BASIC ASSESSMENT REPORT:

THE PROPOSED ROAN 2 PV FACILITY AND ASSOCIATED INFRASTRUCTURE NEAR HARTBEESFONTEIN, NORTH-WEST PROVINCE

TRANSPORT STUDY

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First Issue

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SYNOPSIS

Preparation of a Transport Study for the proposed Roan 2 PV Facility, located near Hartbeesfontein in the North-West Province, pertaining to all relevant traffic and transportation engineering aspects.

KEY WORDS:

Transport Study, Basic Assessment, Solar PV Facility, Photovoltaic, PV

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.

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THE PROPOSED ROAN 2 PV FACILITY
AND ASSOCIATED INFRASTRUCTE
NEAR HARTBEESFONTEIN, NORTH-WEST PROVINCE

TABLE OF CONTENTS

TABLES

FIGURES

ANNEXURES

THE PROPOSED ROAN 2 PV FACILITY AND ASSOCIATED INFRASTRUCTURE NEAR HARTBEESFONTEIN, NORTH-WEST PROVINCE

1 INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives

The Applicant, AMDA November (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility known as Roan 2, located on portions 4, 5, 9 and 16 of the Farm 299 approximately 3km south of Hartbeesfontein in the City of Matlosana local Municipality, which is located within the Dr Kenneth Kaunda District Municipality of the North-West Province of South Africa, as shown in **Figure 1-1**.

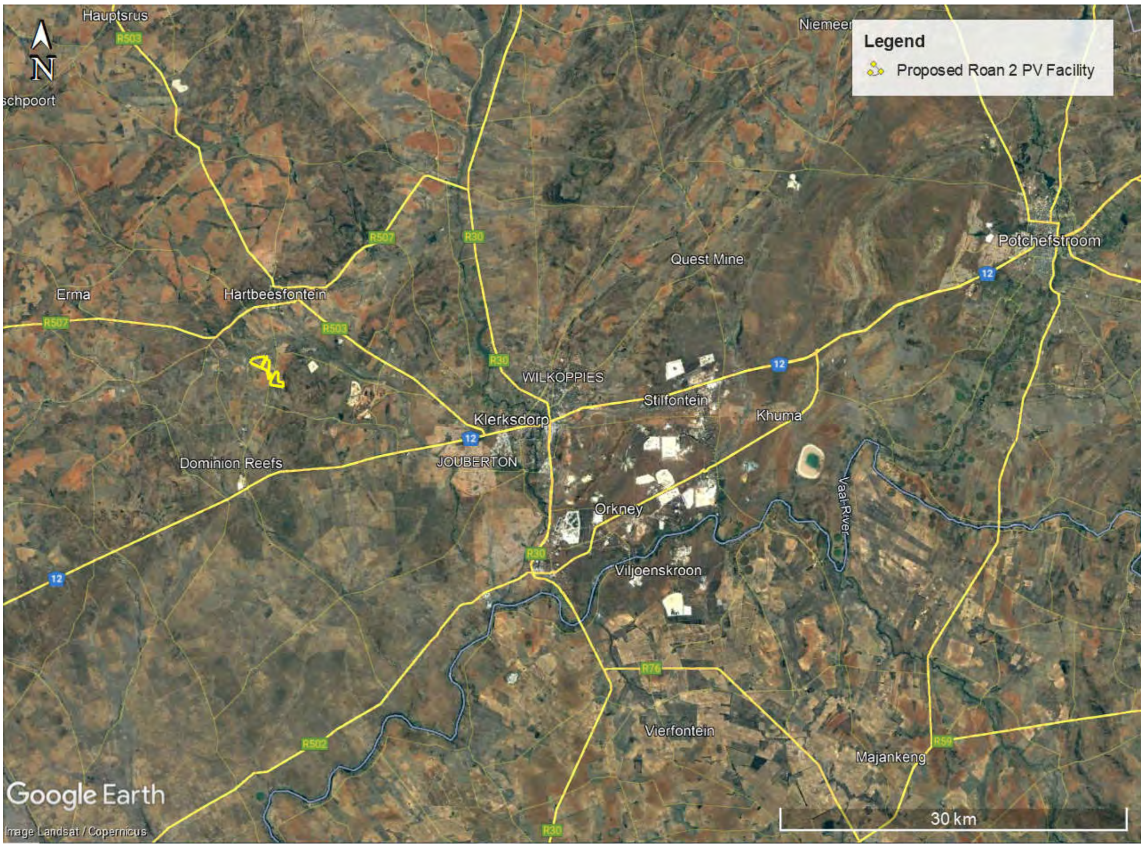

Figure 1-1: Locality Plan

The project is situated within a Renewable Energy Development Zone (REDZ) known as the Klerksdorp REDZ (REDZ10). The solar PV facility will comprise of arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100 MW.

As part of the Basic Assessment (BA) process undertaken, the services of a Transportation Specialist are required to conduct a Transport Study.

The following two main transportation activities will be investigated:

- Abnormal load vehicles transporting components to the site.
- The transportation of construction materials, equipment and people to and from the site/facility.

The transport study will aim to provide the following objectives:

- Assess activities related to traffic movement for the construction and operation (maintenance) phases of the facility.
- Recommend a preliminary route for the transportation of the components to the proposed site.
- Recommend a preliminary transportation route for the transportation of materials, equipment and people to site.
- Recommend alternative or secondary routes where possible.

1.2 Terms of Reference

The Terms of Reference for this Transport Study include the following:

- Provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility;
- Provide a description and assessment of the potential traffic issues associated with the proposed facility; and
- Identify enhancement and mitigation aimed at maximizing opportunities and avoiding and or reducing negative impacts.

The traffic impact assessment should focus on the aspects stated below:

- Location of the Site (Nearest numbered road indicated)
- Trip generation during construction and operation of the plant
- Probable haulage routes (national and provincial routes will be utilised)
- Site access route (from a national roadway)
- Affected communities
- Cumulative impact assessment.

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 of the facility; and
- operation and maintenance during the operational phase.

This transport study was informed by the following:

Site Visit and Project Assessment

- Overview of project background information including location maps, component specs and any possible resulting abnormal loads to be transported; and
- Research of all available documentation and information relevant to the proposed facility.

The transport study considered and assessed the following:

Traffic and Haul Route Assessment

- Estimation of trip generation;
- Discussion on potential traffic impacts;
- Assessment of possible haul routes; and
- Construction and operational (maintenance) vehicle trips.

Site layout, Access Points and Internal Roads Assessment per Site

- Description of the surrounding road network;
- Description of site layout;
- Assessment of the proposed access points; and
- Assessment of the proposed internal roads on site.

1.4 Assumptions and Limitations

The following assumptions and limitations apply:

- This study is based on the project information provided by AMDA November (Pty) Ltd.
- According to the Eskom Specifications for Power Transformers (Eskom Power Series, Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers), the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000 mm, total maximum width 4 300 mm and total maximum length 10 500 mm.
- Maximum vertical height clearances along the haulage route are 5.2 m for abnormal loads.
- Imported elements will be transported from the most feasible port of entry, which is deemed to be Port of Richards Bay.
- If any elements are manufactured within South Africa, these will be transported from their respective manufacturing centres, which would be either in the greater Johannesburg area for the transformer, inverter and the support

structures and in Pinetown/Durban, Cape Town or Johannesburg for the PV modules.

- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- Construction materials will be sourced locally as far as possible.

1.5 Source of Information

Information used in a transport study includes:

- Project Information provided by AMDA November (Pty) Ltd;
- Google Earth .kmz provided by AMDA November (Pty) Ltd;
- Google Earth Satellite Imagery; and
- Project research of all available information, including photographic record of proposed assess points provided by Cape EPrac.

2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE TRANSPORT STUDY

2.1 Port of Entry

It is assumed that if components are imported to South Africa, it will be via the Port of Richards Bay, which is located in the KwaZulu Natal. The Port is located approximately 760 km from the proposed site. A deep-sea water port and boasting 13 berths, the Richards Bay terminal handles dry bulk ores, minerals and break-bulk consignments with a draft that easily accommodates Cape size and Panamax vessels.

The terminal exports over 30 varied commodities from magnetite to ferrochrome, woodchips to aluminium and steel. A large percentage of dry bulk commodities are handled via a computer-controlled network of conveyor belts extending 40 km to seven harbour bound industries. These belts transport cargo between the quayside and the respective manufacturers. Break bulk cargo, on the other hand, is a skip-loading operation that due to the density of the commodities primarily relies on road motor transport (RMT) to and from the point of trade. The Richards Bay Port is operated by Transnet Port Terminals.

Alternatively, components can be imported via the Port of Saldanha (1 310 km from the proposed site) in the Western Cape or the Port of Ngqura (940 km from the proposed site) in Eastern Cape.

2.2 Transportation requirements

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

- Conventional trucks within the freight limitations to transport building material to the site;
- 40ft container trucks transporting solar PV modules, frames and the inverter, which are within freight limitations;
- Flatbed trucks transporting the solar PV modules and frames, which are within the freight limitations;
- Light Differential Vehicle (LDV) type vehicles transporting workers from surrounding areas to site;
- Drilling and piling machines and other required construction machinery being transported by conventional trucks or via self-drive to site; and
- The transformers will be transported as abnormal loads.

2.3 Abnormal Load Considerations

It is expected that the transformers will be transported with an abnormal load vehicle. Abnormal permits are required for vehicles exceeding the following permissible maximum dimensions on road freight transport in terms of the Road Traffic Act (Act No. 93 of 1996) and the National Road Traffic Regulations, 2000:

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

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

2.4 Further Guideline Documentation

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

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

2.5 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.

2.6 Load Limitations

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

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

2.7 Dimensional Limitations

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

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

2.8 Transporting Other Plant, Material and Equipment

In addition to transporting the specialised equipment, the normal Civil Engineering construction materials, plant and equipment will need to be transported to the site (e.g. sand, stone, cement, gravel, water, compaction equipment, concrete mixers, etc.). Other components, such as electrical cables, 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, except for the transformers which require an abnormal load vehicle.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Description of the site

The proposed Roan 2 PV Facility will be located approximately 3 km south of the town of Hartbeesfontein and 26 km north-west of the town of Klerksdorp in the North-west Province, as shown in **Figure 3-1**. The proposed site is bounded by the R507 to the north, the R503 to the east and the N12 to the south. The project is situated within a Renewable Energy Development Zone (REDZ) known as the Klerksdorp REDZ (REDZ10).

The following farm portions are affected:

<u>Solar Power Plant</u>

- Portion No 4 of The Farm No. 299
- Portion No 5 of The Farm No. 299
- Portion No 9 of The Farm No. 299
- Portion No 16 of The Farm No. 299

<u>132 kV Power Line</u>

- The Farm No. 337
- Remainder portion of the Farm No. 338

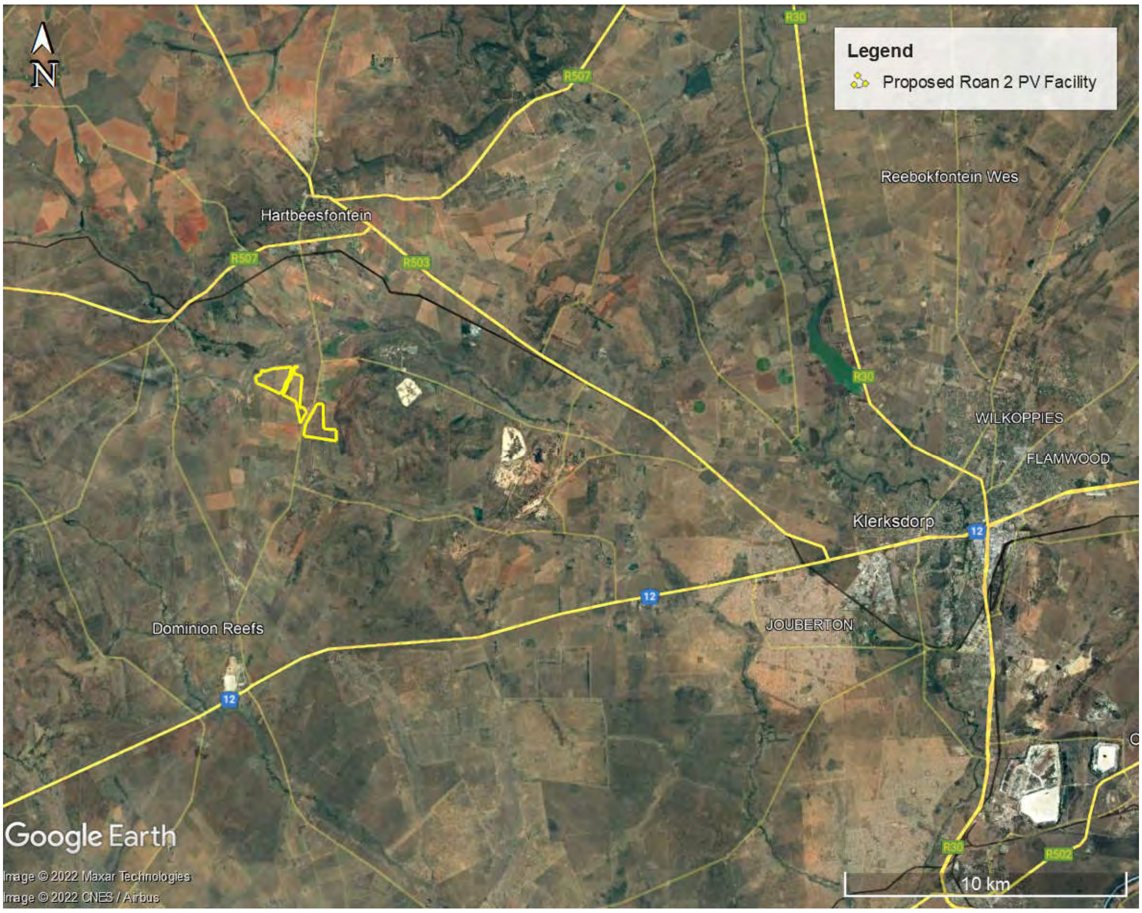

Figure 3-1: Aerial View of the Proposed Roan 2 PV Facility

A development footprint of approximately 250 ha is being assessed as part of the Basic Assessment Report (BAR) and the infrastructure associated with the 100 MW facility includes:

- PV modules and mounting structures;
- Inverters and transformers;
- Cabling;
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 8m wide);
- Auxiliary buildings (33 kV switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Perimeter fencing and security infrastructure;
- Rainwater tanks;
- Temporary and permanent laydown areas;
- Facility substation; and
- Grid connection solution, including:
  - On-site facility substation
  - On-site Eskom Switching station
  - Over-head powerline (up to 132 kV) from the on-site switching station to the Existing Eskom Roan Substation

Additional associated infrastructure will also be required for the grid connection solution, including access roads, feeder bays (inclusive of line bays, busbars, bus section and protection equipment), a fibre and optical ground wire (OPGW) layout, insulation and assembly structures.

A grid connection corridor of approximately 300 m wide is being assessed to allow for the optimisation of the grid connection and associated infrastructure. The grid connection infrastructure will be developed within the 300m wide grid connection corridor, which will allow for the avoidance of identified environmental sensitivities. The grid corridor will connect the PV project to the Eskom Roan Substation. The gridline servitude, once registered, will be 31m in width.

3.2 National Route to Site for Imported Components

There are three viable options for the port of entry for imported components – the Port of Richards Bay in KwaZulu Natal (760 km from the site), the Port of Ngqura in the Eastern Cape (940 km from the site) and the Port of Saldanha in the Western Cape (1 310 km from the site).

The Port of Richards Bay is the preferred port of entry, however, the Port of Saldanha and the Port of Ngqura can be used as alternatives should the Port of Richards Bay not be available.

The preferred route from the Port of Richards Bay is shown in blue in **Figure 3-2** below. The route starts at the Port and primarily follows the R34 to Heilbron. Vehicles will head north-west on the R720 before turning west at Vredefort onto the R59. Vehicles will access the R76 at Viljoenskroon which leads to the R30 into Klerksdorp. Vehicles will head north-west on the R503 before turning off onto D842 and then D860 that are both surfaced roads that access the proposed site. To access the western-most portion of the facility, vehicles will carry on straight at the T-junction of D842 and D860 onto an unnumbered gravel road.

The alternative route from the Port of Saldanha, shown in orange in **Figure 3-2**, will follow the R45 east to Moorreesburg before taking the R46 east to Ceres. Vehicles will head east on the N1, passing Beaufort West before turning onto the N12 at Three Sisters. Vehicles will travel north-east, accessing the D860, a surfaced road, leading to the proposed site.

The alternative route from the Port of Ngqura, shown in green in **Figure 3-2**, will follow the N10 north to Cradock. Vehicles will follow the R390 and the R58 to the N1 at the Gariepdam. Vehicles will turn onto the R700 at Bloemfontein and will travel north-east, accessing the R719 at Buitfontein and the R30 near Bothaville before accessing the R503 at Klerksdorp and then the D842 and D860, that lead to the proposed site.

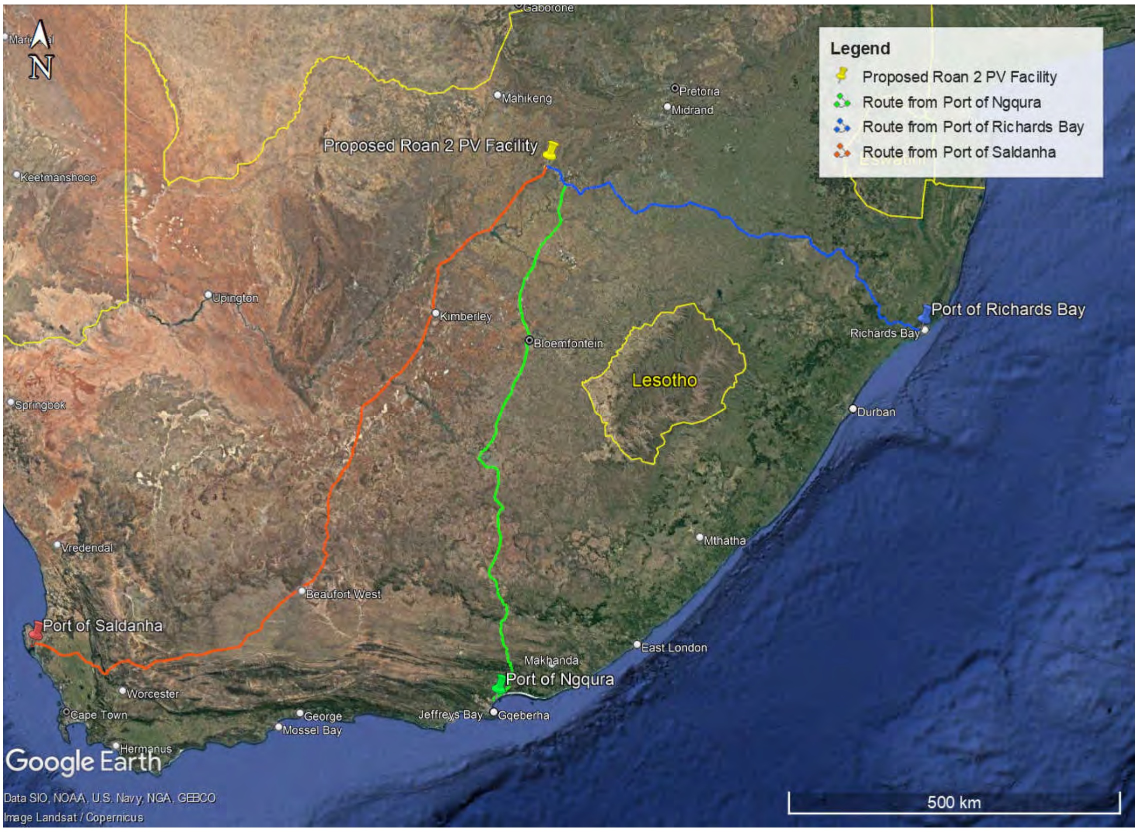

Figure 3-2: Preferred and Alternative Routes

It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred route. The preferred route should be surveyed prior to construction to identify any problem areas, e.g. intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that the delivery will occur without disruptions.

It needs to be ensured that any gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.

3.3 Route for Components manufactured locally

As mentioned in Section 1.4 (Assumptions and Limitations), it is anticipated that elements manufactured within South Africa will be transported to the site from the Cape Town, Johannesburg and Pinetown/Durban areas. It is also assumed that the transformer, which will be transported with an abnormal load vehicle, will be transported from the Johannesburg area and therefore it needs to be verified that the route from the manufacturer to the site does not have any load limitations for abnormal vehicles. At this stage, only a high-level assessment can be undertaken as no information of the exact location of the manufacturer is known and all road structures (such as bridges and culverts) need to be confirmed for their load bearing by the South African National Roads Agency (SANRAL) or the respective Roads Authority.

3.4 Route from Cape Town to Proposed Site

Components, such as PV modules, manufactured in Cape Town will be transported to site via road as shown in **Figure 3-3**. Haulage vehicles will travel from Cape Town on the N1 and the N12, passing Laingsburg, Beaufort West, Three Sisters, Kimberley, and Bloemhof.

Haulage vehicles will mainly travel on national highways and the total distance to the proposed site is approximately 1 260 km.

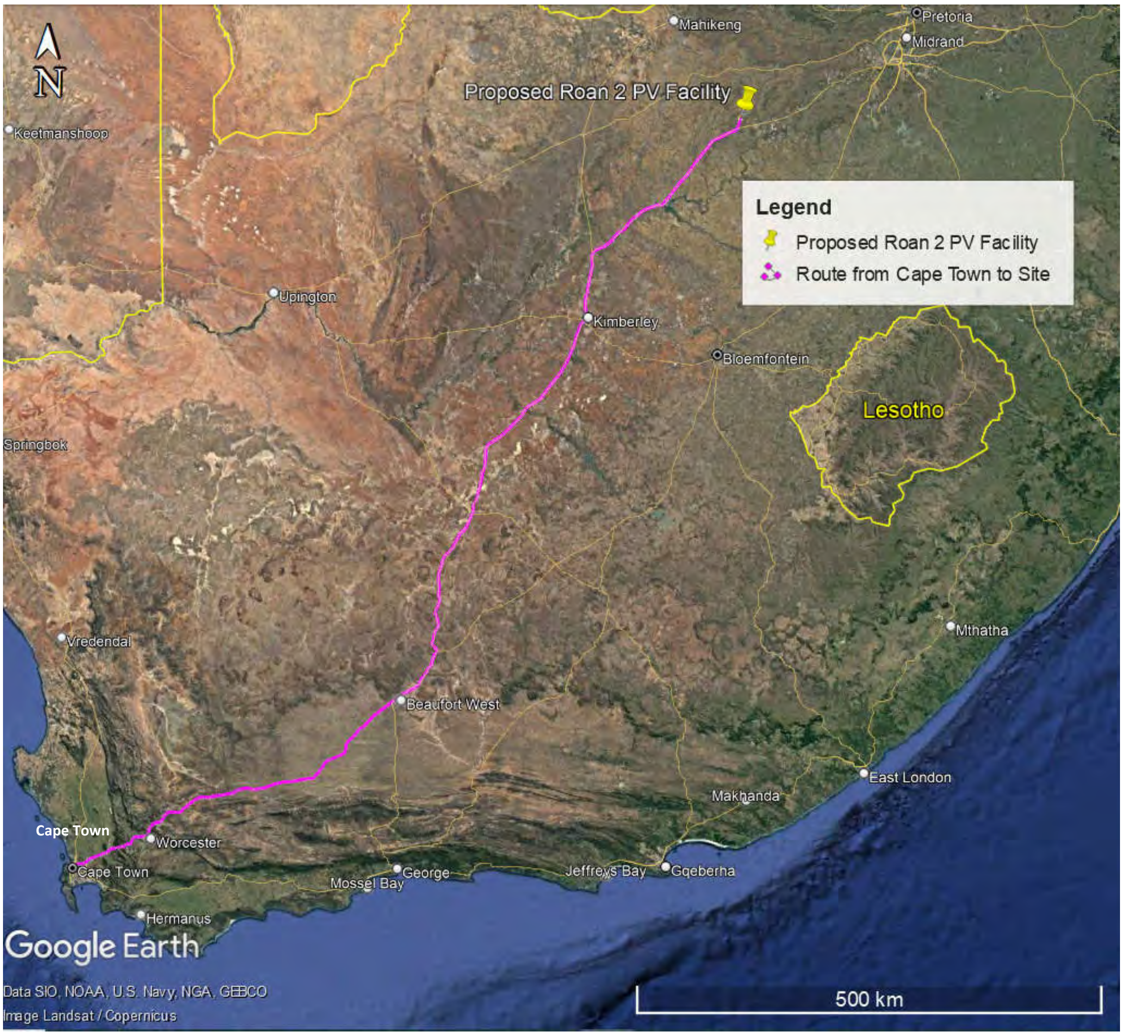

Figure 3-3: Route from Cape Town to Proposed Site

3.5 Route from Johannesburg to Proposed Site

It is assumed that the inverter and support structure will be manufactured in the Johannesburg area and transported to site via the N12 and the R503. The travel distance is around 195 km and no road limitations are expected on this route for normal loads vehicles as it will mainly follow national and provincial roads. The route is shown in **Figure** 3-4.

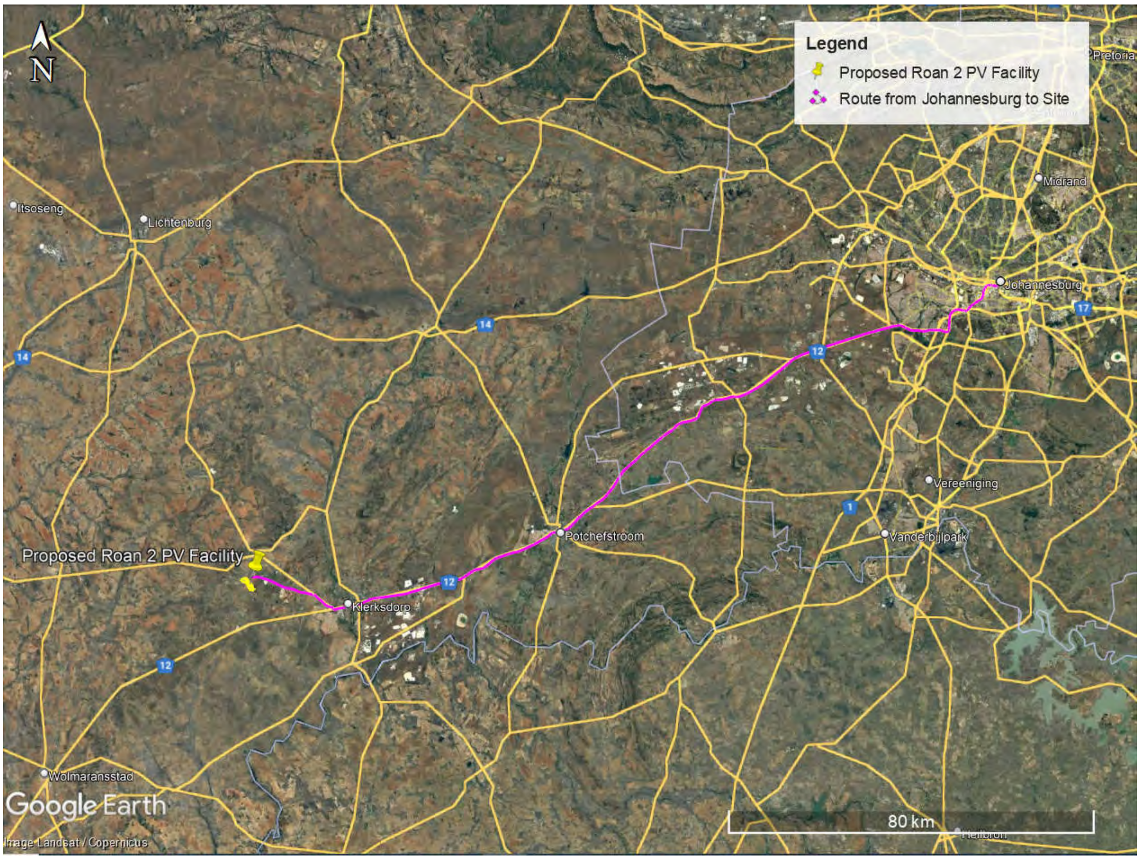

Figure 3-4: Route from Johannesburg to Proposed Site

3.6 Route from Pinetown / Durban to Proposed Site

If the PV modules are manufactured in South Africa, they could possibly be manufactured in the Pinetown area, close to Durban and transported to site via road. These elements are normal loads, and no road limitations are expected along the routes, which is shown **Figure** 3-5. Haulage vehicles will mainly travel on national and provincial roads and the total distance to the proposed site is approximately 650 km.

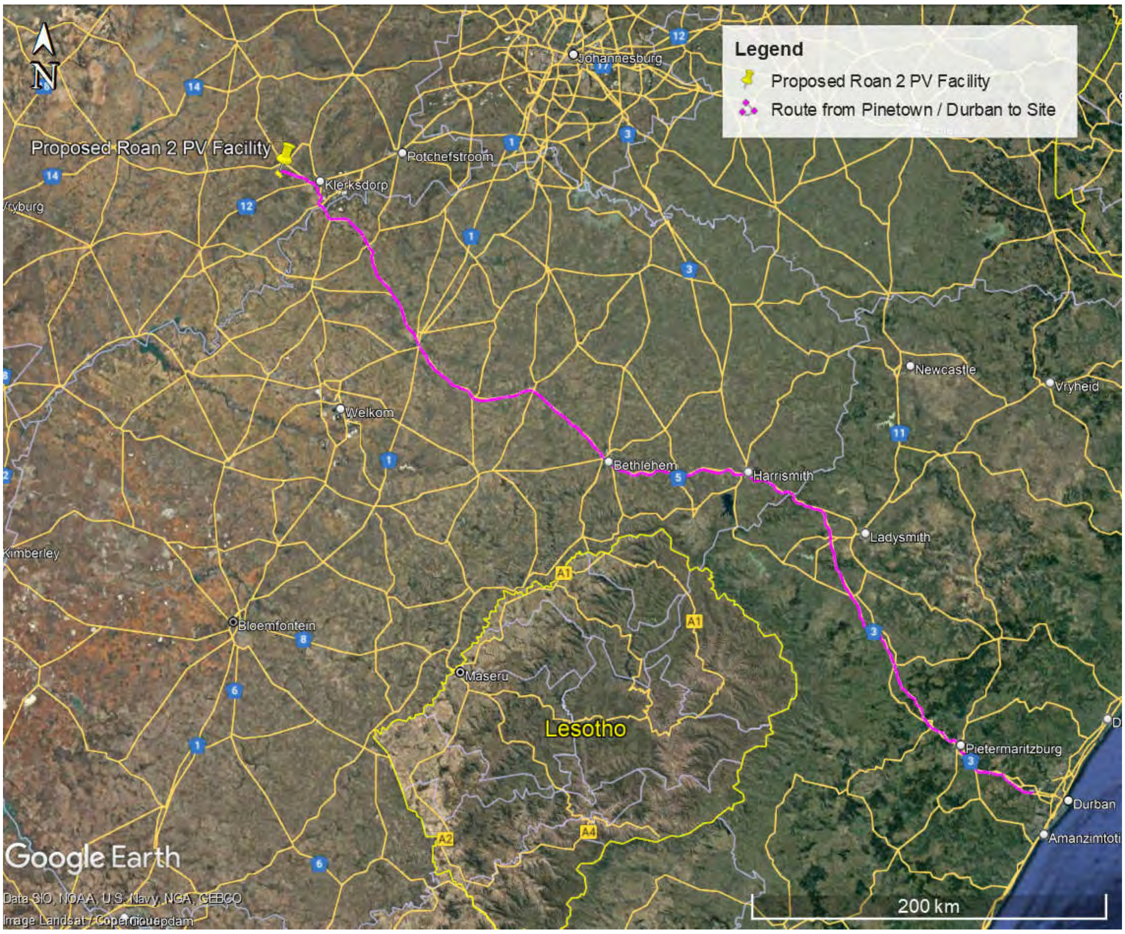

Figure 3-5: Route from Pinetown / Durban to Proposed Site

3.7 Route from Johannesburg Area to Site – Abnormal Load

It is assumed that the transformer will be manufactured locally in South Africa and be transported from the Johannesburg area to site. As the transformer will be transported with an abnormal load vehicle, the route planning needs a more detailed investigation of the feasible routes considering any limitations due to existing road features. Furthermore, a load of abnormal dimensions may cause an obstruction and danger to other traffic and therefore the transformer needs to be transported as far as possible on roads that are wide enough for general traffic to pass. It is expected that the transformer can be transported to site via the same route used for normal loads.

There are several bridges and culverts along this route, which need to be confirmed for load bearing and height clearances. There are several turns along the way and small towns to pass through. According to the desktop study, all turning movements along the route are manageable for the abnormal vehicle.

However, there are many alternative routes which can be investigated if the above route or sections of the route should not be feasible.

3.8 Proposed main access road and access point to the Proposed Development

The main access points for the site will be obtained via the D860 surfaced road (shown in blue in **Figure** 3-6) located between the R507 in the north, and the N12 in the south. An internal site road network will also be required to provide access to the solar field and associated infrastructure.

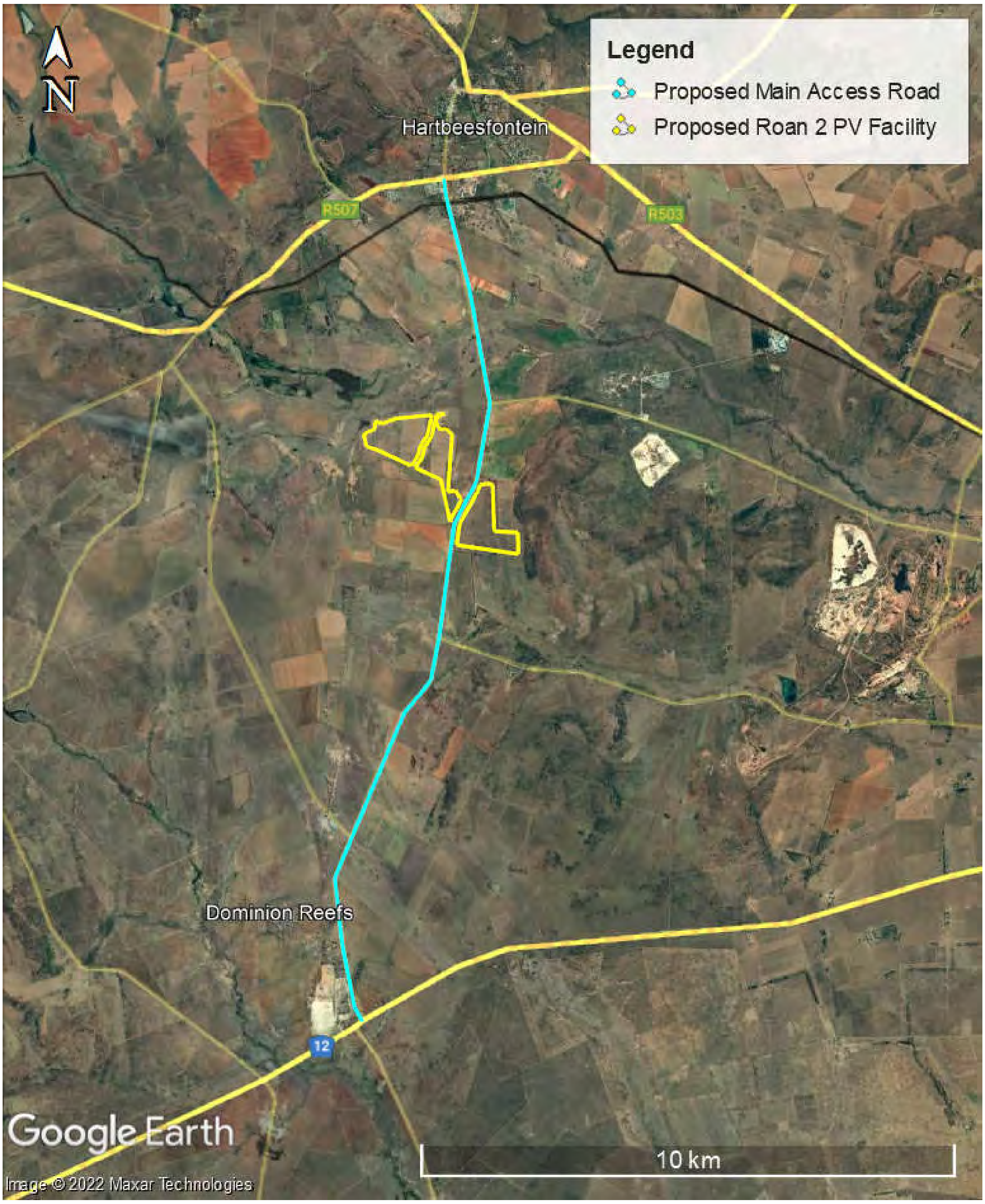

Figure 3-6: Proposed Main Access Road

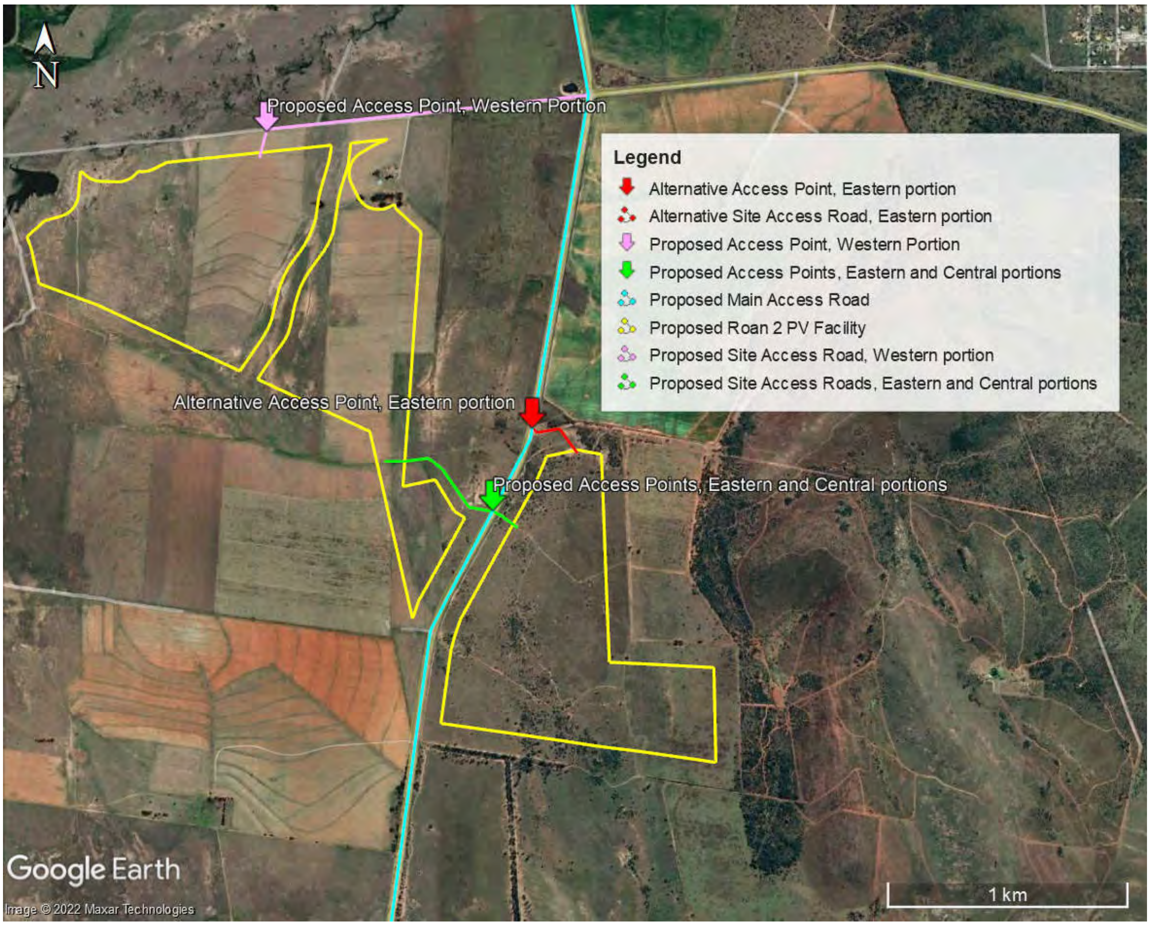

Figure 3-7: Proposed Site Access Roads and Access Points

The proposed access points, as shown in **Figure 3-7**, will need to be upgraded to cater for construction and abnormal load vehicles. Generally, the road width at the access point needs to be a minimum of 8 m. The radius at the access point needs to be large enough to allow for all construction vehicles to turn safely. It is recommended that the access point be surfaced and the internal access roads on site remain gravel.

An alternative site access road and access point was considered for the eastern portion (shown in red in **Figure 3-7**). However, this option is less ideal as the proposed access is skew on the main access road (shown in blue) which might cause reduction in the visibility of oncoming traffic.

The type of access control will determine the required stacking distance. The stacking distance is measured between the access boom and the kerb/road edge of the external road. For example, for a boom-controlled access, this boom will need to be moved sufficiently into the site to allow for at least one abnormal vehicle to stack in front of the boom without impeding on external traffic. It is recommended that the site access be controlled via a boom and gatehouse. It is also recommended that security staff be stationed on site at the access booms during construction. A minimum stacking distance of 25 m should be provided between the road edge of the external road and the boom.

Any geometric design constraints should be taken into consideration by the geometric designer. The internal roads need to be designed with smooth, relatively flat gradients (recommended to be no more than 8%). It should be noted that turning radii of all roads must conform to the specifications needed for the abnormal load vehicles and haulage vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain camber of between 3% and 4% (to facilitate drainage) and regular maintenance blading will also be required. The geometric design of these gravel roads needs to be confirmed at detailed design stage.

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

The nearest towns in relation to the proposed development site are Hartbeesfontein, Klerksdorp, Orkney, Stilfontein, Viljoenskroon and Potchefstroom. It is envisaged that most materials, water, plant, services and people will be procured within a 70 km radius of the proposed facility.

Concrete batch plants and quarries in the vicinity could be contracted, where reasonable and feasible, to supply materials and concrete during the construction phase, which would reduce the impact on traffic on the surrounding road network. Alternatively, mobile concrete batch plants and 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.

4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

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

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

5 IDENTIFICATION OF KEY ISSUES

5.1 Identification of Potential Impacts

The potential transport related impacts are described below.

5.1.1 Construction Phase

Potential impact

- Construction related traffic
- The construction traffic would also lead to noise and dust pollution.
- This phase also includes, in addition to the PV facility, the construction of access roads, feeder bays (inclusive of line bays, busbars, bus-section and protection equipment), a fibre and optical ground wire (OPGW) layout, insulation and assembly structures and other ancillary construction works that will temporarily generate the most traffic.

5.1.2 Operational Phase

During operation, it is expected that staff and security will periodically visit the facility. It is assumed that approximately 20 full-time employees will be stationed on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.

5.1.3 Cumulative Impacts

- Traffic congestion/delays on the surrounding road network.
- Noise and dust pollution

6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Potential Impact (Construction Phase)

6.1.1 Nature of the impact

- Potential traffic congestion and delays on the surrounding road network and associated noise and dust pollution.

6.1.2 Significance of impact without mitigation measures

- Traffic generated by the construction of the facility will have a significant impact on the surrounding road network. The exact number of trips generated during construction will be determined by the contractor, the haulage company transporting the components to site, the staff requirements and where equipment is sourced from.

6.1.3 Trip Generation – Construction Phase

From experience on other projects of similar nature, the number of heavy vehicles per 7 MW installation is estimated to range between 200 and 300 trips depending on the site conditions and requirements. For the 100 MW, the total trips can therefore be estimated to be between 2 858 and 4 286 heavy vehicle trips, which will generally be made over an 18-month construction period. Choosing the worst-case scenario of 4 286 heavy vehicles over an 18-month period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 11. In a rural environment, traffic during the peak hour accounts for roughly 20-40% of the average daily traffic i.e. 20-40% of the daily 11 vehicle trips generated by the facility will travel during the peak hour. This amounts to between 3 and 5 trips.

If the modules are imported instead of manufactured within South Africa, the respective shipping company will be able to indicate how the panels can be packed (for example using 2 MW packages and 40 ft containers). These can be stored at the port and repacked onto flatbed trucks.

It is assumed that during the peak of the construction period, 400 employees will be active on site. Staff trips are assumed to be:

Table 6-1: Estimation of daily staff trips

Vehicle Type	Number of vehicles	Number of Employees
Car	20	30 (assuming 1.5 occupants)
Bakkie	40	60 (assuming 1.5 occupants)
Taxi – 15 seats	10	150
Bus – 80 seats	2	160
Total	**72**	**400**

It is difficult to accurately estimate the construction traffic for the transportation of materials as it depends on the type of vehicles, tempo of the construction, source/location of construction material etc. However, it is assumed that at the peak of construction, approximately 150 construction vehicle trips will access the site per day.

The total estimated daily site trips are shown in the table below.

Table 6-2: Estimation of daily site trips

Activity	Number of trips
Staff trips	72
Component delivery	17
Construction trips	150
Total	**239**

The impact on general traffic on the surrounding road network is therefore deemed nominal as the 239 trips will be distributed across a 9 hr working day. The majority of the trips will occur outside the peak hours.

The significance of the transport impact without mitigation measures during the construction phase can be rated as medium. However, considering that this is temporary and short term in nature, the impact can be mitigated to an acceptable level.

6.1.4 Trip Generation – Operational Phase

During operation, it is assumed that approximately 20 full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network.

The developer is investigating the use of borehole water for the cleaning of the PV panels. Should borehole water not be available or suitable, the following assumptions have been made to estimate the resulting trips generated from transporting water to the site:

- 5 000 litre water bowsers to be used for transporting the water.
- Approximately 5 litres of water needed per module.
- Assuming that 174 360 solar modules are used, this would amount to approximately 175 vehicle trips to clean all the panels.
- Cleaning of modules will occur over a few days.
- Modules will be cleaned a maximum of four times a year.

It is expected that these trips will not have a significant impact on external traffic. However, to limit the impact, it is recommended to schedule these trips outside of peak traffic periods and to arrange for the cleaning of panels to occur over a few days e.g. should modules be cleaned over a period of two weeks, vehicle trips to the facility will amount to less than 20 trips per day. These trips can be accommodated by the existing road network without impacting the existing capacity. Additionally, the provision of rainwater tanks on site would decrease the number of trips required to haul water to the site.

6.1.5 Proposed general mitigation measures

The following are general mitigation measures to reduce the impact that the additional traffic will have on the road network and the environment.

- 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 (including internal roads and any gravel roads off the N12, R503 and R507 used for project purposes) during the construction phase, as required.
- Regular maintenance of gravel roads (including internal roads and any gravel roads off the N12, R503 and R507 used for project purposes) by the Contractor during the construction phase and by the Owner/Facility Manager during the operation phase.
- The use of mobile batch plants and quarries near the site would decrease the traffic impact on the surrounding road network, where available and feasible.
- If required, low hanging overhead lines (lower than 5.1 m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved by the haulage company to accommodate the abnormal load vehicles. The Developer is to notify the Contractor and the haulage company of this requirement. The haulage company is to provide evidence of completed work.
- 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 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 any gravel sections of the haulage routes (including internal roads and any gravel roads off the N12, R503 and R507 used for project purposes) remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.
- The Developer is to notify the Contractor and the haulage company of this requirement.
- Design and maintenance of internal roads. The internal gravel roads will require grading with a grader to obtain a camber of between 3% and 4% (to facilitate drainage) and regular maintenance blading will also be required. The geometric

design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional.

- Staff and general trips should occur outside of peak traffic periods as far as possible during both the construction and operational phases.
- Cleaning of modules during the operational phase could occur over a few days and should take place outside of peak traffic periods. Additionally, the provision of rainwater tanks on site should be considered to decrease the number of trips required to deliver water to the site for the cleaning of the panels.

6.1.6 Significance of impact with mitigation measures

The proposed mitigation measures for the construction traffic will result in a minor reduction of the impact on the surrounding road network, but the impact on the local traffic will remain moderate as the existing traffic volumes are deemed to be low. The dust suppression, however, will result in significantly reducing the impact.

The proposed mitigation measures for the operational traffic will result in a very low impact on the existing traffic on the surrounding road network.

7 NO-GO ALTERNATIVE

The no-go alternative implies that the proposed Roan 2 PV Facility does not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network.

The site is currently zoned for agricultural land use. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist. **Hence, the no-go alternative is not a preferred alternative.**

8 IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in the tables below. The assessment methodology is attached as **Annexure A**.

Table 8-1: Impact Rating - Construction Phase – Traffic Congestion

Environmental Parameter	Traffic Congestion and the associated dust and noise pollution	
Nature of the impact:	Transport of equipment, material and staff to site will lead to congestion.	
	Without Mitigation	**Post Mitigation**
Geographical extent (E):	Local (2)	Local (2)
Probability (P):	Definite (4)	Probable (3)
Reversibility (R):	Completely Reversible (1)	Completely Reversible (1)
Irreplaceable loss of resources (I):	No loss (1)	No loss (1)
Duration (D):	Short Term (1)	Short Term (1)
Cumulative effect (C):	High cumulative impact (4)	High cumulative impact (4)
Intensity / Magnitude (M):	High (3)	Medium (2)
***Significance (S):**	**Negative medium impact (39)**	**Negative low impact (24)**
	*** calculated as S =(E+P+R+I+D+C)*M**	
Level of residual risk:	Low. Traffic will return to normal levels after construction is completed.	
Mitigation Measures	• Stagger component delivery to site • Reduce the construction period • The use of mobile batch plants and quarries in close proximity to the site • Staff and general trips should occur outside of peak traffic periods. • Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.	

Table 8-2: Impact Rating - Operation Phase

IMPACT TABLE – OPERATION PHASE
The traffic generated during this phase will be negligible and will not have any impact on the surrounding road network.

Table 8-3: Impact Rating - Decommissioning Phase

IMPACT TABLE – DECOMMISSIONING PHASE
This phase will have the same impact as the Construction Phase i.e. traffic congestion, air pollution and noise pollution, as similar trips/movements are expected.

9 CUMULATIVE IMPACTS

To assess the cumulative impact, it was assumed that all proposed and authorized renewable energy projects within 30 km be constructed at the same time. This is a precautionary approach, as in reality these projects would be subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom, and construction is likely to be staggered depending on project-specific issues.

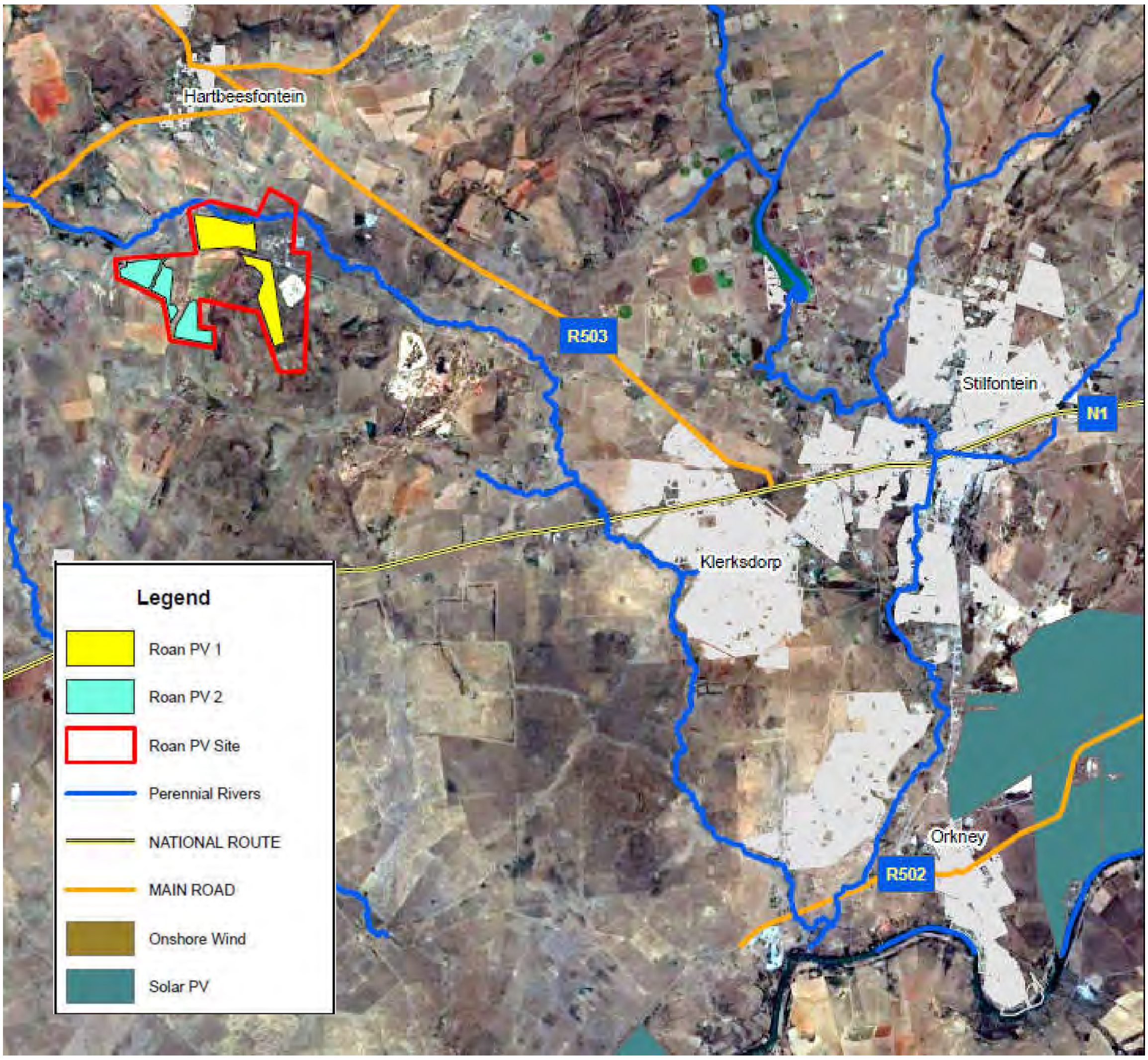

Figure 9-1: Other renewable energy projects within a 30km radius from site

According to the Department of Forestry, Fisheries and Environment's database there are two (2) authorised PV facilities within a 30km radius of the proposed study area, as indicated in **Figure 9-1** above.

It is however unclear whether other projects not related to renewable energy is or has been constructed in this area, and whether other projects are proposed. In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm development may take place within the general area.

9.1 Assessment of cumulative impacts

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

Even if all renewable energy projects within the area are constructed at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

The assessments of cumulative impacts are collated in the table below.

Table 9-1: Cumulative Impact

Environmental Parameter	Traffic Congestion and the associated dust and noise pollution	
Nature of the impact:	Transport of equipment, material and staff to site will lead to congestion.	
	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area**
Geographical extent (E):	Local (2)	Provincial (3)
Probability (P):	Probable (3)	Probable (3)
Reversibility (R):	Completely Reversible (1)	Partly Reversible (2)
Irreplaceable loss of resources (I):	No loss (1)	No loss (1)
Duration (D):	Short Term (1)	Medium term (2)
Cumulative effect (C):	High cumulative impact (4)	High cumulative impact (4)
Intensity / Magnitude (M):	Medium (2)	High (3)
***Significance (S):**	**Negative low impact (24)**	**Negative medium impact (45)**
	*** calculated as S =(E+P+R+I+D+C)*M**	
Level of residual risk:	Low. Traffic will return to normal levels after construction is completed.	
Mitigation Measures	• Stagger component delivery to site • Reduce the construction period • The use of mobile batch plants and quarries in close proximity to the site • Staff and general trips should occur outside of peak traffic periods. • Regular maintenance of roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.	

10 ENVIRONMENTAL MANAGEMENT PROGRAM INPUTS

It is recommended that dust suppression and maintenance of gravel roads form part of the EMPr. This would be required during the Construction phase where an increase in vehicle trips can be expected. No traffic related mitigation measures are envisaged during the Operation phase due to the negligible traffic volume generated during this phase.

Table 10-1: EMPr Input – Construction Phase

Impact	**Mitigation/Management Objectives**	**Mitigation/Management Actions**	**Monitoring**		
			Methodology	***Frequency***	***Responsibility***
A. CONSTRUCTION PHASE					
A.1. TRAFFIC IMPACTS					
Dust and noise pollution Transportation of material, components, equipment and staff to site.	Minimize impacts on road network.	▪ Stagger component delivery to site. ▪ The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network, where available and feasible. ▪ Dust suppression ▪ Reduce the construction period as far as possible. ▪ Maintenance of gravel roads (internal roads and	▪ Regular monitoring of road surface quality. ▪ Apply for required permits prior to commencement of construction.	▪ Before construction commences and regularly during construction phase.	▪ Holder of the EA.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		any gravel roads off the N12, R503 and R507 used for project purposes). ▪ Apply for abnormal load permits prior to commencement of delivery via abnormal loads. ▪ Haulage company to assess the preferred route and undertake a 'dry run' to test. The Developer is to notify the haulage company (and the Contractor) of this requirement. ▪ Staff and general trips should occur outside of peak traffic periods as far as possible. ▪ Any low hanging overhead lines (lower than 5.1m) e.g. Eskom			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		and Telkom lines, along the proposed routes will have to be moved by the haulage company to accommodate the abnormal load vehicles, if required. The Developer to notify the haulage company and Contractor of this requirement. The haulage company is to provide evidence of completed work.			

11 CONCLUSION AND RECOMMENDATIONS

The potential transport related impacts for the construction and operation phases for the proposed Roan 2 PV Facility were assessed.

- The construction phase traffic, although significant, will be temporary and impacts are considered to have a low significance after mitigation measures are implemented.
- During operation, it is expected that staff and security will periodically visit the facility. It is assumed that approximately 20 full-time employees will be stationed on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.

The potential mitigation measures mentioned in the construction phase are:

- Dust suppression
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants 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.
- A "dry run" of the preferred route.
- Design and maintenance of internal roads.
- If required, any low hanging overhead lines (lower than 5.1 m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e. the impact of the traffic on the surrounding road network is temporary and a solar facility, when operational, does not add any significant traffic to the road network.

Both the proposed access point and the access road to the facility are deemed feasible from a traffic engineering perspective.

The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to.

The impacts associated with the proposed Roan 2 PV Facility are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

12 REFERENCES

- Google Earth Pro
- SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa
- Road Traffic Act (Act No. 93 of 1996)
- National Road Traffic Regulations, 2000
- 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

13 ANNEXURES

Annexure A – ASSESSMENT METHODOLOGY

METHOD OF ENVIRONMENTAL ASSESSMENT

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed. Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 13-1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 13-1: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.
The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

Annexure B – SPECIALIST EXPERTISE

IRIS SIGRID WINK

Profession	Civil Engineer (Traffic & Transportation)
Position in Firm	Associate
Area of Specialisation	Manager: Traffic & Transportation Engineering
Qualifications	PrEng, MSc Eng (Civil & Transportation)
Years of Experience	20 Years
Years with Firm	10 Years

SUMMARY OF EXPERIENCE

Iris is a Professional Engineer registered with ECSA (20110156). She joined JG Afrika (Pty) Ltd. in 2012. Iris obtained a Master of Science degree in Civil Engineering in Germany and has more than 20 years of experience in a wide field of traffic and transport engineering projects. Iris left Germany in 2003 and has worked as a traffic and transport engineer in South Africa and Germany. She has technical and professional skills in traffic impact studies, public transport planning, non-motorised transport planning and design, design and development of transport systems, project planning and implementation for residential, commercial and industrial projects and providing conceptual designs for the abovementioned. She has also been involved with transport assessments for renewable energy projects and traffic safety audits.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

PrEng - Registered with the Engineering Council of South Africa No. 20110156
Registered Mentor with ECSA for the Cape Town Office of JG Afrika
MSAICE - Member of the South African Institution of Civil Engineers
ITSSA - Member of ITS SA (Intelligent Transport Systems South Africa)
SAWEA - Member of the South African Wind Energy Association
SARF - South African Road Federation: Committee Member of Council
IRF - Global Road Safety Audit Team Leader

EDUCATION

1996 - Matric – Matric (Abitur) – Carl Friedrich Gauss Schule, Hemmingen, Germany
1998 - Diploma as Draughtsperson – Lower Saxonian State Office for Road and Bridge Engineering
2003 - MSc Eng (Civil and Transportation) – Leibniz Technical University of Hanover, Germany

SPECIFIC EXPERIENCE (Selection)

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)
2016 – Date
Position – Associate

- **Kudusberg Windfarm** – Transport study for the proposed Kudusberg Windfarm near Sutherland, Northern Cape – Client: G7 Renewable Energies

- **Kuruman Windfarm –** Transport study for the proposed Kuruman Windfarm in Kuruman, Northern Cape – Client: Mulilo Renewable Project Developments
- **Coega West Windfarm** – Transportation and Traffic Management Plan for the proposed Coega Windfarm in Coega, Port Elizabeth – Client: Electrawinds Coega
- **Traffic and Parking Audits** for the Suburb of Groenvallei in Cape Town – Client: City of Cape Town Department of Property Management.
- **Road Safety Audit** for the Upgrade of N1 Section 4 Monument River – Client: Aurecon on behalf of SANRAL
- **Sonop Windfarm** – Traffic Impact Assessment for the proposed Sonop Windfarm, Coega, Port Elizabeth – Client: Founders Engineering
- **Universal Windfarm** - Traffic Impact Assessment for the proposed Universal Windfarm, Coega, Port Elizabeth – Client: Founders Engineering
- **Road Safety Audit** for the Upgrade of N2 Section 8 Knysna to Wittedrift – Client: SMEC on behalf of SANRAL
- **Road Safety Audit** for the Upgrade of N1 Section 16 Zandkraal to Winburg South – Client: SMEC on behalf of SANRAL
- **Traffic and Road Safety Studies** for the Improvement of N7 Section 2 and Section 3 (Rooidraai and Piekenierskloof Pass) – Client: SANRAL
- **Road Safety Appraisal**s for Northern Region of Cape Town – Client: Aurecon on behalf of City of Cape Town (TCT)
- **Traffic Engineering Services** for the Enkanini Informal Settlement, Kayamandi - Client: Stellenbosch Municipality
- **Lead Traffic Engineer** for the Upgrade of a 150km Section of the National Route N2 from Kangela to Pongola in KwaZulu-Natal, Client: SANRAL
- **Traffic Engineering Services** for the Kosovo Informal Settlement (which is part of the Southern Corridor Upgrade Programme), Client: Western Cape Government
- **Traffic and Road Safety Studies** for the proposed Kosovo Informal Housing Development (part of the Southern Corridor Upgrade Program), Client: Western Cape Government.
- **Road Safety Audit** Stage 3 – Upgrade of the R573 Section 2 between Mpumalanga/Gauteng and Mpumalanga/Limpopo, Client: AECOM on behalf of SANRAL
- **Road Safety Audit** Stage 1 and 3 – Upgrade of the N2 Section 5 between Lizmore and Heidelberg, Client: Aurecon on behalf of SANRAL
- **Traffic Safety Studies** for Roads Upgrades in Cofimvaba, Eastern Cape – Client: Cofimvaba Municipality
- **Road Safety Audit** Stage 1 and 3 – Improvement of Intersections between Olifantshoek and Kathu, Northern Cape, Client: Nadeson/Gibb on behalf of SANRAL
- **Road Safety Audit** Stage 3 – Upgrade of the Beacon Way Intersection on the N2 at Plettenberg Bay, Client: AECOM on behalf of SANRAL

- **Traffic Impact Assessment** for a proposed Primary School at Die Bos in Strand, Somerset West, Client: Edifice Consulting Engineers
- **Road Safety Audit** Stage 1 and 3 – Improvement of R75 between Port Elizabeth and Uitenhage, Eastern Cape, Client: SMEC on behalf of SANRAL