H-9 *TRAFFIC*

Mukondeleli Wind Energy Facility (WEF) Transport Impact Assessment (EIA phase)

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REVISION 0

Prepared by:
JG AFRIKA (PTY) LTD
Branch: Cape Town
PO Box 38561
Postal code: 7430
Telephone: 021 530 1800
Email: johnsona@jgafrika.com
Project director: Adrian Johnson

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JG AFRIKA (PTY) LTD **Cape Town** PO Box 38651 Pinelands 7430 Tel.: 021 530 1800 Email: johnsona@jgafrika.com	**WSP Environment & Energy** WSP in Africa Building C, Knightsbridge 33 Sloane Street, Bryanston 2191 South Africa Tel: +27 11 361 1392 Email: Ashlea.Strong@wsp.com
AUTHOR	**AUTHOR**
A Ramawa	A Ramawa

SYNOPSIS

Preparation of a Traffic Impact Assessment (TIA) for the proposed development of a 300 MW Wind Energy Facility (i.e., Mukondeleli Wind Energy), in the Govan Mbeki Municipality, Mpumalanga Province.

KEY WORDS:

Wind Energy Facility, Transport Impact Assessment

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.

Verification	Capacity	Name	Signature	Date
By Author	Engineer	A Ramawa		21/10/2022
Checked by:	Senior Technologist	A Johnson		21/10/2022
Authorised by:	Director	D Petersen		21/10/2022

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Mukondeleli Wind Energy Facility (WEF)
Transport Impact Assessment
(EIA phase)

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EXECUTIVE SUMMARY

This report serves as the Traffic Impact Assessment (TIA) aimed at determining the traffic impact of the proposed 300MW Mukondeleli Wind Energy Facility (WEF) and whether such development can be accommodated by the transportation system.

The site is proposed to accommodate Seven (7) access points. The access points make use of existing farm accesses with the exception of one new access point. Access spacing restrictions are not envisaged for the existing access points and the proposed new access is located within TRH 26 Road Classification and Access Management manual limits. The sight lines from each of the four existing farm access points are within the recommended limits.

The access points will need to be upgraded to accommodate the expected construction and haulage vehicles.

The construction phase is conservatively estimated to generate 79 peak hour volumes (pre mitigation measures). The decommissioning phase is expected to generate similar trips as the construction phase. However, these trips can be reduced.

During the operational phase it is estimated that 12 peak hour trips will be generated by the site. The traffic impact during the operational phase is considered negligible.

For the construction, operational and decommissioning phases, the impact expected to be generated by the vehicle trips is an increase in traffic and the associated noise, dust, and exhaust pollution. These impacts are expected to have a moderate significance rating during the construction stage, and a low significance raring during the operational stage. These significance ratings remain valid during the cumulative impact assessment.

To limit traffic congestion and the associated noise, dust, and exhaust pollution it is recommended to:

- Stagger the delivery of components to the site to occur outside of peak traffic periods,
- Use dust suppression on gravel roads during the construction phase, as required.
- Use mobile batch plants and quarries near the site
- Staff and general trips should occur outside of peak traffic periods as far as possible.
- Use buses and taxis to transport workers and limit staff commuter trips.
- Use on site water sources to limit water truck trips
- Maintain internal roads to achieve good riding quality.

The No-Go alternative (i.e., proposed development does not proceed) is not considered preferable because the development is expected to introduce socio-economic benefits to the surrounding communities, as well as aid the government in meeting energy demands.

Traffic impact assessments are generally assessed for the operation phase of a development. Based on similar studies, wind energy facilities have a low peak hour traffic impact with less than 50 peak hour trips expected to be generated. Considering the envisaged low traffic demand posed by the development during the operation phase, the development is supported from a transport perspective provided that the recommendations made in this study are adhered to.

MUKONDELELI WIND ENERGY FACILITY TIA

This report serves as the Traffic Impact Assessment (TIA) prepared as part of the scoping phase of the Environmental Impact Assessment (EIA) for the proposed development of a 300 MW Wind Energy Facility (i.e., Mukondeleli Wind Energy Facility), in the Govan Mbeki Municipality, Mpumalanga Province.

1 INTRODUCTION

1.1 Project Description

The proposed Mukondeleli Wind Energy Facility (WEF) will have a project area of approximately 3100ha, with a maximum export capacity of up to 300 MW (see **Figure 1-2**). Within this project area the extent of the buildable area will be determined subject to finalization based on technical and environmental evaluations and considerations.

The proposed Mukondeleli WEF and associated infrastructure are subject to a full Scoping and EIA process in terms of the 2014 NEMA EIA Regulations, as amended.

The proposed WEF is located in the Govan Mbeki Municipality, near the town of Secunda, in the Mpumalanga Province of South Africa. The project area covers 21 property portions. The details of the properties associated with the proposed Mukondeleli WEF, including the 21-digit Surveyor General (SG) codes for the cadastral land parcels, are outlined in **Table 1-1** .

Table 1-1: Affected farm properties

Portion Number	Farm Number	Farm Names	21 Digit Surveyor General Code of each cadastral land parcel
0	314	Knoppies	T0IS00000000031400000
1	317	van Tondershoek	T0IS00000000031700001
2	317	van Tondershoek	T0IS00000000031700002
2	316	Brandwacht	T0IS00000000031600002
2	291	Bosjesspruit	T0IS00000000029100002
3	316	Brandwacht	T0IS00000000031600003
4	316	Brandwacht	T0IS00000000031600004
5	321	Tweefontein	T0IS00000000032100005
6	291	Bosjesspruit	T0IS00000000029100006
7	317	van Tondershoek	T0IS00000000031700007
8	317	van Tondershoek	T0IS00000000031700008
8	291	Bosjesspruit	T0IS00000000029100008
9	313	Knoppiesfontein	T0IS00000000031300009
9	291	Bosjesspruit	T0IS00000000029100009
10	291	Bosjesspruit	T0IS00000000029100010
11	291	Bosjesspruit	T0IS00000000029100011
11	317	van Tondershoek	T0IS00000000031700011
12	291	Bosjesspruit	T0IS00000000029100012
12	317	van Tondershoek	T0IS00000000031700012
13	316	Brandwacht	T0IS00000000031600013
13	291	Bosjesspruit	T0IS00000000029100013
14	291	Bosjesspruit	T0IS00000000029100014

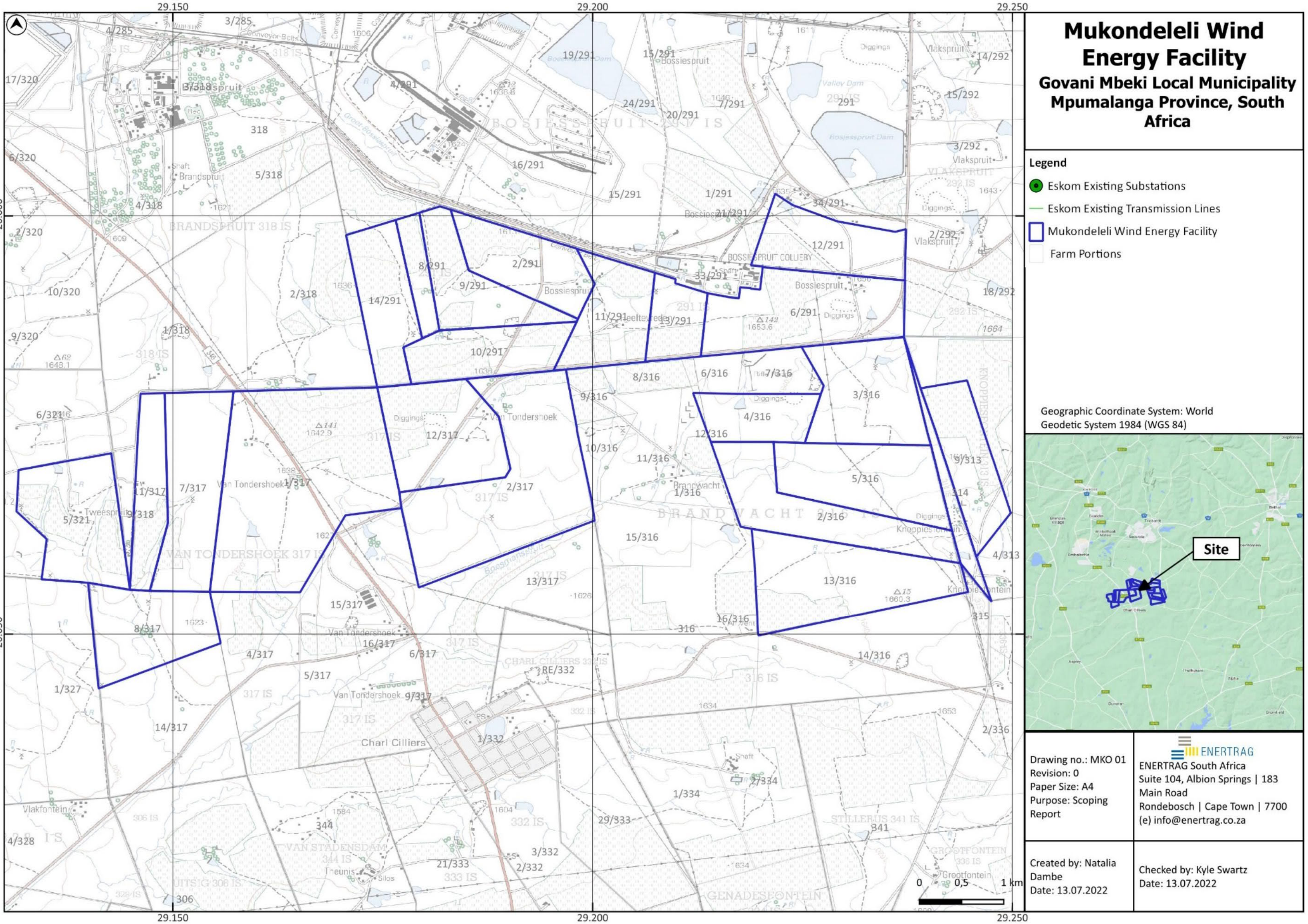

Figure 1-1: Affected farm portions

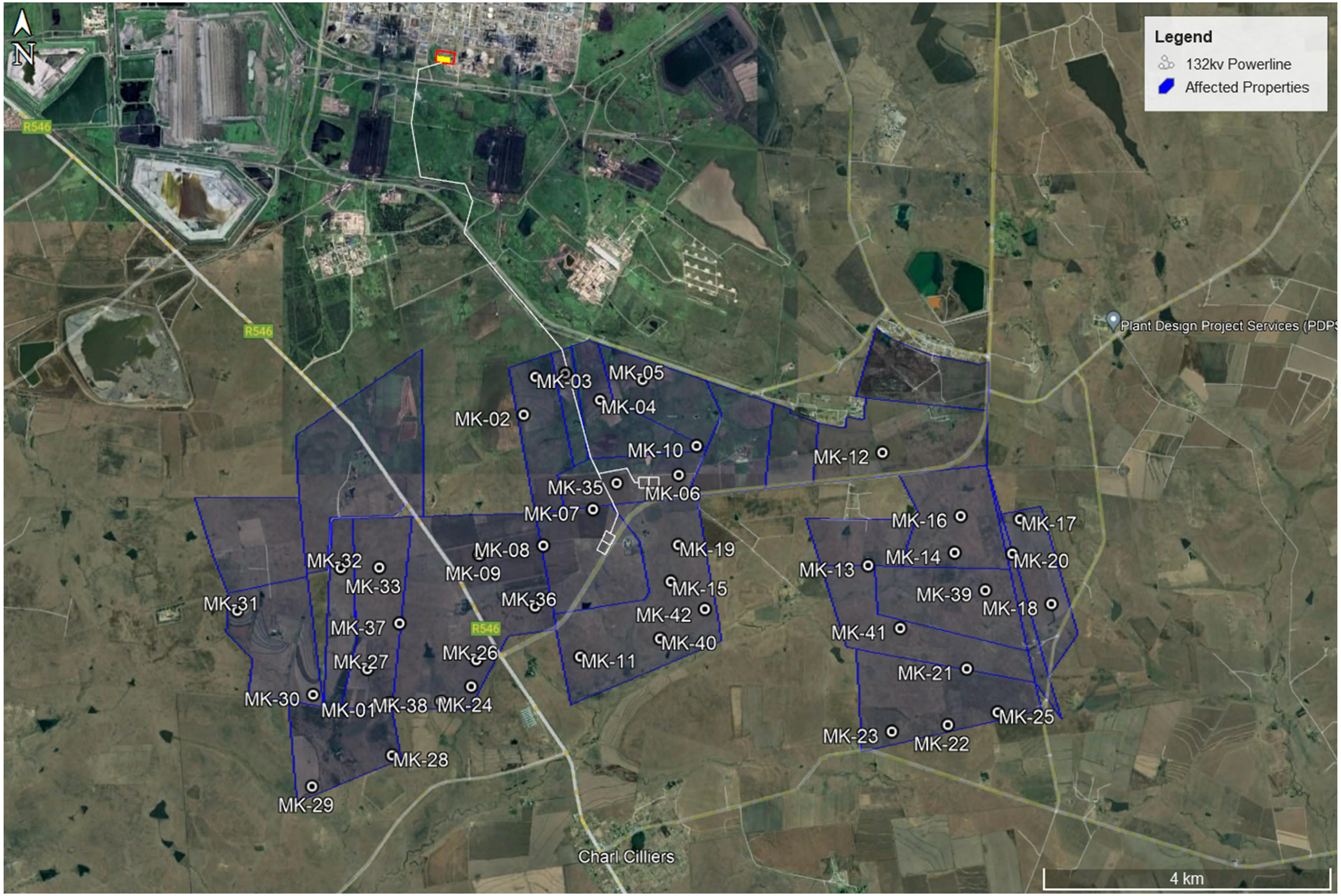

Figure 1-2: Site Layout

1.2 Scope, Purpose, and Objectives of Specialist Report

The TIA is aimed at determining the traffic impact of the proposed land development proposal and whether such development can be accommodated by the external transportation system.

The report deals with the items listed below and focuses on the surrounding road network in the vicinity of the site:

- Extent of the traffic study and study area,
- The proposed development,
- The existing road network and future road planning proposals,
- Trip generation for the proposed development during the construction, operation, and decommissioning phases of the facility,
- Traffic impact of the proposed development,
- Access requirements,
- Determine a main route for the transportation of components to the proposed site,
- Determine a preliminary transportation route for the transportation of materials, equipment, and people to site,
- Recommend alternative or secondary routes where possible.
- Public Transport access,
- Non-motorised Transport facilities, and
- Recommended public transport and NMT upgrades, if necessary.

1.3 Terms of Reference

JG Afrika (Pty) Ltd was appointed by CSIR Environmental Division on behalf of their client ENERTRAG South Africa (Pty) Ltd, to provide a Traffic Impact Assessment to from part of the scoping phase of the Environmental Impact Assessment (EIA) for the proposed 200MW Mukondeleli Wind Energy Facility (WEF).

Mukondeleli Wind RF (Pty) Ltd proposes to develop the Mukondeleli Wind Energy Facility (WEF), with a maximum capacity of up to 300 MW, located in the Govan Mbeki Municipality in the Mpumalanga Province of South Africa (see **Figure 1-3**). The proposed WEF and associated infrastructure are subject to a full Scoping and EIA process in terms of the 2014 NEMA EIA Regulations, as amended.

The proposed Mukondeleli WEF and associated infrastructure include the following components:

- Up to 42 wind turbine generators (WTGs) with a maximum capacity of up to300 MW.
- Turbines with a hub height of up to 200m and a rotor diameter of up to 200 m.
- Hardstand areas of approximately 1 500m^2 per turbine.
- Temporary construction laydown and storage area of approximately 4 500m^2 per turbine.
- Medium voltage cabling connecting the turbines will be laid underground.
- A Battery Energy Storage System (BESS) comprising of several utility scale battery modules within shipping containers or an applicable housing structure on a concrete foundation. Lithium-Ion Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology, however, the specific technology will only be determined following EPC procurement.
- Internal roads with a width of up to 10m providing access to each turbine, the BESS, on-site substation (SS), step-down substation and laydown area. The roads will accommodate cable trenches and stormwater channels (as required) and will include turning circle/bypass areas of up to 20 m at some sections during the construction phase. As such, the roads and cables will be positioned within a 20 m wide corridor. Existing roads will be upgraded wherever possible, although new roads will be constructed where necessary.
- A temporary construction laydown/staging area of approximately 4.5 hectares (ha) which will also accommodate the operation and maintenance (O&M) buildings.
- A 33/132kV on-site SS to feed electricity generated by the proposed Mukondeleli WEF into the step-down substation at the Sasol facility. The on-site SS will accommodate 1 x 132 kV incoming feeder bay, 1x 132 kV outgoing feeder bay and a motorised isolator with protection and metering.

In addition to the wind turbines to be installed on the project sites, the proposed development also comprises a 132 kV overhead power line and a step-down substation to feed the electricity generated by the project into the proposed Green Hydrogen Electrolyser facility located at Sasol Secunda which is between 5 and 10 km from the on-site SS. The 132 kV power line and step-down substation at Sasol is subject to a separate Basic Application to be undertaken by the applicant.

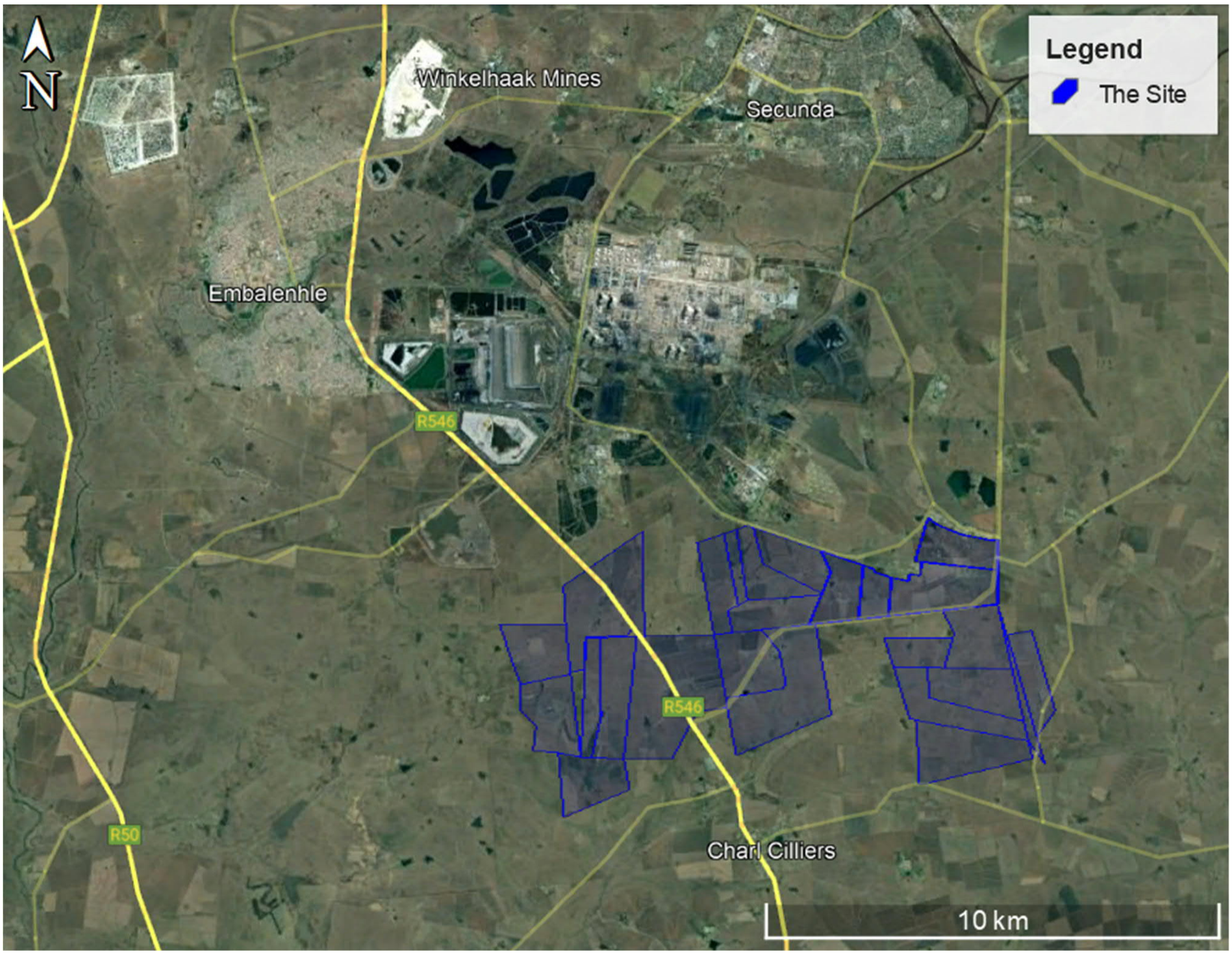

Figure 1-3: Site Locality

2 APPROACH AND METHODOLOGY

The report deals with the traffic impact on the surrounding road network in the vicinity of the site during the:

- Construction phase;
- Operational phase; and
- Decommissioning phase.

This transport study includes the following tasks:

Project Assessment

- Communication with the project team to gain sound understanding of the project.
- Overview of available project background information including, but not limited to, location maps, site development plans, anticipated vehicles to the site (vehicle type and volume), components to be transported and any resulting abnormal loads.
- Research of all available documentation and information relevant to the proposed facility.

Access and Internal Roads Assessment

- Assessment of the proposed access points including:
  - Feasible location of access points
  - Motorised and non-motorised access requirements
  - Queuing analysis and stacking requirements, if required
  - Access geometry
  - Sight distances and required access spacing
  - Comments on internal circulation requirements and observations

Haulage Route Assessment

- Determination of possible haulage routes to site regarding:
  - National routes
  - Local routes
  - Site access points
  - Road limitations due to abnormal loads

Traffic Estimation and Impact

- Construction, operational, and decommissioning phase vehicle trips
  - Generated vehicles trips
  - Abnormal load trips
  - Access requirements
- Investigation of the impact of the development traffic generated during construction, operation, and decommissioning.

Report (Documentation)

- Reporting on all findings and preparation of the report.

2.1 Information Sources

The following guidelines have been used to determine the extent of the traffic study:

- Manual for Traffic Impact Studies, Department of Transport, 1995
- TRH 26 South African Road Classification and Access Management Manual, COTO
- TMH 16 South African Traffic Impact and Site Traffic Assessment Manual (Vol 1), COTO, August 2012
- TMH 16 South African Traffic Impact and Site Traffic Assessment Manual (Vol 2), COTO, February 2014
- Google Earth Pro
- Mpumalanga Road Asset Management System
- Transnet port terminals website
- Govan Mbeki Spatial Development Framework 2014-2034

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations apply:

- This study is based on the project information provided by the client.
- According to the Eskom Specifications for Power Transformers (Eskom Power Series, Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers), the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000mm, total maximum width 4 300mm and total maximum length 10 500mm.
  It is envisaged that for this project, the inverter, transformer, and switchgear will be transported to site in containers on a low bed truck and trailer. A mobile crane and the transformer transport are the only abnormal load envisaged for the site. The crane will be utilised for offloading equipment, such as the transformers.
- Maximum vertical height clearances along the haulage route are 5.2m for abnormal loads.
- If any elements are manufactured within South Africa, these will be transported from their respective manufacturing centres, which would be either in the greater Cape Town area, Johannesburg, or possibly Pinetown/Durban.
- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- Material for the construction of internal access roads will be sourced locally as far as possible.
- The maximum number of turbines to be used at the site is estimated to be 42.
- The final access points are to be determined during the detailed design stage. Only recommended access points are known at this stage.
- Projects in the vicinity of the site to be considered as part of the EIA cumulative impacts are currently unknown.
- An 18-to-24-month construction period is assumed with 48% of the construction period dedicated to site prep and civil works.

2.3 Consultation Processes Undertaken

The TIA is based on available project information and consultation with the Environmental Practitioner assigned to the project.

3 LEGISLATIVE AND PERMIT REQUIREMENTS

Key legal requirements pertaining to the transport requirements for the proposed development are:

- Abnormal load permits, (Section 81 of the National Road Traffic Act 93 of 1996 and National Road Traffic Regulations, 2000),
- Port permit (Guidelines for Agreements, Licenses and Permits in terms of the National Ports Act No. 12 of 2005), and
- Authorisation from Road Authorities to modify the road reserve to accommodate turning movements of abnormal loads at intersections.

4 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE TIA

4.1 Port of Entry

It is envisaged that the components will be imported to South Africa via the Port of Durban or the Port of Richards Bay as the closest ports to the site.

4.1.1 The Port of Durban

The Durban container terminal operates as two terminals Pier 1 and Pier 2, handling 65% of South Africa's (SA) container volumes. It is ideally located to serve as a hub for containerized cargo from the Indian Ocean Islands, Middle East, Far East and Australia.

The Durban Container Terminal is Africa's biggest and busiest - home to the state of the art, twin lift ship-to-shore cranes. Various capacity creation projects are currently underway, including deepening of berths and operational optimization. The terminal currently handles 65% of South Africa's container volumes. (Transnet Port Terminals, n.d.)

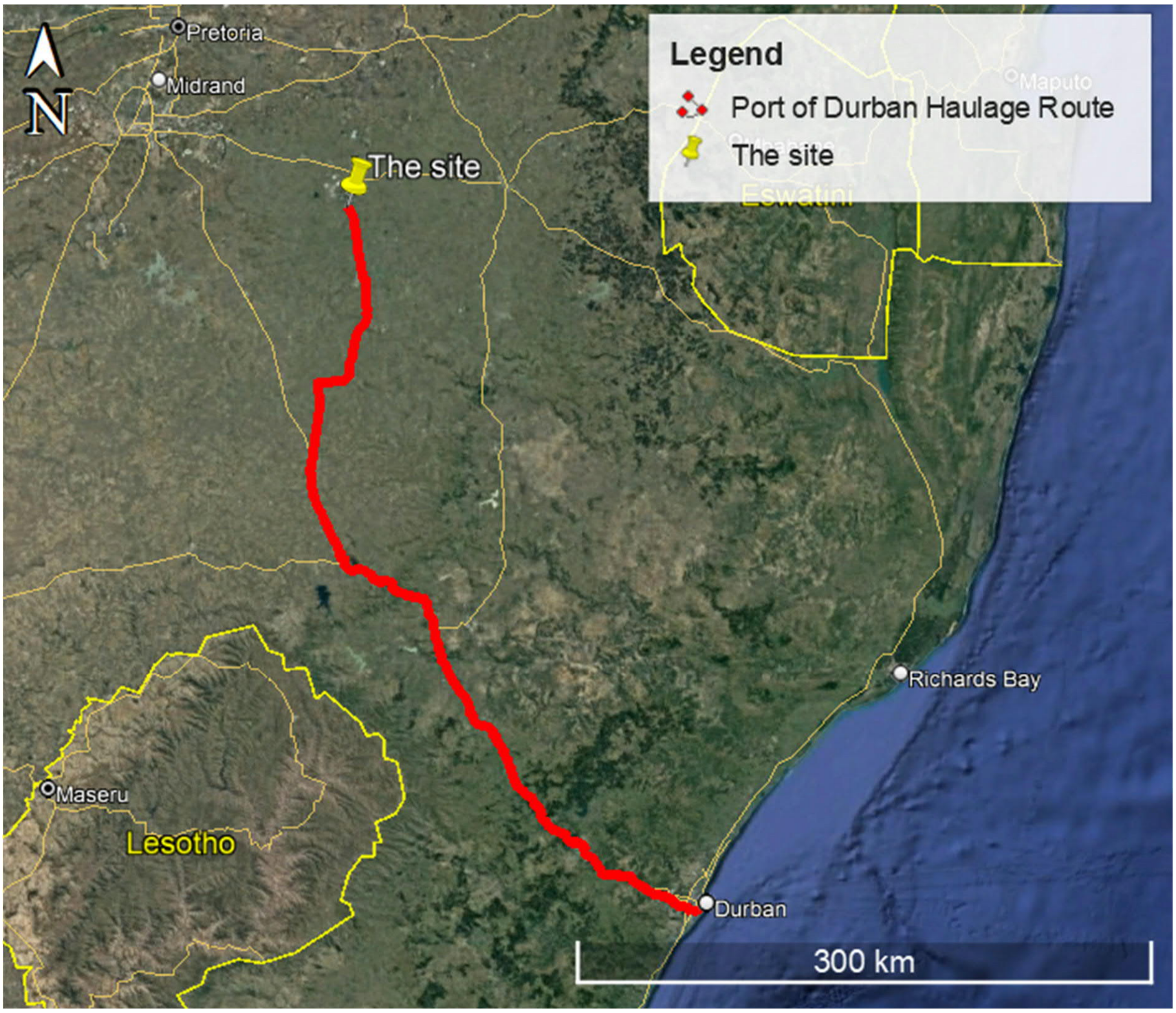

Figure 4-1: Route from the site to the Port of Durban

4.1.2 The Port of Richards Bay

The Port of Richards Bay is situated in the northern industrial hub of Kwa-Zulu Natal and accessible via rail and road. The port is a deep-sea water port with 13 berths. The Port can handle dry bulk ores, minerals and break bulk with a draft that easily accommodates Cape size and Panamax vessels.

The Port is currently creating capacity, investing in new equipment, and undergoing extensive refurbishments. The Richards Bay port will not only be a deep-sea water port, but South Africa's premium bulk mineral port within the next six years. The Richards Bay Expansion Programme is currently in progress, adding new berths and extending rail capacity within the port. (Transnet Port Terminals, n.d.)

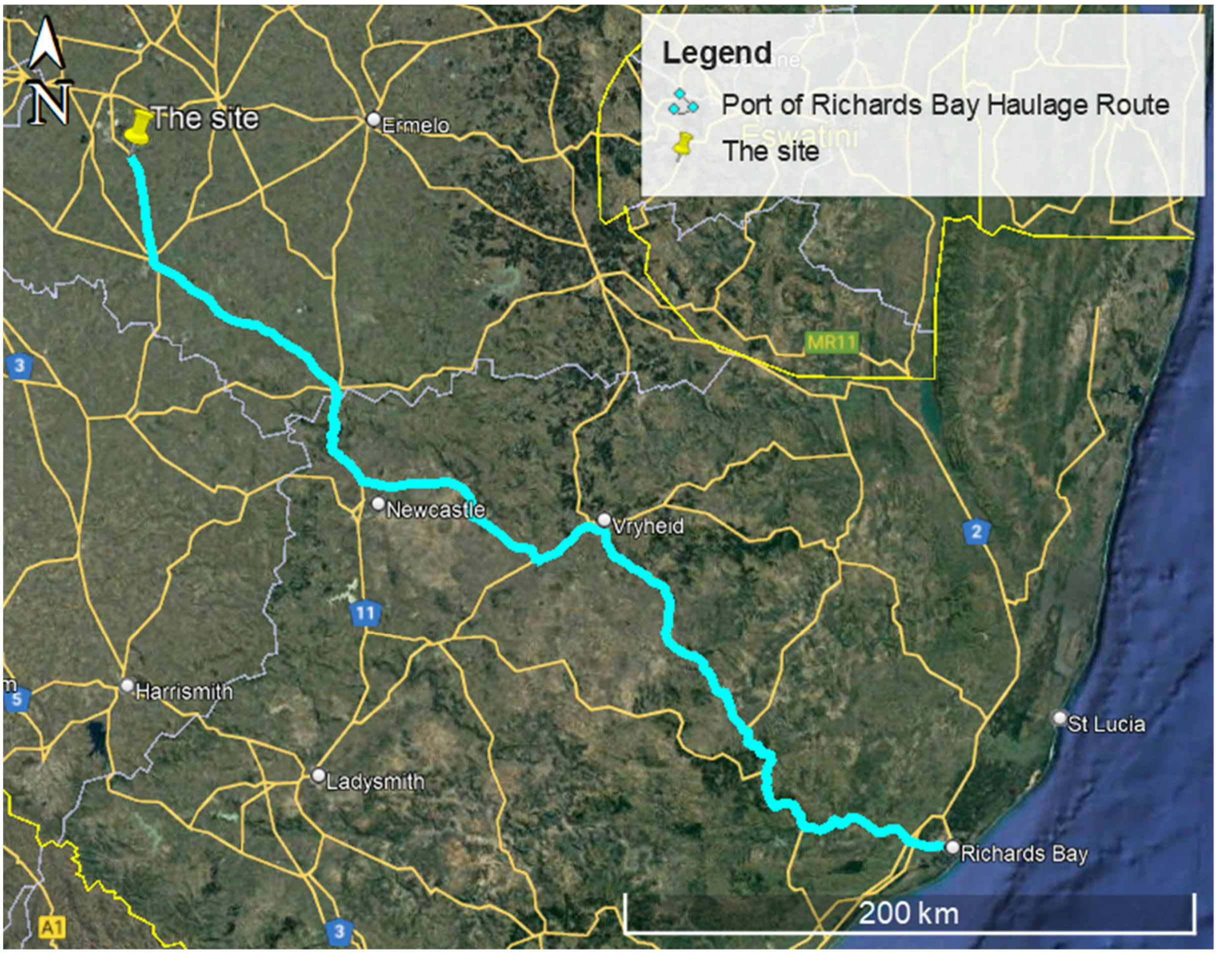

Figure 4-2: Route from the site to the Port of Richards Bay

The Port of Durban is located approximately 513km south-east of the site (see **Figure 4-1**), and the Port of Richards Bay is located approximately 473km south-east of the site (see **Figure 4-2**). The travel routes to the site from the ports comprise mostly high order routes. It is however recommended to conduct a “dry run” with abnormal transport vehicles to determine the route limitations. Adjustments to the road width (e.g., at bellmouths) and road furniture may be required to accommodate the abnormal load vehicles.

Due to the short travel distance to site, the Port of Richards Bay is considered the preferred port of entry. It must, however, be noted that availability at any of the considered ports will need to be confirmed with the Transnet Port authority. Deliveries may also be subject to delays/waiting periods at the port due to backlogs.

4.2 Transportation requirements

It is anticipated that the following vehicles will access the site during construction:

- Conventional trucks within the freight limitations to transport building material to the site,
- Light vehicles and buses transporting workers from surrounding areas to site,
- Drilling machines and other required construction machinery being transported by conventional trucks or via self-drive to site, and
- Nacelle transported by abnormal load,
- Turbine blades transported by abnormal load,
- Tower sections transported by abnormal load,
- Turbine hub and rotary units by abnormal load,
- Abnormal mobile crane for assembly on site, and
- The transformer transported in an abnormal load (on-site substation).

4.3 Abnormal Load Considerations

Abnormal permits are required for vehicles exceeding the following permissible maximum dimensions on road freight transport in terms of the Road Traffic Act (Act No. 93 of 1996) and the National Road Traffic Regulations, 2000:

- Length: 22m for an interlink, 18.5m for truck and trailer and 13.5m for a single unit truck
- Width: 2.6mHeight: 4.3m measured from the ground. Possible height of load – 2.7m.
- Weight: Gross vehicle mass of 56t resulting in a payload of approximately 30t
- Axle unit limitations: 18t for dual and 24t for triple-axle units
- Axle load limitation: 7.7t on the front axle and 9t on the single or rear axles

Any dimension / mass outside the above will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorisation for the conveyance of said load. A permit is required for each Province that the haulage route traverses.

In addition to the above, the preferred routes for abnormal load travel should be surveyed prior to construction to identify any problem areas, e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a “dry-run” with the largest abnormal load vehicle, to ensure that the vehicle can travel without disruptions. It needs to be ensured that gravel sections (if any) of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.

There are bridges and culverts along the National and Provincial routes, which need to be confirmed for load bearing capacity and height clearances. However, there are alternative routes which can be investigated if the selected route or sections of the route should not be feasible.

Any low hanging overhead lines (lower than 5.1m), e.g., Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

The expected abnormal load trip generators are for the transport of the transformer, nacelles, turbine blades, tower sections, and turbine hub and rotary units, as well as the abnormal mobile crane needed for assembly on site.

4.4 Further Guideline Documentation

The Technical Recommendations for Highways (TRH) 11: "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outlines the rules and conditions that apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts.

The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power / mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the Road Traffic Act and the relevant regulations.

4.5 Permitting – General Rules

In general, the limits recommended in TRH 11 are intended to serve as a guide to the Permit Issuing Authorities. It must be noted that each Administration has the right to refuse a permit application or to modify the conditions under which a permit is granted. It is understood that:

a) A permit is issued at the sole discretion of the Issuing Authority. The permit may be refused because of the condition of the road, the culverts and bridges, the nature of other traffic on the road, abnormally heavy traffic during certain periods or for any other reason.
b) A permit can be withdrawn if the vehicle upon inspection is found in any way not fit to be operated.
c) During certain periods, such as school holidays or long weekends an embargo may be placed on the issuing or permits. Embargo lists are compiled annually and are obtainable from the Issuing Authorities.

4.6 Load Limitations

The maximum load that a road vehicle or combination of vehicles will be allowed to carry legally under permit on a public road is limited by:

- the capacity of the vehicles as rated by the manufacturer,
- the load which may be carried by the tyres,
- the damaging effect on pavements,
- the structural capacity on bridges and culverts,
- the power of the prime mover(s),
- the load imposed by the driving axles, and
- the load imposed by the steering axles.

4.7 Dimensional Limitations

A load of abnormal dimensions may cause an obstruction and danger to other traffic. For this reason, all loads must, as far as possible, conform to the legal dimensions. Permits will only be considered for indivisible loads, i.e., loads that cannot, without disproportionate effort, expense, or risk of damage, be divided into two or more loads for the purpose of transport on public roads. For each of the characteristics below there is a legally permissible limit and what is allowed under permit:

- Width,
- Height,
- Length,
- Front Overhang,
- Rear Overhang,
- Front Load Projection,
- Rear Load Projection,
- Wheelbase,
- Turning Radius, and
- Stability of Loaded Vehicles.

4.8 Transporting Wind Turbine Components

Wind turbine components can be transported in several ways with different truck/trailer combinations and configurations. The travel arrangements and logistics will be investigated when the transporting contractor and the plant hire companies apply for the necessary permits from the Permit Issuing Authorities.

4.8.1 Nacelle

The heaviest component of a wind turbine is the nacelle (i.e., approximately 100 tons depending on the manufacturer and design of the unit). Combined with road-based transport, a total vehicle mass of approximately 145 000kg for a 100-ton unit can be expected. Based on the weight limitations, route clearances and permits will be required for transporting the nacelle by road-based transport (see an example of road-based transportation below). The unit will require a minimum height clearance of 5.1 metres.

Figure 4-3:Transporting the Nacelle (Dvorak, 2010)

4.8.2 Blades

A wind turbine's blades are the longest and most vulnerable components and must be protected during shipment. Manufacturers are actively improving on blade designs with blade lengths that go beyond 100m. Blades need to be transported on an extendible blade transport trailer or in a rigid container with rear steerable dollies. Blades can be transported individually, in pairs, or threes, although different manufacturers have different packaging methods for transporting the blades. The transport vehicle typically exceeds the dimensional limitation (length) of 22 metres and will only be allowed under permit, provided the trailer is fitted with steerable rear axles or dollies.

Figure 4-4: Blade transport (Froese, 2019)

For this study, turbine blades of a maximum length of 100 metres have been assessed. Due to this abnormal length, special attention needs to be given to route planning, especially to suitable turning radii and adequate sweep clearance. Therefore, vegetation or road signage may have to be removed before transport. Once transported to the site, the blades need to be carefully stored in their respective laydown areas before being installed onto the rotary hub.

4.8.3 Tower Sections

Tower sections generally consist of sections of around 20 metres in length. The number of tower sections required depends on the selected hub height and type of tower section (i.e., tubular steel, hybrid steel/concrete tower, etc.). For a hub height of 200 metres, a maximum of 10 tower sections is required. Each tower section is transported separately on a low-bed trailer. Depending on the trailer configuration and height when loaded, some of these components may not meet the dimensional limitations (height and width) but will be permitted under certain permit conditions.

Figure 4-5:Transporting the Tower Sections (Montiea, 2014)

4.8.4 Turbine Hub and Rotary Units

The turbine hub needs to be transported separately due to its significant weight. A hub unit weighs around 45 tons.

Figure 4-6:Transporting the rotor hub (Richardstransport, n.d.)

4.9 Transporting Cranes, Mobile Cranes, and other Components

Crane technology has developed rapidly, and several different heavy lifting options are available on the market. Costs involved to hire cranes tend to vary and should be compared beforehand. For this assessment, some possible crane options are outlined as follows.

4.9.1 Examples of Cranes for Assembly and Erection on Site

Option 1: Crawler Crane and Assembly Crane

The main lift crane capable of performing the required lifts (i.e., lifting the tower sections into position, lifting the nacelle to the hub height, and lifting the rotor and blades into place) needs to be similar to the Liebherr Crawler Crane LR1750 with an SL8HS (Main Boom and Auxiliary Jib) configuration. A smaller 200-ton Liebherr Mobile Crane LTM 1200-5.1 is also required to lift the components and assist in the assembly of the crawler crane at each turbine location.

- **Crawler Crane LR1750 with the SL8HS boom system (Main Lifting Crane):**

The Crawler Crane will be transported to the site in components and the heaviest load will be the superstructure and crawler centre section (83 tons). The gross combination mass (truck, trailer, and load) will be approximately 133 000 kg. The boom sections, counterweights and other equipment will be transported on conventional tri-axle trailers and then assembled on site. It will require several truckloads of components to be delivered for assembly of the Crawler Crane before it can be mobilised to perform the heavy lifts.

Figure 4-7: Crawler Crane used to assemble turbine (Liebherr, 2017)

- **Mobile Crane LTM 1200-5.1 (Assembly Crane):**

The Liebherr LTM 1200-5.1 crane is a 5-axle vehicle with rubber tyres, which will travel to site on its own. However, the counterweights will be transported on conventional tri-axle trailers and then assembled on site. The assembly crane is required to assemble the main lift crane as well as assist in the installation of the wind turbine components.

Option 2: GTK 1100 Crane & Assembly Crane

For the single wind turbine at Coega, the GTK 1100 hydraulic crane was used (see example in Figure 3 6). The GTK 1100 was designed to lift ultra-heavy loads to extreme heights and its potential lies in being deployed on facilities such as wind farms.

Figure 4-8: Cranes at work

- **Hydraulic GTK 1100 Crane**

A key benefit of the GTK 1100 is its quick set-up due to the vertical rigging of the self-erecting tower and it can be operational in four to six hours. The crane has a small footprint of 18x18m (including the boom set-up) for a restricted job site area and its self-levelling function results in minimal ground preparation. In addition, the crane can operate at these heights with very heavy loads of up to 100 tons without a counterweight. The GTK 1100 can be transported on four truckloads including two abnormal trailers (for the Boom and Crane).

- **Mobile Crane LTM 1200-5.1 (Assembly Crane):**

As above - a smaller 200-ton Liebherr Mobile Crane LTM 1200-5.1 is also required to lift the components and assist in the assembly of the hydraulic crane at each turbine location.

4.9.2 Cranes at the Port of Entry

Most shipping vessels importing the turbine components will be equipped with on-board cranes to do all the safe off-loading of the wind turbine components to the abnormal transport vehicles, parked adjacent to the shipping vessels.

Figure 4-9: Cranes at Port of Entry

The imported turbine components may be transported from the Port of Entry to the nearby turbine laydown area. Mobile cranes will be required at these turbine laydown areas to position the respective components at their temporary storage location.

4.10 Transporting Other Plant, Material and Equipment

In addition to transporting the specialised equipment, the normal Civil Engineering construction materials, plant and equipment will need to be transported to the site (e.g., sand, stone, cement, gravel, water, compaction equipment, concrete mixers, etc.). Other components, such as electrical cables, battery energy storage compartments, pylons, transformers, and switchgear, will also be transported to site during construction. The transport of these items will be conducted with normal heavy loads vehicles.

5 BASELINE ENVIRONMENTAL DESCRIPTION

5.1 General Description

The site is located in farm property within the Govan Mbeki Local Municipality which forms part of the Gert Sibande District Municipality in the Mpumalanga Province. The site is located to the south of the town of Secunda on the following farm parcels (see **Figure 5-1**):

- Bosjesspruit 291 (Portions 2, 6, 8, 9, 10, 11, 12, 13 and 14)
- Brandwacht 316 (Portions 2, 3, 4, 5 and 13)
- Knoppies 314 (Portion 0)
- Knoppiesfontein 313 (Portion 9)
- Tweefontein 321 (Portion 5)
- Van Tondershoek (Portions 1, 2, 5, 7, 8, 11 & 12)

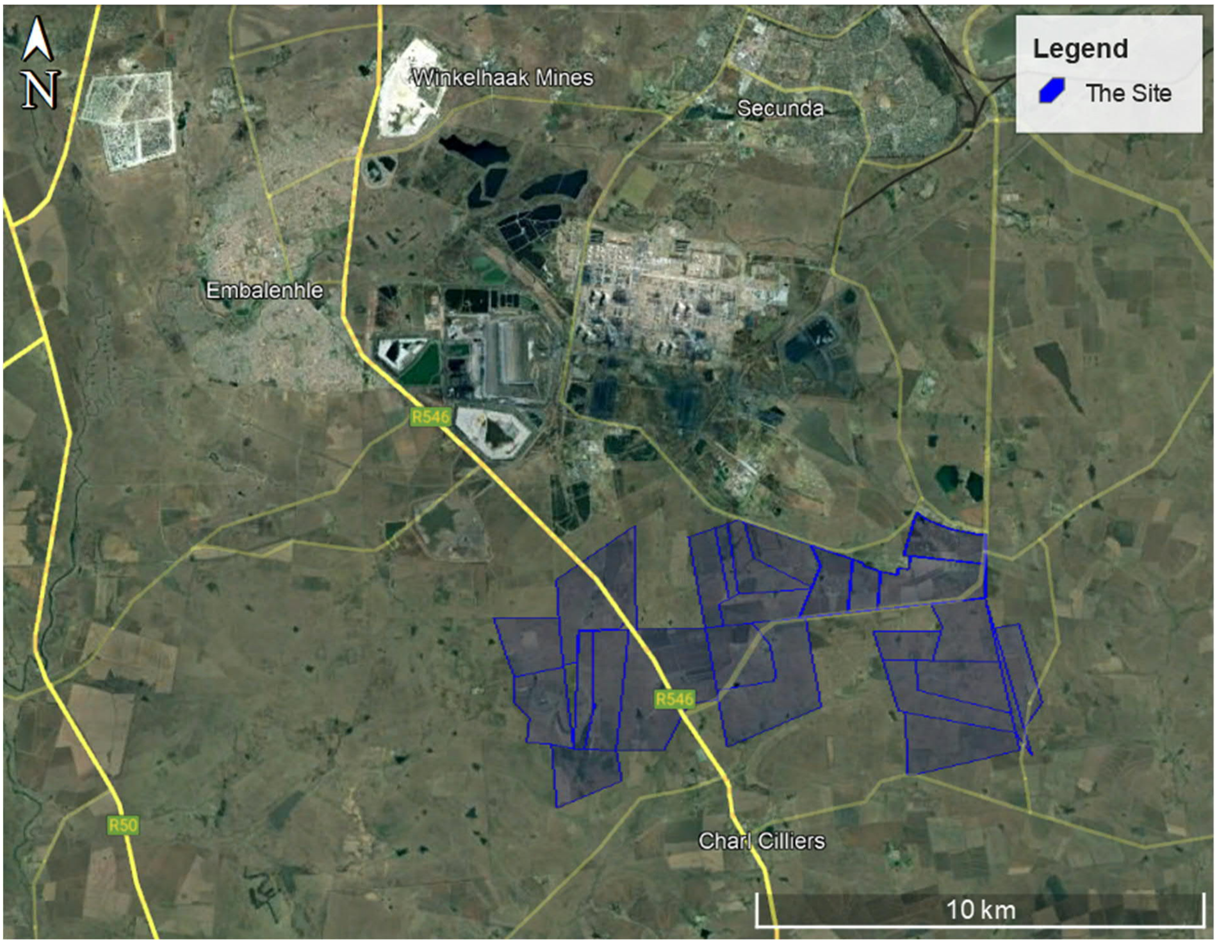

Figure 5-1: The site

5.2 Project Specific Description

5.2.1 Route for Components manufactured within South Africa

In South Africa, more than half (52%) of the manufacturing industry's national workforce resides in three metros - Johannesburg, Cape Town, and eThekwini. It is therefore anticipated that elements that can be manufactured within South Africa will be transported to the site from the Cape Town, Johannesburg, or Pinetown/Durban areas. Components will be transported to site using appropriate National and Provincial routes. It is expected that the components will generally be transported to site with normal heavy load vehicles.

1. **Route from Cape Town Area to Site – Locally sourced materials and equipment**
Cape Town has a large manufacturing sector with twenty-six (26) industrial areas located throughout the metro.

The proposed industrial hubs being considered to source the required materials and components is currently unknown. With quite an extensive and widespread industrial market, a specific route to the site cannot be considered at this point in time, but it is expected that a majority of the route length will be similar to the routes considered for the haulage of imported materials and equipment. No road limitations are envisaged along the route for normal load freight.

2. **Route from Johannesburg Area to Site – Locally sourced materials and equipment**
If components from Johannesburg are considered, normal loads from Johannesburg to the site can be transported via the route as shown in **Figure 5-2** below. No road limitations are envisaged along the route for normal load freight. The distance from Johannesburg to the site is approximately 137km.

Figure 5-2:Route from Johannesburg Area to Site

3. Route from Pinetown / Durban to Site - Locally sourced materials and equipment
Normal loads can transport elements via two potential routes from Durban and Pinetown to the site. No road limitations are envisaged along the route for normal load freight. The shortest distance from Pinetown to the site is approximately 491km as shown in **Figure 5-3** below.

Figure 5-3:Route from Pinetown to the Site

5.2.2 Surrounding road network

The proposed Mukondeleli WEF site is located south of Secunda, Mpumalanga Province. The road network surrounding the site includes the D823 traversing the centre of the site in a west to east direction, the P185/1 traversing the west side of the site in a south to north direction, as well as the D2183 and D863 to the east of the site. The road classification of the surrounding road network as per the Road Infrastructure Strategic Framework for South Africa (RISFSA) is shown in **Figure 5-4** below (sourced form Mpumalanga RAMS system).

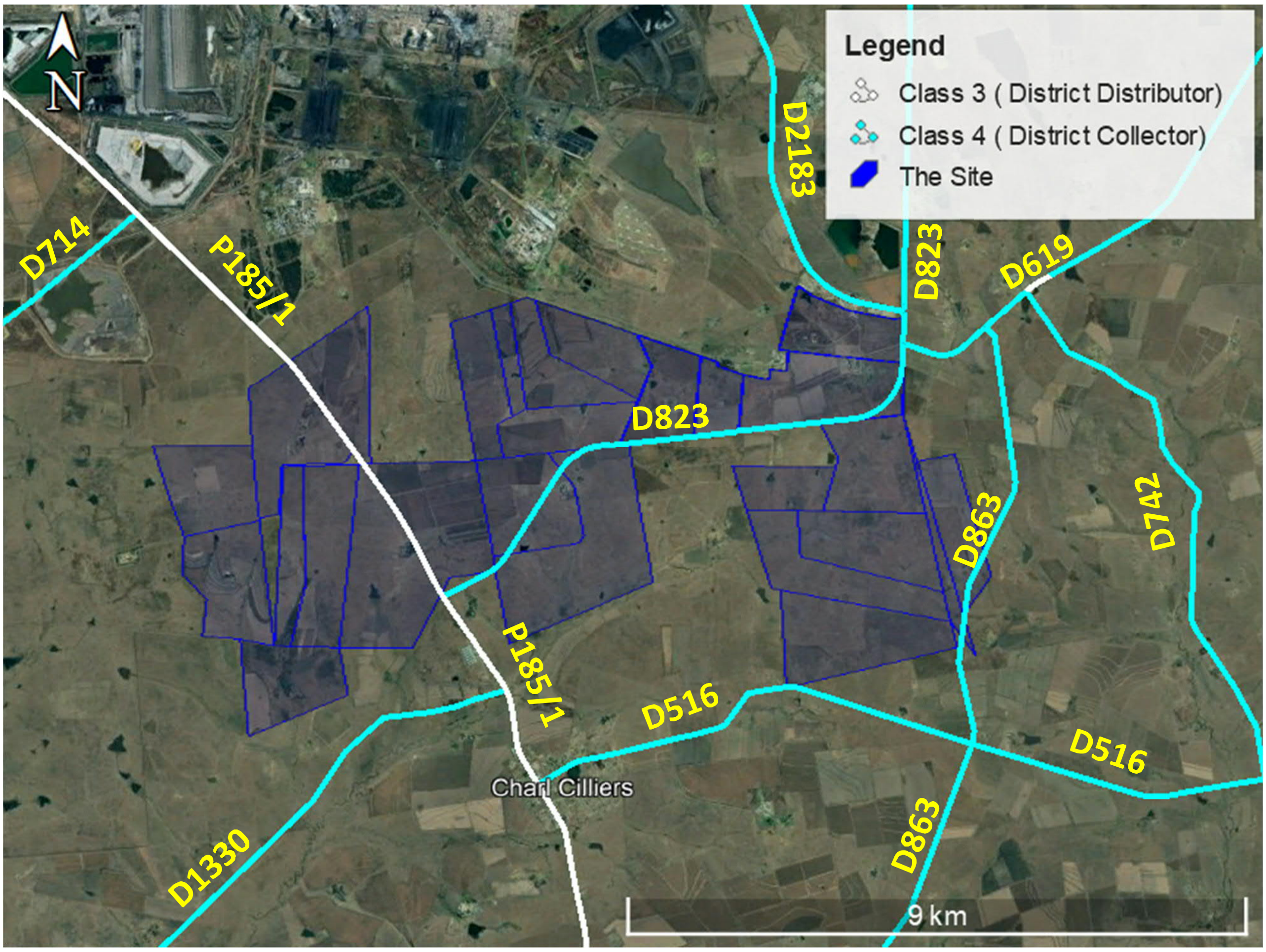

Figure 5-4:Road Classification of surrounding road network

5.2.3 Proposed Access Route

Seven (7) site access points are accommodated at the site (see **Figure 5-5)**. The access points are proposed off the P185/1 (i.e., R546), D823, and D863. The P185/1 and D823 are surfaced single carriage way road with one lane per direction while the D863 is a gravel road.

All proposed access points are located off existing access roads with the exception of Access 03. Based on the TRH 26 road classification and access management manual the recommended minimum spacing for full intersections on class 4 roads is 600 to 800m in rural settings. Access 3 is ±600m east of the D83-D185/1 intersection and ±2.3km west of access 04. No access spacing restrictions are envisaged for the existing access points and Access 03 meets access spacing requirements.

Sight lines from the access points are within the recommended limits.

The final site access points will be based on the access investigation findings, geometric considerations, and site layout restrictions.

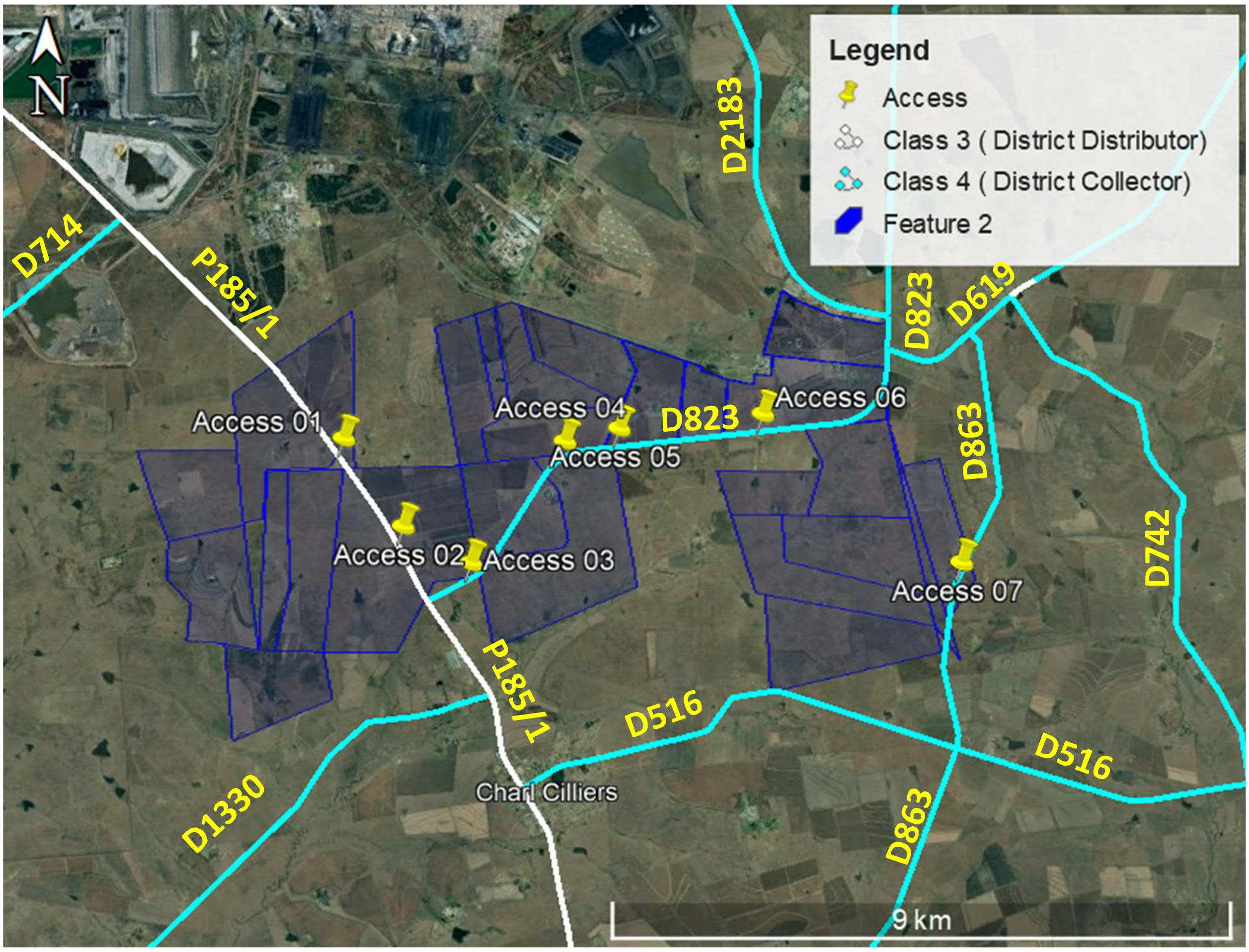

Figure 5-5: Recommended site access points

The access points to the site will need to be able to cater for construction and abnormal load vehicles. A minimum road width of 8m is recommended for the access points and the internal roads can have a minimum width of 5m. The radius at the access point needs to be large enough to allow for all construction vehicles to turn safely.

It is recommended that the site access be controlled via a boom and gatehouse. It is also recommended that security staff be stationed on site at the access booms during construction. A minimum stacking distance of 25m is recommended between the road edge of the external road and the boom.

All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM).

5.2.4 Traffic volume information

Based on the Mpumalanga Road Asset Management System, the 2018 Annual Average Daily Traffic (AADT) on the P185/1 is rated as high, while the AADT on the D823 is rated as medium (see **Table 5-1).** Traffic congestion is therefore expected on the road sections close to the site access points. Traffic congestion mitigation measures are therefore strongly encouraged during the construction stage.

The rest of the routes in the surrounding road network experiences low to medium levels of AADT.

Table 5-1: 2018 AADT

Road No#	from_km	to_km	2018 Link AADT	surface	Volume category
D1330	0	8.66	81	Gravel	Low-Medium
D2183	7.25	14.21	291	paved	Low
D516	30.06	34.45	846	Paved	Low-Medium
D516	34.45	41.29	805	Paved	Low-Medium
D619	4.43	9.91	298	Gravel	High
D619	9.91	10.33	218	Paved	Low
D619	10.33	11.12	112	Paved	Low
D619	11.12	12.51	43	Paved	Low
D823	0	8.52	1771	paved	Medium
D823	8.52	8.94	1771	paved	Medium
D823	8.94	9.04	574	paved	Low-Medium
D823	9.04	18.14	574	gravel	Very High
D863	37.89	46.95	45	Gravel	Low
D863	46.95	53.39	72	Gravel	Low-Medium
P185/1	25.97	30.26	1584	Paved	Medium
P185/1	30.26	31.74	1586	Paved	Medium
P185/1	31.74	33.36	1657	Paved	Medium
P185/1	33.36	40.59	3900	Paved	High

(Source: Mpumalanga Provincial Road Asset Management System (RAMS), n.d.)

An estimated 4% annual traffic growth is deemed suitable for the area. This is based on historical AADT data obtained from Mpumalanga RAMS system.

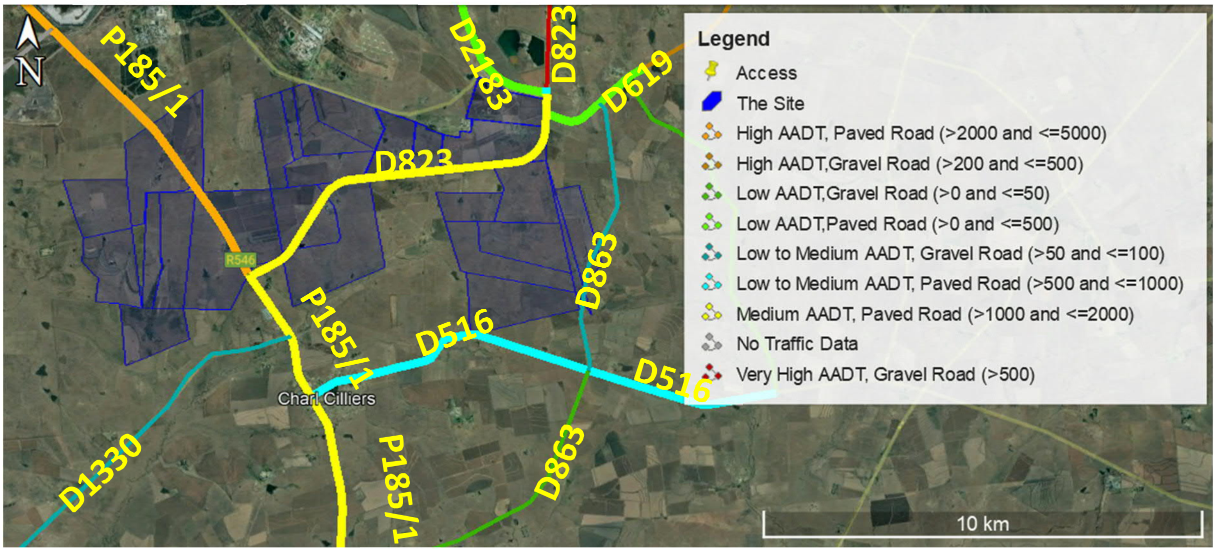

Figure 5-6: Link AADT (Mpumalanga Provincial Road Asset Management System (RAMS), n.d.)

5.2.5 Internal Roads

The geometric design and layout for the internal roads from the access points needs to be established at detailed design stage. Existing structures and services, such as drainage structures, signage, street lighting and pipelines will need to be evaluated if impacting on the roads. It needs to be ensured that gravel sections remain in good condition and will need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed.

The geometric design constraints encountered due to the terrain should be taken into consideration by the geometric designer. Preferably, the internal roads need to be designed with smooth, relatively flat gradients (recommended to be no more than 8%) to allow a larger transport load vehicle to ascend to the respective laydown areas.

5.2.6 Transportation of Materials, Plant and People to the proposed site

It is assumed that the materials, plant, and workers will be sourced from the surrounding towns as far as possible. The closest towns to the site are Secunda, Trichardt, Evander, Embalenhle, Kinross and Bethal (see **Figure 5-7**).

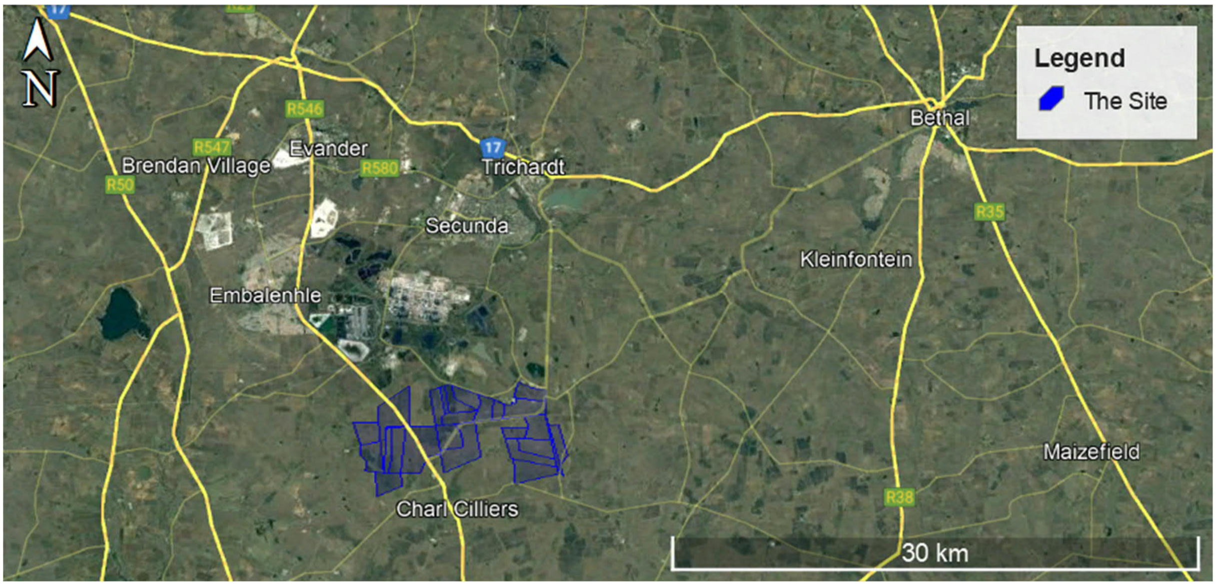

Figure 5-7: Surrounding Towns

6 ISSUES, RISKS AND IMPACTS

6.1 Identification of Potential Impacts/Risks

The potential impacts to the surrounding environment expected to be generated form the development traffic is traffic congestion and associated noise, dust, and exhaust pollution. This will be true for the construction, operation, and decommissioning phase. It must be noted that significance of the impact is expected to be higher during the construction and decommissioning phase because these phases generate the highest development traffic.

It must be noted that:

- The significance of the traffic impacts is expected to be higher during the construction and decommissioning phase because these phases generate the highest development traffic.

- Traffic impacts are typically assessed for the operational stage as the long-term road infrastructure impact. The construction and decommissioning phase are expected to produce high development traffic volume and a traffic management plan document is often compiled and managed throughout these phases to help manage traffic during these phases.

6.1.1 Construction phase

This phase includes the transportation of people, construction materials and equipment to the site. This phase also includes the construction of the WEF, including construction of footings, roads, excavations, trenching, and ancillary construction works. This phase will temporarily generate the most development traffic.

Nature of impact:

The nature of the impact expected to be generated at this stage would be traffic congestion and

delays on the surrounding road network as well as the associated noise, dust, and exhaust pollution due to the increase in traffic.

Estimated peak hour traffic generated by the site:

1. **Wind Energy Facility:**

    i. **Material delivery:** This includes heavy vehicles for the transport of building materials such as reinforced concrete materials for foundations, gravel material for roadworks, brickwork material for buildings, fencing material, etc. The major trip generation activities are assumed to result from the construction of turbine foundations and road material delivery.

- Heavy vehicles (turbine foundations): Based on similar studies, typically 87 trips per 500m^3 foundation is estimated for the turbine foundation.

  The detailed design of the foundation is unestablished at this stage. It is however assumed that a 25m diameter foundation approximately 3m deep can be assumed as a preliminary estimate. This would result in a 1 473m^3 foundation volume.

For 42 turbines, a ***total of 10 765 trips*** can be estimated for concrete foundation material delivery.

- Heavy vehicle (road layer works): Assuming a typical 0.2m gravel wearing course and a 10.2m road width, 2.04m^2 of gravel wearing course is assumed for the purpose of the trip estimate.

  Typically, 1 trip/6m^3 can be assumed for material delivery. The final road length on the site is unknow at this stage. The preliminary layout accommodates approximately 35 km of road. This results in a material volume of 71 400m^3 and the total resulting generated trips for material delivery would be ***11 900 trips***.

- Heavy vehicles (hardstand material): 1 trip/6m^3 is assumed. With an 1500m^2 hardstand per turbine envisaged for the purpose of this estimate a 0.2m gravel wearing course is assumed. ***2 100 total trips*** can be estimated for hardstand material delivery.

  Assuming 235 annual working days, a 9-month site prep and civil works construction period, and 40% of daily traffic occurring during the peak period, ***57 peak hour trips*** are assumed for hardstand material delivery.

It must also be noted that vehicle trips from material delivery vary depending on the construction task/program, fuel supply arrangements, as well as distance from the material source to the site. Project planning can be used to reduce material delivery during peak hours.

ii. **<u>Construction machinery:</u>** This includes cranes for turbine assembly, heavy vehicles required for earthworks and roadworks. These vehicles are expected to have negligible traffic impact as they will arrive on site in preparation for construction. Once on site, these vehicles will produce internal site traffic with minimal effect on the external road network.

iii. <u>Component delivery trips:</u>

The blades*:* For this project a maximum rotor diameter of 200m is assumed (i.e., 100 m blades). As a worst-case scenario, it is assumed that the blades will be transported separately (i.e., *three* (*3) trips per turbine or 126 trips for 42wind turbines*).

The nacelle: one (1) abnormal load trip per turbine *(i.e., 42 trips for 42 turbines)*

The turbine hub and rotor unit: one (1) abnormal load trip per turbine (i.e., 42 trips for 42 turbines)

Tower sections: For a maximum hub height of 200 metres, a maximum of 10 tower sections is required. Each tower section is transported separately on a low-bed trailer *(i.e., 10 abnormal load trips per turbine or 420 trips for 42 turbines)*

Total abnormal loads per turbine (turbine components): 15 trips per turbine (i.e., ***630 total trips for 42 turbines***)

In addition to the turbine component delivery trips, one (1) abnormal load is estimated for the transformer.

The abnormal load trips are highly depended on project planning and abnormal load permitting. These trips are not necessarily concentrated to the peak hours. The number of peak hour vehicle trips generated by abnormal load vehicles is thus unknown at this stage.

iv. **Construction workers trips:**

The number of construction personnel is affected by project programming however the current estimate is at 200 to 250 workers.

It is further assumed that approximately 50% (max 125) will be low skilled workers (construction labourers, security staff etc.), ~30% (max 75) semi-skilled workers (drivers, equipment operators etc.) and approximately 20% (max 50) skilled personnel (engineers, land surveyors, project managers etc.).
Typically, contractors arrange transportation for site workers. Assuming the low skilled and semi-skilled labourers can commute by bus with a 60-passenger capacity, four (4) busses can be assumed for low skilled and semi-skilled labourers. The skilled labourers are conservatively assumed to travel by passenger car (50 trips).

For rural environments it is further estimated that the peak hour trips are around 20-40% of the average daily traffic (i.e., **22 peak hour trips**).

Based on the conservative estimate of peak hour trips above it is highly recommended that trips are managed and reduced to minimise the traffic volume generated by the site at any one time. Methods of peak hour trip reduction and management are provided as part of the impact assessment in section 7 of this report.

2. Traffic during the Construction of Grids/Power lines:

The grid/ powerline expected for the site is a 132 kV overhead power line and a step-down Substation (SS) to feed the electricity generated by the project into the proposed Green Hydrogen Electrolyser facility located at Sasol Secunda which is between 5 and 10 km from the on-site SS.
The powerline components are expected to be transported by normal load vehicles.

Estimated peak hour traffic generated by the site:

i. **Material and component delivery:** Vehicle trips from material and component delivery vary depending on the construction task/program, fuel supply arrangements, as well as distance from the material source to the site. Not enough detail about the powerline is known at this stage to provide an estimated trip generation volume for material and component traffic.

The materials and most components expected for the powerline construction can generally be transported by normal heavy load vehicles. Project planning can be used to reduce delivery trips during peak hours. In addition to this, using a mobile batch plant as well as temporary construction material stockpile yards near the proposed site can also reduce peak hour trips.

The transmission tower sections, and transformer are expected to be transported by abnormal load. The number of tower sections and transformer units is unknown thus the number of abnormal loads cannot be estimated. The abnormal load trips are however expected to be low.

ii. **Construction machinery:** Cranes for pylon/tower assembly, heavy vehicles required for earthworks etc.

These vehicles are expected to have negligible traffic impact as they will arrive on site in preparation for construction. Once on site, these vehicles will produce internal site traffic with minimal effect on the external road network.

iii. **Site personnel and workers:** Based on information obtained from similar projects it is assumed that 20-30 workers can be expected on site per workday for the powerline construction.

Minibus taxis have an average 15 passenger capacity and assuming approximately 5% highly skilled personnel will travel by means of passenger vehicles the following trips are assumed:

- for the skilled personnel a maximum of 2 trips are expected.
- The remaining 28 workers can travel by minibus (i.e., 2 minibus trips).

Assuming 40% of the trips will occur during the peak hour, a maximum of 2 peak hour site personnel trips is assumed for the purposes of this assessment.

3. <u>Total estimated construction trips:</u>

The summary of estimated total development trips is shown in **Table 6-1**.

Table 6-1: Summary of total estimated maximum peak hour trips (construction phase) without trip mitigation

	Trip generator	Total	Daily	Peak
Wind energy component	Material delivery	24 765	141	57
	Construction machinery	Negligible		
	Component delivery	630	Unknown (depends on abnormal load permits)	
	Site personnel	54	-	22
Grid connection	Construction vehicles	Negligible		
	Component delivery	Unknown but estimated to be low		
	Site personnel	4	-	2

The above trip estimates are dependent on the construction period, construction programming, material availability, component delivery, abnormal load permitting etc.
It will be important to schedule the construction trips to spread the trips over the day, minimising congestion.

6.1.2 Operational Phase

This phase includes the operation and maintenance of the WEF throughout its life span.

Nature of impact:

The nature of the impact expected to be generated at this stage would be traffic congestion and delays on the surrounding road network, and the associated noise, dust, and exhaust pollution due to the operational traffic trips.

Estimated peak hour traffic generated by the site:

- **Trips generated by staff traveling to the site:**

The number of permanent staff expected for the operational phase is still unknown. Based on similar studies it can be estimated that approximately 30 full-time employees will be stationed on site. Assuming 40% of the trips occur during the peak hour ***12 peak hour trips*** can be assumed for the operational phase.

The operational peak hour trips generated by staff are expected to be low and will have a negligible impact on the external road network.

6.1.3 Decommissioning phase

This phase will have similar impacts and generated trips as the Construction Phase.

7 IMPACT ASSESSMENT

7.1 Potential Impact (Construction Phase or Decommissioning Phase)

The decommissioning phase will generate construction related traffic including transportation of people, construction materials, water, and equipment (abnormal trucks transporting turbine components). It is therefore expected that the decommissioning phase will generate the same impact as that of the construction phase due to the similarity in nature of the traffic demand expected for both phases. Based on the impact rating, a medium significance rating can be expected during the construction and decommissioning stage.

Nature of the impact

- Noise and dust pollution associated potential traffic

Table 7-1:Impact Assessment (construction phase)

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor			Medium: Processes continue but in a modified way		
Impact Extent (E) The geographical extent of the impact on a given environmental receptor		Local: Inside activity area			
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change			Recoverable: Recovery with rehabilitation		
Impact Duration (D) The length of permanence of the impact on the environmental receptor		Short term: 0-5 years			
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation				Highly Probability	
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ S= - 40				
IMPACT SIGNIFICANCE RATING					
Total Score			**31 to 60**		
Environmental Significance Rating (Negative (-))			**Moderate**		

Potential impact mitigation measures:
Noise, dust, and exhaust pollution during the construction phase cannot be completely mitigated. Where possible, the following mitigation measures will significantly reduce the impact:

- The delivery of components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- Dust suppression of gravel roads during the construction phase, as required.
- The use of mobile batch plants and quarries near the site would decrease the traffic impact on the surrounding road networks.
- Accommodation of secure material storage on site to allow for staggered delivery of materials.
- Staff and general trips should occur outside of peak traffic periods as far as possible. The use of busses and taxis to transport staff can also limit construction phase trips.
- The preferred abnormal load travel routes should be surveyed to identify problem areas (e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification).
- Design and maintenance of internal roads. Any internal gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional.

7.2 Potential Impact (Operation Phase)

Nature of the impact

- Noise and dust pollution associated potential traffic

Based on the impact rating, a low significance rating can be expected during the operational stage.

Table 7-2:Impact Assessment (Operation phase)

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor		Low: Slight impact on processes			
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only				
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change			Recoverable: Recovery with rehabilitation		
Impact Duration (D) The length of permanence of the impact on the environmental receptor				Long term: Project life	
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation		Low Probability			
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ S= -20				
IMPACT SIGNIFICANCE RATING					
Total Score		**16 to 30**			
Environmental Significance Rating (Negative (-))		**Low**			

Noise, dust, and exhaust pollution cannot be completely mitigated. Where possible, the following measures will significantly reduce the impact:

- Encouraging workers to travel outside peak hour periods.
- Dust suppression as well as maintenance of internal roads.

7.3 Potential Impacts during the Decommissioning Phase

This phase will have a similar impact as the Construction Phase (i.e., traffic congestion, air pollution and noise pollution) as similar trips/movements are expected.

7.4 Cumulative Impacts

7.4.1 Construction phase

To assess the cumulative impact, it will be assumed that all authorised and proposed renewable energy projects within the vicinity of the site, would be constructed at the same time. It must be noted that this is a conservative approach.

There are four (4) renewable energy projects located within a 55km radius of the site, namely:

- The authorised Tutuka 65.9 MW Solar Photovoltaic (PV) Energy Facility and its associated infrastructure (Ref: 14/12/16/3/3/2/754) located 23km southwest of the site.
- The authorised Forzando North Coal Mine Solar PV Facility, 9.5MW, (Ref: 14/12/16/3/3/1/452) is located 55km northwest of the site.
- The proposed Impumelelo WEF to be located southeast of the site.
- The proposed Vhuvhili Solar Energy Facility (NEAS No. MPP/EIA/0001063/2022) located approximately 10km east of the site.

The total estimated construction peak hour trips are summarised in **Table 7-3** .It must however be noted that this is a conservative estimate, and the likelihood of occurrence is considered low due to the following:

- Renewable energy projects are affected by funding and economic viability.
- projects targeted to supply energy to the national grid are subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom.
- even if all renewable energy projects are constructed and decommissioned on the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

Table 7-3:Estimated Cumulative construction trips

Developments	Megawatt	Estimated peak hour construction traffic (excluding abnormal loads)
Tutuka Solar Photovoltaic (PV)	65.9	21
Forzando North Coal Mine Solar PV	9.5	9
Impumelelo WEF	200	63
Vhuvhili Solar Energy Facility	300	67
Total peak hour trips		160

Table 7-4: Cumulative Impact Assessment (Construction phase)

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor			Medium: Processes continue but in a modified way		
Impact Extent (E) The geographical extent of the impact on a given environmental receptor			Regional: Outside activity area		
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change			Recoverable: Recovery with rehabilitation		
Impact Duration (D) The length of permanence of the impact on the environmental receptor			Medium term: 5-15 years		
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation				Highly Probability	
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ S= - 48				
IMPACT SIGNIFICANCE RATING					
Total Score			**31 to 60**		
Environmental Significance Rating (Negative (-))			**Moderate**		

7.4.2 Operational phase

The total estimated operational peak hour trips are summarised in **Table 7-5**.

Table 7-5:Estimated Cumulative operational trips

Developments	Megawatt	Estimated peak hour traffic
Tutuka Solar Photovoltaic (PV)	65.9	4
Forzando North Coal Mine Solar PV	9.5	4
Impumelelo WEF	200	12
Vhuvhili Solar Energy Facility	300	12
Total peak hour trips		32

Table 7-6:Cumulative Impact Assessment (Operational phase)

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor		Low: Slight impact on processes			
Impact Extent (E) The geographical extent of the impact on a given environmental receptor		Local: Inside activity area			
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change			Recoverable: Recovery with rehabilitation		
Impact Duration (D) The length of permanence of the impact on the environmental receptor				Long term: Project life	
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation		Low Probability			
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ S= -22				
IMPACT SIGNIFICANCE RATING					
Total Score		**16 to 30**			
Environmental Significance Rating (Negative (-))		**Low**			

7.5 NO-GO ALTERNATIVE

The no-go alternative implies that the proposed development does not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network. However, this would also mean that there would be no socio-economic benefits to the surrounding communities, and it will not assist government in meeting energy demands. **Hence, the no-go alternative is not a preferred alternative.**

8 FINAL SPECIALIST STATEMENT

Traffic impact assessments are generally assessed for the operation phase of a development. Based on similar studies, wind energy facilities have a low peak hour traffic impact with less than 50 peak hour trips expected to be generated. Considering the envisaged low traffic demand posed by the development during the operation phase, the development is supported from a transport perspective provided that the recommendations made in this study are adhered to.

9 REFERENCES

1. Mp-rams.co.za. n.d. *Mpumalanga Provincial Road Asset Management System (RAMS)*. [online] Available at: <http://mp-rams.co.za/rams/rams.html> [Accessed 22 November 2021].
2. Transnetportterminals.net. n.d. *Transnet Port Terminals*. [online] Available at: <https://www.transnetportterminals.net/Ports/Pages/default.aspx> [Accessed 23 November 2021].
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Annexure A: Specialist Expertise

ADRIAN WESLEY NATHANIEL JOHNSON

Profession	*Civil Engineering Technologist*
Position in Firm	*Manager: Traffic and Transportation*
Area of Specialisation	*Traffic & Transportation Engineering*
Qualifications	*PrTechEng, Master of Transport Studies, BSc (Hons) (Applied Science: Transport Planning), BTech Civil Engineering*
Years of Experience	*16 Years*
Years with Firm	*5 Years*

SUMMARY OF EXPERIENCE

Adrian Johnson is a Professional Technologist registered with ECSA (201570274). He joined JG Afrika (Pty)Ltd. in January 2017. Adrian holds a BSc (Hons) (Applied Sciences: Transportation Planning) degree from the University of Pretoria, a BTech degree in Civil Engineering from the Cape Peninsula University of Technology and completed a Masters' degree in Transport Studies at the University of Cape Town in 2020. He has more than 16 years of experience in a wide range of engineering projects.

He has technical and professional skills in traffic impact studies, transport impact assessments, public transport planning, non-motorised transport planning & design, data analysis of public transport systems, access management plans, quality control, project planning and implementation, geometric design, site supervision, transport assessments for renewable energy projects, speed limit reviews and road safety audits.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

PrTechEng - Engineering Council of South Africa, Registration No 201570274
SAICE - South African Institute of Civil Engineering. No 201700129
SARF WR - South African Road Federation Western Region Administrator and Committee Member

EDUCATION

2004 - **National Diploma** (Civil) – Peninsula Technikon
2006 - **BTech** (Civil) – Cape Peninsula University of Technology
2011 - **BSc (Hon)** (Applied Sciences: Transportation Planning) – University of Pretoria
2020 – Master of Transport Studies – University of Cape Town

SPECIFIC EXPERIENCE

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)

September 2022 – Date
Position – Manager: Traffic and Transportation

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)

2017 – June 2022
Position – Senior Technologist (Traffic and Transportation Engineering)
Various Transport Impact Statements (TIA) and Traffic Impact Statements (TIS) for private clients including:

- Weltevreden Clinic TIS for Edifice Consulting Engineers
- Oakhurst Primary TIS for BVZ Plan
- Sinai Academy TIS for Bettesworth Scott Planners
- Rustlamere TIA for Bettesworth Scott Planners
- Joostenbergvlakte Farms 732 and 728 TIA for Asla
- Garden Emporium TIA for Rory Cameron Smith Architects
- Strandfontein Sandmine TIS for Chand Environmental Consultants
- Proposed development of Erf 538 Grassy Park TIA for First Plan
- Riebeek West: Proposed Function/Wedding Venue TIS for Elco Property Developers

Limpopo Road Asset Management System Undertake network level road safety assessments and analysis of accident statistics of the Limpopo road network (5 000km). – Client: Roads Agency Limpopo SOC Ltd

Kampies Housing Development Proposed upgrade of the informal settlement on Cape Farm 616 Philipi and Erf 63 Spring Field, providing 275 units. Client: Ian Rout & Associates

Highlands Housing Project Traffic calming plans for three proposed sites in Mitchells Plain, Cape Town – Client: City of Cape Town

Richards Bay Gas to Power Facility Transport study for the proposed renewable energy facility in Richards Bay, KwaZulu Natal – Client: Private Client

Solid Waste Management Sector Plan – Collections Work Brief Information Analyst assisting with the assessments and detailed analysis of the collections and drop-off facilities operating model of the City of Cape Town – Client: City of Cape Town

Nooiensfontein Housing Project Transport Study for the Nooiensfontein Housing Development in Bluedowns (2500 units) – Client: Ian Rout & Associates

Bardale Housing Development Transport Impact Assessment and Signal timing plan, Western Cape – Client: Integrated Housing Development

Enkanini Housing Transport Impact Assessment for the development of the Enkanini Informal Settlement, Kayamandi - Client: Stellenbosch Municipality

Sutherland and Rietrug Access Road Transport study for the upgrading and widening of the access road to the proposed Sutherland Windfarm, Northern Cape Client: Nala Environmental Consulting

Pienaarspoort Windfarm Transport study for the proposed Pienaarspoort Windfarm, Western Cape Client: Savannah Environmental (Pty) Ltd

Speed Limit Review Main Road 546, Main Road 552 and Divisional Road 2220, Lutzville, Western Cape – Client: Western Cape Government

Gromis and Komis Wind Energy Facility Transport study for the proposed Windfarm, Northern Cape. Client: CSIR

Geelkop Solar Facility Transport study for the proposed Geelkop Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

Khunab Solar Facility Transport study for the proposed Khunab Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

Bloemsmond Solar Facility Transport study for the proposed Bloemsmond Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

NMT Study for the Upgrading of DR1285, Elgin – Client: Western Cape Government

Traffic Study for the Kudusberg and Rondekop Wind Energy Facilities, Northern Cape. Client: G7

Speed Limit Review Main Road 540, Elandsbay, Western Cape – Client: Western Cape Government

Road Safety Audit for N1 Section 16 Winburg to Ventersburg – Client: Aurecon on behalf of SANRAL

Road Safety Audit for the for the N4 at Bapong, Client: Bakwena

Road Safety Audit for N2 Wild Coast Toll Road Projects, Eastern Cape & Natal, Client: Aurecon/Knight Piesold on behalf of SANRAL

Kuruman Wind Energy Facility Transport study for the proposed Kuruman Windfarm, Northern Cape. Client: CSIR

Coega West Windfarm Transportation and Traffic Management Plan for the proposed Coega Windfarm in Coega, Port Elizabeth – Client: Electrawinds Coega

Parking Audit of the Groenvallei area in Bellville – Client: City of Cape Town

Road Safety Appraisals for the Mpumalanga Province – Client: Mpumalanga Provincial Government

Transportation and Traffic Management Plan for the proposed Coega West Wind Energy Facility in Port Elizabeth – Client: Electrawinds Coega (Pty) Ltd

Road Safety Appraisals for North Region of Cape Town – Client: Aurecon on behalf of City of Cape Town

Speed Limit Reviews for North Region of Cape Town – Client: Aurecon on behalf of City of Cape Town

Road Safety Audit for the Upgrade of N1 Section 4 Monument River – Client: Aurecon on behalf of SANRAL

Road Safety Audit for the Upgrade of N2 Section 8 Knysna to Wittedrift – Client: SMEC on behalf of SANRAL

Road Safety Audit for the Upgrade of N1 Section 16 Zandkraal to Winburg South – Client: SMEC on behalf of SANRAL

Traffic and Road Safety Studies for the Improvement of N7 Section 2 and Section 3 (Rooidraai and Piekenierskloofpass) – Client: SANRAL

Traffic Engineer for the Upgrade of a 150km Section of the National Route N2 from Kangela to Pongola in KwaZulu-Natal, Client: SANRAL

GIBB (Pty) Ltd

2014 – 2016
Position – Technologist / Project Leader (Traffic and Transportation Engineering)
Operational Support to the MyCiTi Integrated Rapid Transit System - Tasks included analysis of AFC data, generating monthly operations reports, analysis of passenger surveys, journey time runs, travel time surveys, compilation of a MyCiTi Festive Season Report and compilation of reports for the Century City and V&A Waterfront stakeholders. Client: Transport for Cape Town.

Technical Support to the MyCiTi Business Planning Department - A detailed route-by-route analysis, during peak and off-peak conditions to generate daily demand profiles, with a focus on identifying inefficiencies.
Additional tasks included:

- An assessment of profitability of routes based on patronage, revenue and operating costs;
- Analysis of AFC data;
- Comparison between the manual survey results and the Transportation Reporting System (TRS) data;
- Analysis of the Free Token Card Promotion;
- Route and bus optimisation;
- Station and feeder stop utilization and
- Assessment of Parking Tariffs for Managed Parking Bays within the City of Cape Town.

Client: Transport for Cape Town.

AFC Data Analysis - Data Analysis of AFC Data of the City of Tshwane's A Re Yeng Bus Service.
Client: Development Bank of Southern Africa.

Ghana Transport Statues Quo Study - Transport Status Quo Study for the Greater Accra Regional Spatial Development Framework. Client: Government of Ghana: Ministry of Lands & Natural Resources.

Botswana TIA – Transport Impact Assessment for the Mogoditshane- Kanye Road project in Botswana. Client: Republic of Botswana's Ministry of Transport and Communications: Roads Department.

Botswana Access Management Plan Transport Impact Assessment for the Mogoditshane- Kanye Road project in Botswana. Client: Republic of Botswana's Ministry of Transport and Communications: Roads Department.

MyCiTi System Planning - Rationalisation of the GABS bus routes within the City of Cape Town.
Client: Transport for Cape Town.

Road Safety Master Plan - Compilation of a Road Safety Master Plan for Stellenbosch Municipality.
Client: Stellenbosch Municipality.

Constantia TIS - Transport Impact Statement and Parking Motivation for the proposed redevelopment of Erf 2134, Constantia. Client: High Constantia Properties.

Top Yard TIA - Transport Impact Assessment for the Government Garage Precinct Plan (Top Yard). Client: PricewaterhouseCoopers (PWC).

Boschendal TIA - Transport Impact Assessment for the development of Boschendal Village. Client: Boschendal (Pty)Ltd.

Vergenoegd TIA - Transport Impact Assessment for the development of Portion 19 of Farm 653, Vergenoegd. Client: Headland Planners.

Tygerberg Hospital Traffic Status Quo Study - Traffic Status Quo Study for the Development Framework for the Tygerberg Hospital Site in Bellville. Client: City Think Space.

Eerste River TIA - Transport Impact Assessment for Erf 5541, Eerste River. Client: Headland Planners

BVi Consulting Engineers

2013– 2014
Position – Technologist (Transportation Engineering)

Waaihoek Wind Energy Facility TIA - Transport Impact Assessment for the proposed construction of a Wind Energy Facility on Waaihoek Farm near Utrecht Town in Kwazulu-Natal. Client: Mainstream Renewable Power.

Sere Wind Farm - Supervision of bellmouth widening and other modifications along routes between the Saldanha Port and the Sere Wind Farm near Koekenaap. Client: Siemens.

Slip lane Design for Windhoek Service Station - Geometric design of a slip lane to the existing Windhoek Fuel Centre, Windhoek, Namibia. Client: Multi Consult.

Lafarge Industries

2011– 2013
Position – Quality Controller

Responsible for the quality control at four ReadyMix concrete plants and the Tygerberg Quarry.
- Design of new concrete mixes and optimisation of existing mix designs.
- Assist client with technical matters and problem solving.
- Compile technical reports.
- Motivate, train and develop staff to ensure growth and succession.
- Arrange and monitor staff schedules.
- Conduct Quality training for field technicians, reps and batchers.
- Statistical analysis of concrete results and monitoring product performance.

Aurecon Mozambique

2010– 2011
Position – Roadworks Engineer (Site Supervision)

Mozambique site supervision - Roadworks Engineer responsible for inspection of works and monitoring workmanship for the Construction of a 135km road from Montepuez to Ruaca in Northern Mozambique. Client: Administracao Nacional De Estradas (Mozambican Roads Authority)

Aurecon South Africa

2004– 2010
Position – Technician/Technologist (Traffic and Transportation Engineering)

Kewtown site supervision - Resident Engineer for the Community Residential Units Programme Pilot Project in Kewtown. Client: City of Cape Town.

N2 road design - Vertical and horizontal alignment of the N2 from Coega to Colchester. Client: SANRAL.

Western Cape Provincial Weighbridges - Resident Engineer on various projects involving the upgrading and expansion of the 9 Provincial Weighbridges in the Western Cape. Client: Provincial Administration: Western Cape.

Traffic and Transport tasks - Various traffic counts, traffic data analysis and transport impact statements. Client: Various.

CONTINUED PROFESSIONAL DEVELOPMENT

Courses

2007 - SAICE Flood estimation and Storm Water Drainage for Roads Course
2008 - Certificate in Project Management
2009 - SAICE Practical Geometric Design Course
2011 - C&CI Concrete Technology
2013 - Post graduate Courses – Financial Management and Asset Management
AutoCAD Civil 3D Training
2014 - Leadership Training -Project Risk Training and Anti- Corruption and Integrity Management
Post graduate Courses – Strategic Operations Management and Project Management
2015 - Leadership Training – Report Writing
2016 - Leadership Training - Quality Management and Time Management
2017 - Road Safety Auditor Course (SARF)
2018 - Road Safety in Engineering Seminar (SARF)
2020 Understanding and the Investigation of Road Traffic Accidents
2021 Intersection Optimisation course (SARF)

PERSONAL DETAILS

Nationality – South African
Date of Birth – 1984-05-31
Domicile – Cape Town, South Africa

Languages
English – Very Good
Afrikaans – Good

Engineering Council of South Africa

This is to certify that *Adrian Wesley Nathaniel Johnson*

is registered as *Professional Engineering Technologist*

in terms of the Engineering Profession Act, 2000
(Act No. 46 of 2000)

Date *22 September 2015*

Registration Number *201570274*

President

Chief Executive Officer

ECSA

Annexure B: Impact Assessment Methodology

IMPACT ASSESSMENT METHODOLOGY

SCOPING PHASE

REPORTING REQUIREMENTS

- Project Description
- Legislative Context (as applicable)
- Assumptions and limitations
- Description of Baseline Environment – including sensitivity mapping
- Identification and high-level screening of impacts
- Plan of Study for EIA

HIGH-LEVEL SCREENING OF IMPACTS AND MITIGATION

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase. The screening tool is based on two criteria, namely probability; and, consequence (**Table 0-3**), where the latter is based on general consideration to the intensity, extent, and duration.

The scales and descriptors used for scoring probability and consequence are detailed in **Table 0-3** and **Table 0-2** respectively.

Table 0-1: Probability Scores and Descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 0-2: Consequence Score Descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.

The Pavilion, 1st Floor
Cnr Portswood and Beach Road, Waterfront
Cape Town, 8001
South Africa

T: +27 21 481 8700
F: +086 606 7121
www.wsp.com

3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

Table 0-3: Significance Screening Tool

CONSEQUENCE SCALE

PROBABILITY SCALE		**1**	**2**	**3**	**4**
	1	**Very Low**	**Very Low**	**Low**	**Medium**
	2	**Very Low**	**Low**	**Medium**	**Medium**
	3	**Low**	**Medium**	**Medium**	**High**
	4	**Medium**	**Medium**	**High**	**High**

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (**Table 0-4**) has been applied according to the nature and significance of the identified impacts.

Table 0-4: Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	**Positive Impacts (+ve)**
Negligible	**Negligible**
Very Low	**Very Low**
Low	**Low**
Medium	**Medium**
High	**High**

EIA PHASE

REPORTING REQUIREMENTS

- Project Description
- Legislative Context (as applicable)
- Assumptions and limitations
- Description of methodology (as required)
- Update and/or confirmation of Baseline Environment – including update and / or confirmation of sensitivity mapping
- Identification and description of Impacts
- Full impact assessment (including Cumulative)
- Mitigation measures
- Impact Statement

Ensure that all reports fulfil the requirements of the relevant Protocols.

ASSESSMENT OF IMPACTS AND MITIGATION

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

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in **Table 0-5**.

Table 0-5: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

IMPACT MITIGATION

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

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

The mitigation sequence/hierarchy is shown in **Figure 1** below.

Avoidance / Prevention	Refers to considering options in project location, nature, scale, layout, technology and phasing to **avoid** environmental and social impacts. Although this is the best option, it will not always be feasible, and then the next steps become critical.
Mitigation / Reduction	Refers to considering alternatives in the project location, scale, layout, technology and phasing that would **minimise** environmental and social impacts. Every effort should be made to minimise impacts where there are environmental and social constraints.
Rehabilitation / Restoration	Refers to the **restoration or rehabilitation** of areas where impacts were unavoidable and measure are taken to return impacted areas to an agreed land use after the activity / project. Restoration, or even rehabilitation, might not be achievable, or the risk of achieving it might be very high. Additionally it might fall short of replicating the diversity and complexity of the natural system. Residual negative impacts will invariably still need to be compensated or offset.
Compensation / Offset	Refers to measures over and above restoration to remedy the residual (remaining and unavoidable) negative environmental and social impacts. When every effort has been made to avoid, minimise, and rehabilitate remaining impacts to a degree of no net loss, **compensation / offsets** provide a mechanism to remedy significant negative impacts.
No-Go	Refers to 'fatal flaw' in the proposed project, or specifically a proposed project in and area that cannot be offset, because the development will impact on strategically important ecosystem services, or jeopardise the ability to meet biodiversity targets. This is a **fatal flaw** and should result in the project being rejected.

Figure 1: Mitigation Sequence/Hierarchy