Appendix G.9

TRAFFIC REPORT

iWink Consulting
Traffic & Transport Engineering
Road Safety

PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY

MPUMALANGA PROVINCE

Traffic Impact Assessment
EIA Phase

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FINAL ISSUE

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PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY

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EXECUTIVE SUMMARY

This report serves as the Traffic Impact Assessment (TIA) aimed at determining the traffic impact of the proposed Phefumula Emoyeni One Wind Energy Facility (WEF). The Phefumula Emoyeni One WEF is proposed to be located approximately 16 km northwest of Ermelo in the Mpumalanga Province of South Africa. The project area is proposed accommodate up to 88 wind turbines including associated support structures and facilities to allow for the generation and evacuation of electricity.

Feasible accessibility of the site was assessed in line with required sight lines, access spacing and road safety principles. However, to ensure sight line are kept, it is advised to allow for a setback distance of any obstructions, i.e., cutting back of vegetation/trees, and accommodating convex roadside mirrors where/if necessary.

It is expected that non-motorised transportation (NMT) is a dominant mode of transportation in the environment of the site, with private cars and minibus/taxis being the second-most used mode of transport, followed by buses. Currently, there are no known future planned public transport facilities in the vicinity of the site. However, generally the developer of a renewable energy project will provide shuttle buses for workers during the construction phase.

The highest trip generator for the site is expected during the construction phase. The actual construction stage peak hour trips are dependent on the construction period, construction programming, material availability, component delivery, abnormal load permitting etc. The decommissioning phase is expected to generate similar trips as the construction phase. The traffic impact during the operational phase is considered low.

For the construction 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. Based on the high-level screening of impacts and mitigation, the site is expected to have a low negative significance during the construction and decommissioning stage, and a low negative significance during the operational stage.

PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY

1 INTRODUCTION

1.1 Project Description

Phefumula Emoyeni One (Pty) Ltd. is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on sites located approximately 16km northwest of Ermelo in the Mpumalanga Province (see **Figure 1-1**).

It is proposed that the Phefumula Emoyeni One WEF will comprise of up to 88 turbines with a contracted capacity of up to 550MW on a project site extent of approximately 33 660 ha.

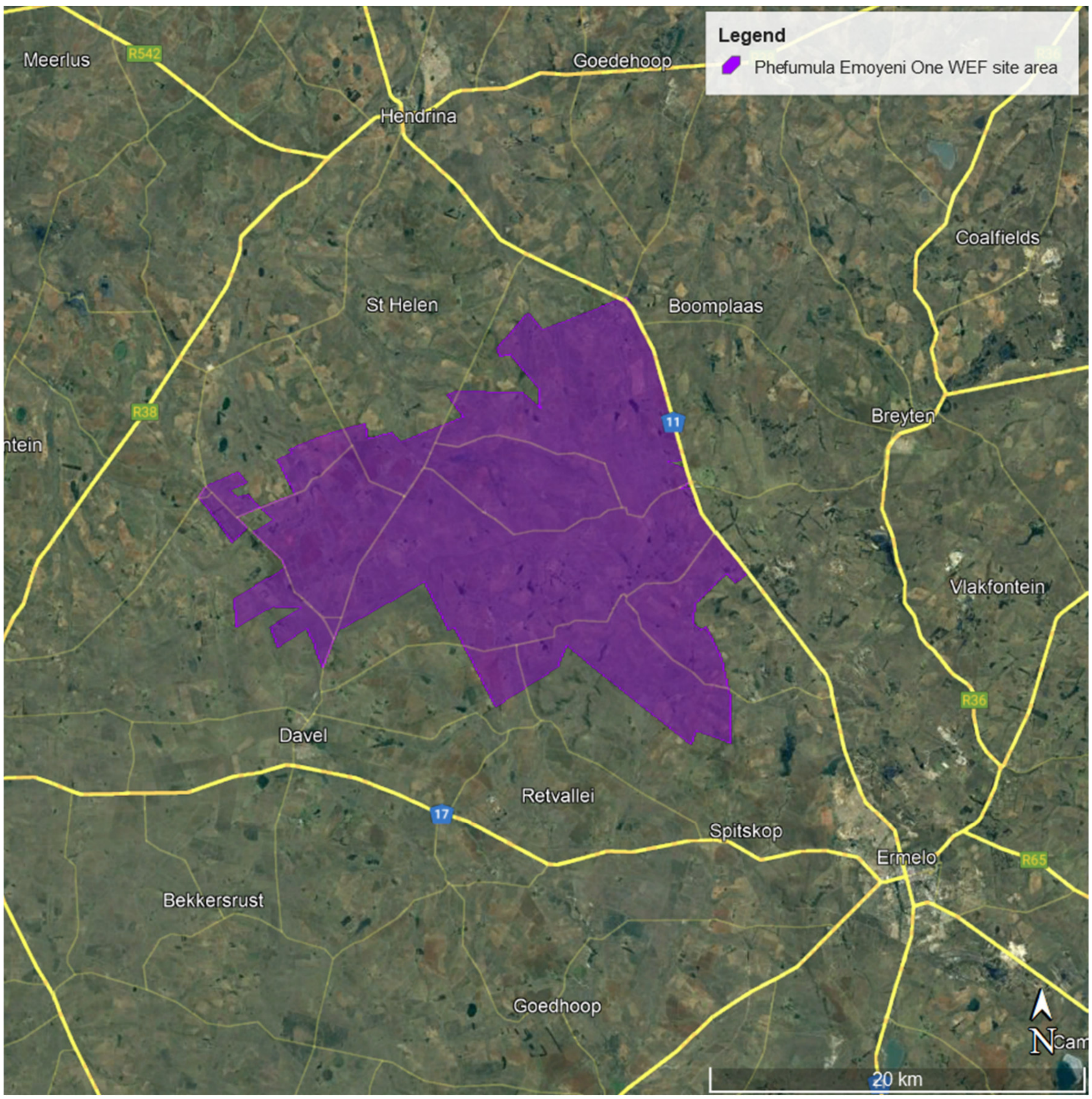

Figure 1-1: Aerial View of Phefumula Emoyeni One WEF site

The proposed Phefumula Emoyeni One WEF is not located within one of the promulgated Renewable Energy Development Zones (REDZ).

The Phefumula Emoyeni One WEF project site is located approximately 120km east of the Johannesburg area and as such it is expected that the site area will be well suited for the transported of components and materials to site. The site comprises of 95 affected farm properties, i.e.:

FARM	PORTION
ISRAEL 207 IS	0
BOSMANSKRANS 217 IS	0
BOSMANSKRANS 217 IS	1
BOSMANSKRANS 217 IS	3
BOSMANSKRANS 217 IS	4
BOSMANSKRANS 217 IS	5
BOSMANSKRANS 217 IS	6
BOSMANSKRANS 217 IS	7
BOSMANSKRANS 217 IS	8
BOSMANSKRANS 217 IS	9
VAALBANK 233 IS	6
KUILFONTEIN No. 234-IS	1
KUILFONTEIN No. 234-IS	2
KUILFONTEIN No. 234-IS	7
KUILFONTEIN No. 234-IS	8
KUILFONTEIN No. 234-IS	9
KUILFONTEIN No. 234-IS	11
KUILFONTEIN No. 234-IS	12
KUILFONTEIN No. 234-IS	14
KUILFONTEIN No. 234-IS	15
KUILFONTEIN No. 234-IS	16
KUILFONTEIN No. 234-IS	17
KUILFONTEIN No. 234-IS	21
KUILFONTEIN No. 234-IS	21
KUILFONTEIN No. 234-IS	22
KUILFONTEIN No. 234-IS	23
KUILFONTEIN No. 234-IS	23
BOSMANSHOEK NO. 235 - IS	3

FARM	PORTION
WITBANK NO. 236 - IS	2
WITBANK NO. 236 - IS	4
WITBANK NO. 236 - IS	5
WITBANK NO. 236 - IS	7
WITBANK NO. 236 - IS	10
WITBANK NO. 236 - IS	11
WITBANK NO. 236 - IS	13
NOOITGEDACHT 237 IS	0
NOOITGEDACHT 237 IS	2
NOOITGEDACHT 237 IS	4
NOOITGEDACHT 237 IS	5
NOOITGEDACHT 237 IS	7
NOOITGEDACHT 237 IS	8
NOOITGEDACHT 237 IS	9
NOOITGEDACHT 237 IS	10
NOOITGEDACHT 237 IS	11
NOOITGEDACHT 237 IS	12
NOOITGEDACHT 237 IS	13
ORPENSKRAAL 238 IS	0
ORPENSKRAAL 238 IS	2
ELIM 247 IS	0
KRANSPOORT 248 IS	0
KRANSPOORT 248 IS	2
KRANSPOORT 248 IS	3
KRANSPOORT 248 IS	4
KRANSPOORT 248 IS	6
KRANSPOORT 248 IS	8
KRANSPOORT 248 IS	9
KRANSPOORT 248 IS	10
KRANSPOORT 248 IS	11
KRANSPOORT 248 IS	12
KRANSPOORT 248 IS	13
KRANSPOORT 248 IS	18

FARM	PORTION
KRANSPOORT 248 IS	19
KRANSPOORT 248 IS	21
KRANSPOORT 248 IS	22
KRANSPOORT 248 IS	23
TWEEFONTEIN 249 IS	1
TWEEFONTEIN 249 IS	2
TWEEFONTEIN 249 IS	3
TWEEFONTEIN 249 IS	8
TWEEFONTEIN 249 IS	9
VOORZORG 250 IS	0
NOOITGEDACHT 251 IS	0
NOOITGEDACHT 251 IS	2
NOOITGEDACHT 251 IS	5
NOOITGEDACHT 251 IS	6
NOOITGEDACHT 251 IS	7
NOOITGEDACHT 251 IS	9
NOOITGEDACHT 251 IS	10
NOOITGEDACHT 251 IS	11
SPION KOP 252 IS	1
SPION KOP 252 IS	2
UITZIGT 450 IS	4
UITZIGT 450 IS	15
DAVELFONTEIN 267 IS	7
MIDDELPLAAT 271 IS	2
MIDDELPLAAT 271 IS	3
MIDDELPLAAT 271 IS	4
MIDDELPLAAT 271 IS	5
MIDDELPLAAT 271 IS	8
DRIEHOEK 273 IS	0
DRIEHOEK 273 IS	1
DRIEHOEK 273 IS	2
DRIEHOEK 273 IS	3
DRIEHOEK 273 IS	7
SPITSKOP 276 IS	59
SPITSKOP 276 IS	68
KRANSPOORT 827 IS	0

The project details for Phefumula Emoyeni One WEF and associated infrastructure are summarized in **Table 1-1.**

Table 1-1:Project information

Facility Name:	Phefumula Emoyeni One Wind Energy Facility
Applicant:	Phefumula Emoyeni One (Pty) Ltd.
Location:	Appr. 16km northwest of Ermelo in the Mpumalanga Province
Municipalities:	Msukaligwa Local Municipality Gert Sibande District Municipality
Affected Farms:	See list above
Extent:	~ 33 660 ha
Total Capacity:	Up to 550 MW
Number of turbines:	Up to 88
Turbine hub height:	Up to 200m
Transformer:	One transformer to be located at the base of each turbine
Battery Energy Storage:	Battery Energy Storage System (BESS) will be provided within development footprint with export capacity of 200MW and storage capacity of 800MWh. Battery types considered include Sold State Batteries (Lithium Ion) as the preferred and Redox Flow Batteries (Vanadium Redox) as the alternative option. Dimensions: ~20m long x 3m wide x 5m high. Footprint: ~5ha.
Turbine Foundation:	Reinforced concrete to support mounting ring. Diameter of approximately 40 m x 6 m excavation depth.
Turbine Hardstand:	Approximately 75m x 120m.
Construction camp / laydown:	Included in the operational and storage buildings are usually site office, stores, workshops, turbine storage areas, fuel storage, worker ablution facilities. Rehabilitation after end of construction. ▪ Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m); ▪ 3x Batching plant of up to 4ha to 7ha; ▪ 3x construction compound / laydown area, including site office of 3ha each (150m x 200m each); and ▪ Laydown and crane hardstand areas (approximately 75m x 120m).
Temporary Batching Plant:	Up to three temporary batching plants of between 4ha and 7ha.
Office & Management (O&M):	Three O&M areas of ~ha each adjacent to the substation.

Internal Roads:	Access roads to the site and between project components inclusive of stormwater infrastructure. Gravel surface. Road width of internal site roads ~12-13m widths to accommodate side drains. Access road length: tbc. Where required for turning circle/bypass areas, access or internal roads need to be up to 12 m.
Cables:	Medium voltage (33 kV) cables/powerlines running from wind turbines to the on-site collector substations. The routing will follow existing/proposed access roads and will be buried where possible.
Substation:	Three 33kV/132kV on-site collector substations are proposed as shown in Figure 1-1 (IPP Portion), to facilitate the connection between the wind farm and the electricity grid. Area of each MTS: up to 5ha.
Water / Electricity:	Construction period water requirement is normally in the region of around 30 kℓ per day used for road construction, hardstand compaction, concrete tower production, concrete foundations, cleaning equipment and dust suppression. For the operational phase (approximately 25 years), the water requirement can be assumed to be about 8kℓ per month for 11 months of the year. It is assumed that potable water will be sourced from the property, or from the Municipality as far as possible. Water tanks can be used to provide potable water. Electricity for construction could be obtained from temporary diesel generators and possibly small scale mobile photovoltaic units.

Grid Infrastructure:	Multiple grid access options are available including a direct Loop-in-Loop-out Main Transmission Substation (MTS) into the 400kV Camden-Komati powerline that runs across the project area, alternatively a servitude routing to the adjacent Ummbila Emoyeni MTS (soon to be constructed) or servitudes directly into either Komati or Hendrina power station(s). The following infrastructure is required additionally to above: ▪ MTS: 400kV / 132kV, area of 600m x 600m required ▪ Internal Overhead Powerlines (OHL): 31m Corridor (15.5m in each direction from centreline) ▪ Eskom will require a 2 x 55m = 110m servitude for 400kV line connecting MTS to grid
Site access:	From N11

1.2 Scope, Purpose, and Objectives of Specialist Report

The Traffic Impact Assessment 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:

- The proposed development(s),
- 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 and feasibility of access points,
- 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 workers 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 Details of Specialist

Iris Sigrid Wink of iWink Consulting (Pty) Ltd. is the Traffic & Transportation Engineering specialist appointed to provide a Traffic Impact Assessment for the Phefumula Emoyeni One Wind Energy Facility. Iris Wink is registered with the Engineering Council of South Africa (ECSA), with Registration Number 20110156. A curriculum vitae is included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.4 Terms of Reference

A specialist report prepared in terms of the Regulations (*published In Government Notice No. 320 Government Gazette 43110 20 March 2020, gazetted for implementation Site Sensitivity Verification requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed*) must contain the following:

(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;
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;
(c) an indication of the scope of, and the purpose for which, the report was prepared;
  (cA) an indication of the quality and age of base data used for the specialist report
  (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(d) the duration date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;
(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;
(g) an identification of any areas to be avoided, including buffers;
(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;
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;
(k) any mitigation measures for inclusion in the EMPr;
(l) any conditions for inclusion in the environmental authorisation;
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n) a reasoned opinion-
  (i) whether the proposed activity, activities or portions thereof should be authorised; and (considering impacts and expected cumulative impacts).
  (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;
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

(q) any other information requested by the competent authority.

Specific:

- Extent of the Traffic study and study area;
- The proposed development;
- Trip generation for the facility during construction and operation;
- Traffic impact on external road network;
- Accessibility and turning requirements;
- National and local haulage routes;
- Assessment of internal roads and site access;
- Assessment of freight requirements and permitting needed for abnormal loads; and
- Traffic accommodation during construction.

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 Traffic 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
  - Stacking requirements
  - 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;
- Technical Recommendations for Highways (TRH) 26 South African Road Classification and Access Management Manual, Committee of Transport Officials (COTO);
- Technical Methods for Highways (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;
- Transnet Port terminals website; and
- Mpumalanga Roads Asset Management System.

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 5 000 mm, total maximum width 4 300 mm and total maximum length 10 500 mm. 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 5.2 m for abnormal loads.
- If any elements are manufactured within South Africa but not on-site, these will be transported from their respective manufacturing centres, which would be either in the greater Cape Town area, Johannesburg, or possibly Pinetown/Durban and Port Elizabeth.
- 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 total number of turbines to be constructed for Phefumula Emoyeni One WEF is estimated to be up to 88.
- The final access points are to be determined during the detailed design stage. Only recommended access points at conceptual level can be given at this stage.
- Projects in the vicinity of the site to be considered as cumulative impacts.
- A 24-months construction period is assumed with 48% of the construction period dedicated to site prep and civil works.

2.3 Consultation Processes Undertaken

The Traffic Impact Assessment is based on available project information and consultation with the developer.

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 to be imported to South Africa, will arrive either via the Port of Richards Bay or the Port of Durban, as these two ports are the closest to the site.

4.1.1 Port of Richards Bay

The Port of Richards Bay is situated on the coast of KwaZulu-Natal and is a deep-sea water port boasting 13 berths. The terminal handles dry bulk ores, minerals and break-bulk consignments with a draft that easily accommodates Cape size and Panamax vessels. The Port is operated by Transnet National Ports Authority. The Port of Richards Bay is located approximately 460 km from the proposed Phefumula Emoyeni One WEF site traveling via the N2 (see **Figure 4-1**).

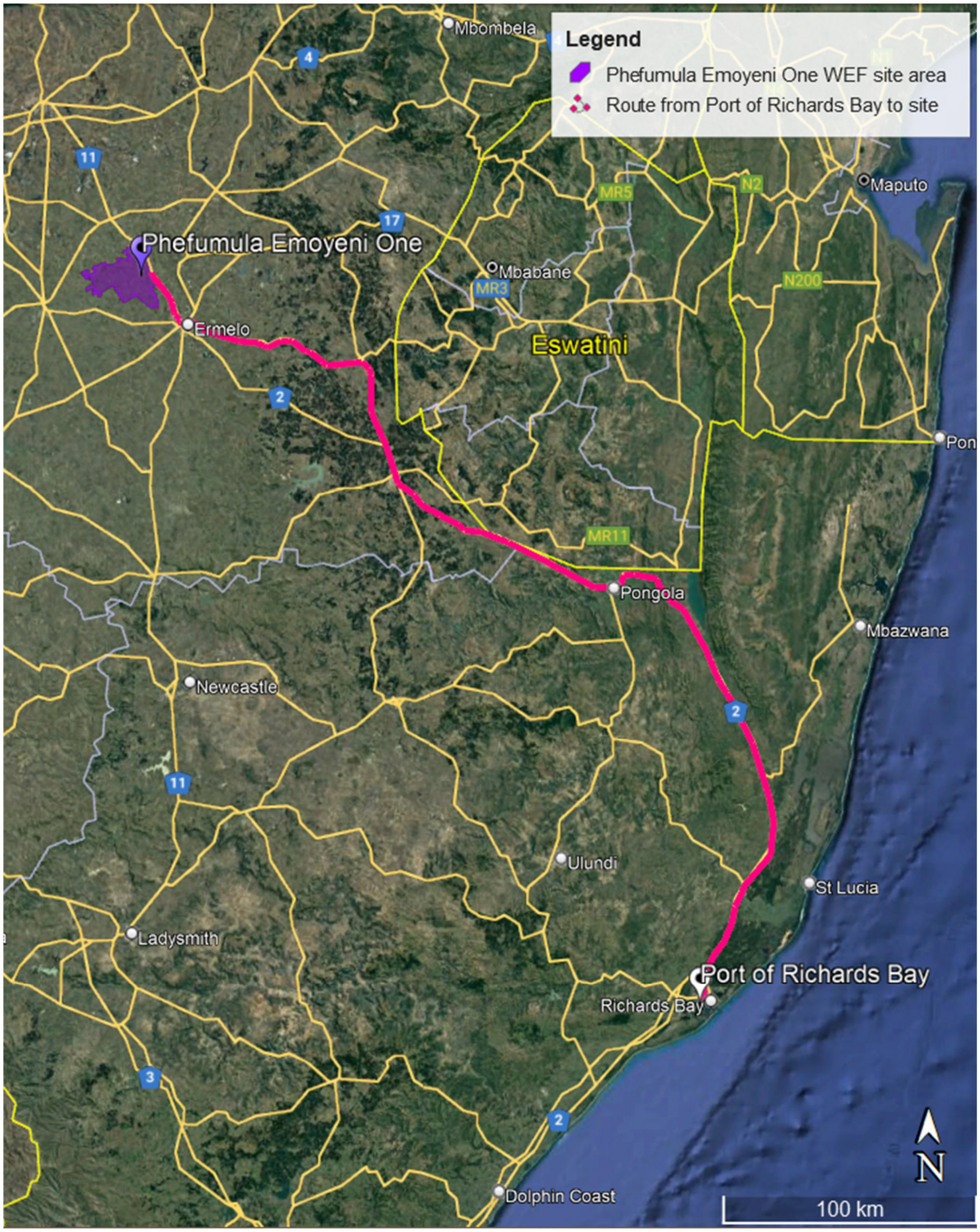

Figure 4-1: Route from the Port of Richards Bay to project site

4.1.2 The Port of Durban

The Durban container terminal is one of the largest container terminals in the African continent and operates as two terminals Pier 1 and Pier 2. It is ideally located to serve as a hub for containerized cargo from the Indian Ocean Islands, Middle East, Far East and Australia. 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). The Port of Durban is located approximately 510 km distance traveling via the N3 and N11 to the proposed project site (see **Figure 4-2**).

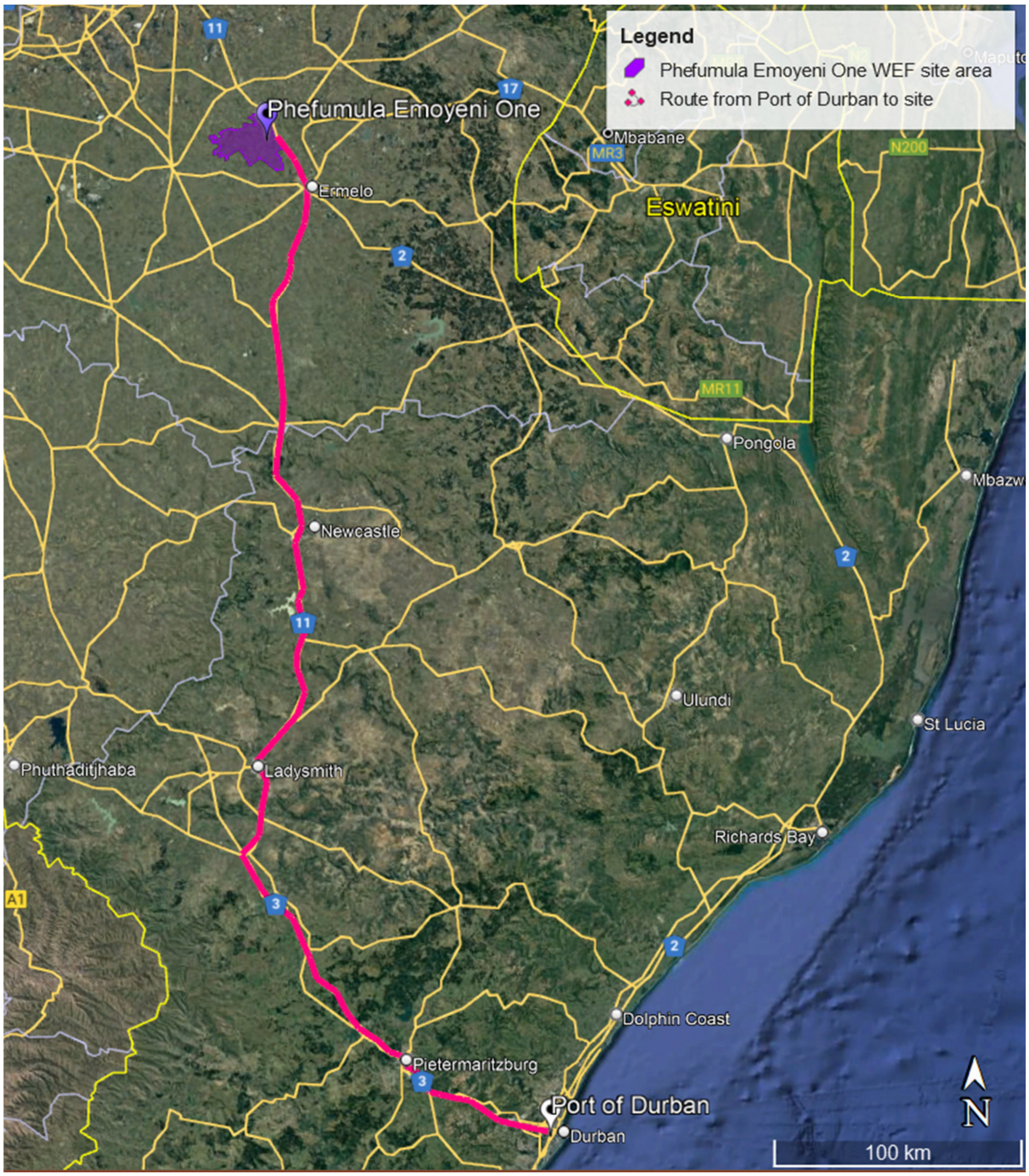

Figure 4-2: Route from Port of Durban to project site

4.2 Transportation requirements

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

Wind Energy Component:

- 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 manufactured on site and/or 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).

On-site Grid Infrastructure:

- 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
- The transformer transported in an abnormal load,
- Abnormal mobile crane for assembly on site, and
- Transmission tower sections transported by abnormal load.

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: 22 m for an interlink, 18.5 m for truck and trailer and 13.5 m for a single unit truck
- Width: 2.6 m Height: 4.3m measured from the ground. Possible height of load – 2.7 m.
- 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, which 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 5.1 m), 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 145 000 kg 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. The unit will require a minimum height clearance of 5.1 metres.

4.8.2 Blades

A wind turbine 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 100 m. Blades need to be transported on an extendible blade transport trailer or in a rigid container with rear steerable dollies (see an example in **Figure 4-3**). 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 4-3: 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

For the purpose of this report, it was assumed that tower sections will need to be transported from elsewhere. 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 (see an example in **Figure 4-4**). 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. An exception are concrete towers, should there be a batch plant on site to manufacture them.

Figure 4-4: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 from around 45 tons.

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 (see an example in **Figure 4-5**) 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 4-5: 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 4-6**). 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 4-6: 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 (see **Figure 4-7**).

Figure 4-7: 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 project site (see **Figure 5-1**) is located approximately 16 km northwest of Ermelo within the Msukaligwa Local Municipality and Gert Sibande District Municipality of the Mpumalanga Province. The entire project area comprises 95 Farm portions, which are listed in Chapter 1 of this report. The proposed project will consist of up to 88 wind turbines with a capacity of up to 550MW.

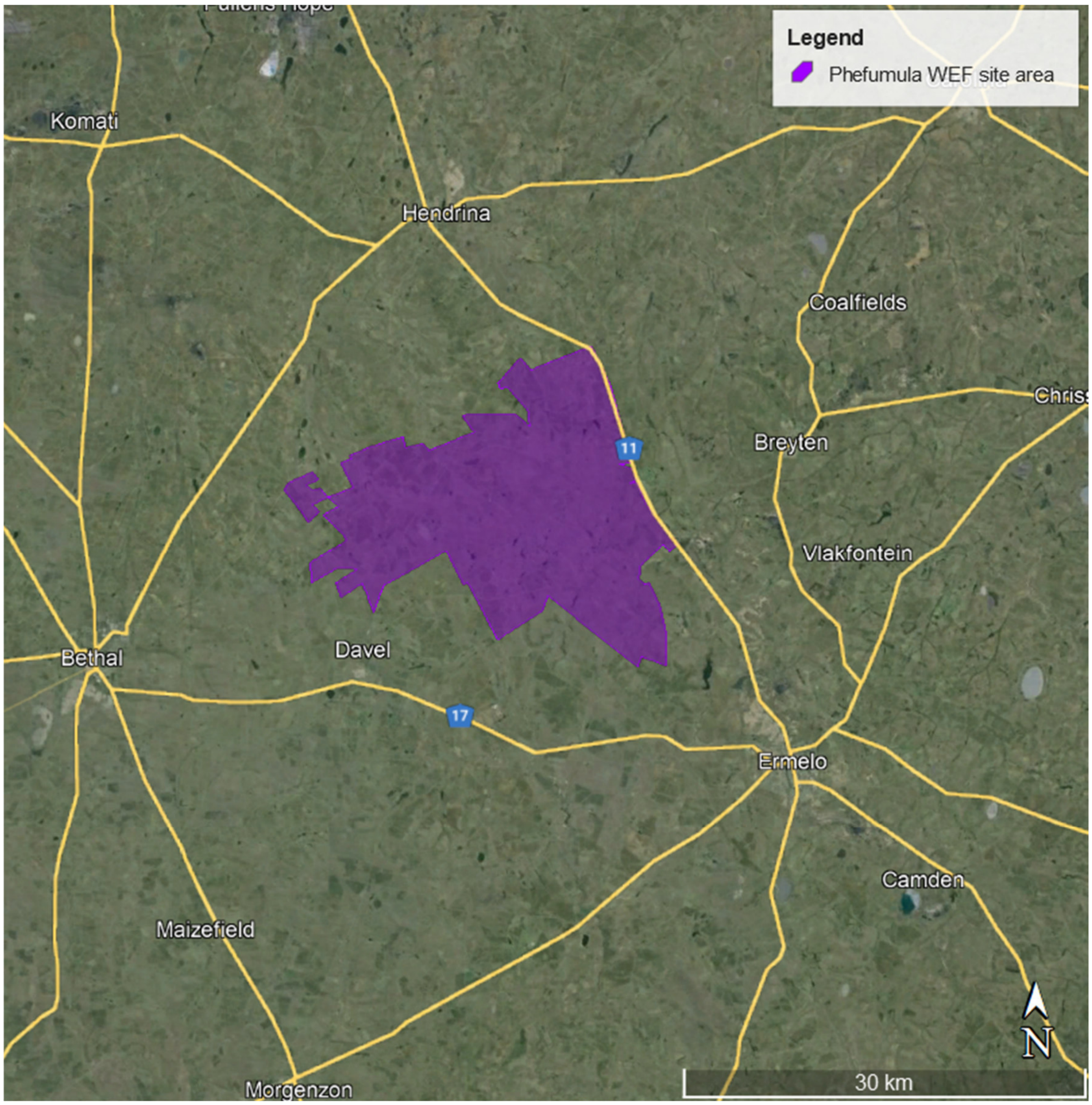

Figure 5-1: Aerial View of Phefumula Emoyeni One WEF site with turbines

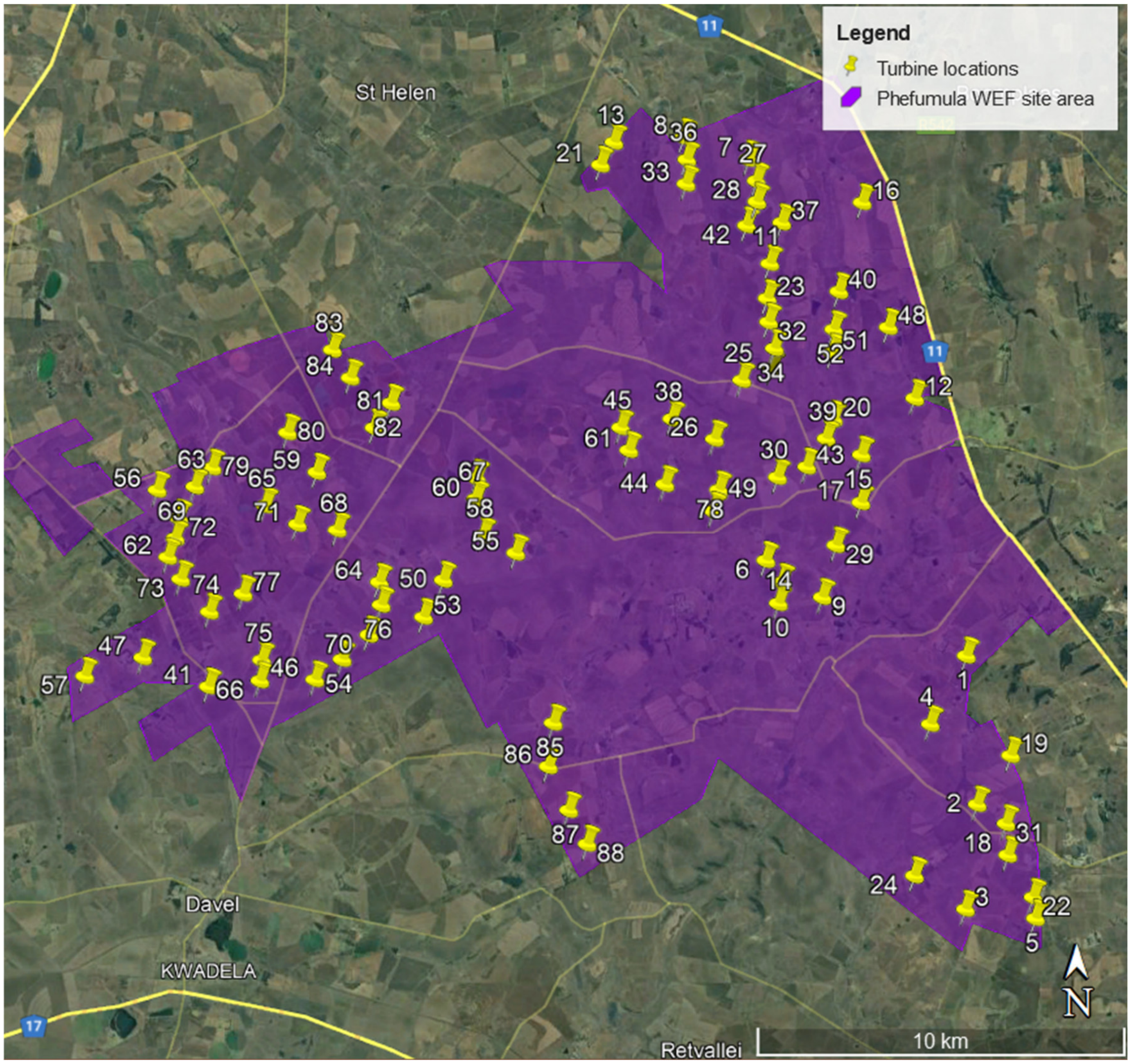

Figure 5-2: Aerial View of proposed turbine locations

5.1.1 Route for Components manufactured within South Africa

In South Africa, the majority of the manufacturing industry's national workforce resides in four metros - Johannesburg, Cape Town, Gqeberha 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, Gqeberha or Pinetown/Durban areas. Some components may be transported from the Coega area in the Eastern Cape. 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.

5.1.1.1 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 (approximately 1 600 km travelling via the N1 to site). No road limitations envisaged along the route for normal load freight (see **Figure 5-3**).

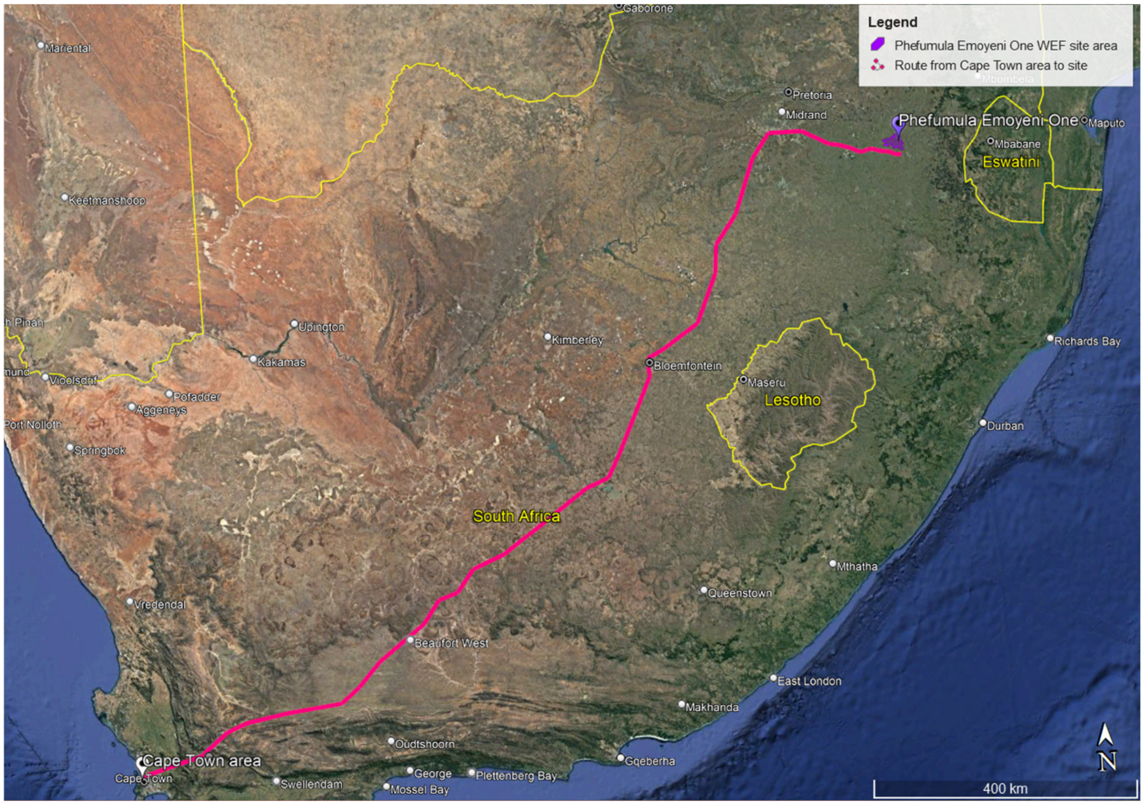

Figure 5-3: Route from Cape Town area to the Phefumula Emoyeni One WEF project site

5.1.1.2 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 several routes, of which one possible is shown in **Figure 5-4**. No road limitations are envisaged along the route for normal load freight. The travel distance via the shown route from the Johannesburg area to site is approximately 240 km via the N1 and N11.

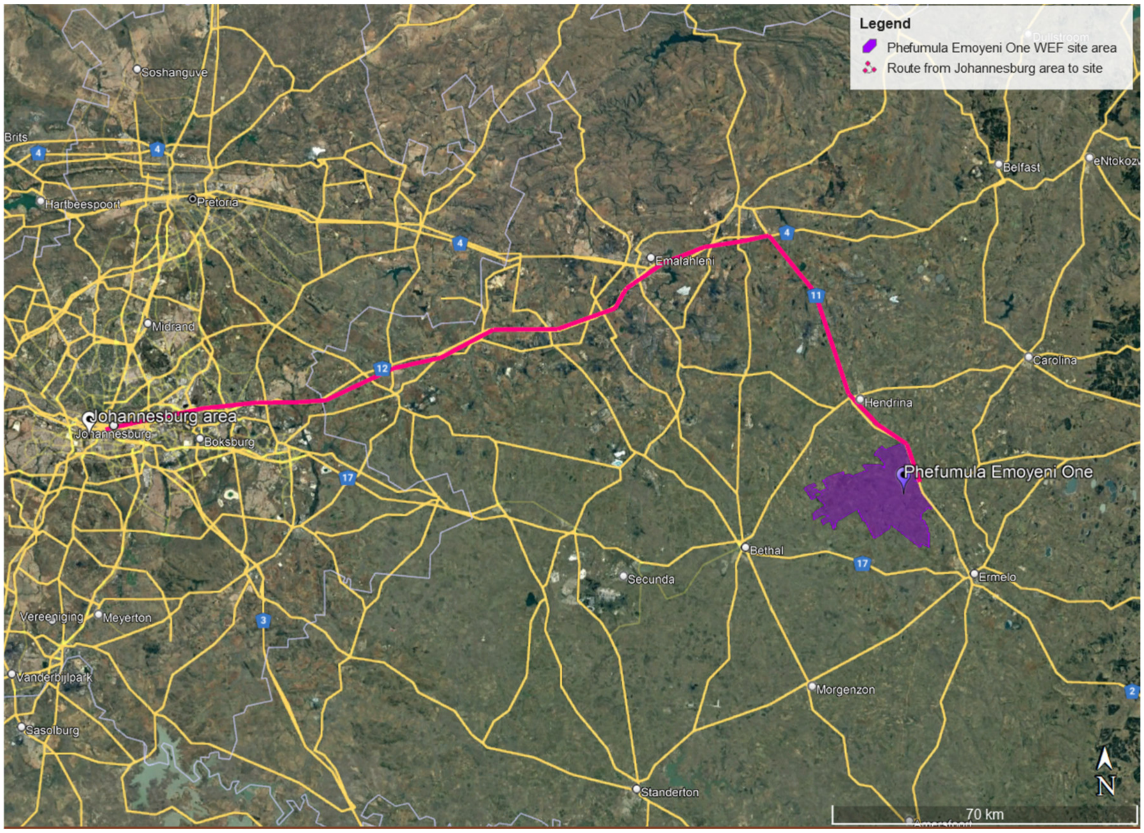

Figure 5-4: Route from Johannesburg Area to the Phefumula Emoyeni One WEF project site

5.1.1.3 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 500 km via the N3 and N11 as shown in **Figure 5-5** below.

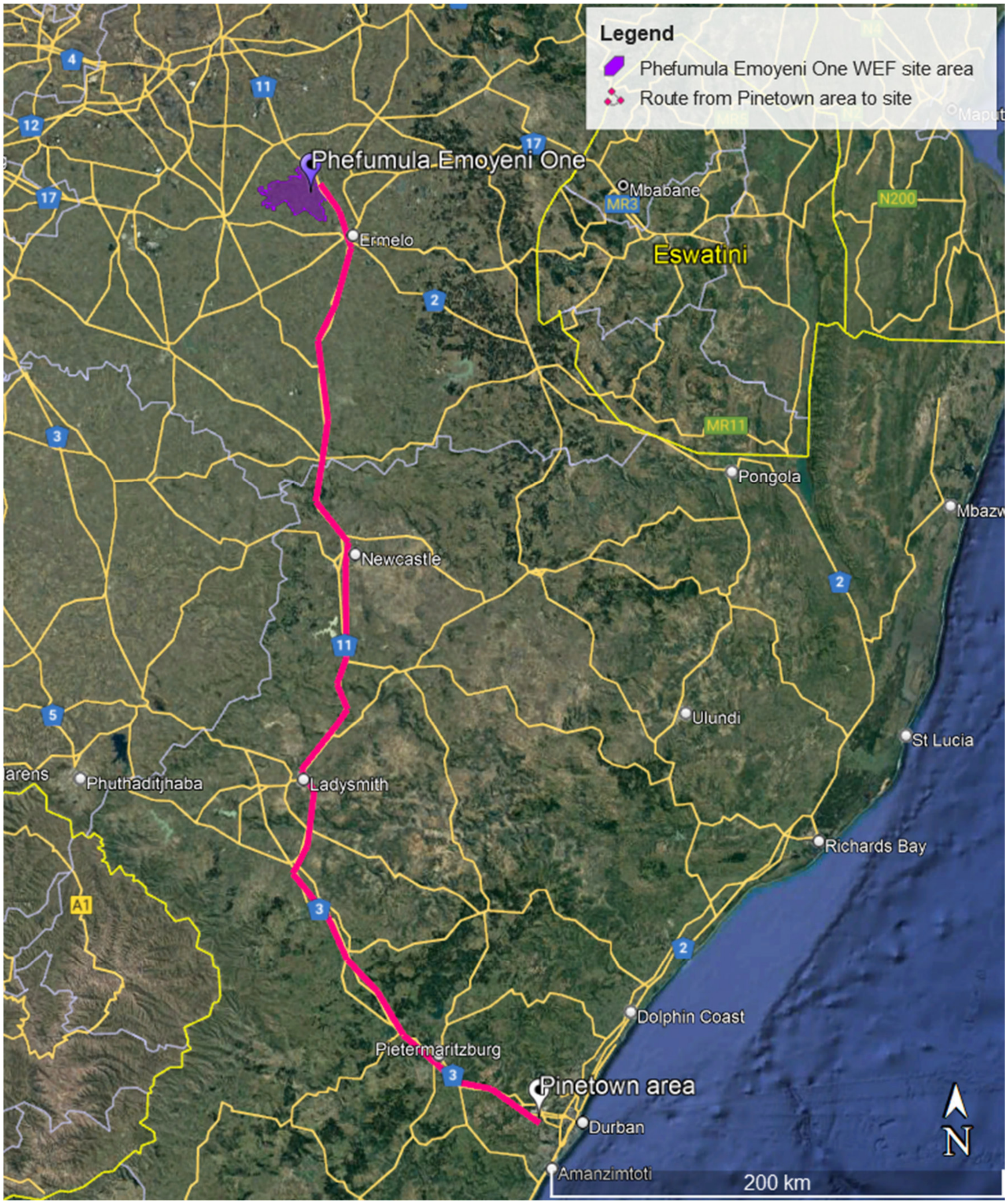

Figure 5-5: Route from Pinetown to the Phefumula Emoyeni One WEF project site

5.1.1.4 Route from Gqeberha area to Site - Locally sourced materials and equipment

If loads are transported from the Gqeberha area to site, several routes to site are available. One potential route is shown in **Figure 5-6** via the N1 and N10 with a travel distance of approximately 1 200km.

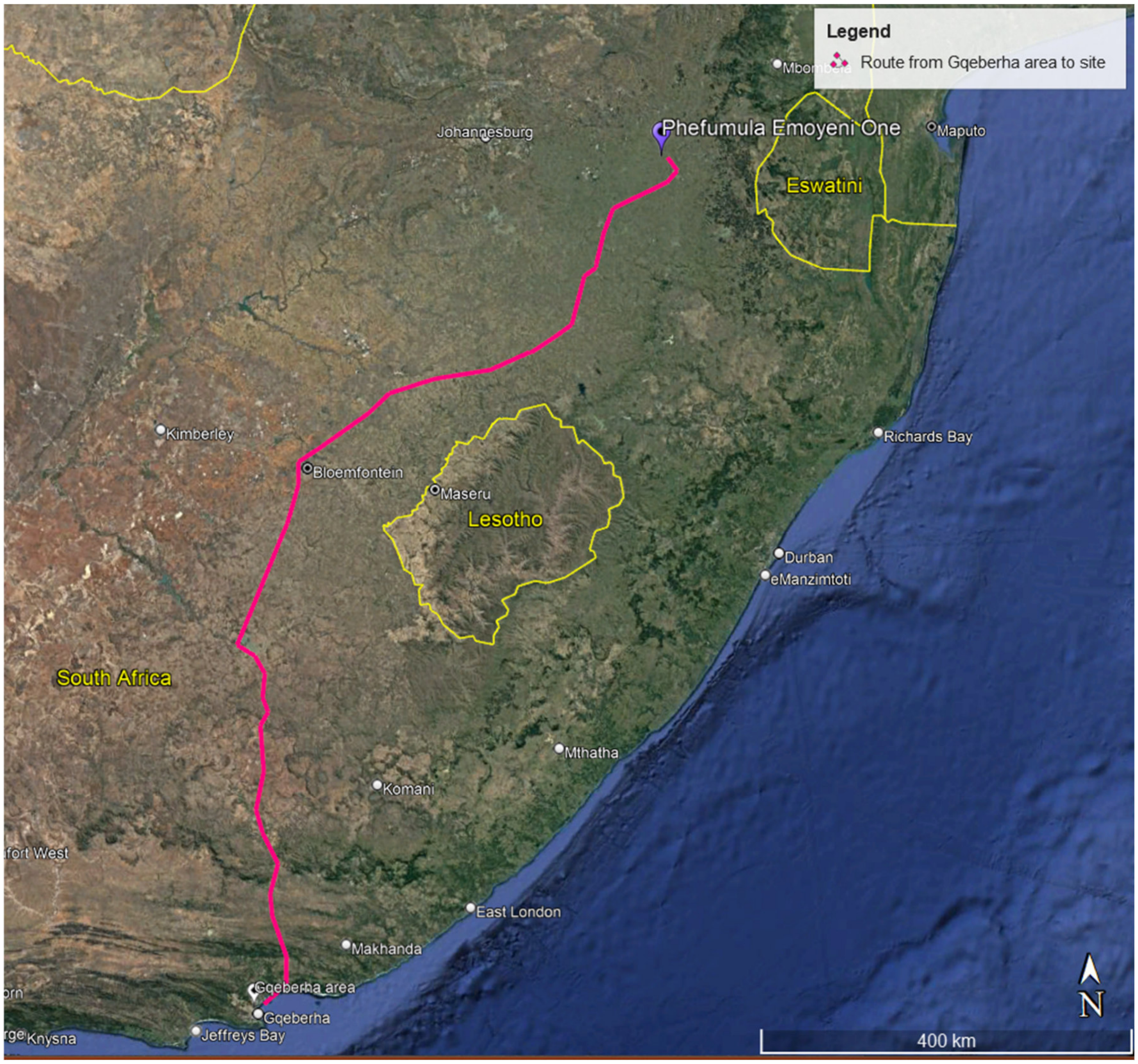

Figure 5-6: Route from Gqeberha area to project site

5.1.2 Surrounding road network

The proposed Phefumula Emoyeni One WEF site is located near Ermelo in Mpumalanga. The road classification of the surrounding road network as per the *Mpumalanga RAMS (Road Asset Management System* is shown in **Figure 5-7**.

The National Route N11 can be classified as a Class R1 Principal Arterial route, which belongs to the major arterial roads that typically carry countrywide traffic between:

- Metropolitan areas and large cities (population typically greater than about 500 000);
- Large border posts;
- Other Class 1 Arterials; and
- Smaller centres than the above when travel distances are very long (i.e., longer than 500 km).

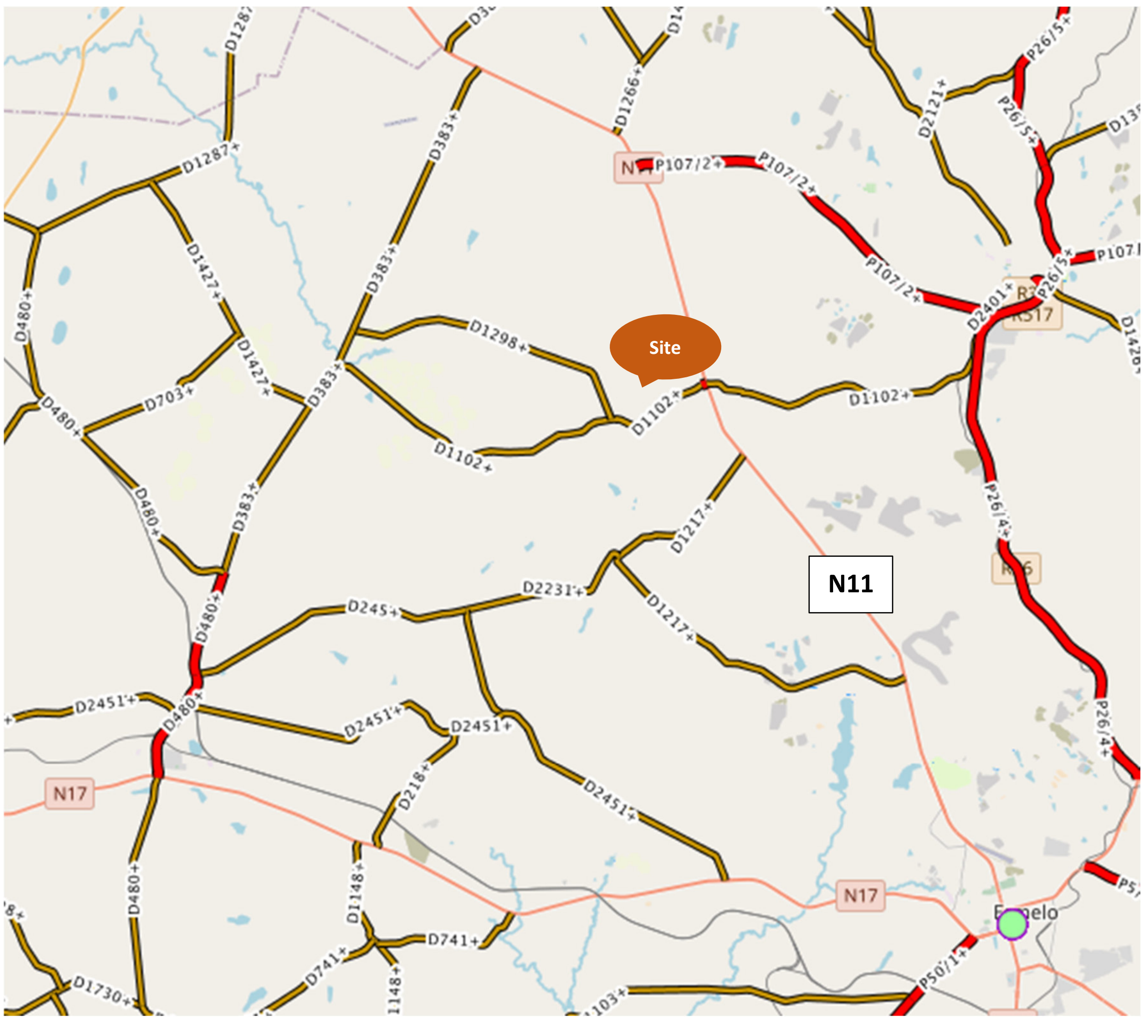

Figure 5-7: Road Network in vicinity of project site

5.1.3 Access Points* from external road network

As there are a number of lower order roads leading towards the site from the external road network, the most feasible access points were assessed in consideration with:

- Reduce traveling via farm properties not part of the project site;
- Required sight distances and sight lines;
- Minimum access spacing requirements;
- Practical haulage routes towards the site in regard to turning movements, condition of roads, and distance;
- Avoiding the railway line to the South of the project area;
- Impact on communities (i.e., reduce travelling through small communities to the site); and
- Road safety principles.

Consequently, four access points were chosen, which are located along the N11 and lead on public roads to the Phefumula Emoyeni One WEF project area. These are more detailed discussed hereafter (see **Figure 5-8**):

- Access Point 1: From N11 turn into D383;
- Access Point 2: From N11 turn into D1102;
- Access Point 2: From N11 turn into D1217 (north); and
- Access Point 4: From N11 turn into D1217 (south).

Further potential access points (i.e., along the N17 and R38) were explored but found not suitable due to the bullet points listed above.

**Please note: For the purpose of this Chapter, all assessed locations along the N11, from which site vehicles would turn off towards the site, are called Access points. It needs to be highlighted that they are not the direct site access locations with access security.*

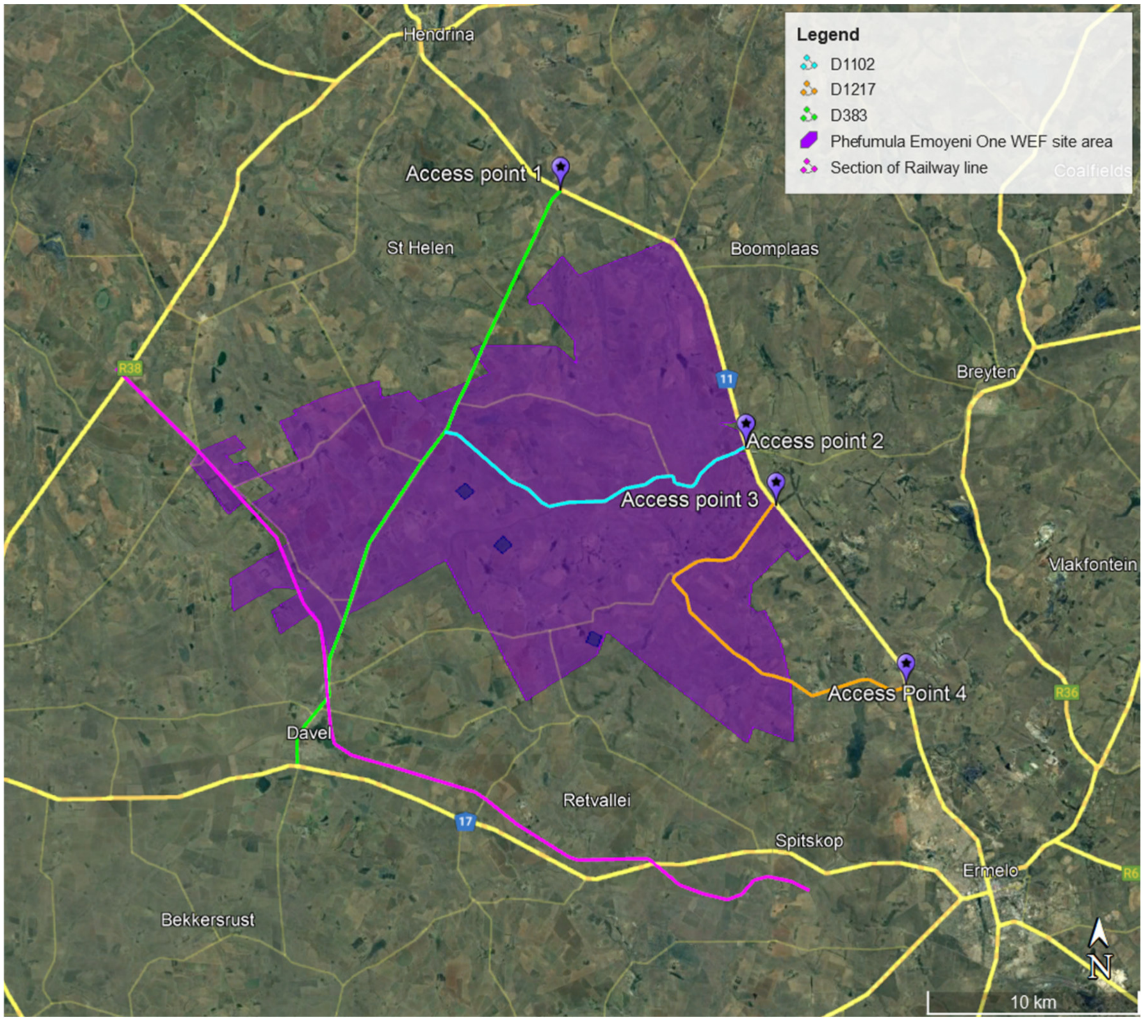

Figure 5-8: Aerial View of recommended Access Points for the Phefumula Emoyeni One WEF

In accordance with *Figure 2.5.5(a) of the TRH17 Guidelines for the Geometric Design of Rural Roads* (see **Figure 5-9**), the shoulder sight distance for a stop-controlled condition from a side road onto a road with a speed limit of 120 km/h, needs to be a minimum of 500 m for the largest vehicle (from 5m set back of the intersecting road).

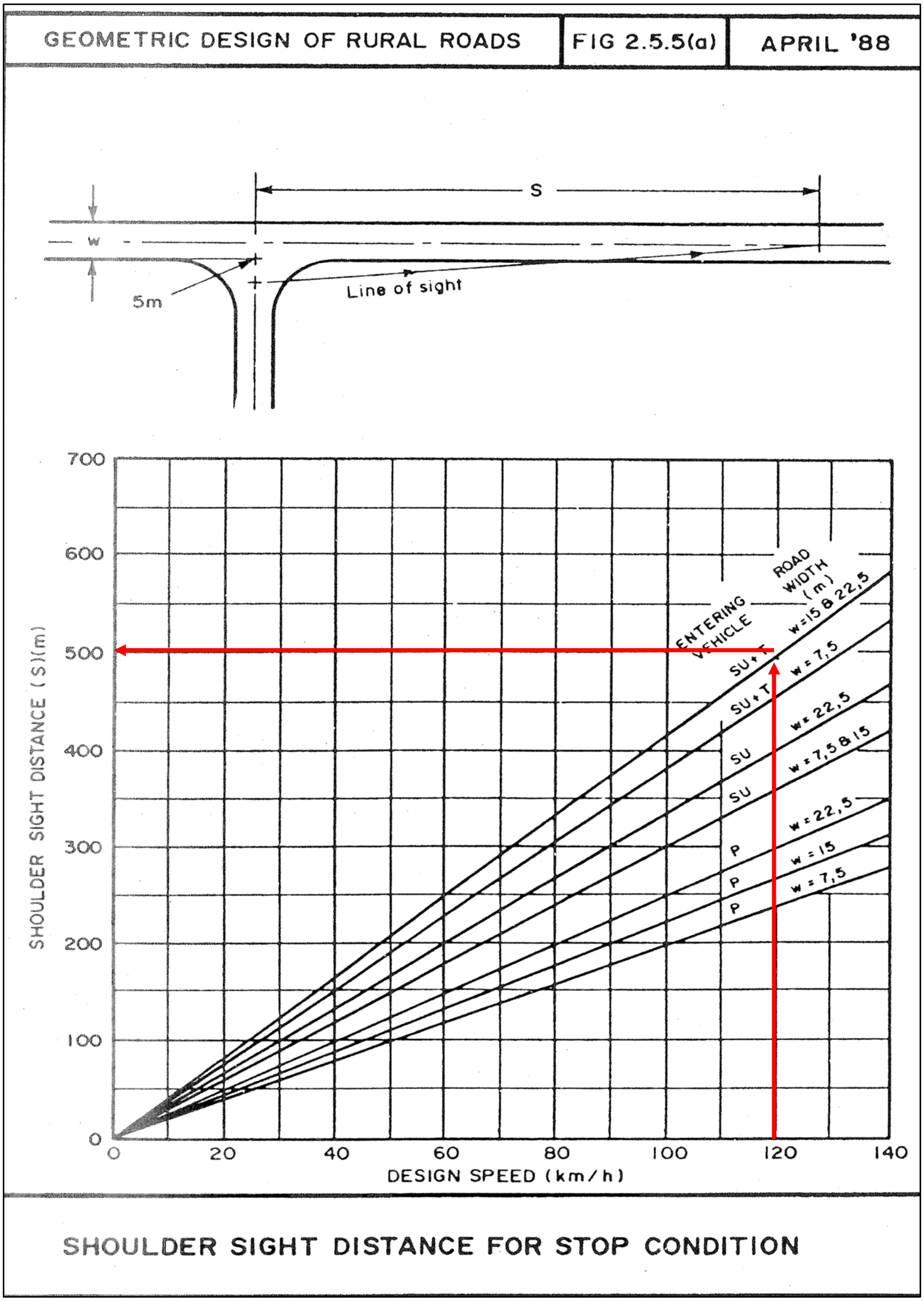

Figure 5-9: Shoulder sight distance (TRH17)

5.2 Access Point 1

Access Point 1 is located at the intersection of the N11 and D383, which is an existing public road leading towards the site (see **Figure 5-10**). This access would need to be maintained if used by heavy construction vehicles to ensure the status quo.

Figure 5-10: D383 from N11 towards site

Required minimum shoulder sight distances are acceptable in both directions when accessing the N11 from the D383 (see **Figure 5-11)**. Due to a crest in an eastern direction on the N11, sight lines may be reduced when entering the N11 from the D383. To reduce any safety risks, it is recommended to:

- Reduce the speed limit temporarily along the section of the N11 past the intersection with the D383 for the duration of the construction phase;
- Provide temporary road signage to alert drivers; and
- Any trees and shrubbery, possibly obstructing sight lines, will need to be cut back and maintained.

Figure 5-11: Aerial View of required Sight Distances at Access Point 1

5.3 Access Point 2

This access point is located at the intersection of the N11 and the D1102, which is shown in **Figure 5-12**.

The required minimum shoulder sight distances are met in both directions accessing the N11 from the D1102 (see **Figure 5-13**). To reduce any safety risks, it is recommended to:

- Reduce the speed limit temporarily along the section of the N11 past the intersection with the D1102 for the duration of the construction phase;
- Provide temporary road signage to alert drivers; and
- Any trees and shrubbery, possibly obstructing sight lines, will need to be cut back and maintained.

Figure 5-12: D1102 from N11

Figure 5-13: Aerial View of required Sight Distances at Access Point 2

5.4 Access Point 3

This access point is located approximately 3km south of Access point 2 on the N11 at the intersection of the N11 and D1217. The corresponding intersection is shown in **Figure 5-14**.

The required minimum shoulder sight distances are met in both directions, accessing the N11 from the D1102 (see **Figure 5-15**).

To reduce any safety risks, it is recommended to:

- Reduce the speed limit temporarily along the section of the N11 past the intersection with the D1102 for the duration of the construction phase;
- Provide temporary road signage to alert drivers; and
- Any trees and shrubbery, possibly obstructing sight lines, will need to be cut back and maintained.

Figure 5-14: D1217 from N11 (at Access Point 3)

Figure 5-15: Aerial view of required Sight distances at Access Point 3

5.4.1 Access Point 4

Access Point 4 is the most southern access in relation to the site and located at the intersection of the N11 and D1217 (south) (see **Figure 5-16**). This access would need to be maintained if used by heavy construction vehicles to ensure that any damage to the road surface is taken care of.

Required minimum shoulder sight distances are acceptable in both directions when accessing the N11 from the D1217 (see **Figure 5-17**).

To reduce any safety risks, it is recommended to:

- Reduce the speed limit temporarily along the section of the N11 past the intersection with the D383 for the duration of the construction phase;
- Provide temporary road signage to alert drivers; and
- Any trees and shrubbery, possibly obstructing sight lines, will need to be cut back and maintained.

This access point is, however, recommended as a secondary access route only (limiting additional heavy vehicle traffic) due to being used by trucks.

Figure 5-16: D1217 from N11 towards site (at Access Point 4)

Figure 5-17: Aerial View of required Sight distances at Access point 4

5.4.2 General

The geometric design and layout for the internal roads from the access points need 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.

The access points to the site will need to be able to cater for construction and abnormal load vehicles. A minimum road width of 8 m is recommended for the access points and the internal roads can have a minimum width of 6 m. 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 security controlled and security staff be stationed on site at the access during construction. A minimum stacking distance of 25 m needs to be kept between the road edge of the external road and the boom.

It is advised to provide temporary road signage along and before the section of the N11 where the access points will be located to alert drivers of large construction vehicles turning in and out of side roads.

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

5.4.3 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, as for example from Ermelo, Bethal or Hendrina.

5.4.4 Public Transport and Non-Motorised Transport

In terms of the National Land Transport Act (NLTA) (Act No.5 of 2009), the assessment of available public transport services is included in this report. The following comments are relevant in respect to the public transport availability for the proposed development.

Non-motorised transportation (NMT) is a dominant mode of transportation, with private cars and minibus/taxis being the second-most used mode of transport, followed by buses. Currently, there are no known future planned public transport facilities in the vicinity of the site. However, generally the developer of a large-scale project, such as many renewable energy projects, will provide shuttle buses or similar for workers during the construction phase.

5.5 Alternatives

The DEA&DP Guideline on Alternatives (2013) states that:

"Every EIA process must identify and investigate alternatives, with feasible and reasonable alternatives to be comparatively assessed. If, however, after having identified and investigated alternatives, no feasible and reasonable alternatives were found, no comparative assessment of alternatives, beyond the comparative assessment of the preferred alternative and the option of not proceeding, is required during the assessment phase. What would, however, have to be provided to the Department in this instance is proof that an investigation was undertaken and motivation indicating that no reasonable or feasible alternatives other than the preferred option and the no-go option exist."

The 2014 EIA Regulations (GN R982) (as amended) provide the following definition:

"Alternatives", in relation to a proposed activity, means different ways of meeting the general purpose and requirements of the activity, which may include alternatives to the -

(a) *property* on which or location where the activity is proposed to be undertaken;
(b) type of *activity* to be undertaken;
(c) *design* or *layout* of the activity;
(d) *technology* to be used in the activity;
(e) *operational* aspects of the activity; and
(f) includes the option of not implementing the activity ("*No-Go*" alternative).

The following alternatives were considered in relation to the proposed activity:

<u>Location Alternatives</u>

The location for the WEFs was selected based on the following parameters:

- Quality of the wind resource;
- Proximity to Eskom grid connection point (i.e., existing Eskom substation which has sufficient capacity (or planned capacity) to support the proposed WEF project);
- Landscape features of the site (being relative flat, which makes construction easier and reduces cost);
- Relatively remote site (fewer sensitive receptors in terms of visual and noise impacts);
- Landowner support of the proposed development; and
- Accessibility from external road network.

Based on, but not limited to, these considerations, the Phefumula Emoyeni One WEF site has been selected as the preferred alternative due to the favourable factors listed above.

<u>Design and layout alternatives</u>

The site layout may change during the application process and in response to the environmental, social and technical sensitivities identified, and via engagement with the public and other stakeholders. The proposed WEF alternative layout(s) will therefore be developed and refined during the Scoping process.

<u>Technology alternatives: Turbines</u>

Turbine technology is continually improving, with newer and more efficient turbine models being released on an ongoing basis. Based on these characteristics, a turbine which is best suited to the site will be selected closer to the time of construction and cannot be confirmed during the EIA process. The maximum turbine specifications are provided in **Table 1-1**.

To derive the desired capacity for the WEF the applicant is proposing to employ up to 88 turbines of between 6 to 15 MW each.

Routing Alternative for Linear Activities

Route alternatives include different access and service route alternatives. Road routings will be designed to follow existing farm tracks and impacted areas as far as possible, while minimising total road length and avoiding environmental sensitivities. Route alternatives may change based micro-siting of the turbines.

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

It needs to be highlighted, that the actual WEF design would have a nominal impact on the findings of the TIA report, unless significantly altered.

6 ISSUES, RISKS AND IMPACTS

6.1 Identification of Potential Impacts/Risks

The potential impacts to the surrounding environment expected to be generated from the development traffic are traffic congestion and associated noise, dust, and exhaust pollution as well as damage to road surfaces. This will mainly be true for the construction and decommissioning phases as the impact is expected to be higher during the construction and decommissioning phase because these phases generate the highest development traffic.

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. Potential damage to road surfaces from large construction vehicles are also noted.

Estimated peak hour traffic generated by the Phefumula Emoyeni One WEF:

- **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, approximately 200 trips per foundation are estimated, which results in a total of 17 600 trips for 88 turbines. With an anticipated construction period of 24 months and 22 workdays per month, 34 daily trips are estimated for the foundation material delivery.

- Heavy vehicle (road layer works): Assuming a typical 0.2 m gravel wearing course and a 10m road width, 2 m^2 of gravel wearing course is assumed for the purpose of the trip estimate.

  Typically, 1 trip/6 m^3 can be assumed for material delivery. The planned length of internal roads will still need to be communicated.

- Heavy vehicles (for construction camp and laydown area material): 1 trip/6 m^3 is assumed. Estimating a total area of approximately 100 000 m^2 (based on details provided in Table 1-1), and an assumed 0.2 m gravel wearing course, around 3 334 trips are generated. Assuming a delivery period of three months, the resulting daily traffic will then be approximately 50 daily trips for construction camp and laydown area 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.

- **<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.

- **<u>Component delivery trips:</u>**
  The blades*:* For this project, a rotor diameter of up to 200 m 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 264 trips for 88 wind turbines*).

  The nacelle: one (1) abnormal load trip per turbine *(i.e., 88 trips for 88 turbines)*

  The turbine hub and rotor unit: one (1) abnormal load trip per turbine (*i.e., 88 trips for 88 turbines*)

  Tower sections: If it is proposed to provide a concrete tower batching plant on site, no additional delivery trips will be generated for the tower sections.

  Total abnormal loads per turbine are then (turbine components): 5 trips per turbine (i.e., 440 trips for 88 turbines).

  In addition to the turbine component delivery trips, one (1) abnormal load is estimated for each transformer, resulting in a total of up to 88 transformers if one transformer will be installed at each turbine.

  If tower sections will be manufactured off-site and transported to site, it was estimated that 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 880 trips for 88 turbines).*

  Total abnormal loads per turbine (turbine components): 15 trips per turbine (i.e., 1 800 trips for 88 turbines).

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

- **<u>Construction workers trips:</u>**
  The number of construction personnel is affected by project programming, however, the estimate from experience with similar developments is at approximately 500 workers.

  It is further assumed that approximately 50% (~250) will be low skilled workers (construction labourers, security staff etc.), ~30% (~150) semi-skilled workers (drivers, equipment operators etc.) and approximately 20% (~100) 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 from pre-arranged pickup points, around four (4) busses can be assumed for low skilled and semi-skilled labourers. The skilled labourers are conservatively assumed to travel by car (2-person occupancy) (100 trips).

For rural environments it is further estimated that the peak hour trips are around 30% of the average daily traffic (i.e., 31 resulting peak hour trips).

6.1.2 Operational Phase

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

Nature of impact:
The nature of the impact expected to be generated at this stage would mainly be a slight increase in traffic generated on the surrounding road network, and the associated noise, dust, and exhaust pollution.

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 30% of trips occur during the peak hour, approximately 9 peak hour trips are estimated for the operational phase.

It is thus not envisaged that the generated operation traffic will go beyond 50 peak hour trips. 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.

6.1.4 Cumulative Impacts

To assess a cumulative impact, for this project, all currently approved and authorized projects within a 55 km radius were assumed to be constructed at the same time.

This is a precautionary approach as in reality, these projects would be subject to a highly competitive bidding process and not all the projects may be selected to enter into a Power Purchase Agreement. Even if all the facilities are constructed and/or decommissioned at 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.

The construction and decommissioning phases of a renewable energy project are the only significant traffic generators. The duration of these phases is short term, i.e., the potential impact of the traffic generated during the construction and decommissioning phases on the surrounding road network is temporary and wind energy projects, when operational, do not add any significant traffic to the road network.

At the time of preparing this report, the following projects (also shown in **Figure 6-1**) were known:

- The Halfgewonnen Solar Photovoltaic (PV) Facilities on Portions 7, 8, 9 and 16 of the Farm Halfgewonnen 190 IS (DFFE Ref: 14/12/16/3/3/2/2068) located 19km northeast of the site;
- The authorised Forzando North Coal Mine Solar PV Facility, 9.5MW, (DFFE Ref: 14/12/16/3/3/1/452) located 13km northwest of the site;
- Eskom Arnot PV Facility at the Arnot Power Station on Remainder of Portion 24 of Reitkuil 491 JS near Middleburg in Mpumalanga (DFFE Ref: 14/12/16/3/3/2/760) located 35km north of the site;
- Proposed establishment of the Haverfontein Wind Energy Facility near Carolina, Mpumalanga Province (DFFE Ref: 12/12/20/2018/AM2) located 42km Northwest of the site;
- Camden I Wind Energy Facility (WEF) (up to 200MW) (subject to a Scoping and Environmental Impact Reporting (S&EIR) process) (DFFE Ref: 14/12/16/3/3/2/2137) located approximately 28km southeast of the site;
- Camden I WEF Grid Connection (up to 132kV) (DFFE Ref: 14/12/16/3/3/1/2769) located approximately 28km southeast of the site;
- Camden Grid Connection and Collector substation (up to 400kV) (DFFE Ref: 14/12/16/3/3/2/2134) located approximately 28km southeast of the site;
- Camden I Solar (up to 100MW) (DFFE Ref: 14/12/16/3/3/2/2136) located approximately 28km southeast of the site;
- Camden I Solar Grid Connection (up to 132kV) (DFFE Ref: 14/12/16/3/3/1/2768) located approximately 28km southeast of the site;
- Camden II Wind Energy Facility (up to 200MW) (DFFE Ref: 14/12/16/3/3/2/2135) located approximately 35km southeast of the site;
- Camden II Wind Energy Facility up to 132kV Grid Connection located approximately 35km southeast of the site;
- Hendrina North WEF (up to 200MW) (DFFE Ref: 14/12/16/3/3/2/2130) located approximately 16km northwest of the site;
- Hendrina North Grid Infrastructure (up to 275kV) (DFFE Ref: 14/12/16/3/3/2/2128) located approximately 16km northwest of the site;
- Hendrina South WEF (up to 200MW) (DFFE Ref: 14/12/16/3/3/2/2131) located approximately 16km northwest of the site;
- Hendrina South Grid Infrastructure (up to 275kV) (DFFE Ref: 14/12/16/3/3/2/2129) located approximately 16km northwest of the site;
- Ummbila Emoyeni WEF (up to 900MW) (DFFE Ref: 14/12/16/3/3/2/2160) located approximately 10km southwest of the site;
- Ummbila Emoyeni Grid Connection (up to 400kV) (DFFE Ref: 14/12/16/3/3/2/2162) located approximately 10km southwest of the site; and
- Ummbila Emoyeni Solar PV (up to 150MW) (DFFE Ref: 14/12/16/3/3/2/2161) located approximately 17km southwest of the site.

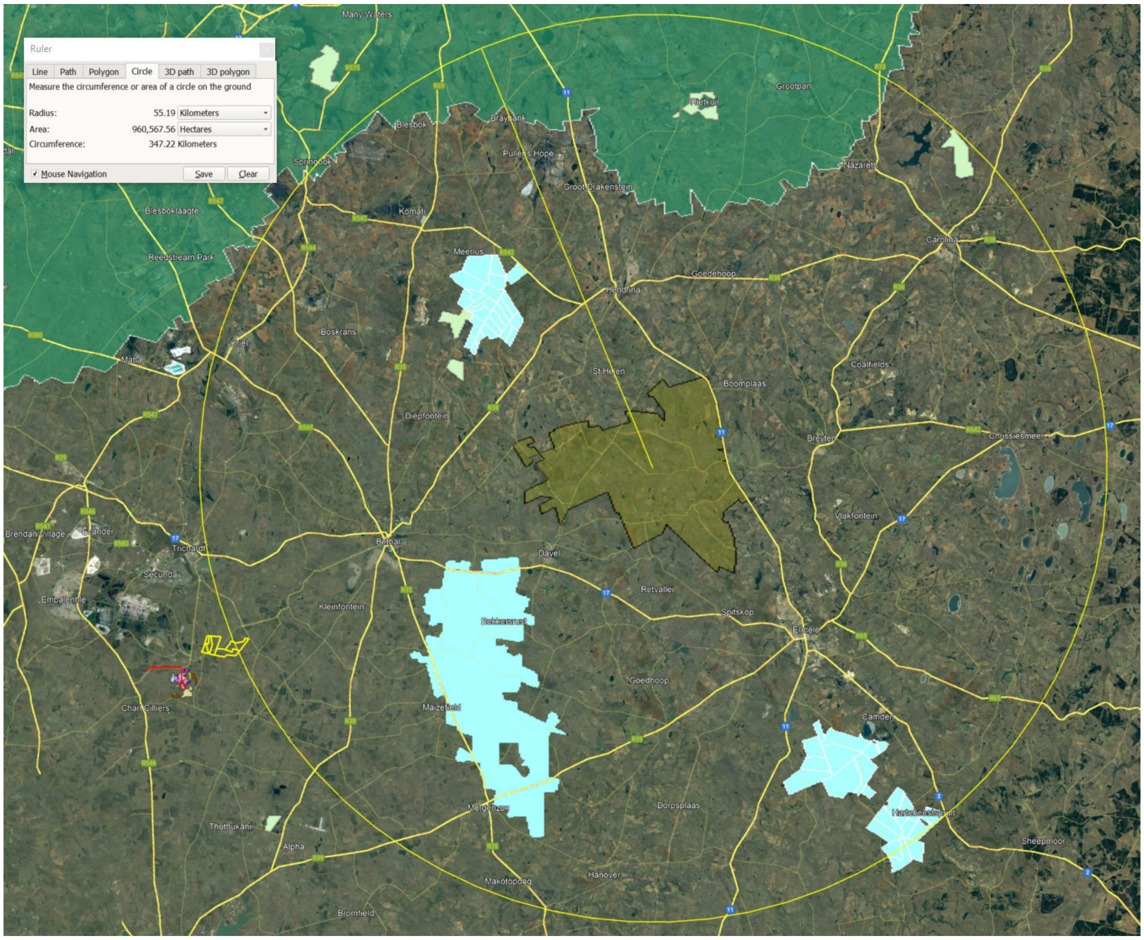

Figure 6-1: Aerial View of cumulative projects within a 55km radius of the project area

It is noted that it is unlikely that the above developments will be constructed at the same time. However, for the event that some of the developments have similar construction periods, it is recommended to agree on a delivery schedule between those projects to reduce development trips and consequently the impact on the external road network.

7 IMPACT ASSESSMENT

7.1 Potential Impact during the Construction Phase

The construction phase will generate traffic including transportation of people, construction materials, water, and equipment (abnormal trucks transporting turbine components). It is therefore expected that both these phases are similar in nature in regard to the traffic demand expected. The exact number of trips generated will be determined by appointed the haulage company. Based on the high-level screening of impacts, a moderate significance rating can be expected during the construction phase.

Nature of the impact

- Temporary increase in traffic,
- Increase in noise and dust pollution associated potential traffic, and
- Potential damage to road surfaces.

7.2 Potential Impact (Operation Phase)

Nature of the impact

- Slight increase in traffic
- Noise and dust pollution associated with potential traffic

The traffic generated during this phase will have a nominal impact on the surrounding road network. The following items need to be clarified:

- The number of permanent employees traveling to and from site.

7.3 Cumulative Impacts

To assess a cumulative impact, it was assumed that projects of similar nature within a 55 km radius, currently proposed or authorized, would be constructed at the same time. This is a precautionary approach as in reality, these projects would be subject to a highly competitive bidding process and not all the projects may be selected to enter into a Power Purchase Agreement. Even if all the facilities are constructed and/or decommissioned at 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.
The construction and decommissioning phases of a WEF are the only significant traffic generators. The duration of these phases is short term, i.e., the potential impact of the traffic generated during the construction and decommissioning phases on the surrounding road network, is temporary and WEFs, when operational, do not add significant traffic to the road network.

At the time of preparing this report, the projects listed under 6.1.4 were considered in the cumulative impact assessment. A summary of impacts is shown in **Table 7-1.**

Nature of the impact

- Temporary increase in traffic,
- Increase in noise and dust pollution associated potential traffic, and
- Cumulative impact on road surfaces.

Table 7-1: Summary Impact Table

CONSTRUCTION/DECOMMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact	Traffic Impact	Increase in development trips for the duration of the construction/decommisoning phase; associated noise and dust pollution. Possible damage to road surfaces by construction vehicles.	Construction/ Decommis-sioning	Negative	yes	3	4	3	2	4	48	N3	2	4	2	2	3	30	N2
					Significance	N3 - Moderate							N2 - Low						
				Mitigation measures:		Stagger component delivery to site * Stagger the construction phase * Use of quarries in close proximity to the site to decrease the impact on the surrounding road network * Staff and general trips should occur outside of peak traffic periods as much as possible * Maintenance of haulage routes * Design and maintenance of internal roads* Provide several access poins to the site to split construction vehicle trips and reduce the risk of congestion at a single access. * Maintenance and repairs of road sections of the N11 and, respectively, D383, D1102 and D1217 that have been damaged by construction vehicles. Any damage needs to be closely monitored to decide on the responsible party to repair it.													

OPERATIONAL

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact	Traffic Impact	Slight increase in trips due to transport of permanent staff to site; irregular periodical maintenance.	Operational	Negative	yes	1	2	1	4	2	16	N2	1	2	1	4	2	16	N2
					Significance	N2 - Low							N2 - Low						
				Mitigation measures:		not required													

CUMULATIVE

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact	Additional Traffic Impact	Further increase in development trips during the construction phase if the projects listed under 6.3.6 will be constructed at a similar time as the Phefumula Emoyeni WEF.	Cumulative	Negative	yes	4	4	3	2	4	52	N3	4	4	2	2	3	36	N3
					Significance	N3 - Moderate							N3 - Moderate						
				Mitigation measures:		Same as for the Construction phase. However, it is noted that it is unlikely that the developments will be constructed at the same time. For the event that the developments have similar construction periods, it is recommended to agree on a delivery schedule between the respective projects if possible.													

8 NO-GO ALTERNATIVE

The no-go alternative implies that the proposed development of the Phefumula Emoyeni One WEF does not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network during the construction and decommissioning phases. 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 its targets for renewable energy. Hence, the no-go alternative is not a preferred alternative.

9 IMPACT ASSESSMENT SUMMARY

The overall impact significance findings, following the implementation of the proposed mitigation measures, are shown in **Table 9-1** below.

Table 9-1: Overall Impact Significance (Post Mitigation)

Phase	Overall Impact Significance
Construction/Decommissioning	Low negative
Operational	Low negative
Cumulative	Moderate negative

The proposed development of the Phefumula Emoyeni One Wind Energy Facility is supported from a Traffic Engineering perspective, provided that the recommendations in this report are adhered to.

10 LEGISLATIVE AND PERMIT REQUIREMENTS

Key legal requirements pertaining to the transport requirements for the proposed WEF 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.

11 REFERENCES

- Gouws. S: "Concrete Towers – a business case for sustained local investment", Concrete growth,www.slideshare.net/SantieGouws/concrete-towers-a-business-case-for-sustained-investmentrev-5
- Road Traffic Act, 1996 (Act No. 93 of 1996)
- National Road Traffic Regulations, 2000
- SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa
- Transnetportterminals.net. n.d. *Transnet Port Terminals*. [online] Available at: <https://www.transnetportterminals.net/Ports/Pages/default.aspx>
- 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
- Google Earth Pro Imagery (2023)

Annexure A: Specialist Expertise

SUMMARY OF EXPERIENCE

Iris is a Professional Engineer registered with ECSA (20110156) and obtained her Master of Science degree in Civil Engineering in Germany in 2003. She has more than 20 years of experience in a wide field of traffic and transport engineering projects.

Iris left Germany in 2003 and has gained work experience as a traffic and transport engineer in South Africa and Germany. She has technical and professional skills in traffic impact studies, public transport planning, non- motorised transport planning and design, design and development of transport systems, project planning and implementation for residential, commercial, and industrial projects.

Her passions are the renewable energies and road safety, and she is highly experiences in providing traffic and transport engineering advise.

Iris is registered with the International Road Federation as a Global Road Safety Audit Team Leader and is a regular speaker at conferences, seminars and similar.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

PrEng	Registered with the Engineering Council of South Africa No. 20110156 Registered Mentor with ECSA
MSAICE	Member of the South African Institution of Civil Engineers
ITSSA	Member of ITS SA (Intelligent Transport Systems South Africa)
SAWEA	Member of the South African Wind Energy Association
SARF	South African Road Federation: Committee Member of Council
SARF WR	South African Road Federation Western Region – Chair
SARF RSC	South African Road Federation National Road Safety Committee
IRF	Registered as International Road Safety Audit Team Leader

EDUCATION

1996 – Matric (Abitur)	Carl Friedrich Gauss Schule, Hemmingen, Germany
1998 - Diploma (Draughtsperson)	Lower Saxonian State Office for Road Engineering
2002 – BSc Eng (Civil)	Leibniz Technical University of Hannover, Germany
2003 - MSc Eng (Civil & Transpt)	Leibniz Technical University of Hanover, Germany

***Master Thesis on the Investigation of the allocation of access rights** to the European rail network infrastructure - Research of the feasibility of the different bidding processes to allocate access rights of railway operators in the European railway market. Client: Technical University of Berlin and German Railway Company.*

SUMMARY OF EXPERIENCE

iWink Consulting (Pty) Ltd – Independent Consultant

2022 – present
Position: Independent Consultant – working as an independent Specialist in the field of Traffic & Transport Engineering, Renewable Energies and Road Safety.

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

2016 – 2022
Position: Associate / Division Head: Traffic & Transport Engineering

Jeffares & Green (Pty) Ltd

2012 – 2016
Position: Senior Traffic & Transport Engineer

Arup (Pty) Ltd

2010 - 2012
Position – Senior Traffic & Transport Engineer

Arup (Pty) Ltd

2004 - 2010
Position – Traffic & Transport Engineer

Schmidt Ingenieursbüro, Hannover, Germany

2000
Position – Engineering Assistant

Leibniz University of Hannover, Germany

2000 - 2003
Position – Engineering Researcher - Institute for Road & Railway Engineering

SELECTION OF PROJECTS

Please note: The below lists show only a *selection* of projects that Iris has been involved in over the last 20 years. More information and a complete Schedule of Experience can be made available on request.

RENEWABLE ENERGY PROJECTS

Transport Impact Assessments /Traffic Management Plans for:

- Selebi Phikwe Solar PV Project, Botswana
- Cradock – Kaladokhwe WEFs
- Britstown WEFs
- Highveld Solar Cluster
- Dealsville & Bloemfontein Solar PV
- Great Karroo Wind and Solar Cluster
- Ummbila Emoyeni Solar Project
- Poortjie Wind&Solar
- Hydra B Solar Cluster
- Choje Windfarm, Eastern Cape
- Richards Bay Gas to Power Project
- Oya Black Mountain Solar Project
- De Aar Solar Project
- Euronotus Wind & Solar Cluster
- Pienaarspoort Wind Energy Project
- Karreebosch Wind Energy Project
- Dyasonsklip Solar Project
- Kuruman Windfarm
- Bloemsmond Solar Farms
- Hendrina Wind Energy Project
- Orkney Solar Project
- Bulskop Solar Project
- Hyperion Solar & Thermal Project
- Gromis & Komas Wind Energy Projects
- Kudusberg & Rondekop Wind Energy Projects
- Bayview Windfarm
- Coega West Windfarm
- Suikerbekkie Solar Project
- Poortjie Solar Project
- Northam Solar Project

- Sibanye Solar Project
- Du Plessis Dam Solar Project
- Mercury Solar Project
- Aberdeen Wind Energy Project
- Saldanha Wind and Solar Projects
- Ummbila Emoyeni Wind Energy Project
- Springhaas Solar Project

Clients:

- G7 Energies
- ABO Wind Renewable Energies
- Atlantic Renewable Energy Partners
- Mulilo
- Acciona
- Enel
- Engie
- DNV GL
- Enertrag
- Scatec Solar
- Red Rocket Energies
- Windlab
- Mainstream
- Africoast
- Genesis

FURTHER PROJECTS

Traffic Impact Studies & Site Development Plan Input:

- Nooiensfontein Housing Development, City of Cape Town
- Belhar Housing Development, City of Cape Town
- Baredale Phase 7, City of Cape Town
- Beau Constantia Wine Farm
- Constantia Glen Wine Farm
- Eagles Nest Wine Farm
- Groenvallei Parking Audit, City of Cape Town
- Kosovo Housing Development, Western Cape Government
- Enkanini Housing Development, Stellenbosch
- Delft Housing Development, City of Cape Town
- Secunda Sasol, Free State
- Marula Platinum Mine
- InnerCity Transport Plan, City of Cape Town
- Stellenbosch Road Master Plan
- Nyanga Public Transport Interchange
- Crawford Campus Cape Town

- Durban RoRo Car Terminal, Transnet
- Durban Farewell Container Site
- Msunduzi Waterfront Housing Development
- Transnet Park Site – Traffic Management and Evacuation Plans
- UWC Bellville Medical Campus
- Bloekombos District Hospital
- Malabar Extension 3, Port Elizabeth

Traffic Engineering for Roads Projects:

- Namibia Noordoewer to Rosh Pina, Road Agency Namibia
- N2 Section 19 Mthatha – NMT Studies
- R63 Alice to Fort Beaufort – NMT, Road Link and Intersection Studies
- N2 Kangela to Pongola Upgrade
- Cofimvaba Eastern Cape – NMT, Road and Intersection Upgrades
- Stellenbosch R44 Traffic Signals
- Secunda Traffic Signals
- Fezile Dabi District Gravel Roads Upgrade, Free State Province
- Zambia RD Rehabilitation Project
- R61 Eastern Cape – NMT Studies, SANRAL

CONTINUED PROFESSIONAL DEVELOPMENT (CPD)

*Last five years*full CPD list available*

2023 – International Traffic Safety Conference, Doha – Speaker

2022 – 7th Regional Conference for Africa & PIARC International Seminar on Rural Roads and Road Safety - Speaker

2022 – Non-motorised Transport Seminar (SARF) – Co-Organizer / Speaker

2021 – SARF KZN Road Safety Considerations (SARF) – Guest Speaker

2021 – Road Safety Audit Course (IRF) – Guest Speaker

2021 – Legal Obligations / Road Safety Act (SARF) – Presenter

2020 – Understanding Road Accidents (SARF)

2020 – Road Safety Auditor Course (SARF) – Co-Lecturer

2018 – African Road Conference (IRF/SARF/PIARC)

2018 – Road Safety in Engineering (SARF) – Presenter

2016 - SATC Road Safety Audit Workshop Pretoria (SARF)

2015 - Non-motorised Transport Planning (SARF

Annexure B: Specialist Statement of Independence

I, Iris Sigrid Wink, 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: I Wink

Name of Company: iWink Consulting (Pty) Ltd

Date: 30/08/2024

Annexure C: Impact Assessment Methodology

ENVIRONMENTAL IMPACT ASSESSMENT

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
- Site Sensitivity Verification Assessment (including sensitivity mapping) (as applicable)
- 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 A**.

[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.

Table A: Impact Assessment Criteria and Scoring System

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

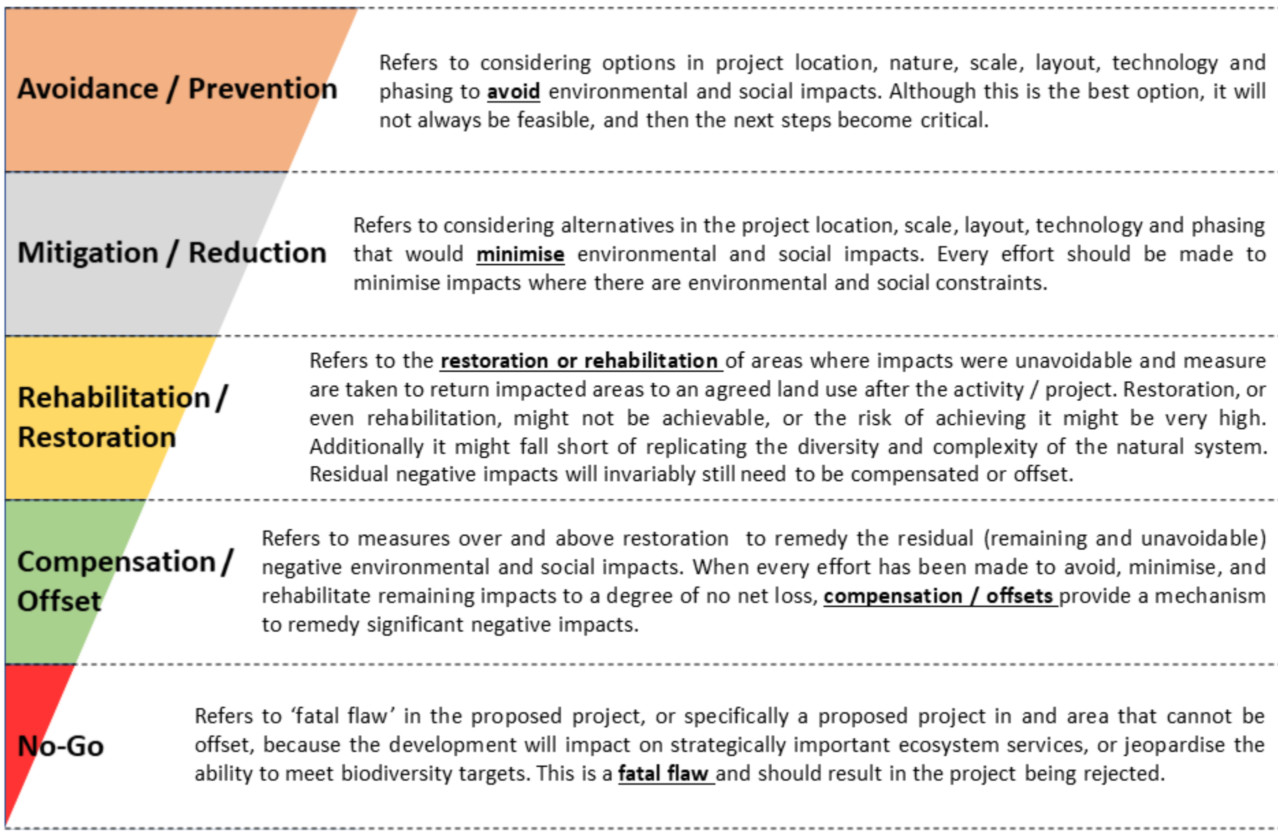

Figure A: Mitigation Sequence/Hierarchy