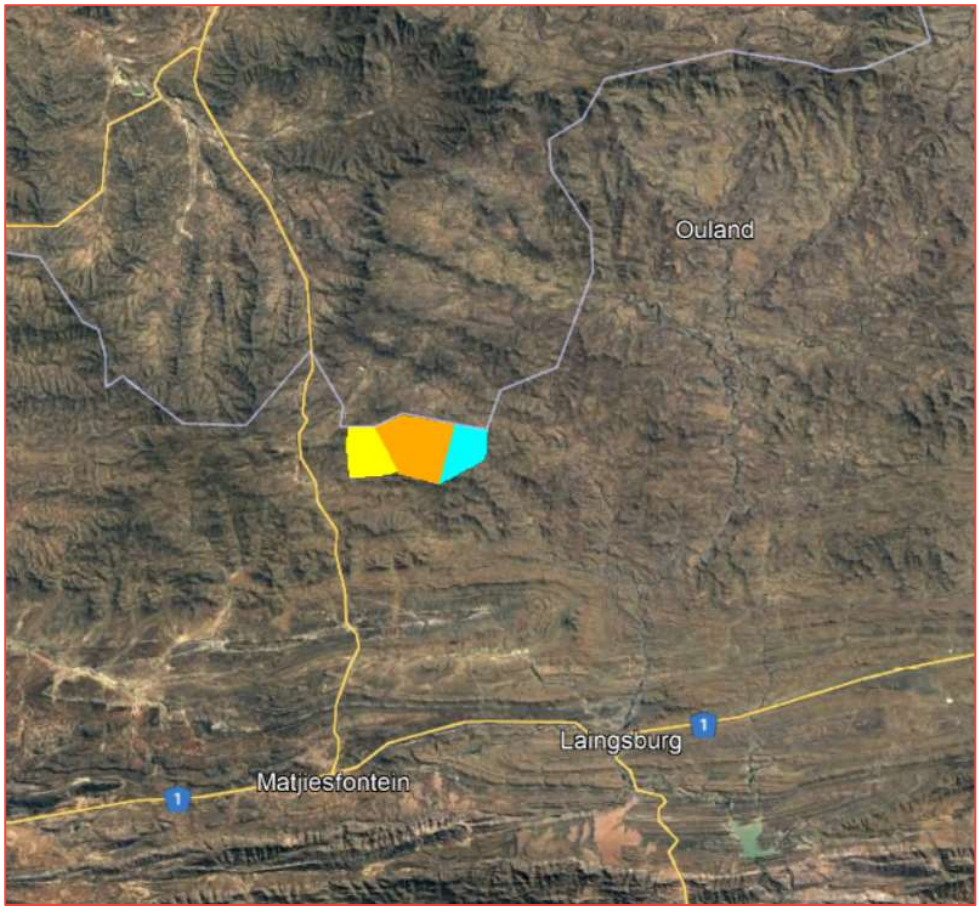
BIOTHERM ENERGY (PTY) LTD

# ESIZAYO EXPANSION WIND ENERGY FACILITY

## TRANSPORT IMPACT ASSESSMENT

17 MARCH 2022

DRAFT



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## TRANSPORT IMPACT ASSESSMENT

### BIOTHERM ENERGY (PTY) LTD

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17 March 2022

DRAFT

Ashlea Strong
BIOTHERM ENERGY (PTY) LTD
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Dear Madam:

**Subject: Esizayo Expansion Wind Energy Facility: Transport Impact Assessment**

Please find attached the draft TIA for your review

Yours sincerely,

Christo Bredenhann
Associate: Transport Planning

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# 1 INTRODUCTION

## 1.1 BACKGROUND

WSP Group Africa (Pty) Ltd (WSP) has been appointed by WSP Environment & Energy on behalf of BioTherm Energy (Pty) Ltd (BioTherm) to undertake a Transport Impact Assessment (TIA) of the proposed Esizayo Wind Energy Facility (Expansion), to be located near Laingsburg in the Western Cape.

On 14 July 2017, BioTherm received Environmental Authorisation for the Esizayo WEF proposed to be constructed on Portion 1 of Aanstoot Farm No 72, Annex Joseph's Kraal Farm No 84 and Aurora Farm No 285. BioTherm proposes to increase the thresholds and add three (3) land parcels to the previously authorised Esizayo WEF.

This assessment is therefore in addition to the previous TIA undertaken for the approved Esizayo WEF as noted above.

It is the intention of the developer, BioTherm, to apply for approval for this extension to the Esizayo WEF.

This report assesses the expected transport related impacts of the facility during the construction, operation and subsequent decommissioning phases. The purpose of this report is to consider the transport impact that the facility will have on the surrounding road network and environment, and to propose mitigating measures to address these impacts, where required.

## 1.1 SCOPE

The Scope of the TIA is as per the requirements of the South Africa Committee of Transport Officials, South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Vol. 1, Version 1, August 2012. The scope covers the following:

- Previous traffic related studies, submissions and approvals (if relevant).
- Description of the extent of the development, including location and land-use/s.
- Description of the phased development of the facility (if applicable).
- Record of liaison with authorities.
- Record of site visits.
- Description of the local and potentially affected road network, including planning and comment on the road condition, where information is available.
- Description of latent development in the vicinity of the facility that may also have an impact on the local road network
- Assessment of the required site access, parking and internal circulation.
- Assessment of expected trip generation (construction & operational phases).
- Capacity analysis (construction & operational phases), including an assessment of the expected total E80's (heavy axle loading) for the life cycle of the facility.
- Assessment of public transport and non-motorised transport.
- Recommendations and conclusions with regards to the required traffic and transport related road upgrades.

## 1.2 PREVIOUS SUBMISSIONS

No prior TIA's has been undertaken for this WEF.

## 1.3 TYPE AND EXTENT OF THE DEVELOPMENT

The Esizayo Expansion Wind Energy Facility (WEF) will be a maximum 200 MW plant located over 3 portions with a total area of 5850 ha.

### PROJECT INFRASTRUCTURE

A summary of the details of the facility and associated infrastructure is included in

Table 1-1.

**Table 1-1: Technical details of the Proposed Esizayo Expansion WEF & associated Infrastructure**

| COMPONENT | DESCRIPTION / DIMENSIONS |
|---|---|
| LOCATION OF THE SITE | Approximately 30km northeast of Laingsburg |
| TOTAL AREA OF THE SITE | 5, 850 ha |
| SIZE OF BUILDABLE AREA I.E. PROJECT INFRASTRUCTURE FOOTPRINT (ONLY REFERRED LAYOUT, INCLUSIVE OF ALL ASSOCIATED INFRASTRUCTURE) | Up to 200ha (including turbines, roads and powerlines) |
| AREA OCCUPIED BY EACH TURBINE | Each turbine with a foundation of up to 25m in diameter and up to 4m in depth, compacted hard standing areas of up to 4.5 ha each |
| FARM NAMES | Portion 2 of Farm Aanstoot Farm 72 (C04300000000007200002)<br>Portion 1 of Farm Leeuwenfontein 71 (C04300000000007100001)<br>Remainder of Farm Leeuwenfontein 71 (C04300000000007100000) |
| EXPORT CAPACITY | Up to 200MW |
| PROPOSED TECHNOLOGY | Wind turbines |
| NUMBER OF TURBINES | Up to 23 wind turbines |
| TURBINE GENERATING CAPACITY | Up to 10 MW |
| HUB HEIGHT FROM GROUND LEVEL | Up to 150m |

| COMPONENT | DESCRIPTION / DIMENSIONS |
|---|---|
| ROTOR DIAMETER | Upto 200m |
| WIDTH OF INTERNAL ROADS | Upto 9m (vertical curves will have a radii upto 55m) |
| LENGTH OF INTERNAL ROADS | 30km |
| AREA OF PREFERRED OPERATIONS AND MAINTENANCE BUILDING | The expansion project will use the authorised Esizayo project's O&M building |
| FOOTPRINT OF OPERATIONS AND MAINTENANCE BUILDING(S) | The expansion project will use the authorised Esizayo project's O&M building |
| AREA OF PREFERRED CONSTRUCTION LAYDOWN AREAS | The expansion project will use the authorised Esizayo project's construction laydown area |
| CEMENT BATCHING PLANT | The expansion project will use the authorised Esizayo project's cement batching plant |
| POWER LINES | 33kV underground cables or overhead powerlines linking groups of wind turbines to onsite 33&132kV substation(s). |

## 1.4 PHASING OF THE DEVELOPMENT

For the purpose of the impact assessment, it was assumed that the facility will be developed in a single phase with an estimated construction period of 2 years.

## 1.5 APPROVAL OF SUBMISSIONS

This report will be subject to approval from the relevant authorities and will be submitted as part of the Environmental Impact Assessment process.

# 2 LIAISON AND DATA COLLECTION

## 2.1 LIAISON

Comments were requested from the Western Cape Provincial Government Department of Transport & Public Works (PGWC) regarding the proposed (now approved) Esizayo WEF and its potential impact on Provincial Road R354. The PGWC made various initial comments in a letter dated 5 October 2016, the relevant points are summarised below:

- A TIA will be required when the LUPA application is made. Amongst the usual items that the TIA addresses it should also consider the impact on road infrastructure and what maintenance measures may be required during construction and decommissioning of the facilities.

These comments are still relevant, as the Esizayo Expansion WEF will also take access off Provincial Road R354.

## 2.2 SITE VISITS

A specific transport related site visit was not deemed necessary at this stage of the assessment.

## 2.3 ROAD NETWORK & MASTER PLANNING

There are no known local, provincial or national roads planned in the vicinity of the site or the greater study area.

## 2.4 LATENT DEVELOPMENTS

Refer to Section 8: Cumulative Transport Impact Assessment.

# 3 SITE LOCATION & SURROUNDING ROAD NETWORK

## 3.1 SITE LOCATION

The WEF will be located on the following 3 land portions:

- Portion 2 of Farm Aanstoot Farm 72 (C04300000000007200002)
- Portion 1 of Farm Leeuwenfontein 71 (C04300000000007100001)
- Remainder of Farm Leeuwenfontein 71 (C04300000000007100000)

The portions are located in the Central Karoo District Municipality, Division Laingsburg, in the Western Cape Province. Refer to Figure 3.1 for the locality map and Figure 3.2 for an aerial image of the farm portions and proposed wind turbine locations.

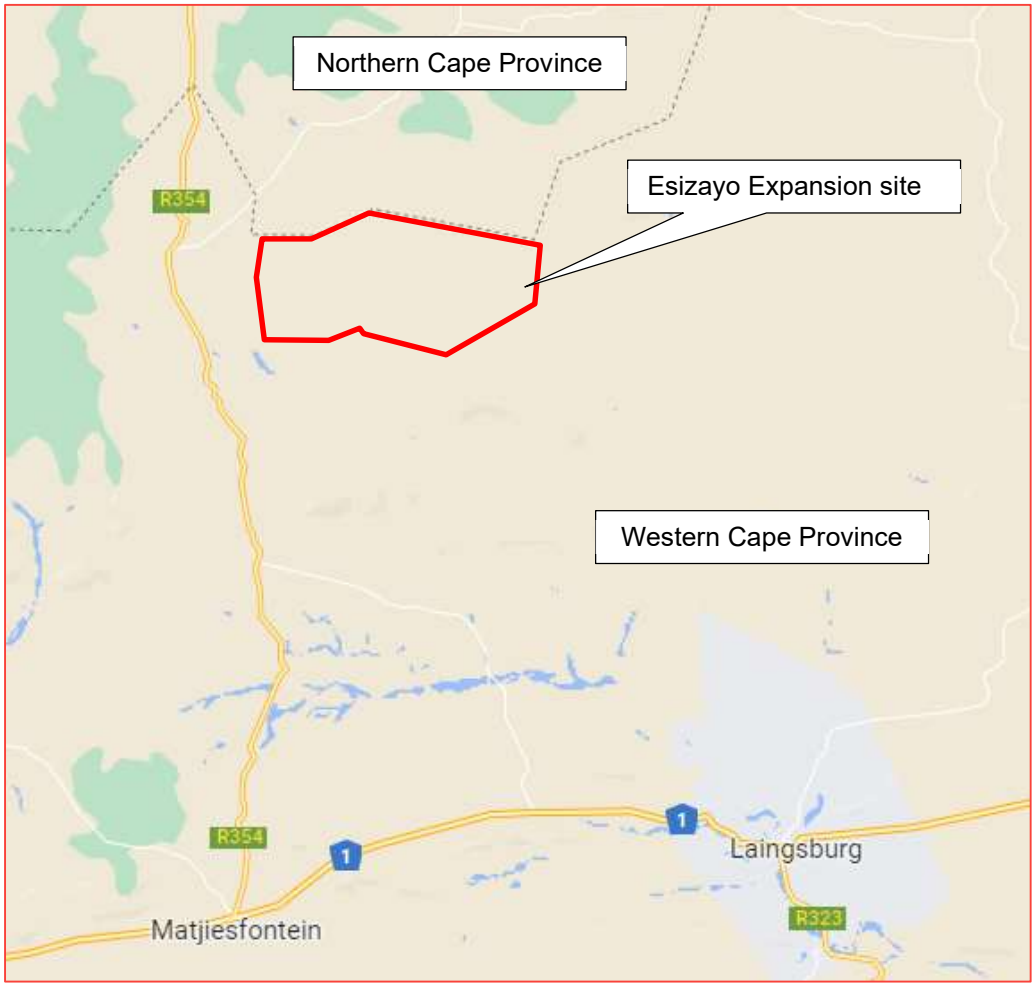


**Figure 3-1 Locality map**

Source: GoogleMaps

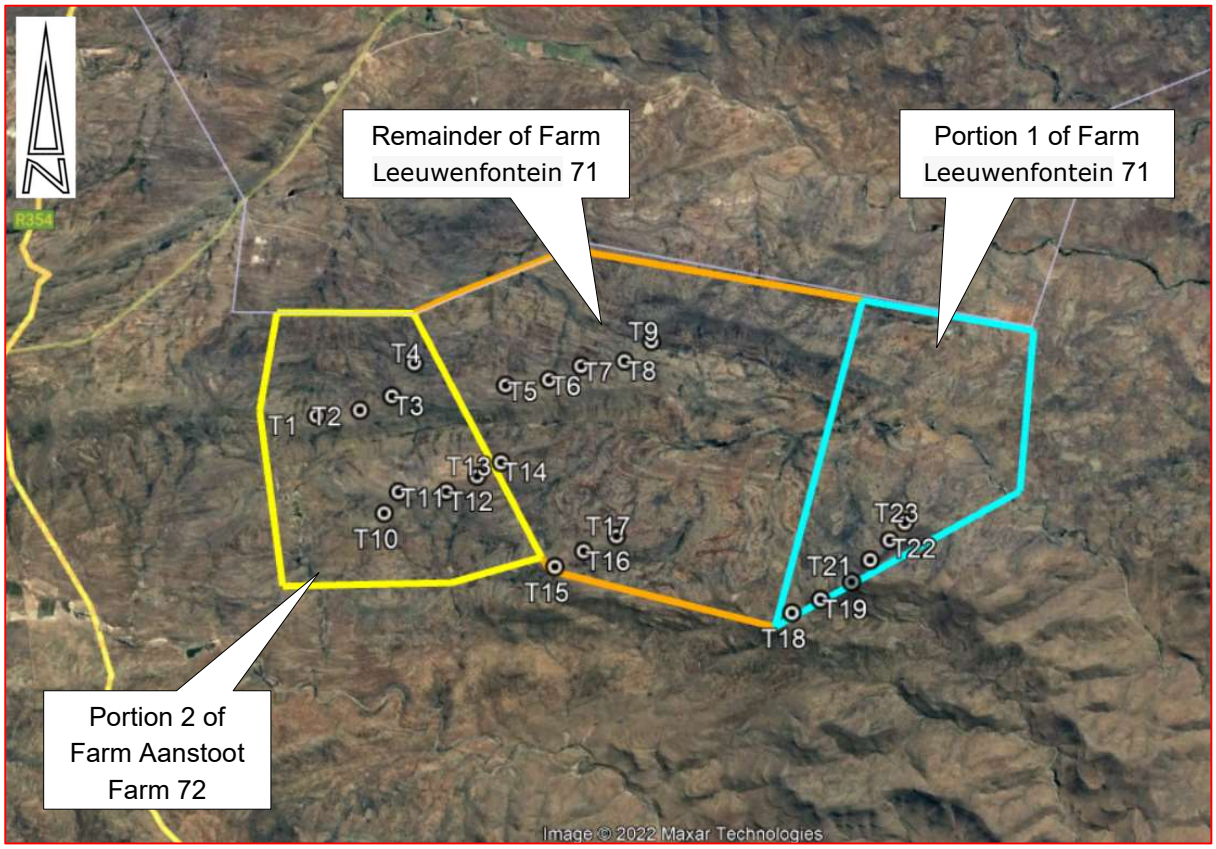


**Figure 3-2 Farm portions and proposed turbine locations**

Source: Google Earth

## 3.2 ROAD NETWORK DESCRIPTION

The site is located east of the provincial route, road R354 (TR02001). The R354 links National Road N1, approximately 24 km to the south at Matjiesfontein; with Sutherland, approximately 86 km to the north in the Northern Cape Province.

The R354 is a single carriageway 2-way surfaced road (1 lane per direction), with no surfaced shoulders. It is regarded as in "Fair" and "Good" condition in the vicinity of the site, as per the Provincial Government of the Western Cape (PGWC) Department of Transport's 2015 Surfaced Road Condition Assessment.

# 4 SITE ACCESS & PARKING

## 4.1 DEVELOPMENT ACCESS

It is recommended that the access road to the Komsberg substation and Kareedoring Kraal off the R354 be utilised for construction and operational vehicle access. This route traverses the middle portion of the site in a roughly north-west to south-east direction.

Alternatively, the existing access road to the farm Aanstoot off the R354 could be utilised during construction and the future operational phase of the facility. Refer to Figure 4.1 for the access roads.

If an alternate access off the Provincial road network such as the R354 is required for the construction and/or operational phases, the access location/s will require assessment in terms of sight distance, topography, access geometry and overall safety and suitability. This assessment will require a formal access application and approval from the Western Cape Department of Roads and Public Works.

The location of the temporary and/or permanent roads that will be constructed on-site to access each of the turbine sites and support buildings has not been determined. It is however recommended that these internal roads take access off the existing farmstead access roads where possible.

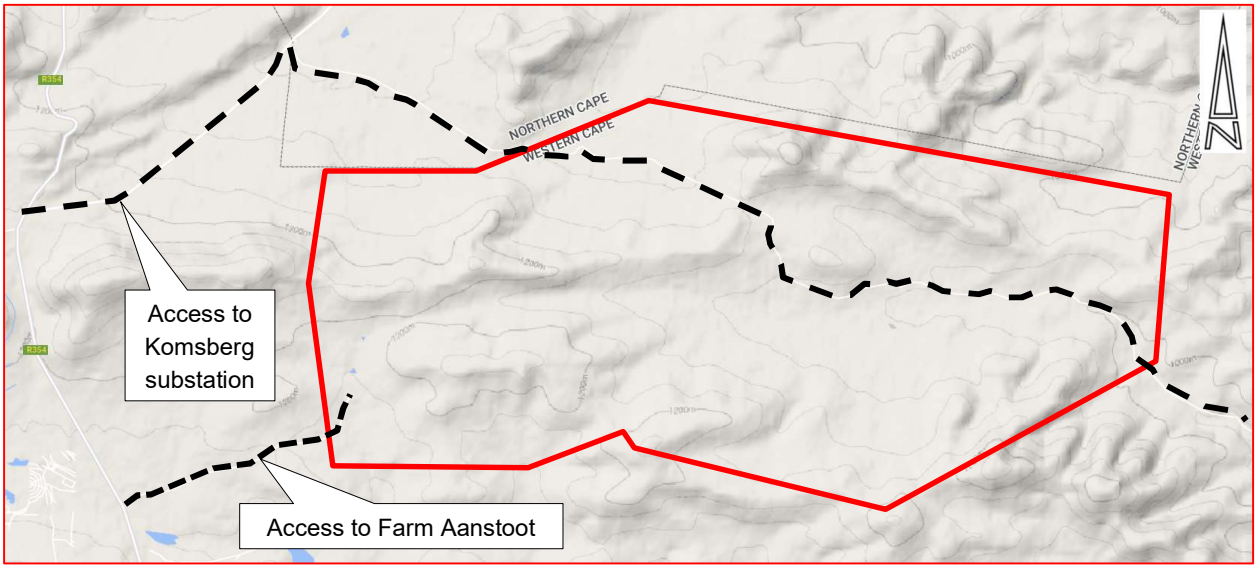


**Figure 4-1 Existing accesses and access roads**

Source: GoogleMaps

The expected traffic increase on the access roads during the construction phase may result in deterioration of the roads, as they are not designed for abnormal loads or high traffic volumes. The cost of maintaining and repairing these gravel roads during the construction and operation phases should be borne by the developer.

The transport route/s of the construction materials, components and any oversized/weight components may be National, Provincial or Local roads; and approval will have to be obtained from each authority for the transportation of any oversized or abnormally heavy components. Upgrades to the vertical or horizontal alignment of the local gravel access road/s may be required depending on the length and width of any abnormal vehicles. These alignment upgrades cannot be determined at this stage.

## 4.2 PARKING PROVISION

The proposed on-site parking provision will be limited to the following:

- Construction phase – temporary parking for construction staff and construction deliveries.
- Operational phase – parking for operational & maintenance staff vehicles.

This parking will be accommodated on-site.

# 5 PUBLIC & NON-MOTORISED TRANSPORT ASSESSMENT

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of public and non-motorised transport be included in a transport impact assessment.

Due to the remote location of the site on private farms, public access will not be allowed or required during the construction or operational phases of the project. There is therefore no need for public transport services or non-motorised transport infrastructure, except for the transport of construction staff, refer to Section 6.3.

# 6 TRAFFIC FLOWS & TRIP GENERATION

## 6.1 EXISTING TRAFFIC FLOWS

Traffic surveys were sourced from the Western Cape Government Road Network Information System (RNIS), (https://rnis.pgwc.gov.za/rnis/rnis_web_reports).

Counts undertaken during April 2015 confirm very low traffic volumes on the R354, these were escalated to the 2022 and is approximately 150 AADT (Annual Average Daily Traffic). The counts were undertaken on the link between the Western Cape/Northern Cape border and the DR2243 Aprilkraal intersection.

## 6.2 LATENT TRAFFIC

Refer to Section 8: Cumulative Transport Impact Assessment.

## 6.3 DEVELOPMENT TRIP GENERATION

The South African Trip Data Manual (TMH17) does not contain estimates for expected trip generation of a wind power facility of this nature. The following sections estimates the expected trip generation.

### *6.3.1 CONSTRUCTION PHASE TRAFFIC*

The construction phase of the facility will generate the only notable traffic that requires assessment. Construction traffic will include vehicles for material and component deliveries, construction staff and all other associated personnel. Trips will include the delivery of over-sized components such as the rotor blades, mast sections and generators. The route/s between the origin of the material and components and the facility may be National, Provincial or Local roads, and each authority will be required to provide the necessary permits for the transportation of any oversized or weight components.

The construction phase traffic was estimated based on the assumptions listed per traffic type below.

**CONSTRUCTION STAFF TRIP GENERATION**

- An estimated construction period of 24 months, with a variable number of staff required depending on the construction phase.
- An estimated maximum of 250 workers will be on-site every day during the peak construction period.
- Workers will not be accommodated on-site.
- 85% of the work force (unskilled and semi-skilled workers) will utilise public transport to site from neighbouring towns, most notably Laingsburg which is located approximately 90 km away.
- Skilled personnel will travel by private car with an average occupancy of 1.5 persons.
- 80% of Public Transport will be by bus, with a 65 person per bus occupancy.

— 20% of Public Transport will be by mini-bus, with a 16 person per vehicle occupancy.
— Staff will not utilise NMT to site due to the excessive distances to the closest towns.
— It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and again depart during the AM and PM peaks.

Refer to Table 6.1 for the total trip generation for the construction staff per facility.

**Table 6-1: Total peak hour trip generation – construction staff**

| *STAFF TYPE* | *TOTAL PERSONS PER DAY* | | |
|---|---|---|---|
| Unskilled/Semi-skilled staff (Maximum workers per day) | 213 | | |
| Skilled staff (Maximum workers per day) | 37 | | |
| Total (Maximum workers per day) | **250** | | |
| **TRIP TYPE** | **TOTAL (VEH/HR)** | **IN (VEH/HR)** | **OUT (VEH/HR)** |
| AM Peak hour bus trips | 6 | 3 | 3 |
| AM Peak hour per mini-bus trips | 6 | 3 | 3 |
| AM Peak hour private vehicle trips | 25 | 25 | 0 |
| **Total AM peak hour trips** | **37** | **31** | **6** |

## CONSTRUCTION MATERIAL TRIP GENERATION

— It is proposed to construct 23 wind turbines and support buildings.
— The turbine towers are expected to have a hub height of up to 150m, with a rotor diameter of up to 200m.
— Each 200m diameter turbine rotor will require 3 blades of up to 100m long (maximum). Rotor blades will be manufactured off-site, and could also be imported from abroad via the most suitable Port. The dimensions of the blades, their point of origin and the resultant route to the facility will determine the vehicle type and special permits that may be required for the transportation of these blades.
— The tower masts will be constructed of tubular steel, pre-cast or in-situ cast concrete or a steel and concrete hybrid. The material type is primarily determined by the height of the tower. Steel tower masts are constructed in sections of up to 30m and are lifted into place on site. Pre-cast concrete masts are usually constructed in sections off-site and lifted into place on-site. Concrete and steel hybrid masts are usually constructed from a concrete base section of up-to 8 m, and an upper section of steel. These components are also manufactured off site and lifted into place on site.
— The type of tower mast components (steel, concrete, hybrid) will determine their origin, port of entry (if imported) and delivery route to the site.

- The route/s between the origin (port of entry) of the components and the site may be National, Provincial or Local roads. The transportation of any oversized or overweight freight along these routes will require authorisation from all these road authorities.
- It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry are confirmed. This plan will cover all aspects such as horizontal and vertical vehicle requirements, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.

Assumptions were made to estimate the expected trip generation of the construction phase, refer to Table 6.2.

- It is assumed that masts will be manufactured of steel, and not hybrid masts with concrete sections.
- Each mast will consist of 5 x 30 m steel segments. One segment can be delivered per vehicle trip.
- One rotor blade can be transported on an abnormal size vehicle.
- The foundation per tower will be maximum 25 m diameter and 4m deep, which is approximately 1964m³ of concrete reinforced with 100 tons of steel.
- Ready-mix concrete is transported in 6m³ loads. Note, it is considered that the batching plant to be established on the adjacent site (Esizayo WEF approved) will be utilised. Therefore the number of trips to deliver the aggregate for the concrete batching plant is expected to be less, as these aggregates can be transported in larger quantities per vehicle. The assumption that ready-mix concrete will be utilised therefore results in a higher, more conservative, trip generation for the material delivery.
- Steel is transported in 40 ton loads on standard flatbed vehicles.
- Component and material deliveries will take place over a period of 24 months. It is assumed that deliveries will take place on 80% of all working days for a conservative trip generation estimate.
- A total of 15 679 delivery trips (in & out total) will be required during the 24 months of construction, which is approximately 39 trips a day (In & Out total).
- The delivery of materials during the AM and PM peak hours will therefore be low, as trucks will arrive and depart throughout the day. If a conservative maximum 20% of the daily trips are generated during the AM and PM peaks, a total of less than 8 trips per peak hour is expected, which is negligible.

**Table 6-2 Estimated maximum Construction phase trip generation**

| | Mast components (no.) | Rotor blades (no.) | Rotor | Nacelle | Generator | Foundation material | |
|---|---|---|---|---|---|---|---|
| | | | | | | Concrete (m³) | Steel (tons) |
| **No. of turbines: 1** | 5 x 30 m steel sections | 3 x 100m blades | 1 | 1 | 1 | 1964 | 100 |
| **No. of turbines: 23** | 115 | 69 | 23 | 23 | 23 | 45 172 | 2300 |
| **No. of vehicle trips (in & out)** | **230** | **138** | **46** | **46** | **46** | **15 058** | **115** |
| **Total no. of trips: Construction phase (in & out)** | **15 679** | | | | | | |
| **Total no. of trips: per day (in & out)** | **39** | | | | | | |
| **Total no. of trips: per workday peak hour (in & out)** | **8** | | | | | | |

## TRIP GENERATION SUMMARY

Refer to Table 6.3 for the expected combined trip generation for the facility during construction.

**Table 6-3: Total maximum peak hour trip generation**

| ESIZAYO FACILITY | VEHICLE TRIPS PER PEAK HOUR | | |
|---|---|---|---|
| | **Staff (In : Out : Total)** | **Material deliveries (In : Out : Total)** | **Total (In : Out : Total)** |
| **Total** | 31:06:37 | 04:04:08 | **35:10:45** |

Engineers opinion: The above analysis and resultant trip generation represents an unlikely worse- case scenario. The background vehicle volumes along the R354 from where all trips will distribute onto the major road network is low. In conclusion, the transport impact of the facility on the local major road network is expected to be negligible. Also refer to Section 7.

## E80 SUMMARY

The total E80 loading of the construction vehicles on the local road network was estimated for the concrete and steel deliveries for the full construction period of the Esizayo facility. The average E80 axle loading per heavy vehicle is estimated at 3.49, refer to Table 6.4. Refer to Table 6.5 for the calculation of the total E80 loading for the construction phase of the facility.

Note that these calculations assume that all delivery and return trips occur along the same route to and from the site, and is therefore a conservative maximum. The return E80 pavement loading of the empty vehicles were not calculated, as these are negligible compared to the loaded vehicles.

**Table 6-4: Average E80 loading – Construction phase**

| VEHICLE TYPE | % COMPOSITION OF TRIPS | E80/HV |
|---|---|---|
| Small | 0.05 | 0.51 |
| Medium | 0.05 | 1.9 |
| Large - Steel | 1.0 | 4.7 |
| Large - Concrete | 98.0 | 3.5 |
| Average number of E80 axles per heavy vehicle | | **3.49** |

**Table 6-5: Total E80 loading - Construction phase**

| VEHICLE TYPE | NO. OF TRIPS (IN TRIPS - LOADED WITH MATERIAL) |
|---|---|
| Large - Steel | 58 |
| Large - Concrete | 7 529 |
| Sub-total | 7 587 |
| Average E80 loading | 3.49 |
| Total E80 loading | **26 477** |

The estimated total E80 loading for the duration of the construction period is approximately 0.02648 million, and no mitigating measures are deemed necessary for bulk material deliveries along the local National or Provincial roads.

The expected traffic increase on the local unsurfaced access roads during the construction phase may result in deterioration of these roads, as they are not designed for abnormal loads and large traffic volumes. The cost of maintaining and/or repairing the access roads during the Construction phase of the project should be borne by the developer.

### 6.3.2 OPERATIONAL PHASE TRAFFIC

The operational phase of the facility will require very few permanent staff. The vehicle trips that will be generated by the personnel will be low and the associated transport impact on the surrounding road network will therefore be negligible.

### 6.3.3 DECOMMISIONING PHASE TRAFFIC

Following the initial 20-year operational period of the facility, its continued economic viability will be investigated. If it is still deemed viable its life may be extended; if not, it will be decommissioned. If it is completely decommissioned, all the components will be disassembled, reused and recycled or disposed of.

It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It is however expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local road network will be lower than during the Construction phase. Any damage to the unsurfaced access roads caused by the decommissioning phase traffic should be repaired at the cost of the developer.

## 6.4 CAPACITY ANALYSIS

A capacity analysis of the potential access intersections off the R354 was not undertaken, and is not required for a development with such a low daily and peak hour traffic generation. However, the safety of these intersections may be compromised due to the increase in especially heavy vehicle volumes along the R354 and

the access roads. The low current traffic volumes along the R354 and the expected construction traffic volumes does not justify the construction of additional turning lanes.

## 6.5 SUPPLEMENTARY ROAD SIGNAGE

The following recommendations are made to improve the safety of the existing access intersections off the R354:

### R354 / KOMSBERG / KAREEDORINGKRAAL ACCESS ROAD

Provide additional warning signs as follows:

- Ensure the Stop Sign (R1.1) on the side road approach to the R354 is clearly visible to oncoming traffic.
- Implement a side road junction warning signs (W108) on the southern approach of the R354, located approximately 100m from the intersection.
- Provide a temporary truck crossing warning sign (TW345) with the W108 signs located at 100m on the southbound approach.
- Implement a side road junction warning sign (W107) on the northern approach of the R354, located approximately 100m from the intersection.
- Provide a temporary truck crossing warning sign (TW344) with the W108 signs located at 100m on the northbound approach.

### R354 / AANSTOOT ACCESS

Provide additional warning signs as follows:

- Ensure the Stop Sign (R1.1) on the side road approach to the R354 is clearly visible to oncoming traffic.
- Implement a side road junction warning signs (W108) on the southern approach of the R354, located approximately 100m from the intersection.
- Provide a temporary truck crossing warning sign (TW345) with the W108 signs located at 100m on the southbound approach.
- Implement a side road junction warning sign (W107) on the northern approach of the R354, located approximately 100m from the intersection.
- Provide a temporary truck crossing warning sign (TW344) with the W108 signs located at 100m on the northbound approach.

# 7 ENVIRONMENTAL IMPACT ASSESSMENT: TRANSPORT

## 7.1 IMPACT ASSESSMENT METHODOLOGY

### 7.1.1 INTRODUCTION

The EIA for the proposed facility, of which this TIA is an informant, uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the "EIA Regulations").

### 7.1.2 ASSESSMENT OF IMPACTS AND MITIGATION

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

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

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in Table 7-1.

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

**Table 7-1: Impact Assessment Criteria and Scoring System**

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** The degree of alteration of the affected environmental receptor | Very low: No impact on processes | Low: Slight impact on processes | Medium: Processes continue but in a modified way | High: Processes temporarily cease | Very High: Permanent cessation of processes |
| **Impact Extent (E)** The geographical extent of the impact on a given environmental receptor | Site: Site only | Local: Inside activity area | Regional: Outside activity area | National: National scope or level | International: Across borders or boundaries |
| **Impact Reversibility (R)** The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change | Reversible: Recovery without rehabilitation | | Recoverable: Recovery with rehabilitation | | Irreversible: Not possible despite action |
| **Impact Duration (D)** The length of permanence of the impact on the environmental receptor | Immediate: On impact | Short term: 0-5 years | Medium term: 5-15 years | Long term: Project life | Permanent: Indefinite |
| **Probability of Occurrence (P)** The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation | Improbable | Low Probability | Probable | Highly Probability | Definite |
| **Significance (S)** is determined by combining the above criteria in the following formula: | $[S = (E + D + R + M) \times P]$ <br> $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | **4 to 15** | **16 to 30** | **31 to 60** | **61 to 80** | **81 to 100** |
| **Environmental Significance Rating (Negative (-))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |
| **Environmental Significance Rating (Positive (+))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |

## 7.1.3 IMPACT MITIGATION

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

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the

footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 7-1.

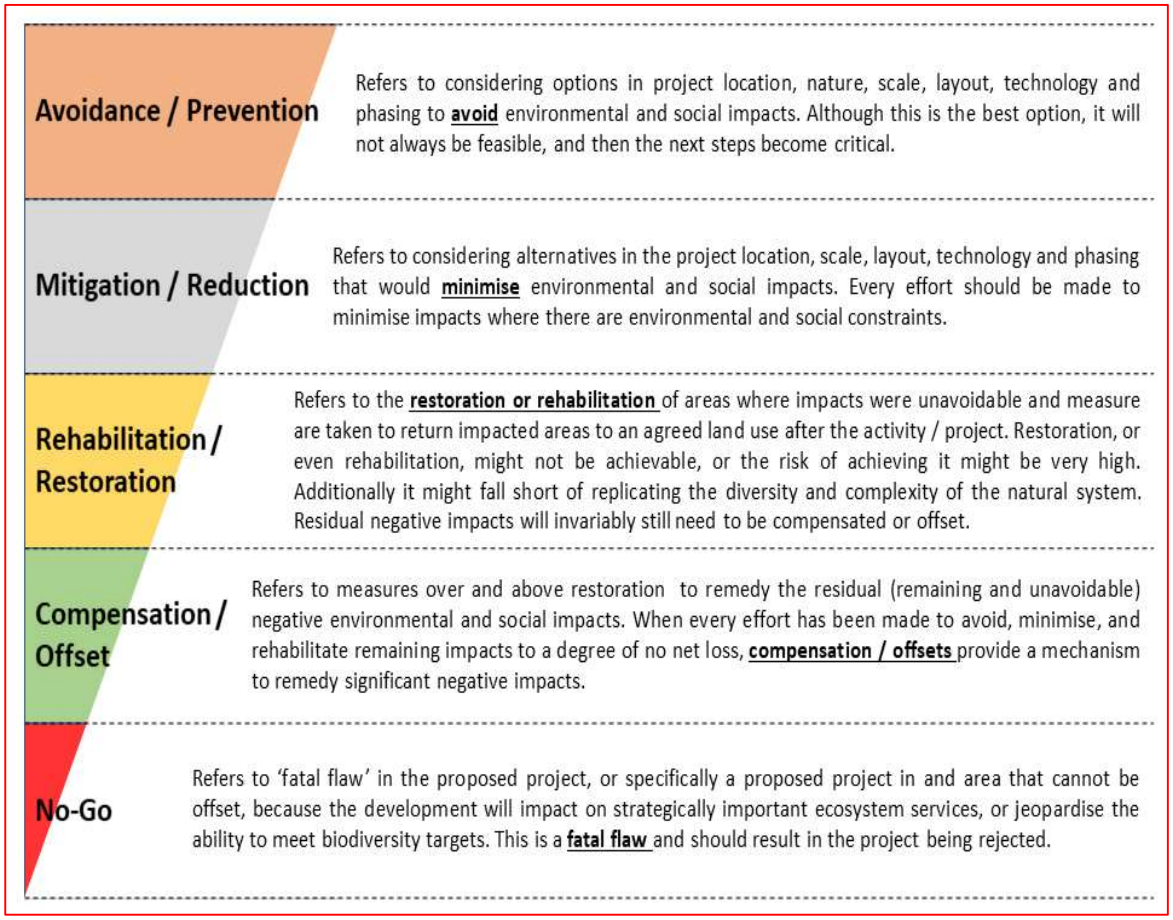


**Figure 7-1 Mitigation Sequence/Hierarchy**

## 7.2 ASSESSMENT RESULTS

The Operational and Decommissioning phases were not assessed, as the trip generation during these phases will be negligible, with a negligible impact.

Refer to Table 7-2 for the Construction Phase traffic related environmental impact assessment of the proposed facility.

**Table 7-2: Impact assessment - Construction phase**

| Impact number | Aspect | Description | Stage | Character | Ease of Mitigation | Pre-Mitigation | | | | | | | Post-Mitigation | | | | | | | Mitigation Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (M+ | E+ | R+ | D)x | P= | S | Rating | (M+ | E+ | R+ | D)x | P= | S | Rating | |
| 1: | Noise, dust & exhaust pollution due to vehicle trips on-site | Vehicle engine and tyre on road noise, dust & exhaust fumes | Construction | Negative | Easy | 2 | 1 | 1 | 1 | 5 | **25** | **N2** | 1 | 1 | 1 | 1 | 2 | **8** | **N1** | • All unsurfaced roads must be regularly sprayed with water to prevent dust generation<br>• All vehicles that access the site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby reducing noise/pollution levels |
| **Significance** | | | | | | **N2 - Low** | | | | | | | **N1 - Very Low** | | | | | | | |
| 2: | Noise, dust and exhaust pollution due to additional trips on the access roads | Vehicle engine and tyre on road noise, dust & exhaust fumes | Construction | Negative | Easy | 2 | 2 | 1 | 1 | 5 | **30** | **N2** | 1 | 2 | 1 | 1 | 2 | **10** | **N1** | • All unsurfaced roads must be regularly sprayed with water to prevent dust generation<br>• All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby reducing noise/pollution levels |
| **Significance** | | | | | | **N2 - Low** | | | | | | | **N1 - Very Low** | | | | | | | |
| 3: | Noise and exhaust pollution due to additional trips on the R354 | Increase in vehicle engine and tyre on road noise & exhaust fumes | Construction | Negative | Easy | 1 | 3 | 1 | 1 | 5 | **30** | **N2** | 1 | 3 | 1 | 1 | 2 | **12** | **N1** | • All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby reducing noise/pollution levels |
| **Significance** | | | | | | **N2 - Low** | | | | | | | **N1 - Very Low** | | | | | | | |

## 7.3 SUMMARY

The overall significance of each impact during the Construction Phase of the facility detailed in Table 7-2 is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.

The proposed mitigating measures are easy to implement, and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

# 8 CUMULATIVE TRANSPORT IMPACT ASSESSMENT

## 8.1 BACKGROUND

The DEA requested that a cumulative transport impact assessment be undertaken of the latent power facilities in the vicinity of the Esizayo Expansion WEF.

## 8.2 LATENT DEVELOPMENTS

The known developments that may have a cumulative impact on the surrounding road network are shown Figure 8.1.

Refer to Table 8.1 for the facilities that were assessed in terms of their potential cumulative transport impact on the road network. This was assessed in combination with the Esizayo facility. The facilities listed below will potentially also take access off the R354 during their construction and operational phases.

**Table 8-1 Latent developments in the study area**

| ID | DEA number | Name | Type | Access to major road network |
|---|---|---|---|---|
| 2 | 12/12/20/1782 | Sutherland 2 WEF* | Wind Energy | Via Klein Roggeveld access road to R354 |
| 6 & 16 | 12/12/20/1988/1/AM1 | Roggeveld Wind Farm** | Wind Energy | Via local access roads to R354 |
| 10 & 13 | 12/12/20/2370 & 12/12/20/2370/2 | Hidden Valley wind energy facility*** | Wind Energy | Via Klein Roggeveld access road to R354 |
| 11 | 14/12/16/3/3/2/962 & 14/12/16/3/3/2/963 | Maralla East & West **** | Wind Energy | Via Klein Roggeveld or Komsberg access roads to R354 |
| tbc | 14/12/16/3/3/2/967 | Esizayo WEF | Wind Energy | Via local access roads to R354 |

Notes:
* The Sutherland 2 WEF site is the western of the 4 sites and is the only facility that was assessed as it will take access off the R354 via the Klein Roggeveld or Komsberg access roads.
** The eastern sites located closest to the R354 were assessed, as these will take access off the R354.
*** The development will consist of 3 phases, namely the Karusa, Soetwater and Great Karoo Wind Farms.
**** Recently approved, EIA undertaken by WSP

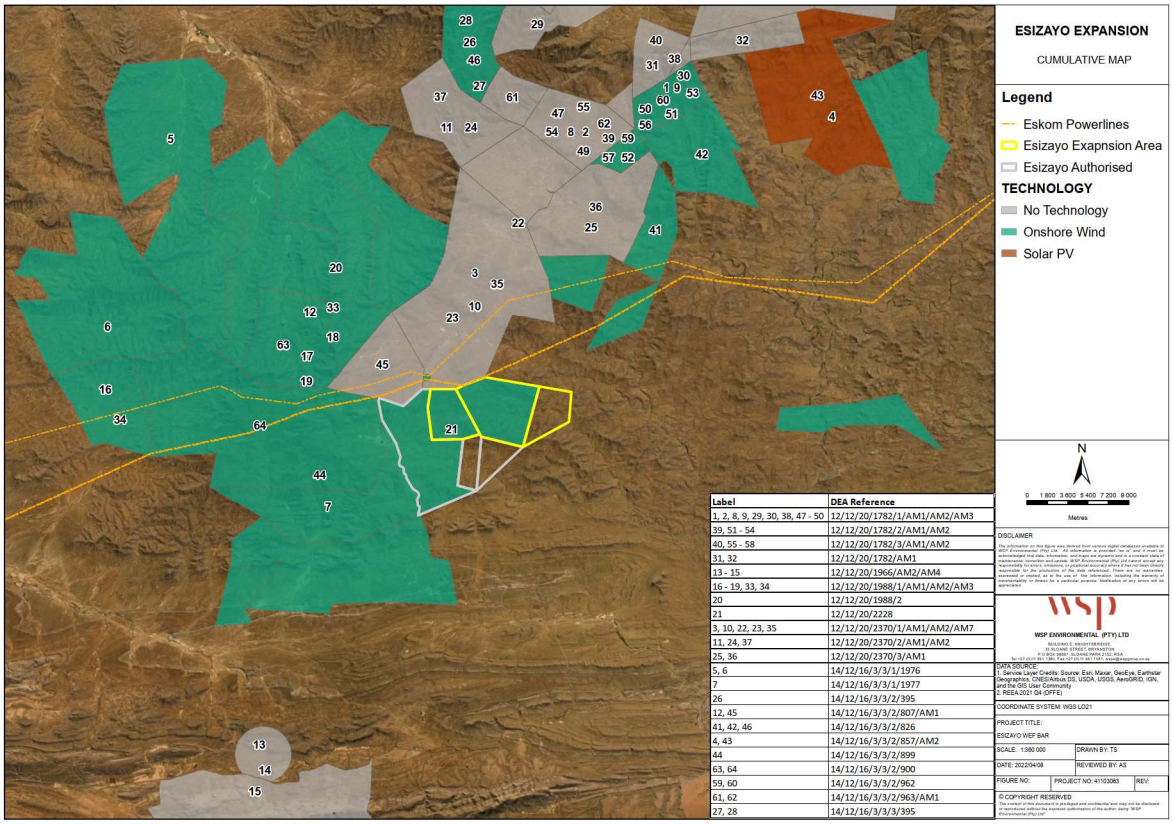


**Figure 8-1 Latent WEF Facilities**

Source: WSP

The EIAs listed in Table 8.2 of the surrounding developments have been either withdrawn or have lapsed and are therefore not been considered as part of the cumulative impact assessment.

**Table 8-2 Latent developments – withdrawn**

| Proposed Development Name | DEA Ref. | Current EA Status | Proponent | Extent | Proposed Capacity | Farms |
|---|---|---|---|---|---|---|
| Proposed wind energy facility near Komsberg, Western Cape | 12/12/20/2228 | S&EIR | Inca Komsberg Wind (Pty) Ltd | | 300 MW | |

## 8.3 CUMULATIVE TRANSPORT IMPACTS

Refer to Table 8.3 for the expected cumulative transport impacts on the local road network due to the latent facilities in the study area.

**Table 8-3 Summary of transport impacts of the latent developments**

| DEA number | Facility | Transport Impact | Cumulative Transport Impact |
|---|---|---|---|
| 12/12/20/1782 | Sutherland 2 WEF | • The EIR do not state the expected number of vehicle trips that will be generated by the facility.<br>• The EIA does not contain a TIA. | No cumulative impact due to maximum traffic generation of each site occurring at an unknown future time period that cannot be determined with the information available.<br><br>Roggeveld, Karusa, and Soetwater are already either built or currently in the construction phase. |
| 12/12/20/1988/1/AM1 | Roggeveld Wind Farm | • The EIR do not state the expected number of vehicle trips that will be generated by the facility.<br>• The EIA does not contain a TIA.<br>• The EIA states that 4 access roads off the R354 will be considered. | |
| 12/12/20/2370 & 12/12/20/2370/2 | Hidden Valley wind energy facility * | • The EIR do not state the expected number of vehicle trips that will be generated by the facility.<br>• The EIA does not contain a TIA. | |
| 14/12/16/3/3/2/962 & 14/12/16/3/3/2/963 | Maralla East & West | • Safety of local access intersections off the R354 to Klein Roggeveld and Komsberg may be compromised due to increased construction traffic.<br>• Mitigating measures are proposed. | |
| 14/12/16/3/3/2/967 | Esizayo WEF | • Safety of local access intersections off the R354 to the sites may be compromised due to increased construction traffic.<br>• Temporary mitigating measures are proposed. | - |

## 8.4 SUMMARY

The maximum traffic generation of each site occurs at an unknown future time period that cannot be determined from the information available. It is known that The Hidden Valley facility will be constructed in 3 phases. It is therefore unlikely that these impacts will occur at the same time, therefore no cumulative transport impact is foreseen.

It should be noted that the Significance of the transport impact of each of these facilities is expected to be similar to the Esizayo Expansion WEF, as their Construction phase trip generation will likely be low to negligible during the workday peak hours.

Refer to Section 6.5 for the proposed road signage upgrades of the access intersections off the R354 that may be utilised. The upgrades will also be required if any of the latent developments are constructed concurrently with the Esizayo WEF or Esizayo Expansion WEF. It is recommended that the cost of the upgrades be shared if the developments are constructed during the same period and take access off the R354 via the same local roads.

# 9 CONCLUSIONS & RECOMMENDATIONS

Based on this study, the following key conclusions and recommendations are relevant:

- The proposed Esizayo Expansion Wind Energy Facility will be located approximately 30km northeast of Laingsburg in the Western Cape Province, bordering the Northern Cape Province.
- The facility will be located over 3 land portions with a total area of a 5850 ha, in the Central Karoo District Municipality, Division Laingsburg namely:
  - Portion 2 of Farm Aanstoot Farm 72 (C04300000000007200002)
  - Portion 1 of Farm Leeuwenfontein 71 (C04300000000007100001)
  - Remainder of Farm Leeuwenfontein 71 (C04300000000007100000)
- The facility will be a 200 MW Wind Energy Facility of 23 turbines with 200m diameter rotors with 100m long blades, and a 150m hub height
- The Scope of the TIA was informed by the Committee of Transport Officials' South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Vol. 1, Version 1, August 2012.
- A single short term (2 year) implementation was assumed for analysis purposes.
- There are no known planned road upgrades in the study area.
- There are no known large scale latent developments in the vicinity of the site that may have an impact on the local road network, except for the latent energy developments that were assessed as part of the Cumulative Impact Assessment.
- The site will take access off existing accesses from the R354, a single carriageway 2-way surfaced road (1 lane per direction), with no surfaced shoulders. It is recommended that the existing access road to the Kareedoringkraal/Komsberg be utilised for access purposes.
- The R354 is regarded as in "Fair" and "Good" condition in the vicinity of the site, as per the Provincial Government of the Western Cape (PGWC) Department of Transport's 2015 Surfaced Road Condition Assessment.
- Construction and operational phase parking will be accommodated on-site.
- There is no need for public transport services or non-motorised transport infrastructure to serve the site for the construction and operational phase, except for the transport of staff.
- The estimated peak trip generation of the facility will be 45 veh/hr in the weekday AM and PM peaks during the Construction phase.
- The trip generation during the Operational phase will be negligible.
- The expected traffic increase on the local access roads during the construction phase could result in deterioration of the road, as it is not designed for abnormal and heavy traffic volumes. The cost of maintaining and repairing this road during the Construction phase of the projects should be borne by the developer.
- The estimated total E80 loading for the duration of the construction period is 0.02648 million, and no mitigating measures are deemed necessary on the R354.
- It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It can however be expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local access roads will be lower than during the Construction phase. Any damage to the road caused by the decommissioning phase traffic should be repaired at the cost of the developer.

- The transport route/s between the origin of the turbine components and the facility may be National, Provincial or Local roads; and each authority will be required to provide the necessary permits for the transportation of any oversized or abnormally heavy components.
- It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry of the tower components (masts, blades, rotor nacelles, generators, etc.) are known. These plans should include all aspects such as horizontal and vertical requirements along the routes, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.
- A capacity analysis of the access intersection off the R354 was not undertaken, and is not deemed necessary for a development with such low daily and peak hour traffic generation. The safety of thee chosen intersection may be compromised due to the increase in especially heavy vehicle volumes along the R354 and the access roads. The low current traffic volumes along the R354 and the expected construction traffic volumes does not justify the construction of additional turning lanes. However, recommendations are made to improve the safety of the intersections with additional road signage.
- The overall significance of each impact during the Construction Phase of the facility detailed in Table 7-2 is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.
- The proposed mitigating measures are easy to implement, and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.
- Cumulative impact assessment: The maximum traffic generation of the latent sites may occur at an unknown future time period that cannot be determined from the information available. The implementation programme of these sites has also not been determined. It is unlikely that these impacts will occur at the same time, therefore no cumulative transport impact is foreseen. It should be noted that the Significance of the transport impact of each of these facilities is expected to be similar to the Esizayo Expansion facility, namely Low, or Very Low with mitigation.
- The maintenance and repair of the local access roads due to damage by construction vehicles should be the responsibility of each of the developers of the latent energy facilities.

It is concluded that the proposed Esizayo Expansion Wind Energy Facility will have a negligible short-term transport impact on the adjacent road network, and it is recommended that the TIA should be accepted as part of the EIA application.

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