2.2 Site Topography

The Kloofsig solar farm area is predominantly flat with gradients less than 1%, sloping to the north. The average elevation of the development area range from 1200 to 1240 meters above sea level (masl), with some soft rolling hills surrounding the development area, not affecting the footprint of the proposed development. **Refer to the extract above, of the 1:50 000 Topographical Maps 2924DC and 3024BA.**

The site is therefore well suited for the development of a PV Solar Energy facility.

3 TRANSPORT REQUIREMENTS

3.1 Typical PV Solar Panels for Large Scale Solar Farms

Photo voltaic solar panels are generally manufactured from small silicon crystals (polycrystalline) and various types are available to be used for large scale solar farms. Solar farms consists of arrays of numbers PV panels installed next to another, to create large surface areas of solar panels to generate electrical energy from the sun. Each panel (for commercial use) is typically in the range of 39 x 77 inches (1m wide x 2m long), and will typically generate 275W to 345W energy (standard test conditions (STC)) per panel, with the real power output being approximately 10 to 15% less efficient.

The selection of type, size and efficiency of the panels will make a huge impact on the cost efficiency of the development, the environmental footprint required, as well as the number of truck loads required to transport all components.

Photos 1 and 2 : Typical PV Solar Panels

PV Solar panels are generally package at the point of manufacturing, in between wooden frames to protect the panels during loading and transportation. Sets of PV panels are packed together, to fit loading in standard shipping containers, lifted and placed carefully with standard forklifts into the containers – see photo 3 below.

3.2 Typical Transport Vehicles and Cranes for handling PV Solar Components

Standard shipping containers are available in lengths of 20 feet (6m) and 40 feet (12 m) variations. It is anticipated that only 40 feet standard shipping containers, with a height of 8,6 feet (2.62m) and a width of 8 feet (2,44m), will be used to load the PV solar panels and transport to site.

Based on the above dimensions, **a standard 40 feet shipping container can hold approximately 230 up to 280 PV solar panels**. The weight of a fully loaded container will not exceed 30 tons.

Photo 3: Typical Loading of PV Solar Components into 40 feet Shipping Containers

Containers will be loaded at the point of manufacturing and lifted onto flatbed trucks to transport to an export harbour from a foreign country or directly to site, if locally manufactured. Flatbed trucks are often equipped with on-board lifting cranes (mounted to the trucks), to assist with the loading and off-loading on site – see photo 4 below.

Photo 4: Typical handing and loading of Shipping Containers at Factory and Harbour

Photo 5: Typical Transport Vehicles for PV Solar Components (40 feet containers)

Based on the above information, it is important to note that the transport of all PV Solar panels will be done with standard shipping containers and standard trucks, as per photo 5 above. No abnormal loads (in terms of length, width, height of weight) are foreseen. **Hence no permits or special transportation licences are required** to travel on national roads or any other route to the site.

It is expected that between 980 to 1200 standard 40 feet containers will have to be transported to site, during the installation period of the Phase 1 development, to deliver all the required PV Solar panels for this development.

Photo 6: Typical handing and off-loading of Shipping Containers on Site, using Mobile Cranes

The shipping containers need to be transported to a temporary central laydown area on site, close to the Phase 1 development, which has to be relatively flat and large enough to accommodate all of the containers. Such a central laydown area will require a maximum area of 10 000m² (1 ha) with containers stacked 3 rows high. Depending on the sequence and tempo of the container delivery and the speed of the installation process, a smaller laydown area may be required.

Single containers can then be transported from the central laydown area to the point of installation, as and when required. Mobile cranes will be required on site at the central laydown area for off-loading (see photo 6), as well at the point of installation (see photo 7), to lift and handle the PV Solar panel containers.

Photo 7: Typical handing of Shipping Containers and PV Solar Panels at point of installation. Note the space required for mobile cranes to manoeuvre during the installation process.

4 TRANSPORT ROUTE ALTERNATIVES TO SITE

4.1 Transport from Harbours

All PV solar panels manufactured in foreign countries will be imported by shipping the PV Solar panels in pre-packed standard shipping containers, to a South African Harbour.

The preferred port of import will be the Ngqura Harbour near Port Elizabeth, with route details as follow :

- 530km from the Ngqura Harbour to Petrusville, with a 5h15 travel time;
- take the N2 eastwards from Neptune Road when exiting the harbour, for approximately 30km;
- follow the N10 northwards via Cradock and Middelburg for 410km to Hanover;
- turn right / northwards at Hanover onto the R389 towards Philipstown;
- travel 75km to Philipstown and continue straight on the R48 for 40km to Petrusville.

The above roads are all surfaced roads and are in a relative good condition. No width or height limitations are foreseen along this route, which will impact negatively on the transportation of the PV Solar farm components. No road upgrades will be required along these roads to Petrusville.

The first alternative port of import will be the Cape Town Harbour, with route details as follow :

- 820km from Cape Town Harbour to Petrusville, with an 8h travel time;
- follow the N1 for 705km to Hanover (toll route);
- turn left / northwards at Hanover onto the R389 towards Philipstown;
- travel 75km to Philipstown and continue straight on the R48 for 40km to Petrusville.

The above roads are all surfaced roads and are in a relative good condition. No width or height limitations are foreseen along this route, which will impact negatively on the transportation of the PV Solar farm components. No road upgrades will be required along these roads to Petrusville.

The Saldanha Bay Harbour can be used as second alternative port of import, with route details as follow :

- 905km from Saldanha Harbour to Petrusville, with a 9h travel time;
- take the R45 and R311 to the N7 at Moorreesburg for approximately 85km;
- follow the R46 for approximately 170km to the N1 at Touws River;
- follow the N1 for 530km to Hanover;
- turn left / northwards at Hanover onto the R389 towards Philipstown;
- travel 75km to Philipstown and continue straight on the R48 for 40km to Petrusville.

The above roads are all surfaced roads and are in a relative good condition. No width or height limitations are foreseen along this route, which will impact negatively on the transportation of the PV Solar farm components. No road upgrades will be required along these roads to Petrusville.

4.2 Transport from Airports

It is not foreseen that any PV Solar components will be imported by air transport due to high cost. However, should it be necessary to import any specific components via air transport, any freight can safely be transported to site by standard trucks on the existing national and provincial road network, without any limitations or obstacles foreseen.

4.3 Transport from National Manufacturers

Any components (PV Solar panels, transformers or electrical equipment and cables) required for this Solar Farm development, which will be manufactured locally, can safely be transported to site by standard trucks on the existing national and provincial road network, without any limitations or obstacles foreseen.

4.4 Location and Description of Local Access Roads to Site

The Traffic Management Plan for Phase 1 (drw no. R2004-RD-TP-01), bound in Annexure A, shows a schematic layout of all local access roads from Petrusville to the Phase 1 development, which can be used for transport routes. Table A, bound in Annexure B summarises the locations and descriptions of all local roads near Petrusville, affected by the Kloofsig PV Solar Farm (Phase 1) development.

Transport and Construction vehicles will use these roads during the construction stage of the Phase 1 development, to gain access to the site.

All the affected roads are briefly discussed below :

4.4.1 *R48 Provincial Main Road*

The affected road section of the R48 Provincial Main Road runs for approximately 15,1km from the centre of Petrusville northwards (towards Luckhoff and past the Van Der Kloof Dam turn-off), up to the intersection with the R369. This provincial road is a single carriageway surfaced road, approximately 6,4m wide. The road surface and geometry are in a fairly good and acceptable condition, but may require periodical minor pothole repairs and crack seal maintenance work.

The first section of this Main Road (R48) runs through the residential areas of the Petrusville town, with several minor kerbed intersections and low hanging electrical and telecom cables – see photo 8 and 9. No limitations or obstacles are however foreseen along this section of the road.

Photo 8: Northern view of Provincial Main Road (R48) in centre of Petrusville, at the intersection with the Provincial District Road (running westwards towards the Kalkpoort Road).

Photo 9: Northern view of Provincial Main Road (R48) through northern residential areas of Petrusville. Note the sedimentation on the road surface due to overland storm water run-off.

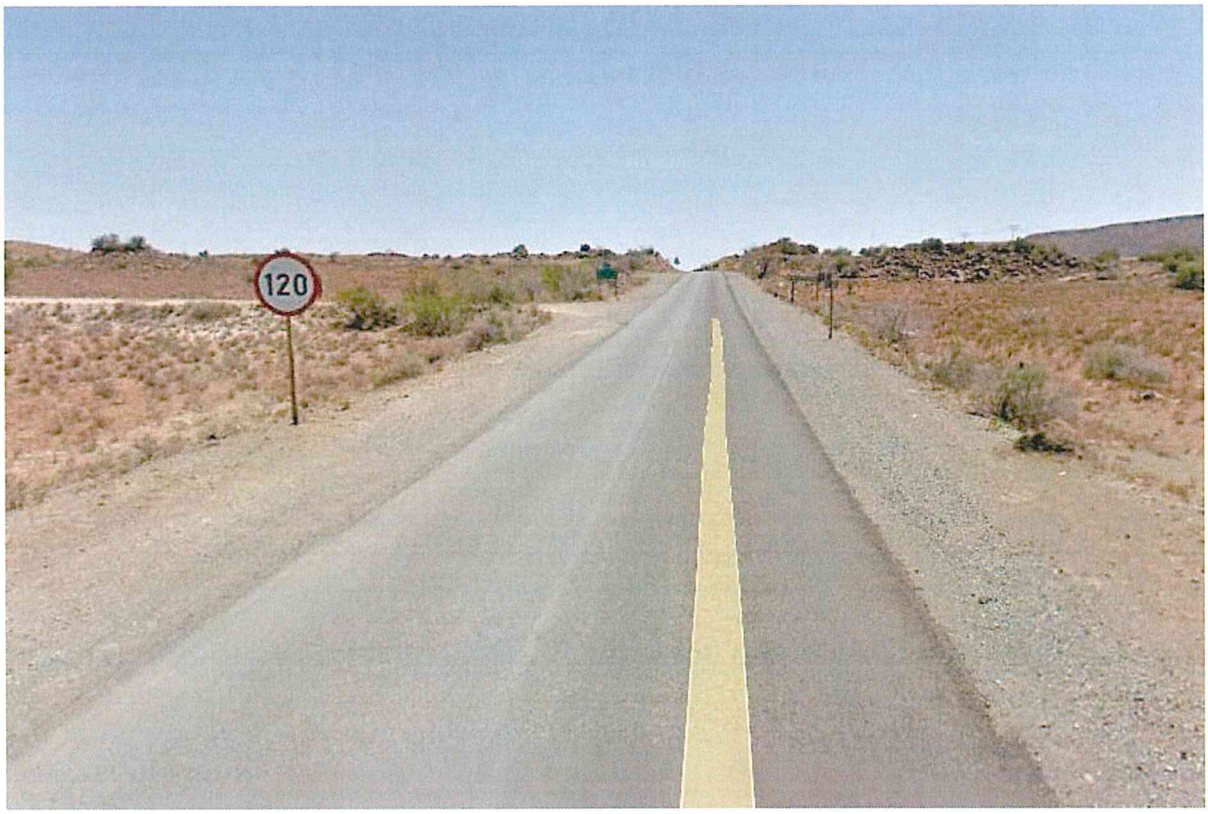

Photo 10: : Northern view Provincial Main Road (R48) north of Petrusville.
Note that no surfaced shoulders exist (only gravel shoulders) and no or poor line markings exist.

Photo 11: Westerly view at intersection with Provincial Main Road (R48) to the left, and the Van Der Kloof Dam road.

Photo 12: Westerly view at intersection with the Provincial Main Road (R48) (rightwards to Luckhoff), and Provincial Main Road (R369) onwards to the '**Site Access No.2**' entrance.