ATLANTIC RENEWABLE ENERGY PARTNERS (PTY) LIMITED

TEHCNICAL LAYOUT DEVELOPMENT REPORT FOR MOGARA SOLAR

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Prepared for:

Cape Environmental Assessment Practitioners (Pty) Ltd

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1. INTRODUCTION

K2018091776 (SOUTH AFRICA) (Pty) Ltd is proposing the establishment of a commercial photovoltaic (PV) solar energy facility (SEF), called Mogara Solar, on the farms known as Legoko Farm No 460 portion 2 and Legoko Farm No 460 portion 1, situated in the District of Kuruman Rd, Northern Cape Province, within the jurisdiction area of the Gamagara Local Municipality.

The technology under consideration is photovoltaic (PV) modules mounted on either fixed-tilt or tracking structures. Other infrastructure includes inverter stations, internal electrical reticulation, internal roads, an on-site switching station / substation, a 132 kV overhead power line (OHL), auxiliary buildings, construction laydown areas and perimeter fencing and security infrastructure. The on-site switching station / substation will locate the main power transformer/s that will step up the generated electricity to a suitable voltage level for evacuating the power into the national electricity grid, via the OHL. Auxiliary buildings include, inter alia, a control building, offices, warehouses, a canteen and visitors centre, staff lockers and ablution facilities and gate house and security offices.

Figure 1 below depicts a typical layout of a solar PV energy facility.

Figure 1: Typical Layout of a Solar PV Energy Facility
(THE MILLION SOLAR ROOF INITIATIVE – SOLAR SALVATION OR SOLAR SCAM? CALIFORNIA PV SOLAR FARMS – A BITTER HARVEST!, 2014)

Mogara Solar will have a net generating capacity of 75 MW_{AC} with an estimated maximum footprint of ± 225 ha. The approximate area that each component of the SEF will occupy is summarised in Table 1 below.

Table 1: Component Areas and % of Total Project Area

SEF Component	Estimated Area	% of Total Area (± 225 ha)	% of Farm Area (856.53 + 1060.65 ha)
PV array	± 200 ha	88.89 %	10.43 %
Permanent and construction laydown areas	± 5 ha	2.22 %	0.26 %
Auxiliary buildings	± 1 ha	0.44 %	0.05 %
Internal roads	± 6 ha	2.67 %	0.31 %
Substation	± 1 ha	0.44 %	0.05 %

2. LAYOUT DEVELOPMENT

It is customary to develop the final / detailed construction layout of the SEF only once an Independent Power Producer (IPP) is awarded a successful bid under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), after which major contracts are negotiated and final equipment suppliers identified. However, for the purpose of the Draft Scoping Report (DSR) in accordance with the minimum requirements prescribed by the Department of Environmental Affairs (DEA), two alternative layouts were identified. The following section elaborates on the layout options for the Mogara Solar facility.

2.1 INITIAL ASSESSMENT AREA

An initial/ conceptual area of ± 225 ha was identified during the initiation phase of the EIA (Scoping) for Mogara Solar. The area is located in the south western corner of Portion 2 of the Farm 460 Legoko. Figure 2 below depicts the 225 ha initial / conceptual area outlined in white.

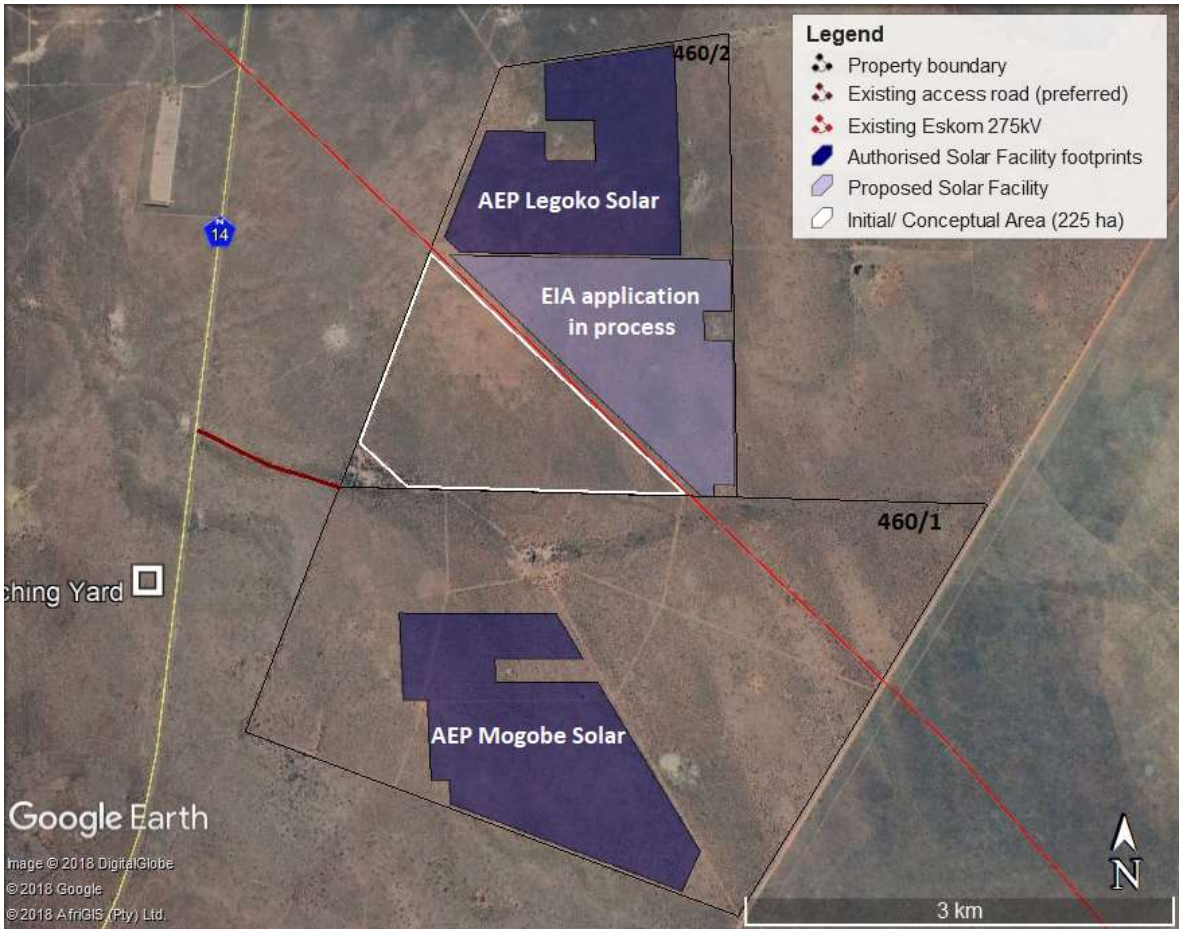

Figure 2: Initial/ Conceptual Area

This initial/ conceptual area only considered the already authorised solar facilities on the properties, namely AEP Legoko Solar (DEA 14/12/16/3/3/2/819) and AEP Mogobe Solar (DEA 14/12/16/3/3/2/820), the existing Eskom 275kV line that runs through both properties, as well as the area under assessment as part of another EIA application (shown in light purple in Figure 2).

The initial/ conceptual area did not consider any environmentally sensitive areas (to be identified by the various specialist studies). This initial/ conceptual area was driven primarily by its proximity to the N14 access road as well as reduced OHL distance to connect into the planned Sekgame Switching Station, located ± 1,5 km to the west of the site.

2.2 SITE SENSITIVITY SCREENING

Following the identification of the initial/ conceptual area, an ecological expert, Mr Simon Todd, was appointed to develop a vegetation and sensitivity rating for the properties. This sensitivity plan was then used to determine the location of the preferred layout alternative, identified therefore in such a manner as to avoid all areas with a medium – high, high and very high sensitivity. This also ensured that potential impact on the protected Acacia erioloba was minimised. Figure 3 below shows the ecological sensitivity for portions 1 and 2 of Legoko 460.

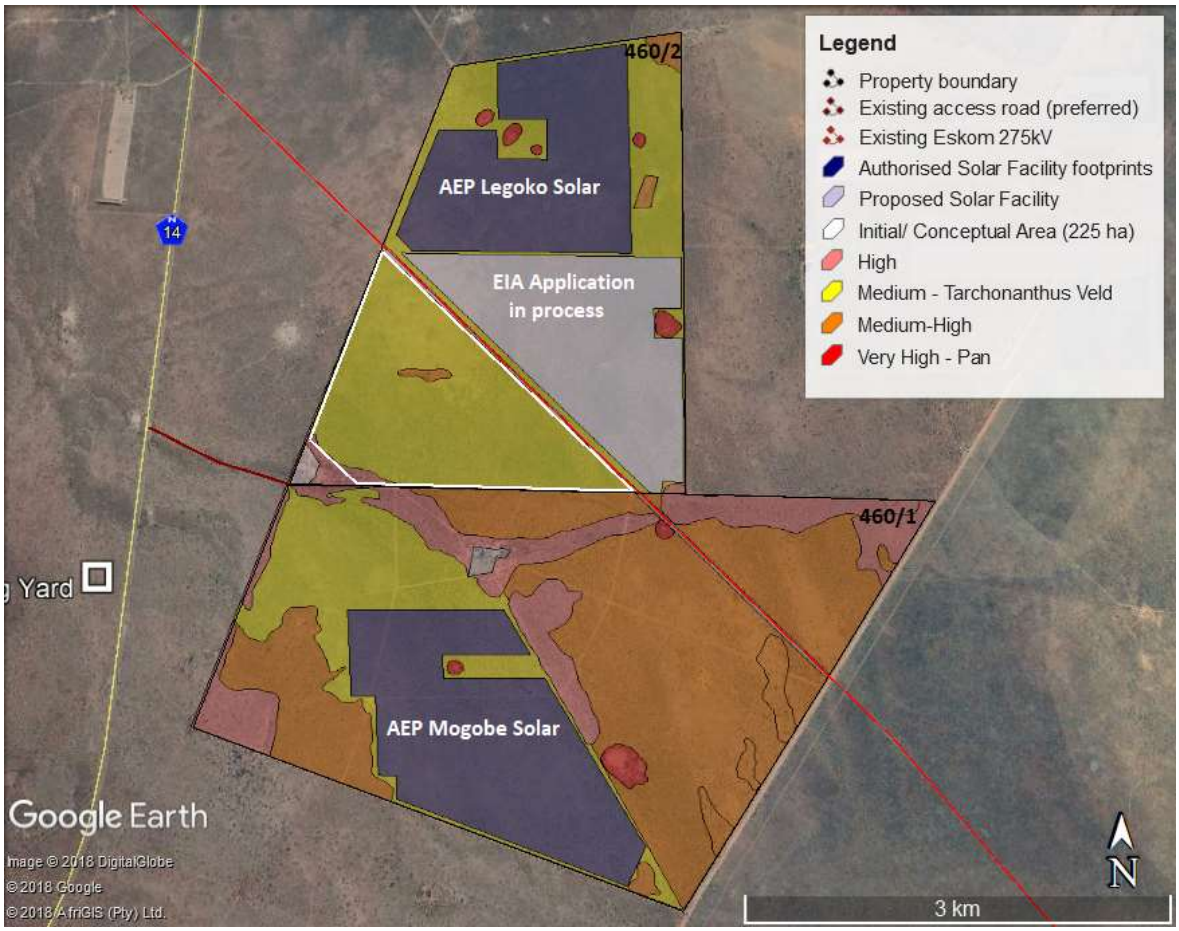

Figure 3: Ecological Sensitivity for Portions 1 & 2 of Legoko 460

2.3 LAYOUT ALTERNATIVE 1 (PREFERRED)

The preferred layout alternative considered during the draft scoping phase of the EIA is depicted in Figure 4 below. Layout Alternative 1 (Preferred) constitutes a preliminary layout area mostly within the initial/ conceptual area, however, due to the high sensitivity erioloba density in the south west corner of the initial/ conceptual area, Layout Alternative 1 has avoided this and has instead extended into Portion 1 of Legoko 460 so that the solar facility footprint occupies only Medium and Medium-High sensitivity area.

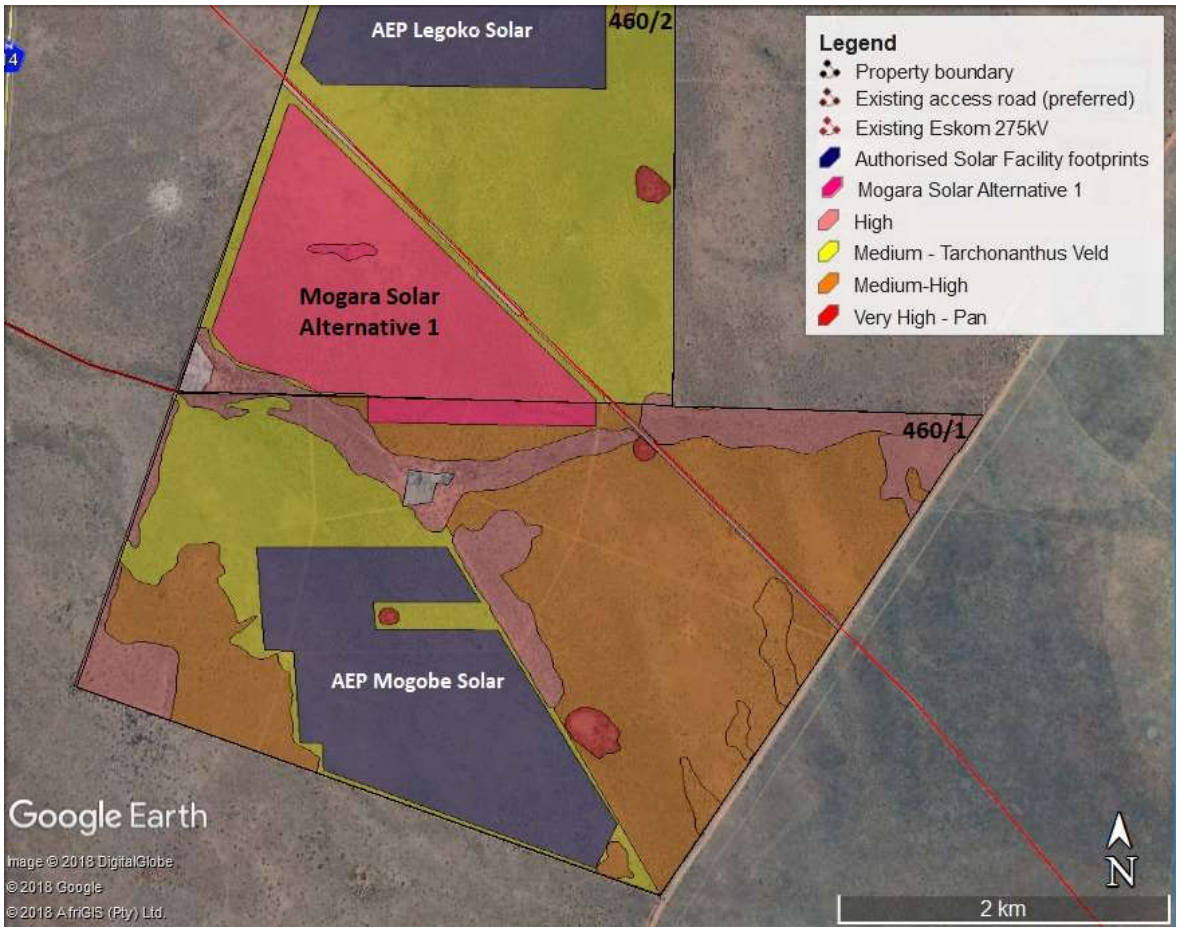

Figure 4: Layout Alternative 1 (Preferred)

2.4 LAYOUT ALTERNATIVE 2

In accordance with the minimum requirements prescribed by the DEA, a second layout option was identified. Layout Alternative 2 is shown in Figure 5 below. Layout Alternative 2 is not preferred because it's solely occupying Medium-High sensitivity, and Layout Alternative 1 only has 19 ha over Medium-High sensitivity.

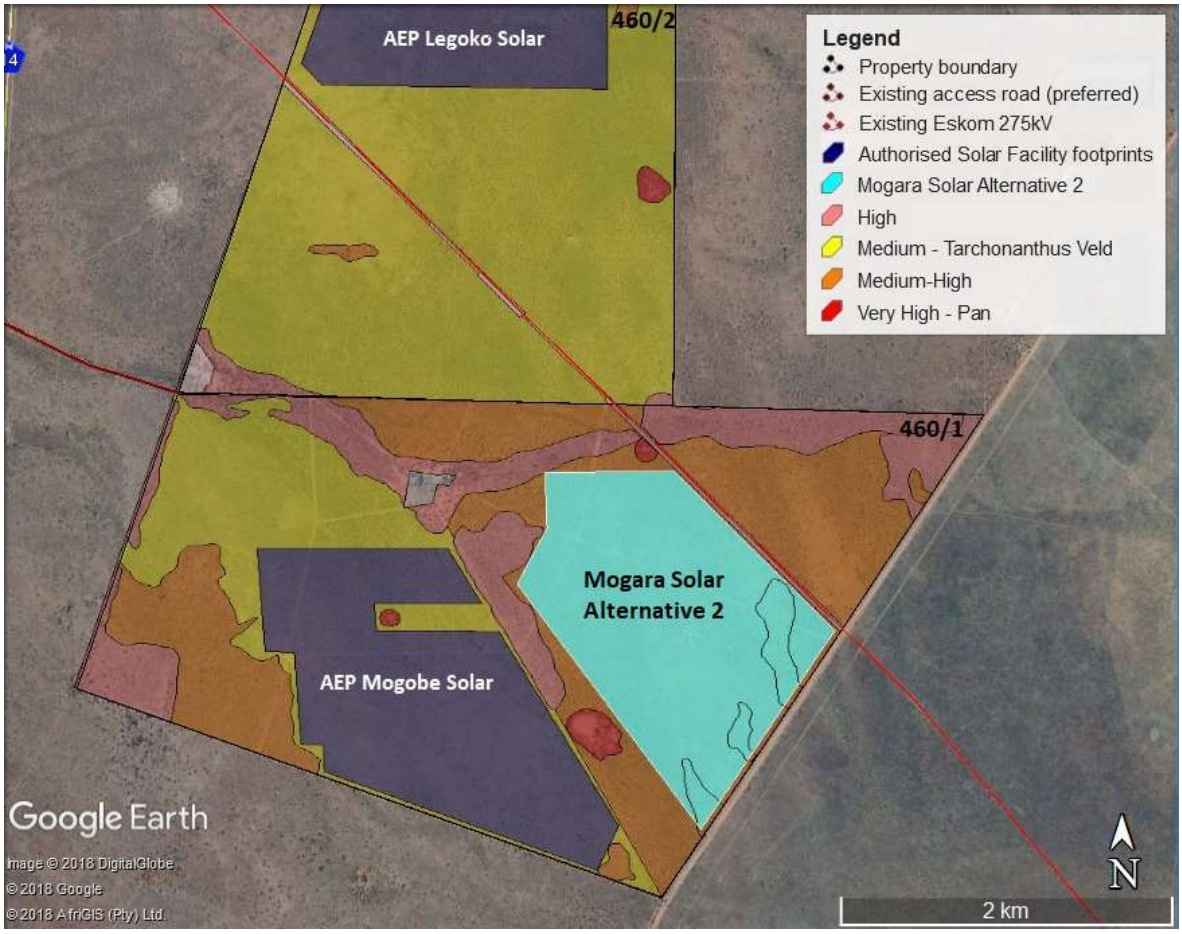

Figure 5: Layout Alternative 2

3. OVERVIEW OF THE SOLAR ENERGY FACILITY

The following section presents an overview of the main components of the solar energy facility layout.

3.1 SOLAR ARRAY

Solar PV modules are connected in series to form a string. A number of strings are then wired in parallel to form an array of modules. PV modules are mounted on structures that are either fixed, north-facing at a defined angle, or mounted to a single or double axis tracker to optimise electricity yield.

3.2 MOUNTING STRUCTURES

Various options exist for mounting structure foundations, which include cast / pre-cast concrete (shown in Figure 6), driven / rammed piles (Figure 7), or ground / earth screws mounting systems (Figure 8).

Figure 6: Cast Concrete Foundation
(Solar Power Plant Business, 2013)

Figure 7: Driven/ Rammed Steel Pile
(SolarPro, 2010)

Figure 8: Ground Screw
(PV MAGAZINE, 2014)

The impact on agricultural resources and production of these options are considered to be the same, however concrete is least preferred due the effort required at a decommissioning phase in order to remove the concrete from the soil, and therefore its impact on the environment. The Hotazel Solar facility will therefore aim to make the most use of either driven / rammed piles, or ground / earth screws mounting systems, and only in certain instances resort to concrete foundations should geotechnical studies necessitate this.

3.3 AUXILIARY BUILDINGS

The auxiliary buildings will comprise of the following as a minimum:

- Control Building / Centre;
- Office;
- 2 x Warehouses;
- Canteen & Visitors Centre;
- Staff Lockers & Ablution; and
- Gate house / security offices.

The total area occupied is approximately 1 ha, excluding the facility switching station/ substation.

3.4 GRID CONNECTION AND CABLING

It is proposed to connect the SEF directly to the planned Sekgame Switching Station located ± 5km to the south of the existing Ferrum MTS; see Figure 9. The SEF substation will be approximately 100m x 100m in size and feature a step-up transformer/s to transmit electricity via a 132 kV OHL directly to the Sekgame Switching Station. The OHL is envisaged to be ± 4km in length, a maximum height of 24m and occupy a servitude width of between 31m – 51m.

A 75 MW_{AC} installation will require specific electrical components to meet the national grid code requirements in order to generate and supply electricity into the national grid.

The conversion from DC (modules) to AC is achieved by means of inverter stations. A single inverter station is connected to a number of solar arrays, are will be placed along the internal service roads for ease of access. A number of inverter stations will be installed for the SEF (up to maximum of ± 60 centralised inverters, or a maximum of ± 840 string inverters), each of which is connected to the on-site / facility substation.

Final placement of the inverter stations and on-site / facility substation will need to take ground conditions into consideration. Interconnecting electrical cabling will be trenched where practical and follow internal access roads to the greatest extent. Sensitive areas will consequently be avoided as far as possible, or alternatively, cables will be fastened above- ground to the mounting structures so as to avoid excessive excavation works and clearing of vegetation.

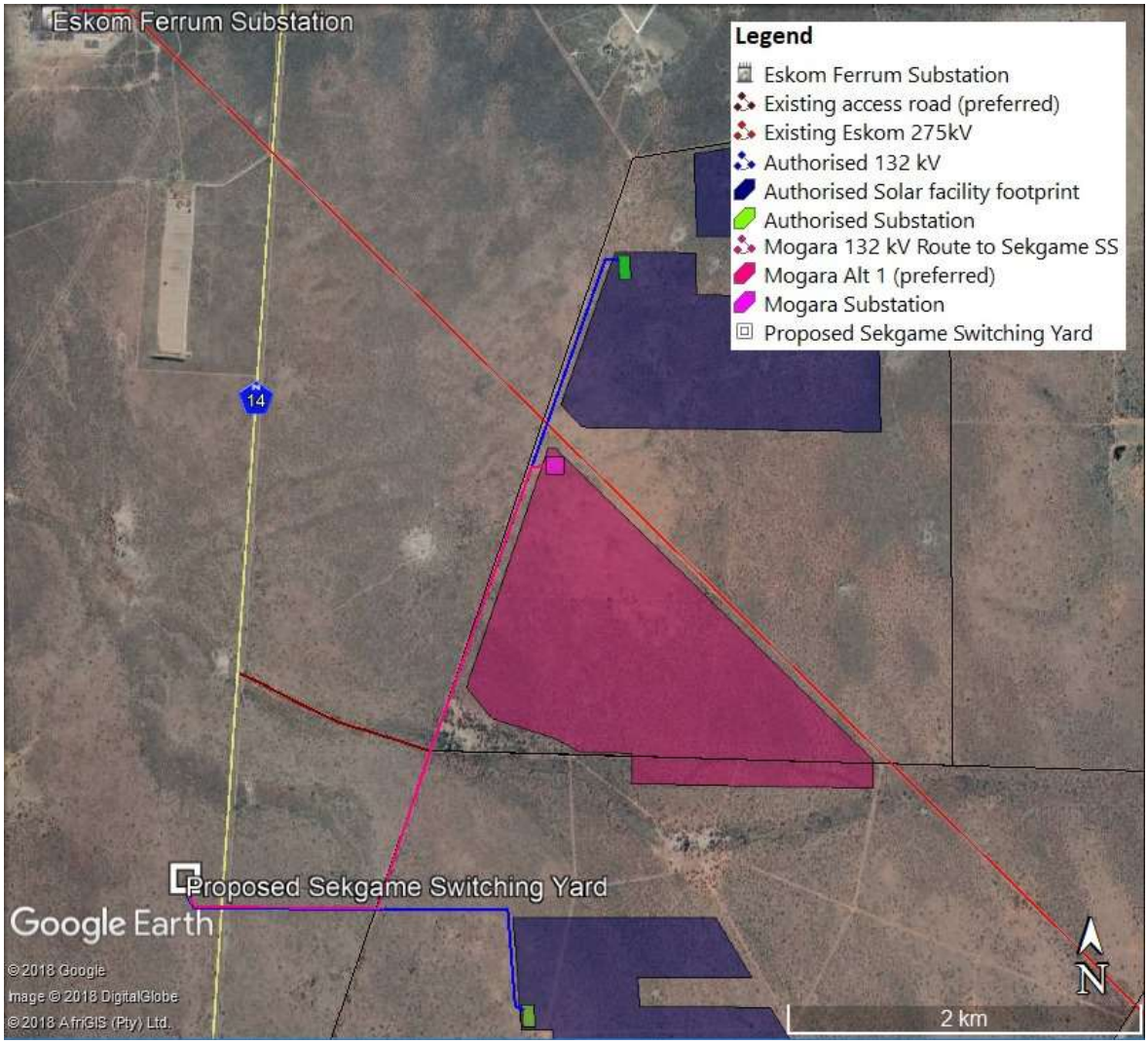

Figure 9: Proposed Grid Connection

3.5 ACCESS ROUTES AND INTERNAL ROADS

Two main access roads are being considered off the N14 to the proposed Mogara Solar facility, as depicted in Figure 10 below (the orange and brown lines).

- Preferred Site Access (brown): follows an existing gravel access road to the site, and then an existing internal farm access road over Portion 2 of the Farm 460 Legoko. This option is in closer proximity to the farm homestead than the alternative, however it is shorter (2.9km) than the alternative.
- Alternative Site Access (orange) follows an existing farm access road to Portion 2 of the Farm 460 Legoko. This option is located further from the farm homestead however it is longer (4.7km) than the preferred access route.

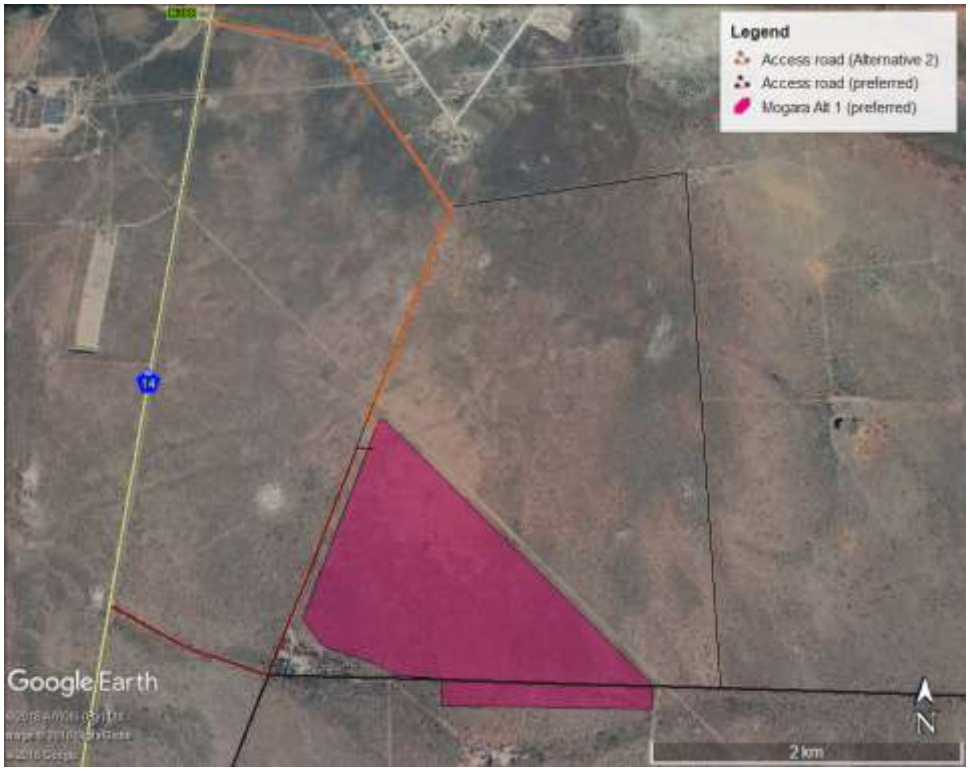

Figure 10: Access Routes to Mogara Solar

The internal road network of the SEF will be gravelled roads, 4 – 5m in width, around the solar array periphery. Roads located in-between the solar modules will be un-surfaced tracks to be used for maintenance and cleaning of solar PV panels.

A detailed transport and traffic plan will be undertaken during the EIA phase of the project. Precautionary measures will be taken to mitigate the risk of ground disturbances where access roads will be constructed. Special attention will be given to drainage, water flow and erosion by applying appropriate building methods.

4. CONCLUSION

Layout Alternative 1 (Preferred) has been developed based on key criteria identified above, including inter alia, already authorised solar footprints, accessibility, assessment of alternatives, proximity to the planned Sekgame Switching Station, as well as consideration of sensitive areas to minimise ecological and other impacts.

Further assessment will be undertaken for the proposed Layout Alternative 1 site during the detailed EIA phase of the project.

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