TRAFFIC IMPACT ASSESSMENT FOR THE

UPGRADING & DEVELOPMENT OF AN ACCESS ROAD FROM THE N10/'BURGERVILLE' DISTRICT ROAD (2448) TURN-OFF TO THE MAIN TRANSMISSION SUBSTATION (MTS) AS WELL AS THE CONSTRUCTION OF A LOOP-IN LOOP-OUT FROM THE MTS TO THE 400 KV HYDRA-POSEIDON TX OVERHEAD LINE (LINE 1), AND OTHER PROJECTS ON THE SUN CENTRAL CLUSTER 1 (300 MW) SOLAR PV FOOTPRINT BETWEEN DE AAR AND HANOVER, NORTHERN CAPE PROVINCE

Project No.: STUR0375

FINAL REPORT
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Upgrading & Development of an Access Road from the N10/'Burgerville' District Road (2448) Turn-Off to the Main Transmission Substation (MTS) as well as the construction of a Loop-in Loop-out from the MTS to the 400 kV Hydra-Poseidon Tx overhead line (Line 1), and other projects on the Sun Central Cluster 1 (300 MW) Solar PV footprint between De Aar and Hanover, Northern Cape Province</td></tr>
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This report assesses the key transportation issues pertaining to the Upgrading and Development of an Access Road from the N10/Burgerville District Road intersection and the construction of associated electrical infrastructure on several portions of farms in the Hanover District in the Northern Cape Province. the</td></tr>
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DECLARATION OF INDEPENDENCE

This report was compiled by Mrs Annebet Krige and Mrs Lize Neethling of Sturgeon Consulting, both who hereby declare that they acted as independent consultants and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which we were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of our performing such work. The CV of the lead author that performed the core duties are contained in Annexure A.

Annebet Krige, Pr Eng

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TIA – Traffic Impact Assessment
TIS – Traffic Impact Statement
COTO – Committee of Transport Officials
AMP – Access Management Plan
RCAM - Road Classification and Access Management Manual
LOS – Level of Service
AM – Morning
PM – Afternoon
EIA – Environmental Impact Assessment
BAR – Basic Assessment Report
PV – Photovoltaic
MW – Megawatt
REDZ – Renewable Energy Development Zone
SEF – Solar Energy Facility
MTS – Main Transmission Substation
CLN – Customer Load Network
NLTA - National Land Transport Act 5 of 2009
COTO – South African Committee of Transport Officials
EIA – Environmental Impact Assessment
WCG – Western Cape Government
SANRAL – South African National Road Agency Limited
NMT – Non-Motorised Transport
vph – Vehicles per Hour

vpd – Vehicles per day
ADT – Average Daily Traffic
AADT – Annual Average Daily Traffic
MR – Proclaimed Main Road
DR – Proclaimed District Road
OP – Proclaimed Minor Road

1. INTRODUCTION

1.1 APPOINTMENT AND BACKGROUND

Sturgeon Consulting (Pty) Ltd was appointed by Ecoleges Environmental Consultants on behalf of SolarAfrica Energy (Pty) Ltd to conduct an Traffic Impact Assessment (TIA) for the Upgrading & Development of an Access Road from the N10/'Burgerville' District Road (2448) Turn-Off to the Main Transmission Substation (MTS) as well as the construction of a Loop-in Loop-out from the MTS to the 400 kV Hydra-Poseidon Tx overhead line (Line 1), and other projects on the Sun Central Cluster 1 (300 MW) Solar PV footprint between De Aar and Hanover, Northern Cape Province.

A previous TIA for the "Proposed development of a 225MW Solar PV Facility on Several Portions of Farms in the Hanover District, Emthanjeni Local Municipality, Northern Cape Province" was submitted in 2017 by Element Consulting Engineers as part of the Environmental Impact Assessment process and subsequently approved.

1.2 PROJECT DESCRIPTION

Eskom has agreed to the construction of a Main Transmission Substation (MTS) to deliver electricity to the Eskom system, specifically the existing 400 kV Hydra-Poseidon overhead transmission line (Line 2 initially and possibly even Line 1 in future) via a new Loop-In, Loop-Out 400 kV electricity transmission line. Eskom has dictated that the MTS be designed for up to 2 GW capacity, so that it has the capacity to receive electricity generated by the applicant's (Solar Africa Energy (Pty) Ltd) 300 MW Solar PV facility (Sun Central Cluster 1) and any future electricity generation facilities that would apply to feed into the grid at the same location.

The 2 GW MTS includes inter alia sufficient feeder bays for up to four (4) 500 MVA transformers. Each transformer must be transported on a 270 tonne, 40 m to 60 m-long truck and trailer combination. Given the weight and length of the trailer delivering the abnormal loads to site (e.g., the turning circle will be a minimum of 24m) the access road must meet the minimum Eskom specifications to ensure the safe delivery of equipment to site during construction and during future maintenance and operations, if ever required.

1.3 LOCALITY

The affected farm portions are located to the north-east of the N10, approximately 28km north-west from Hanover and 35km south-east from De Aar.

Please refer to **Figure 1** for the Locality Plan.

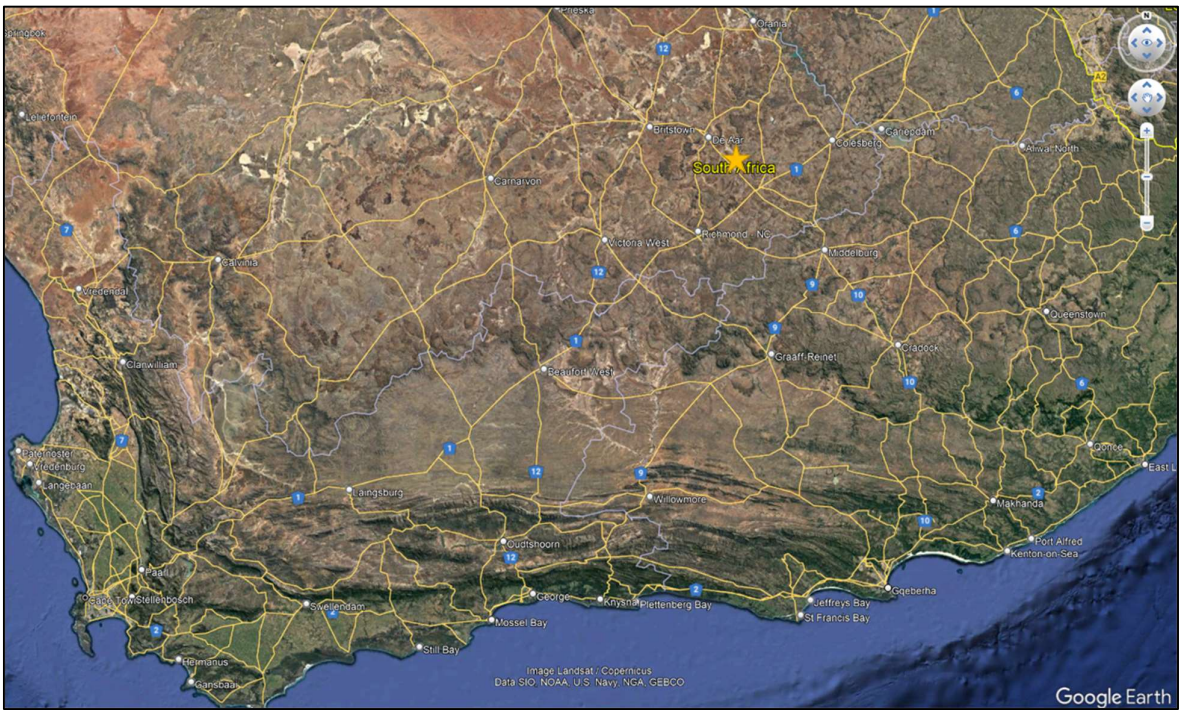

Figure 1: Locality Plan

The section of public 'Burgerville' District Road (2448) that needs to be upgraded extends from its intersection with the N10 (point number 1 indicated in **Figure 2)**, through the Remainder of Farm Blaauwbosch Kuilen Outspan No. 37, the Remainder of Farm Barends Kuilen No. 38, and ends at the boundary of Farm Riet Fountain No. 39C as indicated in **Figure 2**, point number 2.

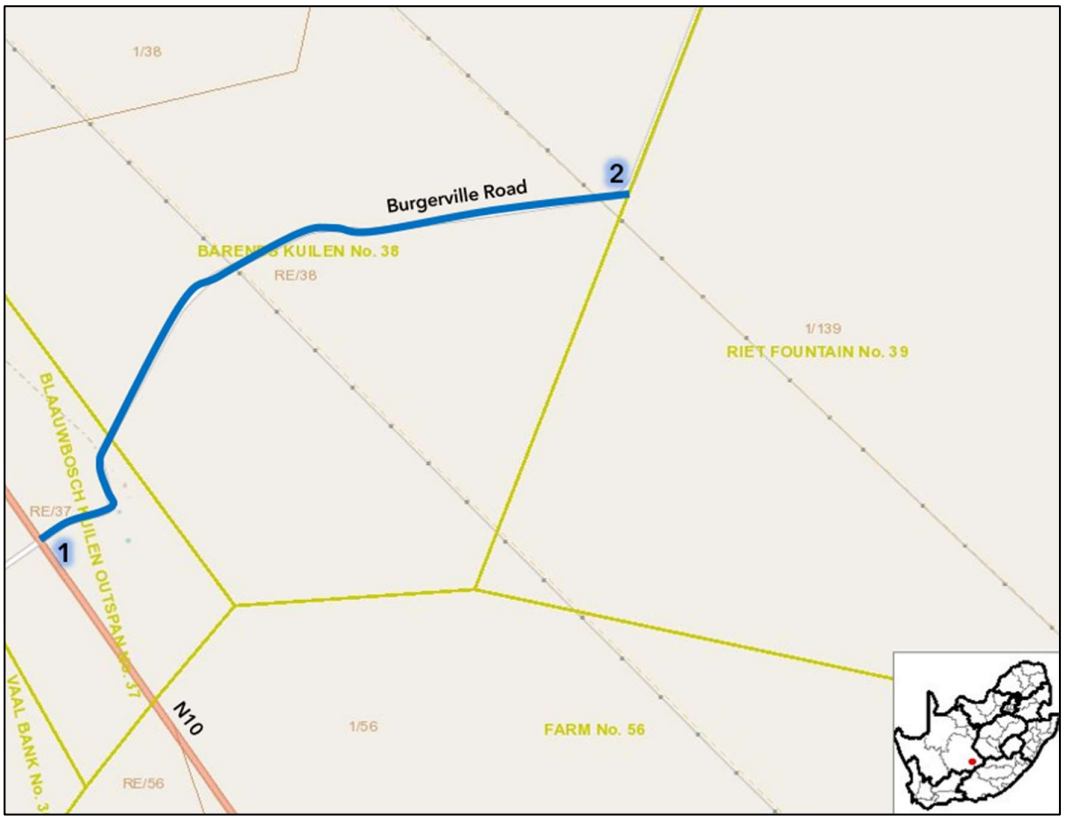

Figure 2: Map of Affected Areas

1.4 SCOPE OF WORKS

This TIA will investigate the transportation implications associated with the abnormal load vehicles transporting components to the site and the transportation of construction materials, equipment and workers to the site during the construction, operational and decommissioning phases.

1.5 METHODOLODY

The broad methodology adopted for this specialist study is as follows:

- Literature review and internet research
- Traffic data collection (Traffic volumes along the N10 provided by SANRAL)
- Data analysis
- Evaluation of initial proposed access configurations
- Liaison with client and/or project team
- Fine tune analysis
- Preparation of report and figures

1.6 LEGISLATION WITH REGARDS TO TRAFFIC STUDIES

A TIA is required to determine what impact a new development's traffic will have on the existing road network and whether or not this development can be

accommodated by the existing transport system. The purpose of a TIA is to support sustainable development by protecting the overall integrity of the transport system for the benefit of all users.

The *South African Committee of Transport Officials (COTO), TMH16 Manual, Volume 1*, states that in terms of the manual, a TIA must be undertaken when "An application is submitted for a change in land use, and the highest total of additional hourly vehicular trip generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour".

From the *TMH16*, the Constitution of the Republic of South Africa empowers a Municipality to govern, on its own initiative, the local government affairs of its community, subject to national and provincial legislation. According to the constitution, the Municipality has executive authority in respect of, and has the right to administer, inter alia, the local government matters listed in Part B of Schedule 4 and Part B of Schedule 5, which includes municipal roads. The Municipality also has the right to exercise any power concerning a matter reasonably necessary for, or incidental to, the effective performance of its functions.

In terms of Section 152(1) of the Constitution, the objects of local government include, inter alia, to ensure provision of services to communities in a sustainable manner and to promote social and economic development. Section 153 emphasises that in its budgeting and planning processes, the Municipality must give priority to the basic needs of the community and to promote social and economic development of the community.

Municipal development planning in South Africa is regulated by the *Municipal Systems Act (Act No 32 of 2000)*. This act requires the preparation and adoption of Integrated Development Plans (IDPs) to guide and regulate all planning and development in the Municipality. The *National Land Transport Act NLTA (Act No 5 of 2009)* requires the integration of land transport planning with the land development process and the preparation of integrated transport plans which constitutes the transport component of the integrated development plans of municipalities. These integrated transport plans include the regulation and provision of transport infrastructure for all modes of transport. According to the National Land Transport Act, property developments within a transport area are subject to traffic impact and transport assessments.

The *National Land Transport Act 5 of 2009 (NLTA) Section 38* does not set out any regulation as to what is required in a TIA. However, Section 38(2b) of the act states that "developments on property within the area of the planning authority are subject

to traffic impact assessments and public transport assessments as prescribed by Minister."

The *National Road Traffic Act 93 of 1996 (NRTA)* provides for road traffic matters to be applied uniformly throughout the Republic and for matters connected therewith.

1.7 STUDY PURPOSE

The primary purpose of this report is to evaluate the expected traffic impact of the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure with the main focus on access and traffic distribution during the construction phase and during the operational phase. In other words, the objective of the Traffic Impact Assessment (TIA) is to assess the impact of the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure activities on the existing external road network surrounding the development. The report identifies the access route to the site, comments on the condition of the existing roads in the site vicinity, identifies access points to the site and recommends road improvements to minimise the impact on the surrounding road network.

This TIA addresses the following traffic and transportation related implications of the proposed PV facility:

- Locality of the site for the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure;
- Existing traffic volumes on N10;
- Acceptability from a traffic safety point of view of the location of the access route to the proposed facility;
- Risk posed by construction and operational vehicles; and
- Based on existing volumes of traffic, recommendations for mitigations measures for traffic impacts where relevant.

In terms of limitation of this TIA, it should be noted that this report does not address the internal traffic circulation in detail and only an oversight will be given.

The TIA will be developed in line with the guidelines of the *Manual of Traffic Impact Studies (RR93/635)* published by the Department of Transport in 1995 and *TMH16 Volume 1 & Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual, October 2020* published by the Committee of Transport Officials (COTO).

2. PROJECT DESCRIPTION

2.1 PROJECT PHASING

The project can be divided into the following two main phases:

- Construction Phase; and
- Operational Phase.

2.1.1 Construction Phase

The construction phase will include the construction and upgrading of the N10/Burgerville Road intersection and the Burgerville Road up to the access point (approximately 5.2km) at Farm Riet Fountain No. 39C. It is anticipated that construction of the Main Transmission Substation and associated Eskom grid (network) integration infrastructure can commence once the upgrading is completed.

The main activities that will form part of the construction phase are:

- Removal of a portion of the vegetation for the proposed infrastructure;
- Establishment of a laydown area for equipment;
- Stockpiling of topsoil and cleared vegetation;
- Creation of employment opportunities and associated transport of employees to and from site;
- Transportation of material and equipment to site, and personnel to and from site;
- Construction of
    - the solar field and the 33kV collector group(s);
    - the independent power producer (IPP)/developer's 132 kV substation;
    - 132kV Eskom Distribution (Dx) switching station;
    - the 132kV overhead line to the
    - 400kV main transmission substation (MTS) and the
    - 400 kV overhead line which loop-in and loop-out (LILO) into the existing 400kV Hydra-Poseidon transmission line. The LILO into the 400kV line from the MTS will be into Line 2 and Line 1. The 132kV Dx switching station will amongst other also include the Control Room, a storeroom and the Operations and Maintenance building.
- Provisions for on-site concrete batching facilities
- Lengthening of a Loop-In, Loop-Out 400 kV electricity transmission line, provision for on-site concrete batching and additional Operational & Maintenance (O&M) facilities; and
- Maintenance and dust suppression of access roads servicing the project site.

Furthermore, it is expected that the construction equipment will include at least:

- Water tankers;

- Graders;
- Tipper trucks;
- Drilling rigs (down to 2m);
- Mobile pile ramming machines (down to 3m at the most). Each pile is 4 to 9m apart;
- Rock crushing plant;
- Excavators;
- TLBs;
- Concrete mixers;
- Compaction equipment;
- Light delivery vehicles; and
- Heavy delivery vehicles (for the transformers).

2.1.2 Operational Phase

The following activities will occur during the operational phase:

- The generation of electricity and the delivery of the energy output to Eskom at the delivery point in the 132kV Dx switching station;
- Maintenance activities of the solar field and 132kV IPP substation. Maintenance of the Eskom Dx Switching station and the 400kV MTS will be undertaken by Eskom; and
- Road maintenance that will focus on the suppression of dust on the access roads as and when required.

2.2 TRANSPORTATION REQUIREMENTS

During the project cycle, it is anticipated that the following vehicles will need to access the site:

- Building materials are to be transported by single-unit trucks within the road freight limitations of South Africa.
- Workers from the surrounding area will be transported by minibus taxi/shuttle/bus or private car.
- Transformers will be transported by abnormal load trucks for which a permit will need to be applied for in terms of Section 81 of the National Road Traffic Act and authorisation needs to be obtained from the relevant road authorities to modify the road reserve to accommodate turning movements at intersections.

3. EXISTING ROAD NETWORK

3.1 POSSIBLE ROUTE ALTERNATIVES

There are three options for the haulage of imported materials for the Main Transmission Substation and associated Eskom grid (network) integration infrastructure as shown in the figures below. The preferred option will be the route from the Port of Ngqura as shown in **Figure 3**. The route is the shortest and fastest route to the site and is approximately 445km and follows the N2 from the Port and then turns north onto the N10 past Hanover and up to the access at Burgerville Road.

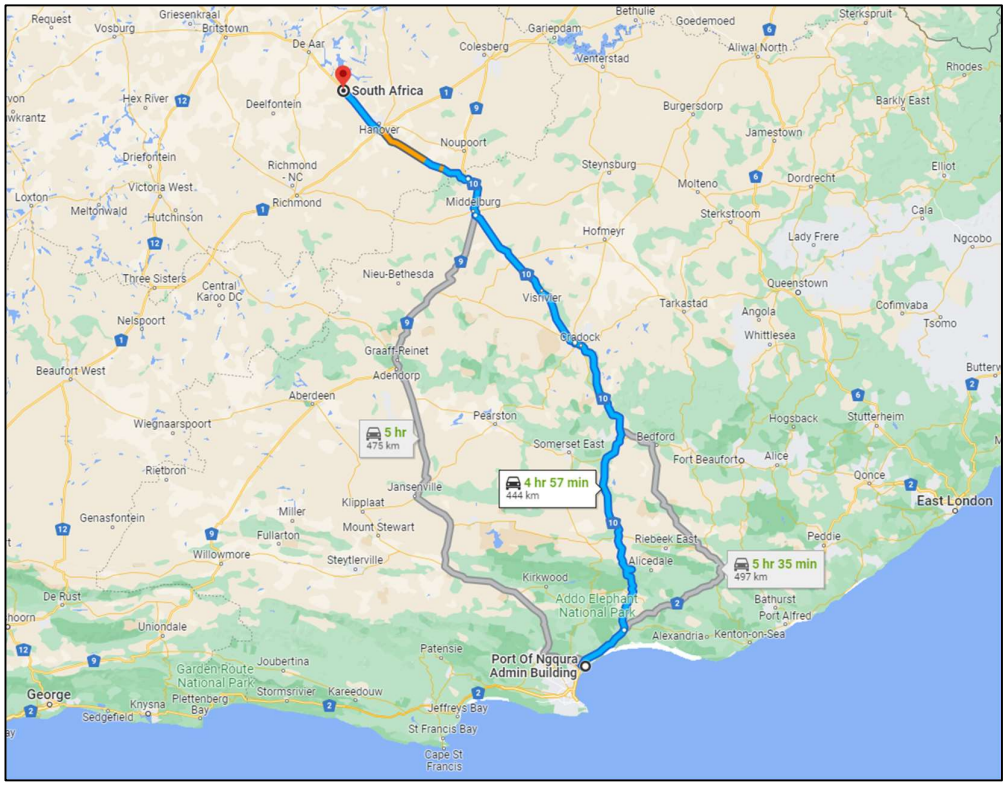

Figure 3: Preferred Route

The first alternative option will be the route from the Cape Town Harbour as shown in **Figure 4**. This route is approximately 730km and follows the N1 from the harbour and then turns north at Hanover onto the N10 up to the access at Burgerville Road.

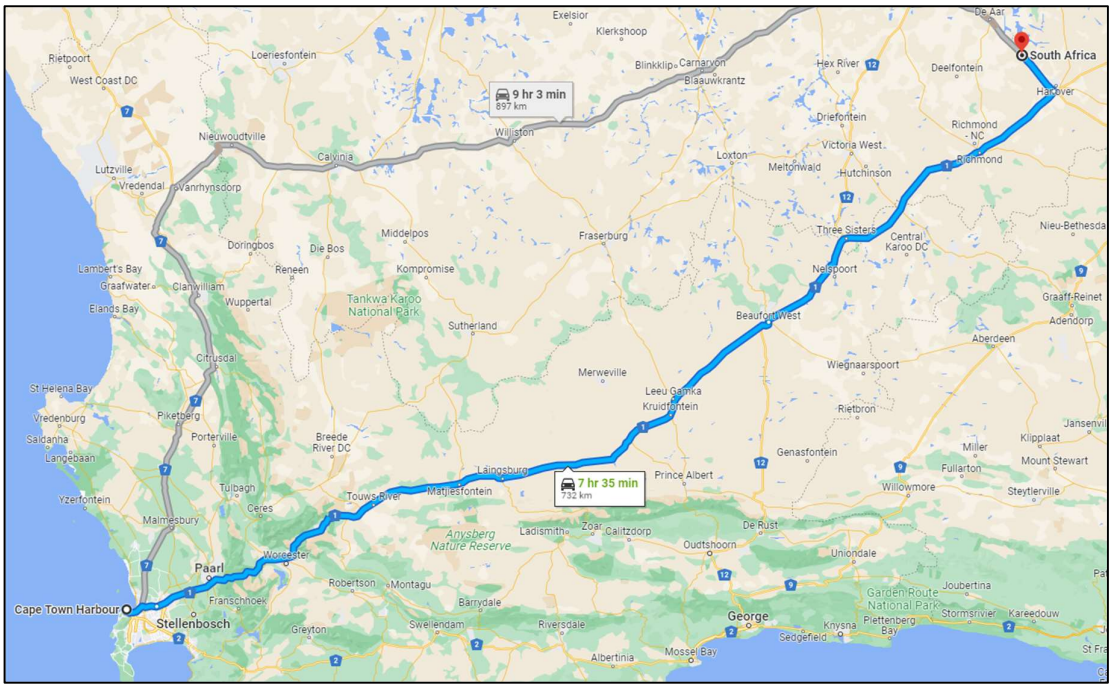

Figure 4: Alternative Route 1

The second alternative option will be the route from the Port of Saldanha as shown in **Figure 5**. This route is approximately 805km and follows the N7 from the Port and then turns east past Calvinia. At Britstown, the N10 will be followed, past De Aar up to the access at Burgerville Road.

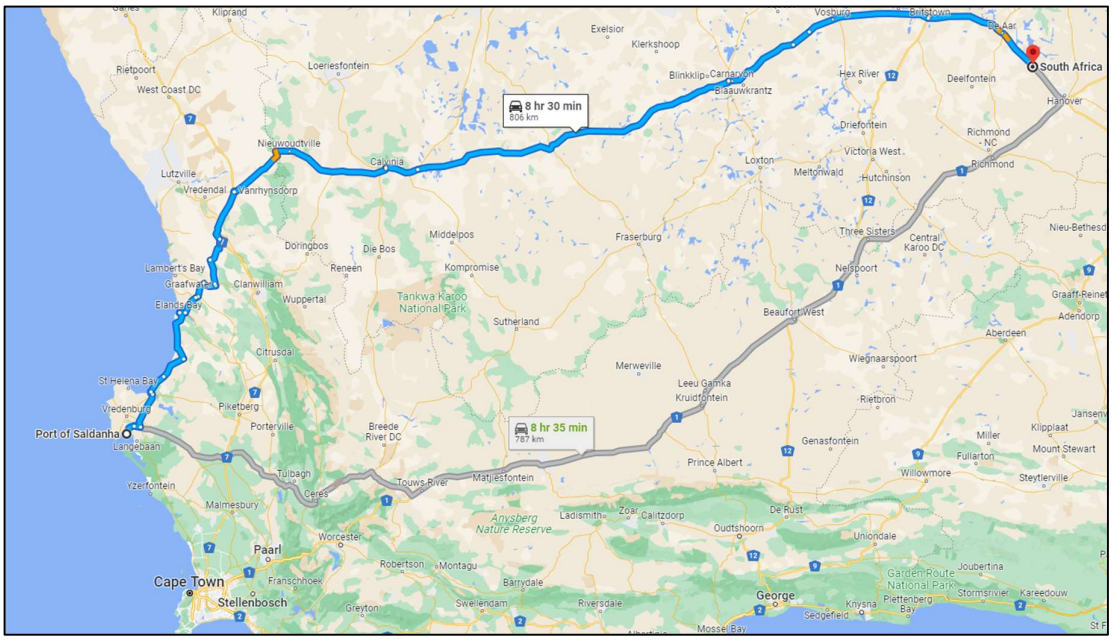

Figure 5: Alternative Route 2

3.2 ROAD NETWORK IN THE SITE VICINITY

The broader road network in the vicinity of the site is shown in **Figure 6** below.

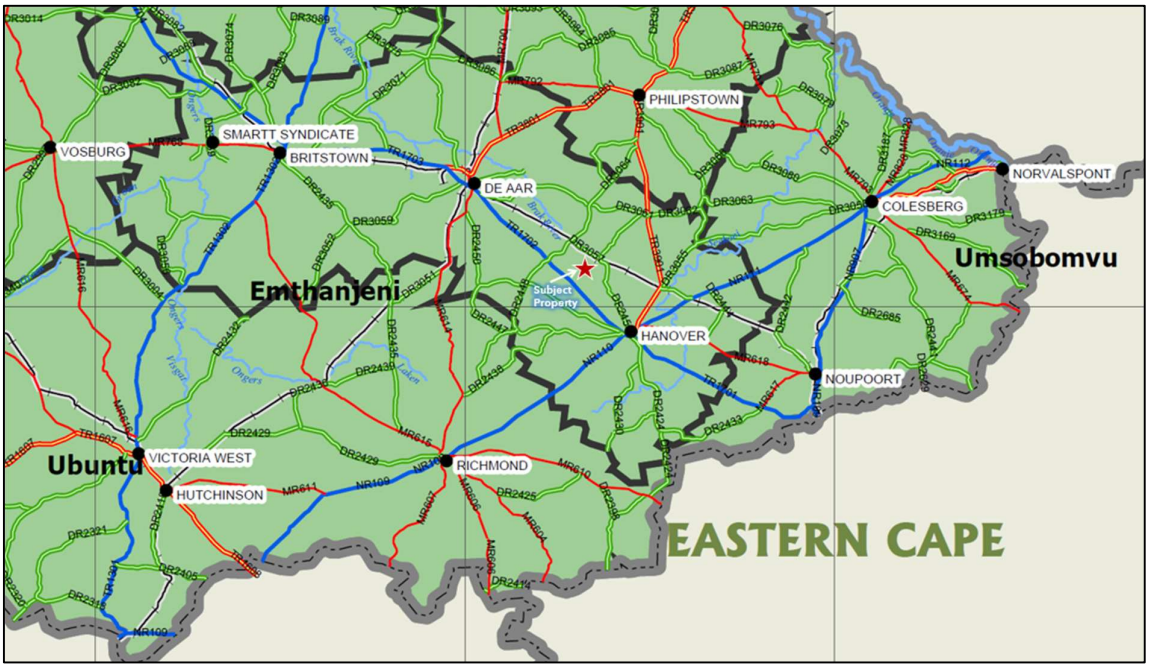

Figure 6: Road Network

3.2.1 National Road 10 (N10)

The N10 is a Class 1 rural principal arterial with an approximate width of 10.5m in the vicinity of the site. The N10 is a two-lane undivided road with one lane per direction and paved shoulders. The N10 is a national interprovincial road linking Gqeberha in the south with Hanover and De Aar in the north and runs all the way north-west, past Upington to the eastern Namibian border.

Figure 7: N10

3.2.2 District Road (Burgerville Road)

Burgerville Road is a gravel two-lane undivided road with one lane per direction and an approximate width of 7.1m.

Figure 8: Burgerville Gravel Road

3.2.3 Internal Roads

Access from the Burgerville Road will be taken at an existing farm access approximately 5.2km from the N10/Burgerville Road intersection. The access (existing farm access) is shown in **Figure 9.**

Figure 9: Main Access to Proposed Facilities

The internal road will follow the existing road/track up to point 1 in **Figure 10**. From this point, a new road will be constructed to the Switching Station and Main Transmission Substation (point 2). The length and width of the new road build will be ± 2,65 km and 8 m (excluding the side/cut-off drain), but 11 m (including the side/cut-off drain).

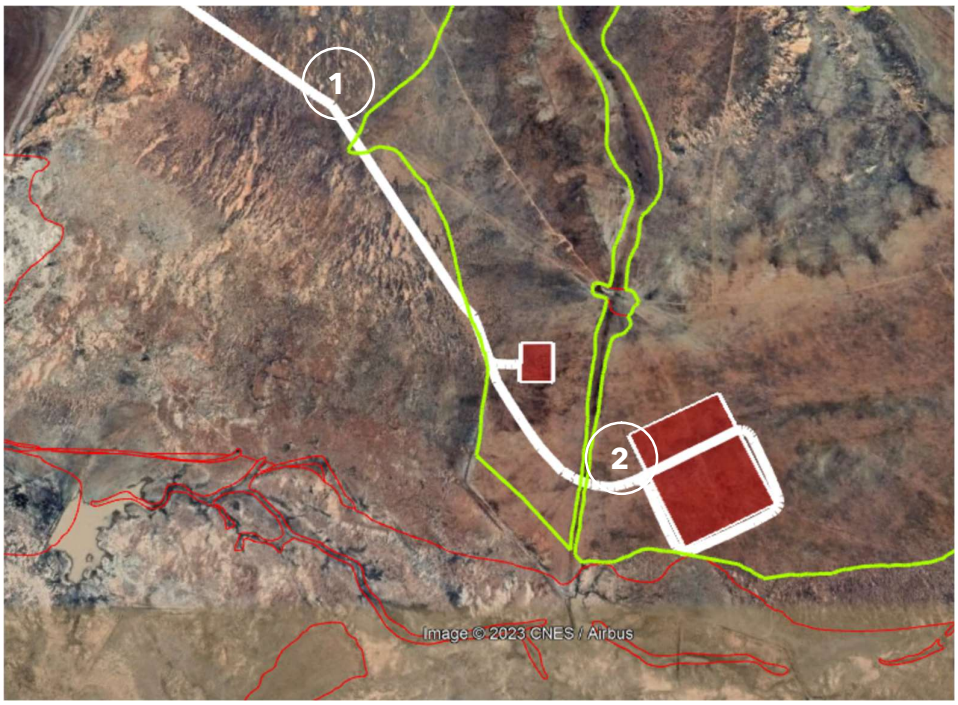

Figure 10: Internal Road Configuration

3.3 ROAD CONDITION

Existing road infrastructure is well developed in the area and thus well connected to surrounding major centres via regional routes. The combination of national roads and first and second order roads provides good inter- and intra- regional accessibility. The South African National Roads Agency (SANRAL) is responsible for the maintenance of the national roads which are in a good condition, however heavy traffic contribute significantly to the deterioration of the road surfaces.

During the site visit it was noted that the national roads maintained by SANRAL in the vicinity of the site were generally in a good to fair condition, except for the N10 between the Middelburg turn off and Hanover which was noted to be in a poor condition and dangerously potholed as a result of the frequent trips by manganese haulers. The gravel provincial roads in the vicinity of the site were in a fair to poor condition. Road freight, transport, specifically heavy vehicle transport, significantly contributed to the deterioration of the road surfaces and the maintenance of these roads are not always adequate.

4. SITE ACCESS CONSIDERATIONS

4.1 N10/BURGERVILLE ROAD INTERSECTION

To accommodate an abnormal load vehicle to safely turn from the N10 onto the gravel Burgerville Road, the bell mouth radius of the Burgerville District Road (2448) must be widened in accordance with **Figure 11**.

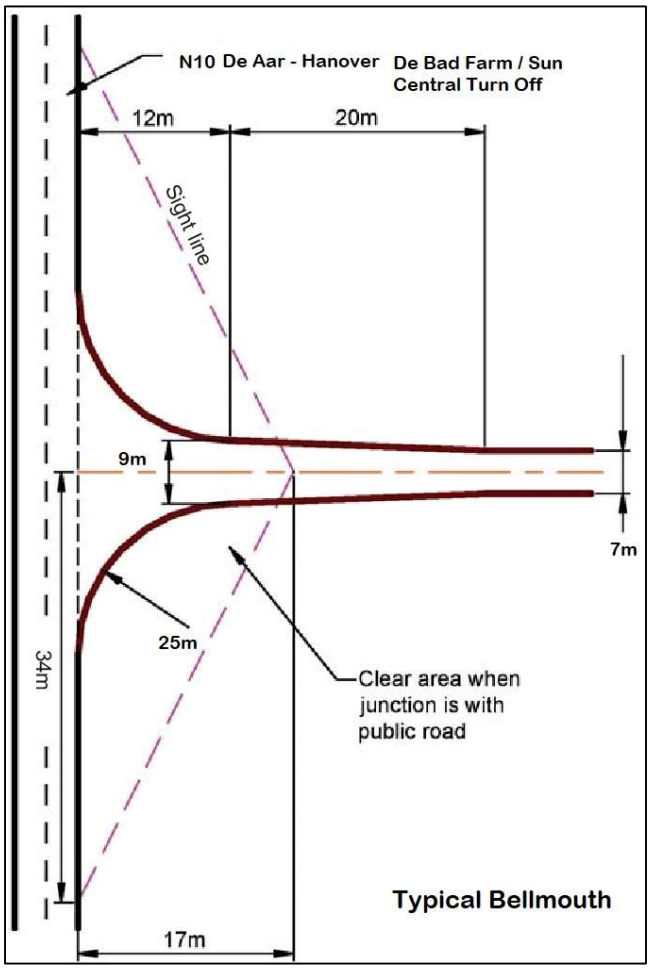

Figure 11: Proposed Bellmouth Design

The intersection adjoining the N10 will be widened from an existing width of approximately 25,7 m to approximately 60 m (measured along the top of the road) to accommodate the required turning circle from both directions and then gradually taper along a length of 20 m to the specified 7 m road width. Refer to **Figure 12.**

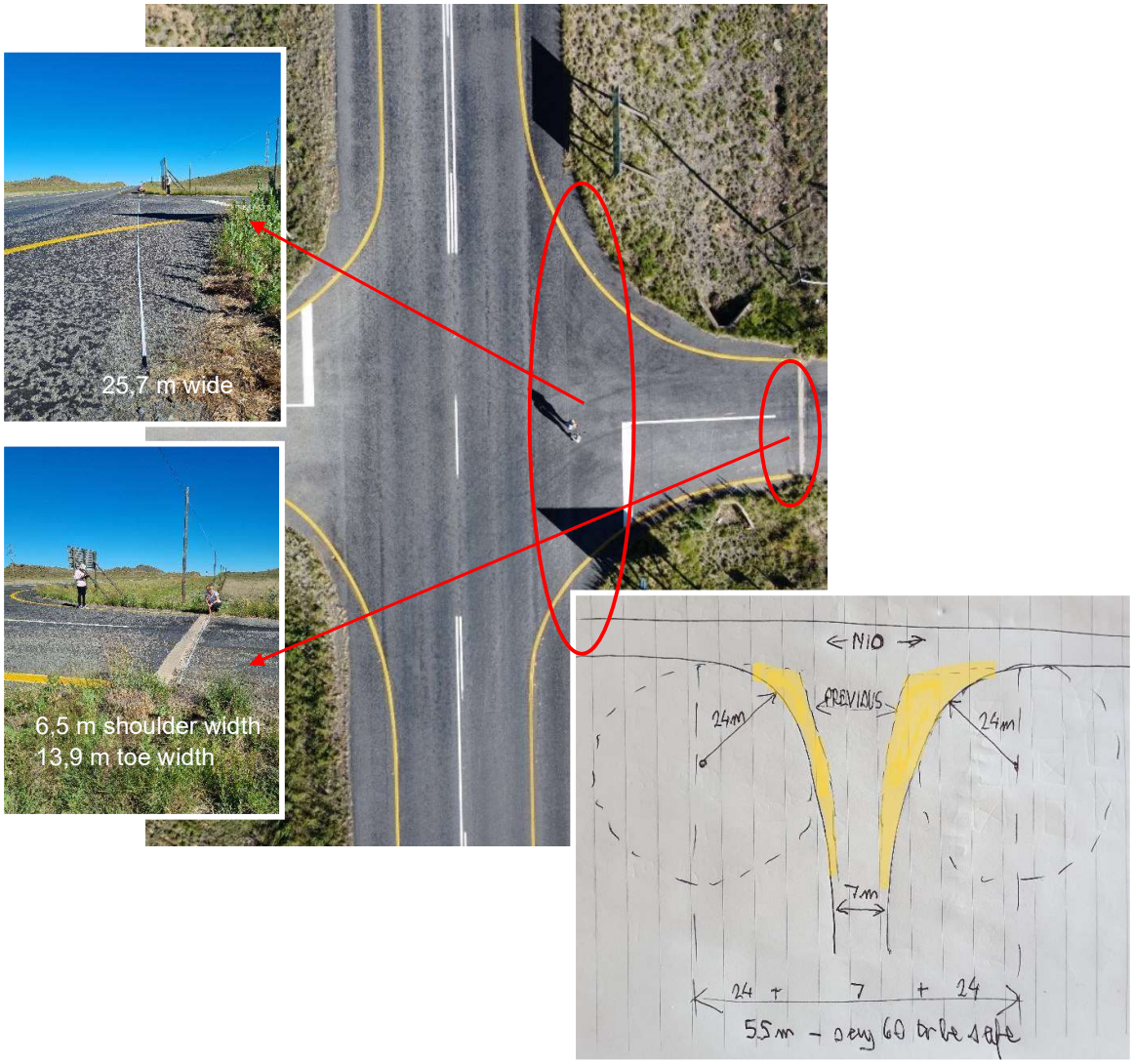

Figure 12: Proposed Bellmouth Design of the N10/'Burgerville' District Road (2448)

4.1.1 Shoulder Sight Distance (SSD)

According to the *TRH17 Geometric Design of Rural Roads, April 1988* for a design speed of 120km/h shoulder sight distances of 240m, 355m and 450m is required for a Passenger vehicle (P), a Single-Unit Truck (SU) and a Single-Unit Truck plus Trailer (SU+T), respectively. The site visit and photos taken at the existing access location indicated that shoulder sight distance to the left will be sufficient. Sight distance to the right was measured as approximately 320m which is sufficient for Passenger vehicles (P). To ensure the safe exit of Single-Unit Trucks (SU) and especially Single-Unit Truck plus Trailers (SU+T), it is proposed that appropriate traffic accommodation be placed on the eastern approach of the N10, indicating a construction access ahead with a

possible flagman to alert drivers and slow them down. Refer to **Figure 13**.

Sight Distance to the Left (>450m)

Sight Distance to the Right (±320m)

Figure 13: Shoulder Sight Distance (SSD) at Existing Access along N10

4.2 BURGERVILLE ROAD (DR2448)

It is proposed that the Burgerville Road also be upgraded to suitable standards to accommodate the additional vehicles and abnormal load vehicles. It is proposed that the length of the gravel road will require subgrade and subbase reconstruction in all areas where stormwater runoff needs to be improved. These are all low-lying areas where water ponding occurs and has softened the layer works to the point where deep rutting occurs due to wheel tracks from traffic on the roads. The balance of the road may only require top layer reconstruction. This however will be investigated in more detail with a Geotechnical Assessment, but it is very likely that the entire road will be reconstructed.

The average toe-to-toe width of the district road is 12,6 m (the average fence line width is 18,9 m). The affected district road is approximately 5.2 km long and will be rebuilt to a width of 8 m, allowing for the roadbed preparation including the surface of the road and its shoulders, and excluding up to 3 m for the side/cut-off drain. Refer to **Table 1** and **Figure 14**.

Table 1 Approximate width(s) (m) of the Burgerville District Road (2448).

Statistic	Top width (Including the surface of the road)	Toe width (Including the surface of the road and its shoulders)	Fence line width
Average	7,71 m	12,59 m	18,87
Range	6,2 m to 10 m	11,2 to 13,6 m	16,6 m to 40 m

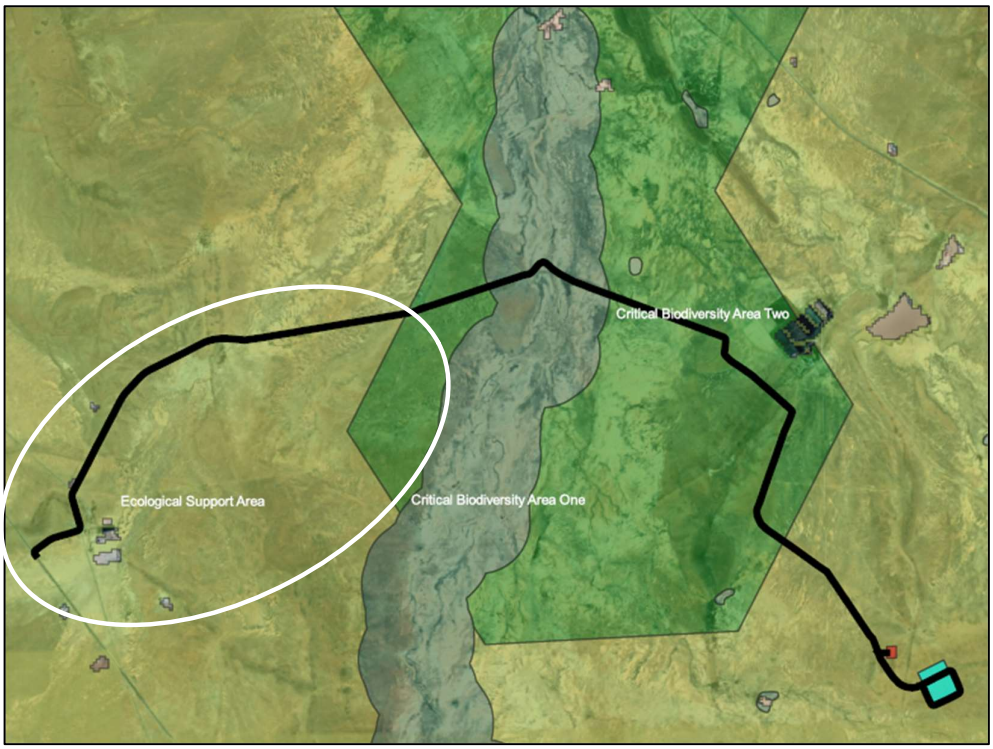

Figure 14: The section of existing public road to be upgraded

4.2.1 Shoulder Sight Distance (SSD)

According to the *TRH17 Geometric Design of Rural Roads, April 1988* for a design speed of 80km/h, shoulder sight distances of 160m, 240m and 305m is required for a Passenger vehicle (P), a Single-Unit Truck (SU) and a Single-Unit Truck plus Trailer (SU+T), respectively. The site visit and photos taken at the proposed access location from the Burgerville Road into the property/site indicated that shoulder sight distance will be sufficient and can be seen in **Figure 15**.

Sight Distance to the Left (>305m)

Sight Distance to the Right (>305m)

Figure 15: Shoulder Sight Distance (SSD) at Existing Access along Burgerville Road

5. EXISTING TRAFFIC CONDITIONS

SANRAL has a permanent counting station (Station 1300) along the N10, approximately 14.6km north-west from Hanover and approximately 44.6km south-east from De Aar. The location of the counting station is indicated in **Figure 16** below. SANRAL provided the traffic count information for the above-mentioned count station along the N10.

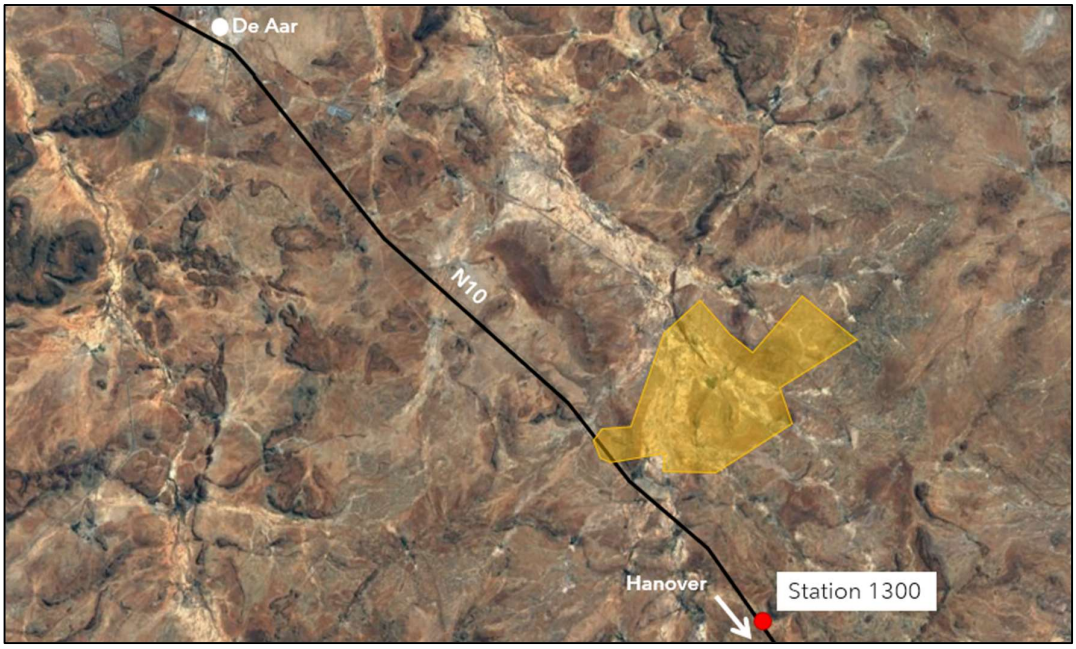

Figure 16: Location of Count Station

A summary of the Average Daily Traffic (ADT), Percentage Trucks and Highest volume on the road recorded yearly from 2007 (when the station was installed) is shown in **Table 2** and **Figure 17** below.

Table 2 Station 1300 Count Data

Year	Average Traffic (ADT) (two-way)	Percentage Trucks (two-way)	Highest daily volume on the road (two-way)
2007	435	14.4%	102
2008	430	15.4%	75
2009	441	14.3%	70
2010	470	14.6%	100
2011	522	18.4%	86
2012	468	12.7%	86
2013	530	18.6%	118
2014	524	15.9%	84
2015	532	14.2%	88
2016	571	14.7%	89

Year	Average Traffic (ADT) (two-way)	Percentage Trucks (two-way)	Highest daily volume on the road (two-way)
2017	566	14.7%	85
2018	561	14.9%	87
2019	584	16.1%	90
2020	600	29.4%	107
2021	790	36.0%	106
2022	1018	48.7%	186

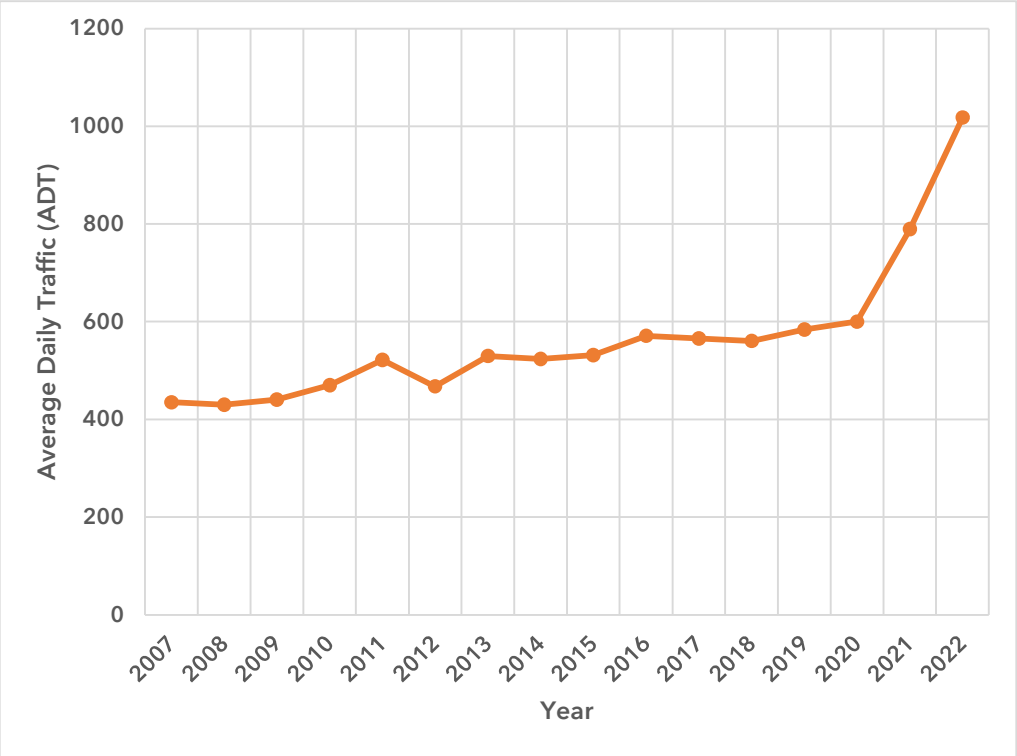

Figure 17: SANRAL Station 1300 Historic Count Information

From the above information, it can be concluded that the growth rate from the recorded 2007 to 2022 ADT values is approximately 6% per annum. A significant increase in ADT and heavy vehicle traffic is evident from 2020 onwards. This can possibly be attributed to increased mining activities and renewable energy projects. It should however be noted that the capacity of a Class 1 road is in the order of **2000 vehicles per hour** and therefore the traffic volumes recorded on this road is still significantly less than the capacity of the road.

A temporary counting station was also commissioned in 2011 along the Burgerville Road (District Road DR 2448). The results of this count indicated the Average Daily Traffic as 20 vehicles and the Average Daily Truck Traffic as 5 trucks. These numbers indicate that there are extremely low volumes of traffic along this road.

6. TRIP GENERATION RATES

Trip Generation Rates do not exist for substation operations and associated activities based on the *THM17 South African Trip Data Manual, August 2020* published by the Committee of Transport Officials (COTO). Therefore, the Trip Generation was calculated based on employee figures anticipated and based on typical traffic generation assumptions relating to similar operations. The trips generated as a result of employment activity are referred to as commuter trips, which are categorised as private vehicle trips and public transport trips. The transportation of commodities and products will generate freight movement on the transport network (road and rail if relevant).

Trip generation will differ during construction as well as during the operational phases. It is estimated that far more people will be employed during the construction of the facilities, with many of the trips for delivering machinery, building materials and equipment to the site. During the operation stage the Main Transmission Substation and associated Eskom grid (network) integration infrastructure will be unmanned and will generate minimal if not zero trips during the day.

For the access and road upgrades required, it is anticipated that an additional ± 45 temporary staff can be expected on site during the construction stage. Based on the numbers received for similar projects, a maximum of ± 120 staff can be expected on site during the construction stage for the Main Transmission Substation and associated Eskom grid (network) integration infrastructure. The substation will be in operation 24 hours a day, 7 days per week but will be unmanned.

It was assumed that most of the workforce will be sourced from De Aar to the north and Hanover to the south.

6.1.1 Construction Workforce Traffic

The workforce required during the construction stage can be expected to reach 120 staff during the peak of the proposed construction. The construction staff required for the access and road upgrade project is only expected to be ± 20 staff and therefore only the workforce during the construction of the Main Transmission Substation and associated Eskom grid (network) integration infrastructure will be considered as this will be the worst-case scenario. It is not anticipated that the two projects will run simultaneously, since the access and road upgrades need to be in place before the construction of the Main Transmission Substation and associated Eskom grid (network) integration infrastructure can commence.

Based on this, it is assumed that approximately 20% (managerial, skilled and semi-skilled construction workers) which equates to 24 workers are expected to use private

vehicles to travel to and from work. Assuming a vehicle occupancy rate of 1.5 persons per vehicles, these categories of workers are expected to generate **16** private vehicles entering the facility during the AM peak hour and similarly **16** exiting the facility during the PM peak hour. This will generate an additional **32 two-way trips per day**. The remaining 80% of the workforce is expected to travel to the site by bus and minibus taxi services or by construction shuttle buses. The maximum traffic generation scenario assumes that all of these construction workers use minibuses or minibus taxis to travel to and from work. Therefore, using an occupancy rate of 15 persons per minibus or minibus taxi, the remaining 96 unskilled workers are expected to generate **12** additional minibus trips during the AM peak hour (**6** vehicles arriving and **6** vehicles leaving). Similarly, **12** additional minibus taxi trips will be generated during the PM peak hour. Therefore, during this stage approximately **24 vehicles** will move to/from the construction site on a daily basis. The distribution of this construction traffic is expected to be approximately similar to the existing distribution of traffic using the surrounding road network. The N10 has an ADT of approximately 1 020 vehicles. Therefore, the additional construction workforce traffic is minimal in proportion to the current daily traffic along the N10.

Based on the above, a total of **56 vehicles** will move to/from the construction site on a daily basis. Should all the trips fall within the peak hours of the road, this will relate to approximately an additional **28 trips** on the road network during the peak hours for the construction phase. Given the estimated low volume of construction traffic daily and during the peak periods, it is not expected that this additional traffic will have a detrimental traffic impact on the surrounding road network.

6.1.2 Construction Vehicles

The construction activities related to the project will generate additional heavy vehicle traffic on the surrounding road network as a result of the construction vehicles travelling to and from the site transporting equipment and construction materials. It is envisaged that the delivery vehicles will be deployed from their origins in the morning. The expected arrival times of these vehicles will fall outside of the traditional peak hours. Therefore, the impact of the heavy construction vehicles on the external road network is expected to be negligible during the peak hours. In addition, heavy vehicles will be used to transport raw material and equipment within the construction site, in which case, these construction vehicles will remain on site overnight for lengthy periods of time and will also have no impact on the surrounding road network. Actual numbers of construction vehicles are unknown at this time but it is assumed that the expected maximum trips for the delivery of materials could be in the order of 10 trips per day. The additional construction traffic will not be significant in comparison to the current daily traffic on the N10.

6.1.3 Permanent Workforce (Operational Stage)

As mentioned above, during the operational stage of the substation there will be no staff on site therefore no additional trips will be generated.

6.1.4 Heavy Delivery Vehicles

The substation is expected to generate a maximum of 10 heavy vehicle trips per day two-way, assuming that the transport operations occur every day of the week and for 10 hours a day (i.e. 30 days per month). This then calculates to a maximum of 1 vehicle two-way per hour which is considered to be very low.
By virtue of this low additional volume of daily traffic required for the delivery of the materials and water during the construction stage, the impact of these delivery vehicles will be negligible on the surrounding road network.

6.2 ANALYSIS REQUIREMENTS FOR THE ADDITIONAL TRAFFIC VOLUMES

In accordance with the Committee of Transport Officials (COTO) TMH 16 Volumes 1 South African Traffic Impact and Site Traffic Assessments document, developments that generate over 50 vehicles per hour, in peak hours, require a full Traffic Impact Assessment (TIA), while those generating less than 50 vehicles per hour only require a Traffic Impact Statement (TIS). The difference between these two assessments is that the TIA must contain recent traffic counts and the analysis of both existing and future traffic flows, whereas in a TIS, little or no analysis is required, instead the Traffic Engineer's professional opinion is given more emphasis based on his or her observations and experience.

The construction stage and operational stage of the new proposed activities will generate significantly less than 50 vph in the peak hours, therefore a detailed analysis of these traffic volumes on the surrounding road network is not required for this study. The Traffic Engineer will instead provide his or her professional opinion based on a qualitative assessment of his or her observations and calculations.

Traffic data from SANRAL provided in **Section 5** was utilised in order to obtain a baseline of the existing traffic conditions on the surrounding road network, and from which to base the impact assessment.

6.3 TRIP DISTRIBUTION

During the construction stage it is assumed that most of the workforce will stay in De Aar or Hanover. All trips in the morning and afternoon peaks will be via the N10 to/ from the construction site.

Other trip purposes (deliveries, heavy vehicle loads and abnormal loads) will occur throughout the day and will mostly come from Hanover's side along the N10.

6.4 PEAK HOUR TRAFFIC GENERATION

The highest AM and PM peak hour traffic distribution are expected during the construction stage of the substation with far less trips during the operational stage of the substation (virtually zero). The number of trips will depend on the shifts that the employees/workforce will work during the construction stage of the project.
From the trip generation information gathered above, the following traffic impacts could be considered, although to a minimal extent:

- Potential congestion and delays on the surrounding road network;
- Potential impact on traffic safety and increase in accidents with other vehicles or animals;
- Potential change in the quality of the surface condition of the roads; and
- Potential noise and dust pollution.

As noted in **Section 5**, the capacity of a Class 1 rural road is in the order of 2000 vehicles per hour (two-way) and the road has sufficient spare capacity to accommodate the additional trips. **The additional trips during the construction and operational phases will have an insignificant traffic impact on the surrounding road network.**

7. ROAD IMPROVEMENTS REQUIRED

7.1 TRAFFIC IMPLICATIONS OF THE PROPOSED DEVELOPMENT

During the construction stage of the development, heavy and abnormal vehicles will bring machinery, materials and equipment to the site. It is envisaged that these vehicles will all travel along the N10 past either De Aar or Hanover. This will add additional heavy vehicles that could have an impact on the existing pavement structure of these roads. It is proposed that the N10/Burgerville Road intersection be ungraded to allow for abnormal loads to turn into the Burgerville Road from the N10 and also the upgrading of the Burgerville Road up to the access point at the boundary of Farm Riet Fountain No. 39C.

After construction, the number of heavy vehicles accessing the site will decrease significantly. During the operational stage there will be no or very few trucks accessing the substation site. These trucks will more than likely be for maintenance.

7.2 ROAD AND INTERSECTION UPGRADES FOR ACCESS ROADS

Based on the expected number of employee trips generated by the proposed development as mentioned above in **Section 6**, it is our opinion that the existing road network has sufficient capacity to accommodate the additional trips during the construction and operational stages. A two-lane road such as the N10 in the vicinity of the site can accommodate approximately **2000 vehicles per hour**. Once construction is completed, the day-to-day operation of the proposed substation will generate no to very little traffic which can easily be accommodated by the current road surface. It is anticipated that the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure will add an additional 28 vehicles a day (±3 vph) during the construction stage and 0 vehicles during the operational stage which is far less than the current capacity of the two-lane road (2 000 vph).

7.3 ABNORMAL LOADS

For the proposed development, it will be necessary for large equipment (transformers)/machinery and materials to be delivered to the site during the construction stage. It is also expected that many abnormal load vehicles will be travelling from major centres via the National Roads, Provincial and District roads to access the site. Depending on the type, weight and length of the load an abnormal load permit may be required with a transport management plan indicating the route and possible limitations on travel.

7.4 IMPACT ON THE CONDITION OF THE ROAD NETWORK

The increase in traffic generated by the proposed development activities during construction will increase the percentage of heavy vehicles using this road network. Some sections of the road network have high percentage of heavy vehicles and others

have a very low percentage. The N10 is in a good condition in the vicinity of the site. The provincial roads especially the gravel roads are in a fair to poor state.

The increase in heavy vehicles will accelerate the deterioration of these roads. This project will include the upgrading the access road from the N10/'Burgerville' District Road (2448) Turn-Off and also the Burgerville District Road (2448) for an approximate length of 5.2km as mitigation measure.

8. TRAFFIC IMPACT ASSESSMENT SUMMARY

8.1 TRAFFIC IMPACT ASSESSMENT SUMMARY FOR PROPOSED FACILITIES

The impacts associated with the traffic generation of the construction of the access and road upgrades and Main Transmission Substation and associated Eskom grid (network) integration infrastructure are summarised in **Table 3** below:

Table 3: Rating of Traffic Related Impacts

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION AND DECOMMISIONING PHASE						
Congestion and Delays on road network	Status	Neutral	Very Low Risk / Impact (5)	Stagger delivery trips and schedule trips outside of peak hours.	Very Low (5)	High
	Spatial Extent	Local				
	Duration	Medium Term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Replaceable				
Condition of road surface	Status	Neutral	Very Low Risk / Impact (5)	Regular maintenance of access road by the contractor. Ensure access roads are restored to original pre-construction road condition.	Very Low (5)	High
	Spatial Extent	Local				
	Duration	Medium Term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Replaceable				
Dust Pollution	Status	Neutral	Low Risk / Impact (4)	Dust control of gravel roads. Speed control by speed limit road signage.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium Term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Replaceable				
Noise Pollution	Status	Neutral	Low Risk / Impact (4)	Stagger delivery trips.	Low (4)	High
	Spatial Extent	Local				
	Duration	Medium Term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Replaceable				
OPERATIONAL PHASE						
The traffic generated during the operational phase will not have a significant impact on the surrounding road network.						

9. CONCLUSIONS AND RECOMMENDATIONS

Sturgeon Consulting (Pty) Ltd prepared this Traffic Impact Assessment (TIA) for the Upgrading & Development of an Access Road from the N10/'Burgerville' District Road (2448) Turn-Off to the Main Transmission Substation (MTS) as well as the construction of a Loop-in Loop-out from the MTS to the 400 kV Hydra-Poseidon Tx overhead line (Line 1), and other projects on the Sun Central Cluster 1 (300 MW) Solar PV footprint between De Aar and Hanover, Northern Cape Province. This report summarises the existing transportation conditions within the site vicinity and provides an assessment of the transportation impacts of the proposed development on the surrounding transport system.

From the traffic impact investigation and discussions in the report the following conclusions can be made:

- The main gravel road, Burgerville Road, in the vicinity of the proposed development is in a fair to poor condition.
- The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition.
- The preferred route for the haulage of imported materials is from the Port of Ngqura along the N10.
- The project will include the construction and upgrading of the N10/Burgerville Road intersection and the Burgerville Road up to the access point (approximately 5.2km) at Farm Riet Fountain No. 39C.
- The access along the N10 and along Burgerville Road complies with sight distance requirements.
- Existing traffic information for 2022 indicates that the N10 carries an ADT of **1018 vpd** (two-way) with the highest hourly volume being **186 vph** (two-way).
- The N10 operates well below the capacity of 2000 vehicles per hour for a Class 1 principal arterial with two lanes.
- Traffic will be generated during the Construction and Operational phases of the project.
- During the Construction phase, a total of **56 vehicles** will move to/from the construction site on a daily basis, this relates to an additional **28 vehicles** during the AM and PM peak hours on the road.
- The following traffic impacts could be considered, although to a minimal extent:
    - Potential congestion and delays on the surrounding road network
    - Potential impact on traffic safety and increase in accidents with other vehicles or animals
    - Potential change in the quality of the surface condition of the roads
    - Potential noise and dust pollution.

- Traffic generated during the Operational phase will have an insignificant traffic impact on the surrounding road network.

The mitigation measures to address the possible traffic impact are recommended:

- Construction of the N10/Burgerville Road intersection; and
- Upgrading of Burgerville Road up to the access point (approximately 5.2km) at Farm Riet Fountain No. 39C.

No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed development of the Main Transmission Substation (MTS) as well as the construction of a Loop-in Loop-out from the MTS to the 400 kV Hydra-Poseidon Tx overhead line (Line 1), and other projects on the Sun Central Cluster 1 (300 MW) Solar PV footprint between De Aar and Hanover, Northern Cape Province.

REFERENCES

1. Department of Transport, Guidelines for Traffic Impact Studies, Report No. PR93/645, Pretoria, 1995.
2. Department of Transport, South African Trip Generation Rates, Report No. RR92/228, Pretoria, 1995.
3. Committee of Transport Officials (COTO), South African Trip Data Manual, TMH 17, Committee Draft 2.2, August 2020.
4. Committee of Transport Officials (COTO), South African Traffic Impact and Site Traffic Assessment Manual Standards and Requirements Manual, Volume 2 TMH 16, Committee Draft 2.0, October 2020.
5. Committee of Transport Officials (COTO), South African Traffic Impact and Site Traffic Assessment Manual, Volume 1 TMH 16, Committee Draft 2.0, May 2018.
6. SANRAL Geometric Design Guide
7. Department of Transport, TRH17, Geometric Design of Rural Roads, 1988

APPENDIX A: CURRICULUM VITAES