - 0.002mm)	12
	% Sand (0.075 - 2.0mm)	51
	% Gravel (>2.0mm)	35
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1843
	OPTIMUM MOISTURE (%)	14,0
	SWELL (%)	0,1
	CBR @ 100% (%)	131
	CBR @ 98% (%)	84
	CBR @ 95% (%)	43
	CBR @ 93% (%)	27
	CBR @ 90% (%)	14
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0243
pH VALUE (TMH1: Method A21)		7,78
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-1-b (0)
UNIFIED SOIL CLASSIFICATION		SM
COLTO CLASSIFCATION		G6

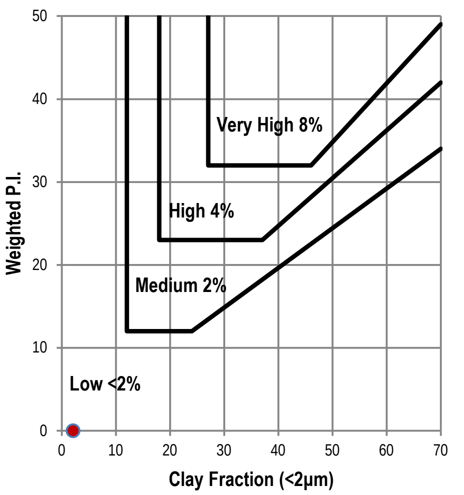
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



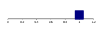
REMARKS.:

* Tests marked "Not SANAS Accredited" in this report are not in the SANAS Schedule of Accreditation for this laboratory.

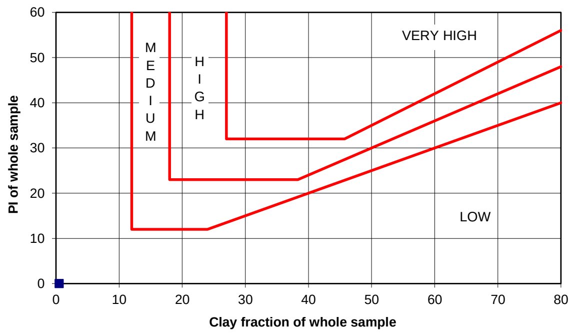
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

PARTICLE SIZE ANALYSIS

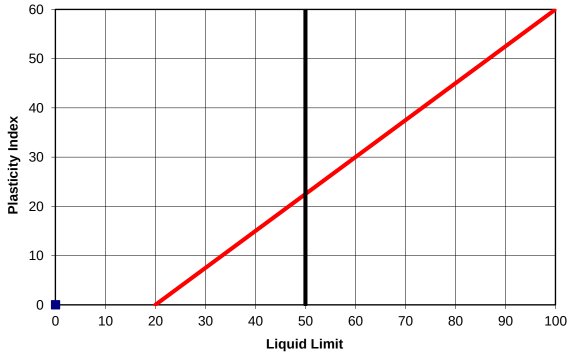
PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

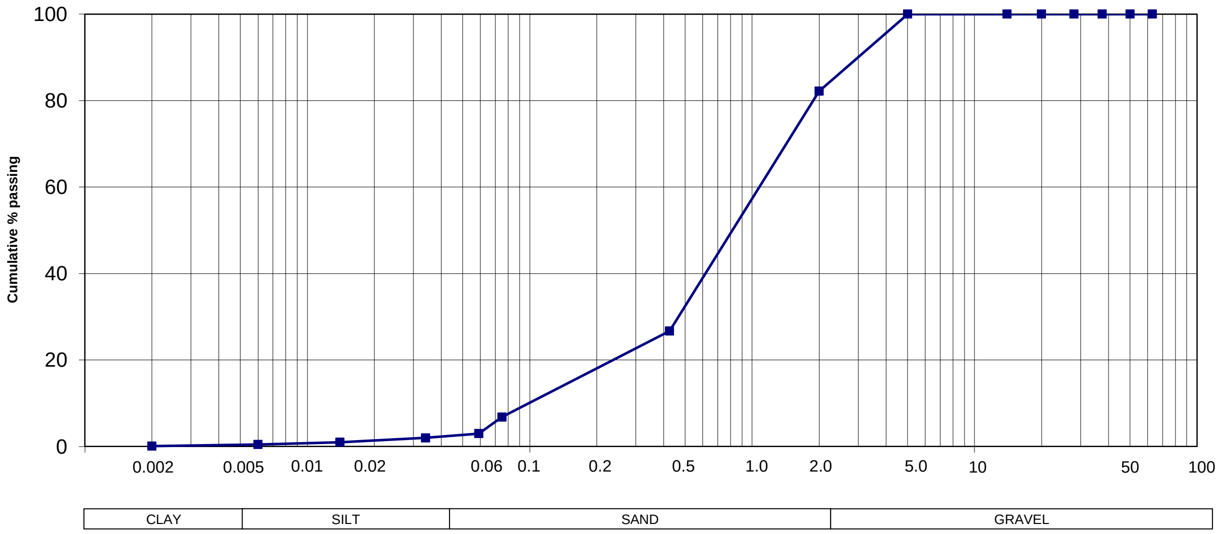
Sample No.	1
Soillab Sample No.	S20-0885-01
Depth (m)	0,4 - 1,5
Position	KF/T1/1
Material Description	DARK BROWN GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.917
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	82
0.425 mm	27
0.075 mm	7
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
59 µm	3
34 µm	2
14 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	3
% Sand	79
% Gravel	18
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	
Plasticity Index	SP
Linear Shrinkage (%)	1.0
Grading Modulus	1.84
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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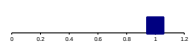
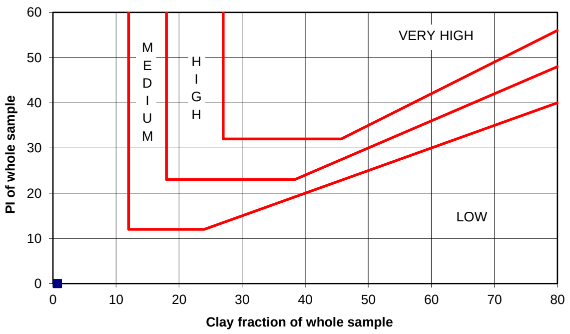
PARTICLE SIZE ANALYSIS

Sample No.	2
Soillab Sample No.	S20-0885-02
Depth (m)	0,3 - 0,9
Position	KF/T5/1
Material Description	DARK BROWN GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.617
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	78
0.425 mm	36
0.075 mm	11
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
62 µm	7
36 µm	5
15 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	6
% Sand	71
% Gravel	22
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	
Plasticity Index	SP
Linear Shrinkage (%)	1.0
Grading Modulus	1.75
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	

PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

POTENTIAL EXPANSIVENESS



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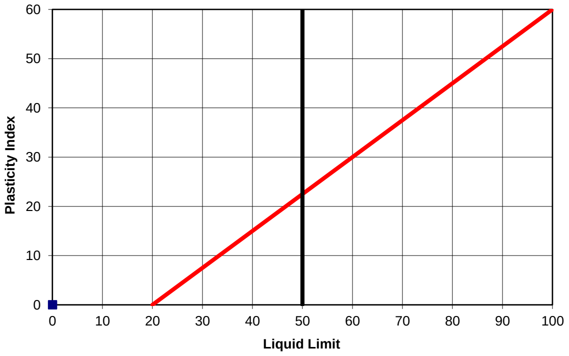
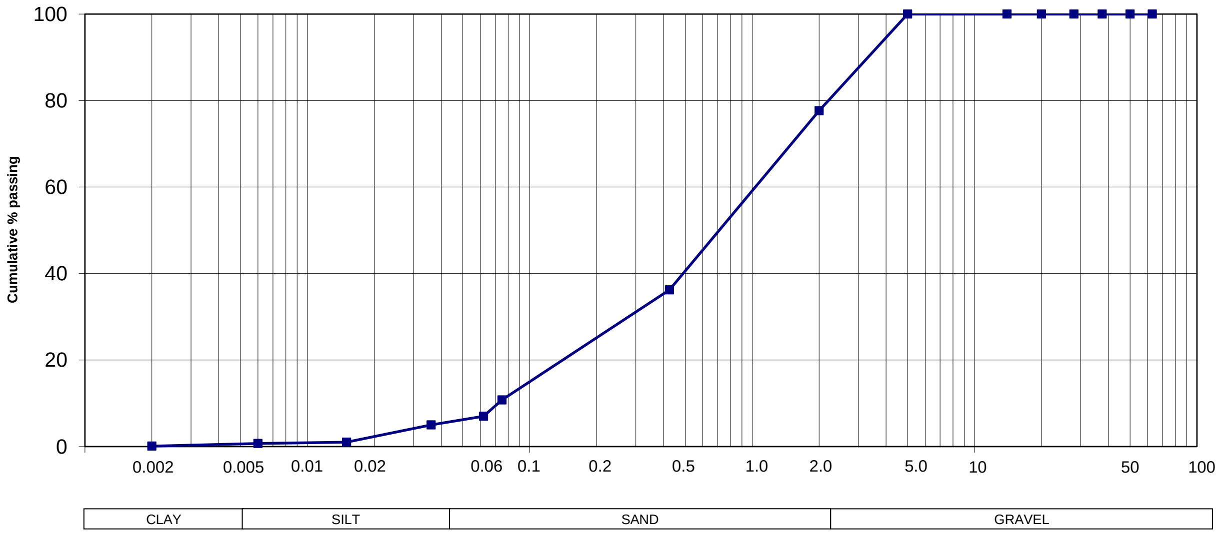
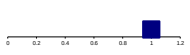


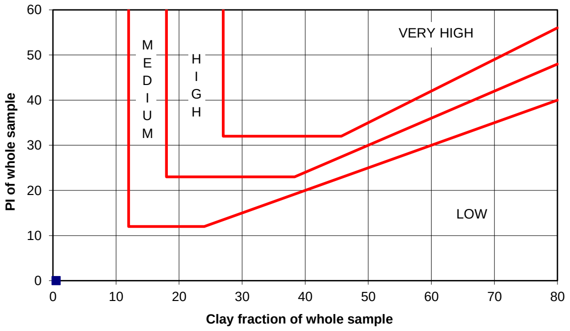


PARTICLE SIZE ANALYSIS

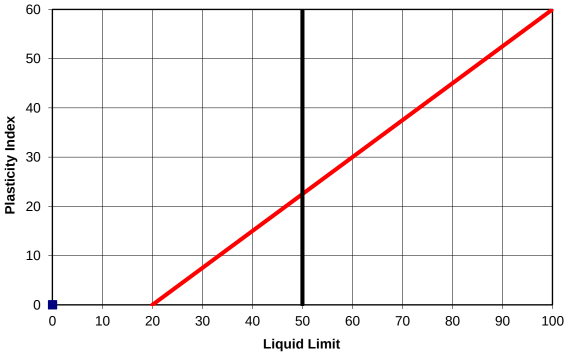
PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

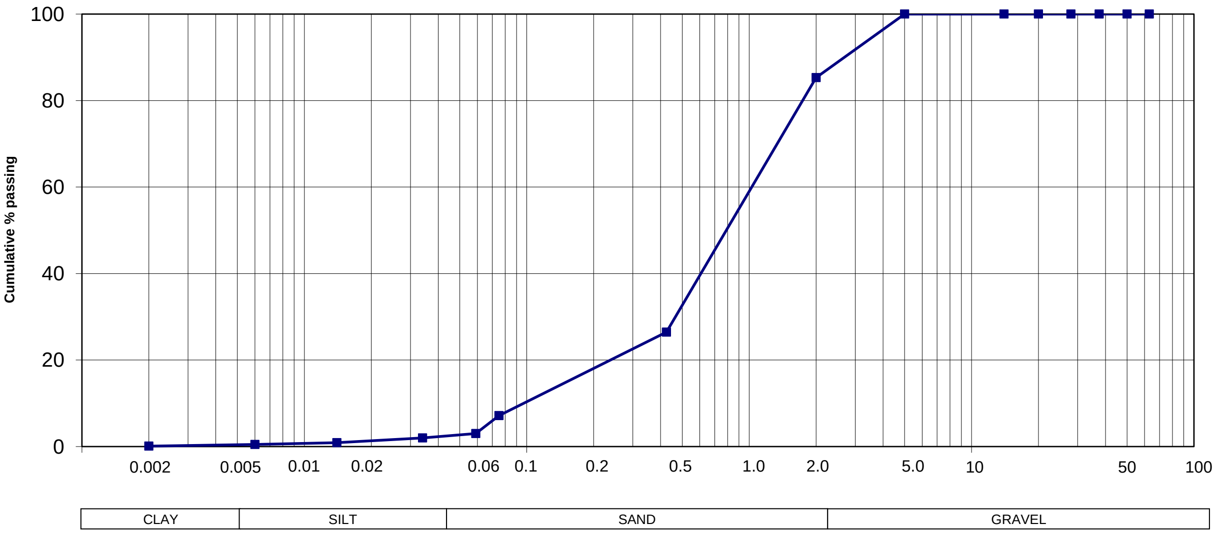
Sample No.	3
Soillab Sample No.	S20-0885-03
Depth (m)	0,3 - 1,4
Position	KF/T7/1
Material Description	DARK BROWN GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.923
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	85
0.425 mm	26
0.075 mm	7
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
59 µm	3
34 µm	2
14 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	3
% Sand	82
% Gravel	15
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	
Plasticity Index	SP
Linear Shrinkage (%)	1.0
Grading Modulus	1.81
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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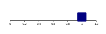
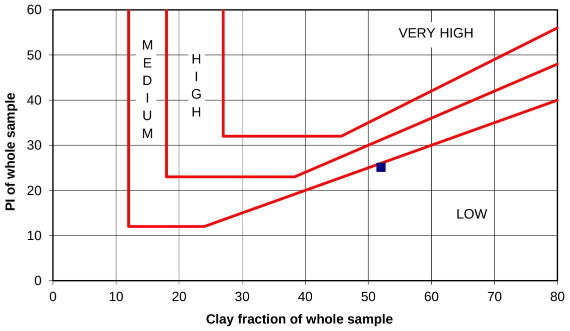
PARTICLE SIZE ANALYSIS

Sample No.	4
Soillab Sample No.	S20-0885-04
Depth (m)	0,3 - 0,7
Position	KF/T9/1
Material Description	DARK REDDISH ORANGE SANDY CLAY
Relative density on < 2 mm **(SANS 5844)**	2.576
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	100
0.425 mm	96
0.075 mm	70
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
54 µm	62
32 µm	58
13 µm	56
6 µm	52
2 µm	45
% Clay	52
% Silt	10
% Sand	38
% Gravel	0
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	52
Plasticity Index	26
Linear Shrinkage (%)	10.5
Grading Modulus	0.34
Classification	A-7-6 (18)
Unified Classification	CH
Chart Reference	

PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

POTENTIAL EXPANSIVENESS



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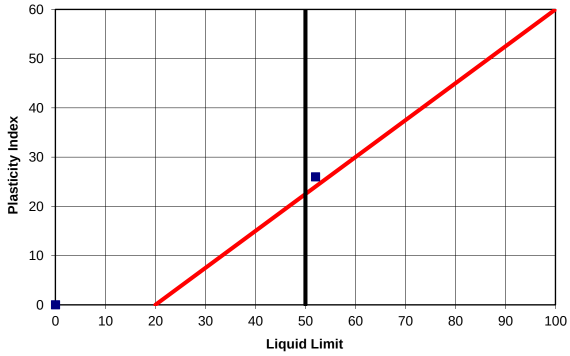
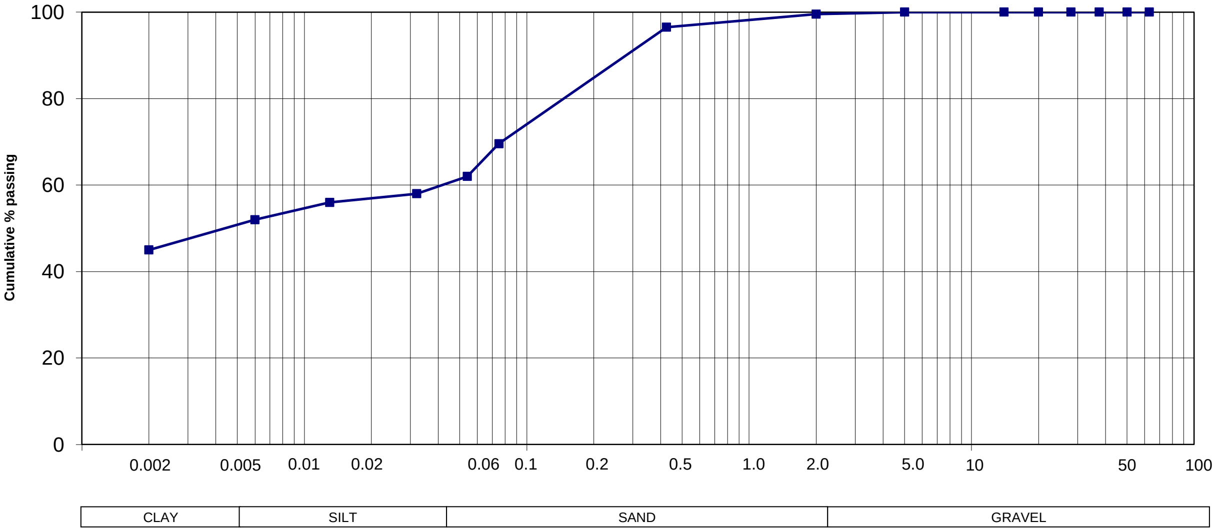


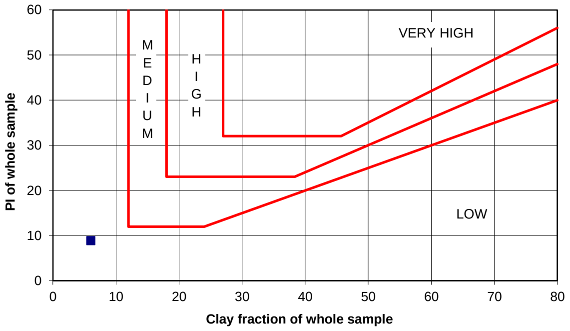


PARTICLE SIZE ANALYSIS

Sample No.	5
Soillab Sample No.	S20-0885-05
Depth (m)	0,6 - 1,9
Position	KF/T11/1
Material Description	LIGHT GREY GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.481
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	95
2.00 mm	78
0.425 mm	55
0.075 mm	20
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
63 µm	18
37 µm	13
15 µm	9
7 µm	6
2 µm	4
% Clay	6
% Silt	12
% Sand	60
% Gravel	22
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	58
Plasticity Index	16
Linear Shrinkage (%)	7.0
Grading Modulus	1.46
Classification	A-2-7 (0)
Unified Classification	SM
Chart Reference	■

PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

POTENTIAL EXPANSIVENESS



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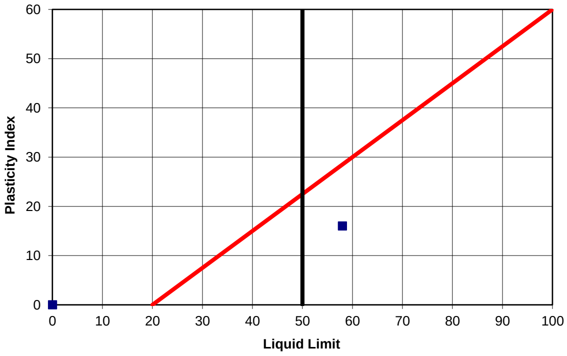

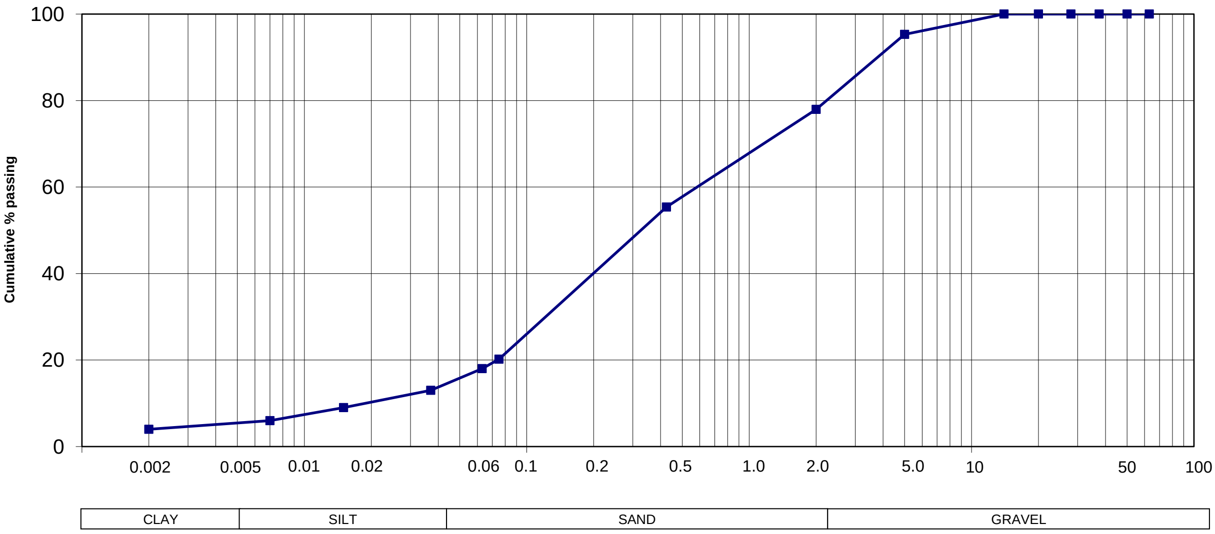

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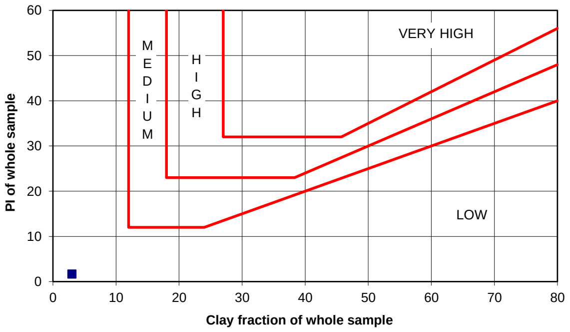
PARTICLE SIZE ANALYSIS

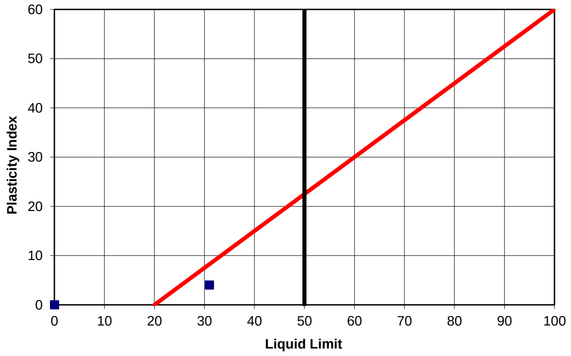
PROJECT : KLIPFONTEIN 1 SOLAR FARM - C1801/30
JOB No. : S20-0885
DATE : 2020-08-12

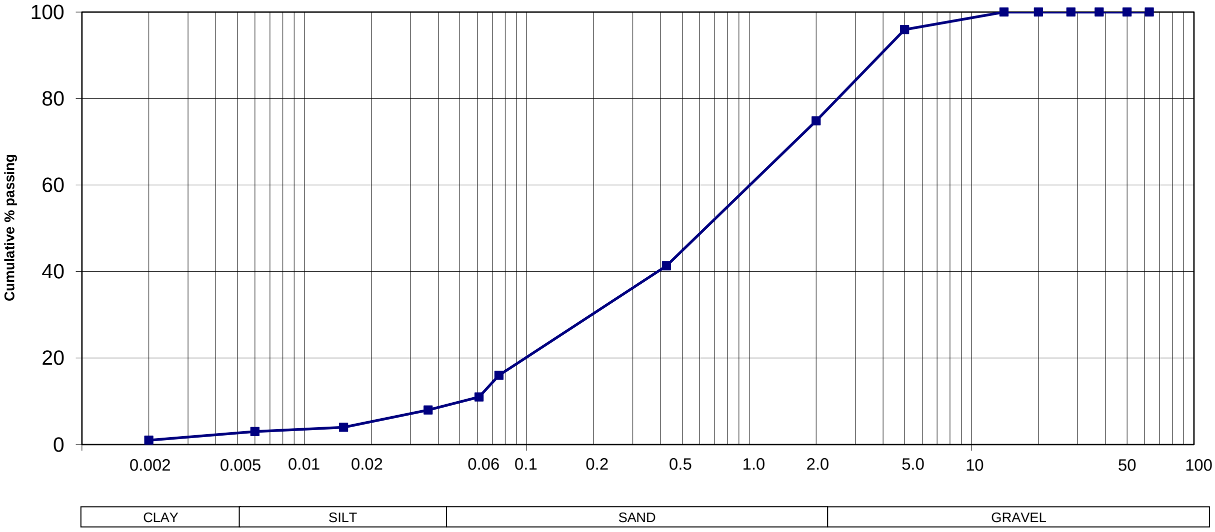
Sample No.	6
Soillab Sample No.	S20-0885-06
Depth (m)	0,4 - 0,8
Position	KF/T18/1
Material Description	LIGHT GREY GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.602
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	96
2.00 mm	75
0.425 mm	41
0.075 mm	16
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
61 µm	11
36 µm	8
15 µm	4
6 µm	3
2 µm	1
% Clay	3
% Silt	8
% Sand	64
% Gravel	25
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	31
Plasticity Index	4
Linear Shrinkage (%)	2.5
Grading Modulus	1.68
Classification	A-1-b (0)
Unified Classification	SM
Chart Reference	■

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Registration Number
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Email: info@soillab.co.za

PO Box 72928, Lynnwood Ridge,
South Africa, 0040

Client: SMEC
Project: KLIPFONTEIN 1 SOLAR FARM - C18018/30
Project No.: S20-0885
Date: 2020-08-12

MOISTURE CONTENT - SANS 3001-GR20

Sample No.:	Description:	Depth (m)	Moisture Content (%)
S20-0885-01	KF/T1/1	0,4 - 1,5	2.7
S20-0885-02	KF/T5/1	0,3 - 0,9	3
S20-0885-03	KF/T7/1	0,3 - 1,4	3.3
S20-0885-04	KF/T9/1	0,3 - 0,7	11.1
S20-0885-05	KF/T11/1	0,6 - 1,9	13.2
S20-0885-06	KF/T18/1	0,4 - 0,8	8.8

Note: Items marked with a star (*) is Not Accredited

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Client: SMEC SA

Project: KLIPFONTEIN 1 SOLAR FARM – C1801/30

Project No.: S20-0885

Date: 2020-07-14

THERMAL CONDUCTIVITY (SANS 10198*)

Sample No.	Moisture Content	Thermal Conductivity (K) W/m.K	Thermal Resistivity (g) K.m/W
S20-0885-01 SAMPLE NO: 01 KF/T1/1 0.4-1.5	**0 %**	0.211	4.743
	2.7% (AS RECEIVED)	0.308	3.249
	5%	0.842	1.187
S20-0885-03 SAMPLE NO: 03 KF/T7/1 0.3-1.4	**0 %**	0.237	4.218
	2 %	0.360	2.786
	3.3% (AS RECEIVED)	0.546	1.831
	5%	0.837	1.194
S20-0885-04 SAMPLE NO: 04 KF/T9/1 0.3-0.7	**0 %**	0.349	2.860
	2 %	0.389	2.569
	5 %	0.536	1.864
	11.1 %(AS RECEIVED)	0.752	1.329
S20-0885-06 SAMPLE NO: 06 KF/T18/1 0.4-0.8	**0 %**	0.255	3.921
	2 %	0.318	3.148
	5 %	0.456	2.194
	8.8%(AS RECEIVED)	0.739	1.353

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Email: info@soillab.co.za

Engineering Materials Laboratory
SMEC Building, 230 Albertus Street
La Montagne, Pretoria, 0184
PO Box 72928, Lynnwood Ridge,
South Africa, 0040

Client: SMEC
Project: KLIPFONTEIN 1 SOLAR FARM - C1801/30
Project No.: S20-0885
Date: 2020/09/03

TEST RESULTS: CHEMICAL

Soillab No	Sample No	Depth (m)	pH (TMH 1 A20)	Electrical Conductivity (TMH 1 A21T)	Cl content (%) *SANS 202	Org. Content (%) *BS 1377-3: 1990	Soluble SO_3 (%) *SANS 5850
S20-0885-01	KF/T1/1	0,4 - 1,5	8,14	0,0195	0,0050	5,06	0,0055
S20-0885-03	KF/T7/1	0,3 - 1,4	7,37	0,0134	0,0046	5,15	0,0041
S20-0885-04	KF/T9/1	0,3 - 0,7	8,33	0,0833	0,0067	6,19	0,0075
S20-0885-06	KF/T18/1	0,4 - 0,8	8,58	0,0241	0,0071	3,90	0,0082

Note: Items marked with a star (*) is Not Accredited

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TABLE 1 RESULTS OF POINT LOAD STRENGTH INDEX TESTS

ROCKLAB
Tel: 0027 12 813 4910
E-mail: Chen@rocklab.co.za

Client: SOILLAB Sampling Site: 17-07-2020

SPECIMEN PARTICULARS				SPECIMEN TEST RESULTS							
ROCKLAB Specimen No 8306-	Sample ID	Sample Depth m	Rock Type	Core Diameter D (mm)	Core Height (mm)	Failue Load P (kN)	Equivalent Core Diameter (mm)	Point Load Strength I_S (MPa)	Corrected $I_{S(50)}$ (MPa)	Test Code	Note
PLT-01	KF/T13/1	2.00 - 9.00		35.97		0.25	35.97	0.19	0.17	1	A
				35.97		0.10	35.97	0.08	0.07	1	A
				35.97		0.60	35.97	0.46	0.40	1	
				35.97		1.10	35.97	0.85	0.73	1	
				35.97		1.35	35.97	1.04	0.90	1	
				35.97		0.35	35.97	0.27	0.23	1	A
PLT-02	KF/T19/1	9.00 - 15.00		36.05		0.35	36.05	0.27	0.23	1	A
				36.05		1.50	36.05	1.15	1.00	1	
				36.05		0.90	36.05	0.69	0.60	1	
				36.05		0.10	36.05	0.08	0.07	1	A

Note: the tests were conducted accoding to the ISRM suggested method.
Test code: 1 - Diametrial loading, 2 - Axial loading

A - specimen was failed on existing cracks /joints

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T0455
REG. No. 1987/004282/07
NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

Enquiries : Bloemfontein
Our ref. : SL / 3092
Your ref. : Soil Classification for Project C1801/30 – Klipfontein 2 Solar Farm, Dealesville, Free State.
File ref. : 020/946(a)
Date : 04/08/2020

ATTENTION: MR. RICHARD ROBERTS

SMEC SOUTH AFRICA (PTY) LIMITED (RANDBURG)
267 Kent Avenue
RANDBURG
2194

Tel. / Cell.: 011 369 0789 / 072 495 0920
E-mail: richard.roberts@smec.com

Sir,

SOIL CLASSIFICATION FOR PROJECT C1801/30, KLIPFONTEIN 2 SOLAR FARM, DEALESVILLE, FREE STATE.

1.) Terms of reference

SMEC SOUTH AFRICA (PTY) LTD (Randburg), Mr Richard Roberts appointed SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) for the soil testing of Project C1801/30 – Klipfontein 2 Solar Farm, Dealesville, Free State, as sampled by client, SMEC SOUTH AFRICA (PTY) LTD, Mr Richard Roberts.

The results for the materials tested by SIMLAB (Pty) Limited (Bloemfontein), can be found in APPENDIX A of this report.

2.) Disclaimer

The opinions expressed, interpretations and recommendations in this Report have been based on the information supplied to SIMLAB (Pty) Limited – Geotechnical Services. (Bloemfontein).

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3.) Test Methods used

SIMLAB (Pty) Limited (Bloemfontein)) (a SANAS Accredited Testing Laboratory – T0455) was instructed to test the following on various samples received: *In Situ* Moisture Content (MC), Foundation Indicator (FI), Maximum Dry Density (MDD), California Bearing Ratio (CBR), pH-Value (pH) and Electrical Conductivity (EC). These tests are used to determine the Engineering Properties of the materials. These tests were conducted from the 22nd of July 2020 to the 3rd of August 2020.

Please visit the SIMLAB or SANAS website for more information regarding SANAS Accreditation. www.simlab.co.za or www.sanas.co.za

Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples).
- * TMH1 : 1986, A20 – The electronic determination of the pH value of a soil suspension
- * TMH1 : 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of SIMLAB (Pty) Limited – Geotechnical Services.

4.) Appendices

APPENDIX A – LABORATORY TEST RESULTS

We trust this meets with your requirements. Should you require further information in this regard, please do not hesitate to contact us.

WT HITGE (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

APPENDIX A

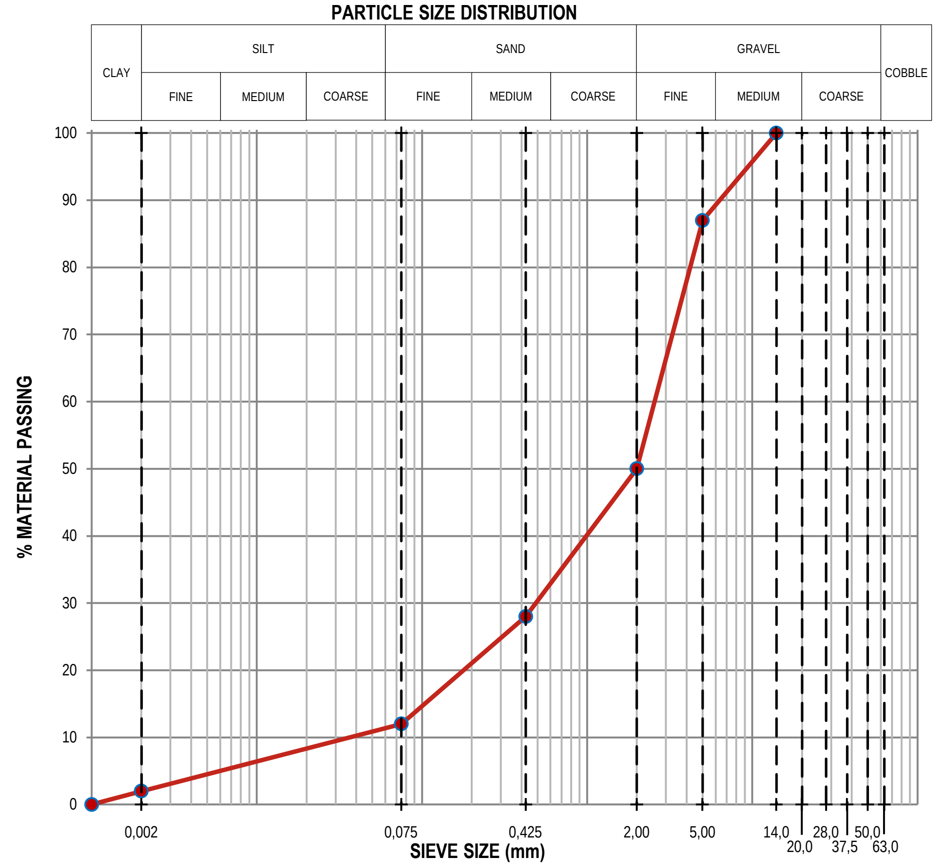
LABORATORY TEST RESULTS

(Particle Size Distribution) (Material Classification)

MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Klipfontein 2	**MATERIAL DEPTH** (mm) **:**	800 - 1700	**SAMPLE No / LABORATORY No.:**	KF2/T4/1 / 020/946
MATERIAL DESCRIPTION :	Well-graded SAND with silty CLAY and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)			3,0
SIEVE ANALYSIS SANS 3001 - GR1 : 2013		**SIEVE SIZE**	**% PASSING**
		63,0 mm	
		50,0 mm	
		37,5 mm	
		28,0 mm	
		20,0 mm	
		14,0 mm	100
		5,00 mm	87
		2,00 mm	50
		0,425 mm	28
		0,075 mm	12
TMH1: METHOD A6		**0,002 mm**	2
SANS 3001 PR5: 2011		**GRADING MODULUS** (GM)	2,10
	SOIL MORTAR	**COARSE SAND**	43
		FINE SAND (Course)	9
		FINE SAND (Medium)	9
		FINE SAND (Fine)	15
		SILT AND CLAY (<0.075mm)	24
ATTERBERG LIMITS	**MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011**	**L.L.** (%)	25
		P.I. (%)	6
		L.S. (%)	2,5
*** MEASURES OF GRADATIONS**		C_U (ASTM D2487)	94,0
		C_C (ASTM D2487)	2,0
		% Clay (>0.002mm)	2
		% Silt (0.075 - 0.002mm)	10
		% Sand (0.075 - 2.0mm)	38
		% Gravel (>2.0mm)	50
CBR DETERMINATION SANS 3001 - GR 40: 2013		**MAX. DRY DENSITY** (kg/m³)	2290
		OPTIMUM MOISTURE (%)	7,5
		SWELL (%)	0,0
		CBR @ 100% (%)	52
		CBR @ 98% (%)	42
		CBR @ 95% (%)	31
		CBR @ 93% (%)	25
		CBR @ 90% (%)	18
PROCTOR MAX. DRY DENSITY (kg/m³)			
COMPACTIBILITY (Ratio) (SABS 1200 LB)			
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)			0,0407
pH VALUE (TMH1: Method A21)			7,55
POTENTIAL EXPANSIVENESS			Low - 0.0mm
AASHTO SOIL CLASSIFICATION			A-1-a (0)
UNIFIED SOIL CLASSIFICATION			SW-SC
COLTO CLASSIFCATION			G6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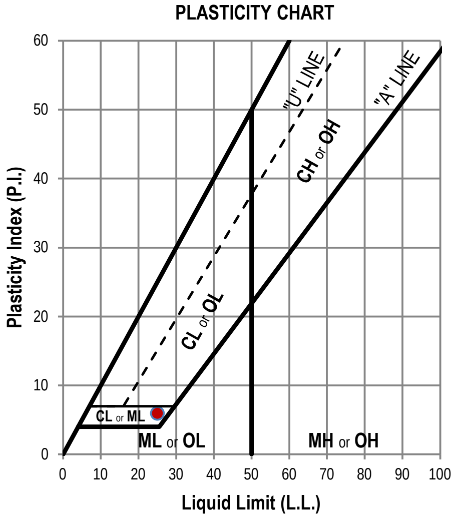
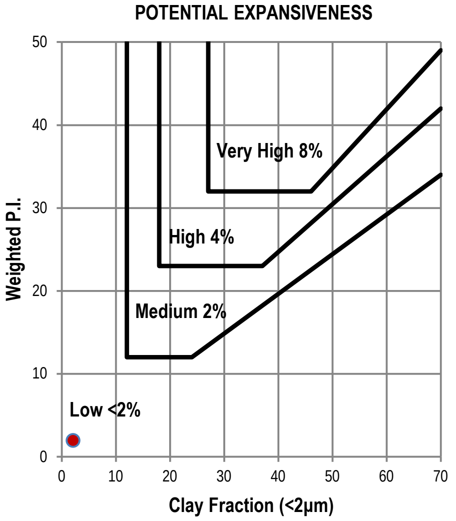

PLASTICITY CHART


POTENTIAL EXPANSIVENESS

REMARKS.:

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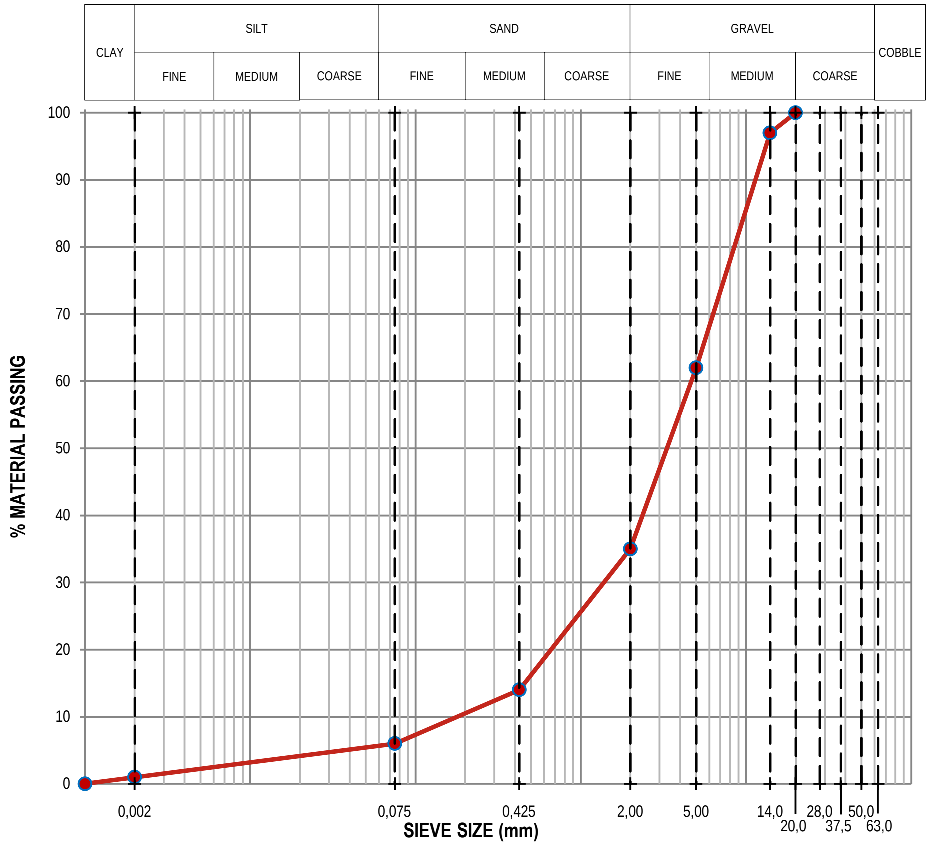
MATERIAL CLASSIFICATION TEST RESULTS

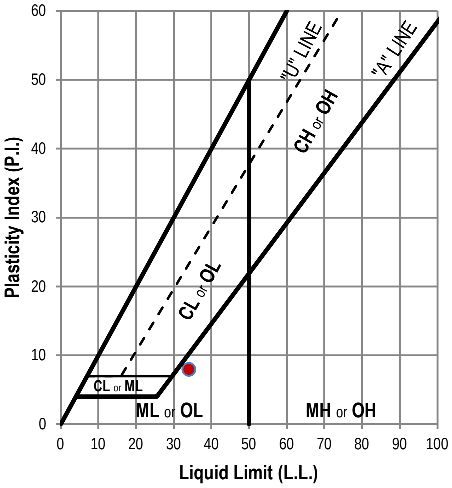
TEST PIT / HOLE No.:	Farm Klipfontein 2	**MATERIAL DEPTH** (mm) :	400 - 1200	**SAMPLE No / LABORATORY No.:**	KF2/T9/1 / 020/947
MATERIAL DESCRIPTION :	Poorly graded SAND with silt and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		2,9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	100
	14,0 mm	97
	5,00 mm	62
	2,00 mm	35
	0,425 mm	14
	0,075 mm	6
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,45
SOIL MORTAR	**COARSE SAND**	61
	FINE SAND (Course)	6
	FINE SAND (Medium)	6
	FINE SAND (Fine)	8
	SILT AND CLAY (<0.075mm)	18
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	34
	P.I. (%)	8
	L.S. (%)	4,5
* MEASURES OF GRADATIONS	**C_U** (ASTM D2487)	67,7
	C_C (ASTM D2487)	0,9
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	29
	% Gravel (>2.0mm)	65
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2314
	OPTIMUM MOISTURE (%)	8,3
	SWELL (%)	0,0
	CBR @ 100% (%)	61
	CBR @ 98% (%)	53
	CBR @ 95% (%)	43
	CBR @ 93% (%)	37
	CBR @ 90% (%)	30
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0514
pH VALUE (TMH1: Method A21)		7,48
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		SP-SM
COLTO CLASSIFCATION		G6

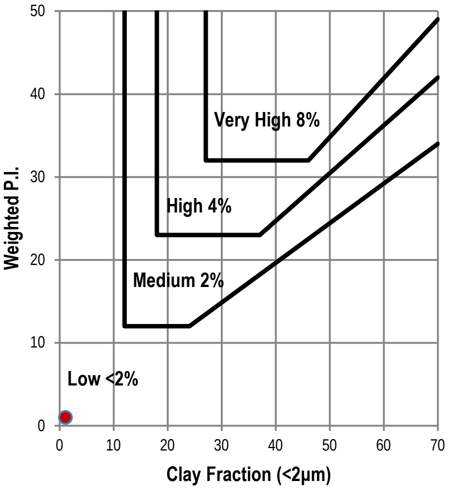
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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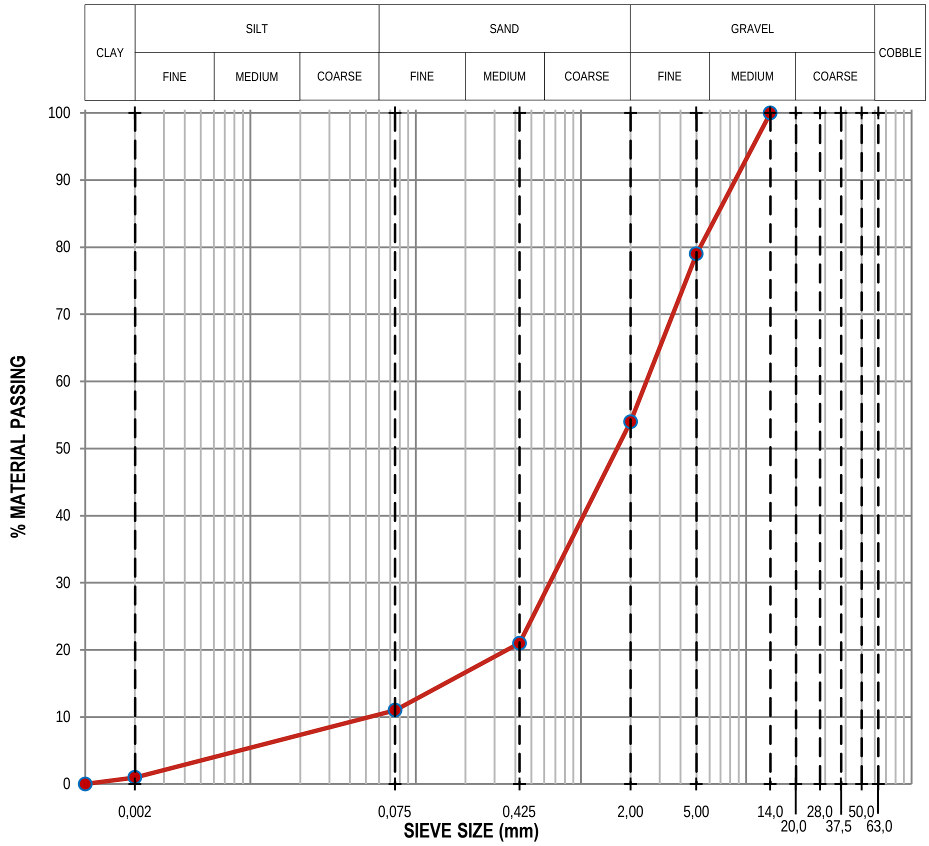
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Klipfontein 2	**MATERIAL DEPTH** (mm) **:**	600 - 1700	**SAMPLE No / LABORATORY No.:**	KF2/T12/1 / 020/948
MATERIAL DESCRIPTION :	Well-graded SAND with silt and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		3,2
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	
	14,0 mm	100
	5,00 mm	79
	2,00 mm	54
	0,425 mm	21
	0,075 mm	11
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,14
SOIL MORTAR	**COARSE SAND**	61
	FINE SAND (Course)	6
	FINE SAND (Medium)	5
	FINE SAND (Fine)	7
	SILT AND CLAY (<0.075mm)	20
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	32
	P.I. (%)	8
	L.S. (%)	4,0
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	61,3
	C_C (ASTM D2487)	2,5
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	10
	% Sand (0.075 - 2.0mm)	43
	% Gravel (>2.0mm)	46
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m^3)	2253
	OPTIMUM MOISTURE (%)	7,5
	SWELL (%)	0,0
	CBR @ 100% (%)	81
	CBR @ 98% (%)	63
	CBR @ 95% (%)	44
	CBR @ 93% (%)	34
	CBR @ 90% (%)	24
PROCTOR MAX. DRY DENSITY (kg/m^3)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm^{-1}) (TMH1: Method A20)		0,0356
pH VALUE (TMH1: Method A21)		7,51
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		SW-SM
COLTO CLASSIFCATION		G6

PARTICLE SIZE DISTRIBUTION



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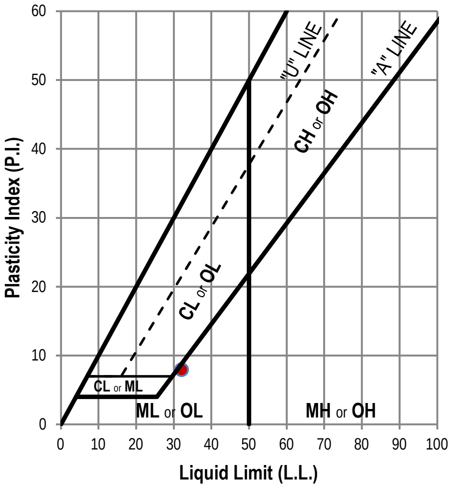
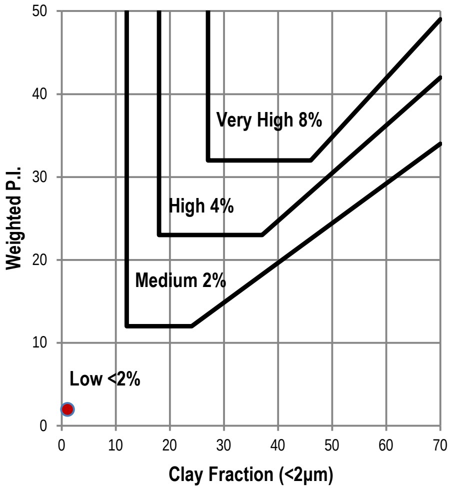


POTENTIAL EXPANSIVENESS



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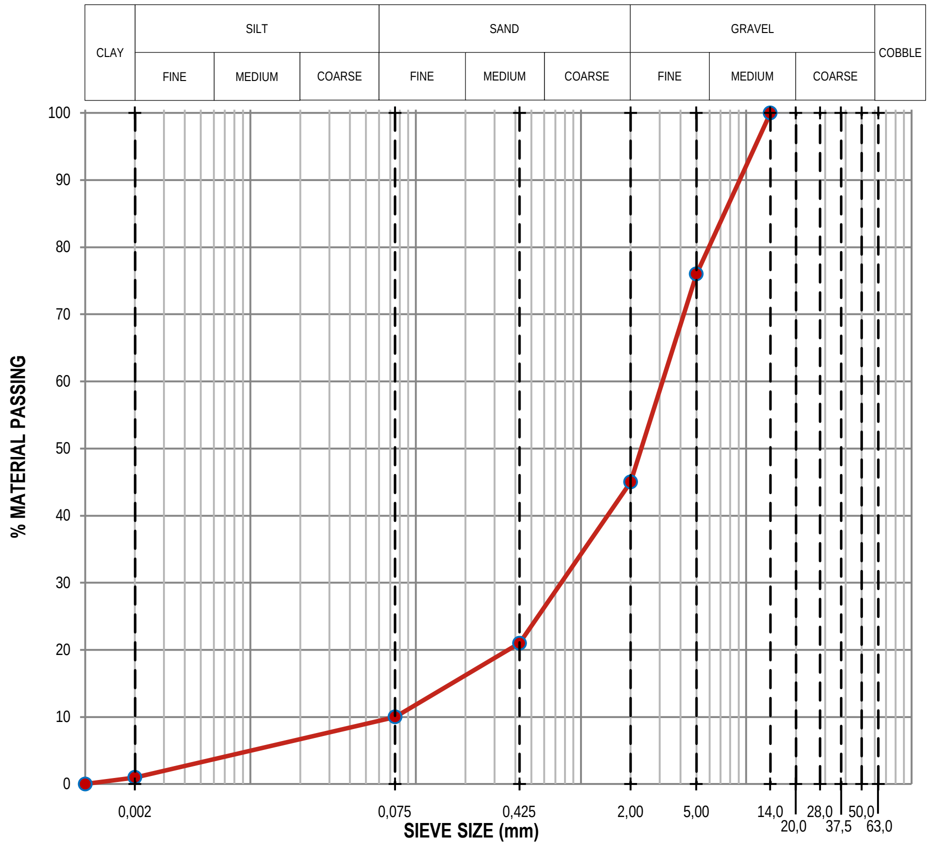
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Klipfontein 2	**MATERIAL DEPTH** (mm) :	1000 - 3000	**SAMPLE No / LABORATORY No.:**	KF2/T16/1 / 020/949
MATERIAL DESCRIPTION :	Well-graded SAND with CLAY and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		3,1
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	
	14,0 mm	100
	5,00 mm	76
	2,00 mm	45
	0,425 mm	21
	0,075 mm	10
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,24
SOIL MORTAR	**COARSE SAND**	52
	FINE SAND (Course)	9
	FINE SAND (Medium)	7
	FINE SAND (Fine)	11
	SILT AND CLAY (<0.075mm)	21
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	33
	P.I. (%)	10
	L.S. (%)	5,5
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	68,4
	C_C (ASTM D2487)	1,5
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	9
	% Sand (0.075 - 2.0mm)	35
	% Gravel (>2.0mm)	55
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m^3)	2280
	OPTIMUM MOISTURE (%)	7,8
	SWELL (%)	0,0
	CBR @ 100% (%)	62
	CBR @ 98% (%)	53
	CBR @ 95% (%)	41
	CBR @ 93% (%)	32
	CBR @ 90% (%)	19
PROCTOR MAX. DRY DENSITY (kg/m^3)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm^{-1}) (TMH1: Method A20)		0,0527
pH VALUE (TMH1: Method A21)		7,52
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		SW-SC
COLTO CLASSIFCATION		G6

PARTICLE SIZE DISTRIBUTION



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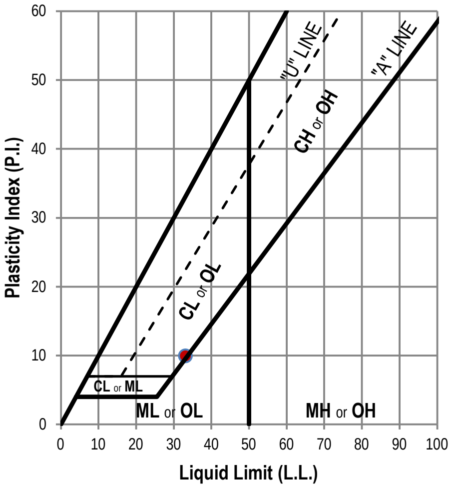
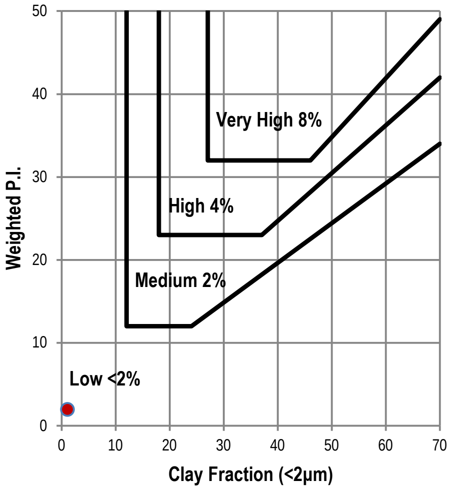


POTENTIAL EXPANSIVENESS



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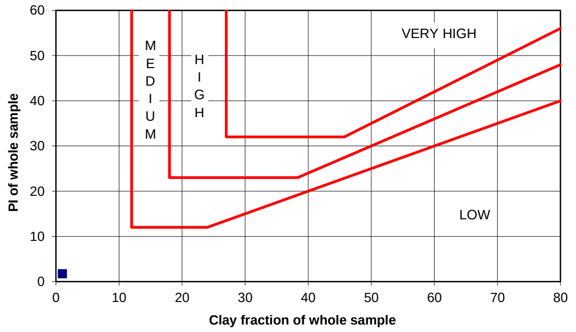
PARTICLE SIZE ANALYSIS

Sample No.	1
Soillab Sample No.	S20-0884-01
Depth (m)	0,5 - 1,4
Position	KF2/T1/1
Material Description	DARK REDDISH ORANGE SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.64
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	92
2.00 mm	50
0.425 mm	19
0.075 mm	9
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
62 µm	4
36 µm	3
15 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	3
% Sand	46
% Gravel	50
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	34
Plasticity Index	9
Linear Shrinkage (%)	3.0
Grading Modulus	2.21
Classification	A-2-4 (0)
Unified Classification	SW - SM
Chart Reference	■

PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



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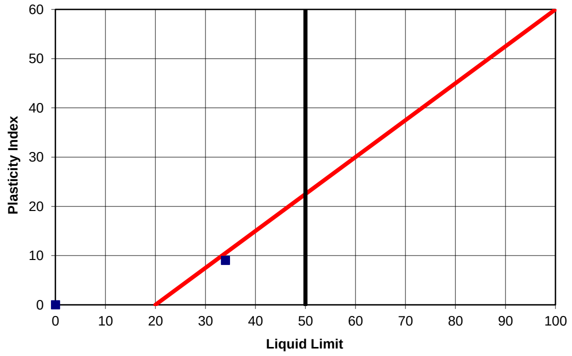

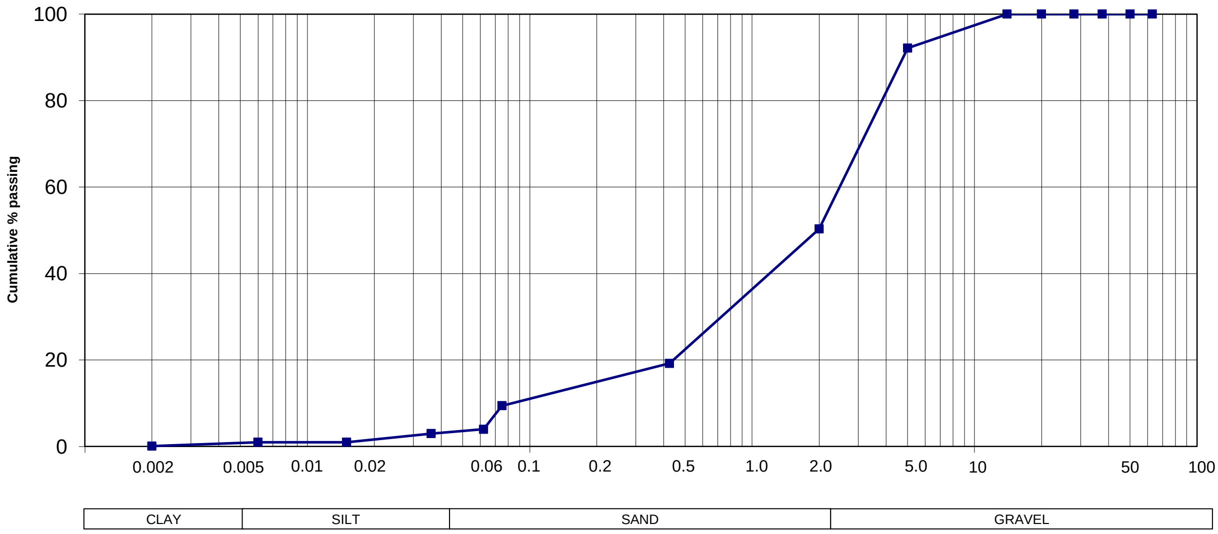

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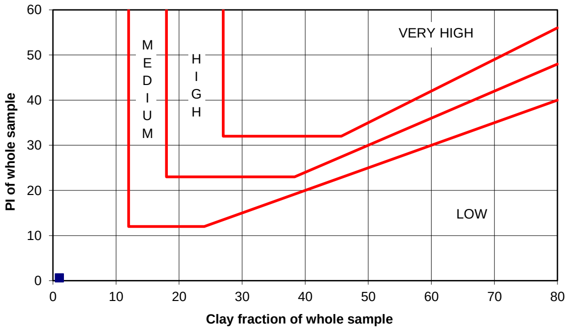
PARTICLE SIZE ANALYSIS

Sample No.	2
Soillab Sample No.	S20-0884-02
Depth (m)	0,3 - 0,9
Position	KF2/T3/1
Material Description	DUSKY RED GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.577
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	96
2.00 mm	59
0.425 mm	20
0.075 mm	7
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
63 µm	4
37 µm	3
15 µm	1
7 µm	1
2 µm	0
% Clay	1
% Silt	3
% Sand	55
% Gravel	41
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	26
Plasticity Index	3
Linear Shrinkage (%)	2.0
Grading Modulus	2.14
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	

PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



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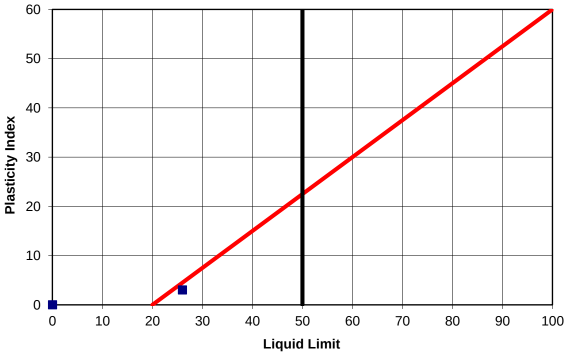

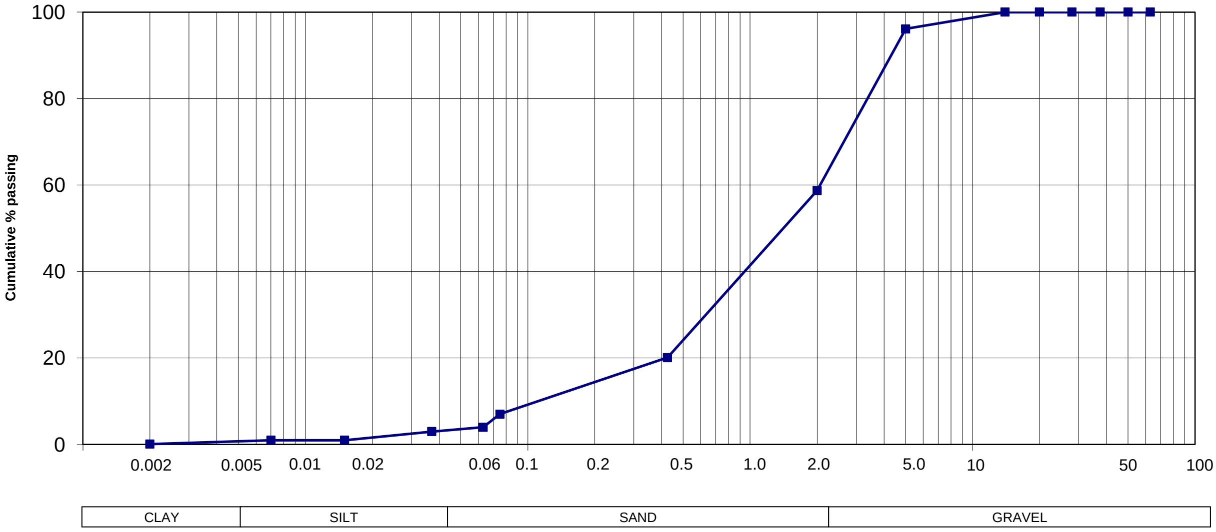

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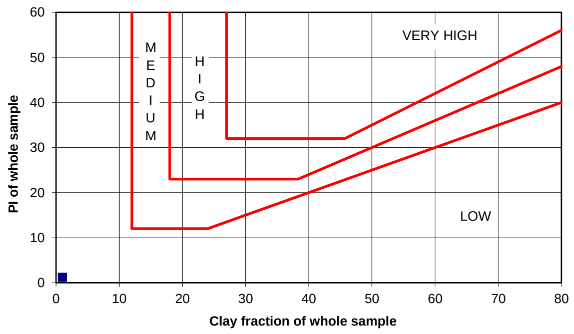
PARTICLE SIZE ANALYSIS

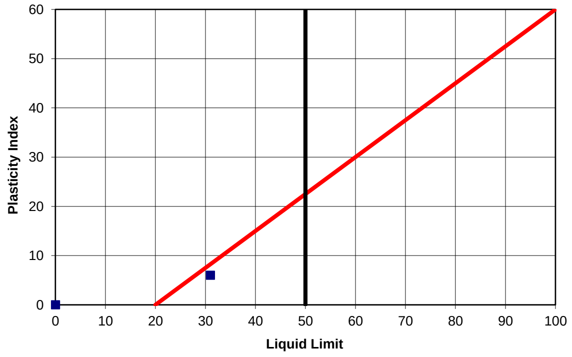
Sample No.	3
Soillab Sample No.	S20-0884-03
Depth (m)	0,4 - 1,0
Position	KF2/T5/1
Material Description	DUSKY RED GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.698
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	94
2.00 mm	54
0.425 mm	20
0.075 mm	10
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
61 µm	5
35 µm	4
15 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	4
% Sand	49
% Gravel	46
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	31
Plasticity Index	6
Linear Shrinkage (%)	3.5
Grading Modulus	2.15
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	

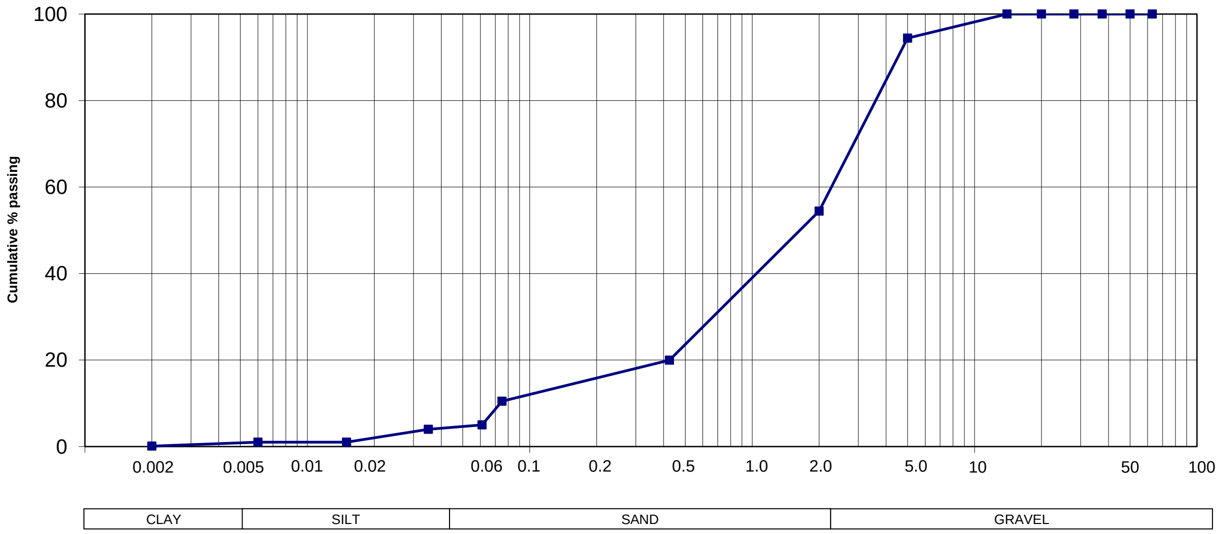
PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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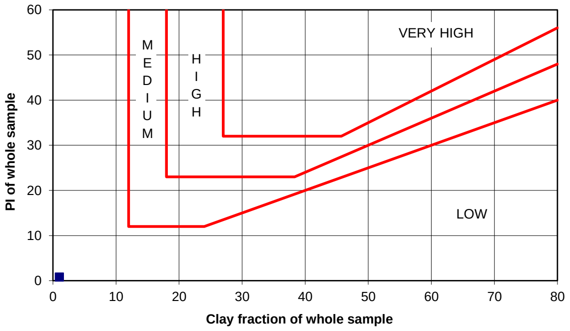
PARTICLE SIZE ANALYSIS

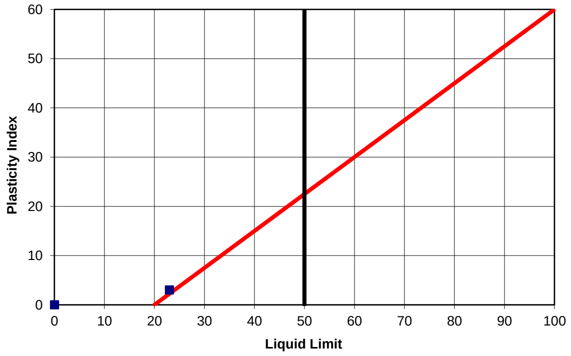
Sample No.	4
Soillab Sample No.	S20-0884-04
Depth (m)	0,4 - 1,1
Position	KF2/T8/1
Material Description	DUSKY RED GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.611
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	96
2.00 mm	63
0.425 mm	26
0.075 mm	8
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
63 µm	5
37 µm	4
15 µm	2
7 µm	1
2 µm	1
% Clay	1
% Silt	4
% Sand	58
% Gravel	37
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	23
Plasticity Index	3
Linear Shrinkage (%)	2.0
Grading Modulus	2.02
Classification	A-1-b (0)
Unified Classification	SW - SM
Chart Reference	■

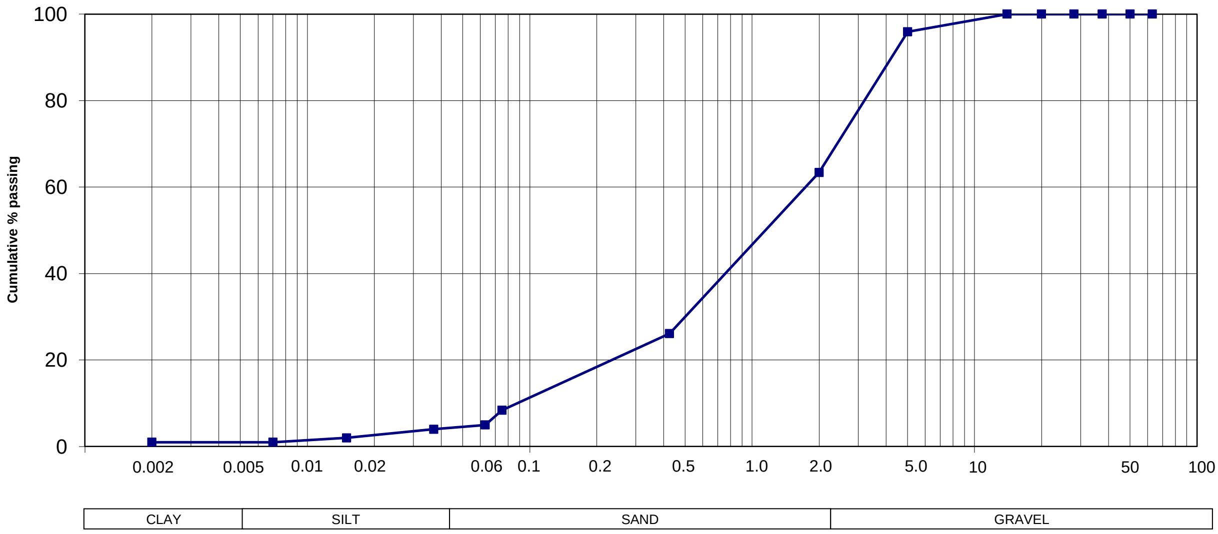
PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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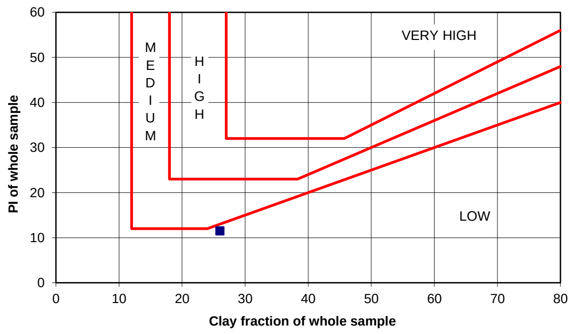
PARTICLE SIZE ANALYSIS

Sample No.	5
Soillab Sample No.	S20-0884-05
Depth (m)	1,1 - 1,8
Position	KF2/T14/1
Material Description	DARK OLIVE GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.6
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	99
20.0 mm	99
14.0 mm	99
5.0 mm	92
2.00 mm	72
0.425 mm	55
0.075 mm	36
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
53 µm	37
31 µm	35
13 µm	29
6 µm	26
2 µm	21
% Clay	26
% Silt	11
% Sand	35
% Gravel	28
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	45
Plasticity Index	21
Linear Shrinkage (%)	10.0
Grading Modulus	1.37
Classification	A-7-6 (3)
Unified Classification	SC
Chart Reference	

PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



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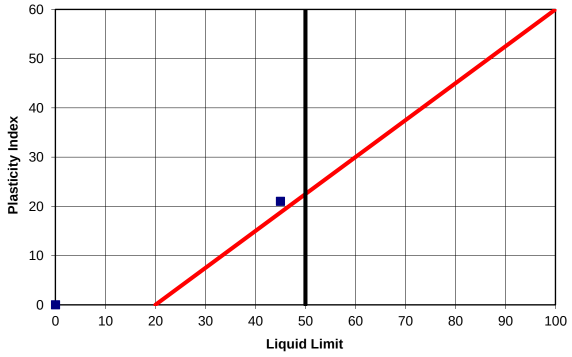

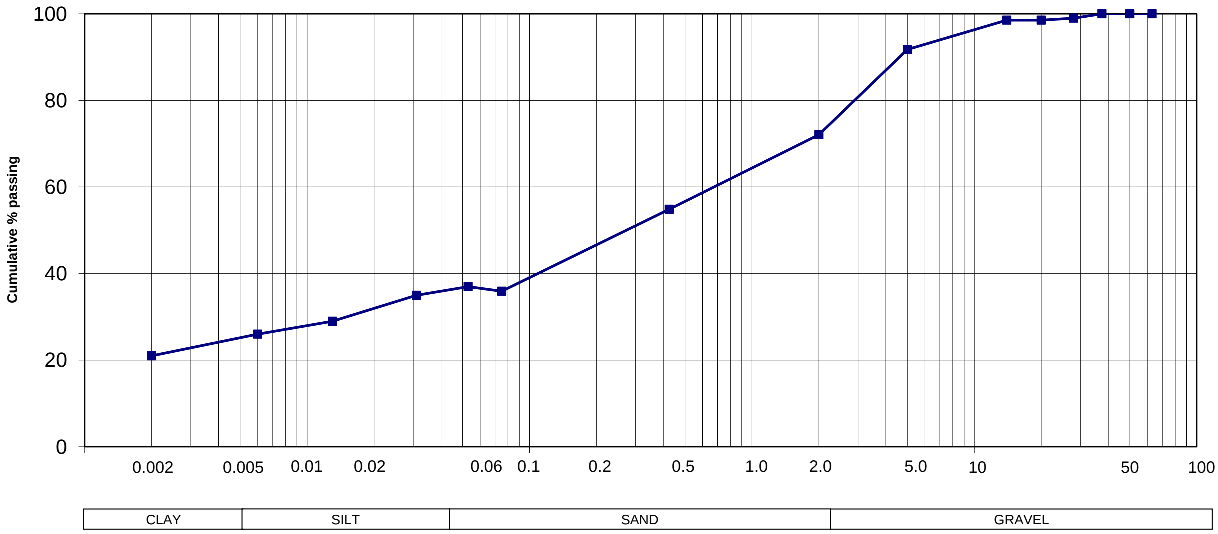

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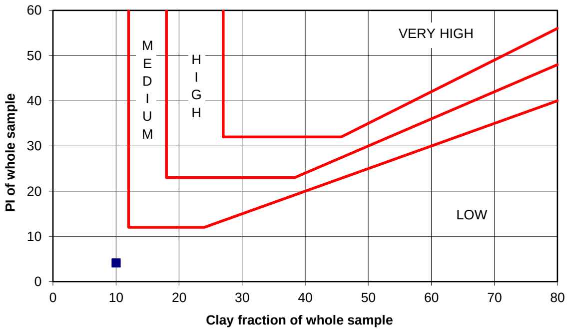
PARTICLE SIZE ANALYSIS

Sample No.	6
Soillab Sample No.	S20-0884-06
Depth (m)	1,0 - 3,0
Position	KF2/T16/1
Material Description	LIGHT OLIVE SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.632
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	97
28.0 mm	94
20.0 mm	83
14.0 mm	83
5.0 mm	73
2.00 mm	40
0.425 mm	19
0.075 mm	14
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
49 µm	15
28 µm	15
12 µm	12
5 µm	10
2 µm	6
% Clay	10
% Silt	5
% Sand	25
% Gravel	60
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	52
Plasticity Index	22
Linear Shrinkage (%)	10.0
Grading Modulus	2.26
Classification	A-2-7 (0)
Unified Classification	SM
Chart Reference	■

PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



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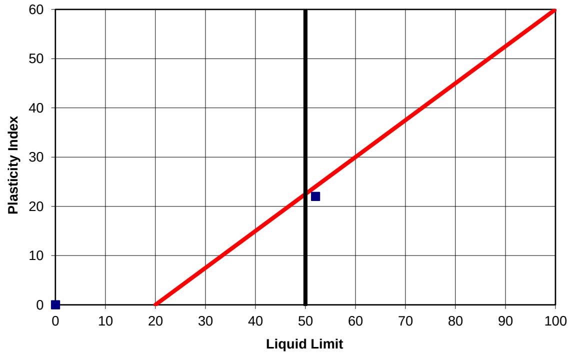

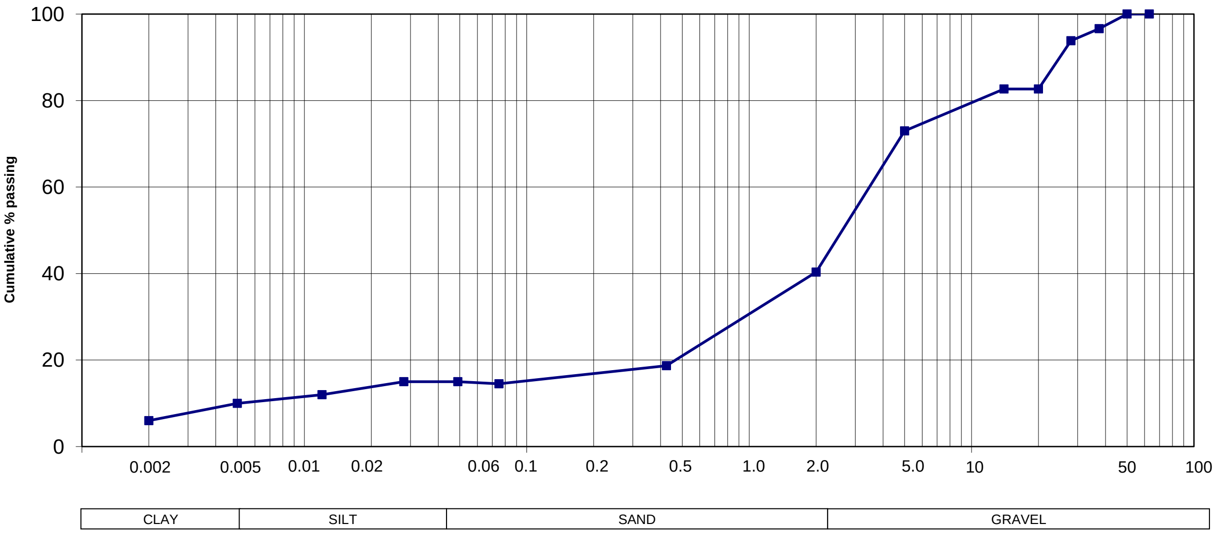

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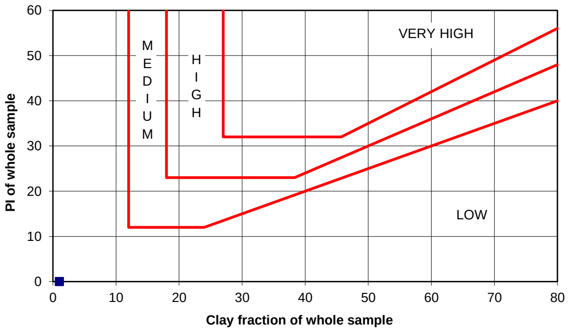
PARTICLE SIZE ANALYSIS

Sample No.	7
Soillab Sample No.	S20-0884-07
Depth (m)	0,5 - 1,3
Position	KF2/T17/1
Material Description	DARK RED GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.606
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	99
2.00 mm	85
0.425 mm	73
0.075 mm	13
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
64 µm	8
37 µm	5
15 µm	1
6 µm	1
2 µm	0
% Clay	1
% Silt	7
% Sand	77
% Gravel	15
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	
Plasticity Index	NP
Linear Shrinkage (%)	0.0
Grading Modulus	1.29
Classification	A-2-4 (0)
Unified Classification	SM
Chart Reference	

PROJECT : KLIPFONTEIN 1 SOLAR FARM
JOB No. : S20-0884
DATE : 2020/08/12

POTENTIAL EXPANSIVENESS



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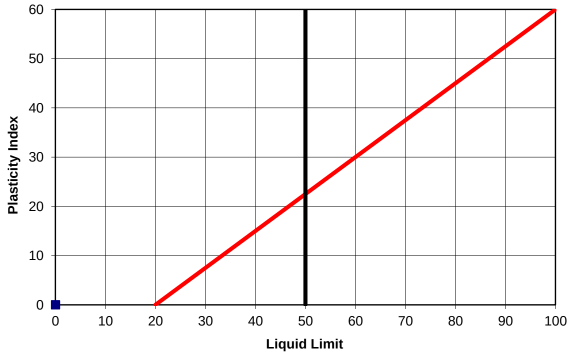

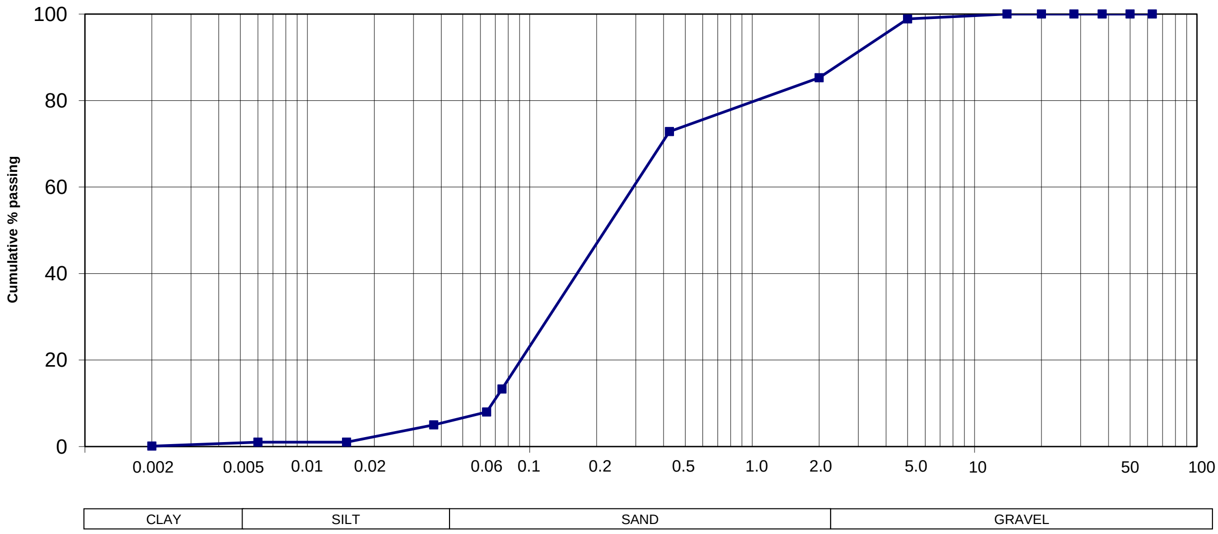

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South Africa, 0040

Client: SMEC
Project: KLIPFONTEIN 1 SOLAR FARM - C1801/30
Project No.: S20-0884
Date: 2020-08-12

MOISTURE CONTENT - SANS 3001-GR20

Sample No.:	Description:	Depth (m)	Moisture Content (%)
S20-0884-01	KF2/T1/1	0,5 - 1,4	4.3
S20-0884-02	KF2/T3/1	0,3 - 0,9	3.4
S20-0884-03	KF2/T5/1	0,4 - 1,0	3.1
S20-0884-04	KF2/T8/1	0,4 - 1,1	2.5
S20-0884-05	KF2/T14/1	1,1 - 1,8	9.0
S20-0884-06	KF2/T16/1	1,0 - 3,0	9.4
S20-0884-07	KF2/T17/1	0,5 - 1,3	6.6

Note: Items marked with a star (*) is Not Accredited

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South Africa, 0040

Client: SMEC
Project: KLIPFONTEIN 1 SOLAR FARM - C1801/30
Project No.: S20-0884
Date: 2020-08-21

TEST RESULTS: CHEMICAL

Soillab No	Sample No	Depth (m)	pH (TMH 1 A20)	Electrical Conductivity (TMH 1 A21T)	Cl content (%) *SANS 202	Org. Content (%) BS 1377-3: 1990	Soluble SO_3 (%) *SANS 5850
S20-0884-01	KF2/T1/1	0.5-1.4	8.06	0.0264	0.0067	4.27	0.0096
S20-0884-03	KF2/T5/1	0.4-1.0	7.72	0.0184	0.0071	3.62	0.0075
S20-0884-05	KF2/T14/1	1.1-1.8	8.14	0.3060	0.0092	3.67	0.0319
S20-0884-07	KF2/T17/1	0.5-1.3	8.31	0.0516	0.0067	2.88	0.0140

Note: Items marked with a star (*) is Not Accredited

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Client: SMEC SA

Project: KLIPFONTEIN 1 SOLAR FARM – C1801/30

Project No.: S20-0884

Date: 2020-07-15

THERMAL CONDUCTIVITY (SANS 10198*)

Sample No.	Moisture Content	Thermal Conductivity (K) W/m.K	Thermal Resistivity (g) K.m/W
S20-0884-01 SAMPLE NO: 01 KF2/T3/1 0.5 – 1.4	**0 %**	0.273	3.662
	2%	0.282	3.556
	4.3% (AS RECEIVED)	0.617	1.620
	5%	0.637	1.572
S20-0884-03 SAMPLE NO: 03 KF2/T5/1 0.4 – 1.0	**0 %**	0.274	3.647
	2 %	0.371	2.705
	3.1% (AS RECEIVED)	0.541	1.847
	5%	0.956	1.014
S20-0884-05 SAMPLE NO: 05 KF2/T14/1 1.1 – 1.8	**0 %**	0.192	5.211
	2 %	0.428	2.350
	5 % (AS RECEIVED)	0.700	1.429
	9%	1.101	0.909
S20-0884-07 SAMPLE NO: 07 KF2/T17/1 0.5 – 1.3	**0 %**	0.317	3.149
	2 %	0.377	2.664
	5 %	0.716	1.393
	6.6%(AS RECEIVED)	1.101	0.908

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
sanas Testing Laboratory
T0455
REG. No. 1987/004282/07
NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

Enquiries : Bloemfontein
Our ref. : SL / 3092
Your ref. : Soil Classification for Project C1801/30 – Leliehoek Solar Farm, Dealesville, Free State.
File ref. : 020/982(a)
Date : 25/08/2020

ATTENTION: MR. RICHARD ROBERTS

SMEC SOUTH AFRICA (PTY) LIMITED (RANDBURG)
267 Kent Avenue
RANDBURG
2194

Tel. / Cell.: 011 369 0789 / 072 495 0920
E-mail: richard.roberts@smec.com

Sir,

SOIL CLASSIFICATION FOR PROJECT C1801/30, LELIEHOEK SOLAR FARM, DEALESVILLE, FREE STATE.

1.) Terms of reference

SMEC SOUTH AFRICA (PTY) LTD (Randburg), Mr Richard Roberts appointed SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) for the soil testing of Project C1801/30 – Leliehoek Solar Farm, Dealesville, Free State, as sampled by client, SMEC SOUTH AFRICA (PTY) LTD, Mr Richard Roberts.

The results for the materials tested by SIMLAB (Pty) Limited (Bloemfontein), can be found in APPENDIX A of this report.

2.) Disclaimer

The opinions expressed, interpretations and recommendations in this Report have been based on the information supplied to SIMLAB (Pty) Limited – Geotechnical Services. (Bloemfontein).

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3.) Test Methods used

SIMLAB (Pty) Limited (Bloemfontein)) (a SANAS Accredited Testing Laboratory – T0455) was instructed to test the following on various samples received: *In Situ* Moisture Content (MC), Foundation Indicator (FI), Maximum Dry Density (MDD), California Bearing Ratio (CBR), pH-Value (pH) and Electrical Conductivity (EC). These tests are used to determine the Engineering Properties of the materials. These tests were conducted from the 24th of July 2020 to the 3rd of August 2020 and pH on the 25th of August 2020.

Please visit the SIMLAB or SANAS website for more information regarding SANAS Accreditation. www.simlab.co.za or www.sanas.co.za

Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples).
- * TMH1 : 1986, A20 – The electronic determination of the pH value of a soil suspension
- * TMH1 : 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of SIMLAB (Pty) Limited – Geotechnical Services.

4.) Appendices

APPENDIX A – LABORATORY TEST RESULTS

We trust this meets with your requirements. Should you require further information in this regard, please do not hesitate to contact us.

WT HITGE (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

APPENDIX A

LABORATORY TEST RESULTS

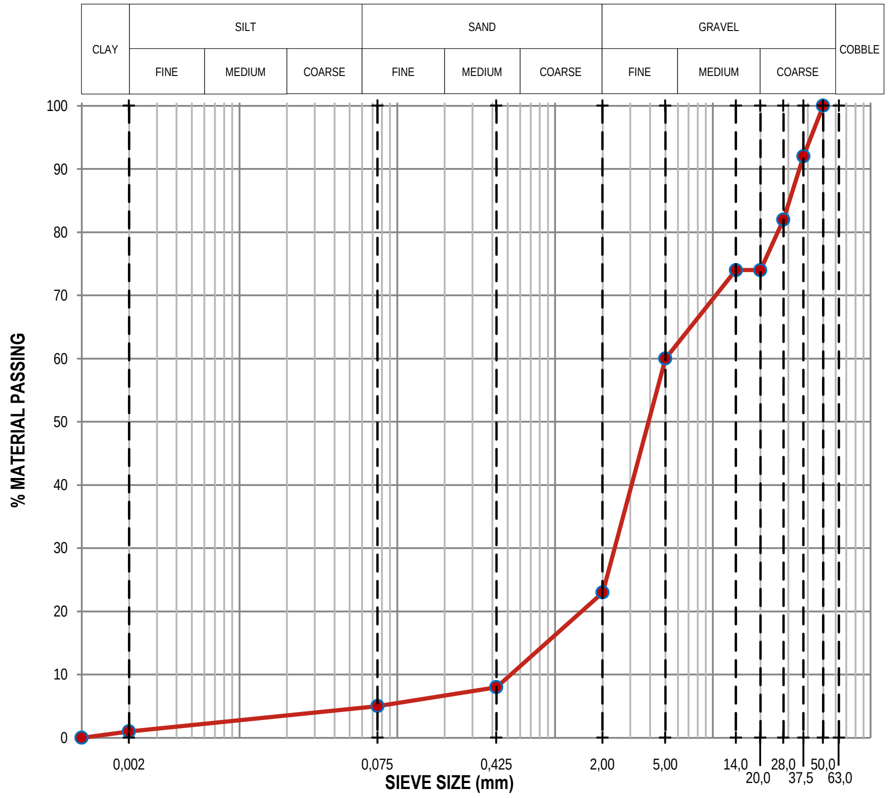
(Particle Size Distribution) (Material Classification)

MATERIAL CLASSIFICATION TEST RESULTS

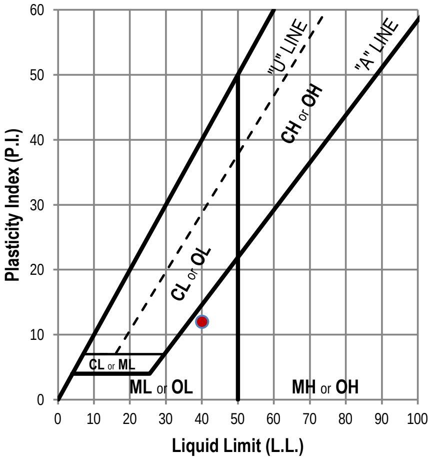
TEST PIT / HOLE No.:	Farm Leliehoek	**MATERIAL DEPTH** (mm) **:**	300 - 2700	**SAMPLE No / LABORATORY No.:**	LH/T5/1 / 020/982
MATERIAL DESCRIPTION :	Well-graded SAND with silt and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		9,7
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	100
	37,5 mm	92
	28,0 mm	82
	20,0 mm	74
	14,0 mm	74
	5,00 mm	60
	2,00 mm	23
	0,425 mm	8
	0,075 mm	5
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,64
SOIL MORTAR	**COARSE SAND**	65
	FINE SAND (Course)	7
	FINE SAND (Medium)	4
	FINE SAND (Fine)	2
	SILT AND CLAY (<0.075mm)	23
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	40
	P.I. (%)	12
	L.S. (%)	6,0
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	9,6
	C_C (ASTM D2487)	2,2
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	4
	% Sand (0.075 - 2.0mm)	18
	% Gravel (>2.0mm)	77
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1810
	OPTIMUM MOISTURE (%)	11,0
	SWELL (%)	0,1
	CBR @ 100% (%)	20
	CBR @ 98% (%)	17
	CBR @ 95% (%)	14
	CBR @ 93% (%)	12
	CBR @ 90% (%)	10
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0578
pH VALUE (TMH1: Method A21)		7,85
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-6 (0)
UNIFIED SOIL CLASSIFICATION		SW-SM
COLTO CLASSIFCATION		G8

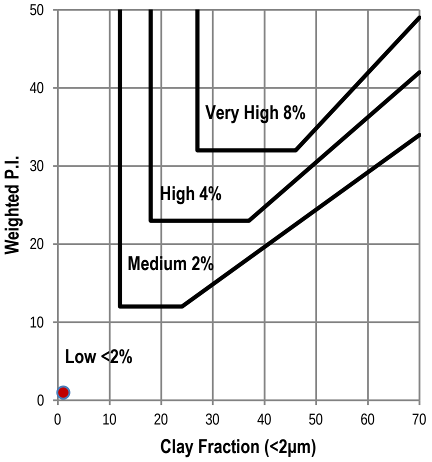
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



REMARKS.:

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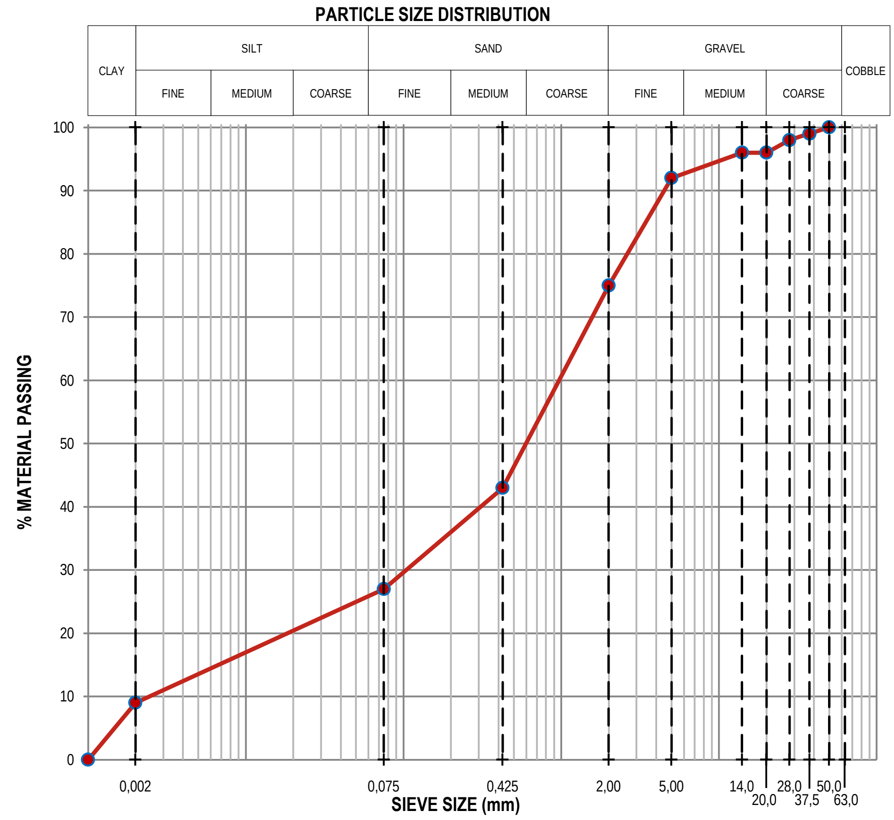
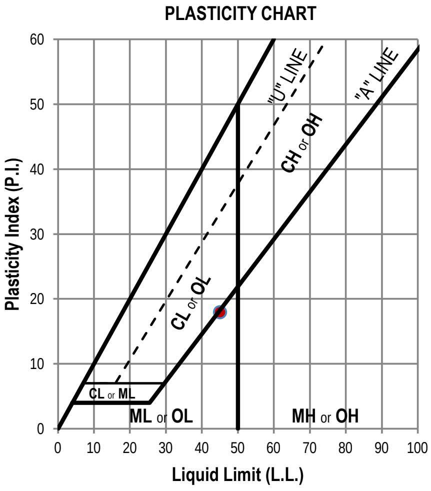
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

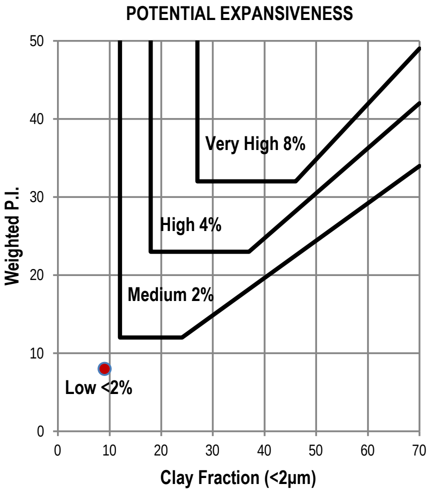
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Leliehoek	**MATERIAL DEPTH** (mm) **:**	800 - 2500	**SAMPLE No / LABORATORY No.:**	LH/T9/1 / 020/983
MATERIAL DESCRIPTION :	Silty SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		9,7
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	100
	37,5 mm	99
	28,0 mm	98
	20,0 mm	96
	14,0 mm	96
	5,00 mm	92
	2,00 mm	75
	0,425 mm	43
	0,075 mm	27
TMH1: METHOD A6	**0,002 mm**	9
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	1,55
SOIL MORTAR	**COARSE SAND**	43
	FINE SAND (Course)	10
	FINE SAND (Medium)	7
	FINE SAND (Fine)	4
	SILT AND CLAY (<0.075mm)	36
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	45
	P.I. (%)	18
	L.S. (%)	9,0
*** MEASURES OF GRADATIONS**	**C_U** (ASTM D2487)	787,0
	C_C (ASTM D2487)	3,4
	% Clay (>0.002mm)	9
	% Silt (0.075 - 0.002mm)	18
	% Sand (0.075 - 2.0mm)	48
	% Gravel (>2.0mm)	25
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m^3)	1912
	OPTIMUM MOISTURE (%)	14,0
	SWELL (%)	0,7
	CBR @ 100% (%)	14
	CBR @ 98% (%)	10
	CBR @ 95% (%)	7
	CBR @ 93% (%)	5
	CBR @ 90% (%)	3
PROCTOR MAX. DRY DENSITY (kg/m^3)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm^{-1}) (TMH1: Method A20)		0,0534
pH VALUE (TMH1: Method A21)		8,64
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (1)
UNIFIED SOIL CLASSIFICATION		SM
COLTO CLASSIFCATION		No Classification







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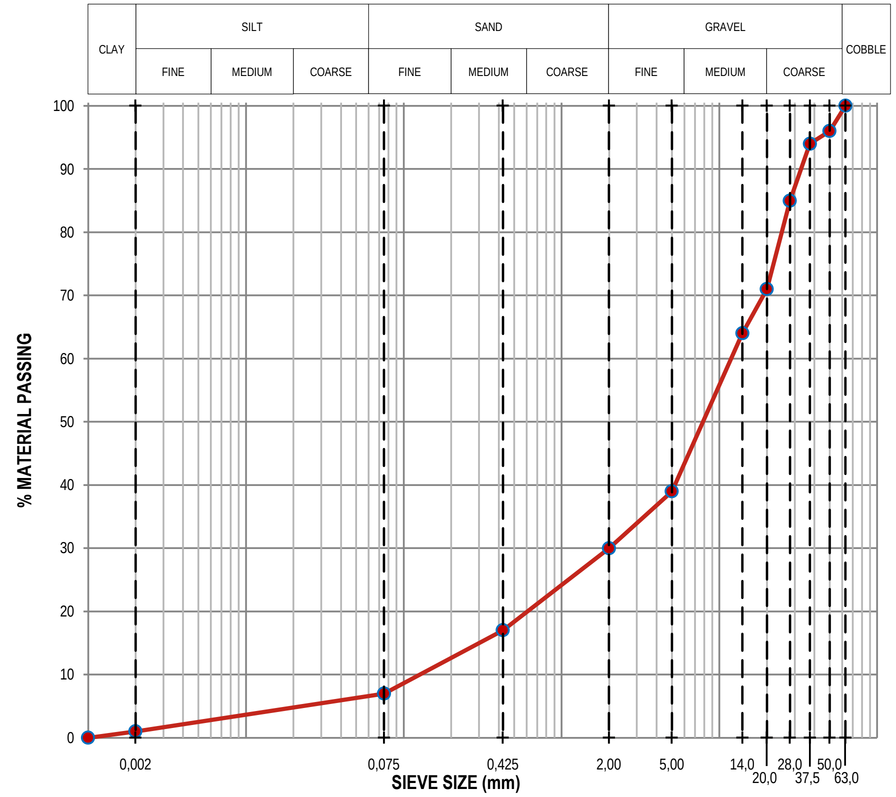
MATERIAL CLASSIFICATION TEST RESULTS

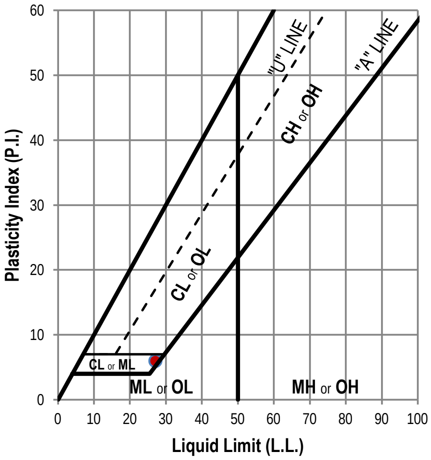
TEST PIT / HOLE No.:	Farm Leliehoek	**MATERIAL DEPTH** (mm) **:**	300 - 800	**SAMPLE No / LABORATORY No.:**	LH/T14/1 / 020/984
MATERIAL DESCRIPTION :	Poorly graded GRAVEL with silty CLAY and SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		8,6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	96
	37,5 mm	94
	28,0 mm	85
	20,0 mm	71
	14,0 mm	64
	5,00 mm	39
	2,00 mm	30
	0,425 mm	17
	0,075 mm	7
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,46
SOIL MORTAR	**COARSE SAND**	45
	FINE SAND (Course)	13
	FINE SAND (Medium)	9
	FINE SAND (Fine)	11
	SILT AND CLAY (<0.075mm)	23
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	27
	P.I. (%)	6
	L.S. (%)	2,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,1
	C_C (ASTM D2487)	4535,1
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	6
	% Sand (0.075 - 2.0mm)	23
	% Gravel (>2.0mm)	70
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2080
	OPTIMUM MOISTURE (%)	10,5
	SWELL (%)	0,0
	CBR @ 100% (%)	136
	CBR @ 98% (%)	108
	CBR @ 95% (%)	76
	CBR @ 93% (%)	60
	CBR @ 90% (%)	42
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0667
pH VALUE (TMH1: Method A21)		8,10
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-1-a (0)
UNIFIED SOIL CLASSIFICATION		GP-GC
COLTO CLASSIFCATION		G5

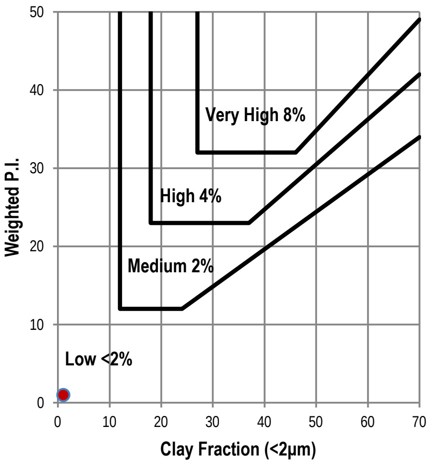
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



REMARKS.:

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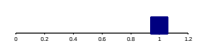
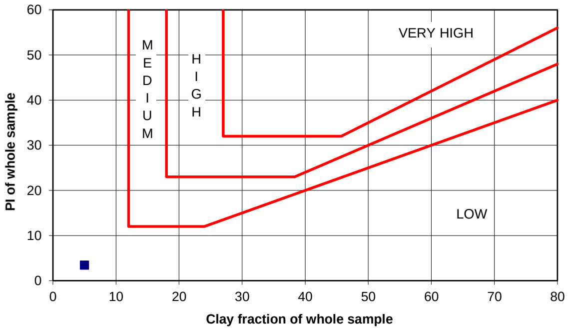
PARTICLE SIZE ANALYSIS

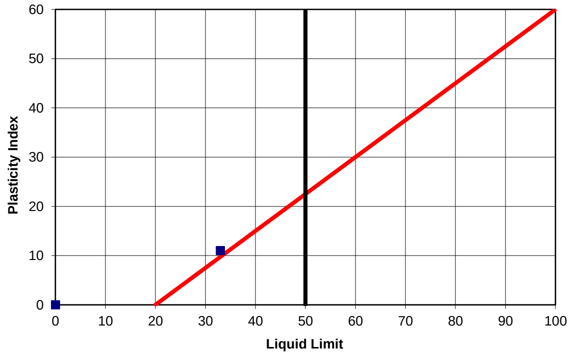
Sample No.	1
Soillab Sample No.	S20-0883-01
Depth (m)	0,4 - 0,8
Position	LH/T2/1
Material Description	DARK REDDISH ORANGE GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.519
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	94
2.00 mm	56
0.425 mm	31
0.075 mm	16
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
63 µm	11
36 µm	10
15 µm	6
7 µm	5
2 µm	3
% Clay	5
% Silt	6
% Sand	45
% Gravel	44
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	33
Plasticity Index	11
Linear Shrinkage (%)	4.5
Grading Modulus	1.96
Classification	A-2-6 (0)
Unified Classification	SC
Chart Reference	

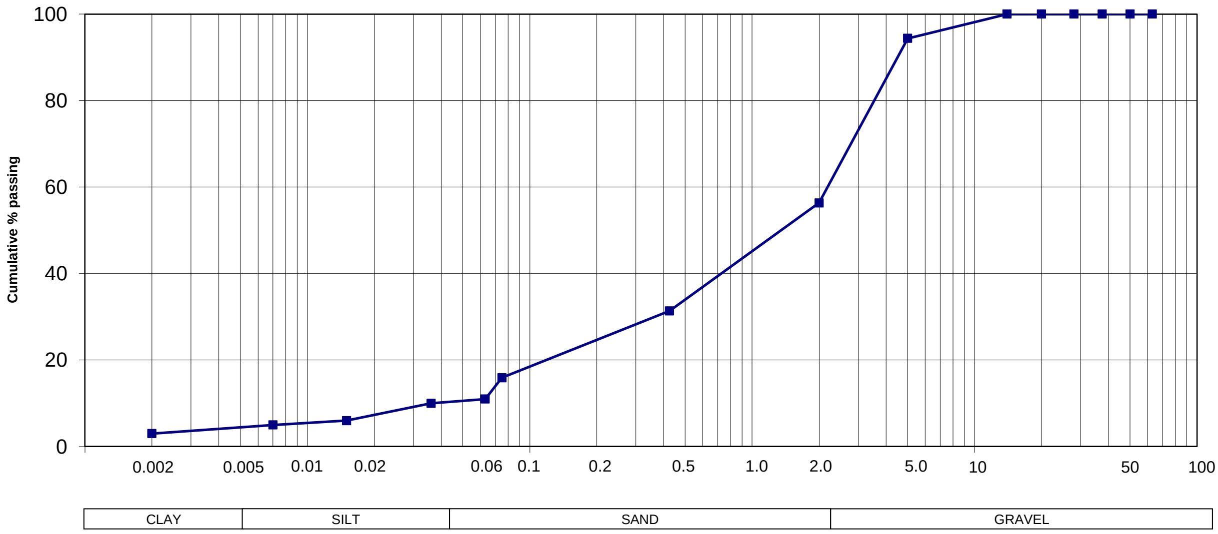
PROJECT : LELIEHOEK SOLAR FARM - C1801/30
JOB No. : S20-0883
DATE : 2020-08-12

POTENTIAL EXPANSIVENESS

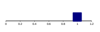


PLASTICITY CHART



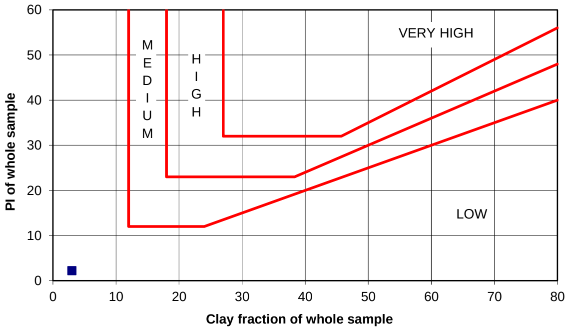


PARTICLE SIZE ANALYSIS

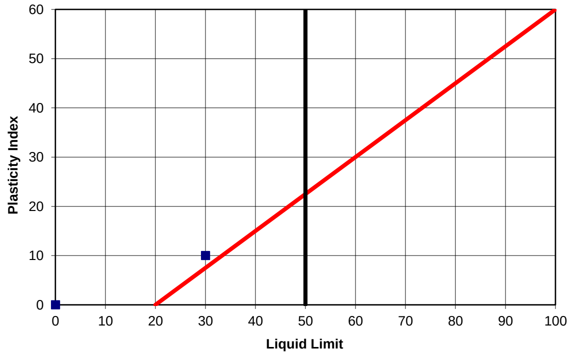
Sample No.	2
Soillab Sample No.	S20-0883-02
Depth (m)	0,4 - 0,8
Position	LH/T3/1
Material Description	DARK REDDISH BROWN GRAVELLY SAND
Relative density on < 2 mm **(SANS 5844)**	2.739
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	94
2.00 mm	58
0.425 mm	22
0.075 mm	11
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
60 µm	6
35 µm	6
14 µm	4
6 µm	3
2 µm	2
% Clay	3
% Silt	3
% Sand	52
% Gravel	42
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	30
Plasticity Index	10
Linear Shrinkage (%)	5.0
Grading Modulus	2.09
Classification	A-2-4 (0)
Unified Classification	SW - SC
Chart Reference	

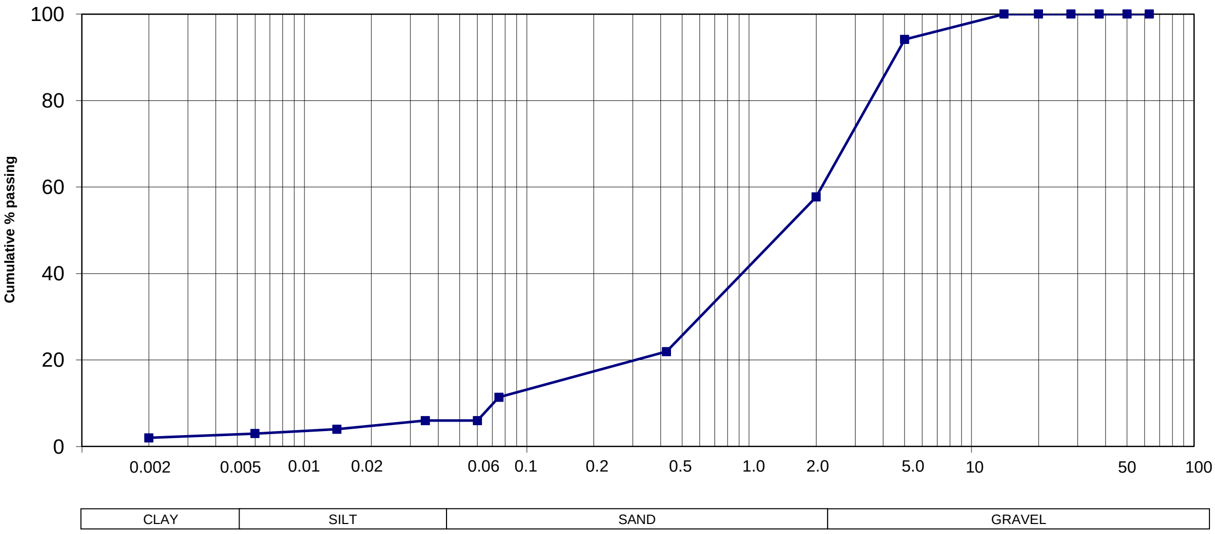
PROJECT : LELIEHOEK SOLAR FARM - C1801/30
JOB No. : S20-0883
DATE : 2020-08-12

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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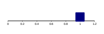
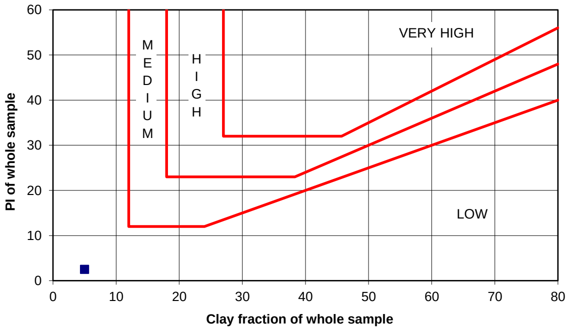
PARTICLE SIZE ANALYSIS

PROJECT : LELIEHOEK SOLAR FARM - C1801/30
JOB No. : S20-0883
DATE : 2020-08-12

Sample No.	3
Soillab Sample No.	S20-0883-03
Depth (m)	0,4 - 1,2
Position	LH/T7/1
Material Description	LIGHT BROWN SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.579
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	94
5.0 mm	67
2.00 mm	44
0.425 mm	25
0.075 mm	13
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
58 µm	12
34 µm	10
14 µm	7
6 µm	5
2 µm	3
% Clay	5
% Silt	7
% Sand	32
% Gravel	56
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	34
Plasticity Index	10
Linear Shrinkage (%)	4.0
Grading Modulus	2.17
Classification	A-2-4 (0)
Unified Classification	SM
Chart Reference	

POTENTIAL EXPANSIVENESS



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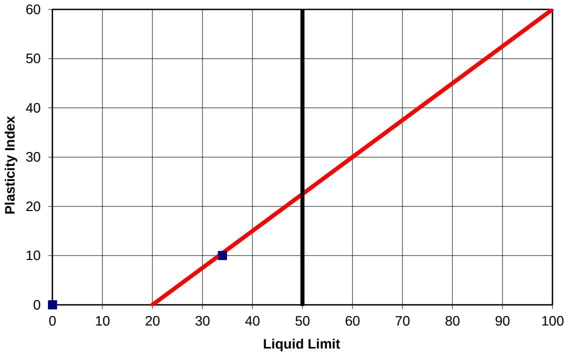

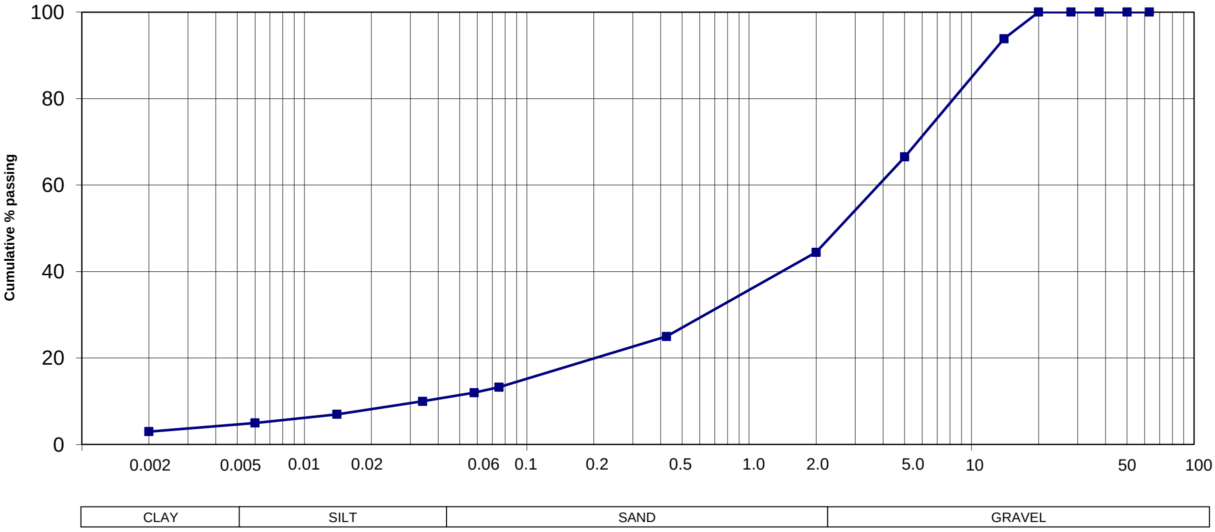

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Registration Number
1971/000112/07
Part of the SMEC Group

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Email: info@soillab.co.za

PO Box 72928, Lynnwood Ridge,
South Africa, 0040

Client: SMEC
Project: LELIEHOEK SOLAR FARM - C1801/30
Project No.: S20-0883
Date: 2020-08-12

MOISTURE CONTENT - SANS 3001-GR20

Sample No.:	Description:	Depth (m)	Moisture Content (%)
S20-0883-01	LH/T2/1	0,4 - 0,8	6.3
S20-0883-02	LH/T3/1	0,4 - 0,8	4.6
S20-0883-03	LH/T7/1	0,4 - 1,2	8.1

Note: Items marked with a star (*) is Not Accredited

Soillab is a SANAS accredited Testing Laboratory according to the Accreditation Scope

R18 revision 2

SOILLAB (PTY) LTD
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SMEC Building, 230 Albertus Street
La Montagne, Pretoria, 0184
PO Box 72928, Lynnwood Ridge,
South Africa, 0040

Client: SMEC
Project: LELIEHOEK SOLAR FARM - C1801/30
Project No.: S20-0883
Date: 2020-08-20

TEST RESULTS: CHEMICAL

Soillab No	Sample No	Depth (m)	pH (TMH 1 A20)	Electrical Conductivity (TMH 1 A21T)	Cl content (%) *SANS 202	Org. Content (%) BS 1377-3: 1990	Soluble SO_3 (%) *SANS 5850
S20-0833-01	LH/T2/1	0.4-0.8	7.52	0.0269	0.0053	4.89	0.0072
S20-0833-02	LH/T3/1	0.4-0.8	7.28	0.0229	0.0064	4.03	0.0089
S20-0833-03	LH/T7/1	0.4-1.2	8.39	0.0497	0.0071	3.87	0.0120

Note: Items marked with a star (*) is Not Accredited

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Client:	SMEC SA
Project:	LELIEHOEK SOLAR FARM – C1801/30
Project No.:	S20-0883
Date:	2020-07-14

THERMAL CONDUCTIVITY (SANS 10198*)

Sample No.	Moisture Content	Thermal Conductivity (K) W/m.K	Thermal Resistivity (g) K.m/W
S20-0883-01 SAMPLE NO: 01 LH/T2/1 0.4 – 0.8	**0 %**	0.266	3.810
	2%	0.374	2.670
	5%	0.868	1.153
	6.3% (AS RECEIVED)	0.915	1.095
S20-0883-02 SAMPLE NO: 02 LH/T3/1 0.4 – 0.8	**0 %**	0.254	3.940
	2 %	0.382	2.619
	4.6% (AS RECEIVED)	0.821	1.131
	5%	0.893	1.218
S20-0883-03 SAMPLE NO: 03 LH/T7/1 0.4 – 1.2	**0 %**	0.235	4.252
	2 %	0.364	2.747
	5%	0.483	2.068
	8.1 %(AS RECEIVED)	0.827	1.210

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
sanas Testing Laboratory T0455
REG. No. 1987/004282/07 NLA No. 2012/187 6249, BLOEMFONTEIN, 9300, SOUTH AFRICA, Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

Enquiries : Bloemfontein
Our ref. : SL / 3092
Your ref. : Soil Classification for Project C1801/30 – Sonoblomo Solar Farm, Dealesville, Free State.
File ref. : 020/954(a)
Date : 25/08/2020

ATTENTION: MR. RICHARD ROBERTS

SMEC SOUTH AFRICA (PTY) LIMITED (RANDBURG)
267 Kent Avenue
RANDBURG
2194

Tel. / Cell.: 011 369 0789 / 072 495 0920
E-mail: richard.roberts@smec.com

Sir,

SOIL CLASSIFICATION FOR PROJECT C1801/30, SONOBLOMO SOLAR FARM, DEALESVILLE, FREE STATE.

1.) Terms of reference

SMEC SOUTH AFRICA (PTY) LTD (Randburg), Mr Richard Roberts appointed SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) for the soil testing of Project C1801/30 – Sonoblomo Solar Farm, Dealesville, Free State, as sampled by client, SMEC SOUTH AFRICA (PTY) LTD, Mr Richard Roberts.

The results for the materials tested by SIMLAB (Pty) Limited (Bloemfontein), can be found in APPENDIX A of this report.

2.) Disclaimer

The opinions expressed, interpretations and recommendations in this Report have been based on the information supplied to SIMLAB (Pty) Limited – Geotechnical Services. (Bloemfontein).

SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this Report apply to the site conditions and features as they existed at the time of SIMLAB (Pty) Limited – Geotechnical Services (Bloemfontein) site inspection / investigation.

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3.) Test Methods used

SIMLAB (Pty) Limited (Bloemfontein)) (a SANAS Accredited Testing Laboratory – T0455) was instructed to test the following on various samples received: *In Situ* Moisture Content (MC), Foundation Indicator (FI), Maximum Dry Density (MDD), California Bearing Ratio (CBR), pH-Value (pH) and Electrical Conductivity (EC). These tests are used to determine the Engineering Properties of the materials. These tests were conducted from the 24th of July 2020 to the 7th of August 2020 and pH on the 25th of August 2020.

Please visit the SIMLAB or SANAS website for more information regarding SANAS Accreditation. www.simlab.co.za or www.sanas.co.za

Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples).
- * TMH1: 1986, A20 – The electronic determination of the pH value of a soil suspension
- * TMH1: 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of SIMLAB (Pty) Limited – Geotechnical Services.

4.) Appendices

APPENDIX A – LABORATORY TEST RESULTS

We trust this meets with your requirements. Should you require further information in this regard, please do not hesitate to contact us.

WT HITGE (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

APPENDIX A

LABORATORY TEST RESULTS

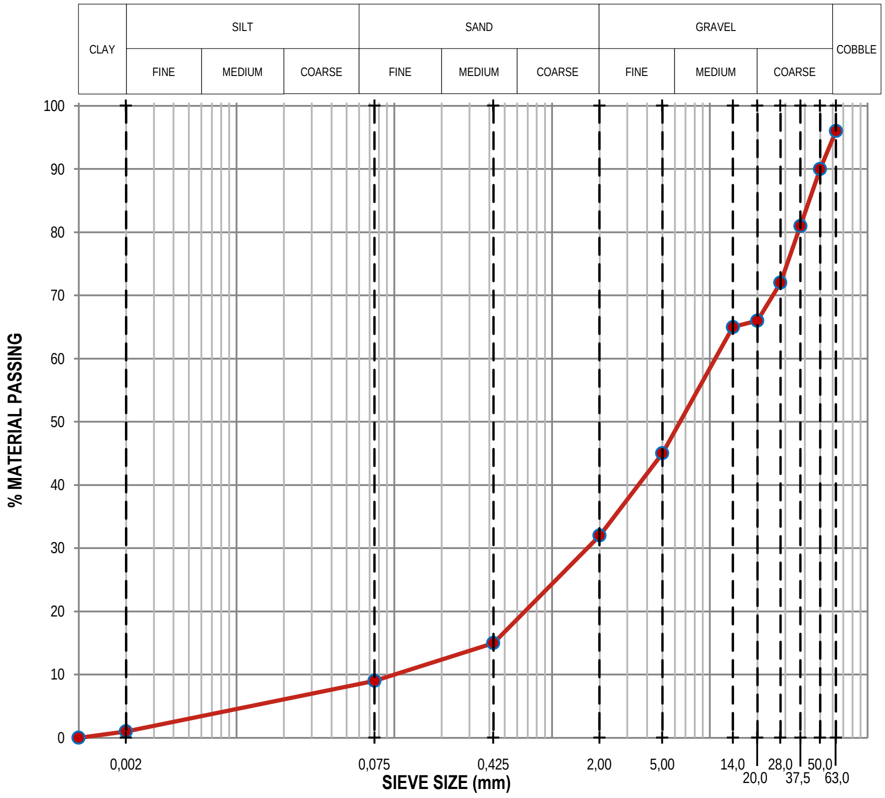
(Particle Size Distribution) (Material Classification)

MATERIAL CLASSIFICATION TEST RESULTS

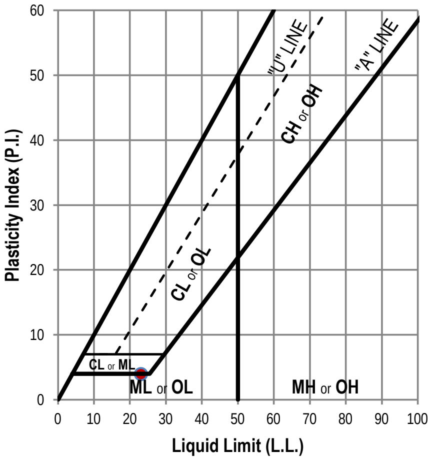
TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	500 - 1400	**SAMPLE No / LABORATORY No.:**	SB/T1/1 / 020/954
MATERIAL DESCRIPTION :	Poorly graded GRAVEL with silty CLAY and SAND.				

	IN SITU MOISTURE CONTENT (GR20) (%)	10,3
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	96
	50,0 mm	90
	37,5 mm	81
	28,0 mm	72
	20,0 mm	66
	14,0 mm	65
	5,00 mm	45
	2,00 mm	32
	0,425 mm	15
	0,075 mm	9
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,44
SOIL MORTAR	**COARSE SAND**	54
	FINE SAND (Course)	8
	FINE SAND (Medium)	4
	FINE SAND (Fine)	5
	SILT AND CLAY (<0.075mm)	29
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	23
	P.I. (%)	4
	L.S. (%)	2,0
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,1
	C_C (ASTM D2487)	1984,9
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	8
	% Sand (0.075 - 2.0mm)	23
	% Gravel (>2.0mm)	68
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1872
	OPTIMUM MOISTURE (%)	14,7
	SWELL (%)	0,0
	CBR @ 100% (%)	98
	CBR @ 98% (%)	82
	CBR @ 95% (%)	63
	CBR @ 93% (%)	53
	CBR @ 90% (%)	41
	PROCTOR MAX. DRY DENSITY (kg/m³)	
	COMPACTIBILITY (Ratio) (SABS 1200 LB)	
	CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)	0,0534
	pH VALUE (TMH1: Method A21)	8,18
	POTENTIAL EXPANSIVENESS	Low - 0.0mm
	AASHTO SOIL CLASSIFICATION	A-1-a (0)
	UNIFIED SOIL CLASSIFICATION	GP-GC
	COLTO CLASSIFCATION	G5

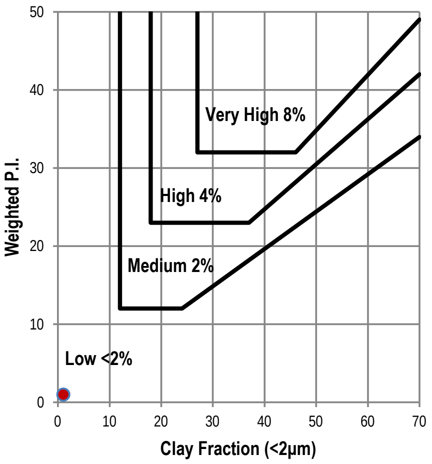
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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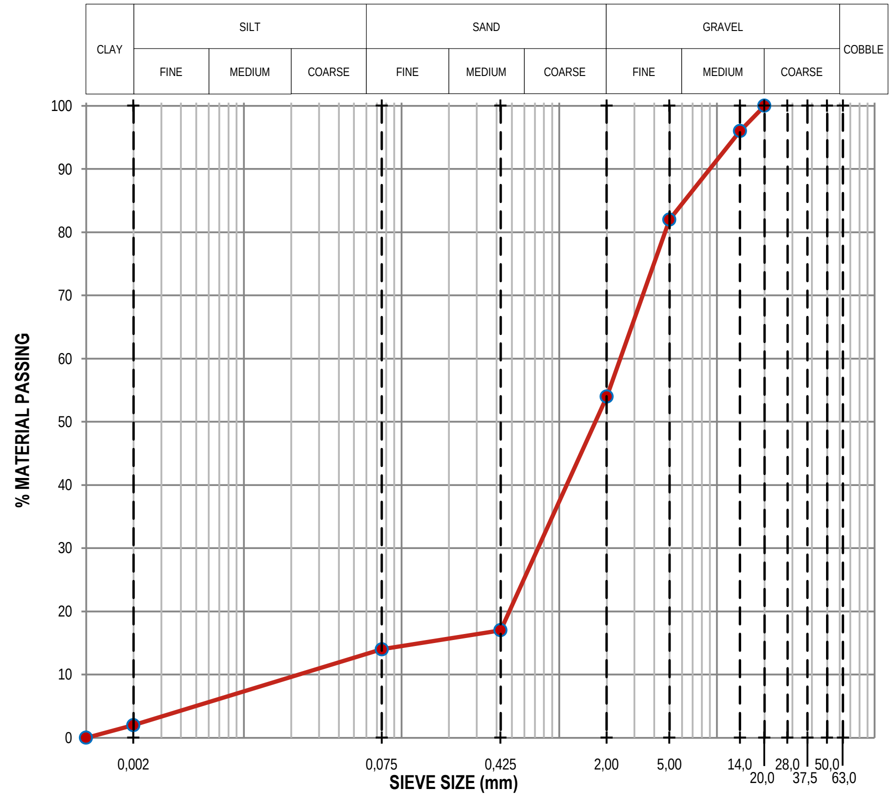
* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

MATERIAL CLASSIFICATION TEST RESULTS

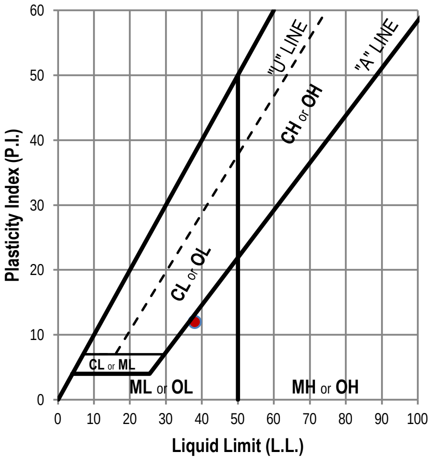
TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	600 - 1100	**SAMPLE No / LABORATORY No.:**	SB/T3/1 / 020/955
MATERIAL DESCRIPTION :	Silty SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		1,6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	
	50,0 mm	
	37,5 mm	
	28,0 mm	
	20,0 mm	100
	14,0 mm	96
	5,00 mm	82
	2,00 mm	54
	0,425 mm	17
	0,075 mm	14
TMH1: METHOD A6	**0,002 mm**	2
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,15
SOIL MORTAR	**COARSE SAND**	68
	FINE SAND (Course)	3
	FINE SAND (Medium)	2
	FINE SAND (Fine)	2
	SILT AND CLAY (<0.075mm)	26
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	38
	P.I. (%)	12
	L.S. (%)	5,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	138,0
	C_C (ASTM D2487)	8,0
	% Clay (>0.002mm)	2
	% Silt (0.075 - 0.002mm)	12
	% Sand (0.075 - 2.0mm)	40
	% Gravel (>2.0mm)	46
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2195
	OPTIMUM MOISTURE (%)	8,4
	SWELL (%)	0,0
	CBR @ 100% (%)	77
	CBR @ 98% (%)	64
	CBR @ 95% (%)	48
	CBR @ 93% (%)	40
	CBR @ 90% (%)	30
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-6 (0)
UNIFIED SOIL CLASSIFICATION		SM
COLTO CLASSIFCATION		G5

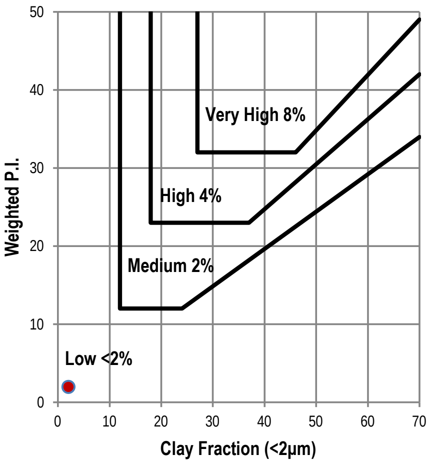
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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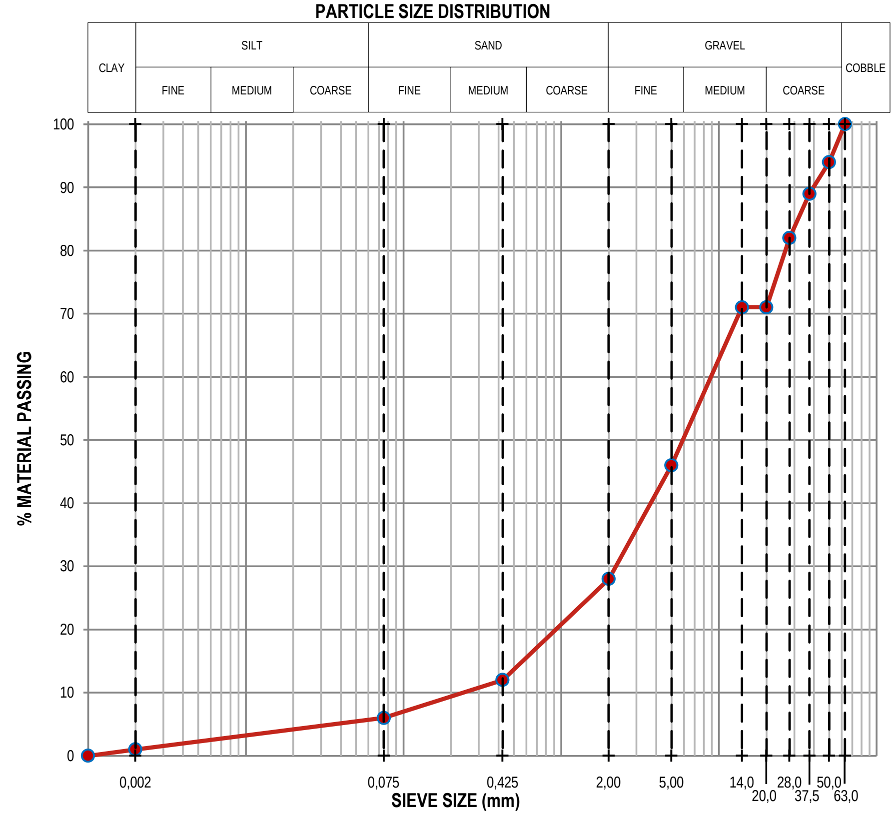
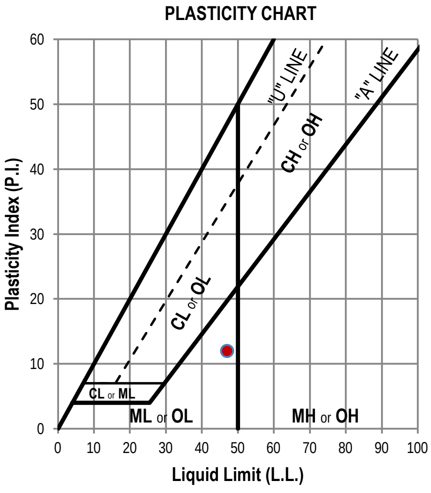
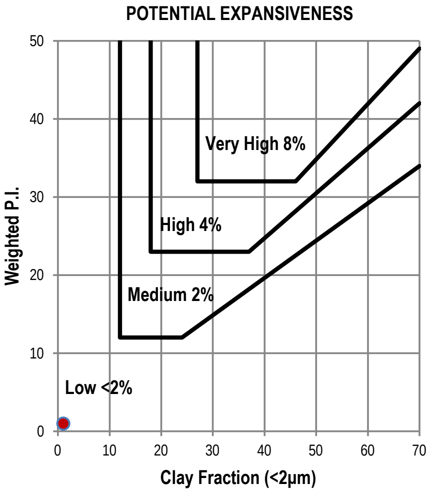
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	300 - 3000	**SAMPLE No / LABORATORY No.:**	SB/T7/1 / 020/956
MATERIAL DESCRIPTION :	Poorly graded GRAVEL with silt and SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		9,2
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	94
	37,5 mm	89
	28,0 mm	82
	20,0 mm	71
	14,0 mm	71
	5,00 mm	46
	2,00 mm	28
	0,425 mm	12
	0,075 mm	6
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,54
SOIL MORTAR	**COARSE SAND**	59
	FINE SAND (Course)	10
	FINE SAND (Medium)	5
	FINE SAND (Fine)	5
	SILT AND CLAY (<0.075mm)	22
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	47
	P.I. (%)	12
	L.S. (%)	6,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,3
	C_C (ASTM D2487)	326,9
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	22
	% Gravel (>2.0mm)	72
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1963
	OPTIMUM MOISTURE (%)	12,0
	SWELL (%)	0,1
	CBR @ 100% (%)	45
	CBR @ 98% (%)	38
	CBR @ 95% (%)	29
	CBR @ 93% (%)	25
	CBR @ 90% (%)	19
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0,0652
pH VALUE (TMH1: Method A21)		8,01
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-7 (0)
UNIFIED SOIL CLASSIFICATION		GP-GM
COLTO CLASSIFCATION		G6


PARTICLE SIZE DISTRIBUTION


PLASTICITY CHART


POTENTIAL EXPANSIVENESS

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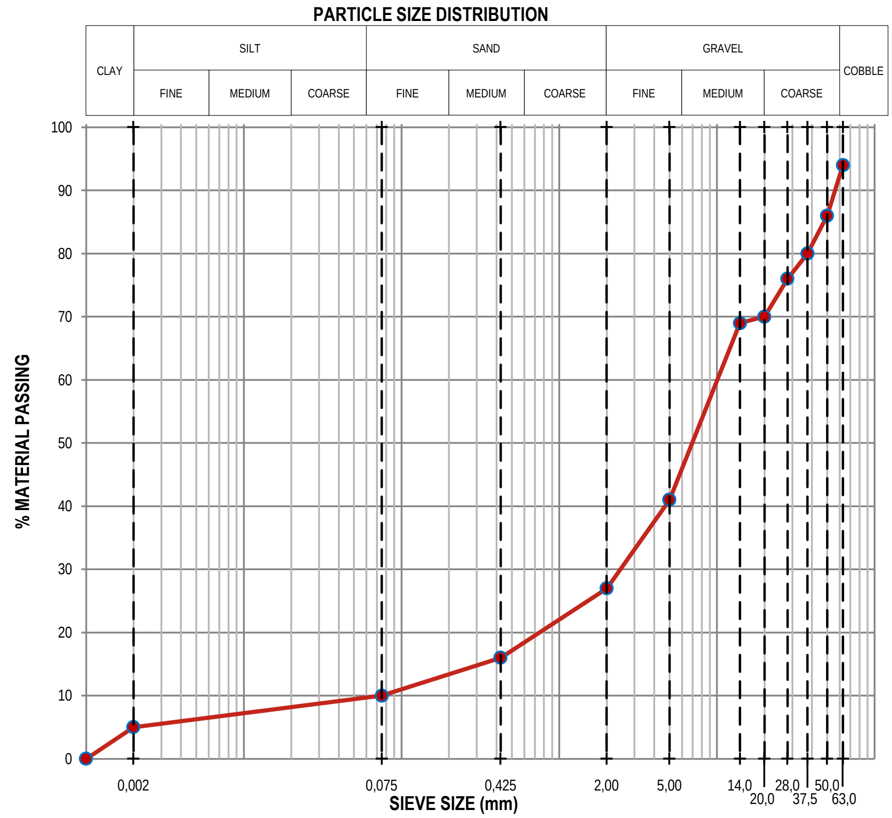
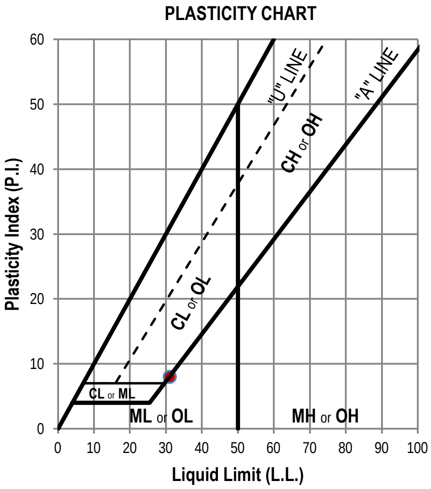
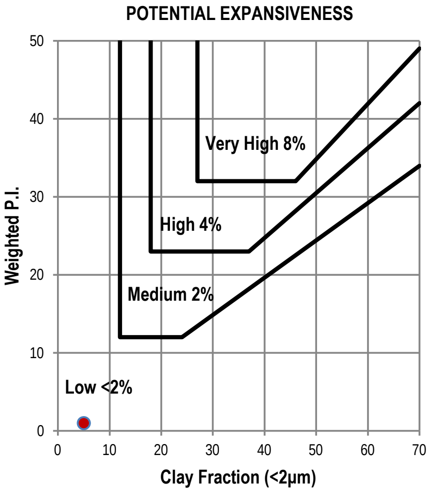
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	300 - 2100	**SAMPLE No / LABORATORY No.:**	SB/T8/1 / 020/957
MATERIAL DESCRIPTION :	Poorly graded GRAVEL with silt and SAND.				

IN SITU MOISTURE CONTENT (GR20) (%)		7,6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	94
	50,0 mm	86
	37,5 mm	80
	28,0 mm	76
	20,0 mm	70
	14,0 mm	69
	5,00 mm	41
	2,00 mm	27
	0,425 mm	16
	0,075 mm	10
TMH1: METHOD A6	**0,002 mm**	5
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,47
SOIL MORTAR	**COARSE SAND**	39
	FINE SAND (Course)	11
	FINE SAND (Medium)	6
	FINE SAND (Fine)	7
	SILT AND CLAY (<0.075mm)	37
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	31
	P.I. (%)	8
	L.S. (%)	4,0
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	0,3
	C_C (ASTM D2487)	3159,7
	% Clay (>0.002mm)	5
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	17
	% Gravel (>2.0mm)	73
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	1907
	OPTIMUM MOISTURE (%)	14,1
	SWELL (%)	0,2
	CBR @ 100% (%)	61
	CBR @ 98% (%)	49
	CBR @ 95% (%)	36
	CBR @ 93% (%)	29
	CBR @ 90% (%)	21
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		GP-GM
COLTO CLASSIFCATION		G6







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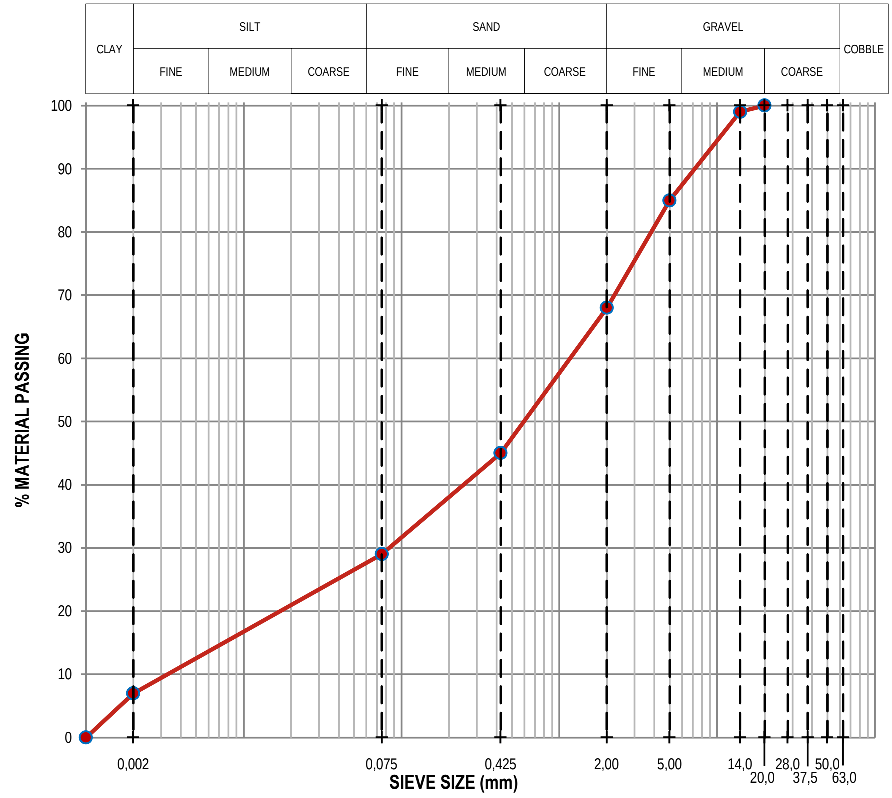
MATERIAL CLASSIFICATION TEST RESULTS

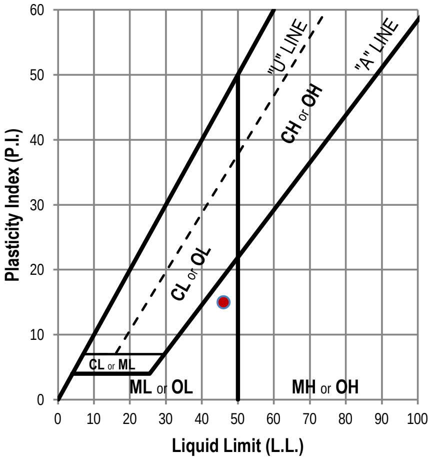
TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	300 - 1700	**SAMPLE No / LABORATORY No.:**	SB/T10/1 / 020/958
MATERIAL DESCRIPTION :	Silty SAND with GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)			11,9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013		**SIEVE SIZE**	**% PASSING**
		63,0 mm	
		50,0 mm	
		37,5 mm	
		28,0 mm	
		20,0 mm	100
		14,0 mm	99
		5,00 mm	85
		2,00 mm	68
		0,425 mm	45
		0,075 mm	29
TMH1: METHOD A6		**0,002 mm**	7
SANS 3001 PR5: 2011		**GRADING MODULUS** (GM)	1,58
	SOIL MORTAR	**COARSE SAND**	35
		FINE SAND (Course)	11
		FINE SAND (Medium)	6
		FINE SAND (Fine)	7
		SILT AND CLAY (<0.075mm)	42
ATTERBERG LIMITS	**MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011**	**L.L.** (%)	46
		P.I. (%)	15
		L.S. (%)	7,0
*** MEASURES OF GRADATIONS**		C_U (ASTM D2487)	707,0
		C_C (ASTM D2487)	1,1
		% Clay (>0.002mm)	7
		% Silt (0.075 - 0.002mm)	22
		% Sand (0.075 - 2.0mm)	39
		% Gravel (>2.0mm)	32
CBR DETERMINATION SANS 3001 - GR 40: 2013		**MAX. DRY DENSITY** (kg/m^3)	1752
		OPTIMUM MOISTURE (%)	16,5
		SWELL (%)	2,5
		CBR @ 100% (%)	13
		CBR @ 98% (%)	10
		CBR @ 95% (%)	8
		CBR @ 93% (%)	6
		CBR @ 90% (%)	5
PROCTOR MAX. DRY DENSITY (kg/m^3)			
COMPACTIBILITY (Ratio) (SABS 1200 LB)			
CONDUCTIVITY (Sm^{-1}) (TMH1: Method A20)			0,0578
pH VALUE (TMH1: Method A21)			8,21
POTENTIAL EXPANSIVENESS			Low - 0.0mm
AASHTO SOIL CLASSIFICATION			A-2-7 (1)
UNIFIED SOIL CLASSIFICATION			SM
COLTO CLASSIFCATION			No Classification

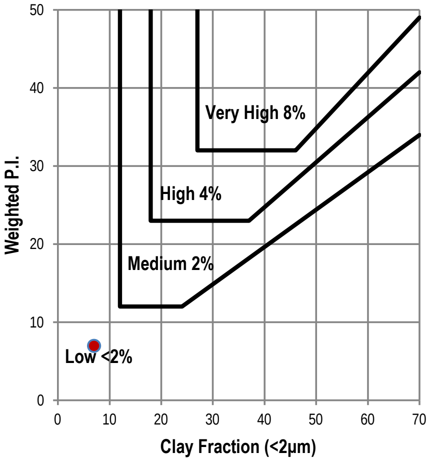
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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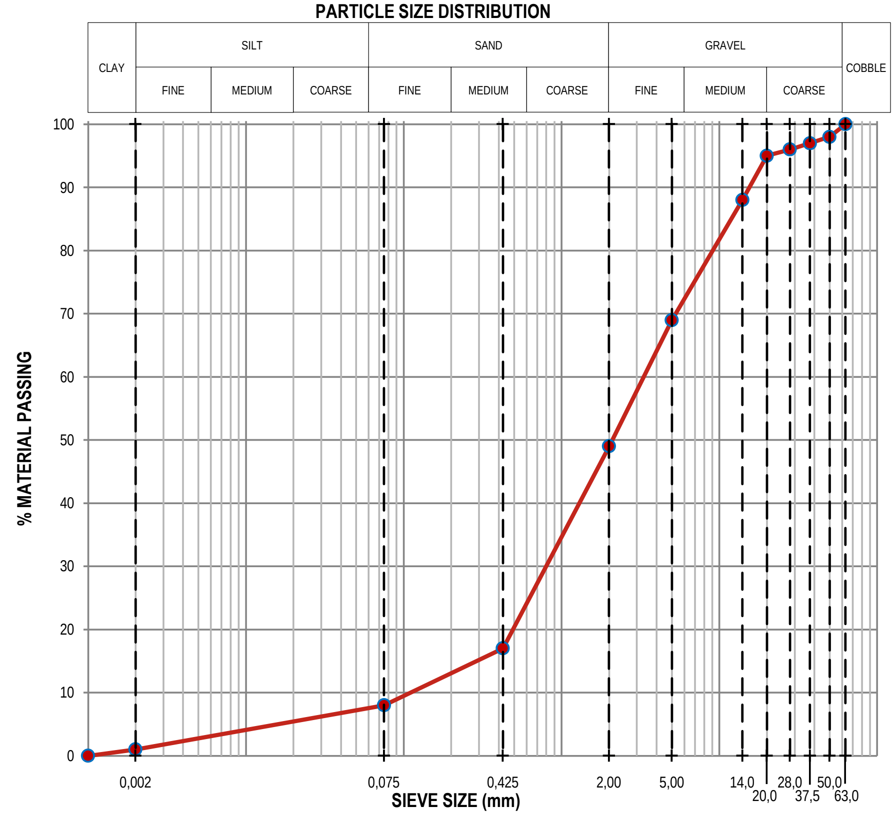
MATERIAL CLASSIFICATION TEST RESULTS

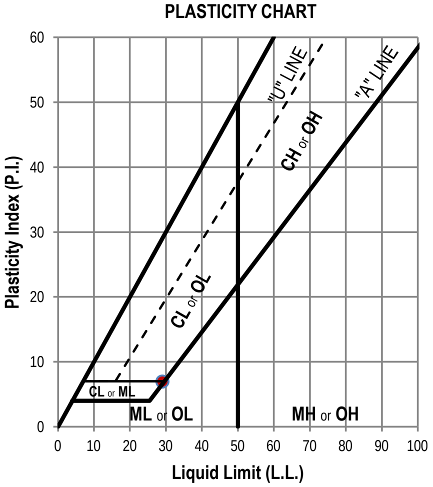
TEST PIT / HOLE No.:	Farm Sonoblomo	**MATERIAL DEPTH** (mm) **:**	600 - 1100	**SAMPLE No / LABORATORY No.:**	SB/T14/1 / 020/959
MATERIAL DESCRIPTION :	Poorly graded SAND with silty CLAY and GRAVEL.				

IN SITU MOISTURE CONTENT (GR20) (%)		4,7
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	**SIEVE SIZE**	**% PASSING**
	63,0 mm	100
	50,0 mm	98
	37,5 mm	97
	28,0 mm	96
	20,0 mm	95
	14,0 mm	88
	5,00 mm	69
	2,00 mm	49
	0,425 mm	17
	0,075 mm	8
TMH1: METHOD A6	**0,002 mm**	1
SANS 3001 PR5: 2011	**GRADING MODULUS** (GM)	2,26
SOIL MORTAR	**COARSE SAND**	65
	FINE SAND (Course)	8
	FINE SAND (Medium)	5
	FINE SAND (Fine)	6
	SILT AND CLAY (<0.075mm)	16
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	**L.L.** (%)	29
	P.I. (%)	7
	L.S. (%)	3,5
*** MEASURES OF GRADATIONS**	C_U (ASTM D2487)	53,0
	C_C (ASTM D2487)	1,0
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	7
	% Sand (0.075 - 2.0mm)	41
	% Gravel (>2.0mm)	51
CBR DETERMINATION SANS 3001 - GR 40: 2013	**MAX. DRY DENSITY** (kg/m³)	2032
	OPTIMUM MOISTURE (%)	9,7
	SWELL (%)	0,0
	CBR @ 100% (%)	76
	CBR @ 98% (%)	59
	CBR @ 95% (%)	41
	CBR @ 93% (%)	32
	CBR @ 90% (%)	22
PROCTOR MAX. DRY DENSITY (kg/m³)		
COMPACTIBILITY (Ratio) (SABS 1200 LB)		
CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
pH VALUE (TMH1: Method A21)		
POTENTIAL EXPANSIVENESS		Low - 0.0mm
AASHTO SOIL CLASSIFICATION		A-2-4 (0)
UNIFIED SOIL CLASSIFICATION		SP-SC
COLTO CLASSIFCATION		G6

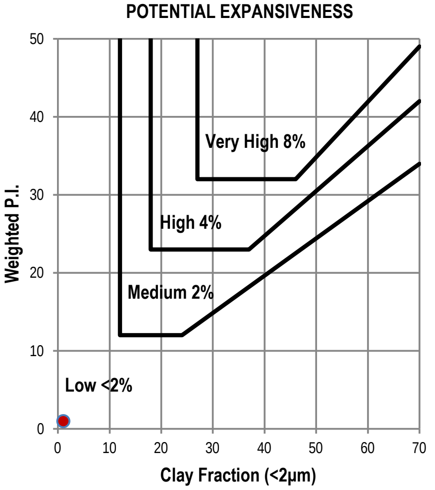
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



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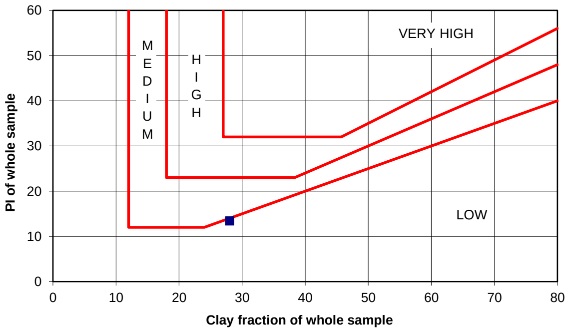
PARTICLE SIZE ANALYSIS

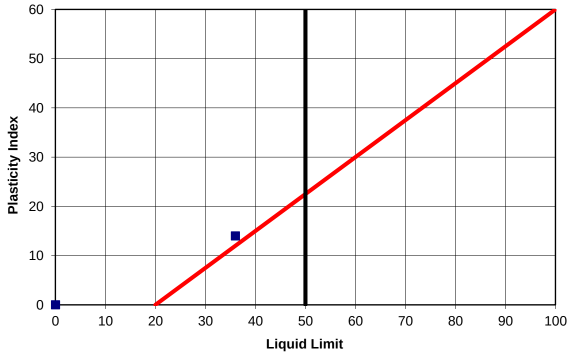
Sample No.	1
Soillab Sample No.	S20-0882-01
Depth (m)	0,4 - 0,5
Position	SB/T4/1U
Material Description	DARK YELLOWISH ORANGE CLAYEY SAND
Relative density on < 2 mm **(SANS 5844)**	2.62
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	99
0.425 mm	96
0.075 mm	48
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
58 µm	42
34 µm	38
14 µm	32
6 µm	28
2 µm	25
% Clay	28
% Silt	14
% Sand	57
% Gravel	1
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	36
Plasticity Index	14
Linear Shrinkage (%)	6.0
Grading Modulus	0.57
Classification	A-6 (4)
Unified Classification	SC
Chart Reference	■

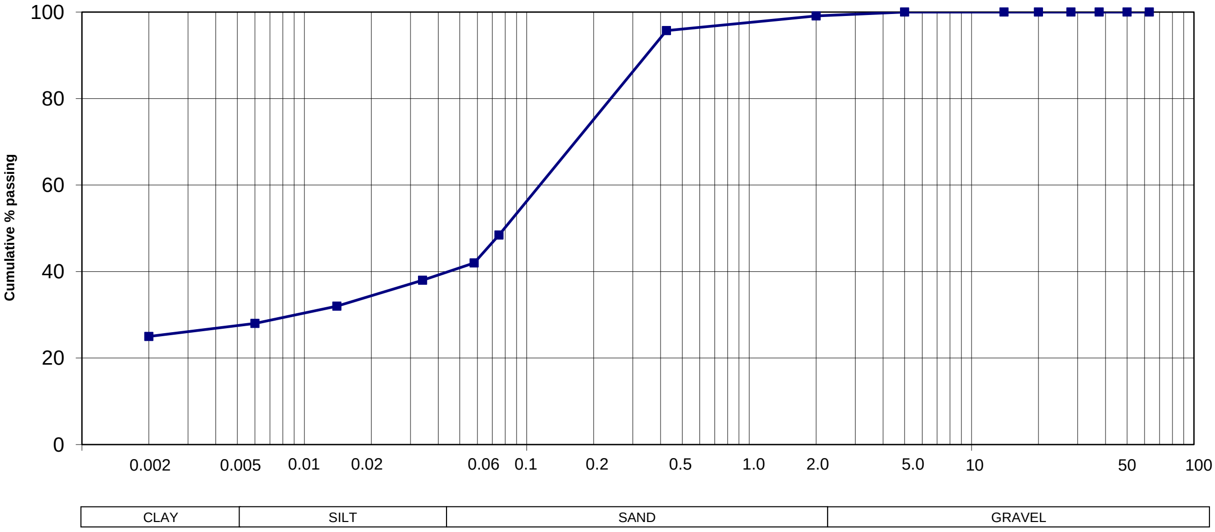
PROJECT : SONOBLOMO SOLAR FARM
JOB No. : S20-0882
DATE : 2020-08-19

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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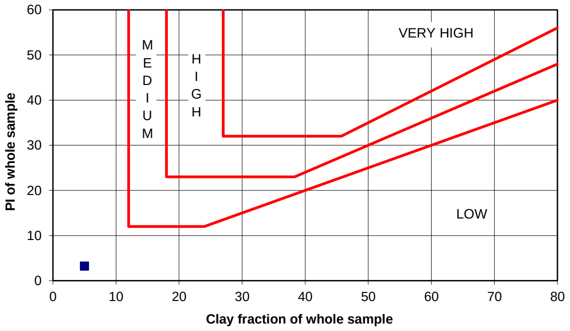
PARTICLE SIZE ANALYSIS

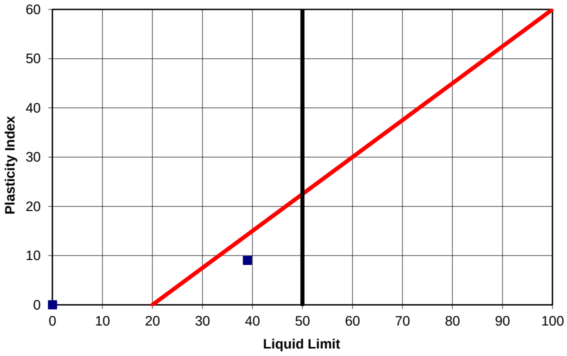
Sample No.	2
Soillab Sample No.	S20-0882-02
Depth (m)	0,3 - 0,6
Position	SB/T9/1
Material Description	LIGHT GREY SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.518
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	95
50.0 mm	93
37.5 mm	87
28.0 mm	82
20.0 mm	74
14.0 mm	70
5.0 mm	56
2.00 mm	47
0.425 mm	36
0.075 mm	18
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
62 µm	13
36 µm	10
15 µm	6
7 µm	5
2 µm	2
% Clay	5
% Silt	8
% Sand	34
% Gravel	53
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	39
Plasticity Index	9
Linear Shrinkage (%)	2.5
Grading Modulus	1.99
Classification	A-2-4 (0)
Unified Classification	GM
Chart Reference	

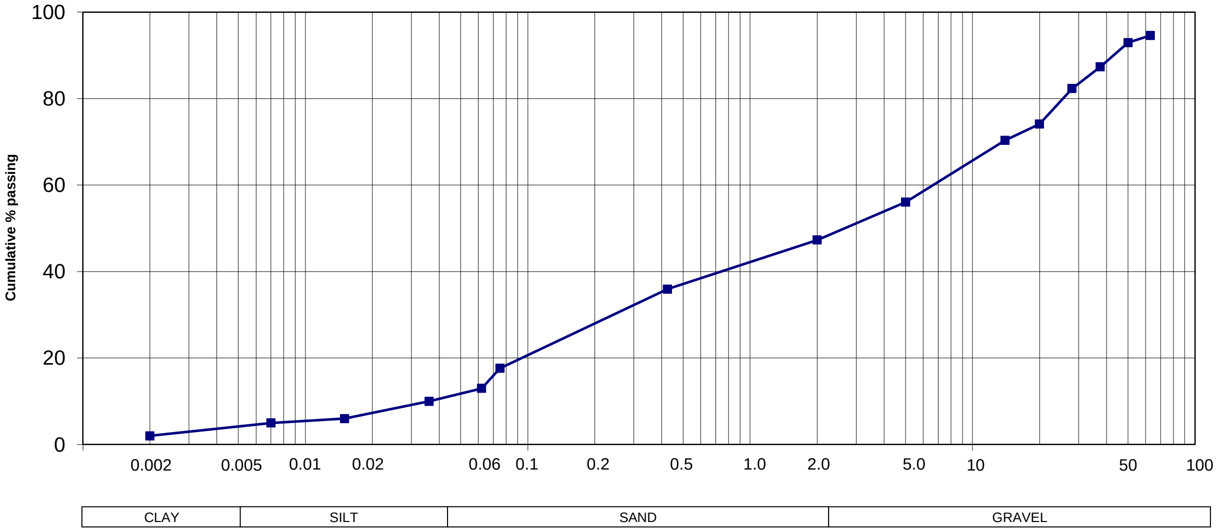
PROJECT : SONOBLOMO SOLAR FARM
JOB No. : S20-0882
DATE : 2020-08-19

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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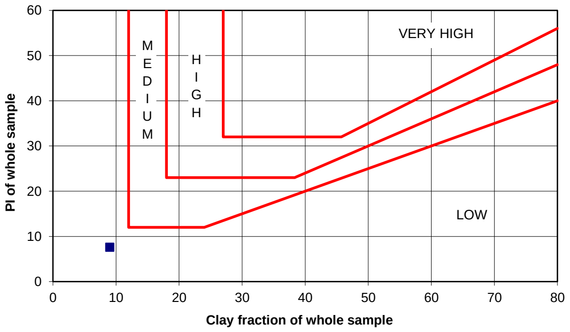
PARTICLE SIZE ANALYSIS

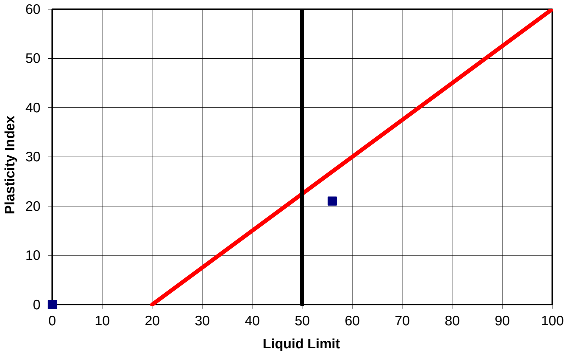
PROJECT : SONOBLOMO SOLAR FARM
JOB No. : S20-0882
DATE : 2020-08-19

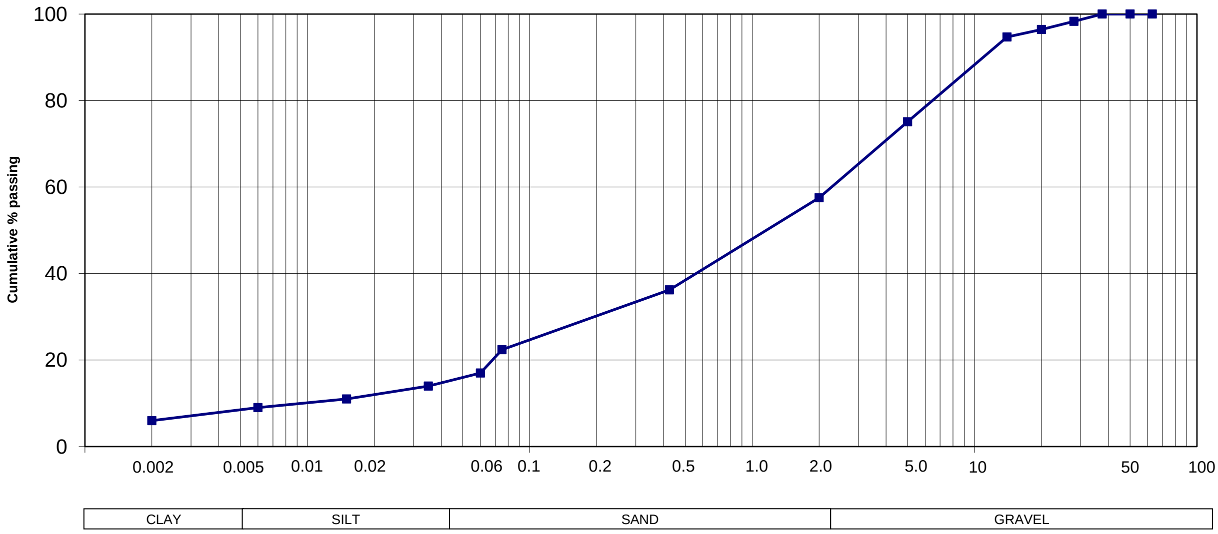
Sample No.	3
Soillab Sample No.	S20-0882-03
Depth (m)	0,3 - 2,1
Position	SB/T10/1
Material Description	LIGHT GREY SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.51
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	98
20.0 mm	96
14.0 mm	95
5.0 mm	75
2.00 mm	58
0.425 mm	36
0.075 mm	22
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
60 µm	17
35 µm	14
15 µm	11
6 µm	9
2 µm	6
% Clay	9
% Silt	8
% Sand	41
% Gravel	42
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	56
Plasticity Index	21
Linear Shrinkage (%)	9.5
Grading Modulus	1.84
Classification	A-2-7 (1)
Unified Classification	SM
Chart Reference	

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



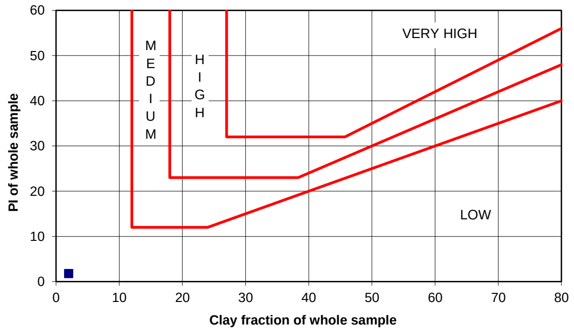


PARTICLE SIZE ANALYSIS

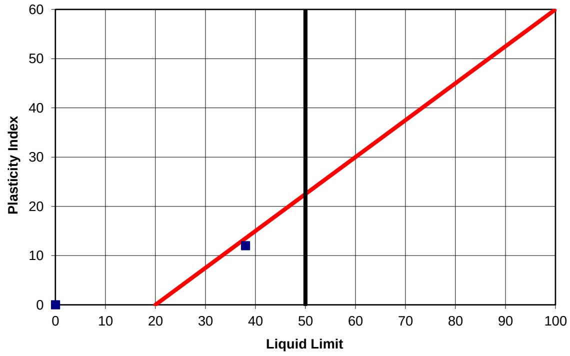
PROJECT : SONOBLOMO SOLAR FARM
JOB No. : S20-0882
DATE : 2020-08-19

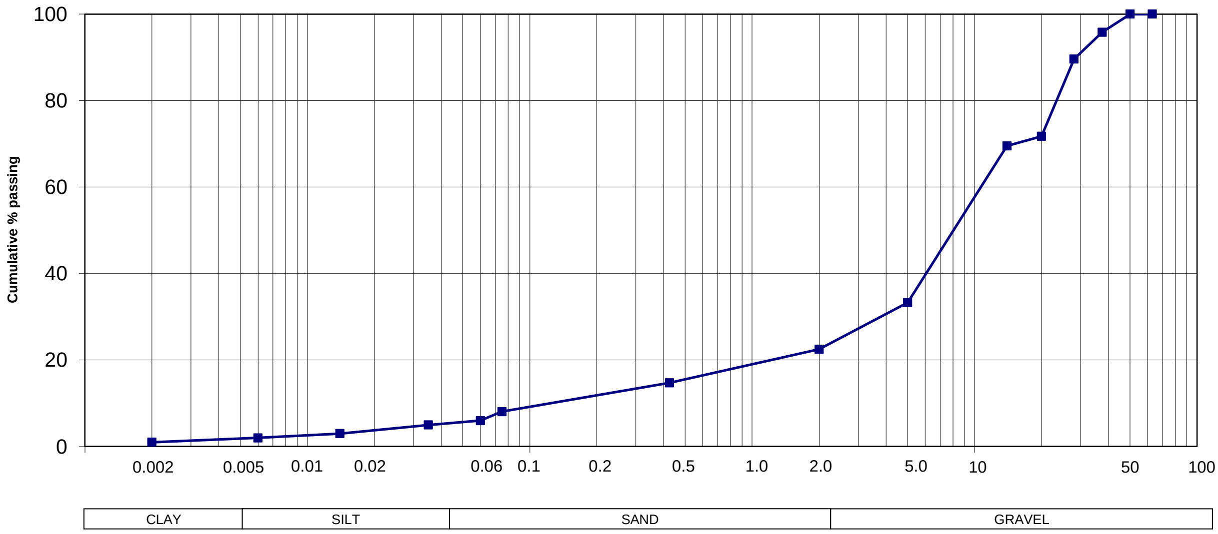
Sample No.	4
Soillab Sample No.	S20-0882-04
Depth (m)	0,5 - 1,8
Position	SB/T13/1
Material Description	LIGHT GREY SANDY GRAVEL
Relative density on < 2 mm **(SANS 5844)**	2.607
Organic Material	
Moisture (%) / Dispersion (%)	
SCREEN ANALYSIS (% PASSING) **(SANS 3001:GR1)**	
63.0 mm	100
50.0 mm	100
37.5 mm	96
28.0 mm	90
20.0 mm	72
14.0 mm	70
5.0 mm	33
2.00 mm	23
0.425 mm	15
0.075 mm	8
HYDROMETER ANALYSIS (% PASSING) **(SANS 3001:GR3)**	
60 µm	6
35 µm	5
14 µm	3
6 µm	2
2 µm	1
% Clay	2
% Silt	4
% Sand	17
% Gravel	77
ATTERBERG LIMITS **(SANS 3001:GR10)**	
Liquid Limit	38
Plasticity Index	12
Linear Shrinkage (%)	5.0
Grading Modulus	2.55
Classification	A-2-6 (0)
Unified Classification	GP - GM
Chart Reference	

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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South Africa, 0040

Client: SMEC
Project: SONOBLOMO SOLAR FARM - C180/30
Project No.: S20-0882
Date: 2020-08-19

MOISTURE CONTENT - SANS 3001-GR20

Sample No.:	**Description:**	**Depth (m)**	**Moisture Content (%)**
S20-0882-01	SB/T4/1U	0,4 - 0,5	-
S20-0882-02	SB/T9/1	0,3 - 0,6	10.4
S20-0882-03	SB/T10/1	0,3 - 2,1	9.8
S20-0882-04	SB/T13/1	0,5 - 1,8	2.3

Note: Items marked with a star (*) is Not Accredited

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PO Box 72928, Lynnwood Ridge,
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Client: SMEC
Project: SONOBLOMO SOLAR FARM - C1801/30
Project No.: S20-0882
Date: 2020-08-18

TEST RESULTS: CHEMICAL

Soillab No	Sample No	Depth (m)	pH (TMH 1 A20)	Electrical Conductivity (TMH 1 A21T)	Cl content (%) *SANS 202	Org. Content (%) BS 1377-3: 1990	Soluble SO_3 (%) *SANS 5850
S20-0882-01	SB/T4/1U	0.4-0.5	8.05	0.0668	0.0067	4.13	0.0082
S20-0882-02	SB/T9/1	0.3-0.6	8.23	0.0629	0.0078	5.55	0.0120
S20-0882-04	SB/T13/1	0.5-1.8	8.14	0.0651	0.0074	3.77	0.0137

Note: Items marked with a star (*) is Not Accredited

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Client: SMEC SA

Project: SONOBLOMO SOLAR FARM – C1801/30

Project No.: S20-0882

Date: 2020-08-12

THERMAL CONDUCTIVITY (SANS 10198*)

Sample No.	Moisture Content	Thermal Conductivity (K) W/m.K	Thermal Resistivity (g) K.m/W
S20-0882-01 SAMPLE NO: 01 SB/T4/1U (0.4-0.5)	**0 %**	0.300	3.333
	2%	0.433	2.307
	5%	0.538	1.858
	7% (AS RECEIVED)	0.644	1.504
S20-0882-02 SAMPLE NO: 02 SB/T9/1 (0.3-0.6)	**0 %**	0.225	4.439
	4 %	0.324	3.086
	6%	0.324	3.079
	11% (AS RECEIVED)	0.772	1.300
S20-0882-04 SAMPLE NO: 04 SB/T13/1 (0.5-1.8)	**0 %**	0.209	4.770
	2.4%(AS RECEIVED)	0.228	4.386
	4 %	0.271	3.684
	6%	0.593	1.684

Shearbox

Project:	Sonoblomo Solar Farm-C1801/30
Client:	SMEC
Geolab Job Nr:	S20-882
Test Method:	ASTM 3080-72

Sample Nr:	SB-T10-1
Sample Depth:	0.3-2.1m_SB
Date:	21/08/2020

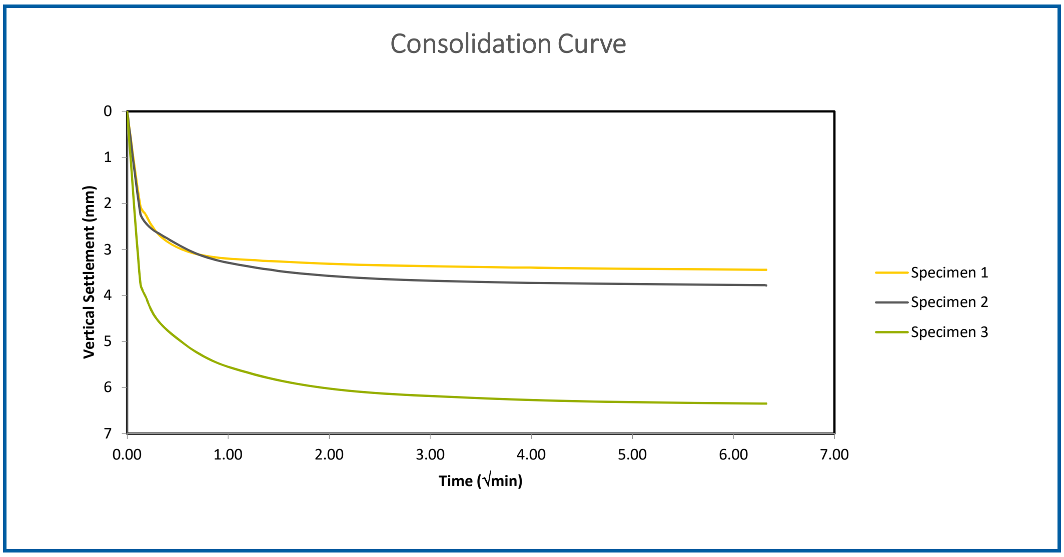
Results		
ϕ' =	**31.0**	**°**
c' =	**0.0**	**kPa**

Sampling Method:	Bag
Disturbed/Undist:	Undisturbed
Remoulded To:	-

Initial Sample Details	1	2	3	
Sample Height:	20	20	20	mm
Sample Diameter:	60	60	60	mm
Sample Mass	89.3	91.1	84.8	g
Dry Density:	1464.2	1493.7	1390.4	kg/m³
Density:	1579.2	1611.0	1499.6	kg/m³
Void Ratio:	0.747	0.712	0.839	
Moisture Content:	7.8	7.8	7.8	%
Specific Gravity		2.557		kg/m³

Shear Stage	1	2	3	
Rate of Shear:	0.007	0.007	0.007	mm/min
Normal Stress at Failure:	76.2	150.8	296.3	kPa
Max Shear Stress:	42.4	89.9	175.2	kPa
Strain at Failure:	6.0	4.7	5.3	%

Final Sample Details	1	2	3	
Moisture Content:	23.2	20.3	18.5	%



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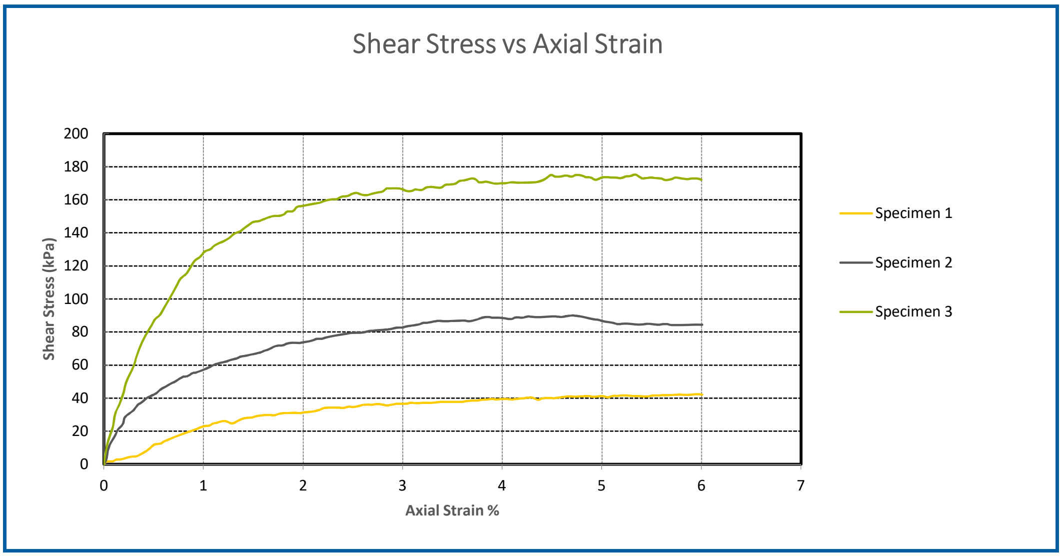
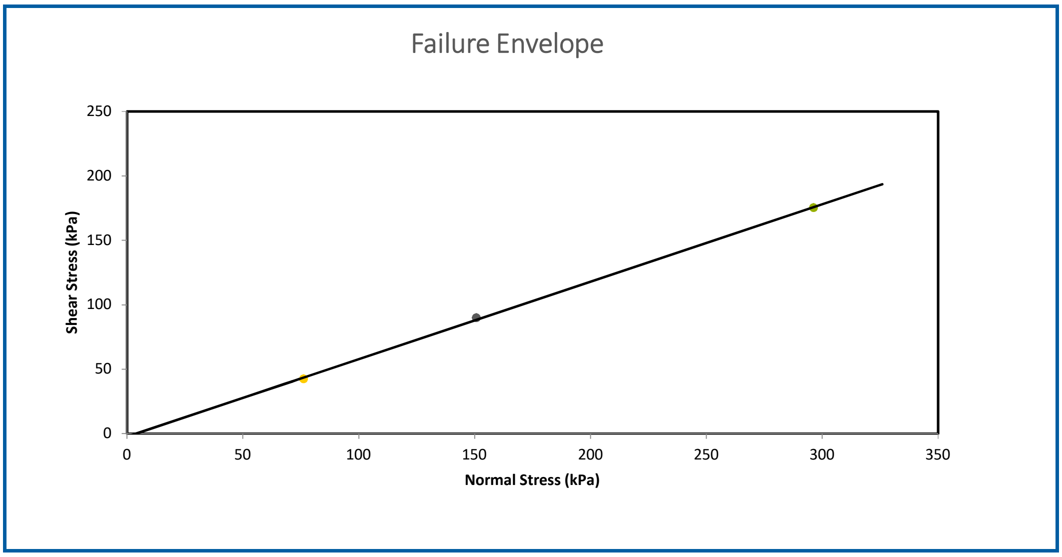
Shearbox

Project:	Sonoblomo Solar Farm-C1801/30
Client:	SMEC
Geolab Job Nr:	S20-882
Test Method:	ASTM 3080-72

Sample Nr:	SB-T10-1
Sample Depth:	0.3-2.1m_SB
Date:	21/08/2020

Results		
ϕ' =	**31.0**	**°**
c' =	**0.0**	**kPa**





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