KARREEBOSCH WIND ENERGY FACILITY
TRANSPORT IMPACT ASSESSMENT

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REVISION 5

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SYNOPSIS

Preparation of a Traffic Impact Assessment for the proposed Karreebosch Wind Energy Facility located in the Northern Cape north of Matjiesfontein. The assessment pertains to all relevant traffic and transportation engineering aspects of the facility.

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
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KARREEBOSCH WIND ENERGY FACILITY
TRANSPORT IMPACT ASSESSMENT

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1 INTRODUCTION & SCOPE OF WORK

1.1 Background

WSP appointed JG Afrika Pty (Ltd) to provide transport impact input for the 140MW Karreebosch Wind Energy Facility as part of the Part 2 Amendment, final layout and Environmental Management process (EMPr) approval process.

Karreebosch Wind Farm (Pty) Ltd (the Applicant) applied for Environmental Authorisation (EA) for the proposed Karreebosch WEF in 2015. The original Environmental Impact Assessment (EIA) was undertaken in September of 2015 for up to 71 wind turbines with a hub height of up to 100m and a rotor diameter of up to 140m including associated infrastructure. Environmental authorisation (EA) for 65 turbines was granted on 29 January 2016 (EA Ref: 14/12/16/3/3/2/807). The project underwent subsequent amendments (EA Ref: 14/12/16/3/3/2/807/AM1, 14/12/16/3/3/2/807/AM2, 14/12/16/3/3/2/807/AM3) which included increases in the hub height (up to 125m), rotor diameter (up to 160m), blade length (up to 80m), and minor amendments to the wording of certain conditions of the authorisation, as well as an extension of the validity of the EA to 2026.

The associated 132V overhead powerline (OHPL) and onsite 33/132kV substation are currently subject to a separate EA application process.

The authorised Karreebosch WEF and associated infrastructure is currently undergoing a Part 2 EA Amendment Process with the proposed amendments tabulated in **Table 1-1** below. Condition 16 of the original EA (EA Ref: 14/12/16/3/3/2/807) requires that the final development layout plan be made available for public comment and thereafter submitted to Department of Forestry, Fisheries and Environment (DFFE) for approval. Condition 18 of the original EA (Ref: 14/12/16/3/3/2/807) states that the Environmental Management Programme (EMPr) submitted as part of the Final EIA Report (2015) was not approved and must be amended to include the final layout which has undergone micro siting and walkdowns by relevant specialists, be made available for public comment and thereafter re-submitted to the DFFE for final approval. The final layout and EMPR approval process will run concurrently with the Part 2 EA Amendment process.

*Table 1-1:*Authorised infrastructure in terms of the Karreebosch WEF EA

COMPONENT	DESCRIPTION / DIMENSIONS
Number of turbines	Up to 65 turbines (generation capacity of up to 140MW)
Hub height	A range up to and including 125m
Blade length	~ 80m
Rotor Diameter	A range up to and including 160m
Area occupied by transformer stations / substation	» Two 33/132kV Substations 100m x 200m » Extension of the existing 400kV substation at Komsberg » Transformer at each turbine: total area <1500 m^2 (2 m^2 per turbine up to $10m^2$ at some locations)
Capacity of onsite substation	132kV
Area occupied by construction camp	300 x 300m = 900 $000m^2$
Area occupied by laydown areas	Operation: (70 x 50) x 71 = 248 500 m2
Areas occupied by buildings	~10 000 m2
Length of (new) internal access roads	~40 km
Width of internal roads	Up to 12 m
Height of fencing	Up to 3m
Type of fencing	Steel or mesh

1.1.1 Project Area

The Karreebosch WEF is located approximately 40km north of Matjiesfontein, and approximately 40 km south of Sutherland. The site falls within the Karoo Hoogland Local Municipality of the Namakwa District Municipality within the Northern Cape Province as well as the Laingsburg Local Municipality of the Central Karoo District Municipality and the Witzenberg Local Municipality of the Cape Winelands District Municipality within the Western Cape Province.

The location of the proposed WEF is as shown in **Figure 1.1** below.

Figure 1-1:Locality Map

The Karreebosch WEF is currently authorised over seventeen (17) properties as described in the **Table 1-2** below. The properties highlighted in grey in the **Table 1-2** are relevant only to the proposed 132kV Karreebosch Overhead Powerline, which is subject to a separate application for Environmental Authorisation. These properties are therefore not affected by the proposed amended Karreebosch WEF final layout. Thus, only the properties relevant to the WEF infrastructure are included in this amendment application. The proposed final layout of the Karreebosch WEF is located over thirteen (13) properties as highlighted in the **Table 1-2** below.

Table 1-2: Farm portions authorised for the Karreebosch WEF (as per the original EA: 14/12/16/3/3/2/807).

	FARM NAME AND NUMBER	21 DIGIT SG CODE	MUNICIPALITY/PROVINCE
Properties affected by the Karreebosch WEF Final Layout	Farm Roode Wal No. 187	C04300000000018700000	Karoo Hoogland LM / Northern Cape
	Farm Appels Fontein No. 201	C04300000000020100000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Ek Kraal No. 199	C04300000000019900001	Karoo Hoogland LM / Northern Cape
	Portion 2 (Nuwe Kraal) of farm Ek Kraal No. 199	C04300000000019900002	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Klipbanks Fontein No. 198	C04300000000019800001	Karoo Hoogland LM / Northern Cape
	Remainder of farm Klipbanks Fontein No. 198	C04300000000019800000	Karoo Hoogland LM / Northern Cape
	Remainder of farm Wilgebosch Rivier No. 188	C04300000000018800000	Karoo Hoogland LM / Northern Cape
	Farm Rietfontein No. 197	C04300000000019700000	Karoo Hoogland LM / Northern Cape
	Remainder of farm Kareebosch No. 200	C04300000000020000000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Karreebosch No. 200	C04300000000020000001	Karoo Hoogland LM / Northern Cape
	Farm Oude Huis No. 195	C04300000000019500000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Karree Kloof No. 196	C04300000000019600001	Karoo Hoogland LM / Northern Cape
	Remainder of farm Brandvalley No. 75[1]	C04300000000007500000	Laingsburg LM / Western Cape

[1] A portion of an existing access road that will require minor road strengthening falls on Brandvalley RE/75. This existing access road will only be used as a 4x4 access track and not as the main access route to the WEF. The full length of this access road was included in the original EIA and layout assessed in 2015. However, Brandvalley RE/75 was omitted from the original application and was therefore not included on the original Environmental Authorisation (14/12/16/3/3/2/807).

	FARM NAME AND NUMBER	21 DIGIT SG CODE	MUNICIPALITY/PROVINCE
Properties affected by the Karreebosch Overhead Powerline	The Farm Kranskraal 189[2]	C04300000000018900000	Karoo Hoogland LM / Northern Cape
	Portion 2 of Standvastigheid 210	C04300000000021000002	Karoo Hoogland LM / Northern Cape
	The Farm Aprils Kraal 105	C04300000000010500000	Laingsburg LM / Western Cape
	The Remainder of Bon Espirange 73	C04300000000007300000	Laingsburg LM / Western Cape
	Portion 1 of Bon Espirange 73	C04300000000007300001	Laingsburg LM / Western Cape

[2] No infrastructure associated with the Karreebosch WEF is located on Kranskraal 189 as indicated in the final layout. This property will therefore be removed from the EA.

1.1.2 Proposed amendments to the EA

Table 1-3 below outlines the amendments proposed to the existing EA. **Figure 1-2** shows the original authorised 65 turbine layout. **Figure 1-3** illustrates the proposed final 40-turbine layout subject to this Part EA amendment, final layout and EMPr approval process.

*Table 1-3:*Proposed amendments to the Karreebosch EA (DFFE Ref: 14/12/16/3/3/2/807/AM3)

ASPECT TO BE AMENDED	AUTHORISED	PROPOSED AMENDMENT
Number of Turbines	Up to 65 with a foundation of 25m in diameter and 4m in depth	Up to 40 turbines with a foundation of 30m in diameter and 5m in depth
Turbine generating capacity	Up to 5.5 MW	up to 7.5 MW in capacity each
Turbine Hub Height	A range up to and including 125m	All turbines up to 140m
Rotor Diameter	A range up to and including 160m	All turbines up to 170m
Blade length	~80m	~85m
Area occupied by transformer stations/ substation	• Two 33/132kV Substation 100m x 200m • Extension of the existing 400kV substation at Komsberg • Transformer art each turbine: total area <1500m² (2 m² per turbine up to 10m² at some locations)	• one 33/132kV substation 150m x 200m (3ha) • Extension of the existing 400kV substation at Komsberg • Transformer at each turbine: 6m x 3m= 720m² total area <0.4ha (up to 10mX10m at some locations)
Capacity of on-site substation	132kV	33/132kV
Areas occupied by construction camp	300 x 300m = 90 000m²	Areas occupied by construction camp and laydown areas up to 14ha
Area occupied by laydown areas	Operation: (70 x 50) x 71 =248 500m²	crane pads and turbine footprints to be an additional 41ha

ASPECT TO BE AMENDED	AUTHORISED	PROPOSED AMENDMENT
Areas occupied by buildings	~10 000m²	~10 000m² and will be located within the construction camp for use during the operational phase
Length of (new) internal access roads	~40 km	~77 km of new internal access roads and up to ~14 km of 4x4 access tracks. ~30km of existing access roads which are 4m wide will be widened by up to 9m.
Width of internal roads	Up to 12m	Internal Access roads up to 12m wide (turns will have a radius of up to 55m) with additional yet associated servitudes/ reserve for above/underground cabling installation and maintenance where needed. 200m wide road corridor along the internal access roads for micro-siting during construction. Internal 4x4 tracks associated with the 33kV and 132kV OHPLs will be up to 4m wide and substation access roads of up to 9m.
Height of fencing	Up to 3m	Up to 4m

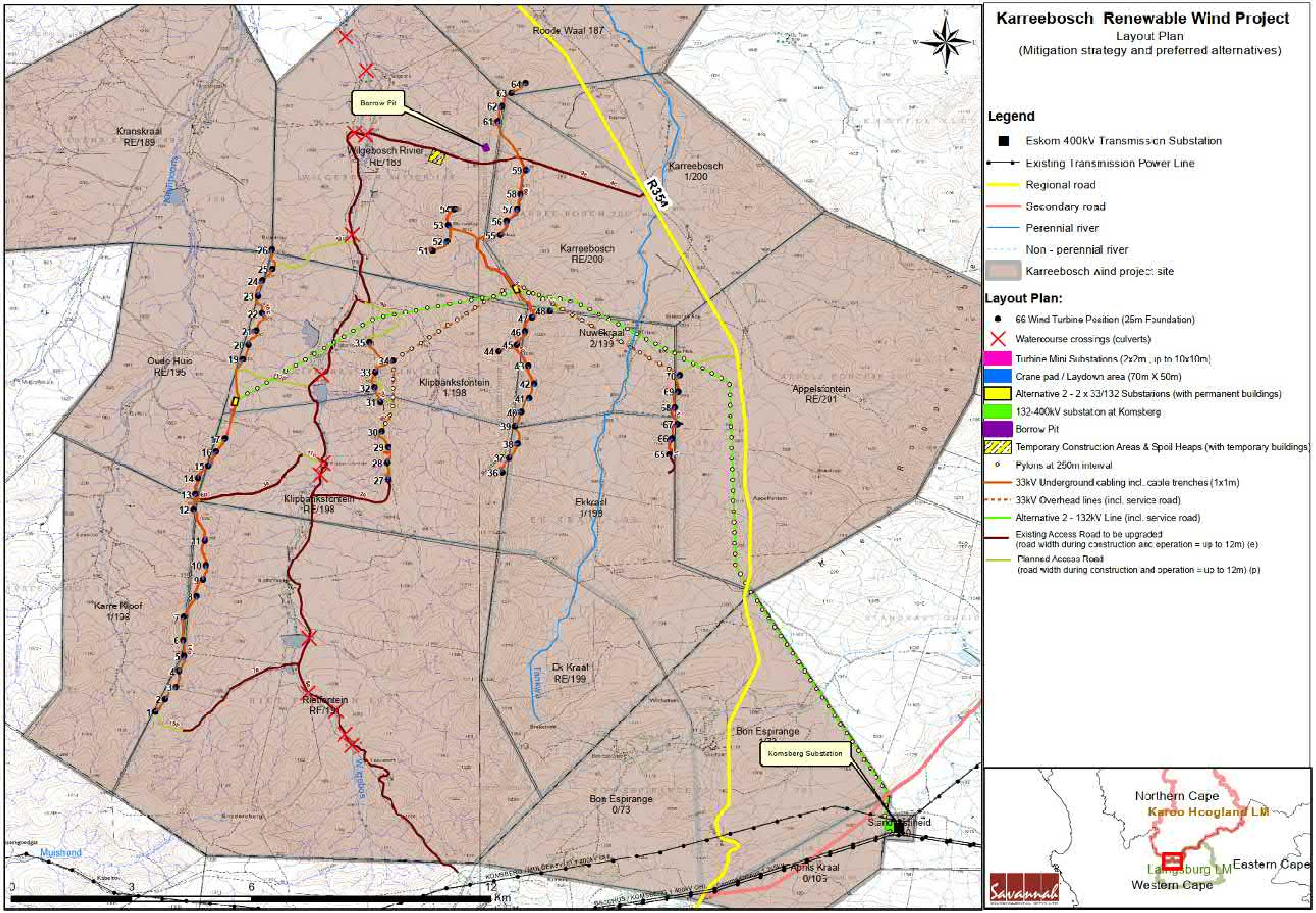

Figure 1-2:Karreebosch WEF and associated infrastructure authorised as per the January 2016 EA (Ref: 14/12/16/3/3/2/807) (source: Savannah Environmental, 2015).

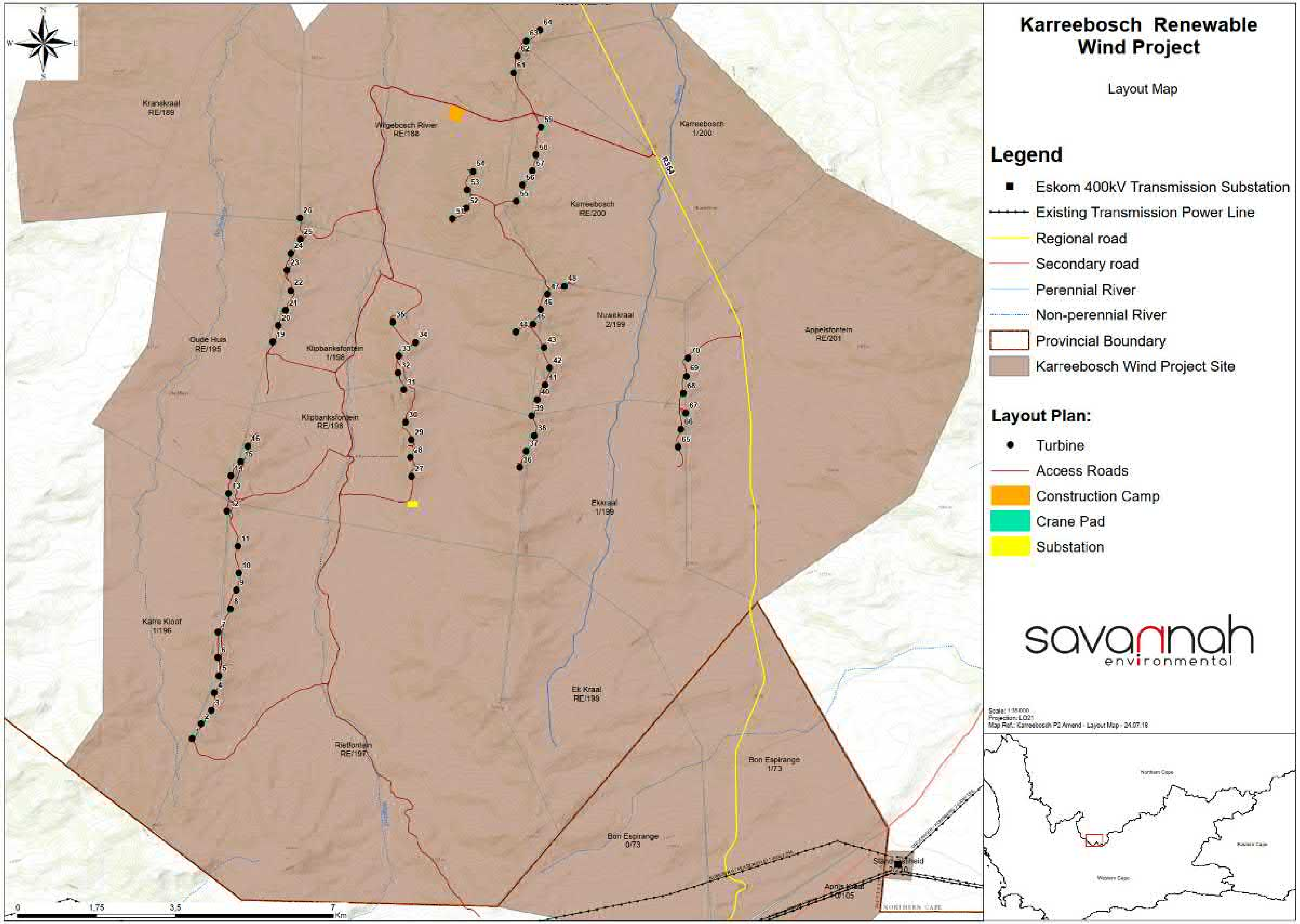

Figure 1-3:Karreebosch WEF and associated infrastructure authorised as per the November 2018 Part 2 EA Amendment (Ref: 14/12/16/3/3/2/807/AM2) (source: Savannah Environmental, 2018).

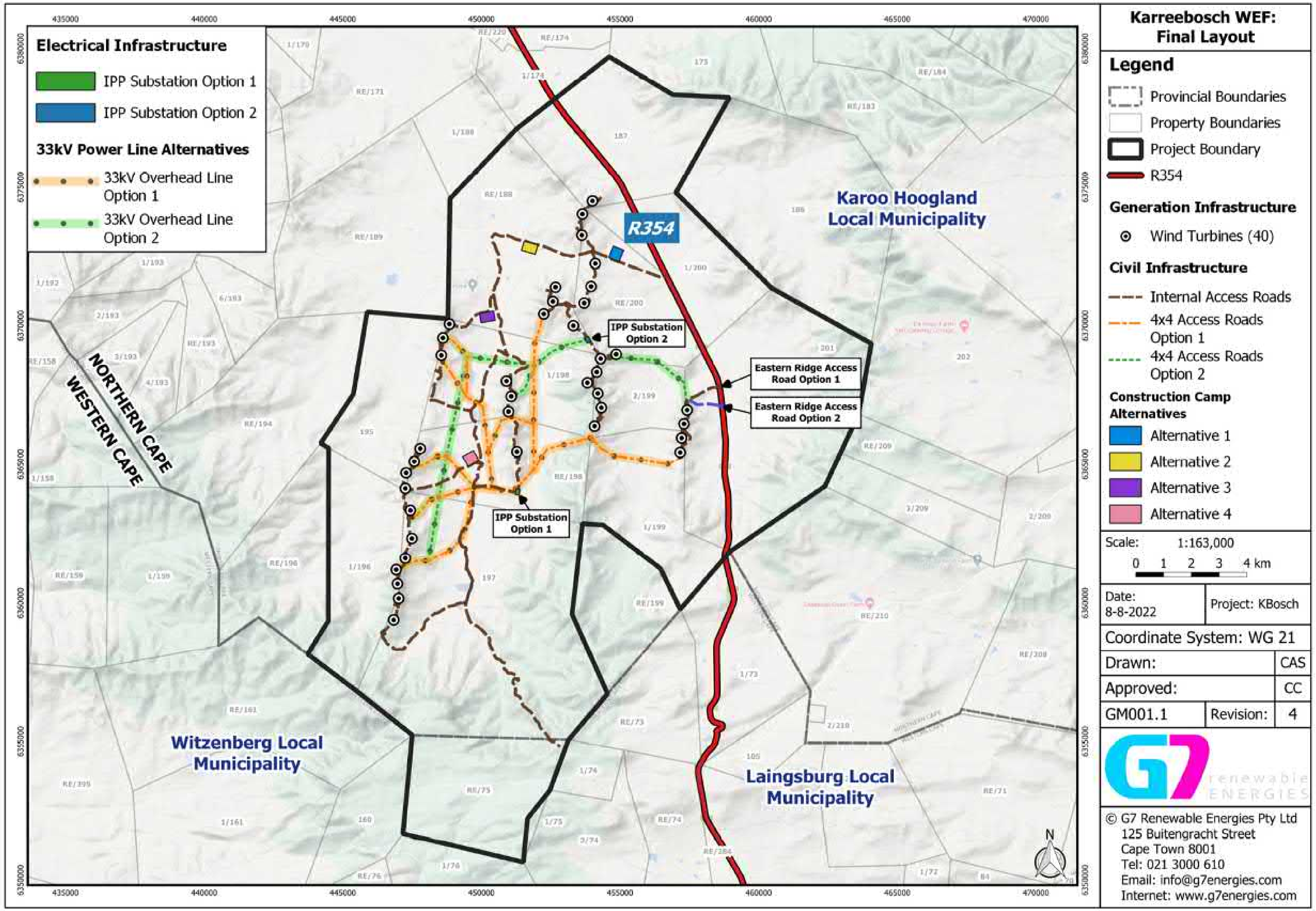

Figure 1-4:Proposed Final layout of the Karreebosch WEF and associated infrastructure (source: G7, 2022).

1.1.3 Surrounding area

The South African government gazetted[3] eight (8) areas earmarked for renewable energy development in South Africa. These areas are known as Renewable Energy Development Zones (REDZ) and this project falls within the Komsberg REDZ**.** The purpose of the REDZ is to cluster development of renewable energy facilities in order to streamline the grid expansion for South Africa, i.e., connect zones to one another as opposed to a wide scatter of projects. Therefore, a number of renewable energy developments within the surrounding area which have submitted applications for environmental authorisation (some of which have been approved). It is important to note that the existence of an approved EA does not directly equate to actual development of the project.

The surrounding projects that have not already been awarded Preferred Bidder (PB) status under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) Bid window 5 or the Risk Mitigation IPP procurement programme (RMIPPPP), are still subject to the REIPPPP bidding process or subject to securing an off taker of electricity through an alternative process. Some of the surrounding proposed WEFs secured EAs several years ago but have not obtained PB status (or a private off taker agreement) and as such have not been developed.

These existing surrounding projects of varying approval status have been detailed in the table and figure below. Given the site's location within the Komsberg REDZ, it is considered to be located within the renewable energy hub that is developing in this focus area.

Table 1-4:Existing surrounding projects

LABEL	DFFE Reference	Project Title	STATUS
1	12/12/20/1782/1/AM5	140MW Rietrug Wind Energy Facility near Sutherland, Northern Cape Province.	Preferred Bidder Round 5
2	12/12/20/1782/2/AM6	140MW Sutherland 1 Wind Energy Facility near Sutherland, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 5
3	12/12/20/1782/3/AM3	140 MW Sutherland 2 Wind Energy Facility near Sutherland, Northern Cape Provinces.	Preferred Bidder Round 5
4	12/12/20/1783/1/AM5	150MW Perdekraal Site 1 Wind Energy Facility, Western Cape Province.	Approved
5	12/12/20/1783/2/AM5	147MW Perdekraal Site 2 Wind Energy Facility, Western Cape Province.	Preferred Bidder Round 4, Operational
6	12/12/20/1988/1/AM6	140MW Roggeveld Phase 1 Wind Farm, North of Matjiesfontein, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 4, Operational
7	12/12/20/2370/1/AM6	140 MW Karusa Wind Energy Facility,Phase 1, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
8	12/12/20/2370/2/AM6	140MW Soetwater Wind Farm Phase 2, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational

[3] Government Notice 114 of 16 February 2018.

LABEL	DFFE Reference	Project Title	STATUS
9	12/12/20/2370/3/AM5	140MW Great Karoo Wind Energy Facility Phase 3, Karoo Hoogland Municipality, Northern Cape Province.	Approved
10	14/1/1/16/3/3/1/2318	310MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
11	14/12/16/3/3/1/2441	360MW Pienaarspoort Wind Energy Facility Phase 2, Witzenberg local Municipality, Western Cape Province.	Approved
12	14/12/16/3/3/1/1976/1/AM 3	226MW Kudusberg Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces.	Approved
13	14/12/16/3/3/1115	325WM Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces	Approved
14	14/12/16/3/3/1/1977/AM3	183MW Rietkloof Wind Energy Facility near Matjiesfontein in the Western Cape Province.	Preferred Bidder Round 5
15	14/12/16/3/3/1/2542	200 MW Esizayo Wind Energy Facility Expansion near Laingsburg, Western Cape.	In Process
16	14/12/16/3/3/2/2009/AM1	Oya Energy Facility	Preferred Bidder Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP)
17	14/12/16/3/3/2/826	140MW Gunsfontein Wind Energy Facility Karoo Hoogland Municipality, Northern Cape Province.	Approved
18	14/12/16/3/3/2/856 /AM4	275MW Komsberg West near Laingsburg, Western Cape Provinces	Approved
19	14/12/16/3/3/2/857/AM4	275 Komsberg East near Laingsburg, Western Cape Provinces.	Approved
20	14/12/16/3/3/2/900/AM2	140MW Brandvalley Wind Energy Facility, WITHIN THE Laingsburg and Witzenberg Local Municipalities in the Western and Northern Cape Province.	Preferred Bidder Round 5
21	14/12/16/3/3/2/962/AM1	140MW Maralla East Wind Energy Facility, Namakwa and Central Karoo District Municipalities, Western and Northern Cape Provinces.	Approved
22	14/12/16/3/3/2/963/AM1	140Maralla West Wind Energy Facility, Karoo Hoogland local Municipality, Northern Cape Province.	Approved
23	14/12/16/3/3/2/967/AM3	140MW Esizayo Wind Farm, Laingsburg Local Municipality Western Cape Province.	Approved
24	12/12/20/2235	10MW Inca Photovoltaic Facility near Sutherland, Northern Cape Province.	Approved

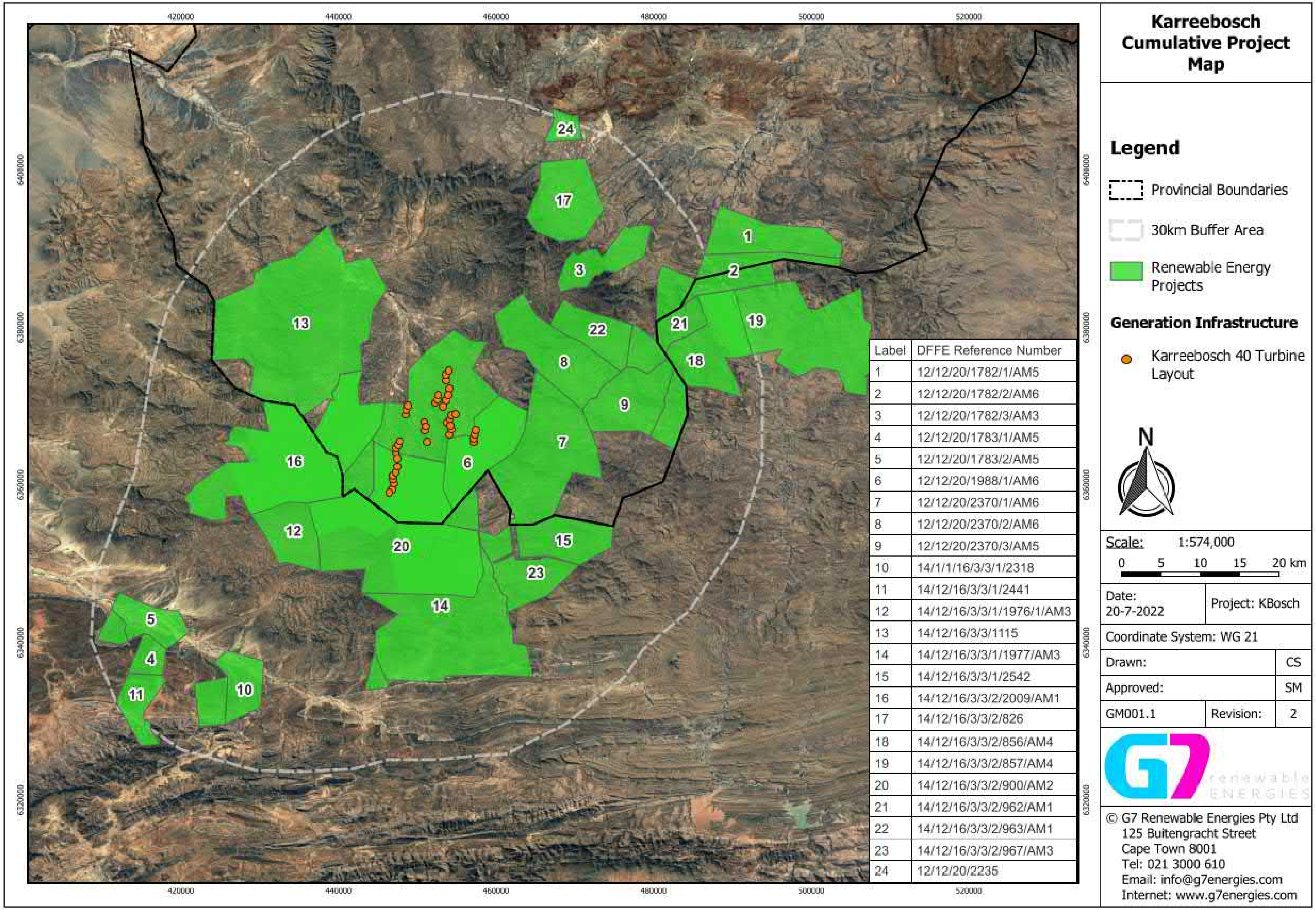

Figure 1-5:Renewable energy projects (by approval status) within a 30km radius of the Karreebosch WEF

1.2 Scope of work

The aim of the TIA is to determine the transport impact of the development on the existing transport network during the construction, operation, and decommissioning phases of the development.

The report will deal with the items listed below and focuses on the surrounding road network that may be impacted by construction and maintenance of the site:

Traffic and Route Assessment

- Trip generation and potential traffic impact
- Possible haul routes between port of entry / manufacturing location and sites in regards of
- National route
- Local route
- Site access route (internal roads)
- Road limitations due to abnormal loads
- Construction and maintenance (operational) vehicle trips
- Generated vehicles trips
- Abnormal load trips
- Access requirements
- Investigation of the impact of the development traffic generated during construction and operation.

Access and Internal Roads Assessment

- Assessment of 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
- High-level input into the proposed internal roads on site
- High-level input into the internal circulation of trucks and proposed roads layout

1.3 Approach and Methodology

The report deals with the traffic impact on the surrounding road network in the vicinity of the site during the construction of the access roads, construction and installation of the turbines and during maintenance.

This transport study includes the following tasks:

Project Assessment

- Overview of project background information including the previous TIA, location maps, component specs and any resulting abnormal loads to be transported
- Research of all available documentation and information relevant to the proposed windfarm and substations

Traffic and Route Assessment

- Trip generation and potential traffic impact
- Possible haul routes between port of entry / manufacturing location and sites in regards of
  - National route
  - Local route
  - Site access route (internal roads)
  - Road limitations due to abnormal loads
- Estimation of construction and maintenance (operational) vehicle trips
  - Generated vehicles trips
  - Abnormal load trips
  - Access requirements
- Investigation of the impact of the development traffic generated during construction and operation.

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

Report (Documentation and Figures)

- Reporting on all findings and preparation of the report.

1.4 General assumptions

The following assumptions were made:

- According to the Eskom Specifications for 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.
- Maximum vertical height clearances along the haulage route is 5.2 m for abnormal loads.
- The imported elements will be transported from the most feasible port of entry, which is deemed to be Port of Saldanha.
- 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 decommissioning phase will have similar transport impact as the construction phase.

1.5 Source of information

Information used in a transport study includes:

- Project information provided by the Client
- Google Earth. kmz provided by the Client
- Google Earth Satellite Imagery
- Chief surveyor general website
- TRH11, Dimensional and mass limitations and other requirements for abnormal loads, August 2009
- 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”, 2000
- National Road Traffic Act, Act 93 of 1996
- National Department of Transport (NDoT), Manual for Traffic Impact Studies, October 2005
- Department of Transport (DoT), Geometric Design of Rural Roads, 1988
- SANS 10280/NRS 041-1:2008 Overhead Power Lines for Conditions Prevailing in South Africa
- Manual for Traffic Impact Studies, Department of Transport, 1995
- TRH26 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

2 SITE DESCRIPTION

2.1 General

It is proposed to develop the Karreebosch WEF with a capacity of 140MW in the Northern Cape, approximately 40km north of Matjiesfontein (see **Figure 2-1**). The site is proposed to accommodate the following infrastructure:

- 40 wind turbines with an individual energy generation capacity of up to 7.5MW each. The maximum wind turbine rotor diameter is proposed to be 170m with a hub height of 140m.
- Concrete foundations approximately 30m in diameter and 5m deep per turbine,
- Transformer for each turbine,
- Laydown and storage areas,
- Construction camp and onsite batching plant,
- Access road corridor,
- Internal road network up to 12m in width,
- Buildings,
- Overhead powerlines and underground cabling,
- One 33/132 KV onsite substations, and
- Fencing.

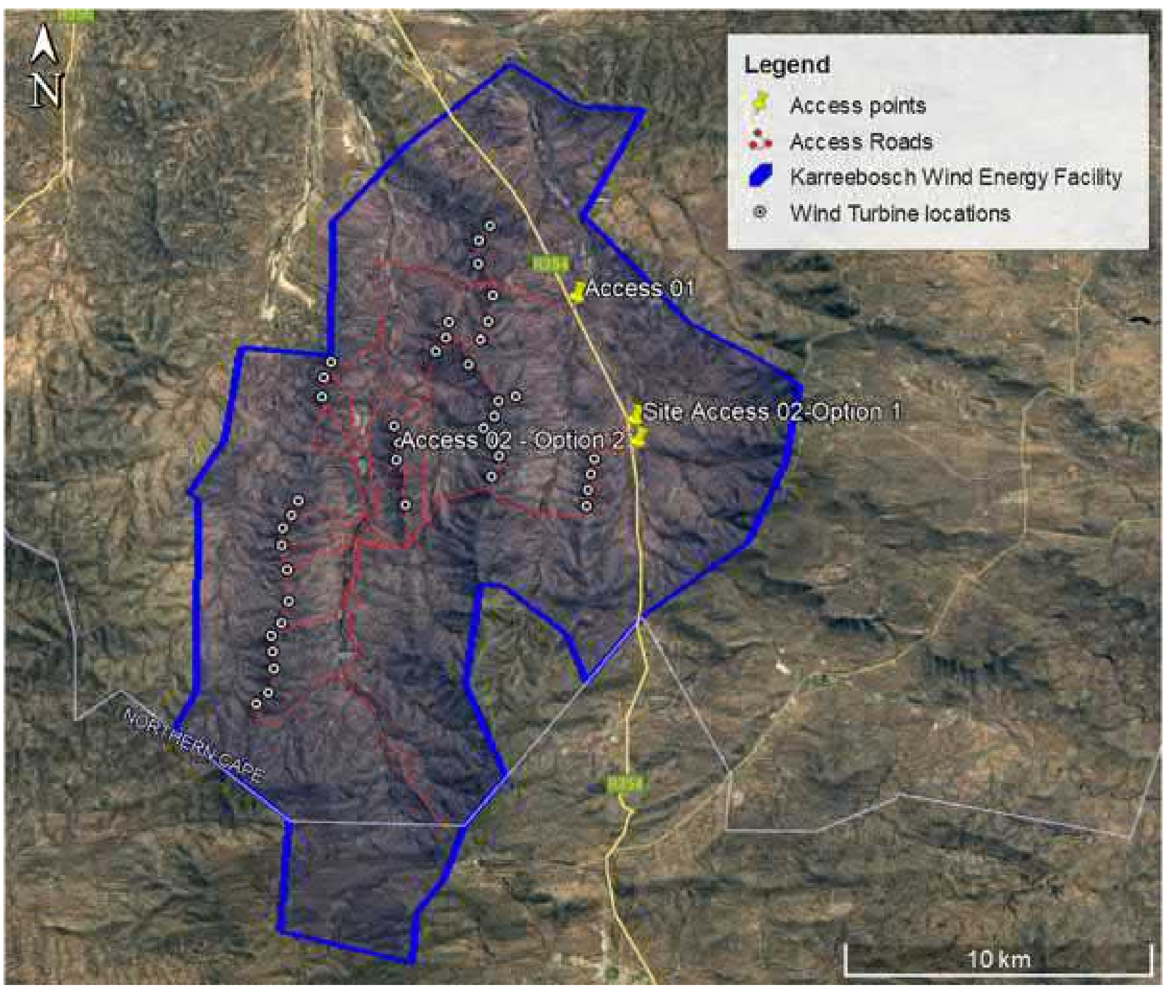

Figure 2-1:The site

3 TRANSPORTATION ROUTES

3.1 Site access points

The proposed Karreebosch WEF facility site can be accessed from two site access points off the R354 located at the site's eastern end. The R354 is a Class 2 minor arterial route running in a north-south-direction from Matjiesfontein to the R356 in the Northern Cape. The road is a surfaced single carriageway with one lane per direction.

The main access (Access 01) is located off an existing access road; therefore, access spacing restrictions are not envisaged.

An additional access point (access 02) is proposed south of the main access (access 01) to access the eastern turbine ridge. Two options are considered for access 02 (option 1 approximately 850m south of an existing farm gate and option 2 located approximately 1.5km south of the same farm gate)

Based on TRH 26, the minimum access spacing recommended along a class 2 road is 5km. This distance may, however, not be feasible due to site boundaries and land terrain limitations. It is therefore noted that TRH17 recommends a minimum spacing of 500m between successive intersections. An access spacing of 500m is recommended for consideration by the approving authority as a more practical access spacing for consideration in a site of this nature.

Access 01 and Access 02-option 2 are located off a straight horizontal curve with relatively flat terrain; therefore, sight line restrictions are not envisaged (i.e., sight lines are expected to meet the 300m minimum sight distance for a 100km/h posted speed). Access 02- Option 1 is located on a horizontal curve with an embankment to the north. Due to the horizontal alignment and roadside terrain of the road section, sight line limitations are envisaged at Access 02-Option 1. Access 02-Option 2 is therefore a more favourable access position to meet sight line requirements .

It is also recommended that appropriate signage is accommodated to warn road users of the access points and that the road reserve be maintained to prevent obstructions to sight lines.

It should be noted that road upgrades may be required along existing access roads to accommodate expected vehicles.

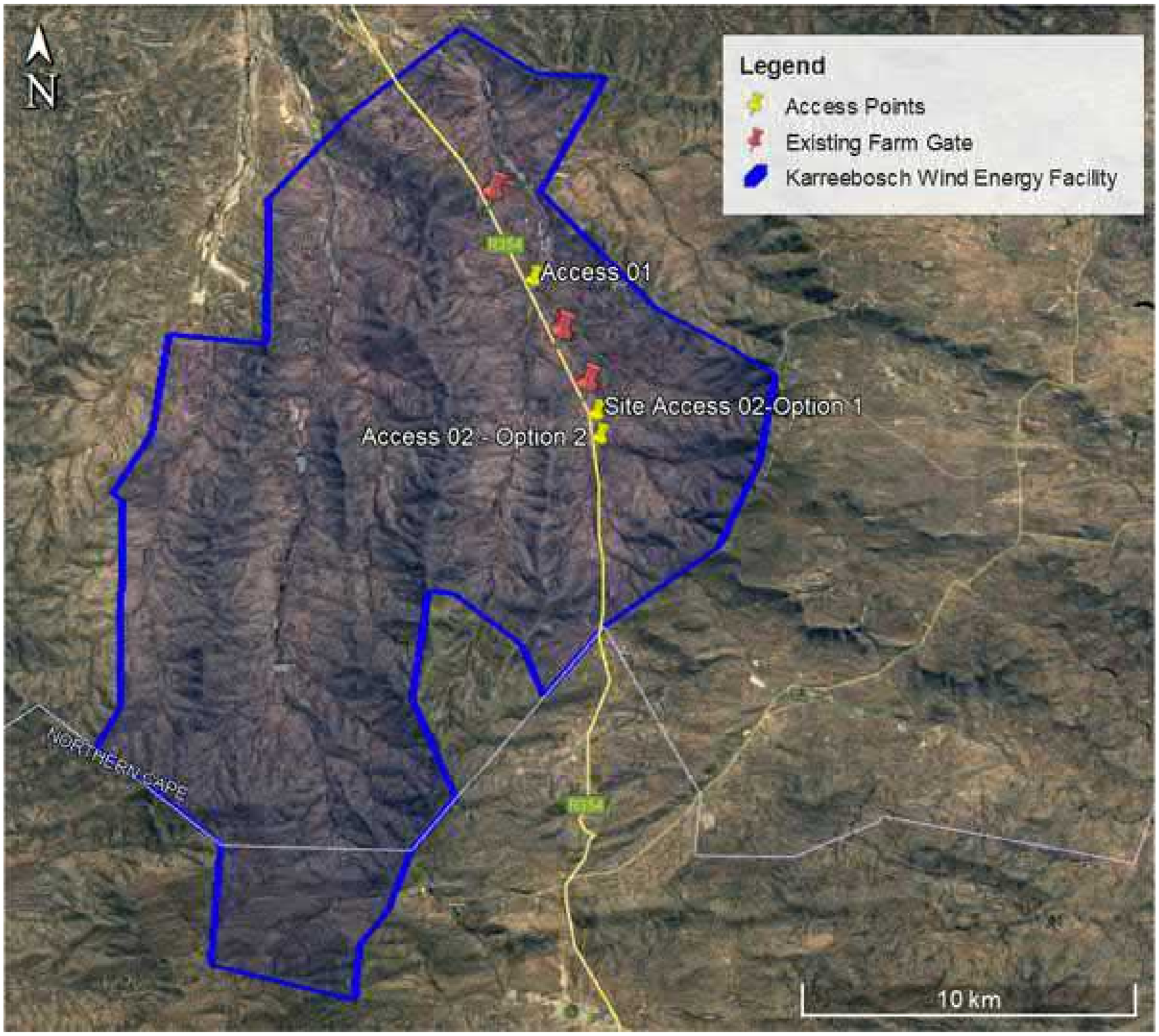

Figure 3-1:The Proposed Site Access Points

It is recommended that the following aspects be considered for the detailed design of the site access points:

- staggered intersections should be avoided where possible.
- 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 to the facility be access controlled. It is also recommended that security staff be stationed on site at the access during construction.
- A minimum stacking distance of 25m is recommended between the road edge of the external road and the access control.
- All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM).

3.2 Port of entry

It is assumed that the blades and nacelle components will be imported to South Africa via the Port of Saldanha. The Port of Saldanha is South Africa's largest natural anchorage and port with the deepest water. It is located 60 nautical miles northwest of Cape Town (Longitude 17^0 58' E and Latitude 33^0 02' S) and is operated by Transnet National Ports Authority.

Depending on the type of turbine and tower, the tower sections can either be imported, or alternatively be manufactured locally. There are several types of towers available on the market, i.e., concrete, steel or hybrid concrete-steel towers. Within South Africa, steel towers can be sourced from the Cape Town area, Atlantis or Port Elizabeth, and concrete towers can be manufactured on or near the site.

3.2.1 Main route for the transportation of the wind turbine components

Based on experience with similar projects as well as input from the previous transport investigation, the possible ports of entry include Port of Saldanha (approximately 360 km from the site) and the Port of Ngqura (approximately 634 km from the site).

The following aspects were considered about the above routes:

1. Port of Saldanha (approximately 360 km from the site):
   This is the shortest route. The route comprises of high order routes surrounded by rural developments and farm properties and passes through Ceres and Moorreesburg. The density of these two towns is lower than the Cape Town area of route option 2 (see **Figure 3-3**).

2. Port of Ngqura (approximately 634km from the site):
   This route has the longest distance to the site (see **Figure 3-2**). It comprises of majority high order routes. It passes through some small towns with low densities. Not much congestion is expected.

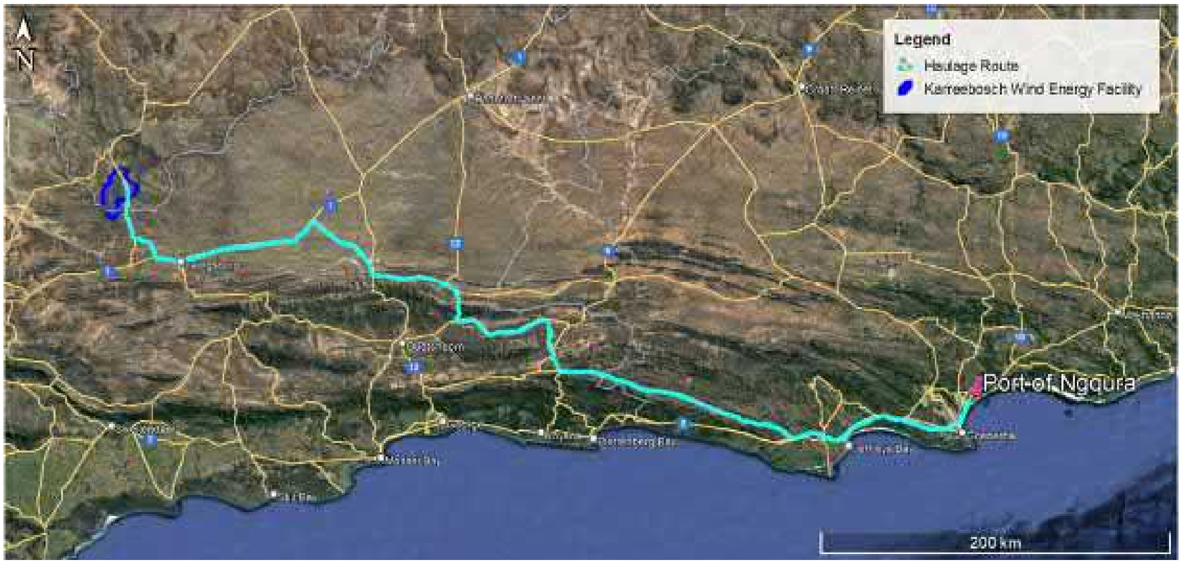

Figure 3-2:Route from the Port of Ngqura to the site

3.2.2 Preferred port of entry

The preferred port of entry to the site is the Port of Saldanha. The haulage route maximises the use of higher order routes, which are designed to handle / accommodate larger vehicles and minimises travelling through towns as far as possible. This was deemed important to minimise congestion and avoid disruptions to communities in these towns.

The delivery company is advised to conduct a dry run of the route to determine the practical suitability of the route for abnormal load travel.

Figure 3-3:Preferred Route from the Port of Saldanha to the site

4 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE TRANSPORT STUDY

4.1 Selected Candidate Turbine

The possible range of wind turbines varies largely with various wind turbine manufacturers operating worldwide. The exact wind turbines to be used on-site have not been finalised yet. For this study, a turbine with a maximum hub height of 140m and a blade length of up to 85m is assumed for the assessment.

In general, each turbine unit consists of a tower, a nacelle (final weight dependent on the supplier and whether the nacelle has gears or not), and rotor blades. It is assumed that all turbine parts will be imported and shipped via the Port of Sadhana.

4.2 Transportation requirements

4.2.1 Abnormal Load Considerations

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

- Length: 22m for an interlink, 18.5m for truck and trailer, and 13.5m for a single unit truck,
- Width: 2.6m,
- Height: 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, and
- Axle load limitation: 7.7t on the front axle and 9t on single or rear axles,

Any dimension/mass exceeding 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.

4.2.2 Further Guideline Documentation

The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and 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 concerning 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.

4.3 Permitting – General Rules

The limits recommended in TRH 11 serve as a guide to the Permit Issuing Authorities. Each Administration has the right to refuse a permit application or modify the conditions to grant a permit. It is understood that:

a. A permit is issued at the sole discretion of the Issuing Authority. The Issuing Authority may refuse a permit because of the condition of the road, the culverts, and bridges, the nature of road traffic, excessive heavy traffic during specific periods, or for any other reason.
b. A permit can be withdrawn if the vehicle is inspected and found unfit for operation.
c. During specific periods, such as school holidays or long weekends, an embargo may be placed on the issuing of permits. Embargo lists are compiled annually and are obtainable from the Issuing Authorities.

4.3.1 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 vehicle capacity 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.

4.3.2 Dimensional Limitations

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

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

4.4 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.

4.4.1 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 4-1:Transporting the Nacelle (Dvorak, 2010)

4.4.2 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 4-2: Blade transport (Froese, 2019)

For this study, turbine blades of a maximum length of 85 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.

4.4.3 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 140 metres, a maximum of 7 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 4-3:Transporting the Tower Sections (Montiea, 2014)

4.4.4 Turbine Hub and Rotary Units

Turbine Hub need to be transported separately, due to their significant weights. A hub unit weighs around 45 tons.

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

4.5 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.

4.5.1 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 4-5: 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 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 4-6: 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.

4.5.2 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 4-7: 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.

4.6 Transporting Other Material and Equipment

In addition to transporting the specialised lifting equipment, the normal Civil Engineering construction materials and equipment will need to be brought to the site (e.g., sand, stone, cement, gravel for road building purposes, excavators, trucks, graders, compaction equipment, cement mixers, transformers in the substation, cabling, transmission pylons etc.). Other components, such as electrical cables, pylons, and substation transformers, will also be transported to site during construction. The transport of these items will generally be conducted with normal heavy loads vehicles.

5 IDENTIFICATION OF TRAFFIC IMPACT

5.1 Activities with potential traffic impact

The traffic expected to be generated by the proposed WEF can be divided into three phases outlined as follows:

5.1.1 Construction phase

The construction phase includes the transportation of people, construction materials and equipment to the site. This phase also includes the construction of roads, excavation of turbine footings, trenching for electrical cables and other ancillary construction works that will temporarily generate the largest amount of traffic.

The exact traffic to be generated during the construction phase cannot be determined until project planning and haulage logistics has been determined. However, for the proposes of assessing traffic impact, the major traffic contributors can be estimated to help advise on mitigation measures.

The following activities with trip generation estimates is assumed for the study:

1. **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 (reinforced concrete materials): 60 trips per turbine (i.e., 2400 trips for 40 turbines)
    - Heavy vehicle (road layer works): 90 trips per turbine (i.e.,3600 trips for 40 turbines)

      The above would result in a total of 6000 heavy vehicle trips for the full site construction.

      Based on a 24-30 month estimated construction period, with ± 235 annual average working days (five-day work week), an estimated maximum of 13 daily trips can be assumed for material delivery. This results in 4 peak hour estimated trips (a 4-hr delivery window/day is assumed).

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.

2. **Wind turbine component delivery:** This includes delivery of wind turbine components (i.e., blades, nacelle, turbine hub, and tower sections).

   The blades, nacelle and turbine hub are expected to be transported by abnormal loads. These are expected to be shipped from the nearest port of entry (i.e., Port of Saldanha Bay). As the worst-case scenario, it will be assumed that the turbine blades will each be delivered separately.

   The wind turbine towers can be manufactured locally. Steel towers can be sourced from Cape Town, Atlantis or Port Elizabeth, and concrete towers can be manufactured near the site. As the worst-case scenario, it will be assumed that the towers will be sourced from a manufacturer and delivered on site.

   - Abnormal loads (turbine components): 12 trips per turbine (i.e., 480 total trips for 40 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. The number of peak hour vehicle trips generated by abnormal load vehicles is thus unknown at this stage.

3. **Construction machinery:** 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.

4. **Site personnel and workers:**

Based on previous experience as well as the previously approved Traffic Impacts Study for the site, the personnel during construction are envisaged to be between 150 and 200 employees. It is further assumed that 15% of the staff will comprise of skilled personnel (i.e., engineers, land surveyors, project managers etc.). The personnel will most likely reside in Sutherland, Matjiesfontein or Laingsburg as the closest communities.

Based on traffic station data sourced from the Western Cape Government Road Network Information System, there are no taxis or busses operating along the R354 east of the site. It is recommended that the majority of construction personnel be transported to and from site by means of busses.

Busses have an average of 65 passenger capacity and assuming the skilled personnel will travel by means of passenger vehicles, the following trips are assumed:

- with a maximum of 170 persons expected to travel by bus, approximately 3 (three) bus trips are assumed.
- for the skilled personnel, a maximum of 15 trips are expected. It is further assumed that 50% of the trips will occur during the peak hour.

Depending on the construction schedule an estimated of 18 peak hour site personnel trips is assumed for the purposes of this assessment.

Based on the above 22 peak hour trips can be assumed for the site excluding abnormal load vehicle trips. Due to permitting restrictions it can be assumed that less than 50 peak hour trips will be generated by the site. According to the Traffic Impact Assessment Manual TMH 16 Vol 1, traffic impact assessments are warranted if vehicle trips exceed 50 peak hour vehicles. It can therefore be assumed that trips less than this are deemed to have a negligible impact on the traffic capacity of the surrounding road infrastructure.

5.1.2 Operation and maintenance phase

The operation and maintenance phase include the operation and maintenance of the WEF. Based on similar studies of this size, the envisaged site traffic would be limited to a few light vehicles, transporting approximately 20 employees per day.

The maintenance or replacement of wind turbine components would require a crane and abnormal vehicles. The maintenance or replacement of components can be planned and staggered, furthermore traffic disruptions can be minimised by transporting the components during off-peak hours. This phase is therefore expected to generate minimal traffic.

5.1.3 Decommissioning phase

The decommissioning phase includes, but is not limited to, the dismantling of wind turbine components (blades, nacelle and tower), removal of electrical systems and substation, dismantling and removal of the operations and maintenance buildings, removal of wind turbine pads and removal of access/ service roads.

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.

5.1.4 Cumulative impacts

According to the Traffic Impact Assessment Manual TMH 16 Vol 1, road network capacity related impacts are considered only if a site generates more than 50 peak hour trips. It is also acknowledged that developments have an impact on the wider road network however, due to the limitations of the Traffic Impact Assessment Methodology, the assessment of wider impacts is addressed by means of master planning. Since the site is not envisaged to generate more than 50 peak hour trips the cumulative impacts considered in this study are discussed below only to help inform the master planning processes conducted by the relevant transport regulating authority.

To assess the cumulative impact, it will be assumed that all wind farms within 30km currently proposed and/or approved, would be constructed at the same time. It must be noted that this is a conservative approach.

5.1.4.1 During Construction

The total estimated construction peak hour trips are summarised in **Table 5-1**. It must however be noted that this is a conservative estimate, and the likelihood of occurrence is considered low due to the following:

- these projects would be subject to a highly competitive bidding process.
- Even if all wind farms 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 5-1:Estimated Cumulative construction trips

Developments within 30km from site	MW	Estimated peak hour construction traffic (excluding abnormal loads)
Rietrug Wind Energy Facility	140	22
Sutherland 1 Wind Energy Facility	140	22
Sutherland 2 Wind Energy Facility	140	22
Perdekraal Site 1	150	24
Great Karoo Wind Energy Facility Phase 3	140	22
Pienaarspoort Wind Energy Facility Phase 1	310	49
Pienaarspoort Wind Energy Facility Phase 2	360	57
Kudusberg Wind Energy Facility	226	36
Rondekop Wind Energy Facility	325	52
Rietkloof Wind Energy Facility	183	29
Esizayo Wind Energy Facility	200	32

Developments within 30km from site	MW	Estimated peak hour construction traffic (excluding abnormal loads)
Gunsfontein Wind Energy Facility	140	22
Komsberg West near Laingsburg	275	44
Komsberg East near Laingsburg	275	44
Brandvalley Wind Energy Facility	140	22
Maralla East Wind Energy Facility	140	22
Maralla West Wind Energy Facility	140	22
Esizayo Wind Farm	140	22
Inca Photovoltaic Facility	10	33
Total		598

5.1.4.2 During Operation

The total estimated operational peak hour trips are summarised in **Table 5-2**. It must, however, be noted that these trips will not necessarily occur during the peak hour and the access roads connect to a higher order road (i.e., R354) which is designed to accommodate high traffic volumes.

Table 5-2:Estimated Cumulative operational phase trips

Developments within 30km from site	MW	Daily traffic
Rietrug Wind Energy Facility	140	20
Sutherland 1 Wind Energy Facility	140	20
Sutherland 2 Wind Energy Facility	140	20
Perdekraal Site 1	150	22
Perdekraal Site 2 Wind Energy Facility	147	21
Roggeveld Phase 1 Wind Farm	140	20
Karusa Wind Energy Facility,Phase 1	140	20
Soetwater Wind Farm Phase 2	140	20
Great Karoo Wind Energy Facility Phase 3	140	20
Pienaarspoort Wind Energy Facility Phase 1	310	45
Pienaarspoort Wind Energy Facility Phase 2	360	52

Developments within 30km from site	MW	Daily traffic
Kudusberg Wind Energy Facility	226	33
Rondekop Wind Energy Facility	325	47
Rietkloof Wind Energy Facility	183	27
Esizayo Wind Energy Facility	200	29
Gunsfontein Wind Energy Facility	140	20
Komsberg West near Laingsburg	275	40
Komsberg East near Laingsburg	275	40
Brandvalley Wind Energy Facility	140	20
Maralla East Wind Energy Facility	140	20
Maralla West Wind Energy Facility	140	20
Esizayo Wind Farm	140	20
Inca Photovoltaic Facility	10	15
Total:		611

5.1.4.3 Decommissioning Stage

It is expected that the decommissioning phase will generate the same impact as that of the construction phase.

6 ASSESSMENT OF TRAFFIC RELATED ENVIRONMENTAL IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 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.

Nature of the impact

- Noise and dust pollution associated potential traffic

Table 6-1: Impact Assessment Table (Construction Phase)

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Noise and dust pollution associated potential traffic									
Without Mitigation	2	2	3	2	5	**45**	**Moderate**	(-)	High
With Mitigation	1	1	3	2	4	**28**	**Low**	(-)	moderate
Possible Mitigation and Management Measures	▪ 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. ▪ Regular maintenance of site gravel roads by the Contractor when needed. ▪ The use of mobile batch plants and quarries near the site would decrease traffic on the surrounding road network. ▪ Staff and general trips should occur outside of peak traffic periods as far as possible.								

Potential Impact (Operation Phase)

Nature of the impact

- Noise and dust pollution associated potential traffic

Table 6-2:Potential Impact (Operation Phase)

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Noise and dust pollution associated potential traffic									
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	High
With Mitigation	1	1	1	2	3	**15**	**Low**	(-)	moderate
Mitigation and Management Measures	▪ Consider scheduling shift changes to occur during off peak hours. ▪ Regular maintenance of site gravel roads by the Owner/Facility Manager when needed.								

6.2 Potential cumulative Impact (Construction Phase or Decommissioning Phase)

The cumulative impact assumes that all wind farms within 30km currently proposed and/or approved, would be constructed at the same time. It must be noted that this is a conservative approach.
Nature of the impact

- Noise and dust pollution associated potential traffic

Table 6-3:Potential cumulative Impact (Construction Phase or Decommissioning Phase)

Potential Impact **Noise and dust pollution associated potential traffic**	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Without Mitigation	3	3	3	2	5	**60**	**Moderate**	(-)	High
With Mitigation	2	2	3	2	3	**27**	**Low**	(-)	moderate
Mitigation and Management Measures	▪ The transport of components to or from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods. ▪ Dust suppression of gravel roads during the decommissioning phase, as required. ▪ Regular maintenance of site gravel roads is required by the Contractor during the decommissioning phase. ▪ Staff and general trips should occur outside of peak traffic periods as far as possible.								

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Access and internal circulation

- Two access points connecting with the R354 provide access to the project site.
- The main access (access 01) is located off an existing access point thus access spacing restrictions are not envisaged.
- An additional access point (access 02) is proposed south of the main access (access 01) to access the eastern turbine ridge. Two options are considered for access 02 (option 1 approximately 850m south of an existing farm gate and option 2 located approximately 1.5km south of the existing farm gate).

  It is therefore noted that a 5km access spacing may not be feasible due to site boundaries and constraints imposed by land terrain. It is recommended that the approving authority consider a minimum 500m access spacing for the site in line with TRH17 access spacing recommendations between successive intersections. This is deemed viable due to the nature of the site (i.e., low operational traffic volumes) and the surrounding site environment (i.e., rural environment with low development densities).
- Access 01 and Access 02-option 2 are located off a straight horizontal curve with relatively flat terrain; therefore, sight line restrictions are not envisaged (i.e., sight lines are expected to meet the 300m minimum sight distance for a 100km/h posted speed). Access 02- Option 1 is located on a horizontal curve with an embankment to the north. Due to the horizontal alignment and roadside terrain of the road section, sight line limitations are envisaged at Access 02-Option 1. Access 02-Option 2 is therefore a more favourable access position to meet sight line requirements.
- It is recommended that appropriate signage is accommodated to warn road users of the access points and that the road reserve be maintained to prevent obstructions to sight lines.
- It needs to be noted that all access and internal roads should be investigated for their topographical suitability, i.e., feasibility for plant and truck access and height clearance for any Eskom lines, Telkom lines or similar.
- Staggered intersections should be avoided where possible.
- 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 to the facility be access controlled. It is also recommended that security staff be stationed on site at the access during construction.
- A minimum stacking distance of 25m is recommended between the road edge of the external road and the access control.
- All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM).

7.2 Haulage routes for wind turbine components

- The proposed haulage route is outlined in Section 3.2. The Port of Saldanha haulage route was chosen as the preferred route because it provides the shortest route to the wind farm site, utilises higher order routes as far as possible and minimises travelling through towns.
- It is recommended that the respective haulage company conducts a dry-run to determine the restrictions relevant to the haulage vehicle to be utilised. With some route's road signs may need to be moved, overhead cables may need to be raised and bellmouths may need temporary widening to accommodate abnormal loads. A dry-run will help establish relevant changes specific to the abnormal load truck used to deliver the components and materials.

7.3 Traffic impact

No capacity improvements are considered necessary based on the following:

- The site gains access of the R354, which is a Class 2 road designed to accommodate large traffic volumes.
- The only notable generated traffic would occur during the construction and decommissioning phases. The trips generated during these phases will only occur for short periods of time and the following mitigation measures are recommended for consideration:
  - i. The delivery of wind turbine components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods,
  - ii. The use of mobile batching plants and any material sources in close proximity to the site would decrease the impact on the surrounding road network,
  - iii. Staff and general trips can occur outside of peak traffic periods,
  - iv. Staff can be shuttled on scheduled busses to minimise the number of trips; and
  - v. Stagger the removal of turbines, foundations, crane pads etc during the decommissioning phase.

7.4 Assessment of traffic related environmental Impacts and Identification of Management Actions

i. The construction phase includes the construction of the Facility, including construction of the roads, excavations, trenching and ancillary construction works. This phase will temporarily generate the most development traffic.

The nature of environmental impact expected with construction traffic is noise and dust pollution. It is estimated that the construction traffic will have a moderate significance rating pre mitigation and a low significance rating post mitigation.

<u>Proposed mitigation measures</u>

- 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 as required.
- Regular maintenance of site gravel roads by the Contractor when needed.
- The use of mobile batch plants and quarries near the site would decrease traffic on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods as far as possible.

ii. The operation and maintenance phase include the operation and maintenance of the WEF

The nature of environmental impact expected with operational traffic is noise and dust pollution. It is estimated that the operational traffic will have a low significance rating pre mitigation and post mitigation.

<u>Proposed mitigation measures</u>

- Consider scheduling shift changes to occur during off peak hours.
- Regular maintenance of site gravel roads by the Owner/Facility Manager when needed.

iii. 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.

iv. The cumulative impact assumes that all wind farms within 30km currently proposed and/or approved, would be constructed at the same time. It must be noted that this is a conservative approach.

The nature of environmental impact expected is noise and dust pollution. It is estimated that the construction traffic will have a moderate significance rating pre mitigation and a low significance rating post mitigation.

The mitigation measures proposed for the site construction phase are considered for the cumulative impacts during the construction stage.

8 SUMMARY

The aim of this study was to investigate traffic and transportation related matters pertaining to the proposed Karreebosch 140 MW WEF north of Matjiesfontein on the border between the Western Cape and Northern Cape.

During operation, the site is expected to have a low impact on the surrounding road environments. During the construction and decommissioning stage, a low impact can be achieved through mitigation measures outlined in this report.

The development of this wind energy facility is supported from a traffic engineering point of view, provided that the recommendations in this report are adhered.

9 WORKS CITED

1. Dvorak, P., 2010. *Transporter simplifies shipping nacelles.* [Online] Available at: https://www.windpowerengineering.com/transporter-simplifies-shipping-nacelles/
[Accessed 02 08 2021].
2. Froese, M., 2019. *New research brings aerospace blade protection to the wind industry.* [Online]
Available at: https://www.windpowerengineering.com/new-research-brings-aerospace-blade-protection-to-the-wind-industry/
[Accessed 02 08 2021].
3. Liebherr, 2017. *Liebherr.* [Online]
Available at: https://www.liebherr.com/en/int/latest-news/news-press-releases/detail/gulf-haulage-heavy-lift-company-erects-the-first-wind-turbine-in-saudi-arabia-using-a-liebherr-lr-1750-crawler-crane.html
[Accessed 02 08 2021].
4. Montiea, B., 2014. *Company completes transportation and erection of wind turbines.* [Online]
Available at: https://www.engineeringnews.co.za/article/company-completes-transportation-and-erection-of-wind-turbines-2014-11-28
[Accessed 02 08 2021].
5. Richardstransport, n.d. *Richardstransport.* [Online]
Available at: http://www.richardstransport.com/services/wind-turbines
[Accessed 02 08 2021].

Annexure A: IMPACT ASSESSMENT METHODOLOGY

BASIC ASSESSMENT PROCESS

OBJECTIVES OF THE BASIC ASSESSMENT PROCESS AS PER THE PROCEDURAL FRAMEWORK

As defined in Appendix 1 of the EIA Regulations, 2014 (as amended), the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—
  - The nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
  - The degree to which these impacts—
    - Can be reversed;
    - May cause irreplaceable loss of resources; and
    - Can be avoided, managed, or mitigated.
- Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to–
  - Identify and motivate a preferred site, activity and technology alternative;
  - Identify suitable measures to avoid, manage or mitigate identified impacts; and
  - Identify residual risks that need to be managed and monitored.

BASELINE ENVIRONMENTAL ASSESSMENT

The description of the environmental attributes of the project area was compiled through a combination of desktop reviews and site investigations. Desktop reviews made use of available information including existing reports, aerial imagery, and mapping.

IMPACT ASSESSMENT METHODOLOGY

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

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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 1**.

Table 1: Impact Assessment Criteria and Scoring System

<table>
<tr><th>CRITERIA</th><th colspan="2">SCORE 1</th><th colspan="2">SCORE 2</th><th colspan="2">SCORE 3</th><th colspan="2">SCORE 4</th><th colspan="2">SCORE 5</th></tr>
<tr><td>Impact Magnitude (M)
The degree of alteration of the affected environmental receptor</td><td colspan="2">Very low:
No impact on processes</td><td colspan="2">Low:
Slight impact on processes</td><td colspan="2">Medium:
Processes continue but in a modified way</td><td colspan="2">High:
Processes temporarily cease</td><td colspan="2">Very High:
Permanent cessation of processes</td></tr>
<tr><td>Impact Extent (E) The geographical extent of the impact on a given environmental receptor</td><td colspan="2">Site: Site only</td><td colspan="2">Local: Inside activity area</td><td colspan="2">Regional: Outside activity area</td><td colspan="2">National: National scope or level</td><td colspan="2">International: Across borders or boundaries</td></tr>
<tr><td>Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change</td><td colspan="2">Reversible: Recovery without rehabilitation</td><td colspan="2"></td><td colspan="2">Recoverable: Recovery with rehabilitation</td><td colspan="2"></td><td colspan="2">Irreversible: Not possible despite action</td></tr>
<tr><td>Impact Duration (D) The length of permanence of the impact on the environmental receptor</td><td colspan="2">Immediate:
On impact</td><td colspan="2">Short term:
0-5 years</td><td colspan="2">Medium term:
5-15 years</td><td colspan="2">Long term:
Project life</td><td colspan="2">Permanent:
Indefinite</td></tr>
<tr><td>Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation</td><td colspan="2">Improbable</td><td colspan="2">Low Probability</td><td colspan="2">Probable</td><td colspan="2">Highly Probability</td><td colspan="2">Definite</td></tr>
<tr><td>Significance (S) is determined by combining the above criteria in the following formula:</td><td colspan="10">$[S = (E + D + R + M) \times P]$
$Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$</td></tr>
<tr><td colspan="11">IMPACT SIGNIFICANCE RATING</td></tr>
<tr><td>Total Score</td><td colspan="3">0 – 30</td><td colspan="4">31 to 60</td><td colspan="3">61 – 100</td></tr>
<tr><td>Environmental Significance Rating (Negative (-))</td><td colspan="3">Low (-)</td><td colspan="4">Moderate (-)</td><td colspan="3">High (-)</td></tr>
<tr><td>Environmental Significance Rating (Positive (+))</td><td colspan="3">Low (+)</td><td colspan="4">Moderate (+)</td><td colspan="3">High (+)</td></tr>
</table>

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

[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.

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 0-1** below.

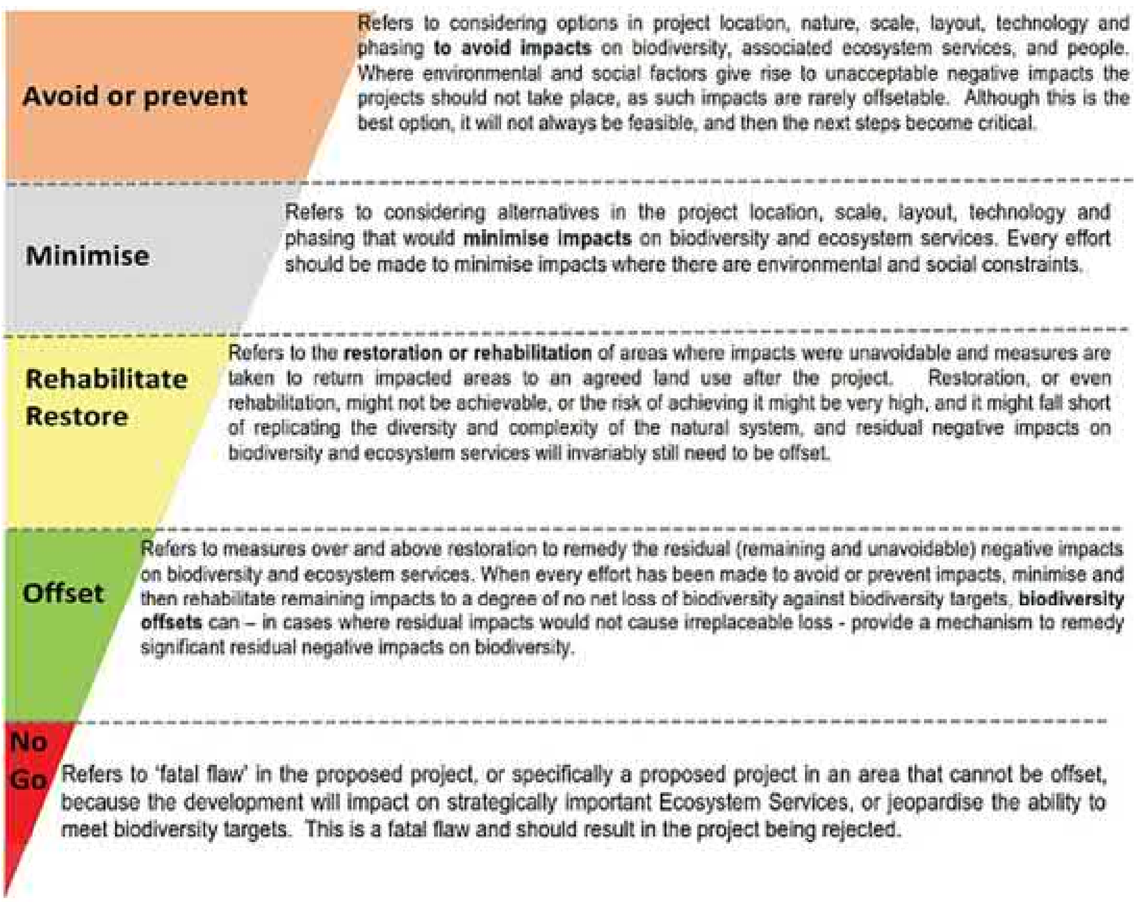

Figure 0-1: Mitigation Sequence/Hierarchy

1 ENVIRONMENTAL IMPACT ASSESSMENT

This Chapter identifies the perceived environmental and social effects associated with the proposed Project. The assessment methodology is outlined above. The issues identified stem from those aspects presented in the baseline assessment as well as project description provided. The impact assessment will be based on the preferred alternative at all project phases. This section only assesses the preferred option along with the no-go section. The mitigation hierarchy criteria for each mitigation measure are indicated in brackets after each measure indicated.

Furthermore, the decommissioning assessment will be considered as part of the decommissioning process that will be subject to a separate authorisation and impact assessment process. The impact assessment in this section encompasses the geographical, physical, biological, social, economic, heritage and cultural aspects in accordance with Appendix 1 of GNR 326.

An example of how the impact assessment methodology is applied is provided below:

1.1 AIR QUALITY

1.1.1 CONSTRUCTION PHASE

DUST AND PARTICULATE MATTER

The National Dust Control Regulations (GNR 827) prescribe general measures for the control of dust in both residential and non-residential areas and will be applicable during construction of the OHPL. **Table 2** provides the acceptable dust fall rates as prescribed by GNR 827.

Table 2: Acceptable dust fall rates (GNR 827)

RESTRICTION AREAS	DUST FALL RATE (D) ($mg/m^2/day$ – 30 DAYS AVERAGE)	PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600 < D < 1200	Two within a year, not sequential months

During the construction phase, dust and vehicular emissions (carbon monoxide (CO), hydrocarbons, particulate matter (PM) and nitrogen oxides (NO_x) will be released as a result of vegetation clearing activities, transportation of equipment and materials to site, and the installation thereof, all of which involves the movement of large plant and trucks along unpaved roads and exposing of soils. The emissions will, however, have short-term impacts on the immediate surrounding areas that can be easily mitigated and thus the authorisation of such emissions will not be required. All construction phase air quality impacts will be minimised with the implementation of dust control measures contained within the EMPr.

The impact of the construction phase on the generation of dust and particulate matter (PM) is shown in **Table 3** below.

Table 3: Construction Impact on Generation of Dust and PM

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
GENERATION OF DUST AND PM									
Without Mitigation	2	2	3	1	4	**32**	**Moderate**	(-)	High
With Mitigation	1	1	3	1	3	**18**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
GENERATION OF DUST AND PM								
Mitigation and Management Measures	— Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and soil/material stockpiles especially. This includes wetting of exposed soft soil surfaces and not conducting activities during high wind periods which will increase the likelihood of dust being generated; — All stockpiles (if any) must be restricted to designated areas and may not exceed a height of two (2) metres; — Ensure that all vehicles, machines and equipment are adequately maintained to minimise emissions; — It is recommended that the clearing of vegetation from the site should be selective, be kept to the minimum feasible area, and be undertaken just before construction so as to minimise erosion and dust potential; — All materials transported to, or from, site must be transported in such a manner that they do not fly or fall off the vehicle. This may necessitate covering or wetting friable materials. — Enforcing of speed limits. Reducing the dust generated by the listed activities above, putting up signs to enforce speed limit in access roads. — No burning of waste, such as plastic bags, cement bags and litter is permitted; and — All issues/complaints must be recorded in the complaints register.								

1.1.2 OPERATIONAL PHASE

There are no anticipated air quality impacts during the operational phase as maintenance activities will occur as and when required and will be extremely short term.

CUMULATIVE IMPACT ASSESSMENT

Although the BA process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified.

IFC PS 1 recognizes that, in some instances, cumulative effects need to be considered in the identification and management of environmental and social impacts and risks. For private sector management of cumulative impacts, IFC considers good practice to be two pronged:

- effective application of and adherence to the mitigation hierarchy in environmental and social management of the specific contributions by the project to the expected cumulative impacts; and
- best efforts to engage in, enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to undertake a cumulative impact assessment (CIA), in paragraph 11 it states that the impact and risk identification process "*will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence*" including "*master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant*."

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities (IFC).

Evaluation of potential cumulative impacts is an integral element of an impact assessment. In reference to the scope for an impact assessment, IFC's Performance Standards specify that "*Risks and impacts will be analysed in the context of the project's area of influence. This area of influence encompasses…areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location."*

A cumulative impact assessment is the process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (IFC).

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed project. While one project may not have a significant negative impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

SURROUNDING AREA

The project area and surrounding areas have been earmarked for renewable energy development. The South African government gazetted[6] eight (8) areas earmarked for renewable energy development in South Africa. These areas are known as Renewable Energy Development Zones (REDZ) and this project falls within the Komsberg REDZ. The purpose of the REDZ is to cluster development of renewable energy facilities in order to streamline the grid expansion for South Africa i.e. connect zones to one another as opposed to a wide scatter of projects. It is therefore not surprising that there are a number of environmental authorisations (EA) issued for wind energy facilities (either issued or in process) in the area surrounding the proposed project site. It is important to note that the existence of an approved EA does not directly equate to actual 'development'.

The surrounding projects, except for the Preferred Bidders, are still subject to the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bidding process or subject to securing an off taker of electricity through an alternative

[6] Government Notice 114 of 16 February 2018

process. Some of the surrounding proposed WEFs secured EAs several years ago but have not obtained Preferred Bidder status and as such have not been developed.

These existing surrounding projects of varying approval status have been detailed in the table and figure below. Given the site's location within the Komsberg REDZ, it is considered to be located within the renewable energy hub that is developing in this focus area.

All specialists must consider the cumulative impact of these projects in their statements / assessments prepared to inform this assessment.

Table 4: Renewable energy applications within 30km of the Karreebosch WEF and Powerline

LABEL	DFFE REFERENCE	PROJECT TITLE	STATUS
1	12/12/20/1782/1/AM5	140MW Rietrug Wind Energy Facility near Sutherland, Northern Cape Province.	Preferred Bidder Round 5
2	12/12/20/1782/2/AM6	140MW Sutherland 1 Wind Energy Facility near Sutherland, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 5
3	12/12/20/1782/3/AM3	140 MW Sutherland 2 Wind Energy Facility near Sutherland, Northern Cape Provinces.	Preferred Bidder Round 5
4	12/12/20/1783/1/AM5	150MW Perdekraal Site 1 Wind Energy Facility, Western Cape Province.	Approved
5	12/12/20/1783/2/AM5	147MW Perdekraal Site 2 Wind Energy Facility, Western Cape Province.	Preferred Bidder Round 4, Operational
6	12/12/20/1988/1/AM6	140MW Roggeveld Phase 1 Wind Farm, North of Matjiesfontein, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 4, Operational
7	12/12/20/2370/1/AM6	140 MW Karusa Wind Energy Facility,Phase 1, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
8	12/12/20/2370/2/AM6	140MW Soetwater Wind Farm Phase 2, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
9	12/12/20/2370/3/AM5	140MW Great Karoo Wind Energy Facility Phase 3, Karoo Hoogland Municipality, Northern Cape Province.	Approved
10	14/1/1/16/3/3/1/2318	310MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
11	14/12/16/3/3/1/2441	360MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
12	14/12/16/3/3/1/1976/1/AM3	226MW Kudusberg Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces.	Approved
13	14/12/16/3/3/1115	325WM Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces	Approved
14	14/12/16/3/3/1/1977/AM3	183MW Rietkloof Wind Energy Facility near Matjiesfontein in the Western Cape Province.	Preferred Bidder Round 5
15	14/12/16/3/3/1/2542	200 MW Esizayo Wind Energy Facility Expansion near Laingsburg, Western Cape.	In Process

16	14/12/16/3/3/2/2009/AM1	Oya Energy Facility	Preferred Bidder Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP)
17	14/12/16/3/3/2/826	140MW Gunsfontein Wind Energy Facility Karoo Hoogland Municipality, Northern Cape Province.	Approved
18	14/12/16/3/3/2/856 /AM4	275MW Komsberg West near Laingsburg, Western Cape Provinces	Approved
19	14/12/16/3/3/2/857/AM4	275 Komsberg East near Laingsburg, Western Cape Provinces.	Approved
20	14/12/16/3/3/2/900/AM2	140MW Brandvalley Wind Energy Facility, WITHIN THE Laingsburg and Witzenberg Local Municipalities in the Western and Northern Cape Province.	Preferred Bidder Round 5
21	14/12/16/3/3/2/962/AM1	140MW Maralla East Wind Energy Facility, Namakwa and Central Karoo District Municipalities, Western and Northern Cape Provinces.	Approved
22	14/12/16/3/3/2/963/AM1	140Maralla West Wind Energy Facility, Karoo Hoogland local Municipality, Northern Cape Province.	Approved
23	14/12/16/3/3/2/967/AM3	140MW Esizayo Wind Farm, Laingsburg Local Municipality Western Cape Province.	Approved
24	12/12/20/2235	10MW Inca Photovoltaic Facility near Sutherland, Northern Cape Province.	Approved

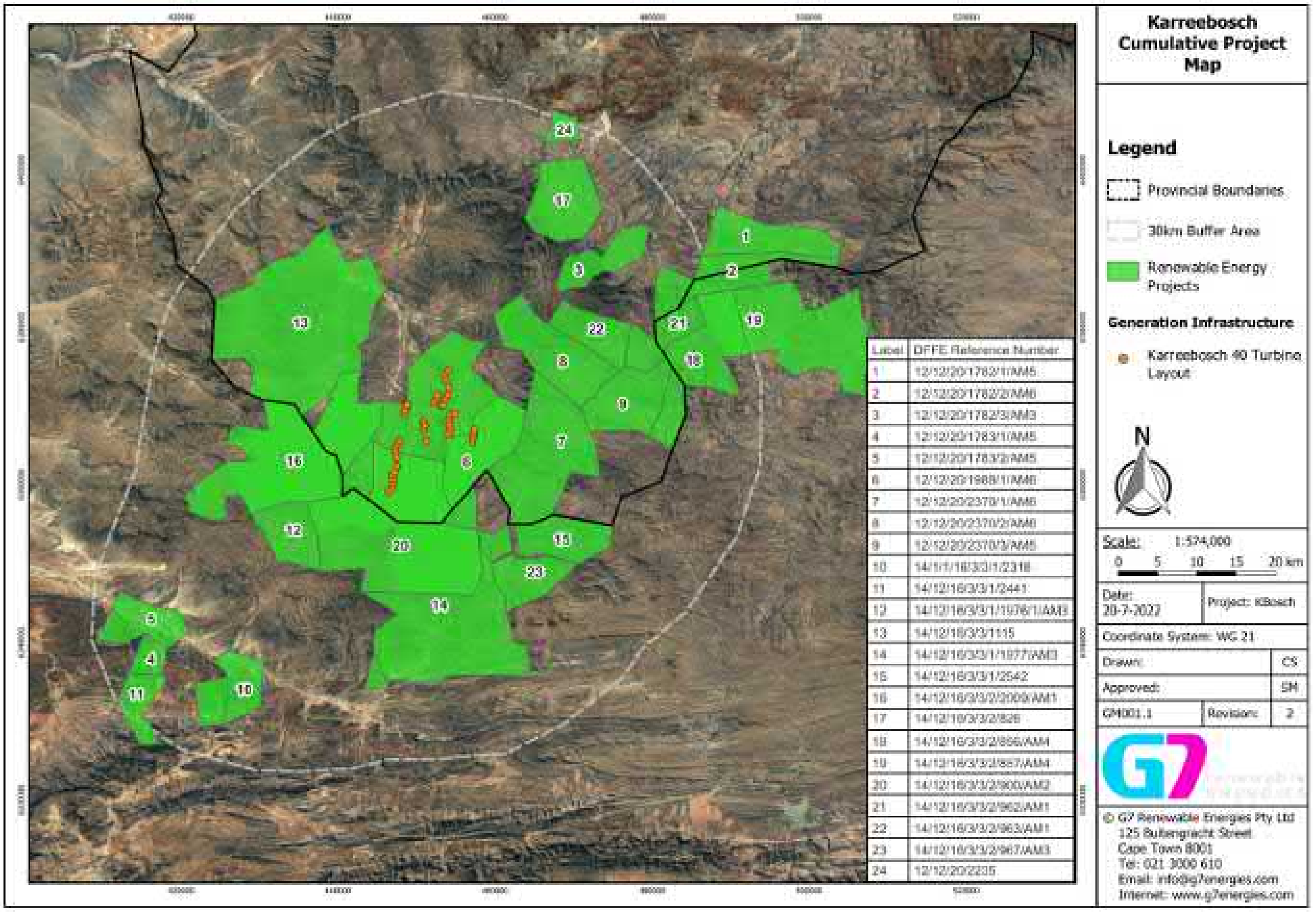

Figure 0-1: Renewable energy projects within a 30km radius of the Karreebosch WEF

KARREEBOSCH WIND ENERGY FACILITY
TRANSPORT MANAGEMENT PLAN

August 2022
REVISION 5

Prepared by:

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SYNOPSIS

Preparation of a Transport Management Plan for the proposed Karreebosch Wind Energy Facility located in the Northern Cape 40 km north of Matjiesfontein.

KEY WORDS:

Wind Energy Facility, Transport Management Plan

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		15/08/2022
Checked by:	Consultant	I Wink		15/08/2022
Authorised by:	Director	D Petersen		15/08/2022

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Report template version: 2017-10-30

KARREEBOSCH WIND ENERGY FACILITY
TRANSPORT MANAGEMENT PLAN

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1 INTRODUCTION

1.1 Background

WSP appointed JG Afrika PTY (Ltd) to provide a Transport Management Plan (TMP) for the Karreebosch Wind Energy Facility as part of the Part 2 Amendment, final layout and Environmental Management process (EMPr) approval process.

Karreebosch Wind Farm (Pty) Ltd (the Applicant) applied for Environmental Authorisation (EA) for the proposed Karreebosch WEF in 2015. The original Environmental Impact Assessment (EIA) was undertaken in September of 2015 for up to 71 wind turbines with a hub height of up to 100m and a rotor diameter of up to 140m including associated infrastructure. Environmental authorisation (EA) for 65 turbines was granted on 29 January 2016 (EA Ref: 14/12/16/3/3/2/807). The project underwent subsequent amendments (EA Ref: 14/12/16/3/3/2/807/AM1, 14/12/16/3/3/2/807/AM2, 14/12/16/3/3/2/807/AM3) which included increases in the hub height (up to 125m), rotor diameter (up to 160m), blade length (up to 80m), and minor amendments to the wording of certain conditions of the authorisation, as well as an extension of the validity of the EA to 2026.

The associated 132V overhead powerline (OHPL) and onsite 33/132kV substation are currently subject to a separate EA application process.

The authorised Karreebosch WEF and associated infrastructure is currently undergoing a Part 2 EA Amendment Process with the proposed amendments tabulated in **Table 1-1** below. Condition 16 of the original EA (EA Ref: 14/12/16/3/3/2/807) requires that the final development layout plan be made available for public comment and thereafter submitted to Department of Forestry, Fisheries and Environment (DFFE) for approval. Condition 18 of the original EA (Ref: 14/12/16/3/3/2/807) states that the Environmental Management Programme (EMPr) submitted as part of the Final EIA Report (2015) was not approved and must be amended to include the final layout which has undergone micro siting and walkdowns by relevant specialists, be made available for public comment and thereafter re-submitted to the DFFE for final approval. The final layout and EMPR approval process will run concurrently with the Part 2 EA Amendment process.

Table 1-1:Authorised infrastructure in terms of the Karreebosch WEF EA

COMPONENT	DESCRIPTION / DIMENSIONS
Number of turbines	Up to 65 turbines (generation capacity of up to 140MW)
Hub height	A range up to and including 125m
Blade length	~ 80m
Rotor Diameter	A range up to and including 160m
Area occupied by transformer stations / substation	» Two 33/132kV Substations 100m x 200m » Extension of the existing 400kV substation at Komsberg » Transformer at each turbine: total area <1500 m^2 (2 m^2 per turbine up to 10m^2 at some locations)
Capacity of onsite substation	132kV
Area occupied by construction camp	300 x 300m = 900 000m^2
Area occupied by laydown areas	Operation: (70 x 50) x 71 = 248 500 m2
Areas occupied by buildings	~10 000 m2
Length of (new) internal access roads	~40 km
Width of internal roads	Up to 12 m
Height of fencing	Up to 3m
Type of fencing	Steel or mesh

1.1.1 Project Area

The Karreebosch WEF is located approximately 40km north of Matjiesfontein, and approximately 40 km south of Sutherland. The site falls within the Karoo Hoogland Local Municipality of the Namakwa District Municipality within the Northern Cape Province as well as the Laingsburg Local Municipality of the Central Karoo District Municipality and the Witzenberg Local Municipality of the Cape Winelands District Municipality within the Western Cape Province.

The location of the proposed WEF is as shown in **Figure 1.1** below.

Figure 1-1:Locality Map

The Karreebosch WEF is currently authorised over seventeen (17) properties as described in the **Table 1-2** below. The properties highlighted in grey in the **Table 1-2** are relevant only to the proposed 132kV Karreebosch Overhead Powerline, which is subject to a separate application for Environmental Authorisation. These properties are therefore not affected by the proposed amended Karreebosch WEF final layout. Thus, only the properties relevant to the WEF infrastructure are included in this amendment application. The proposed final layout of the Karreebosch WEF is located over thirteen (13) properties as highlighted in the **Table 1-2** below.

Table 1-2: Farm portions authorised for the Karreebosch WEF (as per the original EA: 14/12/16/3/3/2/807).

	FARM NAME AND NUMBER	21 DIGIT SG CODE	MUNICIPALITY/PROVINCE
Properties affected by the Karreebosch WEF Final Layout	Farm Roode Wal No. 187	C04300000000018700000	Karoo Hoogland LM / Northern Cape
	Farm Appels Fontein No. 201	C04300000000020100000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Ek Kraal No. 199	C04300000000019900001	Karoo Hoogland LM / Northern Cape
	Portion 2 (Nuwe Kraal) of farm Ek Kraal No. 199	C04300000000019900002	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Klipbanks Fontein No. 198	C04300000000019800001	Karoo Hoogland LM / Northern Cape
	Remainder of farm Klipbanks Fontein No. 198	C04300000000019800000	Karoo Hoogland LM / Northern Cape
	Remainder of farm Wilgebosch Rivier No. 188	C04300000000018800000	Karoo Hoogland LM / Northern Cape
	Farm Rietfontein No. 197	C04300000000019700000	Karoo Hoogland LM / Northern Cape
	Remainder of farm Kareebosch No. 200	C04300000000020000000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Karreebosch No. 200	C04300000000020000001	Karoo Hoogland LM / Northern Cape
	Farm Oude Huis No. 195	C04300000000019500000	Karoo Hoogland LM / Northern Cape
	Portion 1 of farm Karree Kloof No. 196	C04300000000019600001	Karoo Hoogland LM / Northern Cape
	Remainder of farm Brandvalley No. 75[1]	C04300000000007500000	Laingsburg LM / Western Cape

[1] A portion of an existing access road that will require minor road strengthening falls on Brandvalley RE/75. This existing access road will only be used as a 4x4 access track and not as the main access route to the WEF. The full length of this access road was included in the original EIA and layout assessed in 2015. However, Brandvalley RE/75 was omitted from the original application and was therefore not included on the original Environmental Authorisation (14/12/16/3/3/2/807).

	FARM NAME AND NUMBER	21 DIGIT SG CODE	MUNICIPALITY/PROVINCE
Properties affected by the Karreebosch Overhead Powerline	The Farm Kranskraal 189[2]	C04300000000018900000	Karoo Hoogland LM / Northern Cape
	Portion 2 of Standvastigheid 210	C04300000000021000002	Karoo Hoogland LM / Northern Cape
	The Farm Aprils Kraal 105	C04300000000010500000	Laingsburg LM / Western Cape
	The Remainder of Bon Espirange 73	C04300000000007300000	Laingsburg LM / Western Cape
	Portion 1 of Bon Espirange 73	C04300000000007300001	Laingsburg LM / Western Cape

[2] No infrastructure associated with the Karreebosch WEF is located on Kranskraal 189 as indicated in the final layout. This property will therefore be removed from the EA.

1.1.2 Proposed amendments to the EA

Table 1-3 below outlines the amendments proposed to the existing EA. **Figure 1-2** shows the original authorised 65 turbine layout. **Figure 1-3** illustrates the proposed final 40-turbine layout subject to this Part EA amendment, final layout and EMPr approval process.

*Table 1-3:*Proposed amendments to the Karreebosch EA (DFFE Ref: 14/12/16/3/3/2/807/AM3)

ASPECT TO BE AMENDED	AUTHORISED	PROPOSED AMENDMENT
Number of Turbines	Up to 65 with a foundation of 25m in diameter and 4m in depth	Up to 40 turbines with a foundation of 30m in diameter and 5m in depth
Turbine generating capacity	Up to 5.5 MW	up to 7.5 MW in capacity each
Turbine Hub Height	A range up to and including 125m	All turbines up to 140m
Rotor Diameter	A range up to and including 160m	All turbines up to 170m
Blade length	~80m	~85m
Area occupied by transformer stations/ substation	• Two 33/132kV Substation 100m x 200m • Extension of the existing 400kV substation at Komsberg • Transformer art each turbine: total area <1500m² (2 m² per turbine up to 10m² at some locations)	• one 33/132kV substation 150m x 200m (3ha) • Extension of the existing 400kV substation at Komsberg • Transformer at each turbine: 6m x 3m= 720m² total area <0.4ha (up to 10mX10m at some locations)
Capacity of on-site substation	132kV	33/132kV
Areas occupied by construction camp	300 x 300m = 90 000m²	Areas occupied by construction camp and laydown areas up to 14ha
Area occupied by laydown areas	Operation: (70 x 50) x 71 =248 500m²	crane pads and turbine footprints to be an additional 41ha

ASPECT TO BE AMENDED	AUTHORISED	PROPOSED AMENDMENT
Areas occupied by buildings	~10 000m²	~10 000m² and will be located within the construction camp for use during the operational phase
Length of (new) internal access roads	~40 km	~77 km of new internal access roads and up to ~14 km of 4x4 access tracks. ~30km of existing access roads which are 4m wide will be widened by up to 9m.
Width of internal roads	Up to 12m	Internal Access roads up to 12m wide (turns will have a radius of up to 55m) with additional yet associated servitudes/ reserve for above/underground cabling installation and maintenance where needed. 200m wide road corridor along the internal access roads for micro-siting during construction. Internal 4x4 tracks associated with the 33kV and 132kV OHPLs will be up to 4m wide and substation access roads of up to 9m.
Height of fencing	Up to 3m	Up to 4m

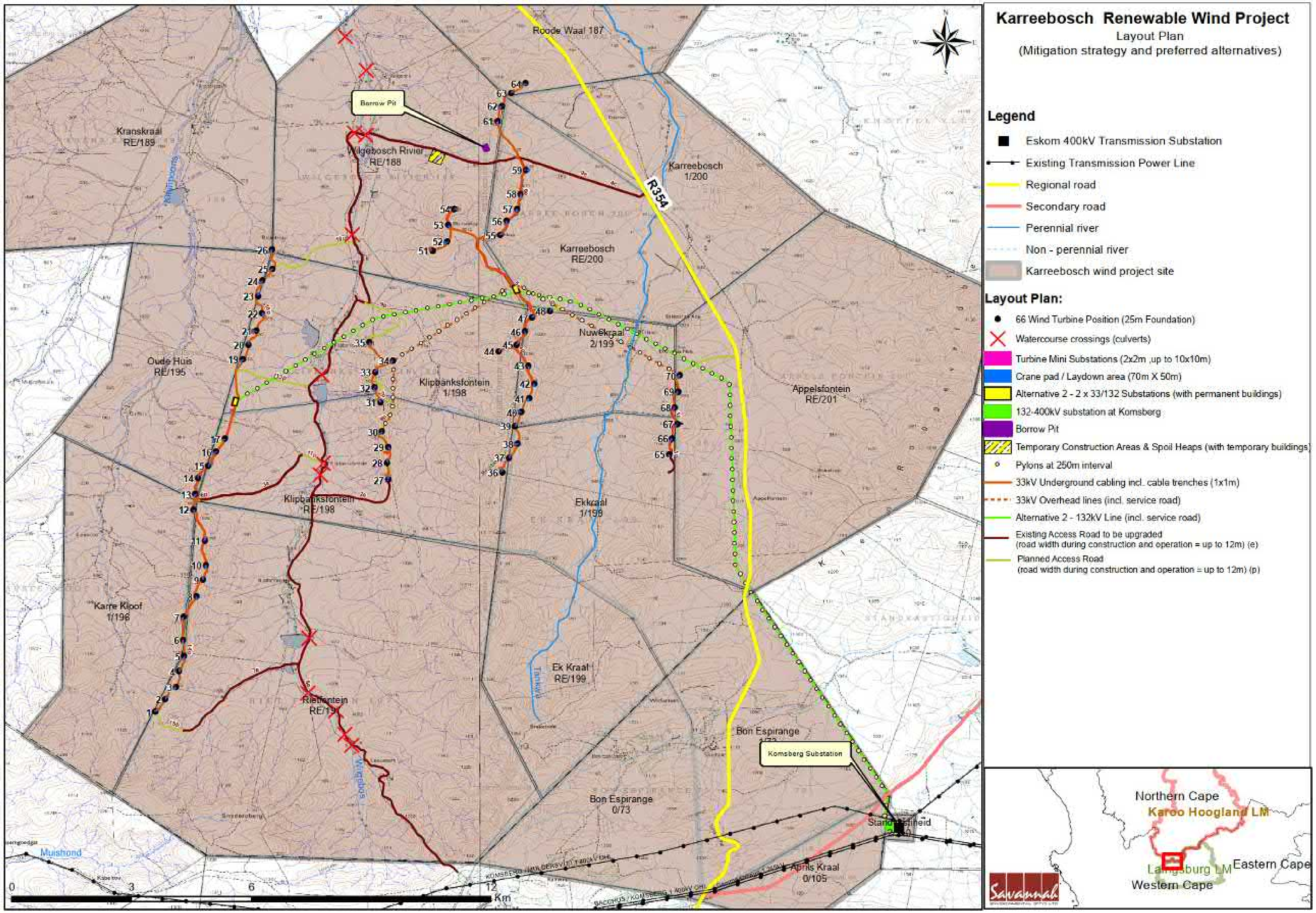


Figure 1-2:Karreebosch WEF and associated infrastructure authorised as per the January 2016 EA (Ref: 14/12/16/3/3/2/807) (source: Savannah Environmental, 2015).

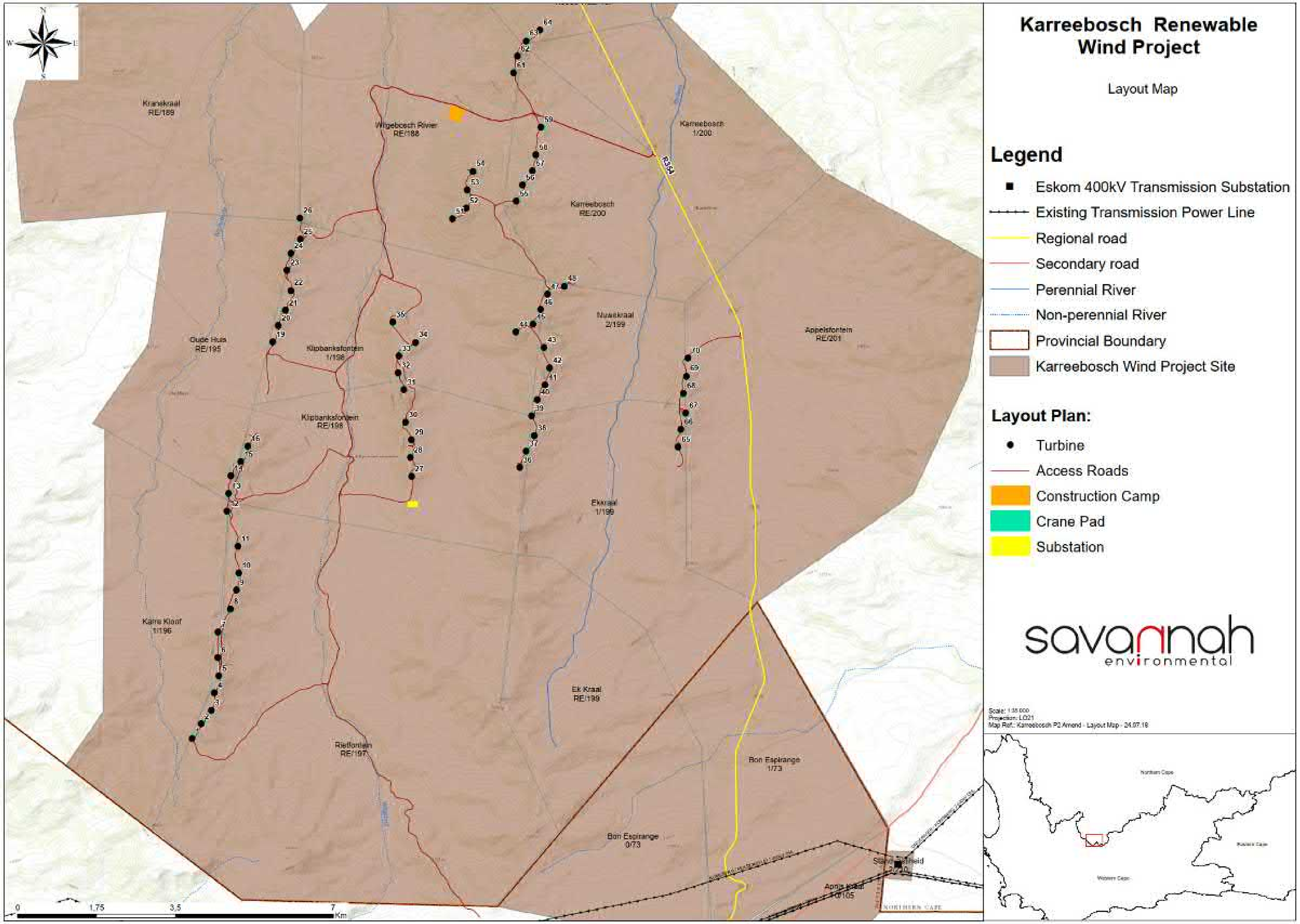


Figure 1-3:Karreebosch WEF and associated infrastructure authorised as per the November 2018 Part 2 EA Amendment (Ref: 14/12/16/3/3/2/807/AM2) (source: Savannah Environmental, 2018).

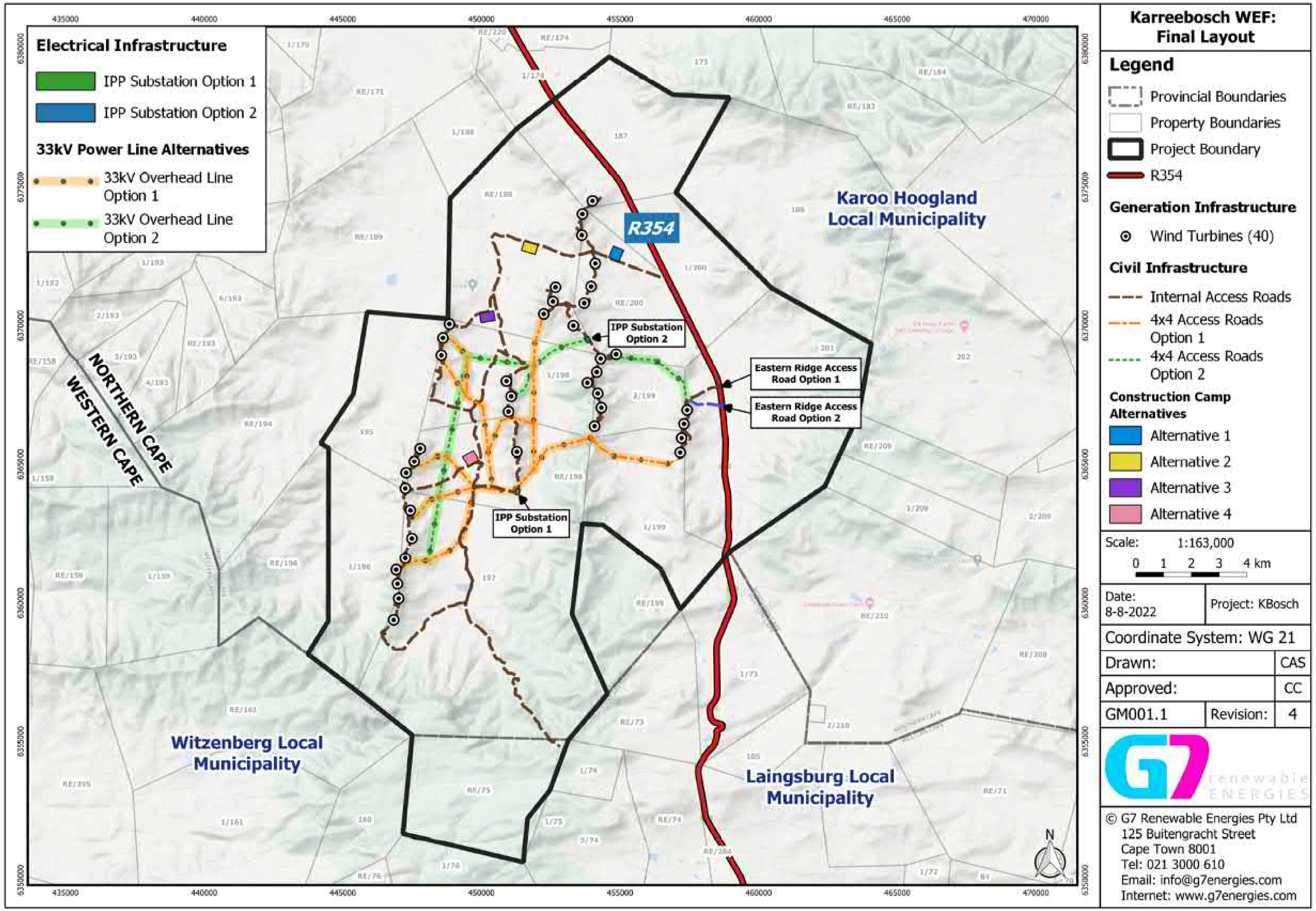


Figure 1-4:Proposed Final layout of the Karreebosch WEF and associated infrastructure (source: G7, 2022).

1.1.3 Surrounding area

The South African government gazetted[3] eight (8) areas earmarked for renewable energy development in South Africa. These areas are known as Renewable Energy Development Zones (REDZ) and this project falls within the Komsberg REDZ**.** The purpose of the REDZ is to cluster development of renewable energy facilities in order to streamline the grid expansion for South Africa, i.e., connect zones to one another as opposed to a wide scatter of projects. Therefore, a number of renewable energy developments within the surrounding area which have submitted applications for environmental authorisation (some of which have been approved). It is important to note that the existence of an approved EA does not directly equate to actual development of the project.

The surrounding projects that have not already been awarded Preferred Bidder (PB) status under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) Bid window 5 or the Risk Mitigation IPP procurement programme (RMIPPPP), are still subject to the REIPPPP bidding process or subject to securing an off taker of electricity through an alternative process. Some of the surrounding proposed WEFs secured EAs several years ago but have not obtained PB status (or a private off taker agreement) and as such have not been developed.

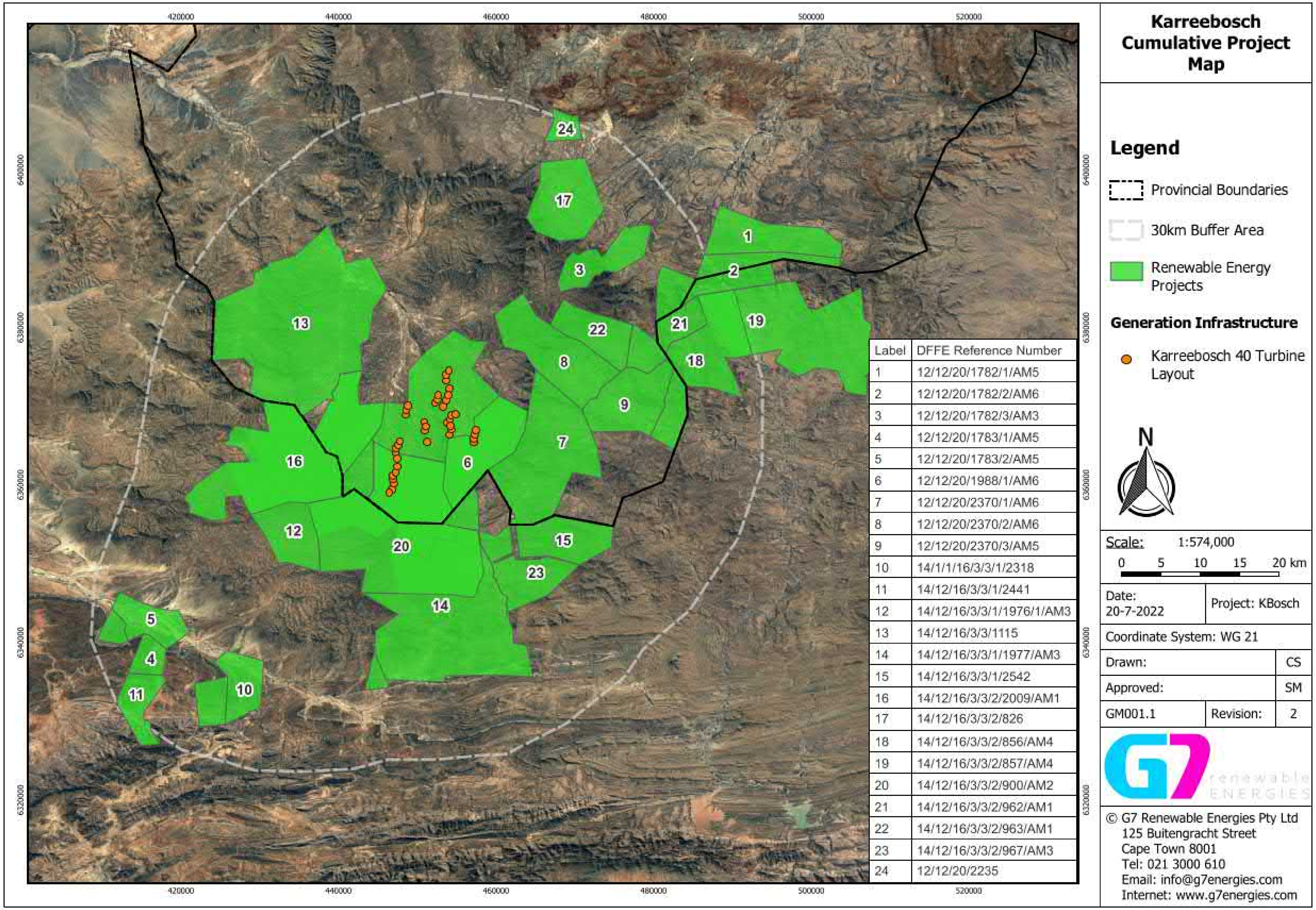
These existing surrounding projects of varying approval status have been detailed in the table and figure below. Given the site's location within the Komsberg REDZ, it is considered to be located within the renewable energy hub that is developing in this focus area.

Table 1-4:Existing surrounding projects

LABEL	DFFE Reference	Project Title	STATUS
1	12/12/20/1782/1/AM5	140MW Rietrug Wind Energy Facility near Sutherland, Northern Cape Province.	Preferred Bidder Round 5
2	12/12/20/1782/2/AM6	140MW Sutherland 1 Wind Energy Facility near Sutherland, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 5
3	12/12/20/1782/3/AM3	140 MW Sutherland 2 Wind Energy Facility near Sutherland, Northern Cape Provinces.	Preferred Bidder Round 5
4	12/12/20/1783/1/AM5	150MW Perdekraal Site 1 Wind Energy Facility, Western Cape Province.	Approved
5	12/12/20/1783/2/AM5	147MW Perdekraal Site 2 Wind Energy Facility, Western Cape Province.	Preferred Bidder Round 4, Operational
6	12/12/20/1988/1/AM6	140MW Roggeveld Phase 1 Wind Farm, North of Matjiesfontein, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 4, Operational
7	12/12/20/2370/1/AM6	140 MW Karusa Wind Energy Facility, Phase 1, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
8	12/12/20/2370/2/AM6	140MW Soetwater Wind Farm Phase 2, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational

[3] Government Notice 114 of 16 February 2018.

LABEL	DFFE Reference	Project Title	STATUS
9	12/12/20/2370/3/AM5	140MW Great Karoo Wind Energy Facility Phase 3, Karoo Hoogland Municipality, Northern Cape Province.	Approved
10	14/1/1/16/3/3/1/2318	310MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
11	14/12/16/3/3/1/2441	360MW Pienaarspoort Wind Energy Facility Phase 2, Witzenberg local Municipality, Western Cape Province.	Approved
12	14/12/16/3/3/1/1976/1/AM 3	226MW Kudusberg Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces.	Approved
13	14/12/16/3/3/1115	325WM Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces	Approved
14	14/12/16/3/3/1/1977/AM3	183MW Rietkloof Wind Energy Facility near Matjiesfontein in the Western Cape Province.	Preferred Bidder Round 5
15	14/12/16/3/3/1/2542	200 MW Esizayo Wind Energy Facility Expansion near Laingsburg, Western Cape.	In Process
16	14/12/16/3/3/2/2009/AM1	Oya Energy Facility	Preferred Bidder Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP)
17	14/12/16/3/3/2/826	140MW Gunsfontein Wind Energy Facility Karoo Hoogland Municipality, Northern Cape Province.	Approved
18	14/12/16/3/3/2/856 /AM4	275MW Komsberg West near Laingsburg, Western Cape Provinces	Approved
19	14/12/16/3/3/2/857/AM4	275 Komsberg East near Laingsburg, Western Cape Provinces.	Approved
20	14/12/16/3/3/2/900/AM2	140MW Brandvalley Wind Energy Facility, WITHIN THE Laingsburg and Witzenberg Local Municipalities in the Western and Northern Cape Province.	Preferred Bidder Round 5
21	14/12/16/3/3/2/962/AM1	140MW Maralla East Wind Energy Facility, Namakwa, and Central Karoo District Municipalities, Western and Northern Cape Provinces.	Approved
22	14/12/16/3/3/2/963/AM1	140Maralla West Wind Energy Facility, Karoo Hoogland local Municipality, Northern Cape Province.	Approved
23	14/12/16/3/3/2/967/AM3	140MW Esizayo Wind Farm, Laingsburg Local Municipality Western Cape Province.	Approved
24	12/12/20/2235	10MW Inca Photovoltaic Facility near Sutherland, Northern Cape Province.	Approved



Label	DFFE Reference Number
1	12/12/20/1782/1/AM5
2	12/12/20/1782/2/AM6
3	12/12/20/1782/3/AM3
4	12/12/20/1783/1/AM5
5	12/12/20/1783/2/AM5
6	12/12/20/1988/1/AM6
7	12/12/20/2370/1/AM6
8	12/12/20/2370/2/AM6
9	12/12/20/2370/3/AM5
10	14/1/1/16/3/3/1/2318
11	14/12/16/3/3/1/2441
12	14/12/16/3/3/1/1976/1/AM3
13	14/12/16/3/3/1115
14	14/12/16/3/3/1/1977/AM3
15	14/12/16/3/3/1/2542
16	14/12/16/3/3/2/2009/AM1
17	14/12/16/3/3/2/826
18	14/12/16/3/3/2/856/AM4
19	14/12/16/3/3/2/857/AM4
20	14/12/16/3/3/2/900/AM2
21	14/12/16/3/3/2/962/AM1
22	14/12/16/3/3/2/963/AM1
23	14/12/16/3/3/2/967/AM3
24	12/12/20/2235

Figure 1-5:Renewable energy projects (by approval status) within a 30km radius of the Karreebosch WEF

2 PURPOSE OF THE TRAFFIC MANAGEMENT PLAN

A Traffic Management Plan is required to ensure that the trips generated by the construction and operational activities associated with the proposed facility are mitigated as far as possible to:

- reduce the traffic impact on the surrounding road network.
- reduce potential conflicts that may results from the development traffic and the general traffic/public; and
- to identify potential routes for vehicles travelling to the site, particularly heavy and abnormal load vehicles.

This Traffic Management Plan has been prepared to enable the identification and implementation of all legal and best practice requirements in respect of the management of traffic associated with the construction and operation of the facility.

3 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply:

- This TMP is based on the project information provided by the Client.
- Maximum vertical height clearances along the haulage route are at least 5.2m to be able to accommodate abnormal loads.
- The imported elements will be transported from the most feasible port of entry, which is deemed to be the Port of Saldanha.
- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- Material for the construction will be sourced locally as far as possible.

4 SOURCE OF INFORMATION

Information used in a transport study includes:

- Project information provided by the Client
- Google Earth. kmz provided by the Client
- Google Earth Satellite Imagery
- Chief surveyor general website
- TRH11, Dimensional and mass limitations and other requirements for abnormal loads, August 2009
- 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”, 2000
- National Road Traffic Act, Act 93 of 1996
- National Department of Transport (NDoT), Manual for Traffic Impact Studies, October 2005
- Department of Transport (DoT), Geometric Design of Rural Roads, 1988
- SANS 10280/NRS 041-1:2008 Overhead Power Lines for Conditions Prevailing in South Africa
- Manual for Traffic Impact Studies, Department of Transport, 1995
- TRH26 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

5 SITE DESCRIPTION

5.1 General

It is proposed to develop the Karreebosch 140 MW WEF in the Northern Cape approximately 40km north of Matjiesfontein. The proposed site will accommodate the following infrastructure:

- 40 wind turbines with an individual energy generation capacity of up to 7.5MW each. The maximum wind turbine rotor diameter is proposed to be 170m with a hub height of 140m.
- Concrete foundations approximately 30m in diameter and 5m deep per turbine,
- Transformer for each turbine,
- Laydown and storage areas,
- Construction camp and onsite batching plant,
- Access road corridor,
- Internal road network up to 12m in width,
- Buildings,
- Overhead powerlines and underground cabling,
- One 33/132 KV onsite substations, and
- Fencing.

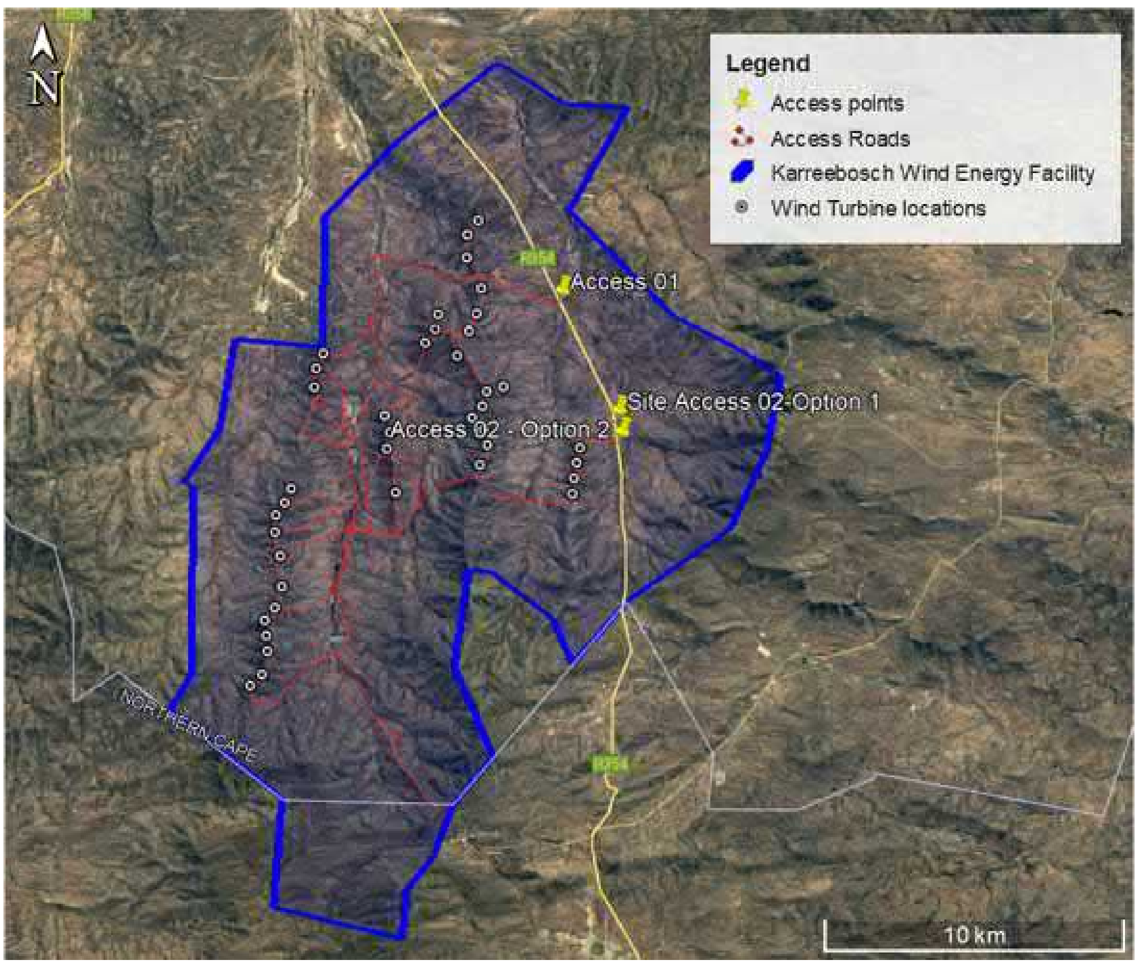


Figure 5-1:The Proposed Site

6 TRANSPORTATION ROUTES

Components will be transported to site using appropriate National and Provincial routes. It is expected that the turbine blades, nacelle, and turbine hub will be transported by abnormal loads. Material delivery and site personnel travel will generally be conducted via normal load traffic. Lifting equipment and counter weighs are required to off-load and assemble the components.

The transportation of abnormal load equipment and components require abnormal load permits as the dimension exceed the permissible maximum dimensions on road freight transport in terms of the Road Traffic Act (Act No. 93 of 1996).

6.1 Site access points

The proposed Karreebosch WEF facility site can be accessed from two site access points off the R354 located at the site's eastern end. The R354 is a Class 2 minor arterial route running in a north-south-direction from Matjiesfontein to the R356 in the Northern Cape. The road is a surfaced single carriageway with one lane per direction.

The main access (Access 01) is located off an existing access road; therefore, access spacing restrictions are not envisaged.

An additional access point (access 02) is proposed south of the main access (access 01) to access the eastern turbine ridge. Two options are considered for access 02 (option 1 approximately 850m south of an existing farm gate and option 2 located approximately 1.5km south of the same farm gate).

Based on TRH 26, the minimum access spacing recommended along a class 2 road is 5km. This distance may, however, not be feasible due to site boundaries and land terrain limitations. It is therefore noted that TRH17 recommends a minimum spacing of 500m between successive intersections. An access spacing of 500m is recommended for consideration by the approving authority as a more practical access spacing for consideration in a site of this nature.

Access 01 and Access 02-option 2 are located off a straight horizontal curve with relatively flat terrain; therefore, sight line restrictions are not envisaged (i.e., sight lines are expected to meet the 300m minimum sight distance for a 100km/h posted speed). Access 02- Option 1 is located on a horizontal curve with an embankment to the north. Due to the horizontal alignment and roadside terrain of the road section, sight line limitations are envisaged at Access 02-Option 1. Access 02-Option 2 is therefore a more favourable position to meet sight line requirements.

It is also recommended that appropriate signage is accommodated to warn road users of the access points and that the road reserve be maintained to prevent obstructions to sight lines.

It should be noted that road upgrades may be required along existing access roads to accommodate expected vehicles.

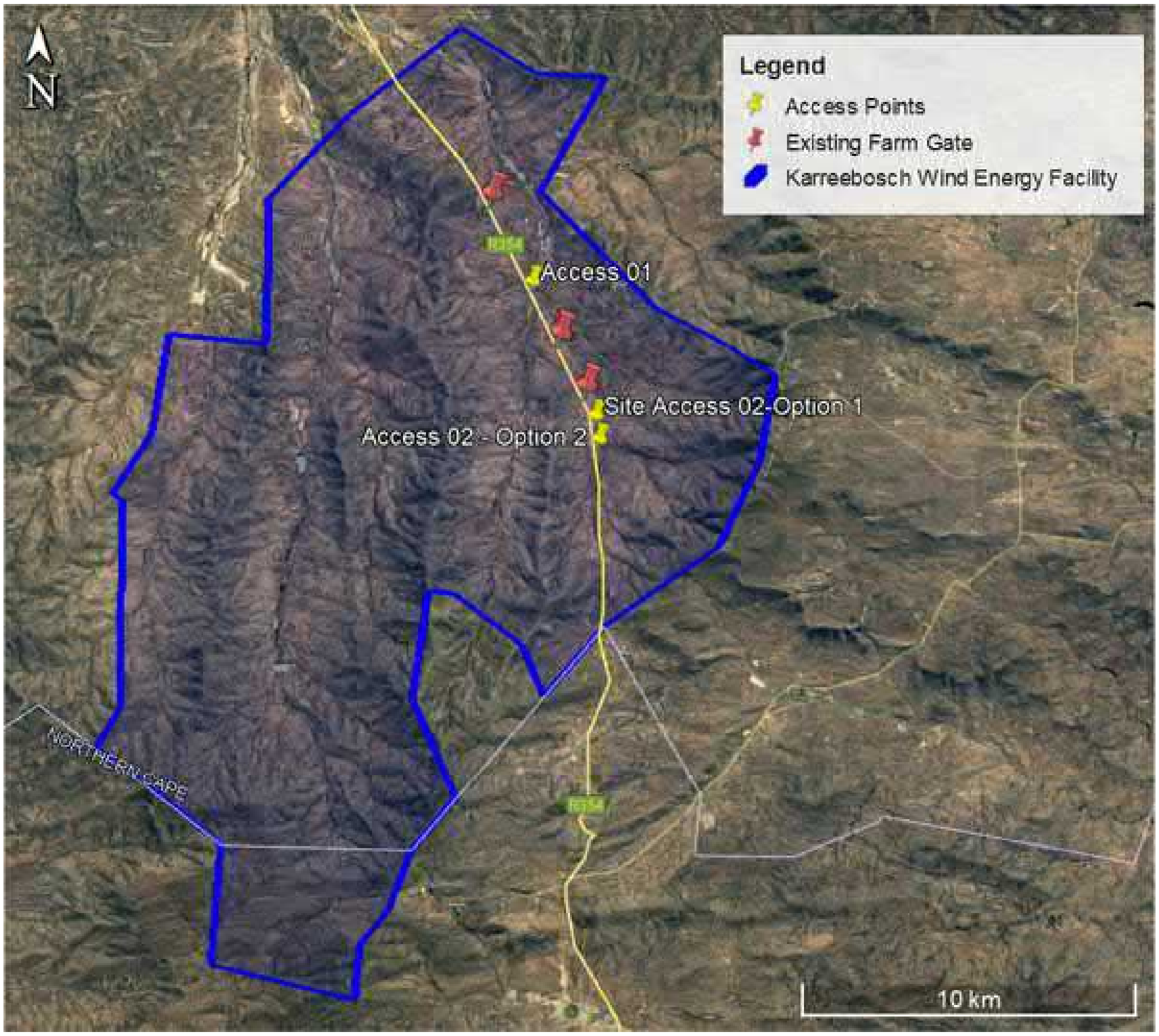


Figure 6-1:The Proposed Site Access Points

It is recommended that the following aspects be considered for the detailed design of the site access points:

- Staggered intersections should be avoided where possible.
- 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 to the facility be access controlled. It is also recommended that security staff be stationed on site at the access during construction.
- A minimum stacking distance of 25m is recommended between the road edge of the external road and the access control.
- All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM).

6.2 Port of entry

It is assumed that the blades and nacelle components will be imported to South Africa via the Port of Saldanha. The Port of Saldanha is South Africa's largest natural anchorage and port with the deepest water. It is located 60 nautical miles northwest of Cape Town (Longitude 17^0 58' E and Latitude 33^0 02' S) and is operated by Transnet National Ports Authority.

Depending on the type of turbine and tower, the tower sections can either be imported, or alternatively be manufactured locally. There are several types of towers available on the market, i.e., concrete, steel, or hybrid concrete-steel towers. Within South Africa, steel towers can be sourced from the Cape Town area, Atlantis or Port Elizabeth, and concrete towers can be manufactured on or near the site.

6.2.1 Main route for the transportation of the wind turbine components

Based on experience with similar projects as well as input from the previous transport investigation, the possible ports of entry include Port of Saldanha (approximately 360 km from the site), and the Port of Ngqura (approximately 634 km from the site).

The following aspects were considered about the above routes:

1. Port of Saldanha (approximately 360 km from the site):
   This is the shortest route. The route comprises of high order routes surrounded by rural developments and farm properties and passes through Ceres and Moorreesburg. The density of these two towns is lower than the Cape Town area of route option 2.

2. Port of Ngqura (approximately 634km from the site):
   This route has the longest distance to the site. It comprises of majority high order routes. It passes through some small towns with low densities. Not much congestion is expected.

Figure 6-2:Route from the Port of Ngqura to the site

6.2.2 Preferred port of entry

The preferred port of entry to the site is the Port of Saldanha. This route maximises the use of higher order routes, which are designed to handle / accommodate larger vehicles and minimise travelling through towns as far as possible. This was deemed important to minimise congestion and avoid disruptions to communities in these towns.

The delivery company is advised to conduct a dry run of the route to determine the practical suitability of the route for abnormal load travel.

Figure 6-3:Preferred Route from the Port of Saldanha to the site

6.3 Main Route for the Transportation of Materials, Plant and People to the proposed site

It is envisaged that the workforce will most likely reside in Sutherland, Matjiesfontein, Touws River or Laingsburg as the closest communities. These towns connect to the site via the N1 and the R354.Due to a lack of public transport near the site it is recommended that the majority of construction personnel be transported to and from the site by means of busses or minibus taxis. This will reduce the number of trips bound for the site.

Building materials will most likely be sourced from Worcester approximately 180km form the site or alternatively from Cape Town approximately 300 km from the site. A significant reduction in heavy vehicle trips can be achieved by using mobile batch plants. In addition to this, temporary construction material stockpile yards could be commissioned on vacant land near the proposed site. Delivery of materials to the mobile batch plant and the stockpile yard could be staggered to minimise traffic disruptions.

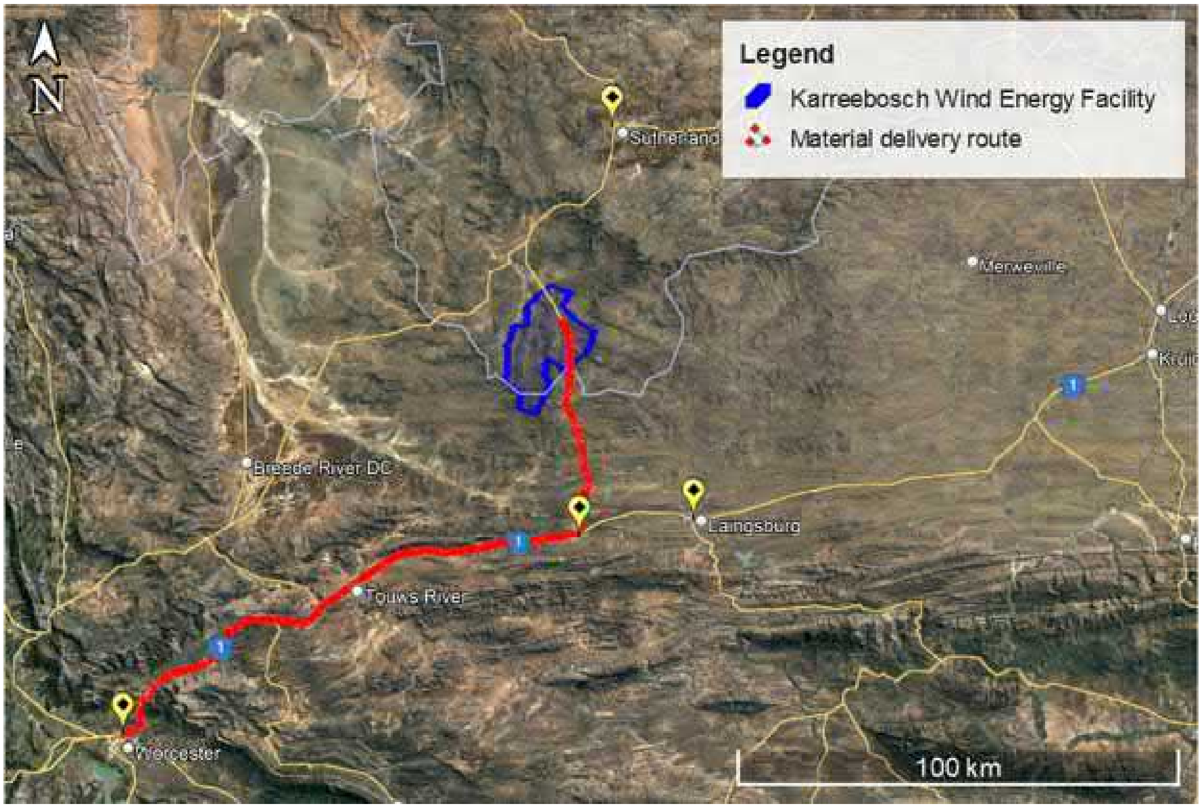


Figure 6-4: Envisaged route for material delivery

7 TRAFFIC MANAGEMENT PLAN

This Traffic Management Plan (TMP)has been prepared in respect of the planning phase of the proposed facility. The Traffic Management Plan should be updated prior to the commencement of the construction phase, when detailed information regarding the delivery of components, and construction activities are available. A designated personnel member of the Contractor's team should be the custodian of the plan and the custodian should ensure that all personnel and subcontractors are trained to ensure compliance. The requirements of the Traffic Management Plan shall apply to all construction personnel and subcontractors appointed to provide vehicles, machinery, or drivers. The Plan needs to be reviewed every four months or immediately after an incident, when corrective measures will be incorporated into the Plan.

Prior to the commencement of the operational phase, the plan should be updated to include the operational traffic requirements. A copy should be kept at the facility. A designated employee should ensure that the plan is enforced and will make sure that the Plan is available to all relevant personnel and external maintenance/repair teams. The Plan will be reviewed every annually or immediately after an incident, when corrective measures will be incorporated into the Plan.

7.1 Preliminary Transport Requirements

It is expected that the highest trip generator will be the construction and decommissioning phase. Abnormal load trips are limited to turbine blades, nacelle, turbine hub and lifting equipment. Staggered delivery and transporting components outside of the peak traffic periods as much as possible will assist in mitigating the impact on the surrounding road network (peak traffic periods for rural areas are assumed to be 6:30am – 8am and 4pm-6pm).

Construction traffic will include vehicles for deliveries, removal of materials and construction staff. Construction activities such as delivery of material or removal of soil can also be staggered or transported in off-peak hours. Based on a 24-30 month estimated construction period, an estimated 4 peak hour material delivery trips, 18 peak hour site personnel trips, and 12 abnormal load trips per turbine are expected to be generated by the site.

Traffic during the operational phase will be low as trips will only be for occasional maintenance requirements and staff trips (i.e., 20 employees per day).

The construction phase and decommissioning phase are expected to generate similar trips.

Proposed mitigation measures

- The delivery of components and construction materials to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods as much as possible.
- The use of batch plants (if required) and quarries near the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods as far as possible.
- During construction Staff shuttle transport can be made available.

7.2 Transport Coordinator

It is recommended that a transport coordinator (or similar designation) be appointed to ensure compliance of the TMP. The coordinator shall make all the necessary arrangements to maintain the required traffic measures for the duration of the construction period.

7.3 Stakeholder Engagement

Interested and affected parties (e.g., local community, the local authorities, law enforcement and affected landowners) should be informed of all transport activities taking place that may affect them or require approval.

Stakeholder engagement should address and provide information to stakeholders regarding general construction activities, construction vehicles routes, projected timelines, procedures for complaints and emergency procedures.

7.4 Licensing

All construction vehicles shall have the necessary licences, a valid roadworthy certificate and shall comply with the relevant traffic and transport licencing requirements (such as abnormal loads or hazardous materials).

All drivers of vehicles shall have the requisite licences to operate any vehicle (or machinery) operated by them on site or on any public roads. A professional driving permit (PrDP) is required if any of the following vehicles are operated:

- Goods vehicles, (more than 3 500 kg).
- Breakdown vehicles.
- Buses (any bus).
- Minibus taxis (more than 3 500 kg), transporting 12 or more people, including the driver.
- Vehicles used to transport people for payment.
- Goods vehicle carrying dangerous goods (more than 3 500 kg).
- Road tank vehicles for petroleum-based flammable liquids.
- Motor vehicles transporting 12 or more people, including the driver.

7.5 Construction Staff

All staff shall be transported safely to site in appropriate vehicles. Staff shall not be allowed to be transported to site on the back of open trucks. Passenger vehicles shall not exceed the carrying capacity of the vehicle.
Collections/Drop-off points for staff shall be located at a safe distance from traffic and construction activities. Roads and areas used by construction vehicles shall, as far as possible be avoided by all personnel. Designated pedestrian pathways shall be demarcated where appropriate.

All staff shall receive the appropriate site safety induction training. Drivers shall be adequately trained in the identification and avoidance of road hazards, vehicle maintenance and care and safety requirements. All staff shall be informed of the construction site risks and training shall include appropriate precautionary measures required to be undertaken to facilitate safe and efficient traffic management (e.g., understanding signage, crossing roadways, and utilising designated pedestrian pathways, reporting incidents).

7.6 Inspection of all Routes

A dry run of all routes is to be undertaken to identify any areas to avoid or obstacles that might disrupt the movement of the construction vehicles. All issues affecting the movement of construction vehicles are to be addressed immediately by the Contractor and relevant stakeholders e.g., law enforcement, relevant roads department and authorities.

7.7 Maintenance of vehicles

All vehicles and construction plant shall be regularly maintained, repaired when necessary and inspected on a regular basis to ensure that the vehicles are in good working order. Construction and passenger vehicles shall be monitored to ensure that vehicles are not overloaded.

7.8 Maintenance of roads

The Contractor shall maintain the road used by construction vehicles, repairing any damage caused by construction traffic to the surrounding road network. Where gravel roads are used, the roads shall be maintained, and dust control measures shall be implemented to avoid dust pollution.

Road verges at the site shall be regularly maintained to ensure that vegetation remains short and that the roads serve as an effective firebreak.

7.9 Signage

Signage, in accordance with the South African Road Traffic Signs Manual, will be required to be noticeably placed at appropriate locations along all access roads, the internal roads to the site and public roads used by construction vehicles (in consultation with the relevant traffic authorities) to indicate the following:

- all road and pedestrian hazards;
- site access;
- site offices;
- wayfinding signs on internal roads e.g., parking, toilets, emergency assembly point;
- crossing points;
- speed limits;
- turning traffic;
- dedicated routes for construction vehicles and staff;
- no-go areas; and
- any traffic control information which may be relevant to the construction activity at the time.

It is recommended that flagmen be implement when high volumes of construction traffic are expected to help direct the traffic, thus ensuring the safe movement of the vehicles and reducing the potential conflicts.

7.10 Speed limit

All drivers operating vehicles shall comply with the posted speed limits (or the maximum allowable speed as per the permit for abnormal load vehicles) on public roads as well as a proposed 40km/h speed limit within the construction site and access roads.

The failure to adhere to the prescribed speed limits is an offence and disciplinary action may be taken by the Contractor.

7.11 Abnormal Loads

Abnormal loads will be transported to site as per the following:

7.11.1 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):

- Length: 22m for an interlink, 18.5m for truck and trailer and 13.5m for a single unit truck
- Width: 2.6m

- Height: 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 front axle and 9t on 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.

7.11.2 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.

7.11.3 Permitting – General Rules

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.

7.11.4 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.

7.11.5 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
- Stability of Loaded Vehicles

7.11.6 Preferred Abnormal load route

The preferred route 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. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that the delivery will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the Contractor, who will modify the road and intersections to accommodate abnormal vehicles.

It needs to be ensured that gravel sections (if any) of the haulage routes remain in good condition. Typically, any public road maintenance conditions are outlined as a condition of development approval. Routes to be maintained are maintained during the additional loading of the construction phase and reinstated after construction is completed.

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.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 General

It is proposed to develop a 140 MW wind energy facility (WEF) located approximately 40 km north of Matjiesfontein. The 140MW WEF is proposed to accommodate 40 turbines.

8.2 Components

In general, each turbine unit consists of a tower, a nacelle (final weight dependent on the supplier and whether the nacelle has gears or not), and rotor blades. It is assumed that all turbine parts will be imported and shipped via the Port of Sadhana.

8.3 Traffic Management Plan

- This TMP has been prepared to enable the identification and implementation of legal and best practice requirements in respect of the management of traffic associated with the construction and operation of the facility.
- The Traffic Management Plan has been prepared in respect of the planning phase of the proposed facility. The Traffic Management Plan should be updated prior to the commencement of the construction phase and the operational phase.
- The potential transport impacts imposed by the construction traffic are temporary, short term in nature, and can be mitigated to an acceptable level.

  Mitigation measures include:

  - ✓ The delivery of components and construction materials to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods as much as possible.
  - ✓ using a mobile batch plant as well as temporary construction material stockpile yards near or on the proposed site.
  - ✓ Transporting site personnel to and from the site by means of busses or minibus taxis. This will reduce the number of trips bound for the site.

- The operation and maintenance phase include the operation and maintenance of the WEF. The envisaged site traffic would be limited to a few light vehicles, transporting approximately 20 employees per day.

  The maintenance or replacement of wind turbine components would require a crane and abnormal vehicles. To minimise traffic congestion, the maintenance or replacement of components can be staggered. Traffic disruptions can be minimised by transporting the components during off-peak hours. This phase is therefore expected to generate minimal traffic.
- For abnormal load vehicles, it is recommended to undertake a “dry-run” with the largest abnormal load vehicle, to ensure that the vehicle can access the site.

8.4 Access Road

- Two access points connecting with the R354 provide access to the project site.
- Additional access roads or tracks may be required to provide access to sections of the powerline route.
- The main access (access 01) is located off an existing access point thus access spacing restrictions are not envisaged.
- An additional access point (access 02) is proposed south of the main access (access 01) to access the eastern turbine ridge. Two options are considered for access 02 (option 1 approximately 850m south of an existing farm gate and option 2 located approximately 1.5km south of the existing farm gate)

  It is therefore noted that a 5km access spacing may not be feasible due to site boundaries and constraints imposed by land terrain. It is recommended that the approving authority consider a minimum 500m access spacing for the site in line with TRH17 access spacing recommendations between successive intersections. This is deemed viable due to the nature of the site (i.e., low operational traffic volumes) and the surrounding site environment (i.e., rural environment with low development densities).
- Access 01 and Access 02-option 2 are located off a straight horizontal curve with relatively flat terrain; therefore, sight line restrictions are not envisaged (i.e., sight lines are expected to meet the 300m minimum sight distance for a 100km/h posted speed). Access 02- Option 1 is located on a horizontal curve with an embankment to the north. Due to the horizontal alignment and roadside terrain of the road section, sight line limitations are envisaged at Access 02-Option 1. Access 02-Option 2 is therefore a more favourable access position to meet sight line requirements.
- It is recommended that appropriate signage is accommodated to warn road users of the access points and that the road reserve be maintained to prevent obstructions to sight lines.
- It needs to be noted that all access and internal roads should be investigated for their topographical suitability, i.e., feasibility for plant and truck access and height clearance for any Eskom lines, Telkom lines or similar.
- Staggered intersections should be avoided where possible.
- 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 to the facility be access controlled. It is also recommended that security staff be stationed on site at the access during construction.
- A minimum stacking distance of 25m is recommended between the road edge of the external road and the access control.
- All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM).

8.5 Haulage routes for wind turbine components

- The proposed haulage route is outlined in Section 6. The Port of Saldanha haulage route was chosen as the preferred route because it provides the shortest route to the wind farm site, utilises higher order routes as far as possible and minimises travelling through towns.
- It is recommended that the respective haulage company conducts a dry run to determine the restrictions relevant to the haulage vehicle to be utilised. With some route's road signs may need to be moved, overhead cables may need to be raised and bellmouths may need temporary widening to accommodate abnormal loads. A dry run will help establish relevant changes specific to the abnormal load truck used to deliver the components and materials.

8.6 Preferred Route for Materials, Plant and Labour

- It is envisaged that the majority of materials, will be sourced from Worcester approximately 180km form the site or alternatively from Cape Town approximately 300 km from the site. The route utilises the N1 and R354 to access the site.
- It is envisaged that the workforce will most likely reside in Sutherland, Matjiesfontein, Touws River or Laingsburg as the closest communities. The travel routes form these towns to the site include the N1 and the R354. These are higher order routes as such geometric limitations are not envisaged.