DYASONS KLIP PV 5 (PTY) LTD

TECHNICAL LAYOUT DEVELOPMENT REPORT FOR DYASONS KLIP 5

Prepared for:

Cape Environmental Assessment Practitioners (Pty) Ltd

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Dyasons Klip PV 5 (Pty) Ltd is proposing the establishment of a commercial photovoltaic (PV) solar energy facility (SEF), called Dyasons Klip 5. The study area refers to the Remaining Extent of Farm Dyason's Klip 454 which is located approximately 20 km south west of Upington and 16 km north east of Keimoes in the Kai!Garib Local Municipality (ZF Mgcawu District Municipality) in the Northern Cape.

The technology under consideration are 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, potentially a 132 kV overhead power line (OHL), battery storage, auxiliary buildings, construction laydown areas, 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. The figure below depicts the typical layout of a solar PV energy facility.

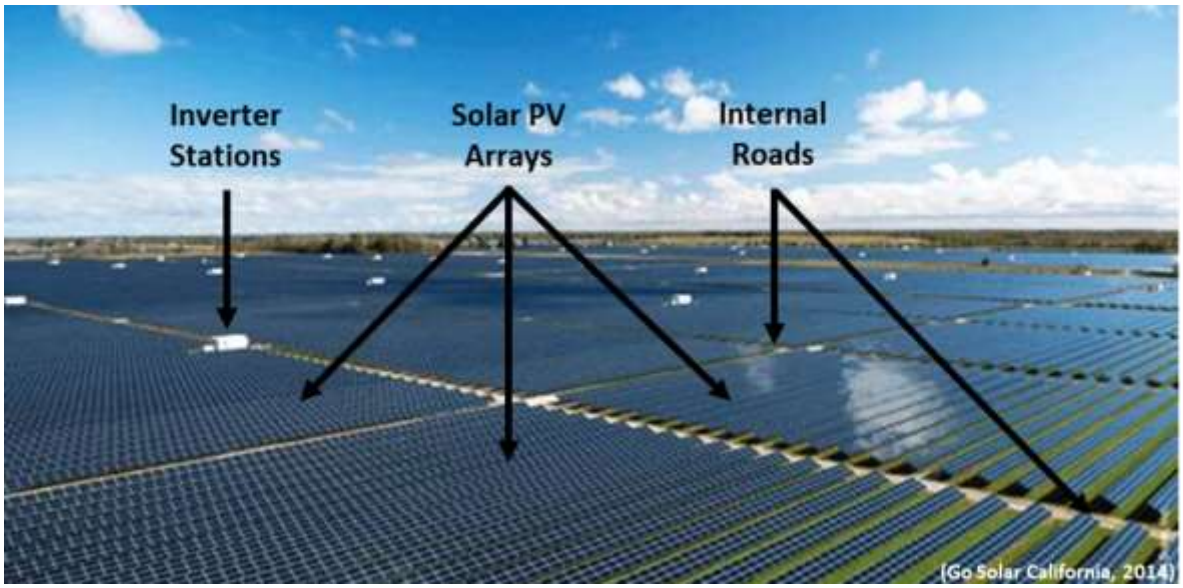

Figure 1: Typical Layout of a Solar PV Energy Facility.

Dyasons Klip 5 will have a net generating capacity of 100 MW_{AC} with an estimated maximum footprint of ± 267 ha within the site development area of 295ha. The approximate development area which each component of Dyasons Klip 5 will occupy is summarised in Table 1 below.

Table 1: Component Areas and % of Total Project Area

SEF Component	Estimated Area	% of Total Area (± 267ha)	% of Farm Area (5725.28 ha)
PV array	± 250ha	93.6 %	4.3 %
Permanent and construction laydown areas	± 3ha	1.1%	0.05 %
Auxiliary buildings	± 1 ha	0.37 %	0.02 %
Internal roads	± 6.5ha	2.4 %	0.11 %
Substation	± 1 ha	0.37%	0.02 %
Battery Storage	± 4 ha	1.5%	0.07 %

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 Basic Assessment (BA) 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 Dyasons Klip 5.

2.1 INITIAL ASSESSMENT AREA

An initial/ conceptual area of ± 1050 ha was identified during the planning phase of the Basic Assessment for Dyasons Klip 5. The initial/ conceptual area is located in the north eastern portion of the Remaining Extent of Farm Dyason's Klip 454. Figure 2 below depicts the 1050ha initial/ conceptual area outlined in red.

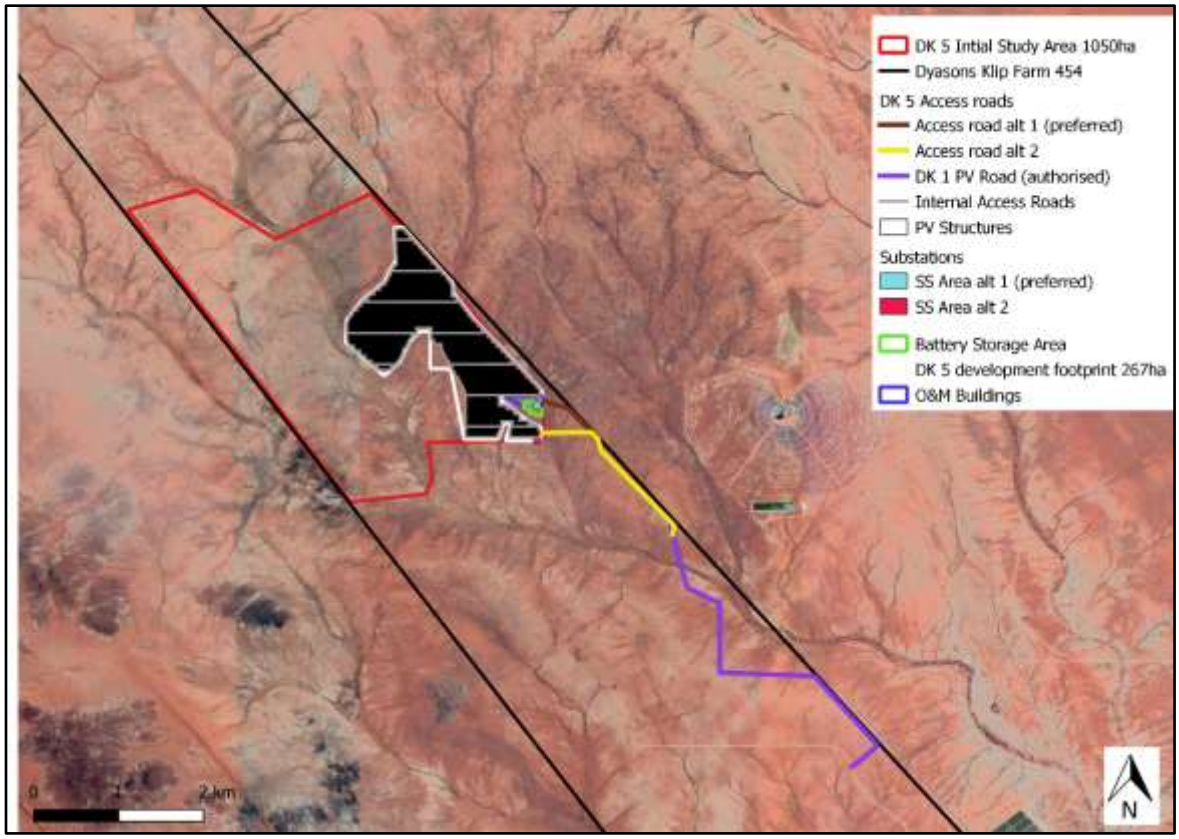

Figure 2: Initial/ Conceptual Area

The initial/ conceptual area did not take environmental sensitive areas (to be identified by the various specialist studies) into consideration. 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 Upington MTS, located ± 9km to the south east of the site.

2.2 SITE SENSITIVITY SCREENING

Following the identification of the initial/conceptual area, various specialists namely ecological, aquatic and avifaunal were appointed to assist in the site selection process in the form of mapping the sensitive area of the initial/ conceptual area following a site visit. These sensitivity files were then used to determine the location of the preferred layout alternative during the planning and design phase, which aimed to avoid all areas with a high and very high sensitivity as indicated Figure 3 below.

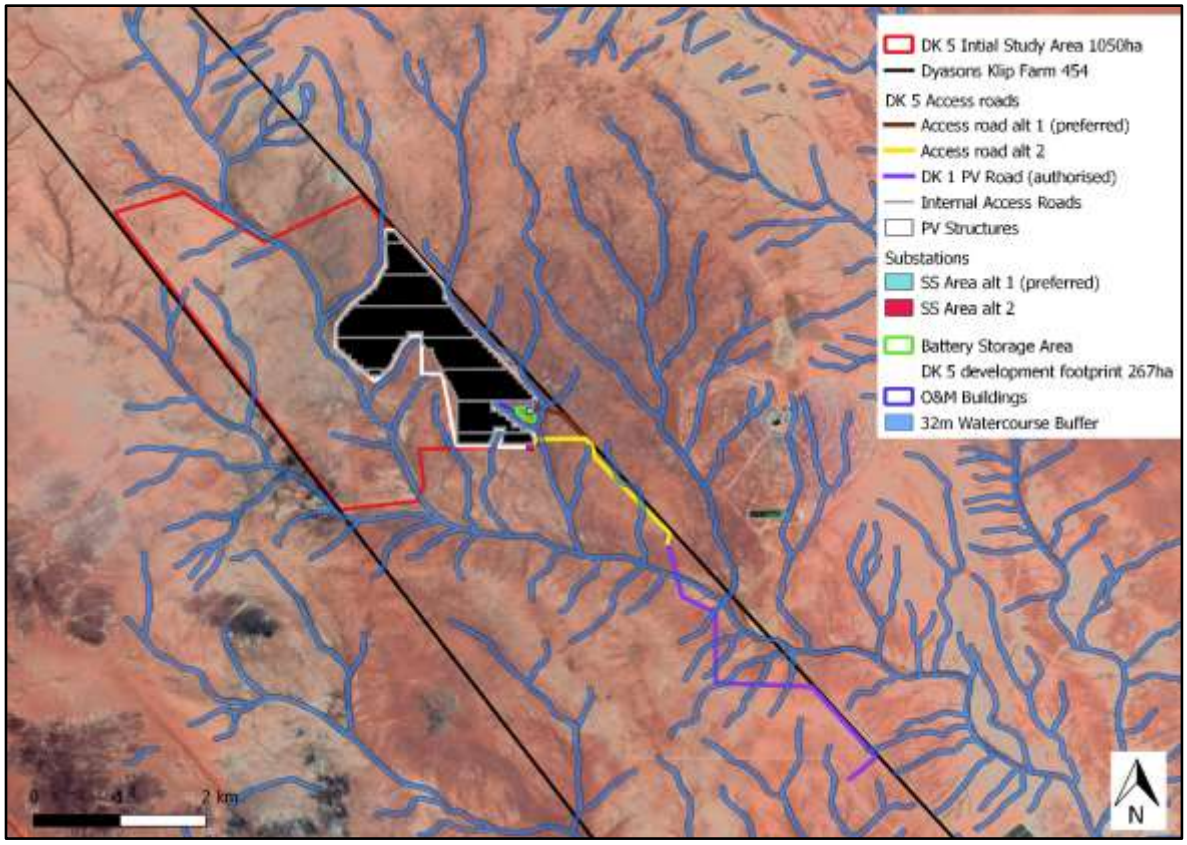

Figure 3: Ecological Sensitivity for Dyasons Klip 5 located on the Remaining Extent of Farm Dyason's Klip 454.

2.3 LAYOUT ALTERNATIVE 1 (PREFERRED)

As mentioned above, extensive upfront consultation was undertaken during the planning and design phase of the project with the various specialists particularly the ecological and aquatic specialists in order to mitigate the proposed impacts on the high and very high sensitive environmental features associated with Dyasons Klip 5 study area. Figure 3 illustrates how this process resulted in Dyasons Klip 5 development area being reduced from the initial 1050ha (red) scoping area which was further reduced to the final development area of 267ha (white).

Therefore the preferred layout alternative within the initial/conceptual area was the only alternative considered for Dyasons Klip 5 as depicted in Figure 4 below. Layout Alternative 1 predominantly occupies only Low/Medium sensitivity areas.

Two substation layout alternatives each with three proposed grid line corridors to connect the Dyasons Klip 5 to the Upington MTS were incorporated into the Dyasons Klip 5 layout to be assessed in the BAR. Substation Alternative 1 (preferred) is located within the south-eastern portion of the Dyasons Klip 5 development footprint, whilst Substation Alternative 2 is located in the south-portion of the development footprint which borders Dyasonsklip Solar Energy Facility 1, or otherwise referred to as Dyasons Klip 4 (DK4). Grid Corridor Alternative 1 (1.1 and 2.1) runs past (switches into) the Dyasonsklip Solar Energy Facility 1 substation, along the north and then western

boundary of DK3 into DK1/2 Switching Station, and then parallel to the existing 132kV line all the way back to Upington MTS. Grid Corridor Alternative 2 (1.2 and 2.2) runs past (switches into) the Dyasonsklip Solar Energy Facility 1 substation, runs down the eastern boundary, and then parallel to the existing 132kV line all the way back to the MTS. This is the preferred route based on technical discussions with both the Project team and Eskom, and also happens to be the shortest route. Grid Corridor Alternative 3 (1.3 and 2.3) runs past (switches into) the Dyasonsklip Solar Energy Facility 1 substation, runs down the eastern boundary, and then parallel to the proposed 400kV Aries-Upington line all the way back to the MTS. Figures 4 and 5 illustrate the grid corridors which connect Dyasons Klip 5 to the Upington MTS, the dimensions of the grid corridors are stipulated in Table 2 and 3.

Table 2: Substation Alternative 1 and Grid Connection Corridor Description

Substation Alternative 1 (Preferred)	**Length**	**Width**
Grid Corridor 1.1	19.7km	400m
Grid Corridor 1.2 (Preferred)	12.7km	400m
Grid Corridor 1.3	13.8km	400m

Table 3: Substation Alternative 2 and Grid Connection Corridor Description

Substation Alternative 2	**Length**	**Width**
Grid Corridor 2.1	19.5km	400m
Grid Corridor 2.2	12.5km	400m
Grid Corridor 2.3	13.6km	400m

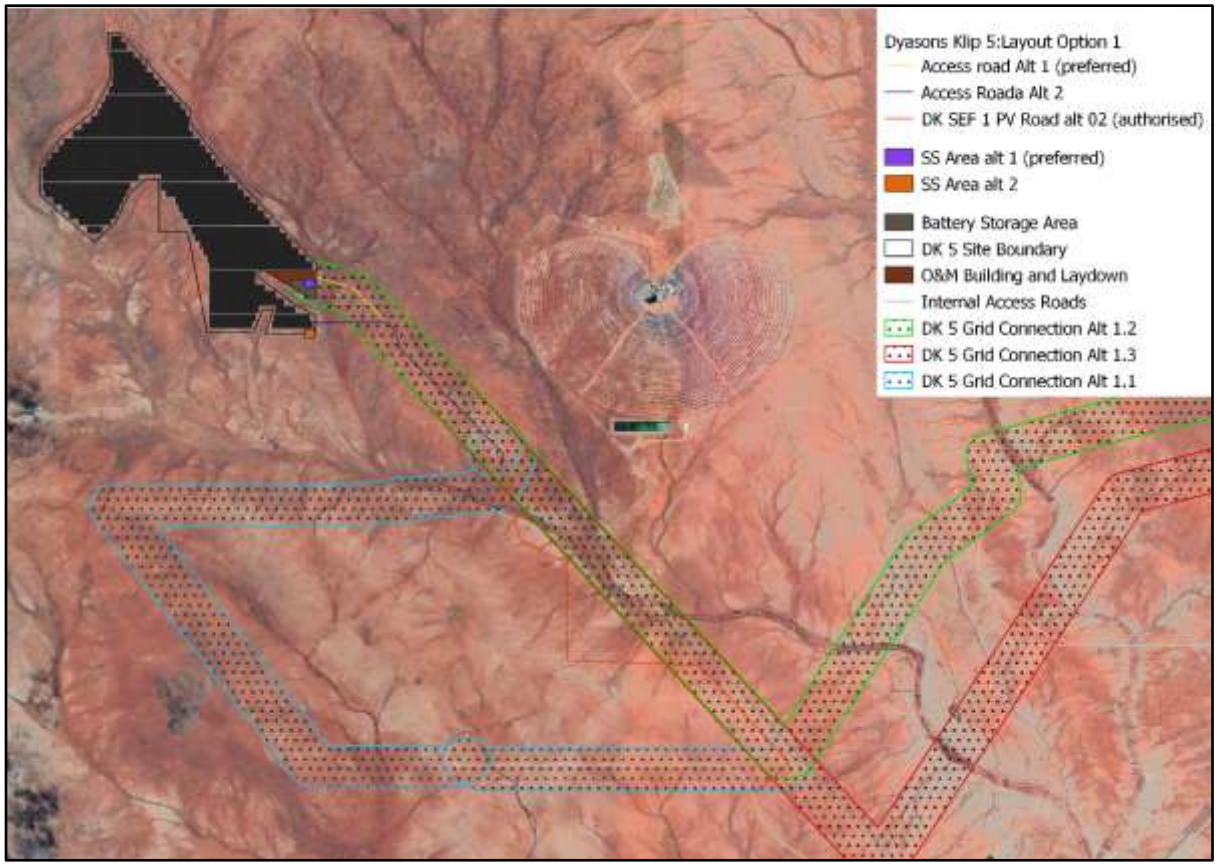

Figure 4: Dyasons Klip 5 Site Development Boundary and Grid Corridor Alternative 1.2 (preferred).

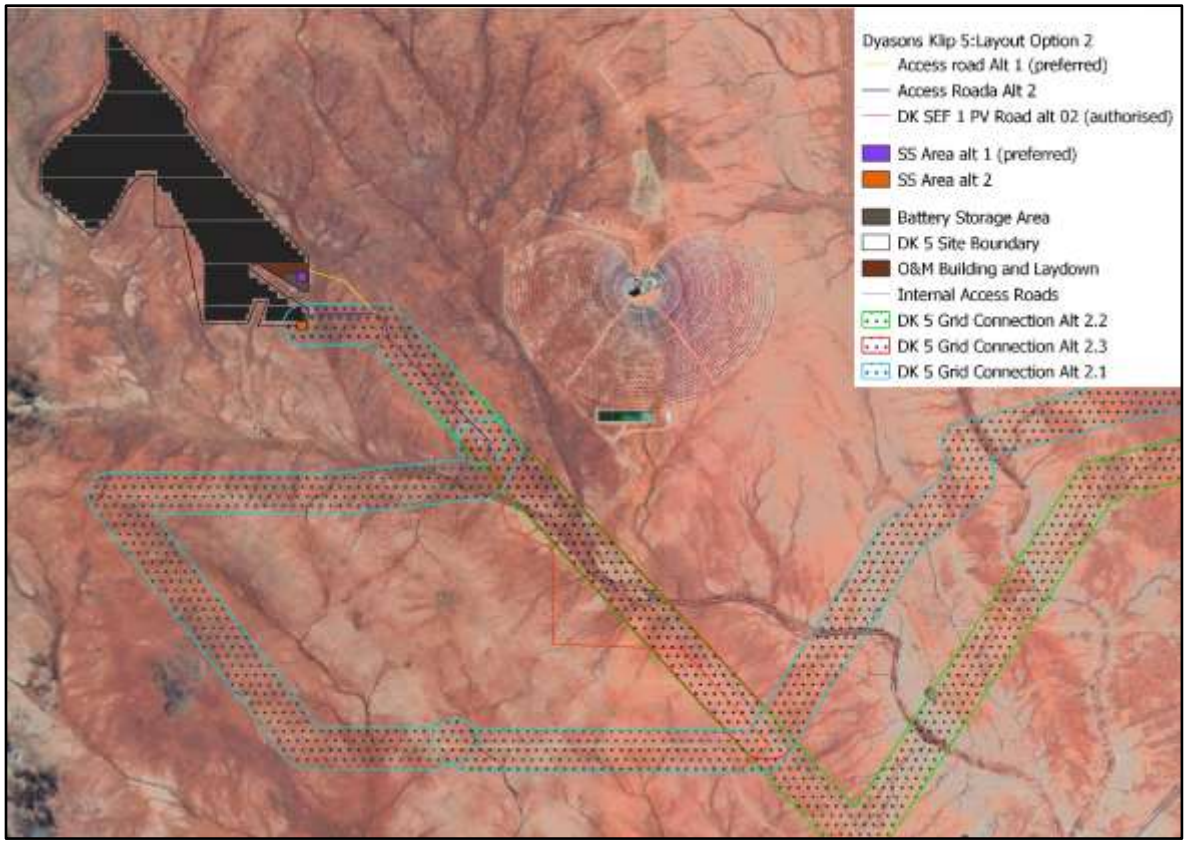

Figure 5: Dyasons Klip 5 Site Development Boundary and Grid Corridor Alternative 2.1

3. OVERVIEW OF THE SOLAR ENERGY FACILITY

The following section presents an overview of the main components of Dyasons Klip 5 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, driven/rammed piles, or ground/earth screws mounting systems (Figure 6).

Figure 6: Mounting Structures. A) Cast Concrete Foundation. B) Driven/ Rammed Steel Pile. C) Ground / Earth Screw.

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. Dyasons Klip 5 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 BATTERY STORAGE

Renewable energy can currently achieve lower costs than fossil fuels. By incorporating energy storage technologies into renewable energy facilities, electricity can be stored during generation peaks and supplied during demand peaks.

Lower costs coupled with improved efficiencies, high energy density, lightweight design and low environmental risks, make Lithium Battery Technologies the preferred alternative. Please see Annexure 1 for the Battery Storage Technical Development Report.

Dyasons Klip 5 will include a 400MWh battery that will cover a maximum area of 4ha (Figure 7).

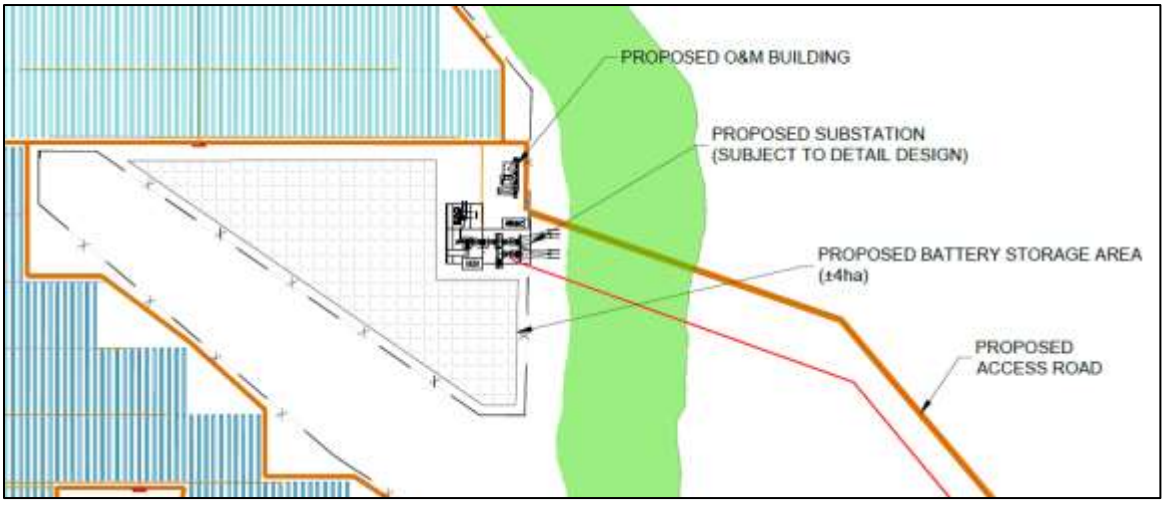

Figure 7: Proposed layout indicating battery storage area.

3.5 GRID CONNECTION AND CABLING

Dyasons Klip 5 intends to connect to the Upington MTS (400/132 kV) located ± 8km to the south east of the site, via the 132kV Dyasons Klip 5 on-site substation/ switching station located within the south eastern boundary of the site. The proposed Dyasons Klip 5 on-site substation/ switching station will be approximately 100m x 100m in total; ± 100m x 50m for the facility side, and ± 100m x 50m for the Eskom Switching Station side. A step-up transformer/s will be installed to transmit electricity via a 132 kV OHL directly from the Dyasons Klip 5 Substation and onto the Upington MTS. The OHL is envisaged to be ± 13km in length, a maximum height of 32m and occupy a servitude width of between 35 and 52m. A 100 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 and will be placed along the internal service roads for ease of access. A number of inverter stations will be installed for the SEF (either centralised or 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.

3.6 ACCESS ROUTES AND INTERNAL ROADS

The proposed Dyasons Klip 5 is accessible via the N14 National Road which connects Upington and Keimoes in a south-west direction.

- Preferred point of access will be via the existing DK 1 and 2 site entrance off the N14 Road. Approx. 2.2km of the existing DK 1 and 2 road will be utilized prior to heading east to utilize approx. 5km of the authorised DK 2 road as indicated in blue in Figure 8.
- The construction of a new access road will be required to gain access from DK2 to the proposed Dyasons Klip 5 site entrance. There are two alternatives proposed for the new access road, alternative 1 represented in brown in Figure 8 is approx. 2.46km in length whereas alternative 2 (yellow) is approx. 2.3km in length.

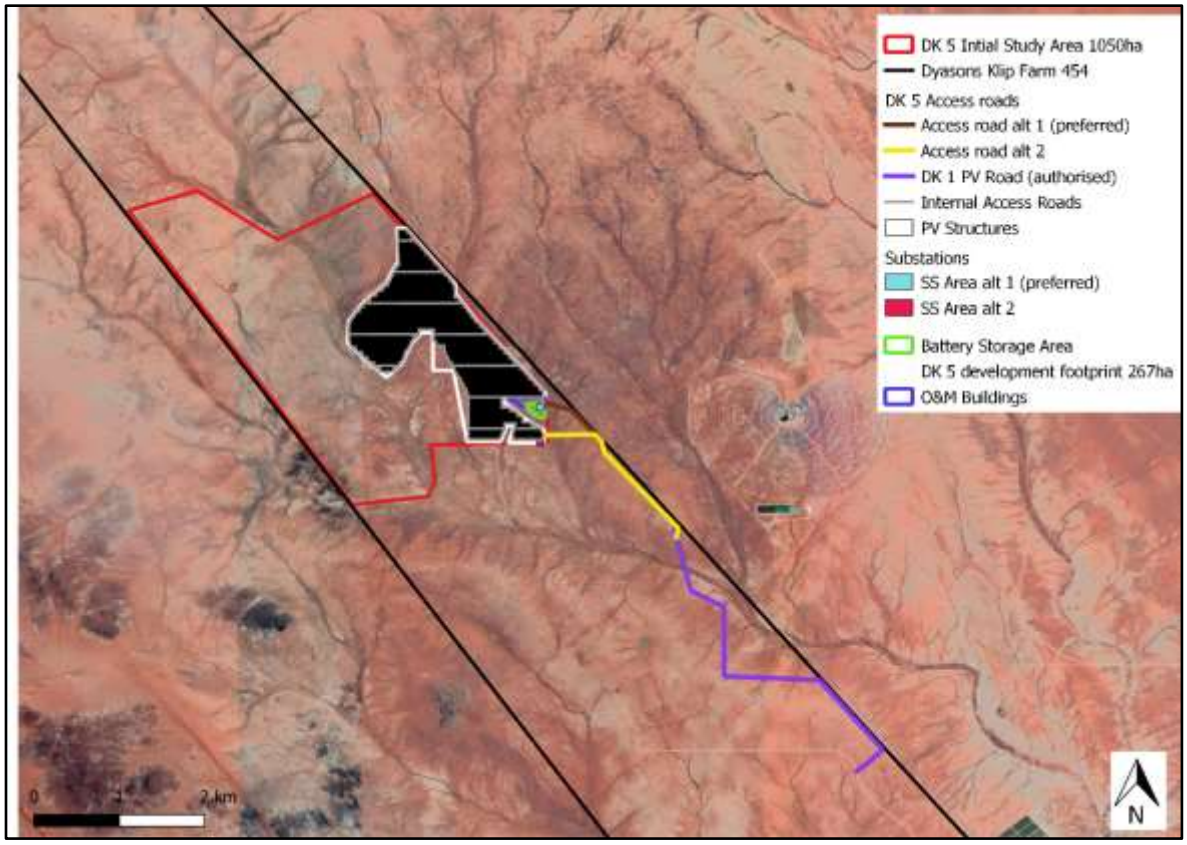

Figure 8: Access Routes to Dyasons Klip 5 Site Entrance

The internal road network of Dyasons Klip 5 will be gravelled roads, approximately 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 is currently being compiled for the project and will be assessed in the impacts tables of the BA Report. 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.

3.7 SERVICES REQUIRED

3.7.1 Water

Water required during the construction and operation phases will be sourced from (in order of priority):

1. The Local Municipality (LM) - Specific arrangements will be agreed with the LM in a Service Level Agreement (SLA). Most likely the water will be either trucked in, or otherwise made available for collection at their Water Treatment Plant via a metered standpipe.
2. Investigation into a third-party water supplier which may include a nearby mine or other private services company.
3. A borehole drilled on site, which will be subject to complete geohydrological testing and a WULA.

3.7.2 Electricity

Electricity will be needed during the construction period as well as the operation period in the support offices, security systems etc. Electricity supply during construction will be arranged with either the LM or Eskom Distribution, via an 11kV or 22kV feeder line.

In addition, diesel/petrol generators for electricity generation may be used during the construction period.

3.7.3 Waste Management

Solid waste

During the construction phase, solid waste will mainly be in the form of construction material, excavated substrate and domestic solid waste. All waste will be disposed of in scavenger proof bins and temporarily placed in a central location for removal by the contractor. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility. Excess excavation material will either be spoiled offsite at a registered facility or used for landscaping berms within the overall PV footprint.

Sewerage

During the construction phase, chemical ablution facilities will be utilised. These ablution facilities will be maintained, serviced and emptied by an appointed contractor, who will dispose of the effluent at a licensed facility off site. Once construction is complete, the chemical ablution facilities will be removed from the construction site. A conservancy tank which will be regularly emptied by a registered service provider will be installed at the Operations & Maintenance building and on-site substation.

Hazardous substances

During the construction phase, use of the following hazardous substances is anticipated:

- Cement associated with the piling activities and construction of buildings and inverter station plinths;
- Petrol/diesel for construction plant; and
- Limited amounts of lubricants and transformer oils.

Temporary storage and disposal of hazardous waste will be done in compliance with relevant legislation (i.e. stored in covered containers with appropriate bunding). Refuelling areas to be in designated positions, with suitable mitigation to reduce the risk of hydrocarbon spills.

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 Upington MTS, as well as consideration of sensitive areas to minimise ecological and other impacts.

5. LIST OF REFERENCES

PV Magazine (January 2018). *South Africa: Outstanding PPAs for solar, renewables to be signed by end of March.* Retrieved from: https://www.pv-magazine.com/2018/01/19/south-africa-outstanding-ppas-for-solar-and-renewables-to-be-signed-by-the-end-of-march/

Sempra Renewables. (23 June 2014) Boulder City, NV – Copper Mountain Solar 1 Retrieved from: *https://www.glassdoor.com/Photos/Sempra-Renewables-Office-Photos-IMG213060.htm*

Solar Power Plant Business. (07 December 2013). *Abandoned Farmland Serves as Solar Site*. Retrieved from: *http://techon.nikkeibp.co.jp/english/NEWS_EN/20131207/321200/?ST=msbe*

SolarPro. (June/July 2010). *Ground-Mounted PV: Page 6 of 9*. Retrieved from *http://solarprofessional.com/articles/design-installation/ground-mounted- pv/page/0/5*

The Million Solar Roof Initiative – Solar Salvation or Solar Scam? California PV Solar Farms – A Bitter Harvest! (2014, January). Retrieved from GO Solar CALIFORNIA: http://www.gosolarcaliforniainformation.com/