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Appendix D7:

Transport Impact Assessment



Transport Impact Assessment

Red Sands Solar Project

Aggeneys, Northern Cape

September 2022

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This transport impact study was prepared in accordance with the South African Traffic Impact and Site Traffic Assessment Manual (TMH 16, COTO, Aug 2012), by a suitably qualified and registered professional traffic engineer. Details of any of the calculations on which the results in this report are based will be made available on request.

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Abbreviations

AMG – Access Management Guidelines (Western Cape Government)

CM – Critical Movement

DR – Divisional Road

HCM – Highway Capacity Manual

LOS – Level of Service

MOE – Measures of Efficiency

MR – Provincial Main Road

OP – Minor Road (Ondergeskikte Pad)

SDP – Site Development Plan

SSD – Shoulder Sight Distance

TIA – Traffic Impact Assessment

1.0 INTRODUCTION

It is proposed to develop Red Sands Solar and Wind Energy Facility (WEF) on a farm in Aggeneys. The Red Sands WEF project will be implemented in four phases. The Red Sands Solar Farm will be developed as a separate phase. This report summarises an investigation of the transport impact related to the construction phase and operational phase of the proposed Solar Project.

2.0 LOCALITY

The Red Sands Solar and WEF is located approximately 35km south of the town of Aggeneys in the Northern Cape. The site is located within the Khâi-Ma Local Municipality which falls within the Namakwa District Municipality. The site can be reached via a proposed access off the N14. The Solar Project will be located on Remaining Extent of the Farm 95 Donkerduispraat.

Refer to **Figure 1** in Appendix A for the Locality Plan of the Red Sands Solar and WEF.

3.0 PROPOSED DEVELOPMENT

The total development is split into four phases for the WEF plus the Solar Farm. Refer to **Table 1** which indicates the number of turbines per phase.

Table 1: Project phases and energy generated

Phase	Number of turbines
<i>Phase 1</i>	36
<i>Phase 2</i>	57
<i>Phase 3</i>	38
<i>Phase 4</i>	61
Solar	-
TOTAL	192

The proposed facility will comprise of a number of solar panels that will convert solar radiation energy into electrical energy. The complete Solar Project will have the combined capacity to generate a maximum electricity output of about 480 Megawatts (MW).

The Solar Facility will include the following Infrastructure:

- Arrays of solar panels with a contract capacity of up to 75MW
- Mounting structures to support the solar panels;
- Cabling between the project components, to be laid underground where practical;
- On-site inverters to convert the power from a direct current (DC) to an alternating current (AC) and a
- on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid;

- Direct connection to the grid via a 132 kV overhead line to the Aggeneys Substation;
- Internal access roads, offices and workshop areas for maintenance and storage; and
- Temporary laydown areas;
- An access road to the site. It is proposed to make use of the existing farm accesses off the N14 at KM92.2E.

Refer to **Figure 2A** in Appendix A for a Site Layout Plan

4.0 TRAFFIC ANALYSIS SCOPE

This report evaluates the expected traffic impact of the proposed development during the construction and operational phases. The report comment on the condition of the existing roads in the site vicinity, identify possible access points to the site and recommend road improvements to the surrounding road network.

The report is based on existing available information on the road network, road condition information obtained during site visits and an assessment of the expected traffic volumes generated by the construction and operational phases of the proposed Red Sands Solar Project.

5.0 EXISTING CONDITIONS

5.1 Existing Cross Sections and Surface Conditions

The National Road (N14) is the only major road in the site vicinity. The N1 has a posted speed limit of 120 km/h. The section of the N1 in the vicinity of the site has a typical rural formation of a National Road, paved with one lane per direction of travel with shoulders along both sides of the road. The lanes are 3.7m wide with 2m shoulders. The typical cross-section of the N14 in the site vicinity is shown in **Photos 1 and 2** in Appendix B.

5.2 Existing Traffic Volumes

The existing traffic conditions are based on the traffic volumes extracted from the SANRAL Comprehensive Traffic Observation (CTO) Stations and Provincial count stations in the area. The table below illustrates the current annual average daily traffic volumes (AADT), the annual daily truck traffic volumes and the peak hour volumes on the road network in the site vicinity.

Table 2: Existing Traffic Volumes

Roadway	AADT	ADTT	Peak Hour Volume	% Heavy Vehicles
N14	1 425	170	155	9%

6.0 SITE ACCESS

Access to the site is proposed via the existing farm access off the N14 close to kilometre marker N14-1/92.2E.

The required shoulder sight distance (SSD) for heavy vehicles along roads with a posted speed limit of 120km/h is 300 metres based on the geometric design guidelines of the UTG. The available SSD is more than 500 metres in both directions, which is acceptable and safe for the existing posted speed limits along the N14. The current SSD along the N14 is illustrated in **Photo 3** and **Photo 4** in Annexure B.

7.0 TRAFFIC IMPACT ANALYSIS

The expected effects of traffic that would be generated by the proposed development during peak hours were analysed as follows:

- The **Existing (2022) traffic** volumes were assessed for the study network in the vicinity of the site.
- The **Background (2027) traffic** volumes were assessed for the study network in the vicinity of the site. These are the traffic volumes that would be on the road network in the absence of the proposed development in five years' time (No-Go Alternative).
- **Construction Phase Traffic** was assessed for the study network
- **Site-generated trips** were estimated for the proposed development;
- The construction phase traffic and the assigned site-generated traffic from the proposed development were added to the **background traffic** volumes to determine the **total traffic** conditions during the construction phase and with the development completed.

7.1 Year 2027 Background Traffic Conditions

For the purposes of this study, year 2027 background traffic volumes were developed by applying a 3.0 percent annual traffic growth rate to the existing traffic volumes on the major links. This estimated growth rate was assumed to allow for the additional traffic volumes that will be generated by other in-process and future developments in the vicinity of the proposed development.

Due to the low traffic volumes along the surrounding road network, it is expected that the road network will continue to operate at acceptable levels-of-service during the background conditions. The roads in the site vicinity are in a fair condition and no major maintenance will be required in the near future.

7.2 Construction Phase

A large amount of traffic will be generated during the construction phase. The following activities will probably occur during the construction phase:

- Construction of the internal access roads,
- Stripping and stockpiling of topsoil,
- Excavation and construction of the foundations for the solar panel racks,
- Construction of the operations building,
- Assembly and disassembly of solar panel arrays,
- Trenching for cabling and
- Reinstatement of the site.

The internal access roads will be constructed mainly of local materials sourced on site if the material is suitable, otherwise material will be imported from commercial sites. These roads will be retained and used for inspection and maintenance of the solar panels.

7.2.1 Trip Generation

Estimates of the peak hour vehicle trips for new developments are typically based on empirical observations at similar land uses. It is expected that approximately 1 000 trucks will be required delivering equipment and building material during the construction period, depending on the type and configuration of the panel arrays. The number of delivery vehicles could vary substantially, but for the purposes of this study it was assumed that 1 000 delivery truck represents a worst-case scenario. The construction period could probably vary between six and eight months. It is assumed that delivery of the equipment will occur within and spread over a six-month period. With a possible 150 working days in a six-month period, it means that on average approximately 7 trucks will visit the site per day which equates to approximately 14 truck trips spread over an eight-hour day.

Based on information supplied it is assumed that approximately 375 construction workers could be employed during the peak construction period. Based on information provided the bulk of these workers will be transported to/from the construction site via bus. If 90 percent of the construction staff travels by bus with an average occupancy of 50 passengers per vehicle it equates to approximately 8 buses visiting the site in the morning and afternoon peak hours. If the remaining 10 percent travel with private vehicles, it equates to approximately 106 motor vehicle and truck trips during the average week day.

It is expected that approximately 20 permanent staff members will be employed at the proposed development during the operational phase. If all of them travel to work with their private vehicles it means 20 trips in during the a.m. peak hour and 20 trips out during the p.m. peak hour.

7.2.2 Trip Distribution and Assignment

It is expected that the trips to/from the proposed Solar Project will come from the following towns Aggeneys, Pofadder, Springbok and Pella. The trucks delivering the building material and equipment could come from direction Gauteng, Cape Town/Saldanha harbour and minority from Durban.

7.2.3 Powerline Construction

The proposed site, located south-west of Aggeneys, is amongst other aspects preferred by virtue of its proximity to a viable point of connection to the National grid at the Eskom Aggeneys Substation. Two options are considered for the overhead power line. Option 1 (approximately 21km long) runs directly south from the substation to the WEF. Option 2 (approximately 26km long) runs to the west parallel along the N14 for approximately 7 km up to the site access and then south to the site.

The powerline route will cross the N14 at the substation at KM99.3E for Option 1 or at the site access at kilometre marker N14-1/92.2E for Option 2. Both these crossing locations are along straight sections of the N14 and no sight distance issues are expected during construction activities. Specific traffic management plans should be confirmed with the Roads Authority prior to any construction activity at the locations where the powerlines cross the N14.

It is not expected that a significant number of trips will be generated during the construction phase. The following activities will probably occur during the construction phase of the powerline; construction of the service road, stripping and stockpiling of topsoil, excavation and construction of foundations, expansion/alterations at the substation and construction of the power line. It is expected that less than 100 trucks will be required delivering equipment and building material during the construction period, depending on the type and size of the power line poles/pylons. The construction period could probably vary between three to eight months. It is assumed that delivery of the equipment will occur within and spread over a six-month period. With a possible 150 working days in a six-month period, it means that on average 1 truck will visit a site per day during the powerline construction phase, which is insignificant.

It is expected that the powerline will be implemented as part of the construction activities of the Red Sands WEF and Solar projects and no additional construction workers will be required specifically for the powerline construction. Maintenance on the powerline will be conducted by the Red Sands Projects staff during the operational phase. The operational phase of the powerline is not expected to generate any additional traffic volumes during the typical weekday peak hours.

7.3 Transport Impact Assessment

7.3.1 Definitions of terminology

The impacts that the development of the Red Sands Solar and WEF will have on traffic on the surrounding road network is assessed in this section. Refer to **Table 3** which provides definitions of the terminology used in this section.

Table 3: Definitions of terminology

ITEM	DEFINITION
EXTENT	
Local	Extending only as far as the boundaries of the activity, limited to the site and its immediate surroundings
Regional	Impact on the broader region
National	Will have an impact on a national scale or across international borders
DURATION	
Short-term	0-5 years
Medium- Term	5-15 years
Long-Term	>15 years, where the impact will cease after the operational life of the activity
Permanent	Where mitigation, either by natural process or human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.
MAGNITUDE OR INTENSITY	
Low	Where the receiving natural, cultural or social function/environment is negligibly affected or where the impact is so low that remedial action is not required.
Medium	Where the affected environment is altered, but not severely and the impact can be mitigated successfully and natural, cultural or social functions and processes can continue, albeit in a modified way.
High	Where natural, cultural or social functions or processes are substantially altered to a very large degree. If a negative impact, then this could lead to unacceptable consequences for the cultural and/or social functions and/or irreplaceable loss of biodiversity to the extent that natural, cultural or social functions could temporarily or permanently cease.
PROBABILITY	
Improbable	Where the possibility of the impact materialising is very low, either because of design or historic experience
Probable	Where there is a distinct possibility that the impact will occur
Highly Probable	Where it is most likely that the impact will occur
Definite	Where the impact will undoubtedly occur, regardless of any prevention measures
SIGNIFICANCE	
Low	Where a potential impact will have a negligible effect on natural, cultural or social environments and the effect on the decision is negligible. This will not require special design considerations for the project
Medium	Where it would have, or there would be a moderate risk to natural, cultural or social environments and should influence the decision. The project will require modification or mitigation measures to be included in the design
High	Where it would have, or there would be a high risk of, a large effect on natural, cultural or social environments. These impacts should have a major influence on decision making.
Very High	Where it would have, or there would be a high risk of, an irreversible negative impact on biodiversity and irreplaceable loss of natural capital that could result in the project being environmentally unacceptable, even with mitigation. Alternatively, it could lead to a major positive effect. Impacts of this nature must be a central factor in decision making.
STATUS OF IMPACT	
Whether the impact is positive (a benefit), negative (a cost) or neutral (status quo maintained)	
DEGREE OF CONFIDENCE IN PREDICTIONS	
The degree of confidence in the predictions is based on the availability of information and specialist knowledge (e.g. low, medium or high)	
MITIGATION	
Mechanisms used to control, minimise and or eliminate negative impacts on the environment and to enhance project benefits Mitigation measures should be considered in terms of the following hierarchy: (1) avoidance, (2) minimisation, (3) restoration and (4) off-sets.	

7.3.2 Scoring System for Impact Assessment Ratings

To comparatively rank the impacts, each impact has been assigned a score using the scoring system outlined in the **Table 4** below. This scoring system allows for a comparative, accountable assessment of the indicative cumulative positive or negative impacts of each aspect assessed.

Table 4: Scoring System

IMPACT PARAMETER		SCORE	
Extent (A)		Rating	
Local		1	
Regional		2	
National		3	
Duration (B)		Rating	
Short term		1	
Medium Term		2	
Long Term		3	
Permanent		4	
Probability (C)		Rating	
Improbable		1	
Probable		2	
Highly Probable		3	
Definite		4	
IMPACT PARAMETER	NEGATIVE IMPACT SCORE	POSITIVE IMPACT SCORE	
Magnitude/Intensity (D)	Rating	Rating	
Low	-1	1	
Medium	-2	2	
High	-3	3	
SIGNIFICANCE RATING (F) = (A*B*D)*C	Rating	Rating	
Low	0 to - 40	0 to 40	
Medium	- 41 to - 80	41 to 80	
High	- 81 to - 120	81 to 120	
Very High	> - 120	> 120	

7.3.3 Construction Phase

Based on the expected number of construction trips generated by the proposed development the existing road network has sufficient capacity to accommodate the additional trips from an operational perspective. During construction it is expected that road surfaces of the gravel roads will require maintenance to prevent damage to the road structure.

It is recommended that once construction is completed the public roads should be inspected and repaired where necessary.

Table 5 below summarises the transport impacts identified and expected as a result of the increase in traffic volumes during the construction phase.

Table 5: Increased Traffic Volumes during Construction Period

IMPACT NATURE	Increase in traffic volumes on the surrounding road network as a result of construction traffic		STATUS	NEGATIVE
Impact Description	During the construction phase there will be an increase in traffic volumes on the surrounding road network that will impact on the general road users.			
Impact Source(s)	Construction Traffic			
Receptor(s)	General public/Road users			
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:	1	Preferred Alternative:	1
	No-Go Alternative:	1	No-Go Alternative:	1
DURATION (B)	Preferred Alternative:	1	Preferred Alternative:	1
	No-Go Alternative:	1	No-Go Alternative:	1
PROBABILITY (C)	Preferred Alternative:	3	Preferred Alternative:	2
	No-Go Alternative:	3	No-Go Alternative:	2
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:	-1	Preferred Alternative:	-1
	No-Go Alternative:	-1	No-Go Alternative:	-1
SIGNIFICANCE RATING (F) = (A*B*D)*C	Preferred Alternative:	-3	Preferred Alternative:	-2
	No-Go Alternative:	-3	No-Go Alternative:	-2
CUMULATIVE IMPACTS	Low			
CONFIDENCE	High			
MITIGATION MEASURES	<ul style="list-style-type: none"> Construction traffic should not be allowed on the public road network during the typical weekday a.m. and p.m. peak hours in built up areas. These measures will be included in the Transport Management Plan 			

7.4 Operational Phase

The operational phase of this project is not expected to generate significant traffic volumes. The typical day-to-day activities will probably only be service vehicles undertaking general maintenance at the site.

7.5 Decommissioning Phase

If the wind farm is not upgraded at the end of the typical lifespan (20 to 25 years from the date of commissioning) the site will be decommissioned. The decommissioning of Phase 4 of the Red Sands WEF is expected to take between 6 to 12 months. The modular components would be removed and recycled, and all disturbed areas will have to be appropriately rehabilitated.

The transport impact during the decommissioning phase will be similar or less than the transport impact during the construction phase. The surrounding road network has sufficient capacity to accommodate the expected traffic volumes associated with the decommissioning phase.

Refer to **Table 6** which provides a summary of the overall impact on traffic related to the development of the Red Sands Solar and WEF.

Table 6: Summary of overall Significance

DESCRIPTION OF IMPACT	Overall Significance (With Mitigation)	
	No-Go Alternative	Preferred Alternative
Increase in traffic volumes on the surrounding road network as a result of construction traffic	Low	Low

7.6 Traffic Management and Transportation Plan

During the construction phase there will be an increase in truck traffic along the roads in the site vicinity, compared to the current truck traffic along these roads. However, the expected total traffic volumes along these roads will still be well within the function of the roads and no operational or safety issues are expected. Due to the rural nature of the area around the development site the daily traffic distribution profile along the roads in the site vicinity is random with no specific peak during the day. The impact of the construction and operational traffic will be insignificant, and no specific measures are required in terms of traffic management.

Most of the equipment will be delivered to site with heavy vehicles in containers. It is expected that the delivery of the equipment will occur over a 6-month period. The impact of the delivery vehicles on the existing traffic along the road network in the site vicinity will be insignificant. Some of the construction machinery/equipment might be delivered with lowbed trucks, but no abnormal loads will be required.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This transport impact assessment was prepared for the proposed Red Sands Solar Project near the town Aggeneys in the Northern Cape. 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 transportation system.

This traffic impact analysis resulted in the following conclusions and recommendations.

Existing Traffic Conditions

- The current demand on the existing road network in the site vicinity is low and the road network and intersections operate at acceptable levels of service.

2027 Background Traffic Conditions

- A growth rate of 3 percent per annum was applied to the existing traffic volumes to determine the 2027 background traffic conditions.

- All the intersections and roadways will continue to operate at acceptable levels-of-service in the future during the worst peak hours of the year without the proposed development.

Access and Power Line Road Crossings

- Access is proposed via the existing farm access off the N14 at KM92.2E
- The two powerline crossing options are both along straight sections of the N14 and no sight distance issues are expected during construction activities.
- It is expected that the powerline will be implemented as part of the construction activities of the Red Sands projects and no additional construction workers will be required specifically for the powerline construction.
- Construction traffic volume for the powerline construction will be low.
- Specific traffic management plans should be confirmed with the Roads Authority prior to any construction activity at the locations where the powerlines cross the N14.

Construction Phase

- It is expected that the construction phase of the proposed Red Sands Solar Project could generate up to 106 vehicular trips during the average weekday of which approximately 14 percent will be truck traffic.
- Access to the site is proposed via the existing farm access off the N14 at KM92.2E.

Operational Phase

- The operational phase of this project is not expected to generate significant traffic volumes. The typical day-to-day activities will probably only be service vehicles undertaking general maintenance at the site.
- The number of permanent staff on site is not expected to be more than 20 people and therefore no additional upgrades are required to accommodate the operational site traffic.

Decommissioning Phase

- If the Solar Project is not upgraded at the end of the typical lifespan (20 to 25 years) the site will be decommissioned. The decommissioning of the Red Sands Solar Project is expected to take between 6 to 12 months. The expected transport impact on the road network during the decommissioning phase will be similar to the transport impact during the construction phase. The surrounding road network has sufficient capacity to accommodate the expected traffic volumes associated with the decommissioning of the Solar Project.

Traffic Management and Transportation Plan

- During the construction phase there will be an increase in truck traffic along the roads in the site vicinity, compared to the current truck traffic along these roads. However, the expected total traffic volumes along these roads will still be well within the function of the roads and no operational or safety issues are expected.
- It is recommended that construction traffic should be limited to outside the typical traffic peaks in build-up areas and through towns.
- Most of the equipment and construction material will be delivered to the site with heavy vehicles. It is expected that the delivery of the equipment can occur over a 6-month period and the impact of the delivery vehicles on the existing traffic along the road network in the site vicinity will be acceptable.

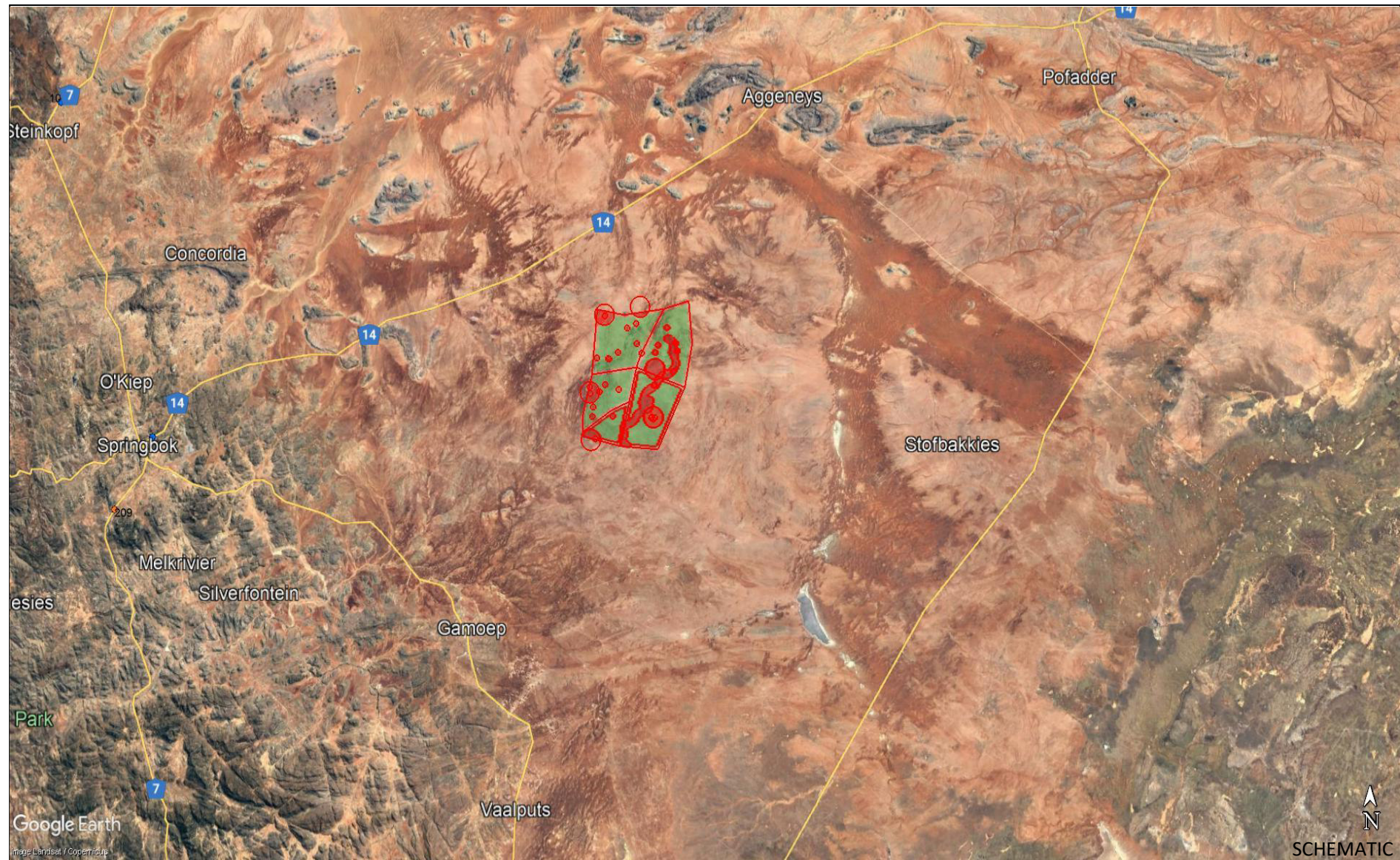
Based on the evaluation as discussed in this report the existing road network has sufficient spare capacity to accommodate trip generation associated with the proposed development, without any road upgrades required to the existing road infrastructure. It is recommended that the proposed Red Sands Solar Project be approved from a transport impact perspective.

REFERENCES

1. Highway Capacity Manual (HCM).
2. Western Cape Government, Access Management Guidelines. 2020
3. Transportation Research Board Highway Capacity Manual, Special Report No. 209. 2000
4. Committee of Transport Officials, South African Trip Data Manual, TMH 17, September 2017
5. Committee of Transport Officials, South African Impact and Site Traffic Assessment Manual, TMH 16 Volume 1, August 2012.

Appendix A

Figures



PROJECT: <p style="text-align: center;">RED SANDS SOLAR AND WEF TIA</p>	FIGURE: <p style="text-align: center;">LOCALITY MAP</p>	NUMBER: <p style="text-align: center;">1</p>
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Google Earth

Image © 2022, Maxar Technologies

FIGURE 2
SITE LAYOUT PLAN



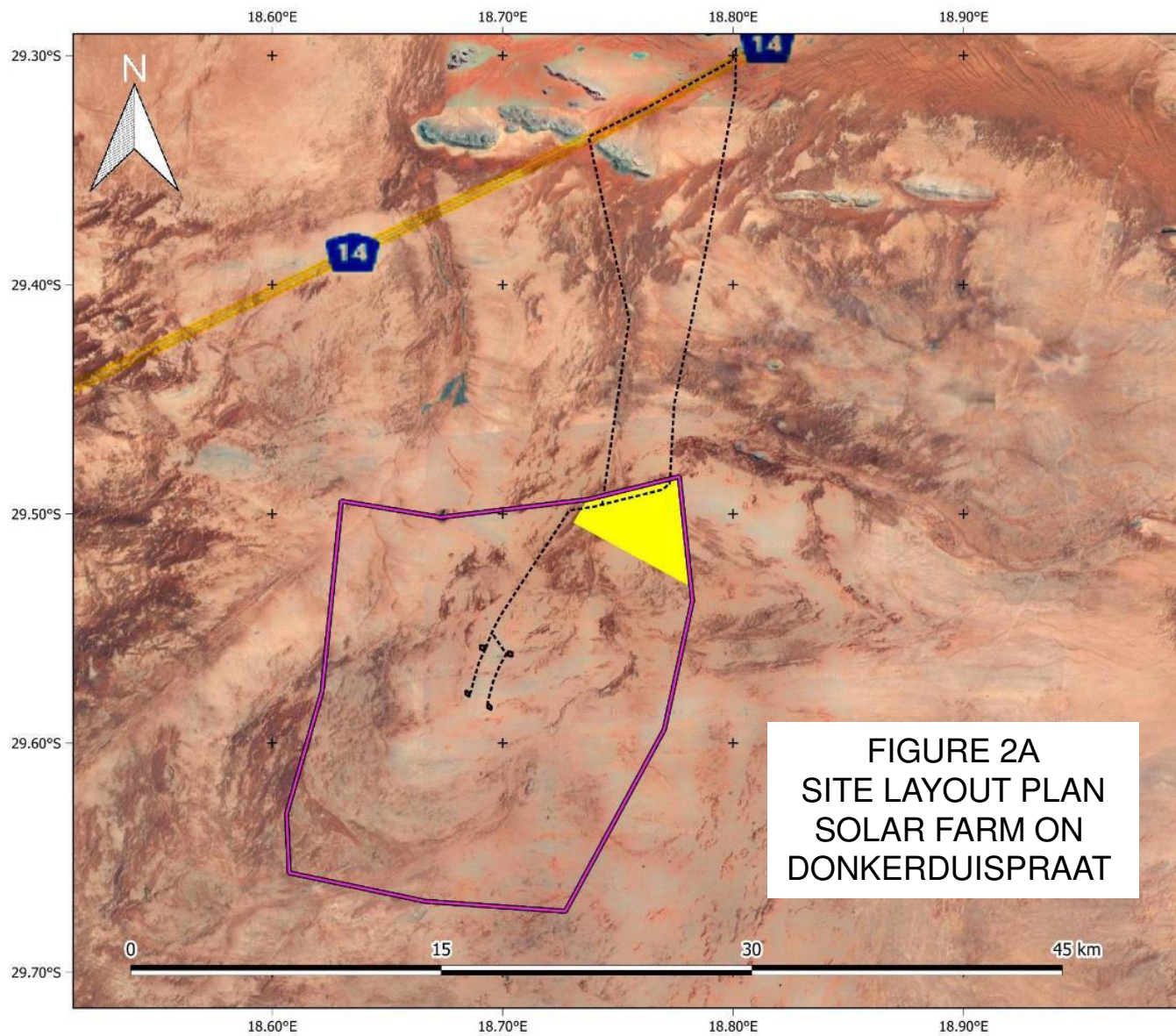


FIGURE 2A
SITE LAYOUT PLAN
SOLAR FARM ON
DONKERDUISPRAAAT

Legend

- Study area
- Lines
- Solar PV area
- Substations

1:160 000

Provincial Context

Appendix B

Photographs



Photo 1: Westbound view along the N14 towards Aggeneys



Photo 2: Westbound view along the N14 towards Springbok



Photo 3: SSD to the West along the N14 from the Access (>500m)



Photo 4: SSD to the East along the N14 from the Access (>500m)