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| 1023 | S30 14 27.5<br>E24 19 26.2 | The Basberg farm complex has an assortment of structures of varying age. The main house is in very good condition and looks to be early-mid-20th century. A large barn made from clay bricks is probably a little older, as is a very small structure with two doors and an internal hearth. Right outside it is a pole with several hooks on it (possibly for hanging hunted animals). A werf wall of dolerite cobbles runs round the back of the main house. |  <br>  | Medium-High |

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| 1024 | S30 14 27.7<br>E24 19 24.4 | | | |

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| 1024B | S30 14 28.1<br>E24 19 23.5 | A large ash and rubbish midden measuring about 35 m long and about 10-20 m wide. It is on sloping ground. The waypoints are near each end. There is plenty of glass and ceramics as well as various types of metal (iron, copper and a grey metal, possibly pewter) and much bone. There are also rock and brick fragments present. Among the ceramics there is some stoneware but the vast majority of pieces are refined white earthenware including hand-painted, sponge-printed, transfer printed in various colours, lined industrial). The glass includes various colours (pink, clear, dark green, brown, black) and various forms (wine, medicine). The material probably does not go back beyond the late 19th century. A large scraper on a dolerite flake was also noted.<br>  |  <br>  <br>  <br>  | Medium-High<br>IIIB |

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| Waypoints 1025-1033 are all on the hill immediately behind (south of) the Basberg farm house. | | | | |
| 1025 | S30 14 28.2<br>E24 19 23.3 | A poorly preserved and possibly unfinished engraving that looks like a horse. Only the top of the head, neck back and tail and back legs are present. |  | Medium<br>GPA |

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| 1026 | S30 14 29.6<br>E24 19 24.2 | Some historical scratched engravings on the side of the hill. One rock has a geometric form similar to the one at waypoint 1018 (Nine Men's Morris-like) with "AS 1948" or "1968" scratched over it. A second rock has what looks like a Nine Men's Morris board with another geometric scratched over it. A third rock includes a probable horse (its head is unclear) with some geometric marks over it. |  <br>  | Medium<br>GPA |

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| 1027 | S30 14 31.5<br>E24 19 25.3 | A rock at the top of the hill with some indeterminate historical scratches on it. | | Very low GPC |
| 1028 | S30 14 31.5<br>E24 19 26.4 | A rock with various indeterminate motifs as well as a fair bit of writing. Among the writing can be seen a date of “25 MAY ‘30” and another with “5 1940” written below the word/name “BABS”. |  | Medium GPA |

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| 1029 | S30 14 31.1<br>E24 19 26.5 | This is a set of rocks at the top of the hill with various mostly scraped initials on various horizontal and vertical faces and also a scraped cross with a backdrop of vertical scratched lines.<br>  |  | Medium GPA |
| 1030 | S30 14 31.6<br>E24 19 27.1 | Another set of rocks at the top of the hill with various historical and (probably mostly) quite recent scratched names and motifs. Included are the names “ANDRE” and “IAN” as well as “A+D” and a heart. | | Medium GPA |
| 1031 | S30 14 32.6<br>E24 19 28.2 | A rock at the top of the hill with some indeterminate historical scratches on it. | | Very low GPC |
| 1032 | S30 14 32.1<br>E24 19 28.5 | A rock at the top of the hill with some indeterminate historical scratches on it. | | Very low GPC |

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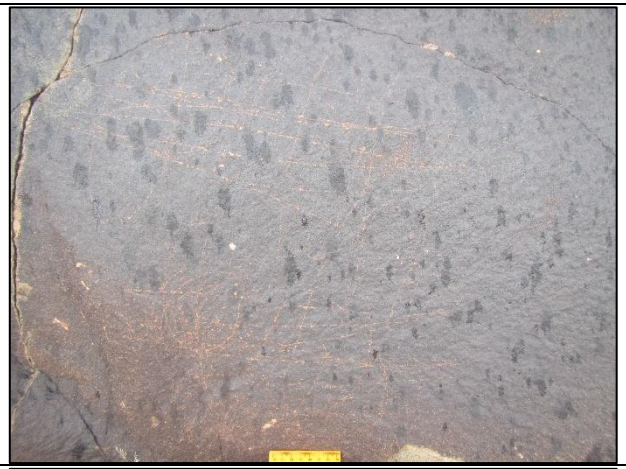
| 1033 | S30 14 31.7<br>E24 19 28.5 | A rock on the side of the hill with an indeterminate geometric historical motif on it. |  | Very low GPC |
| 1034 | S30 14 30.6<br>E24 19 32.3 | A dolerite cobble and cement kraal with an adjoining shed. The cement is fairly modern so likely early-mid-20$^{th}$ century. |  | Medium |
| 1035 | S30 15 01.9<br>E24 18 22.9 | Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area. | | Very low GPC |
| 1036 | S30 15 05.6<br>E24 18 14.1 | Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area. | | Very low GPC |

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| 1037 | S30 14 25.7<br>E24 19 20.0 | A dolerite rock away from the foot of the hill with some historical scratches on it. There is also a small amount of building rubble in the grass here but no evidence of any foundation or walling. |  | Very low<br>GPC |
| 1038 | S30 14 26.7<br>E24 19 17.1 | A heavily overgrown (with grass) but fenced (with a now derelict wire fence) graveyard to the west of the Basberg fam complex. It is impossible to count the graves. There is one double grave for “HENDRIK JOHANNES CHRISTIAN HANEKOM” who lived from 1833 to 1907 and his wife “HENDRINA JOHANNA” who died in 1901 (birth date illegible) and whose maiden name was Badenhorst. These may be the parents of the Badenhorst who left his name at waypoint 1016. Another grave has a stone lying loose on top of it with much cursive writing on it. It is very difficult to read but bears dates that look like 1826 and 1891 near the base. The name “Badenhorst” also appears near the top and at the very base of the stone. There are several graves that only have dolerite cobbles packed over them. |  | High<br>IIIA |

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| 1039 | S30 14 28.5<br>E24 19 17.7 | Occasional fresh hornfels LSA artefacts can be seen in the grass here but it is impossible to determine how extensive or dense the scatter might be. | | Low<br>GPB |
| 1040 | S30 14 32.1<br>E24 19 17.0 | An area at the foot of the hill had many large dolerite flakes of the sort that would be expected from stone dressing. Along this area it is apparent that stones have been moved to the side to create a roadway | | Very low<br>GPC |

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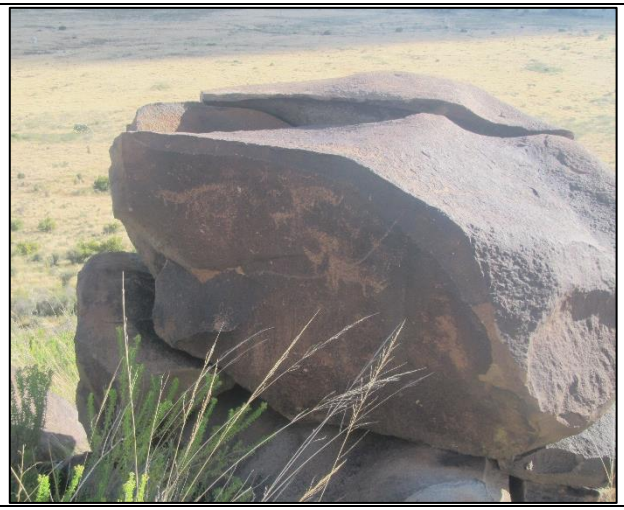
| 1041 | S30 14 35.0<br>E24 19 18.5 | This is an engraving of a single animal, likely an eland. It is somewhat stylised with a very small hump and a nose that ends in a point. The rump is also pointing upwards rather than being square. It is somewhat patinated and poorly preserved and lies halfway up the hill. |  | Medium-High<br>IIIB |
| 1042 | S30 14 35.5<br>E24 19 20.2 | A rock at the top of the hill with a ground patch and some scratches on it. | | Very low<br>GPC |
| 1043 | S30 14 36.2<br>E24 19 20.8 | A rock at the top of the hill with a ground patch on it. | | Very low<br>GPC |
| 1044 | S30 14 37.8<br>E24 19 20.7 | A boulder right on the edge of the hilltop has a number of scraped engravings on its vertical face that faces onto the hill. The engravings look quite fresh but yet are poorly preserved. There seem to be two ostriches towards the right, but the rest are difficult to tell the species of. A large flake of dolerite on top of the boulder has been used as a rock gong and makes a fairly high-pitched sound. |  | High<br>IIIA |

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| 1045 | S30 14 38.5<br>E24 19 21.9 | A rock at the top of the hill with a ground patch on it. | | Very low GPC |
| 1046 | S30 14 40.2<br>E24 19 22.1 | A rock at the top of the hill with a ground patch and two pecked areas on it. |  | Very low GPC |

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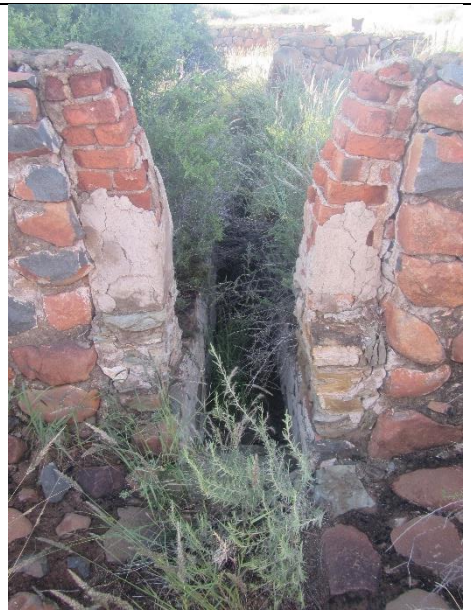
| 1047 | S30 14 42.2<br>E24 19 24.2 | A rock at the base of the hill with a ground patch on it. | | Very low GPC |
| 1048 | S30 14 49.2<br>E24 18 57.8 | Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area. | | Very low GPC |
| 1049 | S30 14 44.6<br>E24 18 57.6 | A sheep dip made with dolerite and grey cement and likely to date to the early-mid-20th century. There are two square enclosures with the dip in between. The enclosure from which the sheep enter the dip has a stone and cement floor, while the other enclosure has an earth floor.<br>  |  | Low |

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| 1050 | S30 14 26.2<br>E24 19 26.1 | This is a pair of historical gate posts at the Basberg farm complex and which stand on either side of a public road. |  | Medium |
| Waypoints 1051 to 1056 are an historical farm complex. The grass in this area was very dense and it is likely that other features may have been missed. Notably, no graves were found and it seems likely that some must be present. | | | | |
| 1051 | S30 11 49.0<br>E24 17 46.9 | An early-mid-20$^{th}$ century ruined building with dressed stone halfway up the walls and red clay bricks above. Grey cement has been used throughout. The brick section was plastered but much of the plaster has peeled off. The joinery is metal, including the door which has fallen off. The roof is missing. |  | Low<br>GPB |

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| 1052 | S30 11 48.4<br>E24 17 47.3 | Two parallel and conjoined rectangular enclosures. One measures about 8 m by 18 m and is only one stone high. The second one to the east is about 6 m by 18 m. On site only the larger enclosure was seen, such was the density of the grass, with the second identified only from aerial photography. The walls are made from stones (two skins and rubble fill). Due to the grass it was impossible to photograph the whole feature, but a detail is provided with the grass removed. |  | Medium GPA |
| 1053 | S30 11 48.4<br>E24 17 46.8 | This is the remains of a house of about 11 m by 20 m. A dressed stone plinth is present, and a semi-circular cement step has been built onto the eastern side. There are many broken red frog bricks and it is evident that both grey cement and mud mortar were used in the construction. The cement may have been added at a later date. |  | Medium GPA |
| 1054 | S30 11 47.1<br>E24 17 46.8 | This is a stone wall of about 100 m length running parallel to the road through the farm complex. The wall is a row of single boulders | | Medium GPA |
| 1054B | S30 11 47.1<br>E24 17 48.2 | | | |

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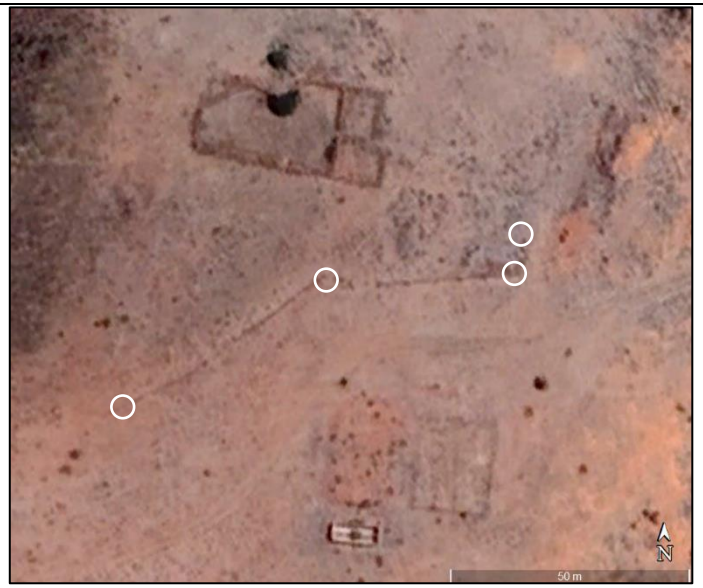
| 1054C | S30 11 46.8<br>E24 17 48.1 | usually in the order of 0.3 to 0.5 m in diameter. The rocks are too big to be the base of an old fence line and the shape of the entire feature (shown by white circles at right) suggests another indeterminate function.<br>  |  | |
| 1054D | S30 11 48.0<br>E24 17 44.9 | | | |
| 1055 | S30 11 46.7<br>E24 17 48.6 | A long feature of about 22 m with the southern part being about 3 m wide and made of bricks (though no in situ bricks could be seen) and the northern part being 5 m wide and of stone. |  | Medium<br>GPA |

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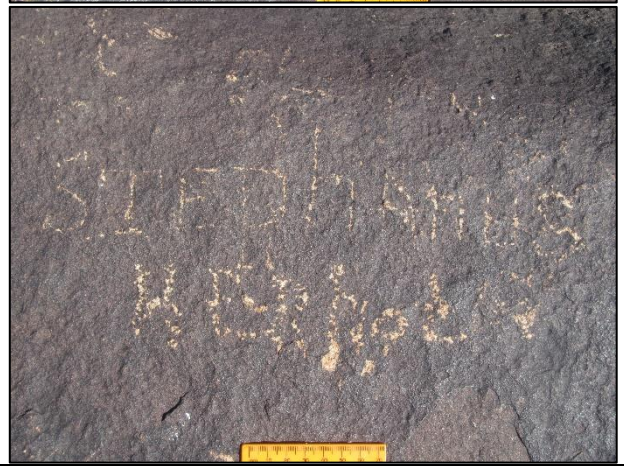
| 1056 | S30 11 46.2<br>E24 17 46.6 | A stone kraal complex with maximum length of about 39 m by 19 m. There are three enclosures with two smaller ones to the east and one larger one to the west. |  | Medium<br>GPA |
| 1057 | S30 11 46.4<br>E24 17 44.3 | Four boulders on a dolerite hill with various inscriptions as follows: “STEPHANUS”, “CNEL”, “J.C.L. v. Vuure...” (middle initial uncertain and right hand end of rock broken) with “1898” below it and another name on a broken rock that includes “VAN VUU…”. Some other graffiti is unclear.<br>  |  <br>  | Medium-<br>High<br>IIIB |

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| 1058 | S30 11 49.6<br>E24 17 40.0 | A cluster of trees, a corrugated iron reservoir, a wind pump and some wire enclosures. Part of the cultural landscape, but directly associated with the historical farm complex. |  | Medium |
| 1059 | S30 11 41.7<br>E24 17 38.2 | A rock with scratched writing on it. Among other things, it includes “JLVV” and “4de oet 07”. The date could be a corruption of August in French, or else could really be “oct”. Neither seem satisfactory explanations, since French is unlikely to have been spoken here and *Oktober* is spelled with a “k” in both Dutch and Afrikaans. |  | Medium-High<br>IIIB |

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| 1060 | S30 11 31.2<br>E24 17 16.8 | Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area. |  | Very low<br>GPC |
| 1061 | S30 11 42.8<br>E24 17 03.1 | Three ground rocks on a dolerite outcrop. | | Very low<br>GPC |
| 1062 | S30 11 42.0<br>E24 17 03.3 | A Nine Men's Morris board has been lightly scratched onto a rock and there is a ground rock here too. |  | Very low<br>GPC |
| 1063 | S30 11 41.4<br>E24 17 03.7 | Two ground rocks and a set of five parallel scratched lines that are between 35 and 45 mm long and a few mm apart from each other. The scratches are likely more recent, possibly less than 100 years old. | | Low<br>GPB |
| 1064 | S30 11 40.8<br>E24 17 04.1 | There are several ground rocks on a dolerite outcrop here. | | Very low<br>GPC |
| 1065 | S30 11 40.1<br>E24 17 04.5 | One ground rock on a dolerite outcrop. | | Very low<br>GPC |

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| 1066 | S30 11 56.8<br>E24 17 22.8 | A small beacon of dolerite rocks on a small dolerite outcrop. |  | Very low<br>GPC |
| 1067 | S30 11 54.0<br>E24 17 36.5 | A 400 m long berm runs from northwest to southeast. Its function could not be ascertained. | | Very low<br>GPC |
| 1067B | S30 12 02.0<br>E24 17 48.1 | | | |
| 1068 | S30 11 51.8<br>E24 17 50.1 | There are two stone-lined dams here that are built end to end and share a short side. They seem well-preserved but are very overgrown and impossible to photograph. They are directly related to the adjacent historical farmstead. | | Low<br>GPB |
| 1069 | S30 11 51.2<br>E24 17 47.2 | This is a concrete plinth that seems like the foundation for a pump. It is likely mid-20$^{th}$ century in age. | | Very low<br>GPC |
| 1070 | S30 11 51.5<br>E24 18 35.8 | A cluster of gum trees and a corrugated iron reservoir. Part of the cultural landscape. | | Low |
| 1071 | S30 12 09.4<br>E24 19 22.5 | An ephemeral scatter of hornfels stone artefacts with variable patina were found in a denuded area with exposed calcrete. Included is a large, circular scraper. | | Very low<br>GPC |

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| 1072 | S30 14 18.1<br>E24 19 24.2 | Several large pepper trees occur alongside the road just north of the Basberg farm complex. These are part of the cultural landscape. |  | Medium |

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| 1073 | S30 14 33.1<br>E24 19 34.0 | Two boulders with pecked and scraped engravings of animals. They look historical/recent.<br>  |  | Low<br>GPB |
| 1074 | S30 14 33.4<br>E24 19 33.8 | Some stone walling running along just below the summit of a dolerite hill. Its function is indeterminate. There is also a boulder with “AS” scratched onto it as well as what looks like an incomplete Nine Men’s Morris board.<br>  |  | Low<br>GPB |

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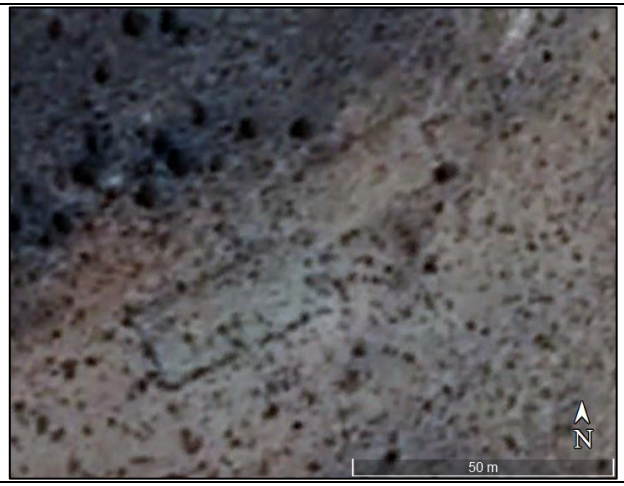
| 1075 | S30 18 07.5<br>E24 21 27.3 | These three points are at the ends of three walls that divide two U-shaped kraal enclosures on the side of a dolerite hill. The total kraal measures about 50 m by 76 m. The lowest sides (towards the northeast) have no walls present. A few hornfels flakes (probably LSA), some glass and some transfer-printed ceramics were also seen here.<br>  |  | Medium<br>GPA |
| 1075B | S30 18 08.0<br>E24 21 28.4 | | | |
| 1076 | S30 18 08.6<br>E24 21 29.8 | | | |
| 1077 | S30 18 14.2<br>E24 21 29.7 | These six points outline a kraal with three enclosures and which was very poorly visible in the long grass. The one is about 36 m by 16 m, while the other two are each about 26 m by 14 m. The latter two share a long side, while the first one shares one of its short sides with the other two. |  | Medium<br>GPA |
| 1077B | S30 18 14.6<br>E24 21 28.9 | | | |
| 1077C | S30 18 15.4<br>E24 21 29.3 | | | |
| 1077D | S30 18 15.0<br>E24 21 30.2 | | | |
| 1077E | S30 18 15.8<br>E24 21 28.0 | | | |
| 1077F | S30 18 15.4<br>E24 21 27.8 | | | |

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| 1078 | S30 18 25.1<br>E24 21 30.0 | This is a small brick cottage that lies outside the study area and was not visited. It looks from a distance to be in ruin. |  | Medium GPA |
| 1079 | S30 18 17.8<br>E24 21 22.3 | This is an old road alignment that has a telephone wire strung alongside it. The road is only represented by a slight indentation in the ground. |  | Very low GPC |
| 1080 | S30 19 14.9<br>E24 21 34.6 | This is an earthen-walled reservoir and wind pump just outside the study area. | | Low |

## 5.3. Graves

Graves are often present close to farm complexes, especially those that are far from towns and municipal graveyards. For this reason, it was unusual to see just one graveyard in the wider study area. This was at the Basberg farmstead and was located a short distance to the west of the complex, far from any potential impacts.

Other graves might still occur in the area, including possibly within the PV11 footprint, but these are most likely to be unmarked graves whose locations cannot be determined or predicted. The chances of such graves being present, however, are very low.

## 5.4. Historical aspects and the Built environment

### 5.4.1. Desktop study

Although the study area is remote from towns, it is worth briefly mentioning the nearest ones. Philipstown was founded in 1863 on the farm Rietfontein and contains a number of Provincial Heritage Sites (Schoeman 2008). Petrusville is slightly younger, having been founded in 1877, although the owner of the farm Rhenosterfontein had already donated a part of his farm to the Dutch Reformed Church in 1822 (Frandsen 2019). De Aar was founded as an important railway junction linking lines from all over southern Africa. Although the site for the junction was chosen in 1881, the town itself was only formally declared just after the end of the Anglo-Boer War (Schoeman 2008). The War was an important period on the region's history resulting in the creation of many heritage resources ranging from battlefields to forts and blockhouses and many smaller stone-walled features. As already noted, battlefields are absent from the vicinity and Green (2022) does not list any blockhouses from the area.

Moving into the immediate study area, a review of historical aerial photography shows that all three currently extant farm complexes in or very close to the study area were present at least 50 years ago and in much the same state as they are now. A barn has had additions at Wolwekuil (on Remainder of Wolwe Kuilen 42) since 1968 (Figure 14), a labourer's cottage was added at Middelplaas Noord (Portion 5 of Grass Pan 40) since 1968 (Figure 15), but Basberg (on Portion 3 of Basberg 88) is no different now than it was in 1974 (Figure 16). Notable at Wolwekuil (on Remainder of Wolwe Kuilen 42) are the two enclosures made from *Agave americana* plants (Figure 14). These spiky plants were used in the past to create enclosures for livestock or vegetables (Baloyi & Klopper 2017). It is evident that small-scale agriculture was undertaken at the first two farms in 1968 but in both cases this land use has long since been discontinued. At Basberg, too, there was small scale agriculture some distance to the southwest of the farmstead but it had already been discontinued by 1974 (not illustrated). Figure 17 shows that in the far south of Annex Wolwe Kuilen 41/rem a prickly pear orchard was planted after 1968. It is in poor condition today, having clearly been abandoned for many years. It is noted that this orchard was planted very far from a homestead, but its location is in a drainage line which must have facilitated it getting enough water.

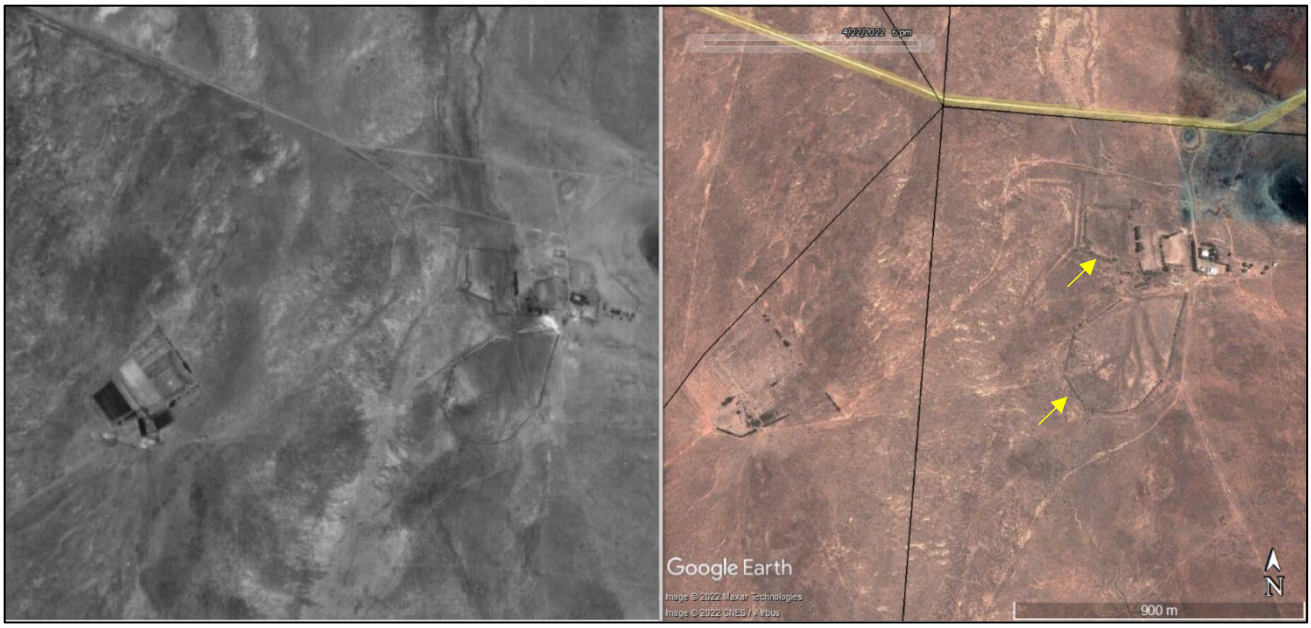


***Figure 14:*** *1968 (611_012_00356) and modern (Google Earth) views of the Wolwekuil farm complex (on Remainder of Wolwe Kuilen 42). Three structures are visible in the main complex (waypoint 947) and the orchard and fields to the southwest (on Remainder of Annex Wolwe Kuilen 41) were in use (waypoints 998 & 999). At the farmstead there are two enclosures of Agave plants that predate 1968 (yellow arrows).*


***Figure 15:*** *1968 (611_012_00354) and modern (Google Earth) views of the Middelplaas Noord farm complex (on Portion 5 of Grass Pan 40). Two structures are visible in the main complex (waypoint 1007) and the larger structure is visible to the north (waypoint 983).*


***Figure 16:*** *1974 (738_025_12970) and modern (Google Earth) views of the Basberg farm complex (on Portion 3 of Basberg 88). All structures present today were present in 1974 as well (waypoint 1008).*

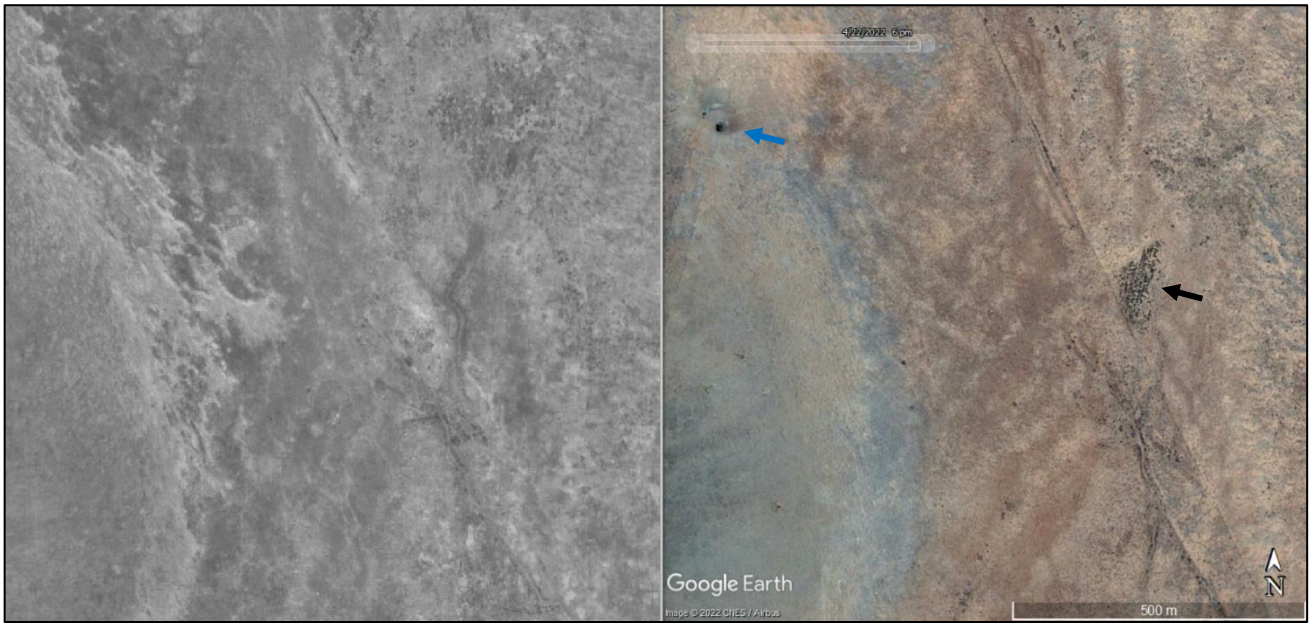


***Figure 17:*** *1974 (738_025_12972) and modern (Google Earth) views showing the location of a prickly pear orchard (black arrow) planted since 1974 on the remainder of Annex Wolwe Kuilen 41. The water point (blue arrow) on Basberg 88/rem also post-dates 1974.*

5.4.2. Site visit

Most significant historical resources that were not archaeological were at the farmsteads and comprised of houses, outbuildings and related features as noted in the desktop study above. No buildings occur within 400 m of the PV facilities. The only other historical features were some of the livestock watering points that have reservoirs older than 60 years but none of these are considered

significant heritage resources. Although some reservoirs occur within PV footprints, none are within the PV11 study area.

### 5.5. Cultural landscapes and scenic routes

Cultural landscapes are the product of the interactions between humans and nature in a particular area. Sauer (1925) defined them thus: "The cultural landscape is fashioned from a natural landscape by a cultural group. Culture is the agent, the natural area is the medium, the cultural landscape the result".

Many water points were present on the landscape as noted above. Some have large karee trees associated with them and others large gum trees. Their ages are variable but it is evident that many new rows of gum trees have been planted at some of these water points in recent decades. They are variable in age with some clearly being modern additions to the landscape (e.g. Figure 18 and 19). Nonetheless, all contribute to the rural character and sense of place of the wider study area. There are none of these water points within the PV11 footprint.


***Figure 18:*** *1968 (611_012_00356) and modern (Google Earth) views of two watering points on Portion 1 of Annex Wolwe Kuilen 41. It is evident that there was more activity at the western one in 1968, while the eastern one was not yet present at that time. These are close to PV11 (the western one is in fact waypoint 948 and the eastern one 980) and are illustrated here as an example.*

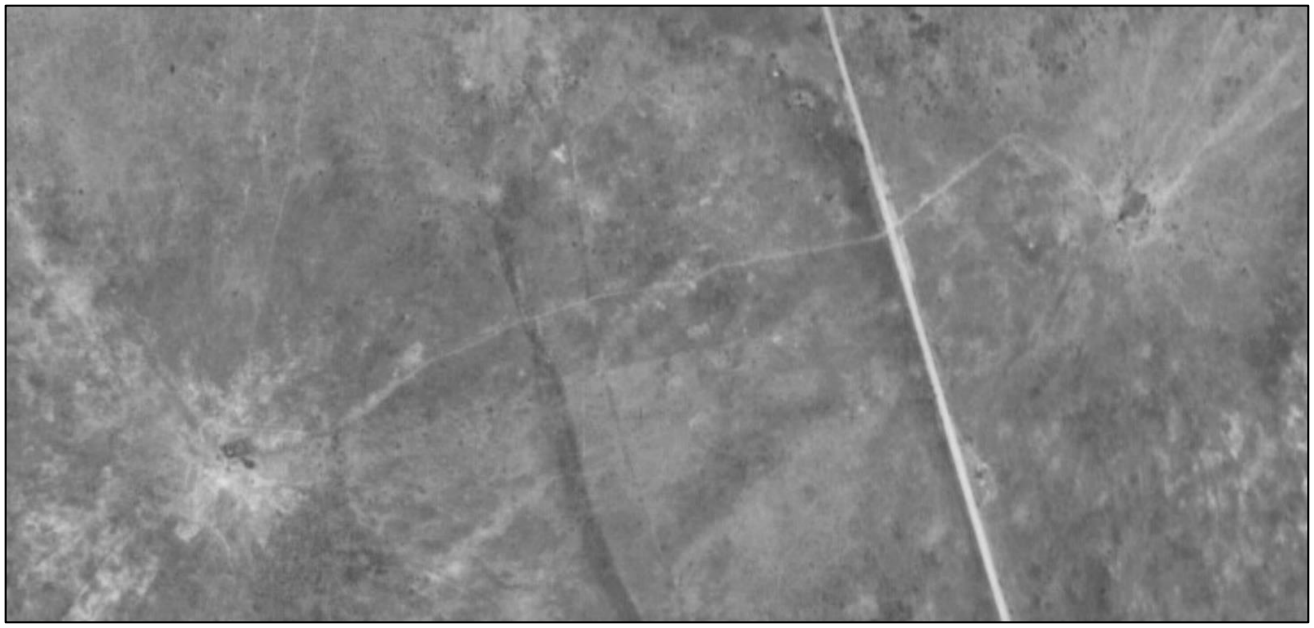

***Figure 19:*** *1974 (738_026_13055) view of two watering points on Portion 3 of Basberg 88. The western one is within PV5 and is illustrated here as an example.*

A key feature of the cultural landscape is the quietness of the Karoo and the darkness at night. While there would be some noise during construction, the operation of the facility is quiet and this is not an issue. However, security lighting can alter the night-time qualities of a place and the large, dark star-lit sky is an important aspect of the local landscape.

The study area is well away from any major roads and there are thus no scenic route concerns.

**5.6. Statement of significance and provisional grading**

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. The reasons that a place may have cultural significance are outlined in Section 3(3) of the NHRA (see Section 2 above).

The archaeological resources within the PV footprint are deemed to have very low cultural significance at the local level for their scientific value and can be graded GPC. Higher significance finds do occur in the wider study area with finds up to grade IIIA having been recorded.

Graves are deemed to have high cultural significance at the local level for their social value. They are allocated a grade of IIIA.

The built environment heritage resources of the area are up to medium significance for their architectural, historical and social values.

The cultural landscape is largely a natural landscape with aesthetic value and is rated as having medium cultural significance at the local level.

Heritage features are mapped in Figure 20 in relation to the proposed Kudu PV11 footprint.

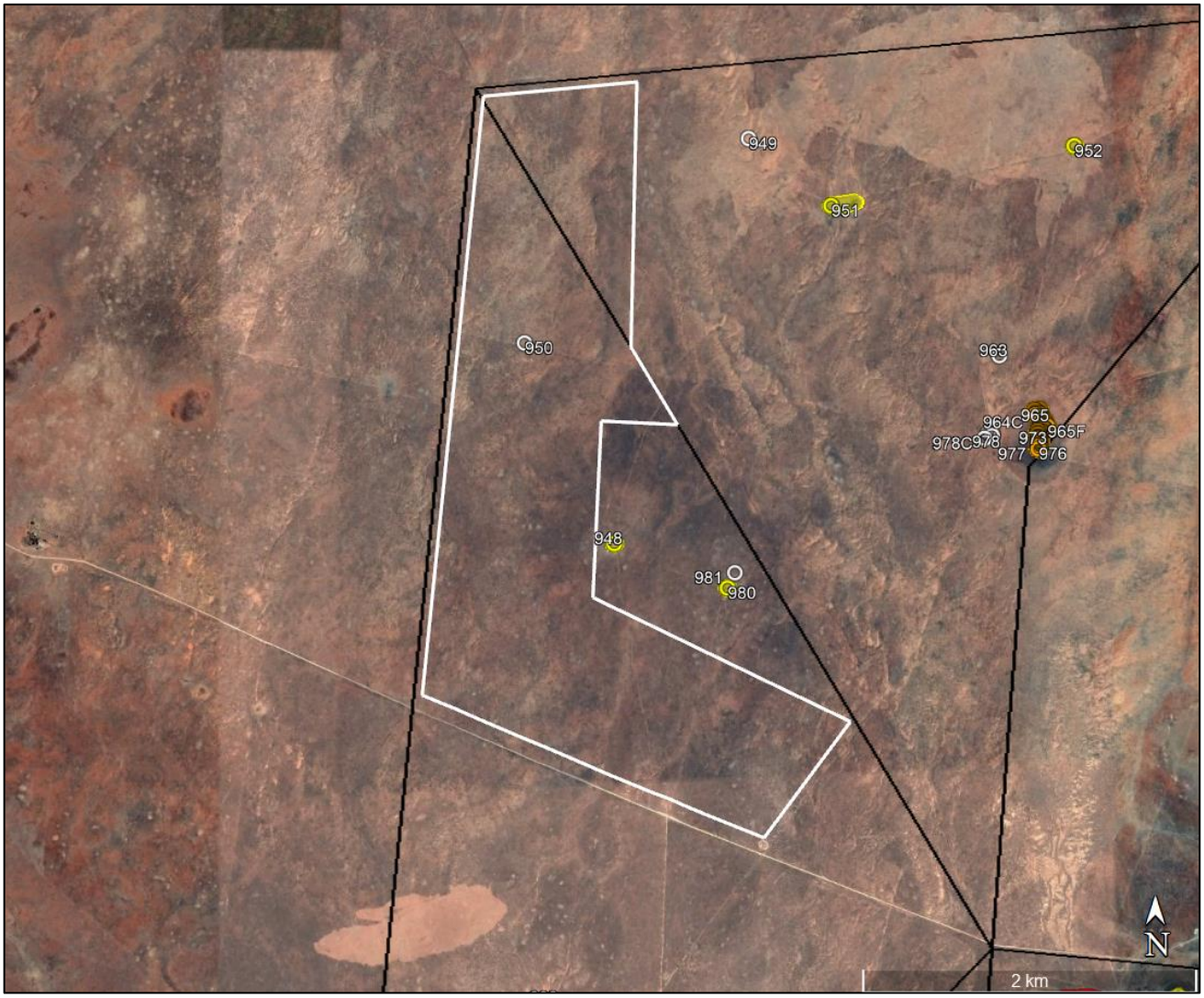


***Figure 20:*** *Map of heritage resources occurring in and around the PV11 study area. They are mapped with 50 m buffers (dark red symbols = IIIA, red = IIIB, orange = GPS, yellow = GPB), but GPC resources are not buffered (white symbols).*

### 5.7. Summary of heritage indicators

- Significant fossils should not be damaged or destroyed by the proposed project.
- Significant archaeological sites should not be damaged or destroyed by the proposed project.
- Graves should not be damaged or destroyed by the proposed project.
- The cultural landscape should not be dominated by the proposed project.

# 6. ISSUES, RISKS AND IMPACTS

## 6.1. Summary of issues identified during the Scoping Phase

The potential heritage issues identified during the scoping phase of this EIA process include:

- Potential impacts to archaeological resources;
- Potential impacts to graves; and
- Potential impacts to the cultural landscape.

Palaeontological impacts were also considered but it was found after a field assessment that no significant impacts would occur and this aspect was not studied further in the EIA Phase.

Consultation was carried out during the Scoping Phase but no heritage issues were raised. A comment was received from SAHRA as follows:

> The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit requests that the HIA must be revised to include a map of the track logs and must be revised to show all project components such as the access roads etc. The table of identified heritage resources i.e. Table 2, must be revised to indicate in which Kudu project each heritage resources is located within and any specific mitigation and/or management measures required.

Their comment has been taken into account in the HIA.

## 6.2. Identification of potential impacts/risks

Based on the fieldwork, impacts to fossils were not considered to be a significant issue and were not studied further in the EIA Phase.

The potential impacts identified during the EIA assessment are:

**Construction Phase**

- Potential impacts to archaeology
- Potential impacts to graves; and
- Potential impacts to the cultural landscape.

**Operational Phase**

- Potential impacts to the cultural landscape.

**Decommissioning Phase**

- Potential impacts to the cultural landscape.

**Cumulative impacts**

- Potential impacts to archaeology
- Potential impacts to graves; and
- Potential impacts to the cultural landscape.

# 7. IMPACT ASSESSMENT

## 7.1. Construction Phase

### 7.1.1. Impacts to archaeological resources

Direct impacts to archaeological resources would occur during the construction phase when equipment is brought to site and grubbing begins. However, because the archaeological materials expected to occur on the grassy plains are of such low cultural significance and likely to be very low density, the impact consequence is deemed to be slight and the probability unlikely leading to an impact significance of **very low negative** (Table 4). The only mitigation measures suggested are to report any chance finds of dense artefact clusters and contract an archaeologist to conduct any sampling that may be required. The chances of such finds being made are extremely small. After mitigation the significance is still **very low negative**.

There are no fatal flaws in terms of construction phase impacts to archaeology.

### 7.1.2. Impacts to graves

Direct impacts to graves would occur during the construction phase when equipment is brought to site and grubbing begins. However, because graves are extremely unlikely to be present in the PV footprint, the impact probability is deemed to be extremely unlikely. Despite the extreme consequence (because of the high cultural significance of graves), the impact significance is **very low negative** (Table 4). Mitigation measures entail reporting and protecting chance finds until they can be professionally dealt with. After mitigation the significance is still **very low negative**.

There are no fatal flaws in terms of construction phase impacts to graves.

### 7.1.3. Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the construction phase when equipment is brought into the area and construction work begins. The activity associated with construction will disrupt the quiet, rural character of the area. Although the impact would be short term, its consequence is considered substantial and it would definitely occur if construction happens. The significance would be **moderate negative** (Table 4). The only mitigation measures suggested are minimising the duration of the construction period and ensuring that any areas not needed during operation are rehabilitated at the end of the construction period. With mitigation, the significance drops to **low negative**.

There are no fatal flaws in terms of construction phase impacts to the cultural landscape.

## 7.2. Operation Phase

### 7.2.1. Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the operation phase as a result of the presence of the PV facility in the rural landscape. Although the activity will have abated, the duration of impact will be long and the consequence is considered substantial. If the facility is built the impact would definitely occur and the significance would be **moderate negative** (Table 4). Mitigation measures include ensuring that operation activities remain in designated areas, that buildings are painted in earthy colours and that night-time light pollution is minimised. With mitigation, the significance drops to **low negative**.

There are no fatal flaws in terms of operation phase impacts to the cultural landscape.

## 7.3. Decommissioning Phase

### 7.3.1. Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the decommissioning phase when equipment is brought into the area and decommissioning of the facility begins. The activity associated with decommissioning will disrupt the quiet, rural character of the area. Although the impact would be short term, its consequence is considered substantial and it would definitely occur if the facility is built and requires decommissioning. The significance would be **moderate negative** (Table 4). The only mitigation measures suggested are minimising the duration of the decommissioning period and ensuring that the site is adequately rehabilitated. With mitigation, the significance drops to **low negative**.

There are no fatal flaws in terms of decommissioning phase impacts to the cultural landscape.

***Table 4:*** *Assessment of impacts.*

| Impact | Impact Criteria | | Significance and Ranking (Pre-Mitigation) | Potential mitigation measures | Significance and Ranking (Post-Mitigation) | Confidence Level |
|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | |
| **Damage or destruction of archaeological materials** | Status | Negative | Very low (5) | - Report any chance finds of dense clusters of artefacts to SAHRA and/or an archaeologist<br>- Protect in situ and appoint archaeologist to sample as needed | Very low (5) | High |
| | Spatial extent | Site specific | | | | |
| | Duration | Permanent | | | | |
| | Consequence | Slight | | | | |
| | Probability | Unlikely | | | | |
| | Reversibility | Non-reversible | | | | |
| | Irreplaceability | High | | | | |
| **Damage or destruction of graves** | Status | Negative | Very low (5) | - Report any chance finds to SAHRA and/or an archaeologist<br>- Protect in situ and appoint archaeologist to exhume | Very low (5) | High |
| | Spatial extent | Site specific | | | | |
| | Duration | Permanent | | | | |
| | Consequence | Extreme | | | | |
| | Probability | Extremely unlikely | | | | |
| | Reversibility | Non-reversible | | | | |
| | Irreplaceability | High | | | | |
| **Intrusion of SEF and equipment into the landscape** | Status | Negative | Moderate (3) | - Minimise duration of construction period<br>- Ensure effective rehabilitation, at the end of the construction period, of areas not needed during operation | Low (4) | High |
| | Spatial extent | Local | | | | |
| | Duration | Short term | | | | |
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |
| **Operational Phase** | | | | | | |
| **Intrusion of SEF into the landscape** | Status | Negative | Moderate (3) | - Ensure that all maintenance vehicles and operational activities stay within designated areas<br>- Paint buildings in earthy colours to reduce contrast<br>- Make use of motion detectors and downlighting to reduce night-time light pollution | Low (4) | High |
| | Spatial extent | Regional | | | | |
| | Duration | Long term | | | | |
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |
| **Decommissioning Phase** | | | | | | |
| **Intrusion of SEF and equipment into the landscape** | Status | Negative | Moderate (3) | - Minimise duration of decommissioning period<br>- Ensure effective rehabilitation of the entire site once the infrastructure has been removed | Low (4) | High |
| | Spatial extent | Local | | | | |
| | Duration | Short term | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |
| **Cumulative impacts – Construction phase** | | | | | | |
| **Impacts to archaeology, graves** | Status | Negative | Low (4) | - Follow stipulated mitigation measures as required per project (none required for this project)<br>- Conduct mitigation if needed per project (none required for this project) | Very Low (5) | High |
| | Spatial extent | Regional | | | | |
| | Duration | Permanent | | | | |
| | Consequence | Moderate | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | Non-reversible | | | | |
| | Irreplaceability | High | | | | |
| **Intrusion of SEF and equipment into the landscape** | Status | Negative | Moderate (3) | - Minimise duration of construction period<br>- Minimise cut-and-fill and landscape scarring in general<br>- Avoid construction on slopes and high ground<br>- Ensure effective rehabilitation, at the end of the construction period, of areas not needed during operation | Low (4) | High |
| | Spatial extent | Regional | | | | |
| | Duration | Short term | | | | |
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |
| **Cumulative impacts – Operational Phase** | | | | | | |
| **Intrusion of SEF into the landscape** | Status | Negative | Moderate (3) | - Make use of motion detectors and downlighting to reduce night time light pollution<br>- Place ancillary infrastructure in less prominent areas | Low (4) | High |
| | Spatial extent | Regional | | | | |
| | Duration | Long term | | | | |
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |
| **Cumulative impacts – Decommissioning Phase** | | | | | | |
| **Intrusion of SEF into the landscape** | Status | Negative | Moderate (3) | - Make use of motion detectors and downlighting to reduce night time light pollution<br>- Place ancillary infrastructure in less prominent areas<br>- Ensure rehabilitation after decommissioning | Low (4) | High |
| | Spatial extent | Regional | | | | |
| | Duration | Short term | | | | |
| | Consequence | Substantial | | | | |
| | Probability | Very likely | | | | |
| | Reversibility | High | | | | |
| | Irreplaceability | Moderate | | | | |

### 7.4. Cumulative Impacts

Table 5 and Figure 21 show the other projects considered for cumulative impacts, although it must be noted that other types of development (e.g. roads, agriculture) can also result in impacts to heritage resources. These impacts are difficult to quantify because of the variable survey conditions that are likely to have pertained during the assessments of the various projects. Nonetheless, it is noted that archaeological finds in the areas typically considered for development in the grasslands tend to be minimal, while finds on hills tend to be avoided in the construction of wind energy facilities (WEFs). It is still possible that some archaeological sites and/or graves might have been overlooked during the various surveys and the potential cumulative impacts for the construction phase are thus rated **low negative** (Table 4). Incorporating the various mitigation measures that are suggested for each project (which might include pre-construction surveys or archaeological mitigation) would reduce the impact significance to **very low negative**.

Impacts to the cultural landscape relate mainly to the amount of change that one could see/experience from one place, including the night-time lighting of the facilities. It is essentially impossible that one could see all the facilities listed in Table 5 from one area due to the various dolerite hills in the landscape. As a result, the consequence is only rated as substantial and the significance as **moderate negative** for all phases (Table 4). Employing the listed mitigation measures in each phase would reduce the impacts after mitigation to **low negative**.

There are no fatal flaws in terms of cumulative impacts.

***Table 5:*** *Proposed renewable energy projects, located within 30 km of the proposed Kudu Solar Facilities, that will be considered in the Cumulative Impact Assessment (in addition to the Kudu Solar Facilities and EGI Projects) (Source: DFFE REEA, Quarter 4, 2022; and SAHRIS).*

| DFFE REFERENCE | TECHNOLOGY | MW/KV | STATUS | PROJECT TITLE |
|---|---|---|---|---|
| 12/12/20/2258<br>12/12/20/2258/1 | Solar PV | 75 | Approved and Preferred Bidder (Operational) | The Proposed Establishment of Photovoltaic (Solar Power) Farms in the Northern Cape Province - Kalkbult |
| 12/12/20/2463/1<br>12/12/20/2463/1/2<br>12/12/20/2463/1/A2<br>12/12/20/2463/1/AM3<br>12/12/20/2463/1/AM4<br>12/12/20/2463/1/AM5 | Onshore Wind | 140 | Approved and Preferred Bidder (Operational) | Longyuan Mulilo De Aar 2 North Wind Energy Facility<br>Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility<br>The Wind Energy Facility (North and South) situated on the Plateau Near De Aar, Northern Cape Province |
| 12/12/20/2463/2<br>12/12/20/2463/2/AM2 | Onshore Wind | 100 | Approved and Preferred Bidder (Operational) | Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility<br>The Wind Energy Facility (North and South) Situated On The Plateau Near De Aar, Northern Cape Province |
| 14/12/16/3/3/1/1166<br>14/12/16/3/3/1/1166/AM3<br>14/12/16/3/3/1/1166/AM4 | Transmission line | 132 | Approved | Basic Assessment for the proposed construction of a 132 kV transmission line corridor adjacent to the existing Eskom transmission line from Longyuan Mulilo De |

| DFFE REFERENCE | TECHNOLOGY | MW/KV | STATUS | PROJECT TITLE |
|---|---|---|---|---|
| | | | | Aar 2 North Wind Energy Facility (WEF) to the Hydra Substation in De Aar, Northern Cape |
| 14/12/16/3/3/1/785 | Transmission line | 132 | Approved | Proposed construction of two 132kV transmission lines from the South & North Wind Energy Facilities on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape. |
| 14/12/16/3/3/2/278<br>14/12/16/3/3/2/278/1<br>14/12/16/3/3/2/278/2 | Onshore Wind | 118 | Approved | Proposed Castle Wind Energy Facility Project, located near De Aar, Northern Cape |
| 14/12/16/3/3/2/564<br>14/12/16/3/3/2/564/AM1<br>14/12/16/3/3/2/564/AM2 | Solar PV | 75 | To be confirmed | Proposed Swartwater 75MW solar PV power facility in Petrusville within Renosterburg Local Municipality, Northern Cape |
| 14/12/16/3/3/2/740 | Solar PV | 300 | Approved | Proposed 300MW Solar Power Plant in Phillipstown area in Renosterberg Local Municipality |
| 14/12/16/3/3/2/744 | Solar PV | unknown | Approved | Proposed PV facility on farm Jakhalsfontein near De Aar |
| 14/12/16/3/3/2/739 | Solar PV | 70 - 100 | To be confirmed | Proposed 70 - 100 MW Solar Power Plant in Petrusville |
| Not issued yet (it is understood that the project is still within the pre-application stage) | Solar PV | 800 (Maximum) | Pre-Application | The Proposed Keren Energy Odyssey Solar PV Facilities (Odyssey Solar 1, Odyssey Solar 2, Odyssey Solar 3, Odyssey Solar 4, Odyssey Solar 5, Odyssey Solar 6, Odyssey Solar 7 And Odyssey Solar 8) |
| To be confirmed | Solar PV | 3050 | Scoping | The Proposed Development of the Crossroads (formally referred to as the Hydra B) Green Energy Cluster of Renewable Energy Facilities and Grid Connection Infrastructure, Pixley Ka Seme District Municipality, Northern Cape Province. The Cluster entails the development of up to 21 solar energy facilities, with the Scoping and EIA Processes consisting of three phases. Phases 1, 2 and 3 consist of 9, 6 and 6 solar facilities, respectively. The Phase 1 Scoping and EIA Processes were launched in January 2023. |
| 14/12/16/3/3/2/2244<br>14/12/16/3/3/2/2245<br>14/12/16/3/3/2/2246<br>14/12/16/3/3/2/2247<br>14/12/16/3/3/2/2248<br>14/12/16/3/3/2/2249<br>14/12/16/3/3/2/2250<br>14/12/16/3/3/2/2251<br>14/12/16/3/3/2/2252<br>14/12/16/3/3/2/2253<br>14/12/16/3/3/2/2254<br>14/12/16/3/3/2/2255 | Solar PV | 2180 | Scoping and EIA Process underway | Proposed Development of 12 Solar Photovoltaic (PV) Facilities (Kudu Solar Facility 1 to 12) and associated infrastructure, near De Aar, Northern Cape Province |

| DFFE REFERENCE | TECHNOLOGY | MW/KV | STATUS | PROJECT TITLE |
|---|---|---|---|---|
| N/A | Transmission Line | 220 | Existing Power Line | HYDRA ROODEKUIL 2 |
| N/A | Transmission Line | 132 | Existing Power Line | HYDRA ROODEKUIL 1 |
| N/A | Transmission Line | 765 | Existing Power Line | BETA HYDRA 2 |
| N/A | Transmission Line | 400 | Existing Power Line | HYDRA PERSEUS 3 |
| N/A | Transmission Line | 220 | Existing Power Line | VAN DER KLOOF ROODEKUIL 2 |
| N/A | Transmission Line | 220 | Existing Power Line | VAN DER KLOOF ROODEKUIL 1 |
| N/A | Transmission Line | 400 | Existing Power Line | BETA HYDRA 1 |
| N/A | Transmission Line | 400 | Existing Power Line | HYDRA PERSEUS 2 |
| N/A | Transmission Line | 132 | Existing Power Line | KALKBULT/KAREEBOSCHPAN 1 |
| N/A | Transmission Line | 132 | Existing Power Line | ROODEKUIL/ORANIA 1 |
| N/A | Transmission Line | 765 | Planned Power Line | Perseus to Gamma 2nd 765 kV line<br>Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line |
| N/A | Transmission Line | 765 | Planned Power Line | Relocate Beta-Hydra 765kV line to form Perseus-Hydra 1st 765kV line<br>Cape Corridor Phase 2: Zeus - Hydra 765kV Integration |
| N/A | Transmission Line | 765 | Planned Power Line | Perseus to Gamma 2nd 765 kV line<br>Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line |

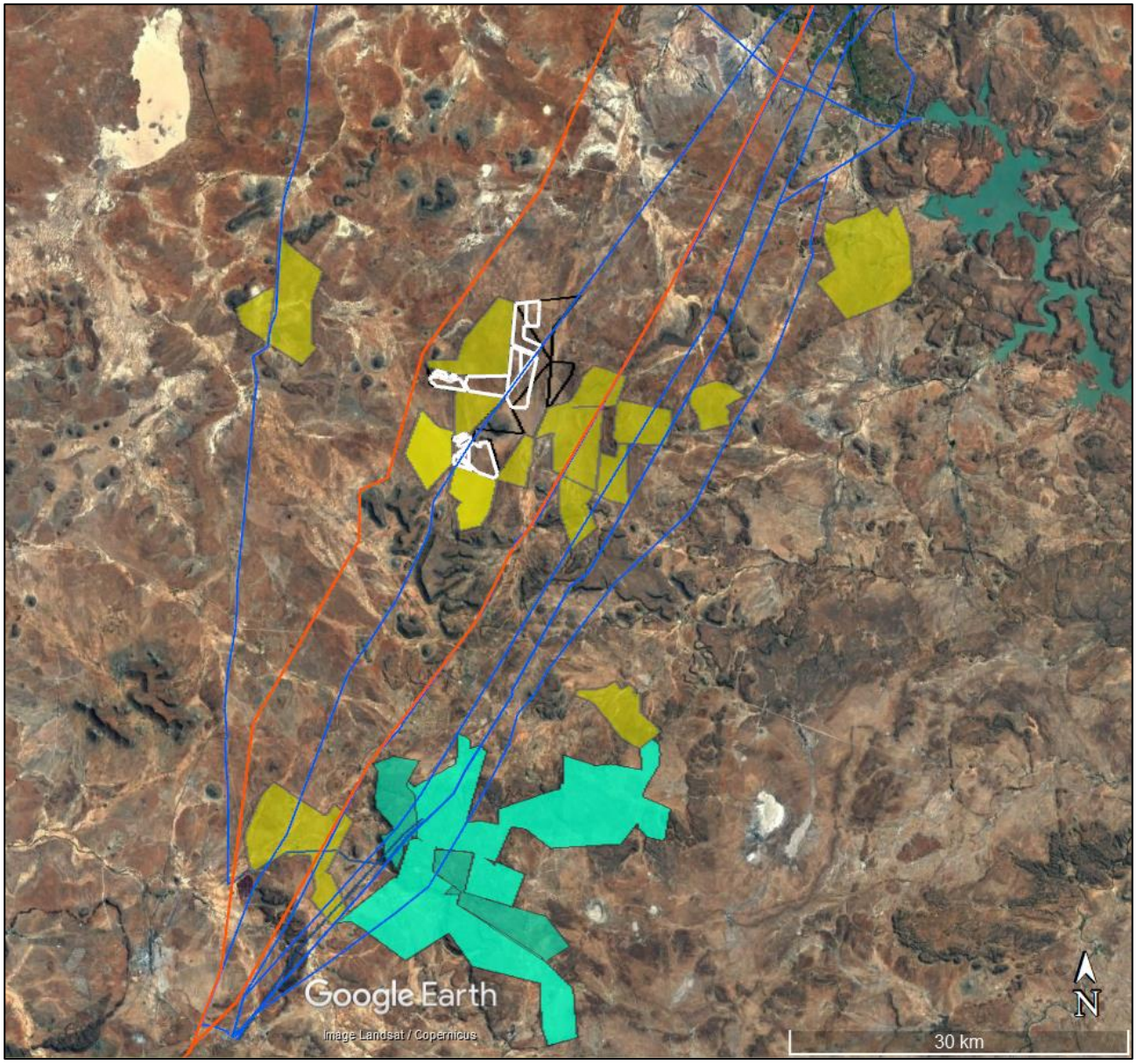


***Figure 21:*** *Map showing renewable energy facilities (operational and proposed) in the vicinity of the Kudu study area. Kudu land parcels shown in white.*

### 7.5. Evaluation of impacts relative to sustainable social and economic benefits

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

The project will provide construction phase jobs but more importantly it will help alleviate the ongoing electricity supply problems which are hampering economic growth in South Africa. Stabilising the electricity supply will thus have significant socio-economic benefits as a growing economy means more jobs and better income all round. These are clear economic and social benefits and, if mitigation is applied as suggested above, then the socio-economic benefits outweigh the residual heritage impacts.

### 7.6. Existing impacts to heritage resources

There are currently no obvious threats to heritage resources on the site aside from the natural degradation, weathering and erosion that might affect archaeological materials. Trampling from grazing animals and/or farm/other vehicles could also occur. These impacts would be of **negligible negative** significance. The only existing impact to the rural cultural landscape relates to the presence of several HV powerlines running though the area. Their impact on the landscape is quite small and the existing impact is thus rates as **very low negative**.

### 7.7. The No-Go alternative

If the project were not implemented then the site would stay as it currently is (impact significance of **negligible** for archaeology and graves and **very low negative** for the landscape). Although the heritage impacts with implementation would be greater than the existing impacts, the loss of socio-economic benefits is more significant and suggests that the No-Go option is less desirable in heritage terms.

### 7.8. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many publicly accessible vantage points is undesirable. Because of the height of the majority of the proposed development and its very remote location, such an impact to the landscape is not envisaged.

## 8. IMPACT ASSESSMENT SUMMARY

The overall impact significance essentially follows the most significant impact in each phase following the implementation of the proposed mitigation measures. These are shown in Table 6.

***Table 6:*** *Overall Impact Significance (Post Mitigation)*

| **Phase** | **Overall Impact Significance** |
|---|---|
| Construction | Low negative |
| Operational | Low negative |
| Decommissioning | Low negative |
| **Nature of Impact** | **Overall Impact Significance** |
| Cumulative - Construction | Low negative |
| Cumulative - Operational | Low negative |
| Cumulative - Decommissioning | Low negative |

# 9. LEGISLATIVE AND PERMIT REQUIREMENTS

This report and the proposed recommendations will need to be approved by SAHRA. There are no further legislative requirements for the approval process under the NHRA but if archaeological mitigation is needed then the appointed archaeologist will need to apply for and be granted a permit from SAHRA to do the work. This must be carried out well in advance of construction to ensure that there is enough time for SAHRA to approve the mitigation work before construction commences.

# 10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The actions recorded in Table 7 should be included in the environmental management program (EMPr) for the project.

***Table 7:*** *Heritage considerations for inclusion in the EMPr.*

| **Impact** | **Mitigation / management objectives & outcomes** | **Mitigation / management actions** | **Monitoring** | | |
|---|---|---|---|---|---|
| | | | **Methodology** | **Frequency** | **Responsibility** |
| **Impacts to archaeology and graves** | | | | | |
| Damage or destruction of archaeological sites or graves | Rescue information, artefacts or burials before extensive damage occurs | Construction, Operation and Decommissioning Phases: Reporting chance finds of graves and dense clusters of artefacts as early as possible to an archaeologist and/or SAHRA (https://www.sahra.org.za/contact/), protect in situ and stop work in immediate area and appoint archaeologist to exhume or sample as needed (where relevant) | Inform staff to be vigilant and carry out inspections of all new excavations | Ongoing basis | Construction Manager or Contractor |
| | | | | Whenever on site (at least weekly) | ECO |
| **Impacts to the cultural landscape** | | | | | |
| Visible landscape scarring | Minimise landscape scarring | Construction Phase: Ensure disturbance is kept to a minimum and does not exceed project requirements. Minimise the duration of the activities. At the end of the construction period, rehabilitate areas, not needed during operation. | Monitoring of surface clearance relative to approved layout | Ongoing basis | Construction Manager or Contractor |
| | | | | As required | ECO |
| Intrusion into cultural landscape | Minimise construction duration | Operational Phase: Ensure that all maintenance vehicles and operational activities stay within designated areas. | Undertake visual inspections and report non-compliance | As required | Environmental Manager |
| Intrusion into cultural landscape | Minimise contrast and light pollution | Operational Phase: Paint buildings in earthy colours to reduce contrast. Make use of motion detectors and | Monitor that this has been considered in the design | Once off | Project Developer |

| | | | | | |
|---|---|---|---|---|---|
| | | downlighting to reduce night-time light pollution. | and operation of the facility | | |
| Visible landscape scarring | Minimise landscape scarring | Decommissioning Phase: Ensure disturbance is kept to a minimum and does not exceed project requirements. Minimise the duration of the activities. Rehabilitate the entire site once the infrastructure has been removed. | Monitoring of surface clearance relative to approved layout | Ongoing basis | Construction Manager or Contractor |
| | | | Undertake visual inspections and report non-compliance | As required | Environmental Manager |

# 11. CONCLUSIONS

There are no significant concerns for the proposed Kudu PV11 project. The heritage indicators and project responses are shown in Table 8. The facility layout has been designed to avoid all known heritage resources with the exception of the cultural landscape which will not be significantly impacted. There are no areas requiring avoidance and no protective buffers are needed. The development footprint and detailed layout (Figure 3) are considered suitable from a heritage perspective. Any further changes to the detailed layouts as might become necessary are deemed acceptable if the changes remain within the overall development footprint area assessed during the Scoping and EIA Process.

***Table 8:*** *Heritage indicators and project responses.*

| **Indicator** | **Project Response** |
|---|---|
| Significant fossils should not be damaged or destroyed by the proposed project. | No significant fossils expected, chance finds procedure to be implemented following guidelines in palaeontological study. |
| Significant archaeological sites should not be damaged or destroyed by the proposed project. | The project has been designed to avoid all significant sites. None fall within the footprint and none are close enough to be at risk of incidental damage. |
| Graves should not be damaged or destroyed by the proposed project. | No known graves fall within the footprint and none are close enough to be at risk of incidental damage. |
| The cultural landscape should not be dominated by the proposed project. | The landscape is characterised by hills in a flat landscape and because the development will be fairly low, it will not overly dominate the landscape. |

### 11.1. Statement and reasoned opinion of the specialist

Given the lack of significant heritage resources in the proposed Kudu PV11 footprint and generally limited impacts to the cultural landscape, it is the opinion of the heritage consultant that the project may be authorised in full using either battery technology.

## 12. RECOMMENDATIONS

It is recommended that the proposed Kudu PV11 SEF be authorised, but subject to the following recommendations which should be included as conditions of authorisation:

- Visually permeable fences, preferably in a dark colour, should be used;
- Buildings to be painted in earthy colours to reduce contrast;
- Night-time light spillage should be minimised, possibly through the use of motion detectors so that the area can stay dark until light is needed; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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# APPENDIX 1 – Curriculum Vitae

*Curriculum Vitae*

## *Jayson David John Orton*

*ARCHAEOLOGIST AND HERITAGE CONSULTANT*

***Contact Details and personal information:***

**Address:** 23 Dover Road, Muizenberg, 7945
**Telephone:** (021) 788 1025
**Cell Phone:** 083 272 3225
**Email:** jayson@asha-consulting.co.za

**Birth date and place:** 22 June 1976, Cape Town, South Africa
**Citizenship:** South African
**ID no:** 760622 522 4085
**Driver's License:** Code 08
**Marital Status:** Married to Carol Orton
**Languages spoken:** English and Afrikaans

***Education:***

| | | |
|---|---|---|
| SA College High School | Matric | 1994 |
| University of Cape Town | B.A. (Archaeology, Environmental & Geographical Science) | 1997 |
| University of Cape Town | B.A. (Honours) (Archaeology)* | 1998 |
| University of Cape Town | M.A. (Archaeology) | 2004 |
| University of Oxford | D.Phil. (Archaeology) | 2013 |

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

***Employment History:***

| | | |
|---|---|---|
| Spatial Archaeology Research Unit, UCT | Research assistant | Jan 1996 – Dec 1998 |
| Department of Archaeology, UCT | Field archaeologist | Jan 1998 – Dec 1998 |
| UCT Archaeology Contracts Office | Field archaeologist | Jan 1999 – May 2004 |
| UCT Archaeology Contracts Office | Heritage & archaeological consultant | Jun 2004 – May 2012 |
| School of Archaeology, University of Oxford | Undergraduate Tutor | Oct 2008 – Dec 2008 |
| ACO Associates cc | Associate, Heritage & archaeological consultant | Jan 2011 – Dec 2013 |
| ASHA Consulting (Pty) Ltd | Director, Heritage & archaeological consultant | Jan 2014 – |

***Professional Accreditation:***

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ ***Memberships and affiliations:***

| | |
|---|---|
| South African Archaeological Society Council member | 2004 – 2016 |
| Assoc. Southern African Professional Archaeologists (ASAPA) member | 2006 – |
| UCT Department of Archaeology Research Associate | 2013 – |
| Heritage Western Cape APM Committee member | 2013 – |
| UNISA Department of Archaeology and Anthropology Research Fellow | 2014 – |
| Fish Hoek Valley Historical Association | 2014 – |
| Kalk Bay Historical Association | 2016 – |
| Association of Professional Heritage Practitioners member | 2016 – |

***Fieldwork and project experience:***

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:

- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 archaeological test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

***Awards:***

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

# APPENDIX 2 - Site Sensitivity Verification

As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool. The details of the site sensitivity verification are noted below:

| | |
|---|---|
| ***Date of Site Visit*** | 21, 22, 24 and 25 April 2022 |
| ***Specialist Name*** | Dr Jayson Orton |
| ***Professional Registration Number*** | Association of Southern African Professional Archaeologists (ASAPA): 233<br><br>Association of Professional Heritage Practitioners (APHP): 043 |
| ***Specialist Affiliation / Company*** | ASHA Consulting (Pty) Ltd |

Method of the Site Sensitivity Verification

Initial work was carried out using satellite aerial photography in combination with the author's accumulated knowledge of the local landscape. This was used to provide sensitivity data. Subsequent fieldwork served to ground truth the site, including areas identified as potentially sensitive. Desktop research was also used to inform on the heritage context of the area. This information is presented in the report (Sections 5.2.1 and 5.4.1).

Outcome

The first map below is extracted from the screening tool report and shows the archaeological and heritage sensitivity to be low throughout the wider Kudu study area. The site visit showed that in fact the majority of the site is of low sensitivity but with several pockets of higher sensitivity being present (where archaeological and other heritage resources were found). The heritage specialist thus disputes the screening tool report sensitivity mapping. The other three maps below show the areas considered to be archaeologically sensitive. Most are sites considered to be of high sensitivity, but those sites marked as low cultural significance can be seen as medium sensitivity. The remaining land in between is of low sensitivity. A photographic record and description of the relevant heritage resources are contained within the impact assessment report.

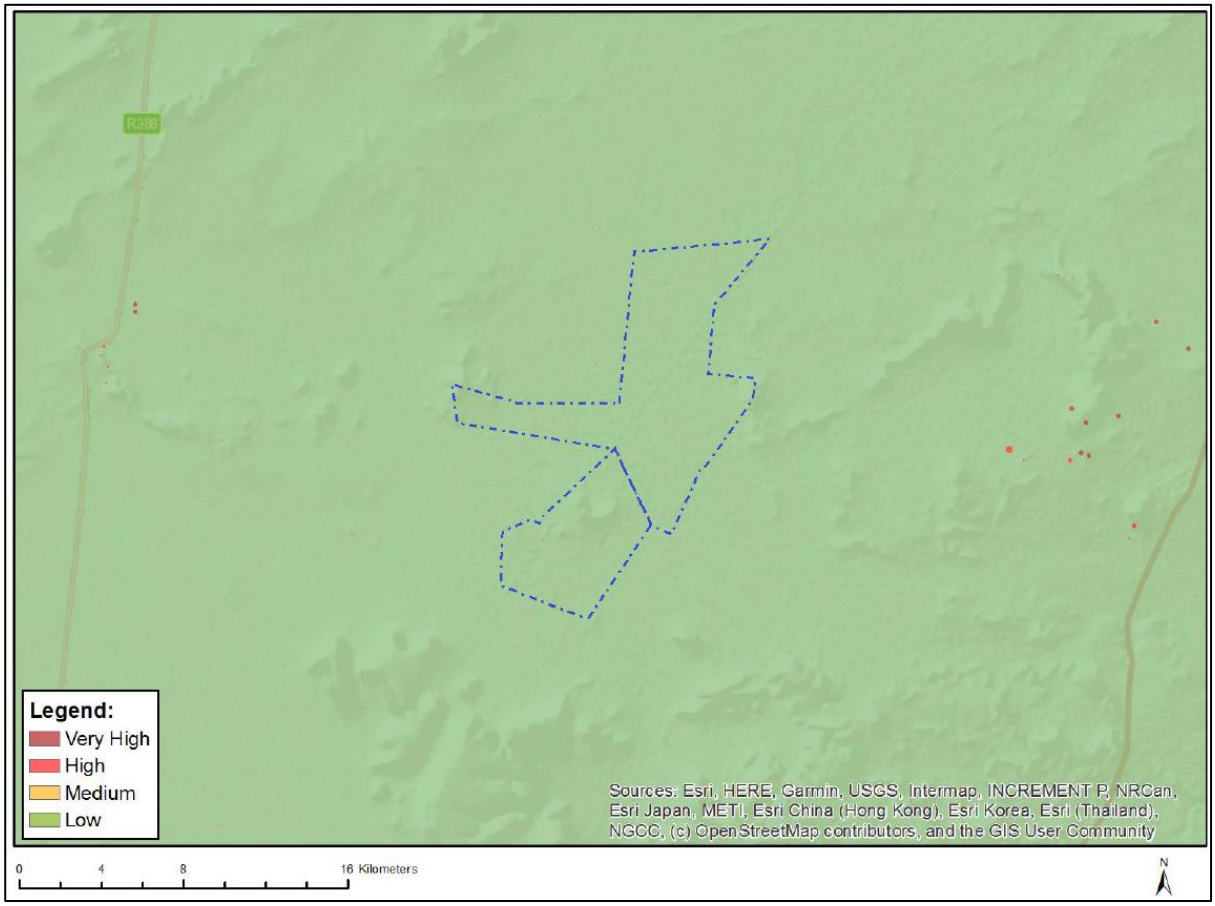


***Figure A2.1:*** *Screening tool map of archaeological and heritage sensitivity.*

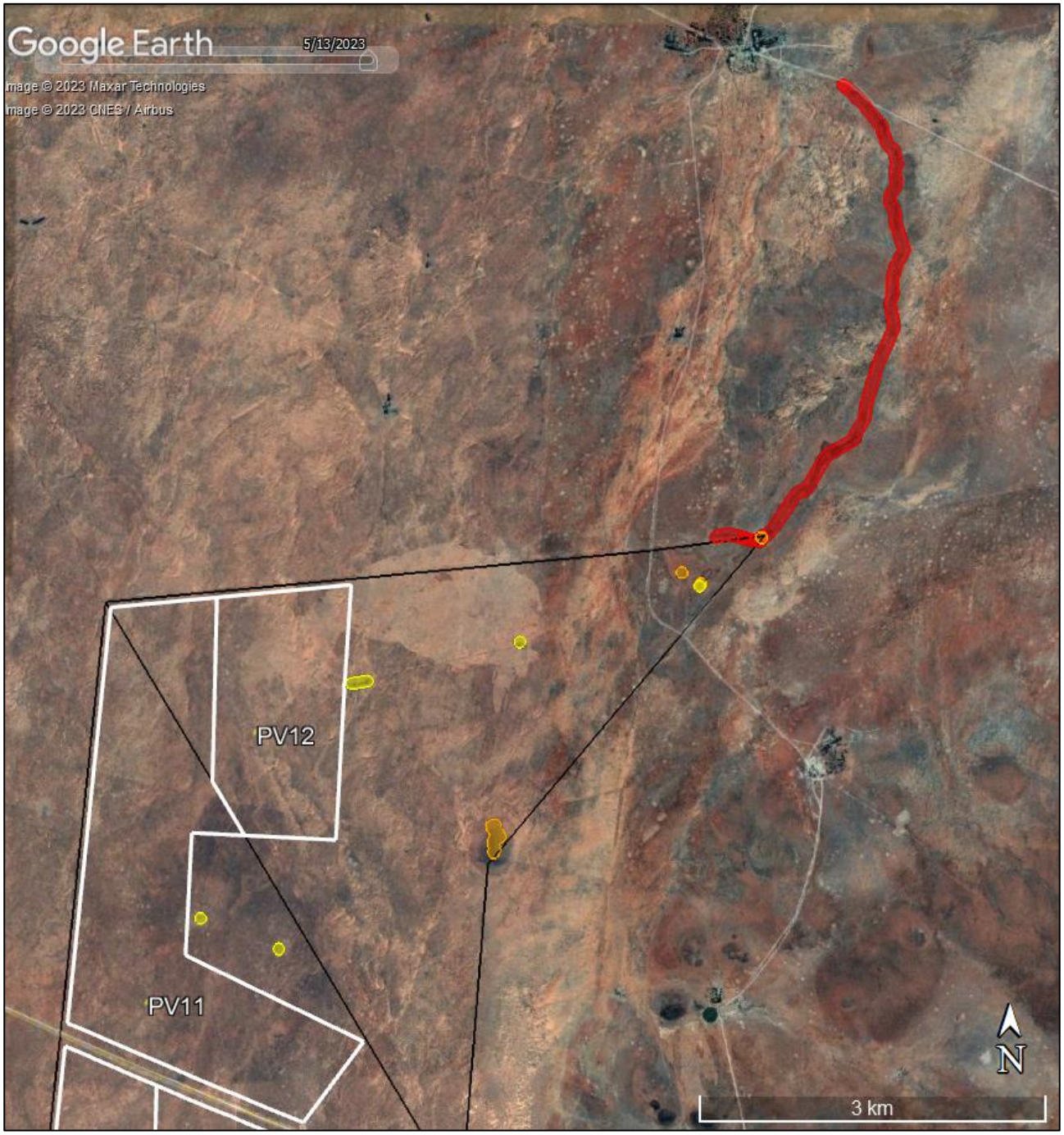
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Image © 2023 CNES / Airbus
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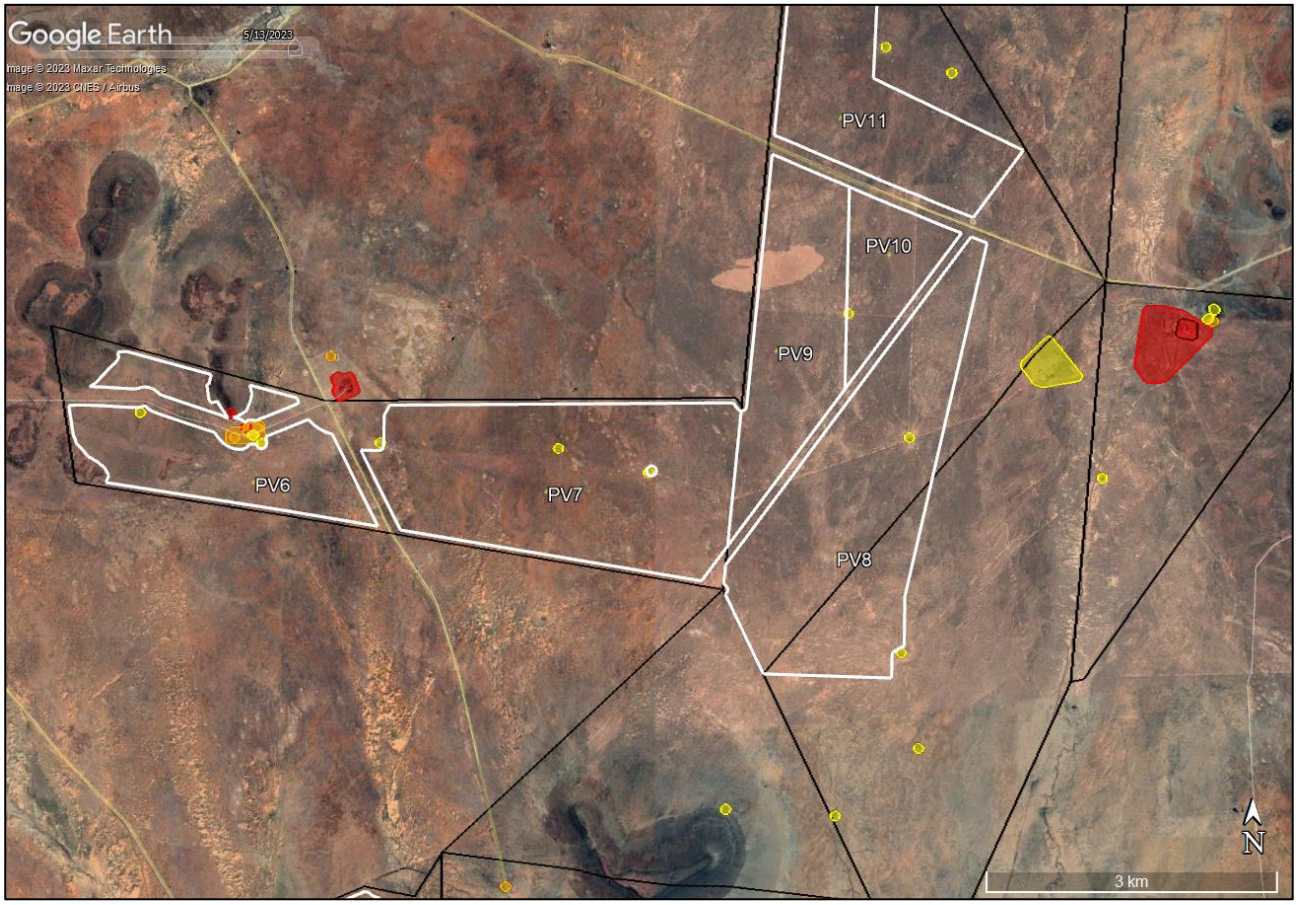
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Image © 2023 Maxar Technologies
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## APPENDIX 3 – Mapping

Key to mapping: Black polygons: farm boundaries
White polygons: project footprints (i.e. fence lines; labelled by yellow pins)
Dark Red: Grade IIIA
Red: Grade IIIB
Orange: Grade GPA
Yellow: Grade GPB
White: Grade GPC

Maps shown with facility fence line only for the sake of mapping clarity. The fence line will contain all the proposed infrastructure as shown in the detailed layout in Figure 3 of the HIA report.

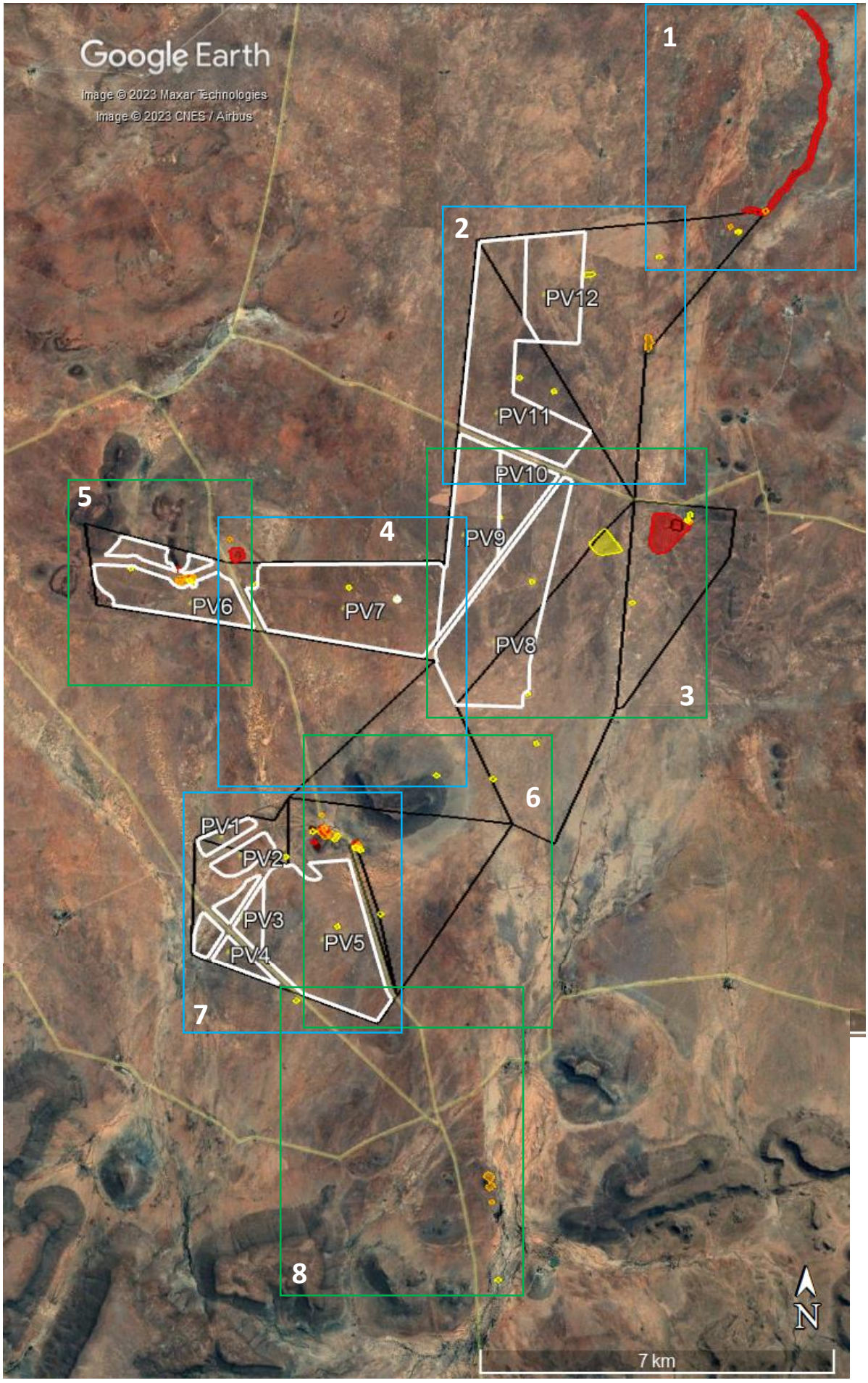
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Image © 2023 Maxar Technologies
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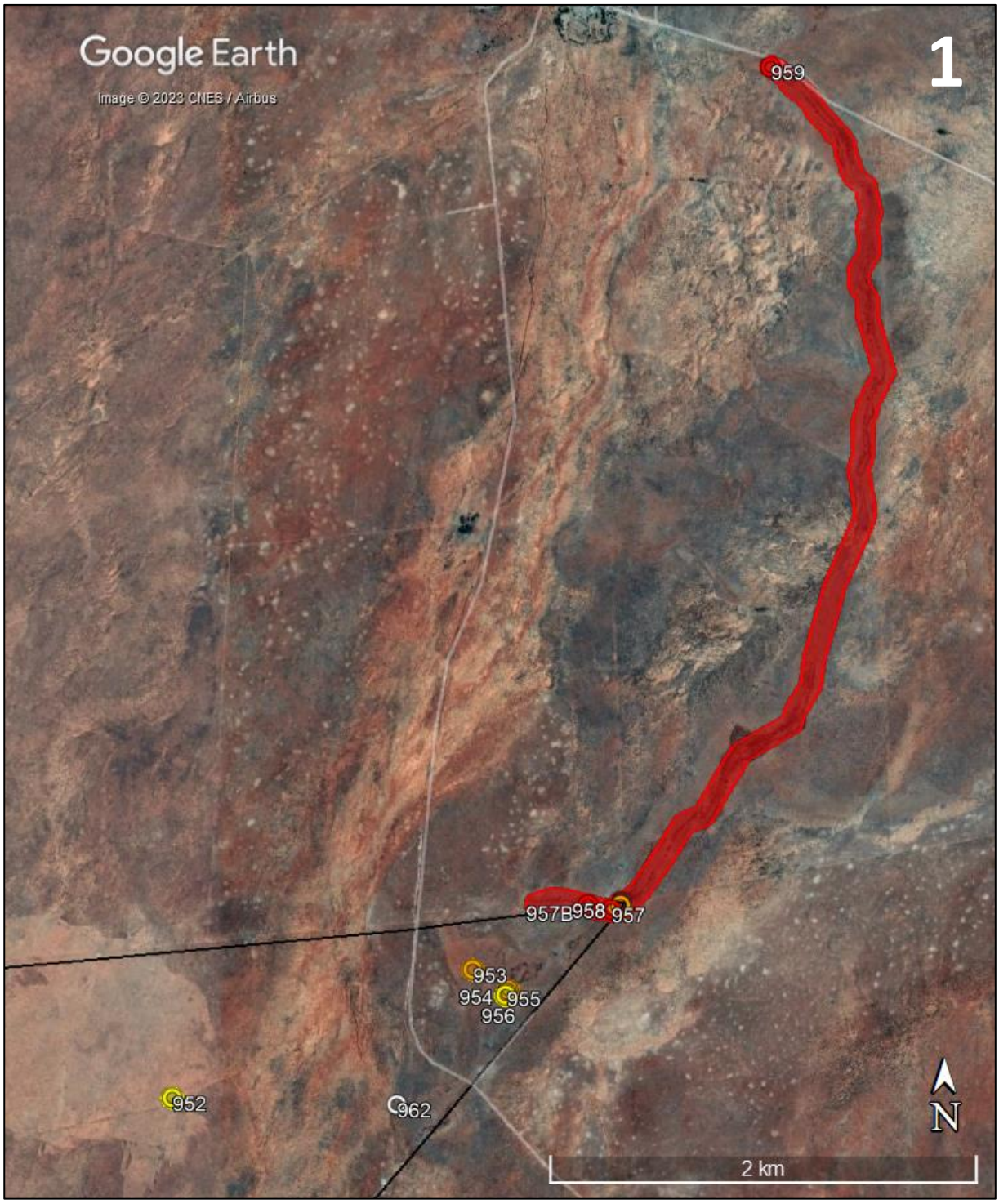
Numbered boxes indicate main enlargements below.



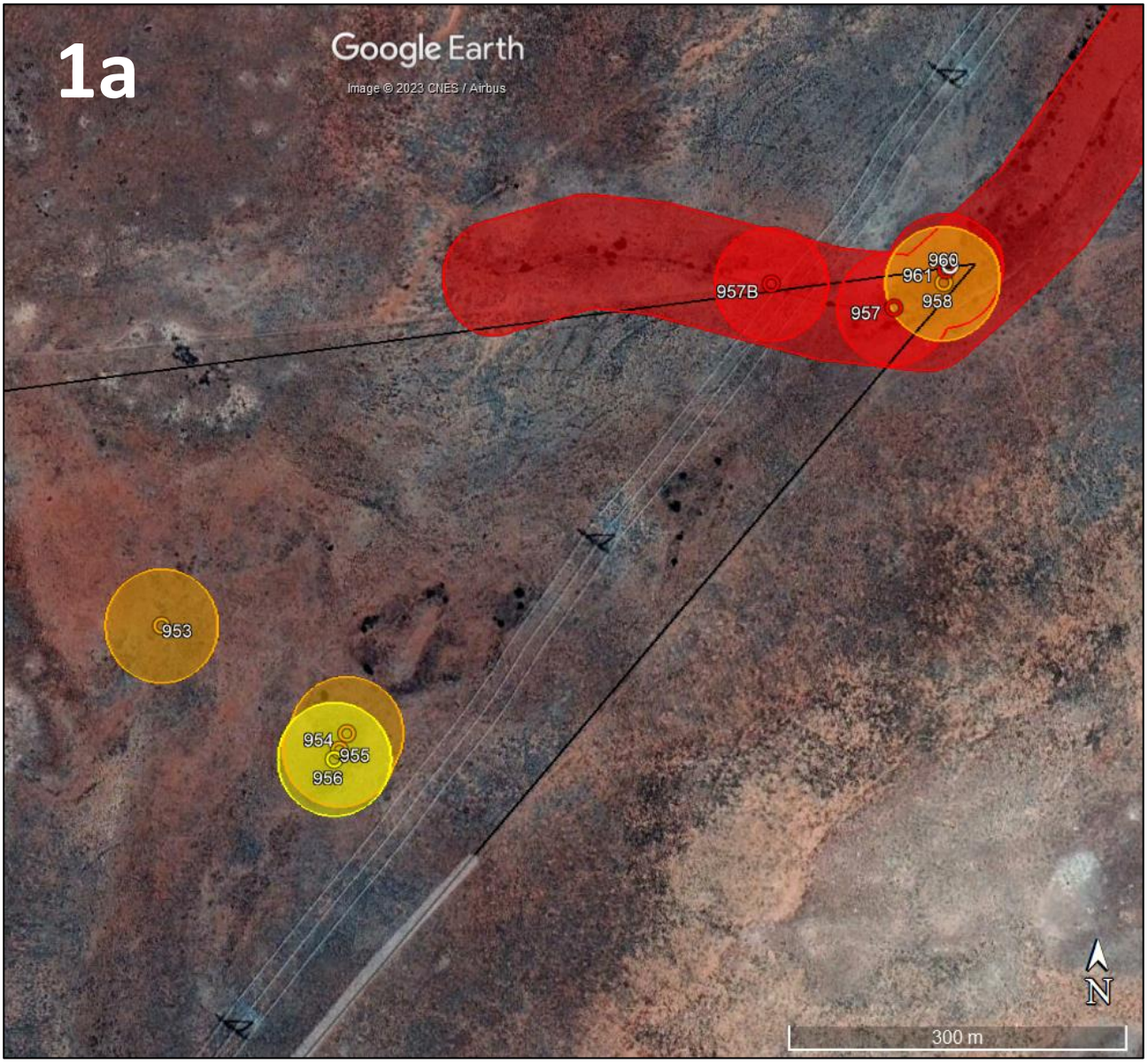

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Image © 2023 CNES / Airbus
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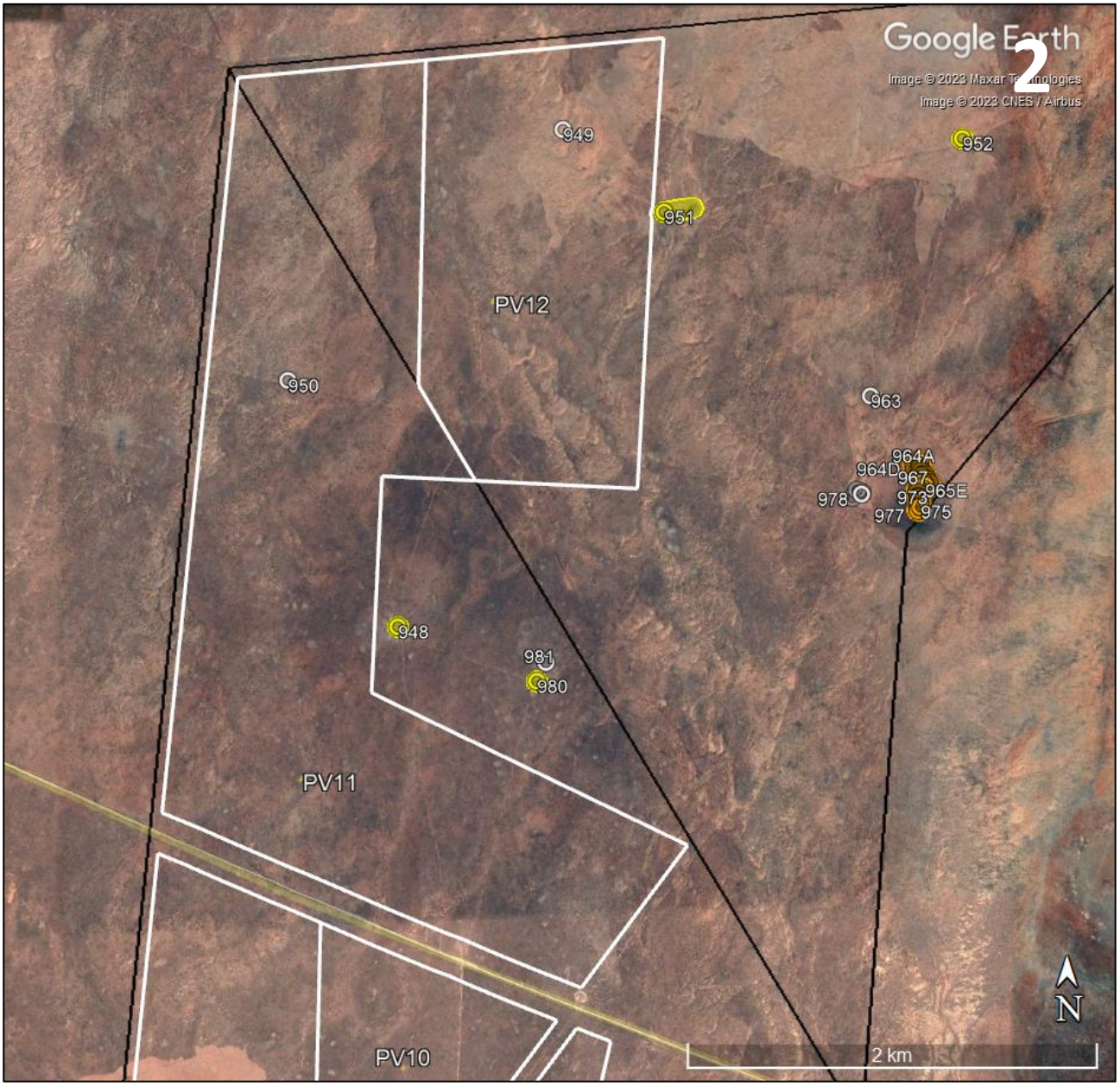
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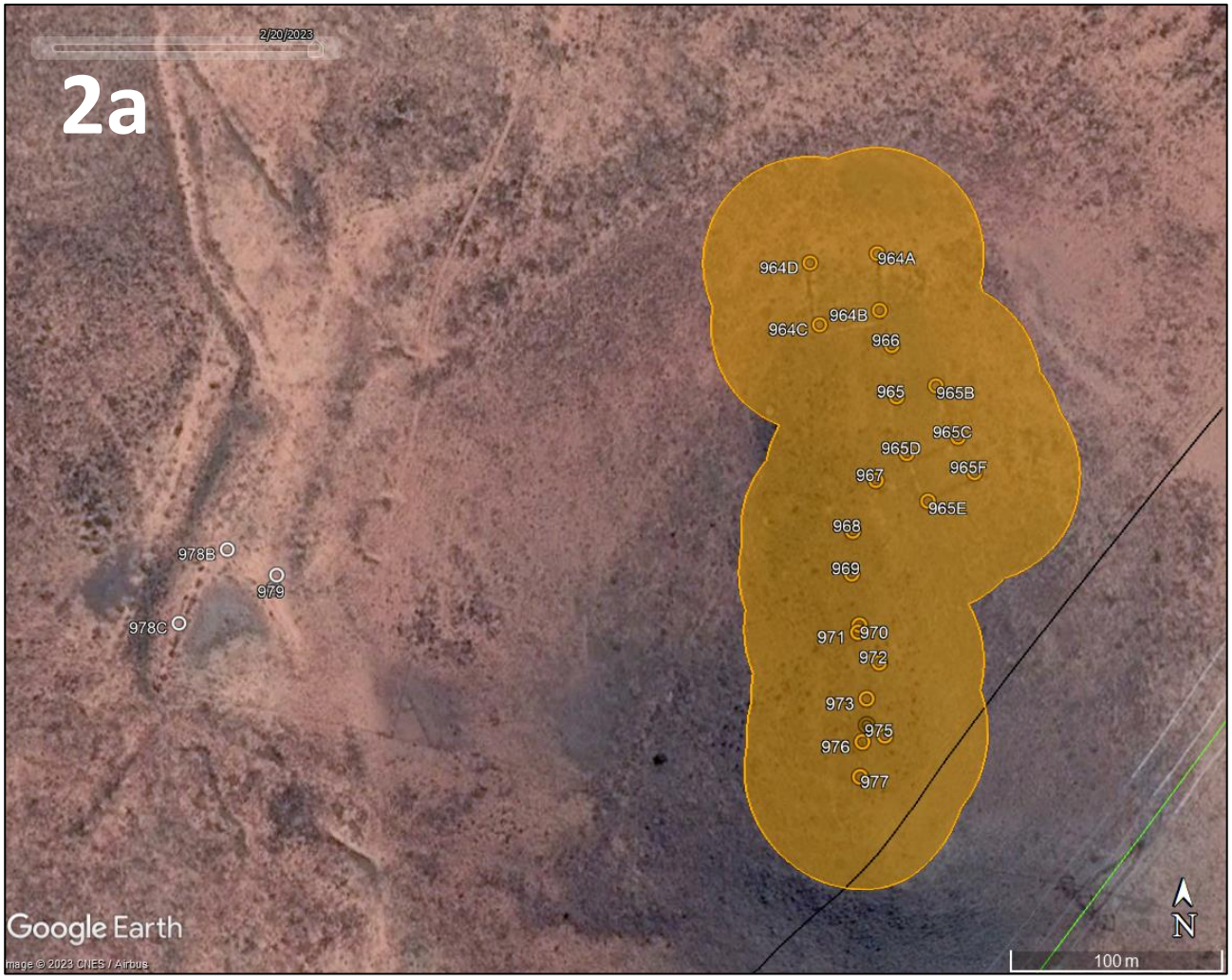
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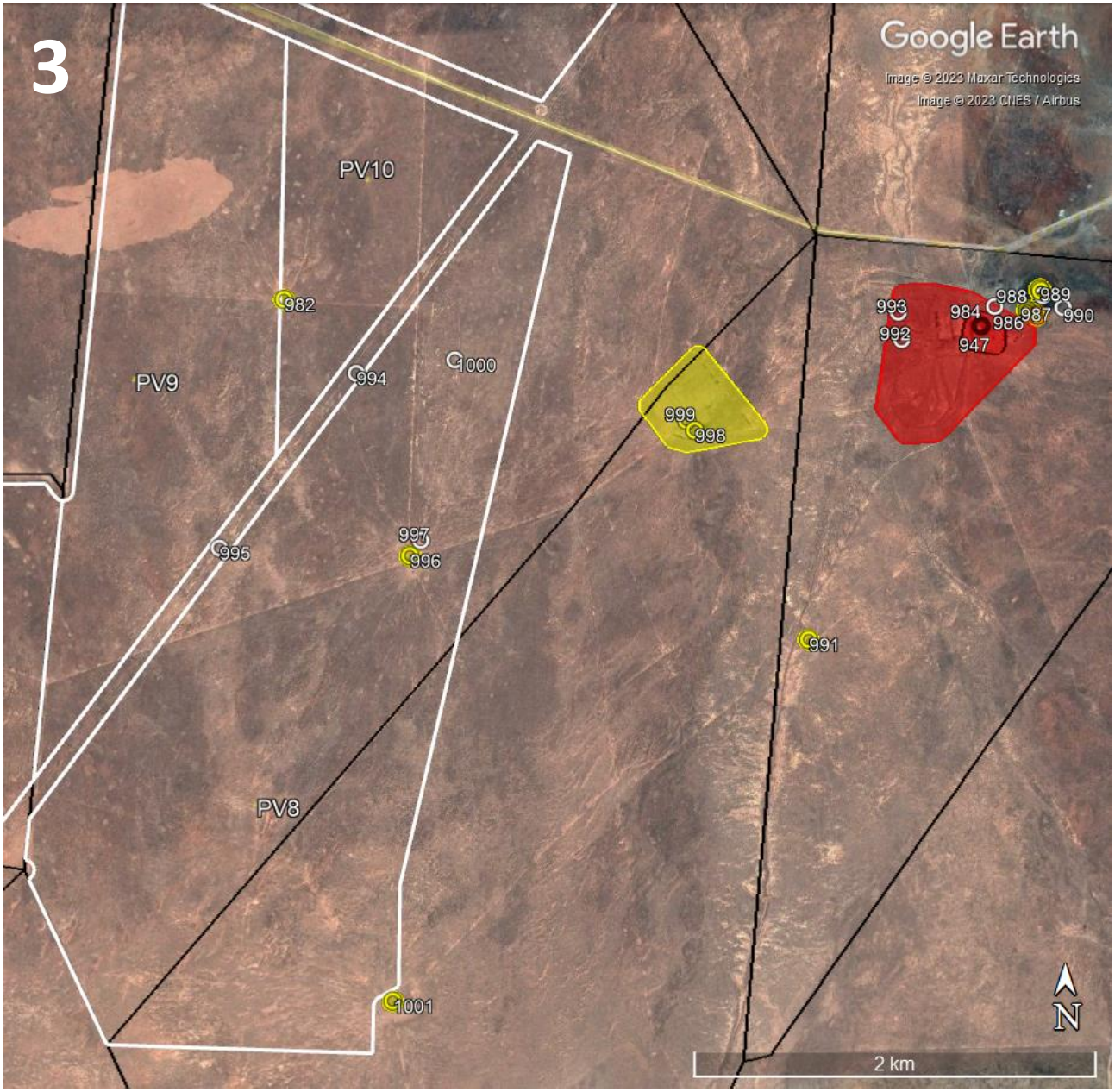
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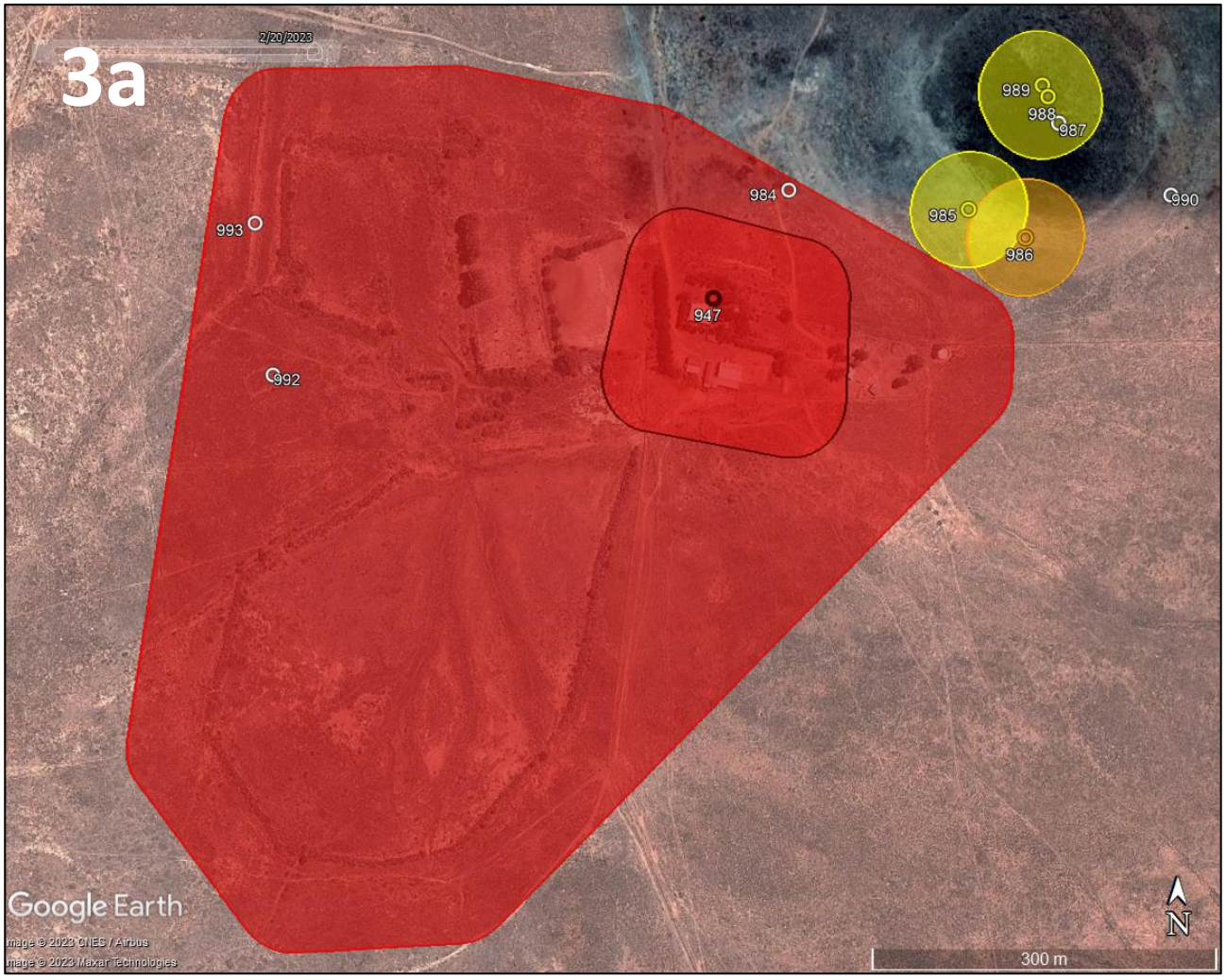
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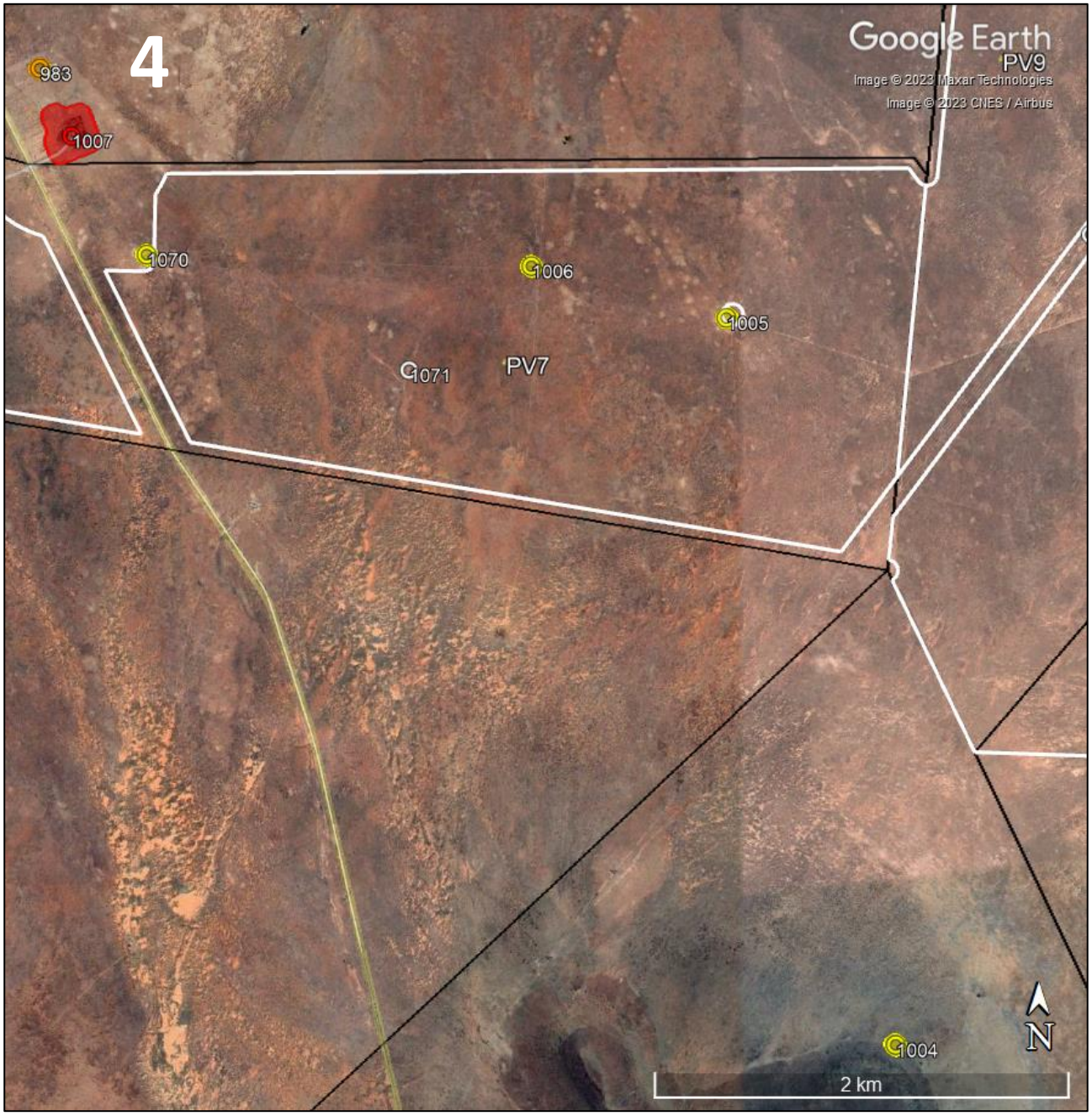
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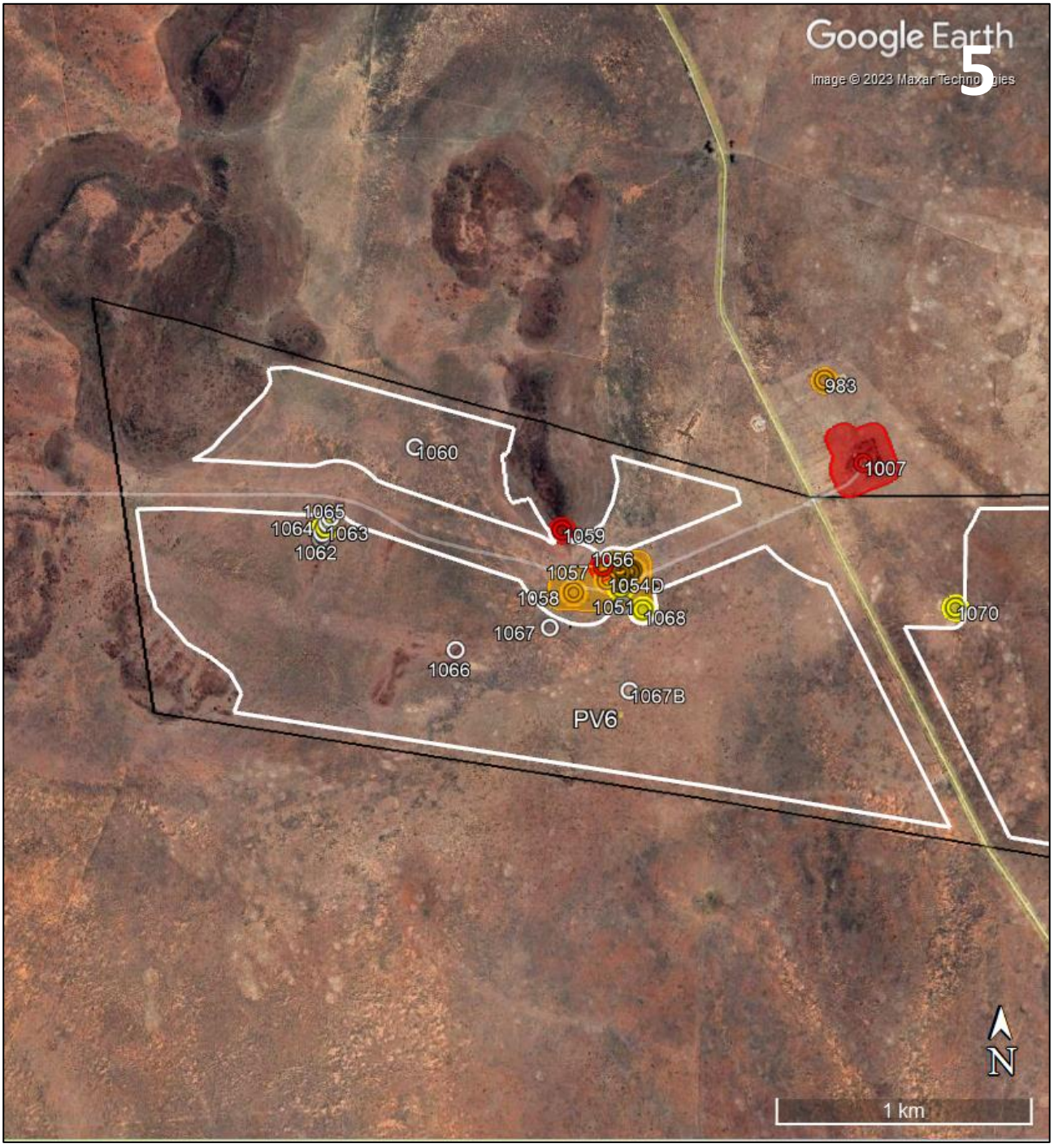
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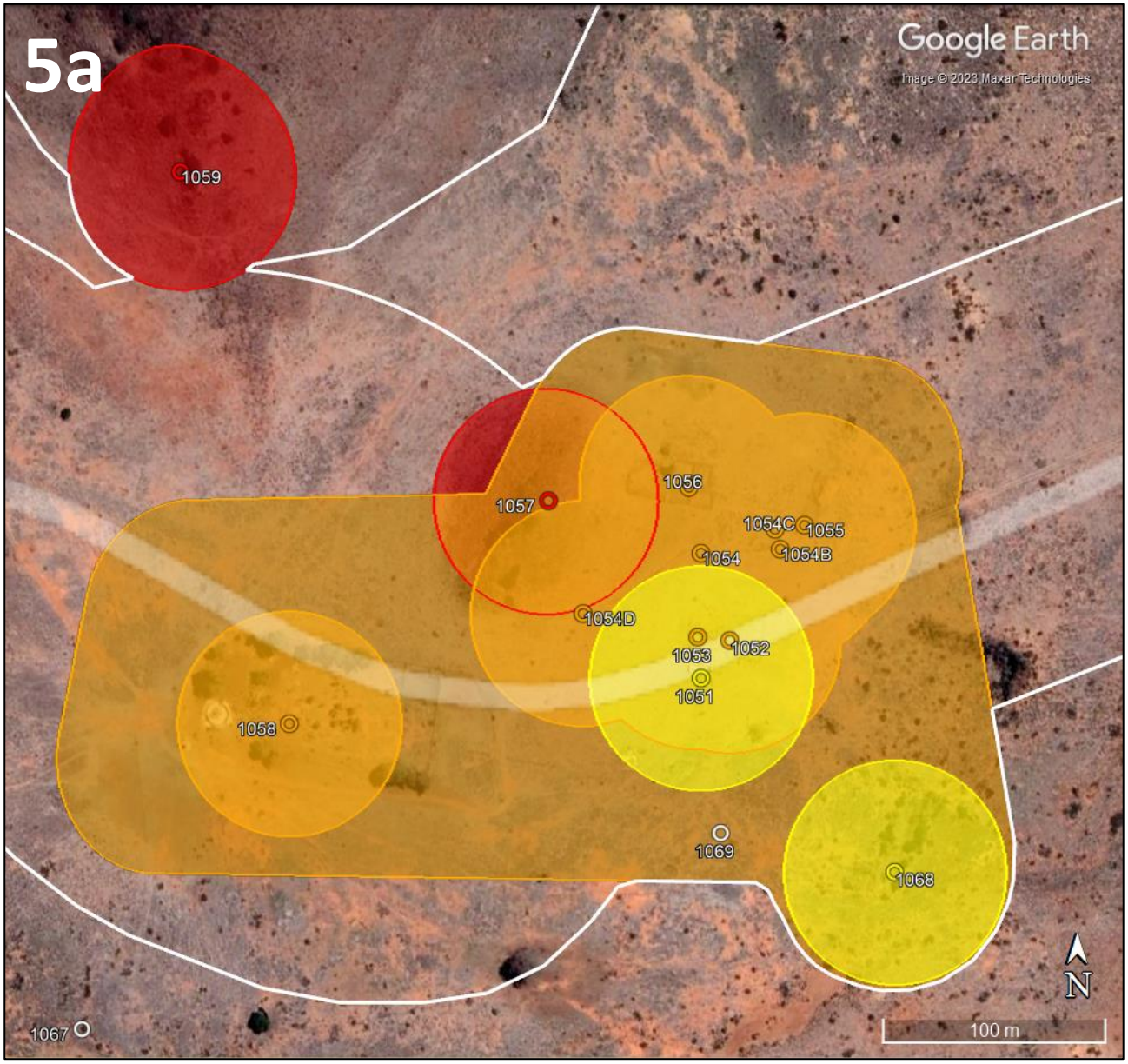
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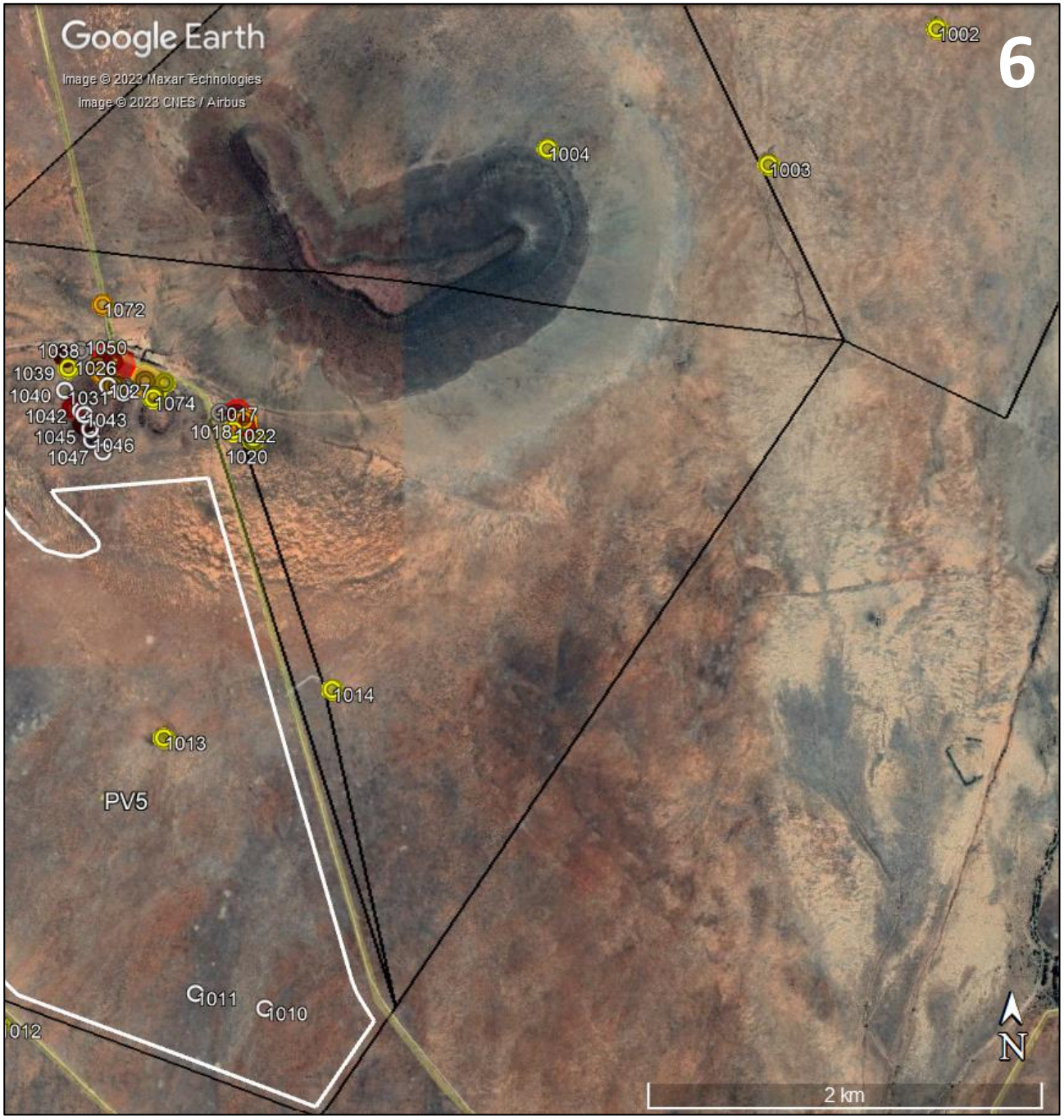
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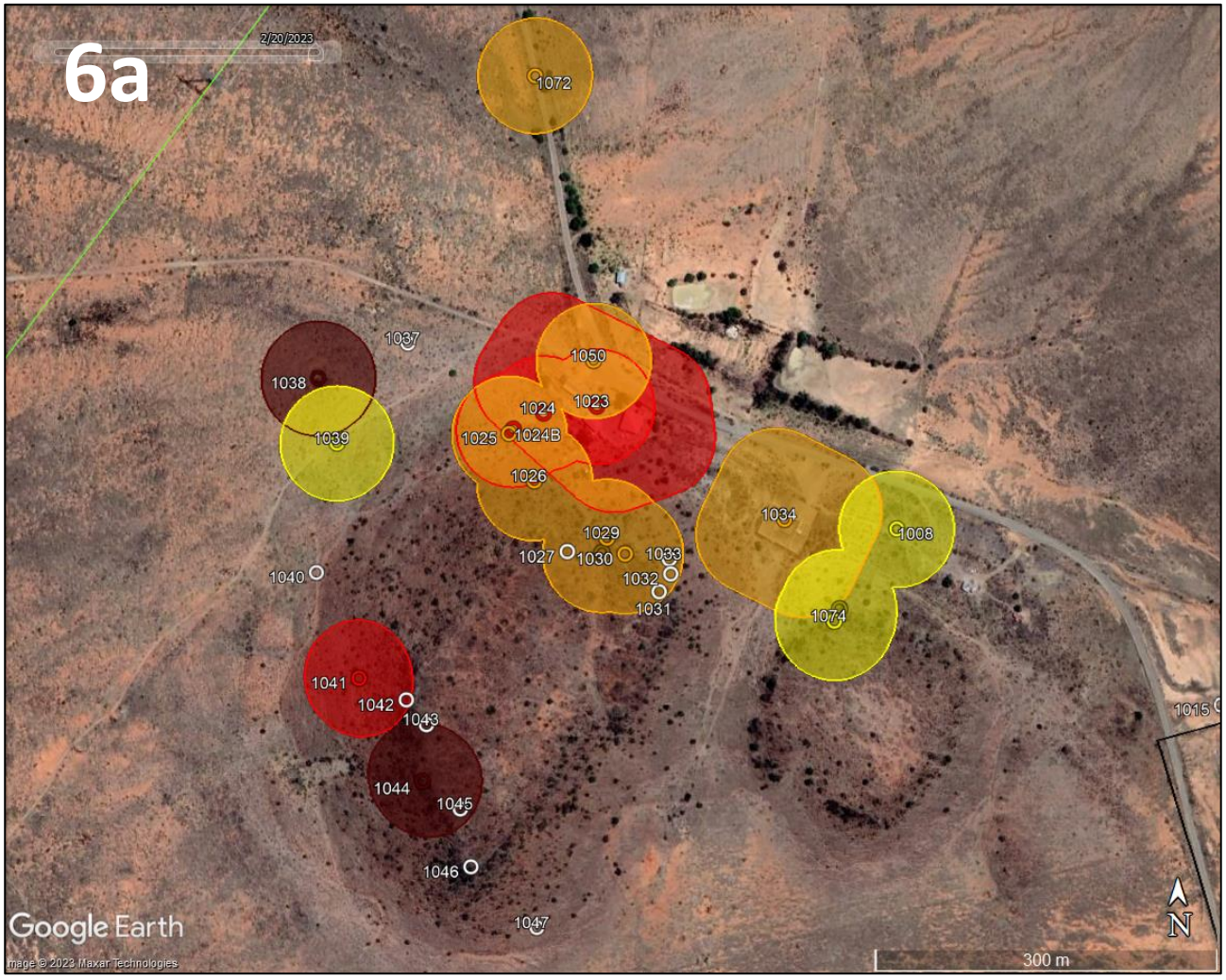
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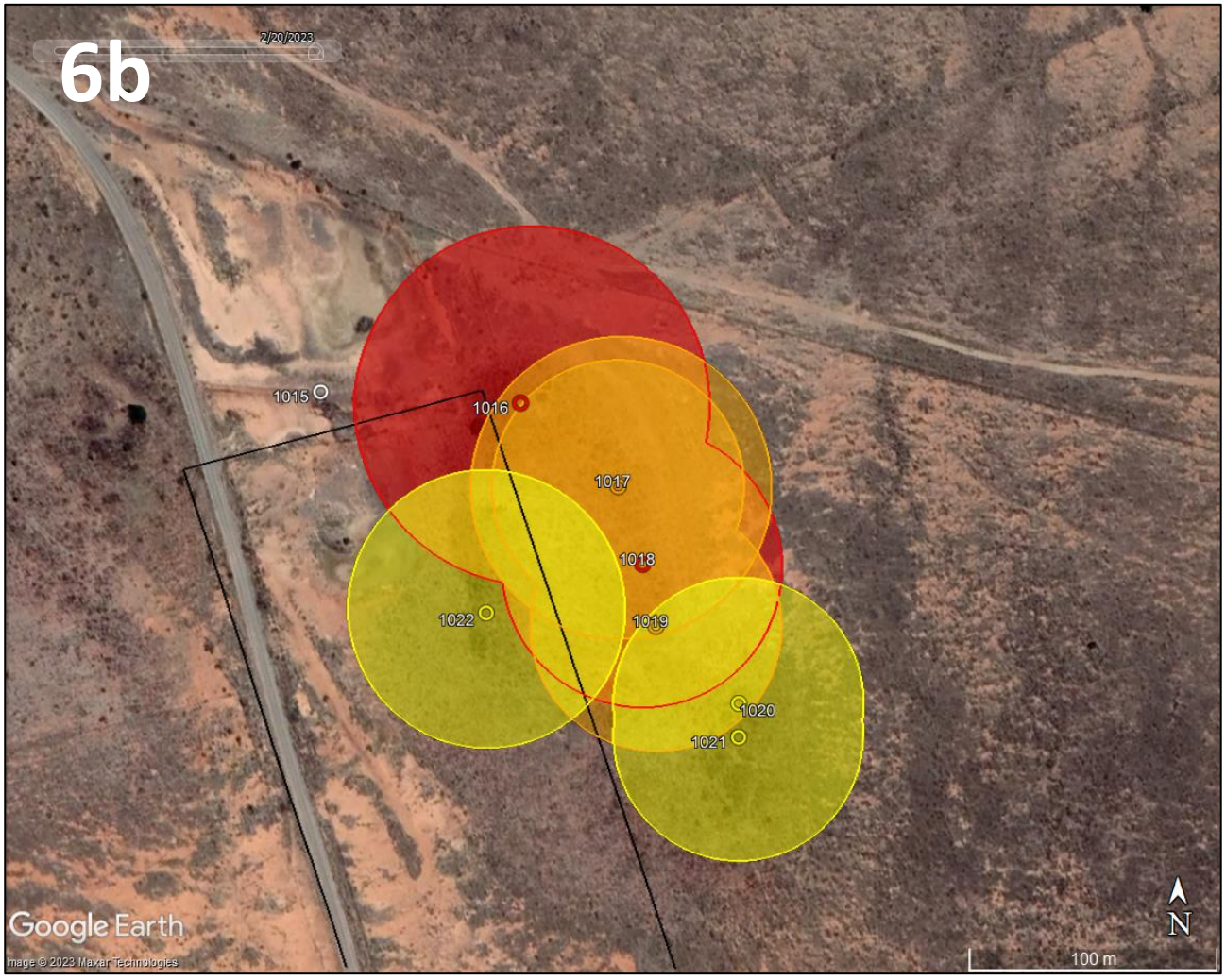
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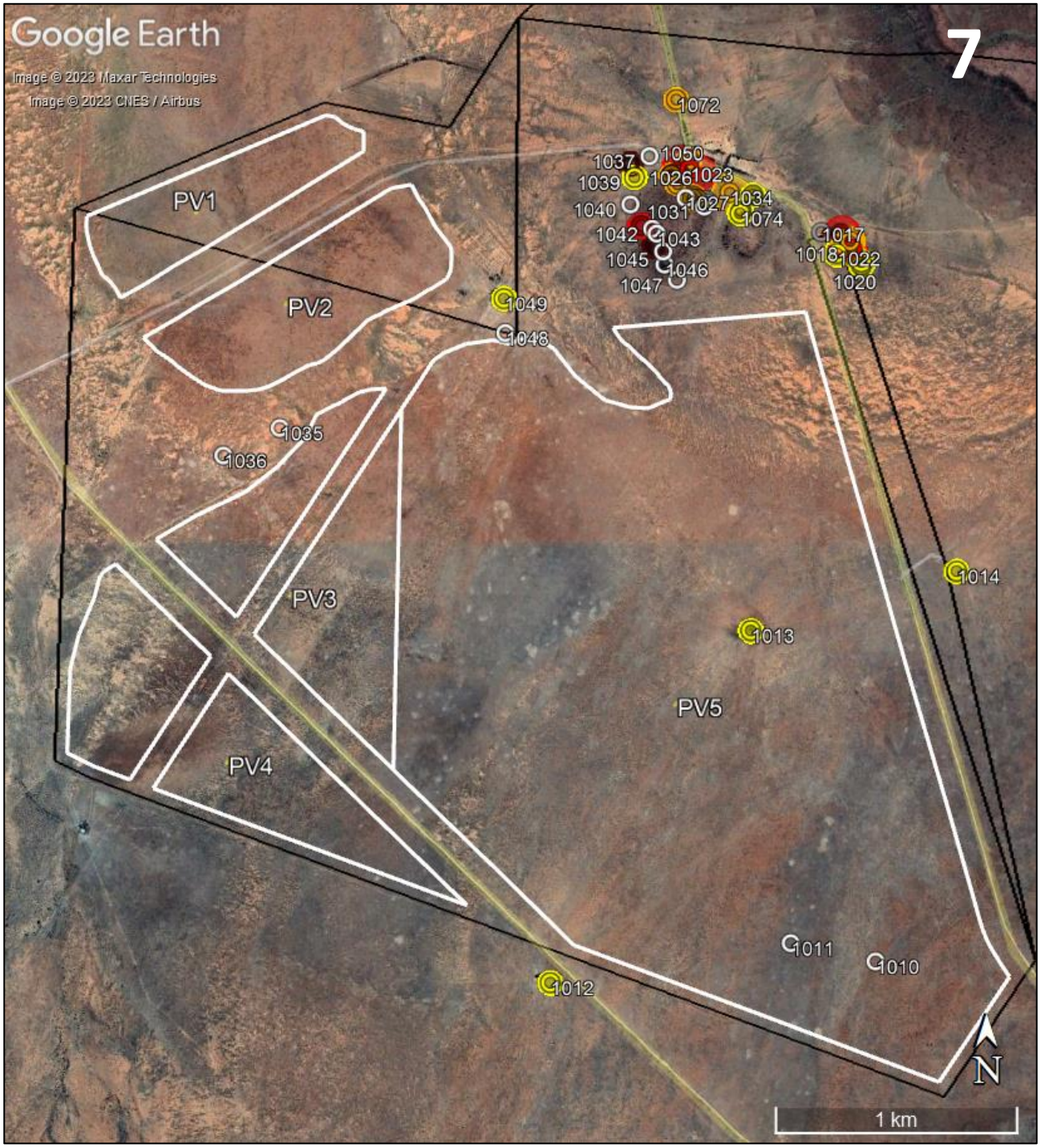
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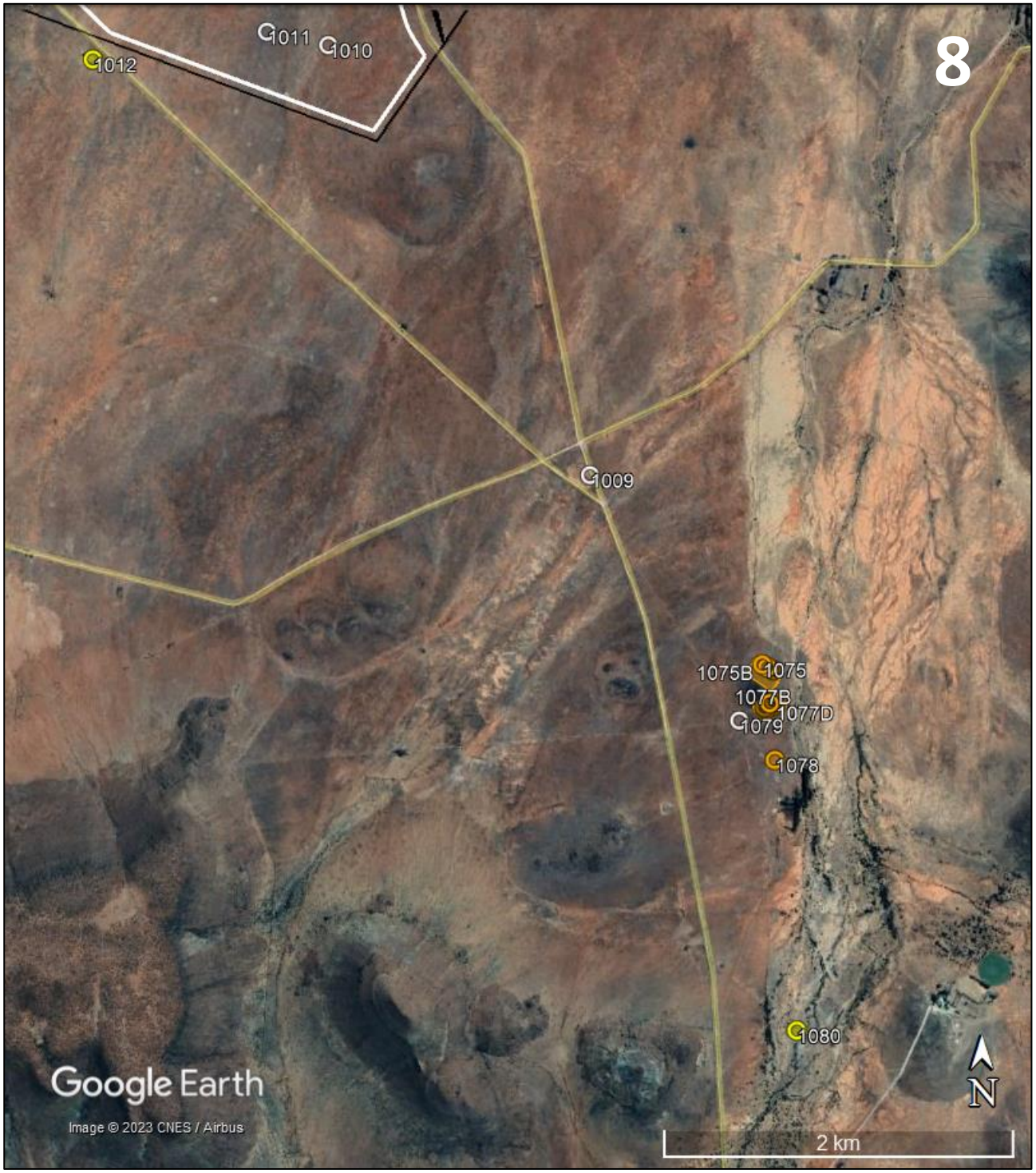
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# CHAPTER 12:
# Palaeontology

CSIR
Touching lives through innovation

## SITE SENSITIVITY VERIFICATION REPORT (IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020)

# PROPOSED DEVELOPMENT OF THE KUDU SOLAR PHOTOVOLTAIC FACILITIES AND ASSOCIATED INFRASTRUCTURE NEAR PHILIPSTOWN AND DE AAR, PIXLEY KA SEME DISTRICT, NORTHERN CAPE PROVINCE

**John E. Almond PhD (Cantab.)**
***Natura Viva* cc, PO Box 12410 Mill Street,**
**Cape Town 8010, RSA**
**naturaviva@universe.co.za**

**Version 3: April 2023**

## EXECUTIVE SUMMARY

ABO Wind renewable energies (PTY) Ltd is proposing to develop the Kudu Solar Photovoltaic (PV) cluster[1] and associated Electricity Grid Infrastructure (EGI) near De Aar in the Pixley Ka Seme District, Northern Cape Province. The Kudu solar facility and grid connection project area largely comprises low-relief terrain mantled with thick Late Caenozioic calcrete hardpans, alluvial deposits, surface gravels and soils that are generally of low palaeosensitivity. Natural bedrock exposure here is very limited and mainly involves unfossiliferous dolerite as well as baked Ecca Group metasediments (probable Waterford Formation) building *kranzes* on upper hillslopes that will not be directly impacted by the proposed development. Early to Middle Permian basinal mudrocks of the Tierberg Formation (Ecca Group, Karoo Supergroup) underlie the majority of the project area but are rarely exposed and, where seen, are generally weathered, friable and extensively disrupted by near-surface calcrete veins. The offshore mudrocks of the Tierberg Formation are not known elsewhere to have a rich fossil record. In the present project area the potential for well-preserved fossils is further reduced by near-surface weathering, calcrete veining as well as baking of sedimentary bedrocks by intensive regional dolerite intrusion in Early Jurassic times. The only fossils recorded from the Ecca Group sediments during the 2-day palaeontological site visit comprise sparse, low diversity trace fossil assemblages of low scientific or conservation interest. Thick sandy to gravelly alluvial deposits associated with long-established drainage lines are extensively calcretised. No fossil remains were recorded within them.

[1] Each PV Facility will have a separate Project Applicant i.e., Kudu Solar Facility 1 (PTY) Ltd to Kudu Solar Facility 12.

According to the Department of Forestry, Fisheries and the Environment (DFFE) screening tool mapping, the majority of the Kudu solar PV facilities and associated grid connection corridor is of Medium to High palaeosensitivity. **This provisional assessment is *contested* in the present Site Sensitivity Verification Report**, based on a 2-day palaeontological site visit and several previous field-based and desktop Palaeontology Impact Assessment (PIA) studies in the broader De Aar – Kimberley region. **It is concluded that the Kudu solar PV and grid connection project areas are in fact of LOW to VERY LOW palaeosensitivity in general.** The only two fossil sites recorded in the region fall *outside* the PV project areas (Appendix 3) and are of low scientific / conservation interest so no mitigation is recommended with regard to them. The potential for rare, largely unpredictable fossil sites of High palaeosensitivity associated with older alluvial and pan deposits hidden in the subsurface cannot be discounted. Most such fossil sites would probably be protected during construction by environmental buffer zones along drainage lines. If any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol outlined in Appendix 2 to this report should be fully implemented. These recommendations should be included within the Environmental Management Programmes (EMPrs) for the Kudu Solar PV Facilities and associated infrastructure developments.

**The project area for all the solar PV facilities, on-site substations, grid connection corridors and associated infrastructure currently under consideration are of LOW to VERY LOW palaeosensitivity. Provided that the Chance Fossil Finds Protocol tabulated in Appendix 2 is incorporated into the EMPrs and fully implemented during the construction phase of the solar PV facility and grid connection developments, there are no objections on palaeontological heritage grounds to authorisation of the proposed renewable energy developments. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, reporting, monitoring or mitigation are recommended for these renewable energy projects.**

**These conclusions and recommendations apply equally to all solar PV Facility developments within the Kudu Solar PV cluster as well as to the development of associated Electricity Grid Infrastructure (See summary table below).**

**Tabulated summary of conclusions regarding palaeontological heritage for each of the Kudu Solar PV Facilities**

| Kudu PV Facility | Rock units present near surface | Desktop & field-based Palaeosensitivity | Recorded fossils | Recommended mitigation |
|---|---|---|---|---|
| **PV1** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV2** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV3** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV4** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV5** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV6** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV7** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV8** | Tierberg Formation (Ecca Group) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |

| Kudu PV Facility | Rock units present near surface | Desktop & field-based Palaeosensitivity | Recorded fossils | Recommended mitigation |
|---|---|---|---|---|
| | Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | | | |
| **PV9** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV10** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV11** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |
| **PV12** | Tierberg Formation (Ecca Group)<br>Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels) | **LOW**<br>**LOW** | **NONE** | **Application of Chance Fossil Finds Protocol during Construction Phase** |

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# TABLES

# FIGURES

# 1. INTRODUCTION

The Project Applicant, ABO Wind renewable energies (PTY) Ltd and Kudu Solar Facility 1 (Pty) Ltd to Kudu Solar Facility 12 (Pty) Ltd, is proposing to develop the Kudu Solar Photovoltaic (PV) cluster and associated Electricity Grid Infrastructure (EGI) near the towns of De Aar and Philipstown in the Pixley Ka Seme District, Northern Cape Province (Figs. 1 & 2). Land parcels concerned with the development are shown in the satellite map in Figure 3; this is the study area covered by the present Site Sensitivity Verification report. The Kudu renewable energy project will entail the proposed development of up to several Solar PV Facilities as well as associated infrastructure and EGI[2]. Each solar PV facility will have a range of associated infrastructure including, but not limited to, an on-site substation complex and battery energy storage systems (BESS) and is proposed to connect to an existing 400 kV power line *via* dedicated 132 kV power lines. Each of the PV facilities would be its own project and would require its own, separate Environmental Authorisation (EA).

The proposed PV projects are not located within any of the Renewable Energy Development Zones (REDZs) that were gazetted in Government Notice (GN) 114 in February 2018 and GN 144 in February 2021. Therefore, full Scoping and Environmental Impact Assessment (EIA) Processes are needed for the PV projects. The proposed EGI projects are located within the Central Strategic Transmission Corridor that was gazetted in GN 113 in February 2018. Therefore, Basic Assessment (BA) and/or EGI Standard Registration Processes are needed for the EGI projects.

According to the Department of Forestry, Fisheries and the Environment (DFFE) National Web-Based Environmental Screening Tool (hereafter referred to as the “screening tool”), the majority of the Kudu Solar PV Facility and associated grid connection corridor study area is of Medium to High palaeosensitivity (Fig. 32). In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations of 2014, a combined field-based and desktop site sensitivity verification has therefore been undertaken in order to confirm or contest the environmental sensitivity of the proposed project area as identified by the Screening Tool.

The independent Environmental Practitioner co-ordinating the various Environmental Assessment processes for the proposed Kudu PV solar and associated infrastructure projects is the CSIR, Environmental Management Services (Contact details: Ms Rohaida Abed. CSIR - Environmental Management Services. P.O. Box 59081, Umbilo, Durban, 4075. Tel: 031 242 2318. E-mail: ems@csir.co.za).

This Palaeontology Site Verification Report has been compiled by Dr. John Almond of Natura Viva cc (CV included in Appendix 1, as well as a declaration of interest).

[2] The Scoping and EIA Process for the Solar PV Projects for Kudu Solar Facility 1 to 12 have commenced (Department of Forestry, Fisheries and the Environment (DFFE) Reference Numbers: 14/12/16/3/3/2/2244 to 14/12/16/3/3/2/2255). The Environmental Assessment Processes for the EGI Projects will be undertaken at a later stage. This Site Sensitivity Verification Report covers both the Solar PV Projects and EGI.

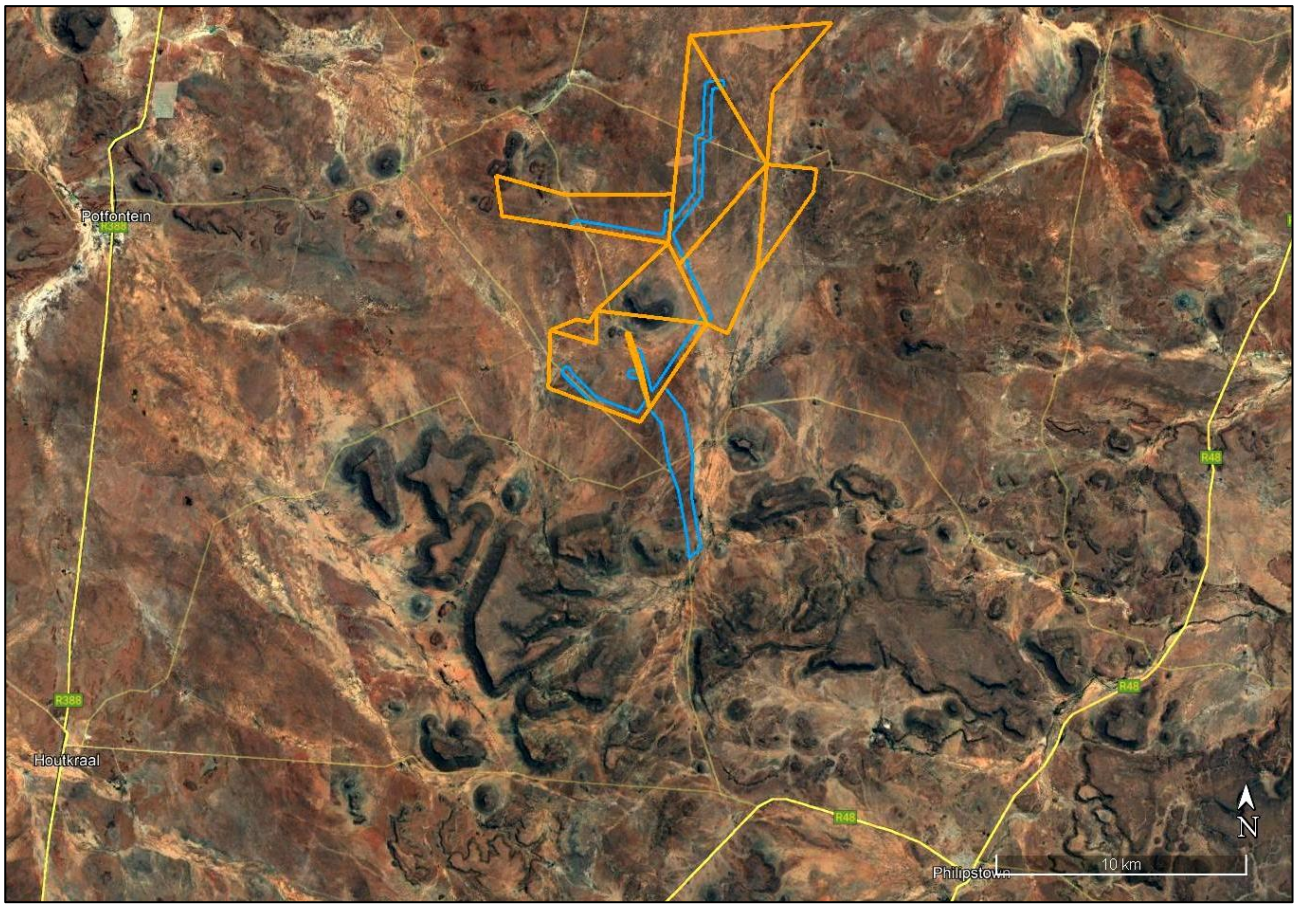


**Figure 1: Google Earth© satellite image showing the project study area (orange polygon) for the proposed Kudu Solar PV Facilities near Philipstown, Pixley Ka Seme District, Northern Cape Province. Corridors for the various grid connection route options are shown in blue, including a 400 kV Loop-In-Loop-Out (LILO) from the existing Hydra-Perseus 400 kV Overhead Power Line to the proposed MTS. Site Sensitivity Verification for the solar PV facility and EGI project area is based on a recent 2-day palaeontological heritage site visit. Land parcels concerned within the project area are identified in Figure 3 below.**

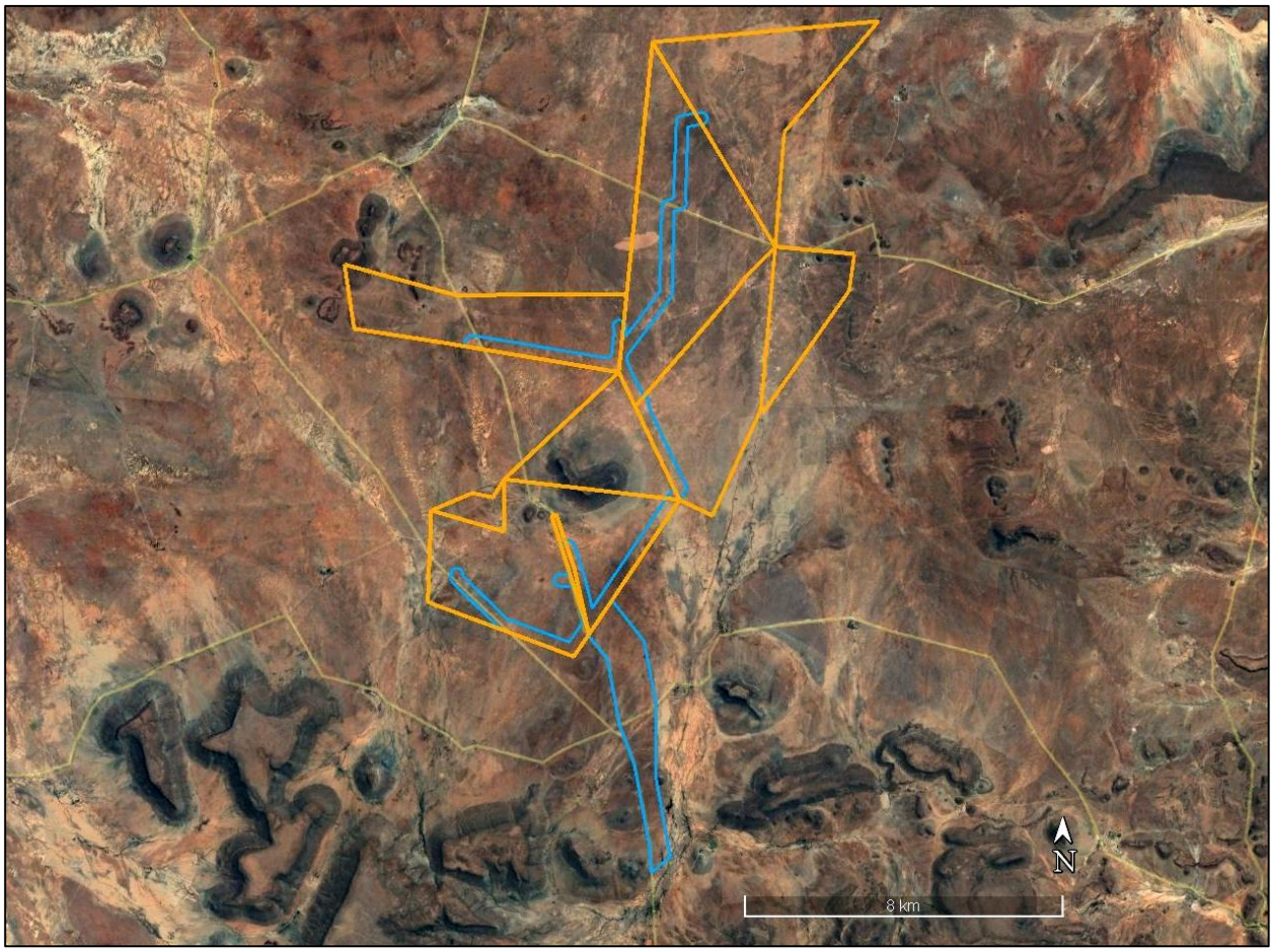


**Figure 2: More detailed Google Earth© satellite image of the Kudu Solar PV cluster project area and associated EGI project area (blue polygon). Most of the project area features low relief, grassy terrain with very little or no bedrock exposure.**

## 2. DATA SOURCES

The palaeontological heritage site sensitivity verification report for the Kudu solar facility and associated infrastructure project area is based on:

- Detailed project descriptions, maps, kmz files, DFFE screening reports and other relevant background documentation provided by the CSIR.

- A desktop review of (a) 1:50 000 scale topographic maps (3024AB Jakkalskuil, 3024AD Philipstown) and the 1:250 000 scale topographic map (sheet 3024 Colesberg), (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including 1:250 000 geological maps (sheet 3024 Colesberg) and relevant sheet explanation (Le Roux 1993), as well as (d) several previous desktop and field-based fossil heritage (PIA) assessments in the De Aar – Kimberley region by the author (See References under Almond).

- A two day field survey of representative rock exposures within the broader PV and associated infrastructure project study area by the author on 22 and 23 April 2022.

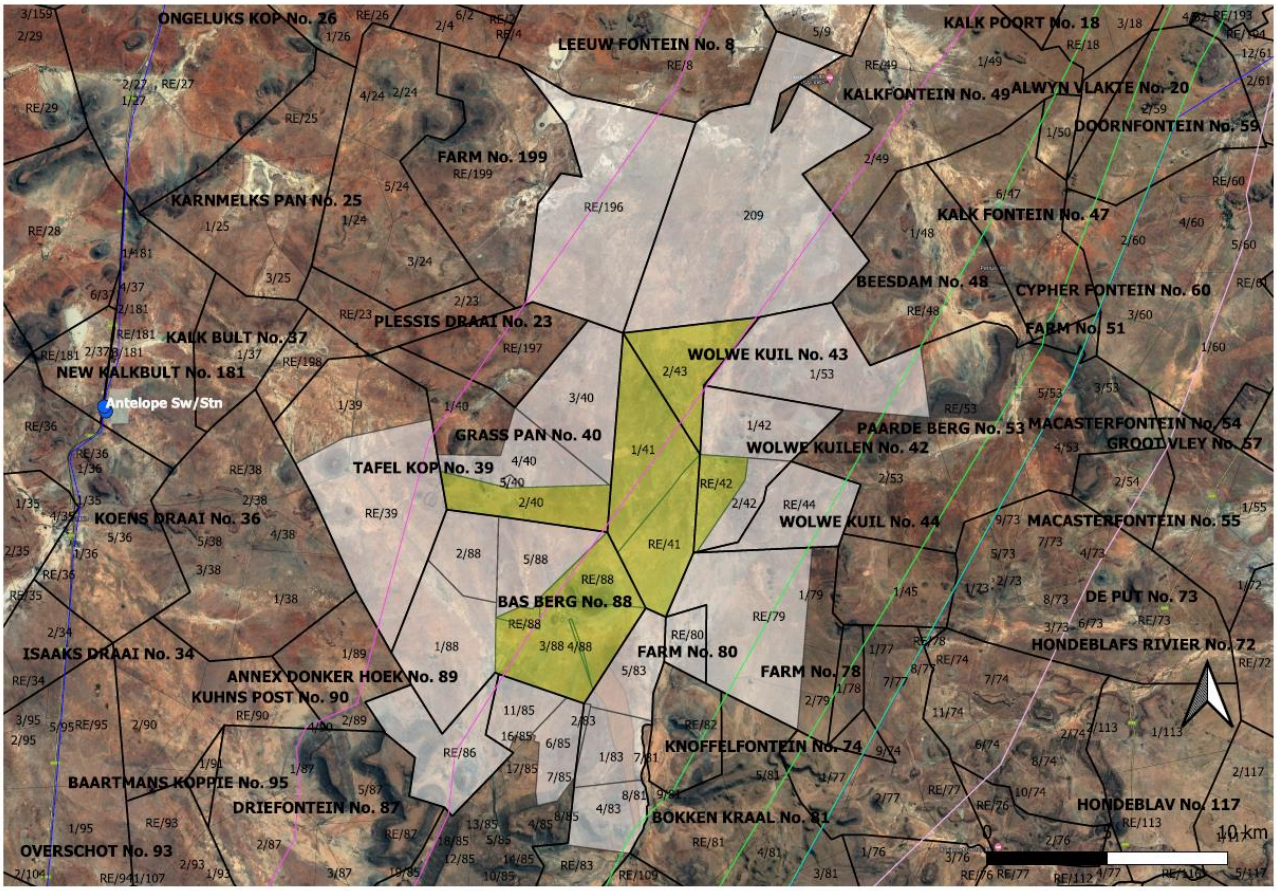


**Figure 3: Overlay on satellite image showing the component land parcels concerned with the Kudu solar renewable energy project near De Aar (Image provided by the CSIR).**

## 3. STATEMENT ON THE STUDY AREA

The study area for all the proposed Kudu Solar Facilities is the full extent of the eight affected farm properties[3] on which the proposed PV Facilities will be constructed (Figure 3), and the EGI Corridor. The full extent of these properties and the EGI Corridor has been assessed in this study in order to identify environmental sensitivities and no-go areas. The total **study area** for all the Kudu Solar Facilities is approximately 8 150 hectares (ha), as well as the EGI corridor.

At the commencement of this Scoping and EIA Process, Original Scoping Buildable Areas were identified by the Project Developer following the completion of high-level environmental screening based on the Screening Tool.

Following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the Revised Scoping Buildable Areas. The Revised Scoping Buildable Areas were

[3] These farm properties are Remaining Extent of the Farm Bas Berg No. 88 (C05700000000008800000); Remaining Extent of Portion 3 of the Farm Bas Berg No. 88 (C05700000000008800003); Portion 4 (Portion of Portion 3) of the Farm Bas Berg No. 88 (C05700000000008800004); Remaining Extent of Portion 2 (Middel Plaats) (a Portion of Portion 1) of the Farm Grasspan No. 40 (C05700000000004000002); Remaining Extent of the Farm Annex Wolve Kuil No. 41 (C05700000000004100000); Portion 1 (Wolve Kuil West) of the Farm Annex Wolve Kuil No. 41 (C05700000000004100001); Portion 2 of the Farm Wolve Kuil No. 43 (C05700000000004300002); and Remaining Extent of the Farm Wolve Kuilen No. 42 (C05700000000004200000). Note that the farm names are extracted from the title deeds, and that all reference to these farm portions throughout this report refer to it as such.

used to inform the design of the layout and were further assessed during this EIA Phase in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The development footprint is where the actual development will be located, e.g. the footprint containing the PV solar arrays and associated infrastructure.

The development footprints or detailed layouts are considered suitable from a palaeontological perspective. Changes to the detailed layouts are deemed acceptable if the changes remain within the approved development footprint and area assessed in the EIA (with avoidance of no-go areas identified by relevant specialists).

## 4. GEOLOGICAL CONTEXT

The project study area for the proposed Kudu Solar Facilities and associated infrastructure (including EGI) is situated in low-relief, semi-arid, karroid to grassy terrain some 40 km SW of the Gariep River in the Northern Cape Province (Figs. 1, 2, 4 to 6). The towns of Philipstown and De Aar lie some 30 km to the SE and 60 km to the SSW respectively. The project study area lies just to the north of a range of low, dolerite-capped hills (*e.g.* Swartkoppies / Tierberg / Perdekop) and includes the small isolated *koppie* Basberg (1466 m amsl). The landscape slopes very broadly towards the north, from around 1370 down to 1250 m amsl. Drainage in this largely flat-lying region is ill-defined, comprising several N-flowing, shallow, intermittently-flowing water courses (unnamed), such as that running through Wolwekuil towards Jakkalskuil, and small pans (larger named pans such as Grasspan and Karringmelkpan lie shortly outside the project study area). Apart from dolerite-capped *koppies* and ridges as well as occasional borrow pits, bedrock exposure within the project area is very limited indeed due to pervasive cover by calcrete, alluvium and soils as well as dense grassy vegetation and *bossieveld*.

**Figure 4: View from a dolerite-capped *koppie* just east of Wolwekuil farmstead (seen in middle ground on Wolwe Kuilen RE/42), looking south-westwards across the Kudu solar project area with the isolated *koppie* Basberg in the distance. The project area consists largely of low-relief, grassy terrain with almost no bedrock exposure.**

**Figure 5: Flat terrain with dense grassy vegetation and no bedrock exposure, typical of large portions of the Kudu solar project area, seen here on Annex Wolwe Kuil RE/41 with Basberg in the background.**

**Figure 6: Open patch within grassy vegetation exposing orange-brown sandy soils and sparse scatter of fine surface gravels (mainly calcrete, hornfels and dolerite clasts), looking due south towards Basberg, on Farm Grass Pan 2/40. These open areas were searched for reworked blocks of petrified wood.**

The geology of the Kudu solar and EGI project area is outlined on 1: 250 000 geology sheet 3024 Colesberg (Council for Geoscience, Pretoria) with a short accompanying sheet explanation by Le Roux (1993) (Fig. 7). The majority of the area is underlain at depth by non-marine basinal mudrocks of the **Tierberg Formation** (**Ecca Group**, **Karoo Supergroup**) of Early to Middle Permian age whose type section has been designated on hillslopes on the farm Swart Koppies 86, just south of the present study area (Viljoen 2005).

The Tierberg Formation *sensu stricto* is a recessive-weathering, mudrock-dominated succession consisting predominantly of dark, well-laminated, carbonaceous shales with subordinate thin, fine-grained sandstones (Visser *et al.* 1977, Prinsloo 1989, Zawada 1992, Bosch 1993, Le Roux 1993, Viljoen 2005, Johnson *et al*., 2006). The Tierberg shales are Early to Middle Permian in age and were deposited in a range of offshore, quiet water environments below wave base. These include basin plain, distal turbidite fan and distal prodelta settings in ascending order (Viljoen 2005, Almond 2008a). Thin, coarsening-upwards cycles occur towards the top of the formation with local evidence of soft-sediment deformation, ripples and common calcareous concretions (often rusty-brown with well-developed cone-in-cone structures). A restricted, brackish water environment is reconstructed for the Ecca Basin at this time. Close to the contact with Karoo dolerite intrusions the Tierberg mudrocks are baked to a dark grey hornfels which typically develops an orange to reddish-brown surface weathering crust or patina (Prinsloo 1989).

These Ecca sedimentary bedrocks are currently only mapped at surface on the slopes of Basberg (Pt, pale brown in Fig. 7) as well as the *koppies* just east of Wolwekuil farmstead on Farm 42/RE where they crop out intermittently as low cliffs of metasediments which have been thermally metamorphosed by dolerite intrusion Figs. 8 to 10). More recent mapping along the Ecca – Beaufort Group contact in the northern sector of the Main Karoo Basin suggests that the prominent-weathering packages of wackes seen at higher elevations on hillslopes here, and which were originally included within the upper Tierberg Formation (*e.g.* Viljoen 2005), should be referred rather to the deltaic **Waterford Formation** (*cf* Groenewald *et al.* 2022). These delta front and platform sediments build the uppermost part of the Ecca Group succession and are conformably overlain by continental sediments of the **Adelaide Subgroup** (undifferentiated) in the De Aar region (cf Almond 2012a). Since neither the Waterford Formation nor Adelaide Subgroup bedrocks will be directly or indirectly impacted by the proposed Kudu renewable energy developments, they will not be discussed further here.

Well-developed sills and dykes of the Early Jurassic **Karoo Dolerite Suite** build and / or cap all the *koppies* within and on the margins of the Kudu project area (including Basberg) and also underlie some lower-lying areas (Figs. 15 to 18). Rubbly **colluvial deposits** of dolerite blocks and corestones mantle steeper hillslopes and obscure most underlying sedimentary bedrocks. Weathering of calcium-rich dolerite under semi-arid climates – probably in Pleistocene times for the most part - has contributed to the development of a pervasive, thick (up to 1 to 2 m or more) hardpan of cream-coloured **pedogenic calcrete** across most of the project area (Qc, yellow in Fig. 7). This hardpan is usually obscured by soil, alluvium and vegetation but is well exposed in occasional borrow pits inside and just outside the project area where extensive veining and disruption of weathered Ecca bedrocks by calcrete veins can also be seen (Figs. 12, 23 to 25). These pedogenic limestone deposits reflect seasonally arid climates in the region over the last five or so million years and are briefly described for the Britstown sheet area by Le Roux (1993). Although calcrete is still forming in the study area today, it forms subsurface and when exposed at the surface is “almost definitely fossil” (Botha 1988). The older, Pliocene - Pleistocene calcretes in the broader Kalahari region, including sandy limestones and calcretised conglomerates, have been assigned to the **Mokalanen Formation** of the **Kalahari Group** and are possibly related to a globally arid time period between 2.8 and 2.6 million years ago, *i.e.* late Pliocene (Partridge *et al.* 2006). Key review papers on South African calcretes are those by Netterberg (1969a-b, 1978, 1980, 1985, among other works). Calcrete types commonly encountered in the Northern Cape study area include glaebular calcrete (with discrete nodules), honeycomb calcrete (with coalescent glaebules) and hardpan calcrete (solid limestone within at most minor voids). The surface limestones may reach thicknesses of over 10m, but are often much thinner, and are locally conglomeratic with clasts of reworked calcrete as well as exotic pebbles.

Thick deposits of orange-brown, **sandy to sparsely gravelly older alluvium** of probable late Caenozoic age (perhaps Pleistocene or older) are associated with major drainage lines, such as that running just east of the EGI corridor (Figs. 19 to 22). Roadside borrow pit exposures of these sandy to gritty sediments on farm Koppy Alleen 83 show that they are semi- to well-consolidated and extensively calcretised (3D polygonal networks of calcrete veins, intermittent thin hardpans). The upper part of the succession includes calcretised gravel lenses incorporating flaked hornfels artefacts showing that at least these upper layers are of Pleistocene age or younger. Other Late Caenozoic superficial deposits encountered within the Kudu project area include eluvial (downwasted / sheetwashed) surface gravels – mainly composed of hornfels, dolerite, siltstone flakes and calcrete rubble with some grey-green wacke – as well as thick silty to sandy soils (Figs. 6, 26 to 29). Middle Stone Age (MSA) artefacts of patinated hornfels are common within the unconsolidated younger soils and are often concentrated along the interface with the underlying calcrete hardpan. Some of the orange-hued unconsolidated or partially calcretised surface sands within the project area might be relict patches of aeolian sands of the **Gordonia Formation** (**Kalahari Group**) of Pleistocene or younger age (*cf* Almond 2013b). Pale rounded features up to several decameters in diameter seen in flat-lying areas on satellite images are characterised by thick sandy soils with calcrete glaebules which are often extensively burrowed by modern mammals.

Representative exposures of the various rock units seen within or on the margins of the project area are illustrated below in Figures 8 to 29 with explanatory figure legends.

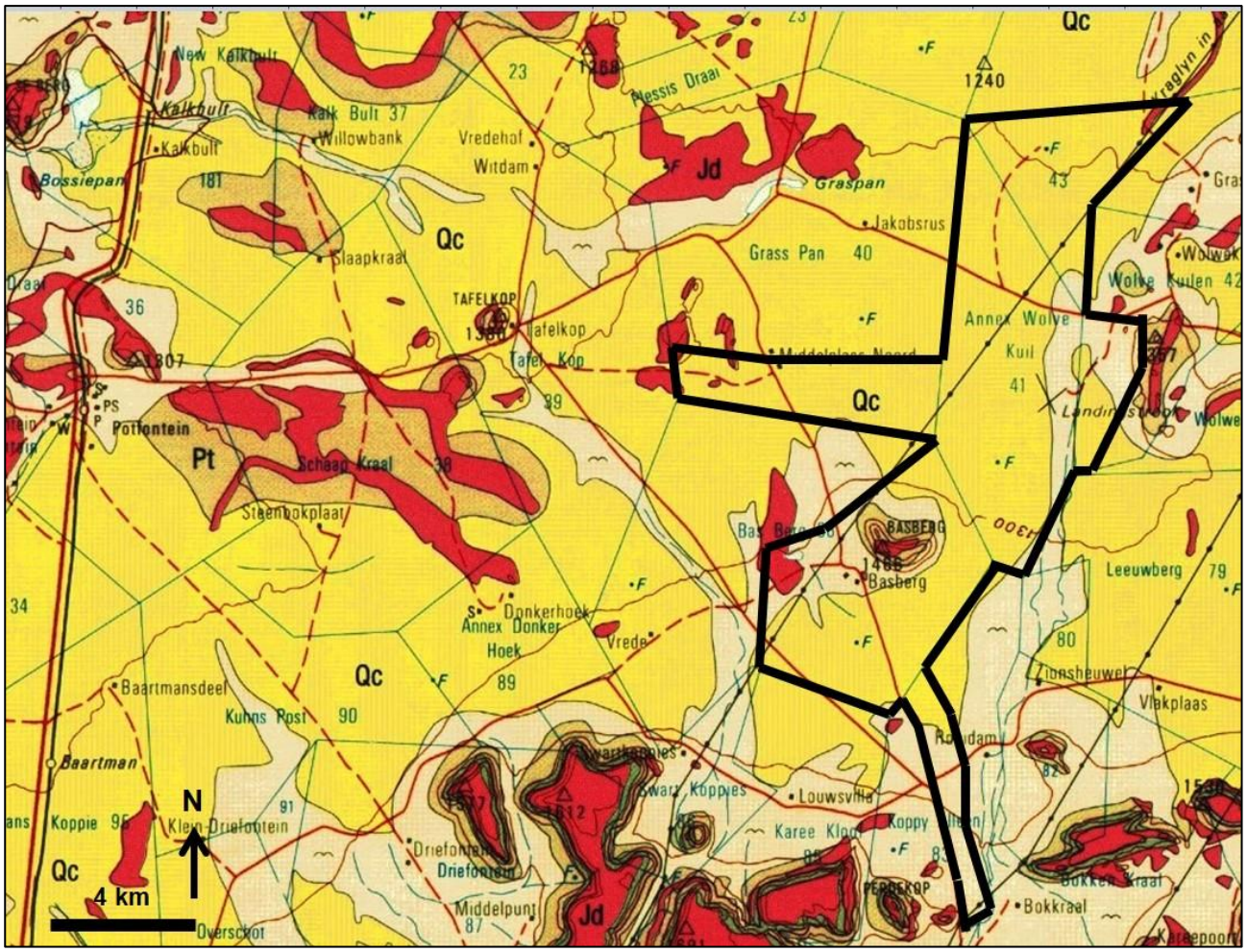


**Figure 7: Extract from 1: 250 000 geology map 3024 Colesberg (Council for Geoscience, Pretoria) showing the project study area for the proposed Kudu solar facilities and associated infrastructure (including EGI corridor) near Philipstown and De Aar, Pixley Ka Seme District, Northern Cape (black polygon).**
**The main geological units mapped within the wider study region include:**
**Tierberg Formation (Ecca Group, Karoo Supergroup) – Pt (pale brown) (*N.B.* the upper part of this succession is now referred to the Waterford Formation)**
**Adelaide Subgroup – Pa (pale green) (*outside* Kudu project area)**
**Karoo Dolerite Suite – Jd (red)**
**Quaternary calcrete hardpans – Qc (yellow)**
**Late Caenozoic alluvium – off white (flying –bird symbol)**
**Unmapped Late Caenozoic superficial sediments include colluvium, eluvial surface gravels and soils (including possible relict aeolian sands of the Gordonia Formation, Kalahari Group).**


**Figure 8: Upper north-eastern slopes of the isolated *koppie* Basberg on Farm Bas Berg RE/88 showing baked Ecca metasediments (EC, probably Waterford Formation) sandwiched between sills of dolerite (Jd). See following figure for more detail.**

**Figure 9: Close-up of brownish-weathering, bedded wackes of the Ecca Group on Basberg seen in the previous illustration. These beds are mapped as basinal Tierberg Formation but probably belong to the overlying deltaic Waterford Formation (uppermost Ecca Group). They will not be directly impacted by the proposed Kudu renewable energy projects.**

**Figure 10: Thin bedded, baked shales and / or wackes of the Tierberg Formation exposed among doleritic colluvium on the higher southern slopes of the *koppie* just east of Wolwekuil homestead on Farm Wolwe Kuilen RE/42 (Image kindly provided by Dr Jayson Orton, ASHA Consulting).**

**Figure 11: View westwards towards *koppie* on Zionsheuwel 82 (just east of and outside EGI corridor) showing laterally-persistent *kranz* of prominent-weathering Waterford Formation wackes on middle slopes as well as dolerite sill capping. The low-lying EGI corridor project area in the foreground is underlain by the Tierberg Formation but the recessive-weathering bedrocks are not exposed here.**

**Figure 12: Dark grey, weathered, crumbly Tierberg Formation mudrocks with extensive secondary calcrete veination (probably Quaternary age) exposed in roadside borrow pit excavation on Farm Wolwe Kuilen 1/42, just north of Wolwekuil farmstead on Farm Wolwe Kuilen RE/42.**

**Figure 13: Rusty-brown weathering large carbonate concretion weathered out at surface from the Tierberg Formation on Bas Berg 3/88 (scale in cm and mm). Such diagenetic concretions might contain fossil palynomorphs (spores *etc*) or microvertebrate remains.**

**Figure 14: Isolated downwasted block of greyish, baked wacke of the Tierberg Formation among doleritic rubble, Wolwe Kuilen RE/42 (hammer = 30 cm).**

**Figure 15: Apron of orange-patinated hornfels gravels on the margins of the dolerite-capped *koppie* on Wolwe Kuilen RE/42. The hornfels forms an important raw material for Stone Age artefacts in the region.**

**Figure 16: Dolerite sill showing well-developed columnar jointing capping Tafelkop, *c*. 4.5 km west of and outside the Kudu solar project area (Tafel Kop 39).**

**Figure 17: Ecca Group bedrocks on hillslopes below dolerite sills are typically very poorly exposed due to cover by rubbly doleritic colluvium, soils and vegetation, as seen here on Wolwe Kuilen RE/42.**

**Figure 18: Shallow stream exposure of a pervasive subsurface calcrete hardpan covered by orange-brown sandy soils of alluvial and / or aeolian provenance, EGI corridor on Koppy Alleen 83.**

**Figure 19: Large roadside borrow pit on Koppy Alleen 1/83 excavated into calcretised sandy alluvial deposits such as those represented beneath large portions of the EGI corridor and related to the long-established drainage line just to the east of the corridor.**

**Figure 20: 3D polygonal network of calcrete veins and calcrete hardpans within orange-brown, gritty to sandy alluvium exposed in the borrow pit shown in the previous illustration (hammer = 30 cm).**

**Figure 21: Lens of calcretised fine gravels within the consolidated alluvium shown in the previous two figures (scale in cm). The incorporated gravel clasts include several flaked hornfels artefacts showing that the deposits are Pleistocene or younger in age.**

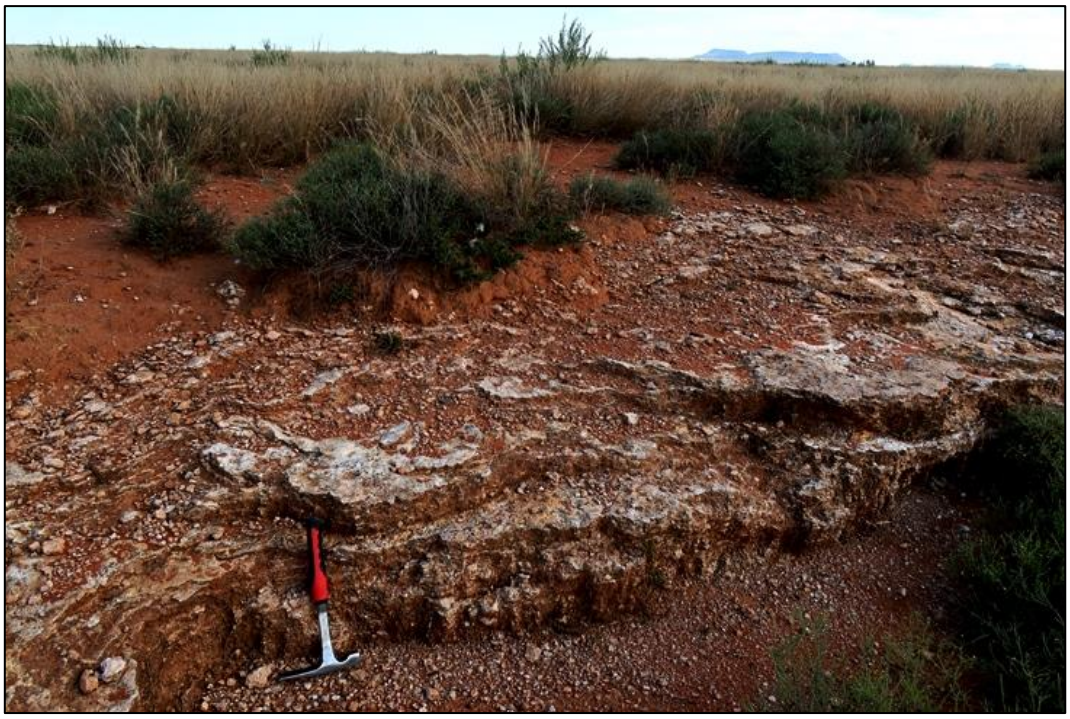

**Figure 22: Heavily calcretised, orange-brown cover sands overlying weathered Tierberg Formation bedrocks on the margins of a borrow pit on Farm Wolwe Kuilen 1/42, just north of Wolwekuil farmstead on Farm Wolwe Kuilen RE/42 (See Figure 12) (hammer = 30 cm).**

**Figure 23: Good borrow pit exposure of the pervasive, thick calcrete hardpan overlying most of the low-lying terrain within the Kudu renewable energy project area, seen here on farm RE/197, outside and *c*. 4.7 km west of the project area itself.**

**Figure 24: Sporadic exposure of a near-surface calcrete hardpan and overlying rubbly calcrete gravels as well as hornfels clasts on Annex Wolwe Kuil 1/41.**

**Figure 25: Good exposure of dark-grey, weathered, friable Tierberg Formation mudrocks showing extensive near-surface disruption and veining by Quaternary calcrete veins, seen here in an elongate roadside borrow pit on farm Grass Pan 1/40, *c*. 6.5 km west of and outside the Kudu renewable energy project area.**

**Figure 26: Occasional greyish areas on satellite images of the project area prove, on the ground, to represent weathered siltstone bedrocks of the Tierberg Formation with downwasted surface gravels of flaky mudrock, hornfels and dolerite (seen here on Portion 0 (RE) of Farm Wolve Kuilen 42). Well-preserved fossils are unlikely in this context.**

**Figure 27: Close-up of weathered, fissile, greyish Tierberg Formation siltstones and surface gravels shown in the previous image (hammer = 30 cm).**

**Figure 28: Eluvial, sheetwashed surface gravels of dolerite, hornfels and wacke overlying sandy soils on the southern side of Basberg (Bas Berg 3/88). Reworked blocks of silicified wood from the Waterford Formation *might* occur in such contexts but none were recorded here.**

**Figure 29: Patches of thick, orange-brown sands with dispersed calcrete rubble are often intensely burrowed by modern mammals, as seen here on Annex Wolwe Kuil 1/41. They appear as pale rounded features on satellite images and probably have a biological basis (*cf heuweltjies*). The sands themselves might originally have had an aeolian provenance.**

# 5. PALAEONTOLOGICAL HERITAGE

Potential and recorded fossils within the various rock units mapped within the Kudu solar PV project and grid connection project areas have already been reviewed in some detail in several previous PIA reports for the De Aar – Kimberley region by the author (See References). Since the Waterford Formation (Ecca Group) and Adelaide Subgroup beds in the region will not be impacted by the proposed developments, they are not treated further here.

The fossil record of the **Tierberg Formation** has been reviewed in detail by Almond (2008a). Rare body fossil records include disarticulated microvertebrates (*e.g.* fish teeth and scales) from calcareous concretions in the Koffiefontein sheet area (Zawada 1992) and allochthonous plant remains (drifted leaves, petrified wood). The latter become more abundant in the upper, more proximal (prodeltaic) facies of the Tierberg (*e.g.* Wickens 1984). Prinsloo (1989) records numerous plant impressions and unspecified "fragmentary vertebrate fossils" (possibly temnospondyl amphibians) within fine-grained sandstones in the Britstown sheet area. Dark carbonaceous Ecca mudrocks are likely to contain palynomorphs (*e.g.* pollens, spores, acritarchs). Bosch (1993) and Visser *et al.* (1977) briefly mention body fossils within the Tierberg mudrocks in the broader Kimberley region. Concretions within the lower part of the formation may contain fish scales, coprolites and sponge spicules. Records of abundant silicified wood within the upper Tierberg succession are now referred to the Waterford Formation (see below).

The commonest fossils by far in the Tierberg Formation are sparse to locally concentrated assemblages of trace fossils that are often found in association with thin event beds (*e.g.* distal turbidites, prodeltaic sandstones) within more heterolithic successions. A modest range of ten or so different ichnogenera have been recorded from the Tierberg Formation (*e.g.* Abel 1935, Anderson 1974, 1976, Wickens 1980, 1984, 1994, 1996, Prinsloo 1989, De Beer *et al*., 2002, Viljoen 2005, Almond 2008a). These are mainly bedding parallel, epichnial and hypichnial traces, some preserved as undertracks. Penetrative, steep to subvertical burrows are rare, perhaps because the bottom sediments immediately beneath the sediment / water interface were anoxic. Most Tierberg ichnoassemblages display a low diversity and low to moderate density of traces. Apart from simple back-filled and / or lined horizontal burrows (*Planolites, Palaeophycus*) they include arthropod trackways (*Umfolozia*) and associated resting impressions (*Gluckstadtella*), undulose fish swimming trails (*Undichna*) that may have been generated by bottom-feeding palaeoniscoids, horizontal epichnial furrows (so-called *Scolicia*) often attributed to gastropods (these are also common in the co-eval Collingham Formation; Viljoen 1992, 1994), arcuate, finely-striated feeding excavations of an unknown arthropod (*Vadoscavichnia*), beaded traces ("*Hormosiroidea*" or "*Neonereites*"), small sinusoidal surface traces (*Cochlichnus*), small star-shaped feeding burrows (*Stelloglyphus*) and zigzag horizontal burrows (*Beloraphe*), as well as possible narrow (<1cm) *Cruziana* scratch burrows. The symmetrical, four-pronged trace *Broomichnium* (= *Quadrispinichna* of Anderson, 1974 and later authors) often occurs in groups of identical size (*c*. 3.5cm wide) and similar orientation on the bedding plane. This trace has frequently been misinterpreted as a web-footed tetrapod or arthropod trackway (*e.g.* Van Dijk *et al*. 2002 and references therein). However, Braddy and Briggs (2002) present a convincing case that this is actually a current-orientated arthropod resting trace (cubichnion), probably made by small crustaceans that lived in schools of similar-sized individuals and orientated themselves on the seabed with respect to prevailing bottom currents. Distinctive broad (3-4cm), strap-shaped, horizontal burrows with blunt ends and a more-or-less pronounced transverse ribbing occur widely within the Tierberg mudrocks. They have been described as "fucoid structures" by earlier workers (*e.g.* Ryan 1967) by analogy with seaweeds, and erroneously assigned to the ichnogenera *Plagiogmus* by Anderson (1974) and *Lophoctenium* by Wickens (1980, 1984). Examples up to one metre long were found in Tierberg mudrocks near Calvinia in 1803 by H. Lichtenstein, who described them as "eel fish". These are among the first historical records of fossils in South Africa (MacRae 1999). These as yet unnamed burrows are infilled with organized arrays of faecal pellets (Werner 2006). Sandstone sole surfaces with casts of complex networks of anastomosing (branching and fusing) tubular burrows have been attributed to the ichnogenus *Palaeodictyon*

(Prinsloo 1989) but may more appropriately assigned to *Megagrapton* (Almond 1998). These so-called graphoglyptid burrows are associated with turbidite facies from the Ordovician to Recent times and have been interpreted as gardening burrows or *agrichnia* (Seilacher, 2007). Microbial mat textures, such as *Kinneyia*, also occur in these offshore mudrocks but, like the delicate grazing traces with which they are often associated, are generally under-recorded.

The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks (including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008a, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al*., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes of the **Mokolanen Formation** might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings such as pans; Partridge & Scott 2000) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient, Plio-Pleistocene alluvial gravels.

No High Palaeosensitivity fossil sites of scientific or conservation value were identified within the Kudu renewable energy project area during the palaeontological two-day site visit.

The only fossil material recorded from bedrock exposures here comprises low diversity trace fossil assemblages within fossil mudrocks of the Tierberg Formation excavated from a deep, steep-sided trench on farm Bas Berg RE 88 (30.245804° S, 24.315688° E) (Fig. 30 and Appendix 3, Fig. A3.1). The traces comprise poorly-preserved, simple to possibly branching horizontal burrows of *c*. 5 to 10 mm diameter which appear variously darker or paler than the surrounding speckled, grey-green siltstone matrix. Siltstone float blocks encountered among surface gravels sometimes contain broadly comparable simple horizontal burrows (*e.g.* south of Basberg on Bas Berg 3/88; 30.241383° S, 24.327129° E) (Fig. 31 and Appendix 3 Figure A3.1). These ichnoassemblages are of very widespread occurrence within the Tierberg Formation outcrop area and are not of significant scientific or conservation interest.

No fossils at all were recorded from the various Late Caenozoic superficial deposits within the Kudu renewable energy project area during the site visit. The potential for rare, largely unpredictable fossil sites of High palaeosensitivity associated with older alluvial and pan deposits in the subsurface cannot be entirely discounted (*e.g.* local concentrations of mammalian teeth, horncores and bones, non-marine molluscs, calcretised termitaria). Reworked blocks of silicified wood are likely to occur within surface gravels in the region but none were identified during the recent site visit.

**Figure 30: Excavated block of speckled, grey-green Tierberg Formation siltstone containing vague, pale horizontal burrows (scale in cm and half-cm), farm Bas Berg RE 88 (30.245804° S, 24.315688° E). See Loc. 583 on satellite maps in Appendix 3.**


**Figure 31: Simple horizontal burrows preserved in dark material contrasting with the pale yellowish-grey matrix which is probably of baked Tierberg Formation mudrock, float block on farm Bas Berg 3/88 (30.241383° S, 24.327129° E) (scale in cm and mm). See Loc. 586 on satellite maps in Appendix 3.**

## 6. SITE SENSITIVITY VERIFICATION

Provisional site sensitivity mapping for palaeontological heritage prepared by the CSIR using the DFFE National Web-Based Environmental Screening Tool suggests that the Kudu solar facility project area as well as the associated grid connection corridors are largely of Medium to High palaeosensitivity, with scattered small areas of zero or negligible sensitivity reflecting intrusions of Karoo dolerite (Fig. 32).

Based on several previous desktop and field-based PIA studies by the author in the broader De Aar region (listed in References) as well as the recent 2-day palaeontological site, it is concluded that the Kudu solar facility and grid connection project areas are in fact of **Low to Very Low palaeosensitivity overall**, although the potential for rare, largely unpredictable fossil sites of High palaeosensitivity associated with older alluvial and pan deposits in the subsurface cannot be entirely discounted. The DFFE-based palaeosensitivity mapping is accordingly *contested* here.

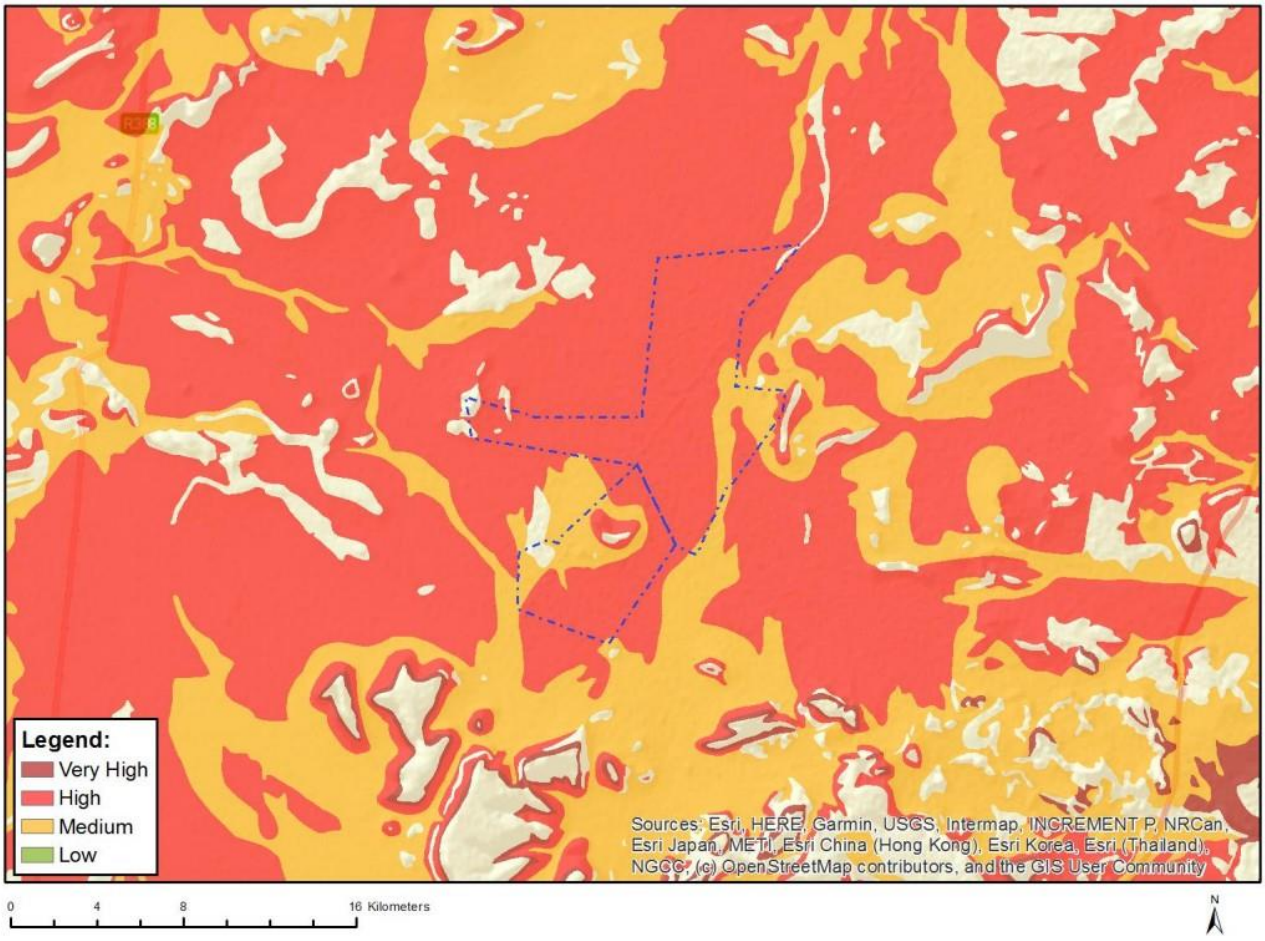


**Figure 32: Palaeontological sensitivity map for the Kudu solar facility project area near De Aar, Northern Cape (blue dotted polygon), abstracted from the DFFE Screening Report prepared by the CSIR (February 2022[4]). The outcrop area of the Tierberg Formation is assigned a High palaeosensitivity, Late Caenozoic alluvium a Medium sensitivity while Karoo dolerite intrusions are designated as insensitive, according to the Screening Tool. This sensitivity mapping is *contested* in this report which concludes the entire Kudu project study area (including EGI corridor in the southeast) is of Low to Very Low palaeosensitivity overall.**

[4] Screening Tool Reports generated in December 2022 and May 2023 do not result in any changes to the sensitivities depicted in this report.

# 7. CONCLUSIONS

The Kudu solar facility and grid connection project area near De Aar, Northern Cape, largely comprises low-relief terrain mantled with thick Late Caenozioic calcrete hardpans, alluvial deposits, surface gravels and soils that are generally of low palaeosensitivity. Natural bedrock exposure here is very limited and mainly involves unfossiliferous dolerite as well as baked Ecca Group metasediments (probable Waterford Formation) building *kranzes* on upper hillslopes (*e.g.* Basberg) that will not be directly impacted by the proposed development. Early to Middle Permian basinal mudrocks of the Tierberg Formation (Ecca Group, Karoo Supergroup) which are mapped as underlying the majority of the project area are hardly ever exposed and, where seen (*e.g.* in borrow pits), they are generally weathered, friable and extensively disrupted by near-surface calcrete veins. The offshore mudrocks of the Tierberg Formation are not known elsewhere to have a rich fossil record (mainly low-diversity trace fossil assemblages, petrified wood, palynomorphs and rare microvertebrate remains such as fish scales and teeth). In the present project area the potential for well-preserved fossils is further reduced by near-surface weathering, calcrete veining as well as baking of sedimentary bedrocks by intensive regional dolerite intrusion in Early Jurassic times. The only fossils recorded from the Ecca Group sediments during the 2-day palaeontological site visit comprise sparse, low diversity trace fossil assemblages of low scientific or conservation interest. Thick sandy to gravelly alluvial deposits associated with long-established drainage lines are extensively calcretised. No fossil remains were recorded within them.

According to the DFFE screening tool mapping, the majority of the Kudu solar PV facility and associated grid connection corridor is of Medium to High palaeosensitivity. This provisional assessment is *contested* in the present Site Sensitivity Verification Report, based on a 2-day palaeontological site visit and several previous field-based and desktop PIA studies in the broader De Aar - Kimberley region. It is concluded that the Kudu solar PV and grid connection project areas are in fact of LOW to VERY LOW palaeosensitivity in general. However, the potential for rare, largely unpredictable fossil sites (*e.g.* mammalian bones, teeth, horncores, non-marine molluscs, calcretised termitaria) of High palaeosensitivity associated with older alluvial and pan deposits hidden in the subsurface cannot be discounted. Most such fossil sites would probably be protected during construction by environmental buffer zones along drainage lines.

If any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol outlined in Appendix 2 to this report should be fully implemented. These recommendations should be included within the Environmental Management Programmes (EMPrs) for the Kudu Solar PV Facilities and associated infrastructure developments.

All of the various sites for solar PV facilities, on-site substations, grid connection corridors and associated infrastructure currently under consideration are of LOW to VERY LOW palaeosensitivity. The only two fossil sites recorded in the region fall *outside* the PV project areas (Appendix 3) and are of low scientific / conservation interest so no mitigation is recommended with regard to them. Provided that the Chance Fossil Finds Protocol tabulated in Appendix 2 is incorporated into the EMPrs and fully implemented during the construction phase of the solar PV facility and grid connection developments, there are no objections on palaeontological heritage grounds to authorisation of the proposed renewable energy developments. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, reporting, monitoring or mitigation are recommended for these renewable energy projects.

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## APPENDIX 1: John Almond Short CV

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and the University of Tübingen in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

**Declaration of Independence (See overleaf)**

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was 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 my performing such work.

**Dr John E. Almond**
**Palaeontologist**
***Natura Viva* cc**

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

**Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Natura Viva cc | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | 4 | Percentage Procurement recognition | 100 |
| Specialist name: | Dr John Edward Almond | | | |
| Specialist Qualifications: | PhD (Palaeontology) University of Cambridge, UK | | | |
| Professional affiliation/registration: | Palaeontological Society of Southern Africa<br>Association of Professional Heritage Practitioners (Western Cape) | | | |
| Physical address: | 76 Breda Park, Breda Street, Oranjezicht, CAPE TOWN | | | |
| Postal address: | As above | | | |
| Postal code: | 8001 | Cell: | 071 947 0577 | |
| Telephone: | 021 462 3622 | Fax: | n/a | |
| E-mail: | naturaviva@universe.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, **Dr John Edward Almond**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

J. E. Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company:

3 July 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

**3. UNDERTAKING UNDER OATH/ AFFIRMATION**

I, **Dr John Edward Almond**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company

3 July 2023

Date

Signature of the Commissioner of Oaths

03 July 2023

Date

KERRY AUGUST
Commissioner of Oaths
Master HR Professional (MHRP)
Member Number: 53544596
25 Bordeaux Close
Stellenbosch
7600

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Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

## APPENDIX 2: Kudu Solar PV Facilities and Associated Infrastructure near De Aar

<table>
<tr><td>Province & region:</td><td colspan="2">Northern Cape: Pixley Ka Seme District</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za).</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Early to Middle Permian Tierberg and Waterford Formation (Ecca Group), Late Caenozoic calcrete hardpans, alluvium, aeolian sands, pan sediments, surface gravels (Kalahari Group)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Trace fossil assemblages, petrified wood, microvertebrate remains within Ecca Group sediments.<br>Potential for concentrations of mammalian fossil remains (bones, teeth, horncores), trace fossils, non-marine molluscs in association with calcrete hardpans.<br>Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material in Late Caenozoic alluvium and pan deposits.</td></tr>
<tr><td rowspan="5">Environmental Control Officer (ECO) protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:<ul><li>Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo</li><li>Context – describe position of fossils within stratigraphy (rock layering), depth below surface</li><li>Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</li></ul></td></tr>
<tr><td>3. If feasible to leave fossils in situ:<ul><li>Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</li><li>Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</li></ul></td><td>3. If not feasible to leave fossils in situ (emergency procedure only):<ul><li>Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)</li><li>Photograph fossils against a plain, level background, with scale</li><li>Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags</li><li>Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist</li><li>Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</li></ul></td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
</table>

## APPENDIX 3: Fossil Locality Data for Kudu Solar Photovoltaic Facilities

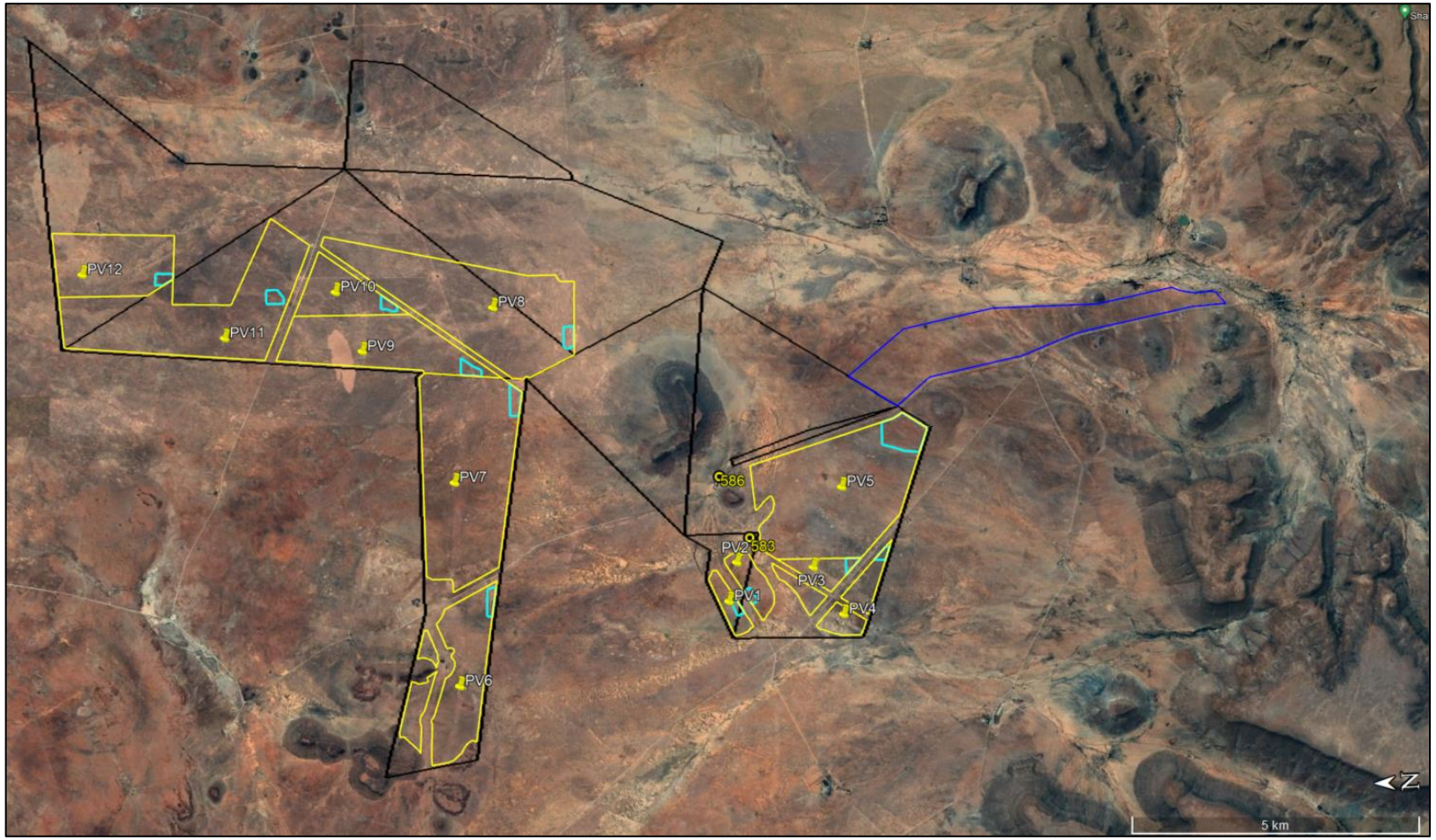


**Figure A3.1: Google Earth© satellite image showing the project area for the Kudu Solar Photovoltaic Facilities and associated infrastructure near Philipstown and De Aar, Northern Cape (black and blue polygons) as well as the buildable area/development footprint for each PV project (yellow polygon) and proposed on-site substation complex sites (small, pale blue polygons). The two recorded fossil sites are indicated by the numbered yellow circles (Please see following figure for more detail). *N.B.* North is towards the LHS.**

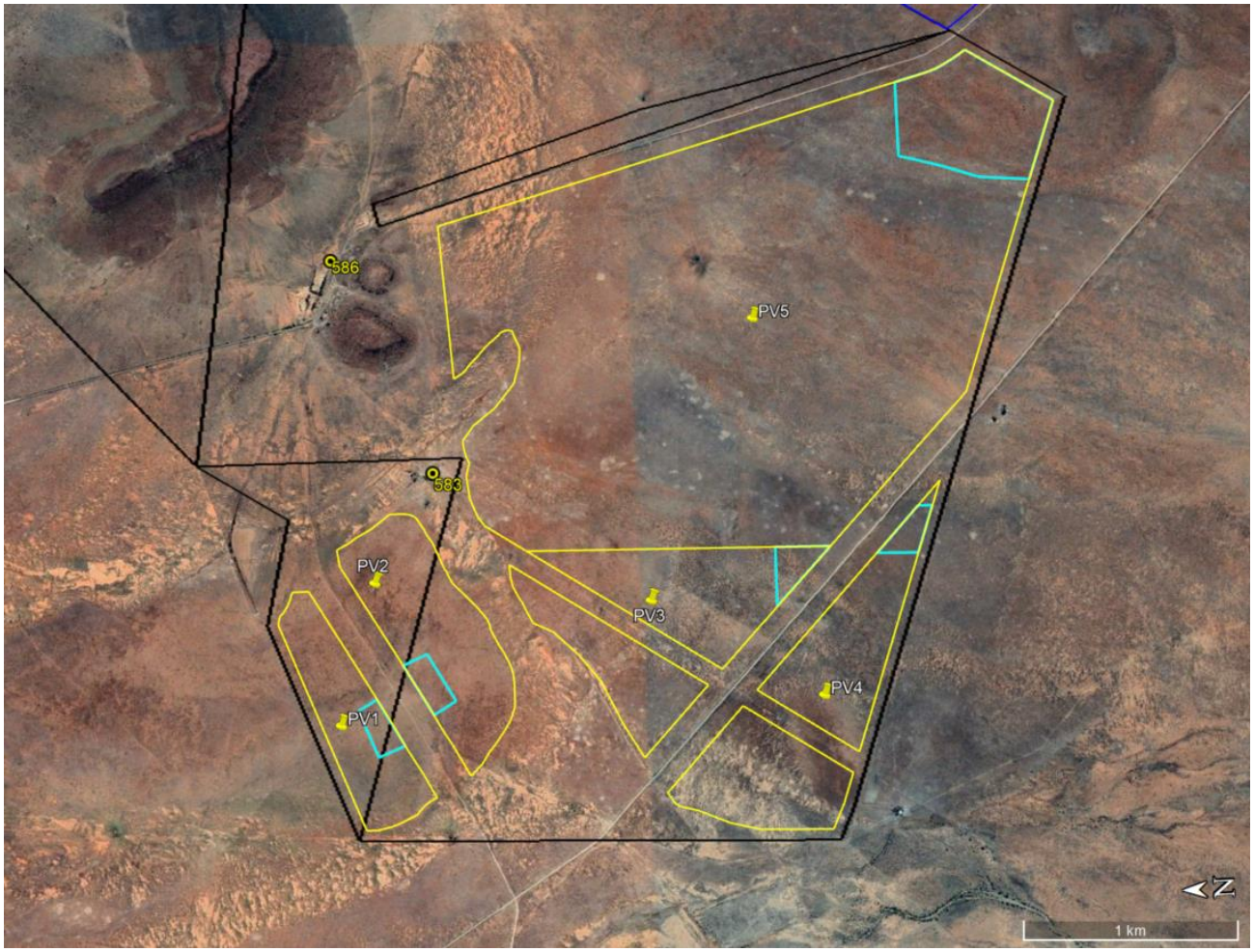


**Figure A3.2: Google Earth© satellite image showing the project area for the southern cluster of Kudu Solar Photovoltaic Facilities and associated infrastructure near Philipstown and De Aar, Northern Cape. The two recorded fossil sites indicated by the numbered yellow circles (583, 586) both fall *outside* the PV buildable areas/development footprints and are of low scientific / conservation value so no mitigation is proposed with regard to them. *N.B.* North is towards the LHS.**

**Table A3.1: Palaeontological heritage data for Kudu Solar Photovoltaic Facilities**

| Kudu Solar PV Facility project | Recorded fossil heritage | Recommended mitigation |
|---|---|---|
| **PV1** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV2** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV3** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV4** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV5** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV6** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV7** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV8** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV9** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV10** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV11** | None | Application of Chance Fossil Finds Protocol during Construction Phase |
| **PV12** | None | Application of Chance Fossil Finds Protocol during Construction Phase |

| **PALAEONTOLOGICAL SSV SITE VISIT APRIL 2022** | | |
|---|---|---|
| **LOC** | **GPS data** | **Comments** |
| **583** | **30.245804° S, 24.315688° E** | **Excavated block of speckled, grey-green Tierberg Formation siltstone containing vague, pale horizontal burrows (scale in cm and half-cm), farm Bas Berg RE 88. Provisional Field Rating IIIC Local Resource. Located *outside* PV project development area. No mitigation recommended.** |
| **586** | **30.241383° S, 24.327129° E** | **Simple horizontal burrows preserved in dark material contrasting with the pale yellowish-grey matrix which is probably of baked Tierberg Formation mudrock, float block on farm Bas Berg 3/88. Provisional Field Rating IIIC Local Resource. Located *outside* PV project development area. No mitigation recommended.** |

# CHAPTER 13:

# Socio-Economic Assessment

CSIR
Touching lives through innovation

# SOCIO-ECONOMIC ASSESSMENT

# KUDU PV 11 SOLAR ENERGY FACILITY

# NORTHERN CAPE PROVINCE

**VERSION 0: APRIL 2023**
**VERSION 1: JULY 2023**

**Prepared**

**By**

**Tony Barbour and Schalk van der Merwe**

***Tony Barbour***
***ENVIRONMENTAL CONSULTING***

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(E-Mail) tony@tonybarbour.co.za. www.tonybarbour.co.za

# EXECUTIVE SUMMARY

## INTRODUCTION AND LOCATION

The CSIR was appointed to manage the Environmental Impact Assessment (EIA) process for the proposed Kudu PV Solar Energy Facility (SEF) Cluster located approximately 60km north of the town of De Aar in the Northern Cape Province. The project site is situated within the Renosterberg Local Municipality (RLM), which is located within the Pixley Ka Seme District Municipality (PKSDM). The Kudu PV11 SEF forms part of a cluster consisting of 12 PV SEFs (PV1-PV12) with a combined generation capacity of 2 180 MW.

Tony Barbour was appointed to undertake a specialist Socio-economic Assessment as part of the EIA process. This report assesses the social impacts associated with the 330 MW Kudu PV 11 SEF.

## SUMMARY OF KEY FINDINGS

## KEY FINDINGS

The key findings of the study are summarised under the following sections:

- Fit with policy and planning.
- Construction phase impacts.
- Operational phase impacts.
- Cumulative impacts.
- Decommissioning phase impacts.
- No-development option.

## POLICY AND PLANNING ISSUES

The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The PKSDM Spatial Development Framework (SDF) and Integrated Development Plan (IDP) also support the development of renewable energy. The development of the proposed SEF is therefore supported by key policy and planning documents.

## CONSTRUCTION PHASE

### Potential positive impacts

- Creation of employment and business opportunities, and the opportunity for skills development and on-site training.

The construction phase is expected to extend over a period of 12 to 18 months and create approximately 300 employment opportunities. The total wage bill for the construction phase is estimated to be in the region of R 35 million (2023 Rand value). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area and the RLM and Emthanjeni Local Municipality (ELM).

Members from the local communities in De Aar, Phillipstown and Petrusville may potentially qualify for low skilled and semi-skilled and some skilled employment opportunities. Most of these employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills to local employment targets the benefits for members from the local communities may be limited. In addition, the low education and skills levels in the area may also hamper potential opportunities for local communities.

The capital expenditure associated with the construction phase will be approximately R 2.5-3 billion (2023 Rand value). This will create opportunities for local companies and the regional and local economy. Due the lack of diversification in the local economy the potential for local companies is likely to be limited. The majority of benefits are therefore likely to accrue to contractors and engineering companies based outside the RLM and ELM. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site.

**Potential negative impacts**

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of job seekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Noise, dust, and safety impacts of construction related activities and vehicles.
- Impact on productive farmland.

The findings of the SIA indicate that the significance of all the potential negative impacts with mitigation are likely to be **Low Negative**. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. Table 1 summarises the significance of the impacts associated with the construction phase.

**Table 1: Summary of social impacts during construction phase**

| Impact | Significance No Mitigation/Enhancement | Significance With Mitigation/Enhancement |
|---|---|---|
| **Creation of employment and business opportunities** | Medium (+) | Medium (+) |
| **Presence of construction workers and potential impacts on family structures and social networks** | Medium (-) | Low (-) |
| **Influx of job seekers** | Low (-) | Low (-) |
| **Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers** | Medium (-) | Low (-) |
| **Increased risk of grass fires** | Medium (-) | Low (-) |
| **Impact of heavy vehicles and construction activities** | Medium (-) | Low (-) |
| **Loss of farmland** | Medium (-) | Low (-) |

**OPERATIONAL PHASE**

**Potential positive impacts**
- Establishment of infrastructure to improve energy security and support renewable sector.
- Creation of employment opportunities.
- Benefits associated with socio-economic contributions to community development.
- Benefits for local landowners.

The proposed project will supplement South Africa's energy and assist to improve energy security. In addition, it will also reduce the country's reliance on coal as an energy source. This represents a positive social benefit.

**Potential negative impacts**
- Visual impacts and associated impacts on sense of place.
- Potential impact on property values.
- Potential impact on tourism.

The findings of the SIA indicate that the significance of all the potential negative impacts with the exception of visual impacts will be **Low Negative** with mitigation. The majority of potential negative impacts can therefore be effectively mitigated. The significance of the impacts associated with the operational phase are summarised in Table 2.

**Table 2: Summary of social impacts during operational phase**

| Impact | Significance No Mitigation/Enhancement | Significance With Mitigation/Enhancement |
|---|---|---|
| **Establishment of infrastructure to improve energy security and support renewable sector** | High (+) | High (+) |
| **Creation of employment and business opportunities during maintenance** | Low (+) | Medium (+) |
| **Benefits associated with socio-economic contributions to community development** | Medium (+) | High (+) |
| **Benefits for landowners** | Low (+) | High (+) |
| **Visual impact and impact on sense of place** | Low (-) | Low (-) |
| **Impact on property values** | Low (-) | Low (-) |
| **Impact on tourism** | Low (-) | Low (-) |

**CUMULATIVE IMPACTS**

***Cumulative impact on sense of place***
The establishment of the proposed PV SEF and other renewable energy facilities in the area will create the potential for combined and sequential visibility impacts. This impact is rated as **Medium Negative**.

***Cumulative impact on local services and accommodation***
The significance of this impact with effective mitigation was rated as **Low Negative**.

***Cumulative impact on local economy***
The significance of this impact with enhancement was rated as **Medium Positive**.

**DECOMMISSIONING**

Given the moderate number of people employed during the operational phase (~ 16), the potential negative social impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be **Low Negative**.

**NO-DEVELOPMENT OPTION**

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its

position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost. The No-Development option is not supported by the findings of the SIA.

**ASSESSMENT OF BESS SITE**

Based on the findings of the SIA the proposed BESS site and both proposed technology alternatives are suitable from a social impact assessment point of view.

**CONCLUSIONS AND RECOMMENDATIONS**

The findings of the SIA indicate that the proposed Kudu PV 11 SEF will result in several social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phases. The project will also create economic development opportunities for the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as **High Positive**. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

The findings also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be **Low Negative** with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented.

**Statement and reasoned opinion**
The establishment of the proposed Kudu PV 11 SEF and associated infrastructure is therefore supported by the findings of the SIA.

# TABLE OF CONTENTS

## CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

| **Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6** | **Section of Report** |
|---|---|
| (a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*; | Section 1.6, Annexure C |
| (b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Section 1.7, Annexure D |
| (c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1.1, Section 1.2 |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 1.2, Section 3 |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 4 |
| (d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; | N/A for SIA |
| (e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 1.2, Annexure B |
| (f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Section 4, Section 5 |
| (g) an identification of any areas to be avoided, including buffers; | N/A |
| (h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section 3 |
| (i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 1.5 |
| (j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities; | Section 4, Section 5, |
| (k) any mitigation measures for inclusion in the EMPr; | Section 4 |
| (l) any conditions for inclusion in the environmental authorisation; | Section 4, Section 5 |
| (m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | N/A |
| (n) a reasoned opinion—<br>i. as to whether the proposed activity, activities or portions thereof should be authorised;<br>iA. Regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan; | Section 5.3 |
| (o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | N/A |
| (p) any other information requested by the competent authority | N/A |
| Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | |

# ACRONYMS

| | |
|---|---|
| BESS | Battery Energy Storage System |
| DEA | Department of Environmental Affairs |
| DEA&DP | Department of Environmental Affairs and Development Planning |
| DM | District Municipality |
| EIA | Environmental Impact Assessment |
| ELM | Emthanjeni Local Municipality |
| HD | Historically Disadvantaged |
| IDP | Integrated Development Plan |
| IPP | Independent Power Producer |
| kV | Kilovolts |
| LED | Local Economic Development |
| LM | Local Municipality |
| MW | Megawatt |
| NC | Northern Cape |
| NCPPGDS | Northern Cape Province Provincial Growth and Development Strategy |
| NCSDF | Northern Cape Spatial Development Framework |
| PGDS | Provincial Growth and Development Strategy |
| PKSDM | Pixley Ka Seme District Municipality |
| RLM | Renosterberg Local Municipality |
| SDF | Spatial Development Framework |
| SED | Socio-economic Development |
| SEF | Solar Energy Facility |
| SIA | Social Impact Assessment |

# SECTION 1: INTRODUCTION

## 1.1 INTRODUCTION

The CSIR was appointed to manage the Environmental Impact Assessment (EIA) process for the proposed Kudu PV Solar Energy Facility (SEF) Cluster located approximately 60km north of the town of De Aar in the Northern Cape Province (Figure 1.1). The project site is situated within the Renosterberg Local Municipality (RLM), which is located within the Pixley Ka Seme District Municipality (PKSDM). The Kudu PV SEF Cluster consists of 12 PV SEFs (PV1-PV12).

Tony Barbour was appointed to undertake a specialist Social Impact Assessment (SIA) as part of the EIA process. This report assesses the social impacts associated with the 330 MW Kudu PV 11 SEF.

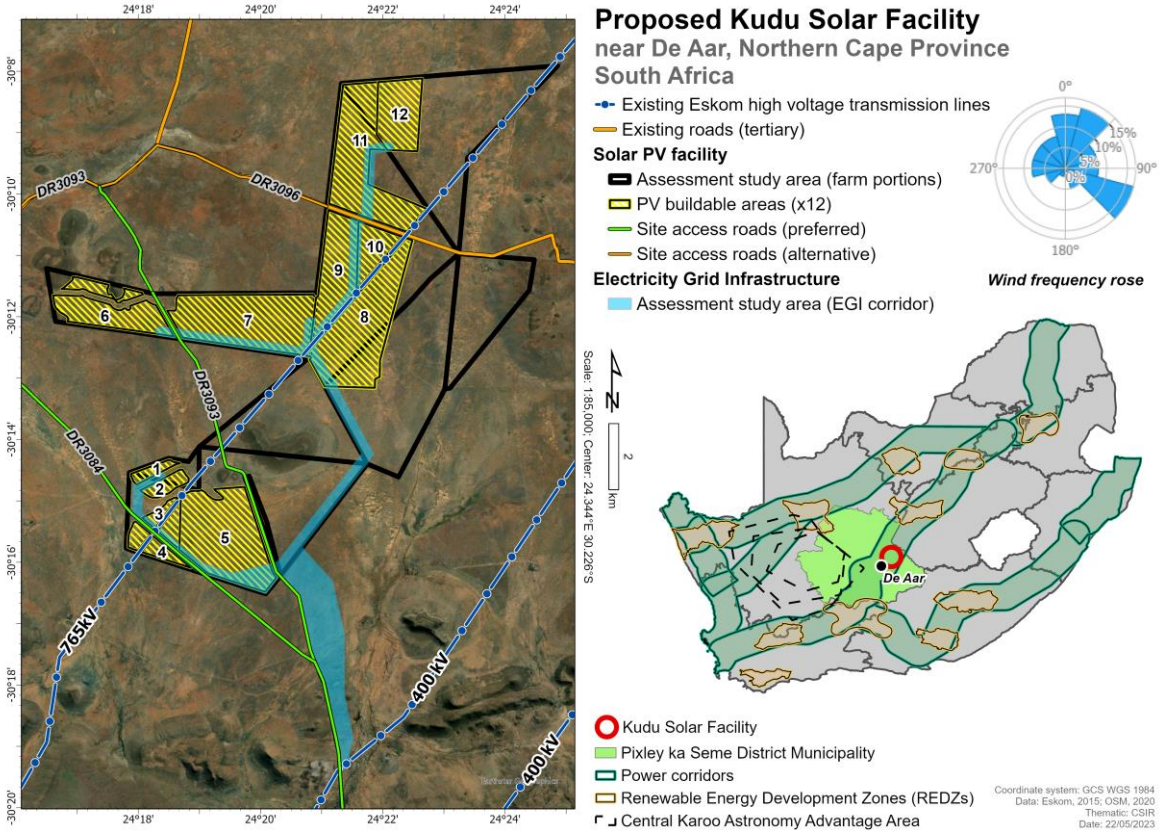



**Figure 1.1: Location of the Kudu PV11 SEF within the SEF cluster**

## 1.2 TERMS OF REFERENCE AND APPROACH

The approach to the SIA study is based on the Western Cape Department of Environmental Affairs and Development Planning (WC DEA&DP) Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice and are used throughout South Africa. The key activities in the SIA process embodied in the guidelines include:

- Describing and obtaining an understanding of the proposed intervention (type, scale, and location), the settlements, and communities likely to be affected by the proposed project.
- Collecting baseline data on the current social and economic environment.
- Identifying the key potential social issues associated with the proposed project. This requires a site visit to the area and consultation with affected individuals and communities. As part of the process a basic information document was prepared and made available to key interested and affected parties. The aim of the document was to inform the affected parties of the nature and activities associated with the construction and operation of the proposed development to enable them to better understand and comment on the potential social issues and impacts.
- Assessing and documenting the significance of social impacts associated with the proposed intervention.
- Identifying and assessing alternatives and recommending alternatives and mitigation measures.

In this regard the study involved:

- Review of socio-economic data for the study area.
- Review of relevant planning and policy frameworks for the area.
- Review of information from similar studies, including the SIAs undertaken for other renewable energy projects.
- Site visit and interviews with key stakeholders.
- Identifying the key potential social issues associated with the proposed project.
- Identifying and assessing the significance of social impacts associated with the proposed project.
- Identification of enhancement and mitigation measures aimed at maximizing opportunities and avoiding and or reducing negative impacts.

Annexure A contains a list of the secondary information reviewed and interviews conducted. Annexure B summarises the assessment methodology used to assign significance ratings to the assessment process.

## 1.3 PROJECT DESCRIPTION

ABO Wind is intending to develop the proposed Kudu PV SEF Cluster. As noted above, the project will entail the proposed development of up to 12 Solar PV SEFs and associated electrical infrastructure. The proposed projects are not located within any of the Renewable Energy Development Zones (REDZs) that were gazetted in Government Notice (GN) 114 in February 2018 and GN 144 in February 2021. Therefore, full Scoping and EIA Processes are needed.

During the scoping phase, the specialists considered the entire study area, which included the Original Scoping Buildable Areas that included the development of up to 15 Solar PV Facilities. However, following the identification of sensitivities and the Bidding Window 6 Request for Proposal capacity limits, the proposed projects were re-clustered and a total of up to 12 Solar PV Facilities are now being proposed. The 330 MW Kudu PV 11 SEF will consist of:

- Solar PV array comprising fixed-tilt, single axis tracking, dual axis tracking, mono-facial or bi-facial PV technology (Photograph 1.1).

- Access roads. Existing roads will be used as main access were possible and may need to be widened or expanded.
- New internal service roads will need to be established and these would either comprise farm (compacted dirt/gravel) roads or be paved.
- Underground cabling (22-33 kV), with the potential for above-ground routing where needed (22-33 kV).
- On-site substation complex at each PV Facility including the following:
  - On-site Independent Power Producer (IPP) or Facility Substation (+-1 ha).
  - Battery Energy Storage System (discussed below).
  - Switching Station and Collector Station (this is the subject of a separate Environmental Assessment process).
- Overhead powerlines (132 kV) (this is the subject of a separate Environmental Assessment (EA) process).
- Laydown areas.
- Temporary site compound.
- Auxiliary buildings to be developed include, but are not limited to Operations and Maintenance (O&M) buildings, site offices, staff lockers, bathrooms, warehouses/workshops, guardhouses, etc.
- Battery energy storage systems (BESS) of 500 MW (or 500 MWh), which could be either lithium-ion or redox flow technology only (Photograph 1.2).

It is the developer's intention to bid the proposed project under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme (or similar programme), with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP).

**Photograph 1.1: Typical PV SEF facility**

**Photograph 1.2: Example of BESS located in storage containers**

## 1.4 ASSUMPTIONS AND LIMITATIONS

### 1.4.1 Assumptions

**Technical suitability**
It is assumed that the development site represents a technically suitable site for the establishment of the proposed PV SEF and associated infrastructure.

**Strategic importance of the project**
The strategic importance of promoting renewable and other forms of energy is supported by the national and provincial energy policies.

**Fit with planning and policy requirements**
Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard, a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported.

### 1.4.2 Limitations

**Demographic data**
Some of the provincial documents do not contain data from the 2011 Census and or 2016 Household Community Survey. However, where required the relevant 2011 and 2016 data has been provided.

## 1.5 SPECIALIST DETAILS

Tony Barbour, the lead author of this report, is an independent specialist with 30 years' experience in the field of environmental management. In terms of SIA experience Tony Barbour has undertaken in the region of 300 SIAs and is the author of the Guidelines for Social Impact Assessments for EIA's adopted by the DEA&DP in the Western Cape in 2007. Annexure C contains a copy of Tony Barbour's CV.

Schalk van der Merwe, the co-author of this report, has an MPhil in Environmental Management from the University of Cape Town and has worked closely with Tony Barbour over the last seventeen years.

## 1.6 DECLARATION OF INDEPENDENCE

This confirms that Tony Barbour and Schalk van der Merwe, the specialist consultants responsible for undertaking the study and preparing the SIA Report, are independent and do not have any vested or financial interests in the proposed power line being either approved or rejected. Annexure D contains a signed declaration of independence.

## 1.7 REPORT STRUCTURE

The report is divided into five sections, namely:

- Section 1: Introduction.
- Section 2: Summary of key policy and planning documents.
- Section 3: Overview of the study area.
- Section 4: Identification and assessment of key social issues.
- Section 5: Summary of key findings and recommendations.

# SECTION 2: POLICY AND PLANNING ENVIRONMENT

## 2.1 INTRODUCTION

Legislation and policy embody and reflect key societal norms, values, and developmental goals. The legislative and policy context therefore plays an important role in identifying, assessing, and evaluating the significance of potential social impacts associated with any given proposed development. An assessment of the "policy and planning fit[1]" of the proposed development therefore constitutes a key aspect of the Social Impact Assessment (SIA). In this regard, assessment of "planning fit" conforms to international best practice for conducting SIAs.

Section 2 provides an overview of the policy and planning environment affecting the proposed project. For the purposes of meeting the objectives of the SIA the following policy and planning documents were reviewed:

- National Energy Act (2008).
- White Paper on the Energy Policy of the Republic of South Africa (December 1998).
- White Paper on Renewable Energy (November 2003).
- Integrated Resource Plan (IRP) for South Africa (2019).
- National Infrastructure Plan (NIP) (2012 and 2021).
- National Development Plan (2011).
- Northern Cape Provincial Growth and Development Strategy (2004-2014).
- Northern Cape Climate Change Response Strategy.
- Northern Cape Spatial Development Framework (2012).
- Northern Cape Province Green Document (2017/2018).
- Pixley ka Seme District Municipality Integrated Development Plan (2019-2020).
- Pixley ka Seme District Municipality Spatial Development Framework (2017).
- Emthanjeni Local Municipality Integrated Development Plan (2021-2022).
- Renosterberg Local Municipality Integrated Development Plan[2].

The section also provides a review of the renewable energy sector in South Africa.

## 2.2 NATIONAL POLICY ENVIRONMENT

### 2.2.1 National Energy Act (Act No 34 of 2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar and wind:

"To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management

[1] Planning fit" can simply be described as the extent to which any relevant development satisfies the core criteria of appropriateness, need, and desirability, as defined or circumscribed by the relevant applicable legislation and policy documents at a given time.
[2] At the time of undertaking the study a copy of the 2017-2022 Renosterberg Local Municipality Integrated Development Plan (IDP) could not be sourced.

requirements (…); to provide for (…) increased generation and consumption of renewable energies…"(Preamble).

### 2.2.2 White Paper on the Energy Policy of the Republic of South Africa

Investment in renewable energy initiatives, such as the proposed SEF, is supported by the White Paper on Energy Policy for South Africa (December 1998). In this regard, the document notes:

"Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future".

The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:

- Ensuring that economically feasible technologies and applications are implemented.
- Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential, and compared to investments in other energy supply options; and,
- Addressing constraints on the development of the renewable industry.

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive, and many appropriate applications exist.

The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- Minimal environmental impacts in operation in comparison with traditional supply technologies; and
- Generally lower running costs, and high labour intensities.

Disadvantages identified at the time include:

- Higher capital costs in some cases.
- Lower energy densities.
- Lower levels of availability, depending on specific conditions, especially with sun and wind-based systems.

### 2.2.3 White Paper on Renewable Energy

The White Paper on Renewable Energy (November 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This Paper

sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The White Paper notes that while South Africa is well endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol[3], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms of the accord South Africa committed itself to a reduction target of 34% compared to business as usual. In this regard, the IRP 2010 aims to allocate 43% of new energy generation facilities in South Africa to renewables.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act).

Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels.

### 2.2.4 Integrated Resource Plan (2019)

South Africa's National Development Plan (NDP) 2030 offers a long-term plan for the country. It defines a desired destination where inequality and unemployment are reduced, and poverty is eliminated so that all South Africans can attain a decent standard of living. Electricity is one of the core elements of a decent standard of living. In formulating its vision for the energy sector, the NDP took as a point of departure the Integrated Resource Plan (IRP) 2010–2030 promulgated in March 2011. The IRP is an electricity infrastructure development plan based on least-cost electricity supply and demand balance, taking into account security of supply and the environment (minimize negative emissions and water usage).

On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment (Draft IRP). Following a lengthy public participation and consultation process the Integrated Resource Plan 2019 (IRP 2019) was gazetted by the Minister of Mineral Resources and Energy, Gwede Mantashe, on 18 October 2019, updating the energy forecast for South Africa from the current period to the

[3] The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia).

year 2030. The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost.

The IRP notes that South Africa is a signatory to the Paris Agreement on Climate Change and has ratified the agreement. The energy sector contributes close to 80% towards the country's total Green House Gas (GHG) emissions of which 50% are from electricity generation and liquid fuel production alone. A transmission from a fossil fuel-based energy sources is therefore critical to reducing GHG emissions. In September 2021 South Africa released its latest emission targets, indicating that it intended to limit Green House Gas (GHG) emissions to 398-510 MrCo2e by 2025, and 350-420 MrCo2e by 2030. These emissions are significantly lower than 2016 emission targets and will see South Africa's emissions decline in absolute terms from 2025, a decade earlier than planned (World Resource Institute, 2021).

The IRP (2019) notes that 39 730 MW of new generation capacity must be developed. Of the 39 730 MW determined, about 18 000 MW has been committed to date. This new capacity is made up of 6 422 MW under the REIPPP with a total of 3 876 MW operational on the grid. Under the Eskom build programme, the following capacity has been commissioned: 1 332 MW of Ingula pumped storage, 1 588MW of Medupi, 800 MW of Kusile and 100MW of Sere Wind Farm. In addition, IPPs have commissioned 1 005 MW from two Open Cycle Gas Turbine (OCGT) peaking plants (IRP 2019, page 14).

In terms of IRP (2019) provision has been made for the following new additional capacity by 2030:

- 1 500 MW of coal.
- 2 500 MW of hydro.
- 6 000 MW of solar PV.
- 14 400 MW of wind.
- 1 860 MW of nuclear.
- 2 088 MW for storage.
- 3 000 MW of gas/diesel.
- 4 000 MW from other distributed generation, co-generation, biomass and landfill technologies.

Figure 2.1 provides a summary of the allocations and commitments between the various energy sectors.

| | Coal | Coal (Decommis-sioning) | Nuclear | Hydro | Storage | PV | Wind | CSP | Gas & Diesel | Other (Distributed Generation, CoGen, Biomass, Landfill) |
|---|---|---|---|---|---|---|---|---|---|---|
| Current Base | 37,149 | | 1 860 | 2,100 | 2 912 | 1 474 | 1 980 | 300 | 3 830 | 499 |
| 2019 | 2,155 | -2,373 | | | | | 244 | 300 | | Allocation to the extent of the short term capacity and energy gap. |
| 2020 | 1,433 | -557 | | | | 114 | 300 | | | |
| 2021 | 1,433 | -1403 | | | | 300 | 818 | | | |
| 2022 | 711 | -844 | | | 513 | 400 1,000 | 1,600 | | | |
| 2023 | 750 | -555 | | | | 1000 | 1,600 | | | 500 |
| 2024 | | | 1,860 | | | | 1,600 | | 1000 | 500 |
| 2025 | | | | | | 1000 | 1,600 | | | 500 |
| 2026 | | -1,219 | | | | | 1,600 | | | 500 |
| 2027 | 750 | -847 | | | | | 1,600 | | 2000 | 500 |
| 2028 | | -475 | | | | 1000 | 1,600 | | | 500 |
| 2029 | | -1,694 | | | 1575 | 1000 | 1,600 | | | 500 |
| 2030 | | -1,050 | | 2,500 | | 1000 | 1,600 | | | 500 |
| TOTAL INSTALLED CAPACITY by 2030 (MW) | 33,364 | | 1,860 | 4,600 | 5,000 | 8,288 | 17,742 | 600 | 6,380 | |
| % Total Installed Capacity (% of MW) | 43 | | 2.36 | 5.84 | 6.35 | 10.52 | 22.53 | 0.76 | 8.1 | |
| % Annual Energy Contribution (% of MWh) | 58.8 | | 4.5 | 8.4 | 1.2* | 6.3 | 17.8 | 0.6 | 1.3 | |

Installed Capacity
Committed/Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030.
- Koeberg power station rated/installed capacity will revert to 1,926MW (original design capacity) following design life extension work.
- Other/ Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility.
- Short term capacity gap is estimated at 2,000MW.

**Figure 2.1: Summary of energy allocations and commitments based on the 2019 IRP**

As indicated above, the changes from the Draft IRP capacity allocations see an increase in solar PV and wind, and a significant decrease in gas and diesel; and new inclusions include nuclear and storage.

In terms of renewable energy, six bidding rounds have been completed for renewable energy projects under the RE IPP Procurement Programme. The most dominant technology in the IRP2019 is renewable energy from wind and solar PV technologies, with wind being identified as the stronger of the two technologies. There is a consistent annual allocation of 1 600 MW for wind technology commencing in the year 2022 up to 2030. The solar PV allocation of 1 000 MWs per year is incremental over the period 2022 to 2030, with no allocation in the years 2024 (being the year the Koeberg nuclear extension is expected to be commissioned) and the years 2026 and 2027 (presumably since 2 000 MW of gas is expected in the year 2027). The IRP 2019 states that although there are annual build limits, in the long run such limits will be reviewed to take into account demand and supply requirements.

### 2.2.5 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

### 2.2.6 The New Growth Path Framework

The aim of the New Economic Growth Path Framework is to enhance growth, employment creation and equity. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard, the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.

The New Growth Path also identifies five other priority areas as part of the programme, through a series of partnerships between the State and the private sector. The Green Economy as one of the five priority areas to create jobs, including expansions in construction and the production of technologies for solar, wind and biofuels. In this regard, clean manufacturing and environmental services are projected to create 300 000 jobs over the next decade.

### 2.2.7 National Infrastructure Plan

Government adopted a National Infrastructure Plan (NIP) in 2012. The aim of the plan is to transform the economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. The aim of the NIP is support investments is to improve South Africans' access to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, ***electricity plants***, hospitals, schools, and dams will contribute to improved economic growth.

As part of the National Infrastructure Plan, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). The Committee identified and developed 18 strategic integrated projects (SIPS). The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions) and included three energy SIPs, namely SIP 8, 9 and 10.

- SIP 8: Green energy in support of the South African economy.
- SIP 9: Electricity generation to support socio-economic development.
- SIP 10: Electricity transmission and distribution for all.

The NIP 2050 was gazetted for public comment on 10 August 2021[4]. The first phase of the NIP 2050 focuses on four critical network sectors that provide a platform, namely, energy, freight transport, water, and digital infrastructure. In line with the NDP, the vision for the energy sector is to promote:

- Economic growth and development through adequate investment in energy infrastructure" (generation, transmission, and distribution) and reliable and efficient energy service at competitive rates, while supporting economic growth through job creation by stimulating supply chains.
- Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households.
- Environmental sustainability through efforts to reduce pollution, reduce water usage and mitigate the effects of climate change.

The NIP 2050 notes that by 2030, the NDP set a target that more than 90% of the population should enjoy access to grid connected or off-grid electricity by 2030. To

[4] Gazette No. 44951

realise this vision, South Africa's energy system will be supported by effective policies, institutions, governance systems, regulation and, where appropriate, competitive markets. In terms of energy mix, NIP 2050 notes that coal will contribute significantly less to primary-energy needs in the future, while gas will have an important enabling role, energy supply will be ***increasingly dominated by renewable energy resources– especially wind and solar which are least cost and where South Africa has a comparative advantage.***

NIP 2050 also notes that South Africa is a signatory of the Paris Agreement which aims to achieve Net Zero greenhouse gas emissions by 2050. To achieve this will require a shift to a least cost energy path that is increasingly reliant on renewables. For South Africa this is imperative for the following reasons:

- SA cannot afford to overspend while dramatically expanding capacity
- Renewables can be built quickly and in modular form thereby avoiding many of the challenges associated with mega projects.
- Trade partners are expected to increasingly impose border carbon taxes harming SA exports.
- SA will need to commit to emission reductions as a global citizen.

### 2.2.8 Astronomy Geographic Advantage Act

The purpose of the Act (Act No 21 of 2007) is to preserve the geographic advantage areas that attract investment in astronomy. The entire Northern Cape Province, excluding the Tsantsabane Municipality, has been declared an astronomy advantage area. The Northern Cape optical and radio telescope sites were declared core astronomy advantage areas. The Act allowed for the declaration of the Southern Africa Large Telescope (SALT), Meerkat and Square Kilometre Array (SKA) as astronomy and related scientific endeavours that has to be protected.

## 2.3 PROVINCIAL AND LOCAL LEVEL POLICY AND PLANNING

### 2.3.1 Northern Cape Province Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) (2004-2014)[5] identifies poverty reduction as the most significant challenge facing the government and its partners. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

- Agriculture and Agro-processing.
- Fishing and Mariculture.
- Mining and mineral processing.
- Transport.
- Manufacturing.
- Tourism.

However, the NCPGDS also notes that economic development in these sectors also requires:

[5] An updated PGDS has not been prepared.

- Creating opportunities for lifelong learning.
- Improving the skills of the labour force to increase productivity.
- Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

- Developing requisite levels of human and social capital.
- Improving the efficiency and effectiveness of governance and other development institutions.
- Enhancing infrastructure for economic growth and social development.

Of specific relevance to the SIA the NCPGDS makes reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development and notes that the current level of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of Small Micro Medium Enterprises (SMME) Development and Black Economic Empowerment. The proposed SEF therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape Province.

In this regard, care will need to be taken to ensure that the proposed development and associated renewable energy facilities do not negatively impact on the region's natural environment. In this regard, the NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa.

### 2.3.2 Northern Cape Provincial Spatial Development Framework

Northern Cape Provincial Spatial Development Framework (NCSDF) (2012) lists a number of sectoral strategies and plans that are to be read and treated as key components of the Provincial SDF (PSDF). Of these there are a number that are relevant to the proposed SEFs. These include:

- Sectoral Strategy 1: Provincial Growth and Development Strategy of the Provincial Government.
- Sectoral Strategy 2: Comprehensive Growth and Development Programme of the Department of Agriculture, Land Reform and Rural Development.

- Sectoral Strategy 5: Local Economic Development (LED) Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 11: SMME Development Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 12: Tourism Strategy of the Department of Economic Development and Tourism.
- Sectoral Strategy 19: Provincial renewable energy strategy (to be facilitated by the Department of Economic Development and Tourism).

Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. Of relevance the objectives listed in 2012 include:

- Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.
- There is a national electricity supply shortage, and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
- Develop and institute innovative new energy technologies to improve access to reliable, sustainable, and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution, and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government as well as the private sector.
- Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003). This target relates to the delivery of 10 000 GWh of energy from renewable energy sources (mainly biomass, wind, solar, and small-scale hydro) by 2013[6].

Section C8.3.3, Energy Policy, sets out the policy guidelines for the development of the energy sector, with specific reference to the renewable energy sector.

- The construction of telecommunication infrastructure must be strictly regulated in terms of the spatial plans and guidelines put forward in the PSDF. They must be carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible.
- Renewable energy sources such as wind, solar, thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020. The following key policy principles for renewable energy apply:
  - Full cost accounting: Pricing policies will be based on an assessment of the full economic, social and environmental costs and benefits of energy production and utilisation.
  - Equity: There should be equitable access to basic services to meet human needs and ensure human well-being. Each generation has a duty to avoid impairing the ability of future generations to ensure their own well-being.

[6] Note: The PSDF is dated 2012. The targets for renewable energy have been updated in terms of the 2019 IRP (see above).

- Global and international cooperation and responsibilities: Government recognises its shared responsibility for global and regional issues and act with due regard to the principles contained in relevant policies and applicable regional and international agreements.
- Allocation of functions: Government will allocate functions within the framework of the Constitution to competent institutions and spheres of government that can most effectively achieve the objectives of the energy policy.
- The implementation of sustainable renewable energy is to be promoted through appropriate financial and fiscal instruments.
- An effective legislative system to promote the implementation of renewable energy is to be developed, implemented, and continuously improved.
- Public awareness of the benefits and opportunities of renewable energy must be promoted.
- The development of renewable energy systems is to be harnessed as a mechanism for economic development throughout the province in accordance with the Sustainable Development Initiative (SDI) approach (refer to Toolkit D10) or any comparable approach.
- Renewable energy must, first, and foremost, be used to address the needs of the province before being exported.

### 2.2.3 Northern Cape Provincial Climate Change Response Strategy

The key aspects of the Provincial Climate Change Response Strategy (PCCRS) are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key Sectors to ensure proactive long term responses to the frequency and intensity of extreme weather events such as flooding and wild fire, with heightened requirements for effective disaster management".

Key points from MEC's address include the NCPG's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the NCP's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, is identified as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The MEC also indicated that the NCP was involved in the processing a number of Wind Energy Facility (WEF) and SEF EIA applications.

### 2.2.4 Northern Cape Province Green Document

The NCP Green Document (2017-2018) was prepared by the Northern Cape Department of Economic Development and Tourism and provides an impact assessment of IPPs on the communities in the province located within a 50 km radius from existing facilities. The document notes that the NCP is nationally a leader in commercial-scale renewable energy projects. By 2018 a total of 23 IPP

projects in the province had been integrated into the national grid[7]. These projects include Solar PV, Concentrated Solar and WEFs. The document notes that through their economic development obligations these projects have already made a significant positive contribution to affected communities. Much of the effort has been directed at supporting local education. The document also notes that, as these projects are committed to 20-year minimum lifespans and collectively hold a tremendous potential for socio-economic upliftment.

Key issues identified with regard to improving the potential beneficial impact of IPPs in the NCP (as at 2018) include:

- Local community members abusing project benefits for personal gain.
- Difficulty in outreach to local community beneficiaries due to high local illiteracy levels.
- A lack of business skills generally hampers the successful establishment of local small enterprises which could benefit from projects.
- Community benefit obligations are currently met in a piecemeal and uncoordinated fashion.
- Anticipated community benefits are often frustrated by inadequate engagement and insufficient ongoing consultation.
- The scarcity of people skilled in maths and sciences in local communities hampers meaningful higher-level local skills development and employment.
- Insufficient support from local municipalities for IPP development.

### 2.3.4 Pixley ka Seme District Municipality Integrated Development Plan

The vision for the PKSDM is "Developed and Sustainable District for Future Generations" (2019-2020).

To mission statement that underpins the vision is:

- Supporting our local municipalities to create a home for all in our towns, settlements, and rural areas to render dedicated services.
- Providing political and administrative leadership and direction in the development planning process.
- Promoting economic growth that is shared across and within communities.
- Promoting and enhancing integrated development planning in the operations of our municipalities.
- Aligning development initiatives in the district to the National Development Plan.

The Strategic Objectives to address the vision that are relevant to the project includes the promotion of economic growth in the district and enhance service delivery. Chapter 4, Development of Strategies, highlights the key strategies of the PKSDM. The promotion of economic development is the most relevant strategy for the project. The IDP also notes that the growth and development context in the district has also changed radically since 2013 (after it had been stagnant for decades) owing mainly to private and public investments in the area as a hub for renewable energy generation and astronomy.

The IDP notes that the economy in the Pixley ka Seme municipal area is characterized by:

[7] This total would be higher in 2022.

- High levels of poverty and low levels of education.
- Low levels of development despite the strategic location in terms of the national transport corridors.
- High rate of unemployment, poverty and social grant dependence.
- Prone to significant environmental changes owing to long-term structural changes (such as climate change, energy crises and other shifts).

Of specific relevance the IDP highlights the potential for renewable energy to help address some of these challenges.

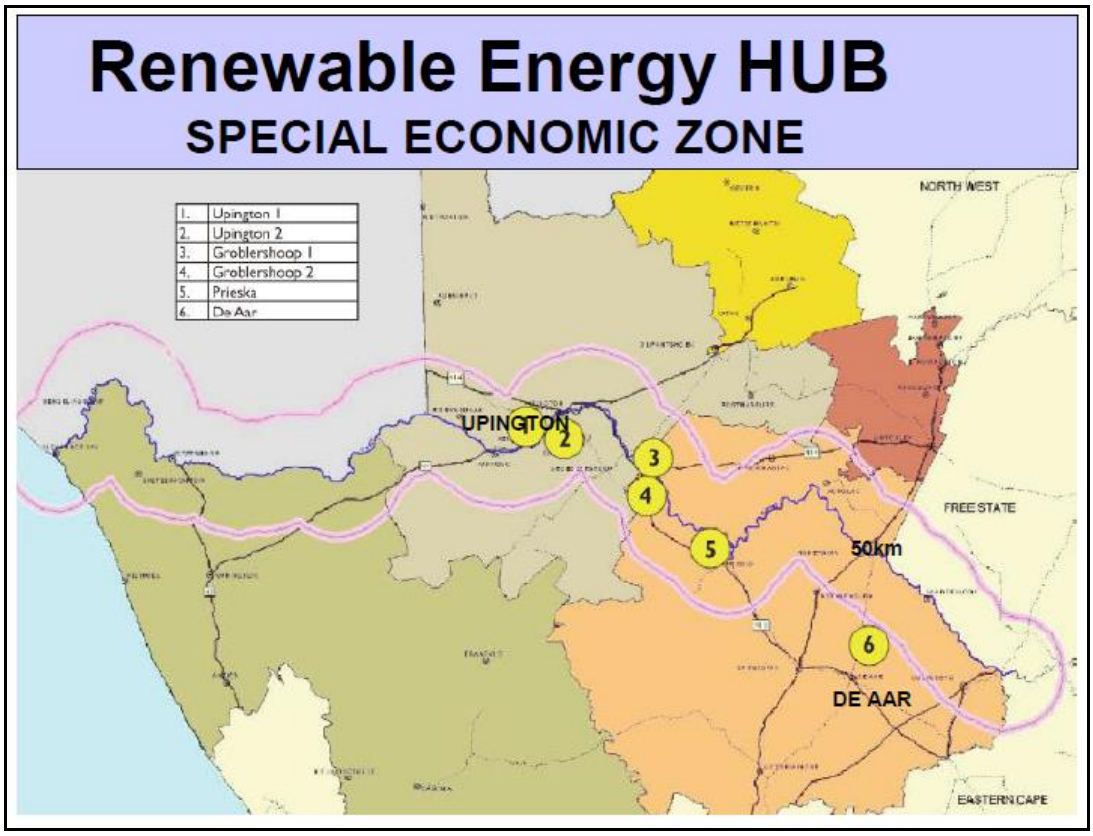
### 2.3.5 Pixley ka Seme District Municipality Spatial Development Framework

The SDF (2017) notes that the vision for the PKSDM is "Pixley Ka Seme DM, pioneers of development, a home and future for all". The Mission Statement that underpins the vision refers to:

- Effective and efficient service delivery.
- Optimal human and natural resource development.
- Local economic growth and development, job creation and poverty alleviation.
- A vibrant tourism industry.
- To participate in the fight to reduce the infection rate and lessen the impact of HIV/ Aids and other communicable diseases.
- A safe, secure and community friendly environment.

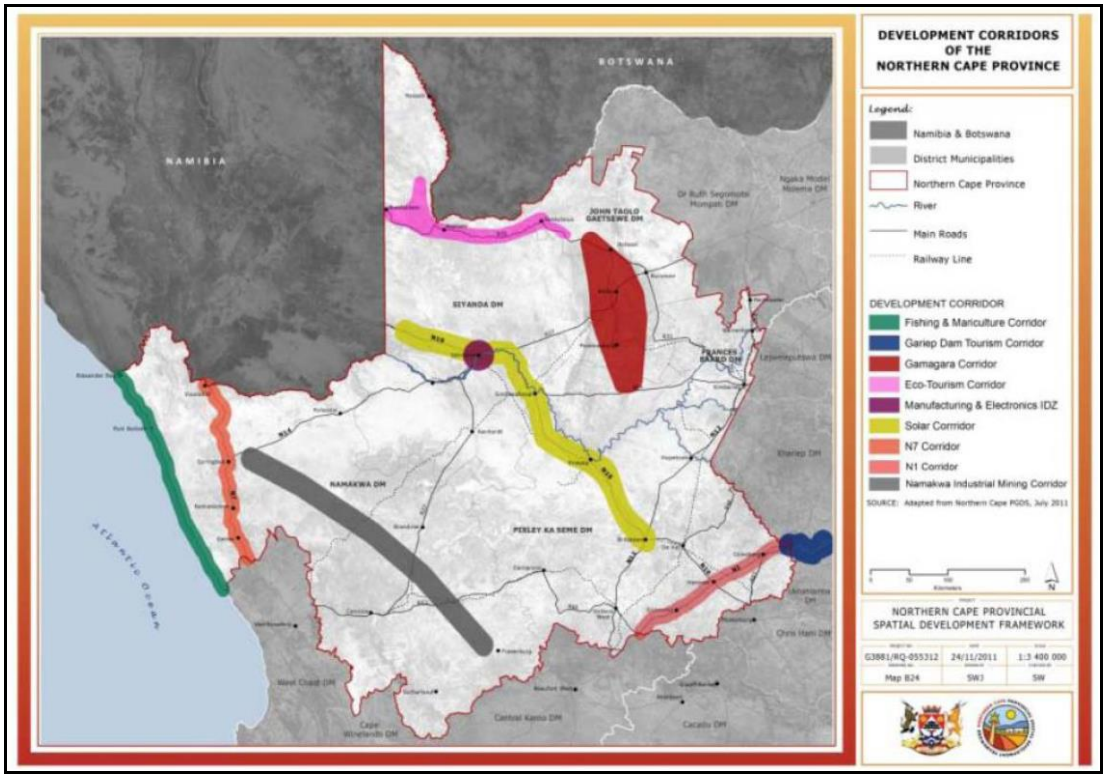
The SDF identifies the opportunities and constraints associated with the district. The opportunities that are of relevance to the project are discussed below.

Renewable energy and the identification of a renewable energy hub in the region. The natural environment and maintenance and conservation of the pristine natural environment to support sustainable farming into the future is also identified as an opportunity. The SDF notes that Pixley Ka Seme District area with its abundance of sunshine and vast tracts of available land has attracted considerable interest from solar energy investors. The high solar index of the area provides many opportunities in terms of the development of renewable energy. This has been acknowledged by the Northern Cape Government with the identification of the Renewable Energy Hub. Section 5.6.1 of the SDF refers to the establishment of a Renewable Energy Hub stretching from the west coast up to De Aar region (Figure 2.3). A number of special economic development zones are located within the area, including the De Aar (No.6, Figure 2.2). The PKSDM also falls within the Solar Development Corridor as identified in the Northern Cape Provincial Spatial Development Framework. The corridor extends from Kakamas to Upington and down to De Aar in the south-east (Figure 2.3). The proposed project is located within the corridor.




*Source: Northern PKSDM SDF*

**Figure 2.2: Northern Cape Renewable Energy Hub**




*Source: Northern Cape SDF*

**Figure 2.3: Northern Cape Development Corridors-Solar Corridor (yellow)**

The SDF does however also note that the area is known for its clean air and open skies with limited light pollution. Potential visual impacts are therefore an issue that needs to be considered.

In this regard the SDF notes that the topography of Pixley Ka Seme region is one of its main assets with vast open spaces and unspoilt panoramic visual vistas stretching over great distances. This asset makes for excellent scenic drives throughout the whole of the region from the flat plains to crossing the main rivers of South Africa. Visual vistas, ridges and "koppies" are assets within the region and they must be handled with sensitivity.

The relevant constraints include high levels of poverty and unemployment, backlog in basic services, including electricity and housing in rural areas, the limited supply of water and overall scarcity of water in the region to support economic development.

The development challenges that face the Pixley Ka Seme District Municipality include high unemployment and poverty rates and low income which are placing increasing demand on service delivery because very few people are able to pay for services. Declining population numbers, and alcohol and substance abuse are also key challenges.

In terms of services, inadequate schools in farming areas results in children having to travel long distances to areas where they go to school. There are also insufficient health centres and lack of amenities and recreational services. Where these services do exist, they are often poorly managed and maintained. The level of key services, such as refuse removal, are also low, while many rural and a number of urban households rely on boreholes for their water supply.

Climate change is also identified as a key risk. The SDF notes that the Karoo is predicted to experience more drought periods, coupled with increased evaporation and temperatures and this will negatively impact already restricted water supply. It is likely that the greatest impacts will be on water supply.

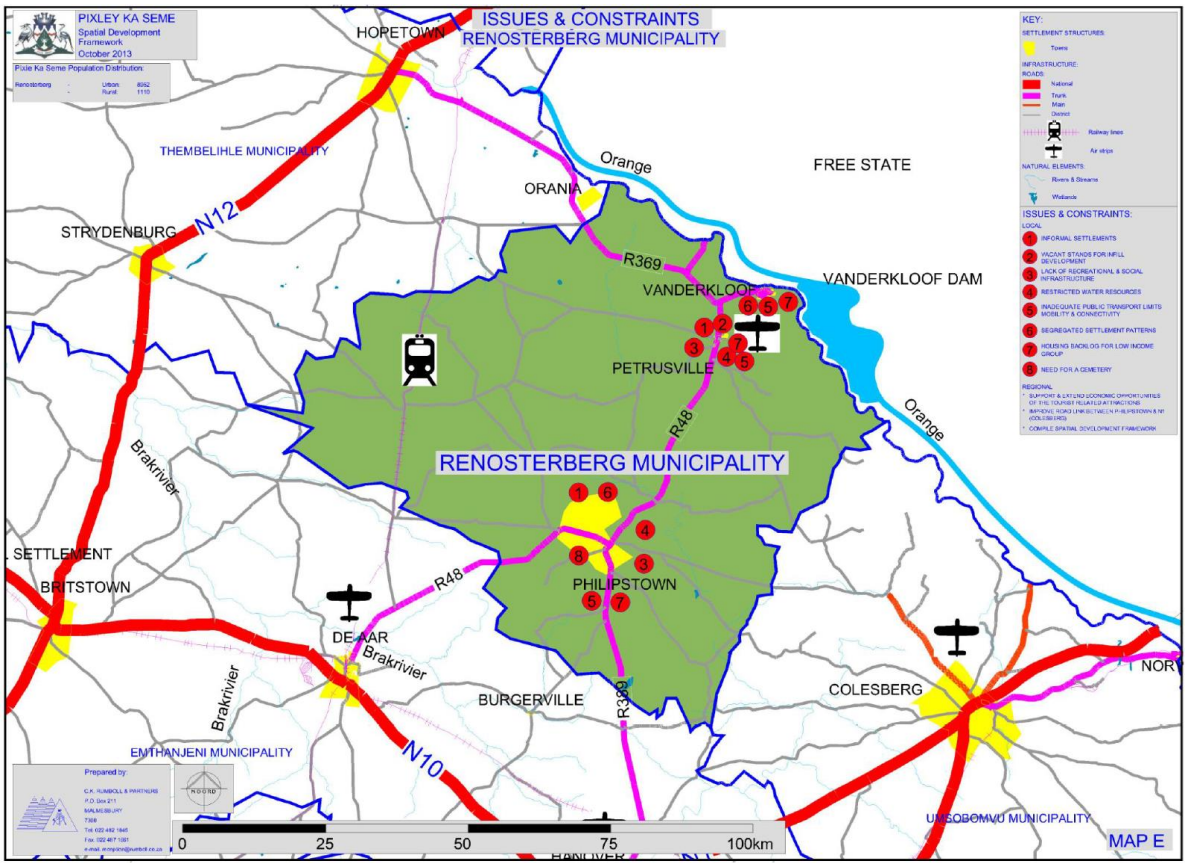
### 2.3.6 Renosterberg Local Municipality Integrated Development Plan

A copy of the latest five-year IDP (2017-2021) for the RLM was not available at the time preparing this report. This is likely linked to the dissolution of RLM by the Northern Cape Provincial Government on 7 September 2020[8]. A statement by the Premier of the Northern Cape, Dr, Zamai Saul (7 September 2020) noted that the "Renosterberg Local Municipality has been plagued with political and administrative challenges and failing to fulfil the prescripts of Chapter 7 as enshrined in Section 152 of the Constitution". The statement also notes that the intervention efforts made by the Department of Cooperative Governance, Human Settlements and Traditional Affairs (CoGHSTA), Provincial Treasury and the PKSDM and the respective MECs to monitor and provide support to RLM had not succeeded. The Municipal Council has also failed to implement and support the National Treasury discretionary Financial Recovery Plan that commenced in 2018 and was on-going until November 2019.

[8] Premier Zamani Saul: Dissolution of Renosterberg Municipal Council South African Government (www.gov.za)

The information on the RLM is therefore based on the information contained in the Pixley Ka Seme District SDF 2013 - 2018 Sixth Draft May 2014.

The locality of the RLM along the southern bank of the Gariep (Orange) River provides a sustainable water resource and creates a number of development opportunities in terms of tourism and agriculture. Development opportunities are also supported by close locality of Phillipstown to the N10 and N1 as major transport routes that cross the Pixley District Municipal Area. The municipal area consists of the towns of Petrusville, Phillipstown and Vanderkloof (Figure 2.4). The administrative centre is Petrusville.




*Source: PKSSDF (2017)*

**Figure 2.4: Renosterberg Local Municipality**

The small town of Petrusville is located on the northern part of the of the Renosterberg Municipal area, near the Vanderkloof Dam and functions as a service centre for the surrounding farming areas. The economic opportunities for the town are linked to expanding its role at the areas administrative centre and capitalising on the proximity of the Vanderkloof Dam and the N1 (to the east) and N12 (to the west). The socio-economic challenges include water shortages during the dry months, shortage of lower income housing and lack of recreational and social facilities. The construction of a pipeline from the Vanderkloof Dam has been identified as a solution to address the water issue.

Philipstown is located on the southern section of the Renosterberg Municipal area, to the northeast of De Aar. The economic opportunities for the town are linked to the proximity of the N1 (to the east), N12 (to the west) and N10 (to the south). The socio-economic challenges include high levels of youth unemployment, water

shortages during the dry months, shortage of lower income housing and lack of recreational and social facilities. The construction of a pipeline from the Vanderkloof Dam has been identified as a solution to address the water issue. The tourism potential of the town and surrounding area is linked to farm stays and hunting. There are also a number of San Rock Art sites in the area.

Vanderkloof is located on the southern bank of the Vanderkloof Dam in the northern section of the Renosterberg Municipal area. The main focus of the town is for residential and recreational purposes and the town is a well-established holiday resort town. The tourism potential of the town and the surrounding area are linked to the water sports activities in the Vanderkloof Dam (boating, swimming, fishing etc), and the Vanderkloof and Rolfontein Nature Reserves. The socio-economic challenges include a shortage of lower income housing units.

### 2.3.7 Emthanjeni Local Municipality Integrated Development Plan

The IDP for the Emthanjeni Local Municipality (ELM) (2019-2021) notes that the municipality borders onto the southern boundary of the Renosterberg Local Municipality (RLM) and is a category B municipality consisting of three towns, namely, De Aar, Britstown and Hanover. The vision of the RLM is "Leading sustainable development for inclusive economic growth". The mission statement linked to the vision is "To create a viable economic development plan that is relevant to the characteristics of the Emthanjeni Municipal area, designed to create and maintain a sound and healthy local economy, drawing upon local strengths and resources". This will be achieved through:

- Strategic partnerships and collaboration.
- Effective stakeholder communications.
- Supporting existing businesses and encourage the expansion and repositioning of desirable commercial and industrial uses.
- To increase the number of farms or agricultural land in the community.

The Integrated Development Plan (IDP) refers to the national economic pillars adopted on the National Framework for Local Economic Development in South Africa which launched in 2014. The pillars are aligned to the main thrusts and opportunities within RLM to ensure an integrated approach for optimal rate of implementation and economic development in the municipality. The five pillars are:

- Pillar 1: Building a Diverse Economic Base.
- Pillar 2: Developing learning and skilful economies.
- Pillar 3: Developing Inclusive Economies.
- Pillar 4: Enterprise Development and Support.
- Pillar 5: Economic Governance and Infrastructure.

Pillars 1, 2, 3 and 4 are relevant to the proposed development.

***Pillar 1: Building a Diverse Economic Base***
The first pillar focuses on building a diverse economic base and growing the local economy through industrial and sector-specific (e.g., Tourism, Mining, Agriculture, Manufacturing, etc.).

***Pillar 2: Developing learning and skilful economies***
The IDP notes that addressing the skills gap and improving skills levels is critical to the to the successful implementation of all the other pillars, as increased skills lead to increased opportunities for stimulating local economies.

***Pillar 3: Developing Inclusive Economies***
Creating decent work and sustainable livelihoods improves the living standards and ensures a dignified existence for individuals.

***Pillar 4: Enterprise Development and Support***
The IDP highlights the importance of supporting economic development and creating a diverse economic sector. The need to support SMMEs is also noted.

The development of the project will support these pillars, specifically the SED and ED spend linked to the project. The IDP also lists 7 Key Performance Areas (KPAs) of which KPA 1: Basic Services and Infrastructure Development, KPA 5: Local Economic Development and KPA 7: Social Development, are relevant to the project.

The IDP highlights the importance to the renewable energy sector and refers to a number of IPP projects located in the RLM and PKSDM.

## 2.4 OVERVIEW OF THE RENEWABLE ENERGY SECTOR IN SOUTH AFRICA

The section below provides an overview of the potential benefits associated with the renewable energy sector in South Africa. Given that South Africa supports the development of renewable energy at national level, the intention is not to provide a critical review of renewable energy. The focus is therefore on the contribution of renewable energy, specifically in terms of supporting economic development.

The following documents were reviewed:

- Independent Power Producers Procurement Programme (IPPPP): An Overview (December 2021), Department of Energy, National Treasury and DBSA.
- Green Jobs Study (2011), IDC, DBSA Ltd and TIPS.
- Powering the Future: Renewable Energy Roll-out in South Africa (2013), Greenpeace South Africa.
- WWF SA, Renewable Energy Vision 2030, South Africa, 2014.
- Jacqueline M. Borel-Saladin, Ivan N. Turok, (2013). The impact of the green economy on jobs in South Africa), South African Journal of Science, *Volume 109 /Number 9/10, September/October 2013.*
- The potential for local community benefits from wind farms in South Africa, Louise Tait (2012), Master's Thesis, Energy Research Centre University of Cape Town.

### 2.4.1 Independent Power Producers Procurement Programme (IPPPP): An Overview

The document presents an overview of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) undertaken by the Department of Energy, National Treasury, and the Development Bank of South Africa in December 2021. The programme's primary mandate is to secure electrical energy from the private sector for renewable and non-renewable energy sources. With regard to renewables, the programme is designed to reduce the country's reliance on fossil fuels, stimulate an indigenous renewable energy industry and contribute to socio-economic development and environmentally sustainable growth. The IPPPP has been designed not only to procure energy but has also been structured to contribute to the broader national development objectives of job creation, social upliftment and broadening of economic ownership.

The Integrated Resource Plan for electricity (IRP) provides South Africa's long-term plan for electricity generation. It primarily aims to ensure security of electricity supply, minimise the cost of that supply, limit water usage and reduce greenhouse gas (GHG) emissions, while allowing for policy adjustment in support of broader socio-economic developmental imperatives. The IRP 2019 was promulgated in October 2019 and replaced the IRP 2010 as the country's official electricity infrastructure plan.

It calls for 37 696 MW of new and committed capacity to be added between 2019 and 2030 from a diverse mix of energy sources and technologies as ageing coal plants are decommissioned and the country transitions to a larger share of renewable energy. By 2030, the electricity generation mix is set to comprise of 33 364 MW (42.6%) coal, 17 742 MW (22.7%) wind, 8 288 MW (10.6%) solar photovoltaic (PV), 6 830 MW (8.7%) gas or diesel, 5 000 MW (6.4%) energy storage, 4 600 MW (5.9%) hydro, 1 860 MW (2.4%) nuclear and 600 MW (0.8%) concentrating solar power (CSP). Additionally, a short-term gap of at least 2000 MW is to be filled between 2019 and 2022, thereby further raising new capacity requirements, while distributed or embedded generation for own-use is positioned to add 4 000 MW between 2023 and 2030. The IRP is intended to be frequently updated, which could impact future capacity allocations from various energy sources and technologies.

***Energy supply***
By the end of December 2021, the REIPPPP had made the following significant impacts.

- 6 323 MW of electricity had been procured from 92 RE Independent Power Producers (IPPs) in BW1-4.
- 5 661 MW of electricity generation capacity from 85 IPP projects has been connected to the national grid.
- 71 073 GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational in November 2013.

Renewable energy IPPs have proved to be very reliable. Of the 85 projects that have reached COD, 77 projects have been operational for longer than a year. The energy generated over the past 12-month period for these 77 projects is 14 117 GWh, which is 95% of their annual energy contribution projections (P50) of 14 924 GWh over a 12-month delivery period. Thirty-one (31) of the 77 projects (40%) have individually exceeded their P50 projections.

Comparatively, the following statistics were presented at the REIPPPP Bid Window 6 Bidders Conference on 7 July 2022 by the IPP Office based on data as of March 2022 following seven bid rounds (IPP Office, 2022[9]):

- 92 IPPs have been selected as preferred bidders.
- 6 323 MW of electricity capacity procured.
- 5 826 MW already operational from 87 IPPs.
- 74 805 GWh energy generated by Renewable Energy sources.

[9] IPP Office (2022). RENEWABLE ENERGY INDEPENDENT POWER PRODUCER PROCUREMENT PROGRAMME (REIPPPP) BID WINDOW 6 BIDDERS' CONFERENCE, 7 JULY 2022 [online]. Accessed July 2022. https://www.ipp-renewables.co.za/PressCentre/GetPressRelease?fileid=16a21004-f9fd-ec11-9578-2c59e59ac9cd&fileName=BW6%20Bidders%20Conference%20Consolidated.pdf.

***Energy costs***

In line with international experience, the price of renewable energy is increasingly cost competitive when compared with conventional power sources. The REIPPPP has effectively captured this global downward trend with prices decreasing in every bid window. Energy procured by the REIPPPP is progressively more cost effective and has approached a point where the wholesale pricing for new coal-and renewable-generated energy intersect.

Through the competitive bidding process, the IPPPP effectively leveraged rapid, global technology developments and price trends, buying clean energy at lower and lower rates with every bid cycle, resulting in SA getting the benefit of renewable energy at some of the lowest tariffs in the world. The price for wind power has dropped by 50% to R0.94/kWh, while solar PV has dropped with 75% to R1.14/kWh between BW1 and BW4. This compares with the industry estimates in April 2020 of R1.45/kWh for Medupi. Considering the on-going delays incompletion, indications are that these costs may even be significantly higher.

Prices contracted under the REIPPPP for all technologies are well below the published REFIT prices. The REIPPPP has effectively translated policy and planning into delivery of clean energy at very competitive prices. As such it is contributing to the national aspirations of secure, affordable energy, lower carbon intensity and a transformed 'green' economy.

***Investment***

The document notes that the REIPPPP has attracted significant investment in the development of the REIPPs into the country. The total investment (total project costs[10]), including interest during construction, of projects under construction and projects in the process of closure is R209.6 billion (this includes total debt and equity of R209 billion, as well as early revenue and VAT facility of R0.5 billion).

The REIPPPP has attracted R42 billion in foreign investment and financing in the seven bid windows (BW1 – BW4). This is almost double the inward FDI attracted into South Africa during 2015 (R22.6 billion). The document notes that the share of foreign investment and equity showed an increase in the most recent bid window (2S2), suggesting that the REIPPPP continued to generate investor confidence despite the poor economic conditions in South Africa in recent years.

Comparatively, based on the information presented at the REIPPPP Bid Window 6 Bidders Conference on 7 July 2022 by the IPP Office (IPP Office, 2022), approximately R209.6 billion investment has been attracted for energy infrastructure in all bid windows; and as of March 2022 an actual R1.9 billion contribution was realised for socio-economic development.

***South African citizen shareholding***

The importance of retaining local shareholding in IPPs is key condition of the procurement requirements. The RFP notes that bidders are required to have South African Equity Participation of 40% in order to be evaluated. South African (local) equity shareholding across BW1-4 equates to 52% (R31.4 billion) of the total equity shareholding (R61.0 billion) was held by South Africans across BW1 to BW4, 1S2

[10] Total project costs means the total capital expenditure to be incurred up to the commercial operations date in the design, construction, development, installation, and or commissioning of the project)

and 2S2. This equates to substantially more than the 40% requirement. Foreign equity amounts to R29.6 billion and contributes 49% of total equity.

The REIPPPP also contributes to Broad Based Black Economic Empowerment (BBBEE) and the creation of black industrialists. In this regard, Black South Africans own, on average, 34% of projects that have reached financial close (BW1-BW4), which is 4% higher than the 30% target. This includes black people in local communities that have ownership in the IPP projects that operate in or near their communities and represents the majority share of total South African Entity Participation.

On average, black local communities own 9% of projects that have reached financial close. This is well above the 5% target. In addition, an average of 21% shareholding by black people in engineering, procurement, and construction (EPC) contractors has been attained for projects that have reached financial closure. This is higher than 20% target. The shareholding by black people in operating companies of IPPs has averaged 30% (against the targeted 20%) for the 85 projects in operation (i.e. in BW1–4).

The target for shareholding by black people in top management has been set at 40%, with an average 68% achieved to date. The target has therefore been significantly exceeded.

***Community shareholding and community trusts***

The regulations require a minimum ownership of 2.5% by local communities in IPP projects as a procurement condition. This is to ensure that a substantial portion of the investments has been structured and secured as local community equity. An individual community's dividends earned will depend on the terms of each transaction corresponding with the relevant equity share. To date all shareholding for local communities have been structured through the establishment of community trusts. For projects in BW1 to BW4, qualifying communities will receive R25.5 billion net income over the life of the projects (20 years). The report notes that the bulk of the money will however only start flowing into the communities from 2028 due to repayment obligations in the preceding years (repayment obligations are mostly to development funding institutions). However, despite the delay, this represents a significant injection of capital into mainly rural areas of South Africa. If the net projected income for the first seven bid windows (BW1-BW4) was structured as equal payments overtime, it would represent an annual net income of R1.27 billion per year.

Income to all shareholders only commences with operation of the facility. Revenue generated to date by the 85 operational IPPs amounts to R149.9 billion.

***Procurement spend***

In addition to the financial investments into the economy and favourable equity structures aimed at supporting BEE, the REIPPPP also targets broader economic and socio-economic investment. This is through procurement spend and local content.

The total projected procurement spend for BW1 to BW4 during the construction phase was R71.1 billion, while the projected operations procurement spend over the 20 years operational life is estimated at 75.2 billion. The combined (construction and operations) procurement value is projected as R146.3 billion of which R92.1 billion has been spent to date. For construction, of the R71.1 billion already spent to date, R71 billion is from the 85 projects which have already been completed. These 85 projects had planned to spend R64.2 billion. The actual

procurement construction costs have therefore exceeded the planned costs by 11% for completed projects.

***Preferential procurement***

The share of procurement that is sourced from Broad Based Black Economic Empowered (BBBEE) suppliers, Qualifying Small Enterprises (QSE), Exempted Micro Enterprises (EME) and women owned vendors are tracked against commitments and targeted percentages. The IA target requirement for BBBEE is 60% of total procurement spend. However, the actual share of procurement spend by IPPs from BBBEE suppliers for construction and operations combined is currently reported as 83%, which is significantly higher than the target of 60%, but also the 71% that had been committed by IPPs. BBBEE, as a share of procurement spend for projects in construction, is also reported as 84% with operations slightly lower at 74%.

The majority of the procurement spend to date has been for construction purposes. Of the R76 billion spent on procurement during construction, R64.3 billion has reportedly been procured from BBBEE suppliers, achieving 84.6% of total procured. Actual BBBEE spend during construction for BW1 and BW2 alone was R25.5 billion, 81% more than the 14.1 billion planned by the IPPs. The R64.3 billion spent on BBBEE during construction is 30% more than the R49.7 billion that had originally been anticipated by all IPPs procured in BW1-4.

Total procurement spend by IPPs from QSE and EMEs has amounted to R28.1 billion (construction and operations) to date, which exceeds commitments by 250% and is 30% of total procurement spend to date (while the required target is 10%). QSE and EME's procurement spend for construction was 31% of construction procurement to date and 26% of operational procurement, exceeding the 10% targets set. QSE and EME share of construction procurement spend totals R23.8 billion, which is 5.4 times the planned spend for construction of R4.4 billion during this procurement phase.

In terms of procurement from women-owned vendors to date, 5% of total construction procurement spend has been from woman-owned vendors (against a targeted 5%), and 6% of operational procurement spend has been realised from woman-owned vendors to date, thereby exceeding the targeted 5%. In terms of construction spend, R 4.1 billion was undertaken by women-owned vendors, which is almost double the R 1.8 billion expected to be spent for the construction of projects that have reached financial close.

The REIPPPP has therefore created significant employment opportunities for black South African citizens and local communities beyond planned targets. This highlights the importance of the programme in terms of employment equity and the creation of more equal societies.

***Local Content***[11]

The report notes that the REIPPP programme represents the country's most comprehensive strategy to date in achieving the transition to a greener economy. Local content minimum thresholds and targets were set higher for each subsequent bid window. The report notes that for a programme of this magnitude, with construction procurement spend alone estimated at R71.1 billion, the result is a substantial stimulus for establishing local manufacturing capacity. The local content

[11] Local content is expressed as a % of the total project value and not procurement or total project costs.

strategy has created the required incentives for a number of international technology and component manufactures to establish local manufacturing facilities.

The documents notes that for the portfolio as a whole, the expectation would reasonably be for local content spend to fall between 25% and 65% of the total project value (considering the range of targets and minimum requirements). Local content commitments by IPPs amount to R66.3 billion or 45% of total project value (R148.2 billion for all bid windows).

Actual local content spend reported for IPPs that have started construction amounts to R63.3 billion against a corresponding project value (as realised to date) of R127.2 billion. This means that 50% of the project value has been locally procured, exceeding the 45% commitment from IPPs and the thresholds for BW1 – BW4 (25-45%).

To date, the R63.3 billion local content spend reported by active IPPs is already 96% of the R66 billion local content expected. This is with 6 projects still in construction, and 85 of the 91 active projects having reached COD (i.e. 93% of the active portfolio complete). For the 85 projects that have reached COD, local content spend has been R58.72 billion of a committed R58.67 billion, which is 0.1% more than the planned local spend.

***Leveraging employment opportunities***

To date, a total of 63 291 job years[12] have been created for South African citizens, of which 48 110 job years were in construction and 15 182 in operations. These job years should rise further past the planned target as more projects enter the construction phase. Employment opportunities across BW1-4 are 143% of the planned number during the construction phase (i.e. 33 707 job years), with 6 projects still in construction and employing people. The number of employment opportunities is therefore likely to continue to grow beyond the original expectations. By the end of December 2021, 85 projects had successfully completed construction and moved into operation. These projects created 44 172 job years of employment, compared to the anticipated 30 488. This was 45% more than planned.

The report notes that employment thresholds and targets were consistently exceeded across the entire portfolio. The average share of South African citizens of total South Africa based employees for BW1 – BW4 was 91% during construction (against a target of 80%), while it was 96% during operations for BW1 – BW4 (against a target of 80%). The report notes that the construction phase offers a high number of opportunities over shorter durations, while the operations phase requires fewer people, but over an extended operating period.

To date, 48 110 job years for SA citizens were achieved during construction, which is 43% above the planned 33 707 job years for active projects. These job years are expected to rise further since 6 projects are still in construction.

In terms of benefits for local communities, significantly more people from local communities were employed during construction than was initially planned. For active projects, the expectation for local community participation was 13 284 job

[12] The equivalent of a full-time employment opportunity for one person for one year

years. To date 25 272 job years have been realised (i.e. 90% more than initially planned), with 6 projects still in, or entering, construction. The number of black SA citizens employed during construction also exceeded the planned numbers by 74%.

Black South African citizens, youths and rural or local communities have been the major beneficiaries during the construction phases, as they respectively represent 81%, 44% and 48% of total job opportunities created by IPPs to date. However, woman and disabled people could still be significantly empowered as they represent a mere 10% and 0.4% of total jobs created to date, respectively. Nonetheless, the fact that the REIPPPP has raised employment opportunities for black South African citizens and local communities beyond planned targets, indicates the importance of the programme to employment equity and the drive towards more equal societies.

The share of black citizens employed during construction (81%) and the early stages of operations (85%) has significantly exceeded the 50% target and the 30% minimum threshold. Likewise, the share of skilled black citizens (as a percentage of skilled employees) for both construction (71%) and operations (82%) has also exceeded the 30% target and minimum threshold of 18%. The share of local community members as a share of SA-based employees was 48% and 70% for construction and operations respectively – significantly exceeding the minimum threshold of 12% and the target of 20%.

***Socio-economic development (SED) contributions***

An important focus of the REIPPPP is to ensure that the build programme secures sustainable value for the country and enables local communities to benefit directly from the investments attracted into the area. In this regard, IPPs are required to contribute a percentage of projected revenues accrued over the 20-year project operational life toward SED initiatives. These contributions accrue over the 20-year project operation life and are used to invest in housing and infrastructure as well as healthcare, education, and skills development.

The minimum compliance threshold for SED contributions is 1% of the revenue with 1.5% the targeted level over the 20-year project operational life. For the current portfolio of projects, the average commitment level is 2%, which is 101% higher than the minimum threshold level. To date (across BW1-4) a total contribution of R22.8 billion has been committed to SED initiatives. Assuming an even, annual revenue spread, the average contribution per year would be R1.1 billion. Of the total commitment, R18.5 billion is specifically allocated for local communities where the IPPs operate. With every new IPP on the grid, revenues and the respective SED contributions will increase.

As a percentage of revenue, SED obligations become effective only when operations commence, and revenue is generated. Of the 91 IPPs that have reached financial close (BW1–BW4), 85 are operational. The SED contributions associated with these 85 projects has amounted to R 1.8 billion to date.

In terms of ED and SED spend, education, social welfare, and health care initiatives have a SED focus. SED spend on education has been almost double the expenditure on enterprise development. This is despite enterprise development being a stand-alone commitment category in terms of the IA. This is, in part, due to the fact that some early childhood development programmes have also been incorporated in educational programmes. IPPs have supported 1 388 education institutions with a total of R437 million in contributions, from 2015 to the end of June 2021. A total of 1 276 bursaries, amounting to R210.8 million, have been awarded by 67 IPPs from

2015 until the end of June 2021. The largest portion of the bursaries were awarded to African and Coloured students (97.4%), with women and girls receiving 56.3% of total bursaries. The Northern Cape province benefitted most from the bursaries awarded, with 57.2%, followed by the Eastern Cape (20.2%) and Western Cape (14.1%). Enterprise development and social welfare are the focus areas that have received the second highest share of the contributions to date.

***Enterprise development contributions***

The target for IPPs to spend on enterprise development is 0.6% of revenues over the 20- year project operational life. However, for the current portfolio, IPPs have committed an average of 0.63% or 0.03% more than the target. Enterprise development contributions committed for BW1-4, amount to R7.2 billion. Assuming an equal distribution of revenue over the 20-year project operational life, enterprise development contributions would be R358 million per annum. Of the total commitment, R5.6 billion is specifically committed directly within the local communities where the IPPs operate, contributing significantly to local enterprise development. A total contribution of R504.1 million has already been made to the local communities (i.e. 94%of the total R537.9 million enterprise development contributions made to date).

***Contribution to cleaner energy and water savings***

As part of the global commitment, South Africa is targeting an emissions trajectory that peaks at 34% below a "business as usual" case in 2020, 42% below in 2025 and from 2035 declines in absolute terms. The REIPPPP contributes constructively to economic stability, energy security and environmental sustainability.

The emission reductions for the programme during the preceding 12 months (June 2019-June 2020) is calculated as 15.1 million tonnes $CO_2$ ($MtonCO_2$) based on the 14 835 GWh energy that has been generated and supplied to the grid over this period. This represents 75% of the total projected annual emission reductions (20.5 $MtonCO_2$) achieved with only partial operations. A total of 72.1 Mton $CO_2$ equivalent reduction has been realised from programme inception to date.

The March 2019 Report also notes that since operation, the IPPs have saved 42.8 million kilolitres of water related to fossil fuel power generation. This saving will have increased with the increase in energy generated by renewable energy since 2019. The REIPPPP therefore contributes significantly towards meeting South Africa's GHG emission targets and, at the same time, supporting energy security, economic stability, and environmental sustainability.

### 2.4.2 Green Jobs Study

The study notes that South Africa has one of the most carbon-intensive economies in the world, therefore making the greening of the electricity mix a national imperative. Within this context the study notes that the green economy could be an extremely important trigger and lever for enhancing a country's growth potential and redirecting its development trajectory in the 21st century. The attractiveness of wind and solar technologies is not only supported by local conditions, but also by the relatively mature stage of their technological development.

The aim of the Green Jobs study was to provide information on the net direct job creation anticipated to emerge in the formal economy across a wide range of technologies/activities that may be classified as green or contributing to the greening of the economy. The study looked at the employment potential for a number of green sectors, including power generation, over three consecutive

timeframes, namely, the short term (2011 – 12), medium term (2013 – 17) and long term (2018 – 25). The analysis attempts to estimate the employment potential associated with: building, construction and installation activities; operations and maintenance services; as well as the possible localisation spin-offs for the manufacturing sector as the domestic production of equipment, parts and components benefits from preferential local procurement.

It is also worth noting that the study only considered direct jobs in the formal economy. Multiplier effects were not taken into account. As a result, the analysis only captures a portion of the potential employment impact of a greening economy. International studies have indicated that there are considerable backward and forward linkages through various value chains of production, as well as of indirect and induced employment effects. The employment figures can therefore be regarded as conservative.

The analysis reveals the potential of an unfolding green economy to lead to the creation of approximately 98 000 new direct jobs, on average, in the short term, almost 255 000 in the medium term and around 462 000 employment opportunities in the formal economy in the long term. The number of jobs linked to the power generation was estimated to be ~ 12 500 in the short term, 57 500 in the medium term and 130 000 in the long term. Power generation jobs therefore account for 28% of the employment opportunities created in the long term. However, the report notes that the contribution made by a progressively expanding green energy generation segment increases from 14% of the total in the short term, or just over 13 500 jobs, to more than 28% in the long term (166 400) (Table 2.3). The study also found that energy generation is expected to become an increasingly important contributor to green job creation over time, as projects are constructed or commissioned.

**Table 2.3: Net direct employment potential estimated for the four broad types of activity and their respective segments in the long term, and an indication of the roll-out over the three timeframes**

| Broad green economy category | | Segment | Technology/product | Total net direct employment potential in the long-term | Net direct manufacturing employment potential in the long-term | Total net direct employment potential (ST, MT, LT) | Net direct manufacturing employment potential (ST, MT, LT) |
|---|---|---|---|---|---|---|---|
| ENERGY GENERATION | Renewable (non-fuel) electricity | Wind power | Onshore wind power | 5 156 | 2 105 | VL, L, M | L, M, H |
| | | | Offshore wind power | | | | |
| | | Solar power | Concentrated solar power | 3 014 | 608 | N, VL, M | N, VL, M |
| | | | Photovoltaic power | 13 541 | 8 463 | M, H, H | H, VH, VH |
| | | Marine power | Marine power | 197 | 0 | N, N, VL | N, N, N |
| | | Hydro power | Large hydro power | 272 | 111 | VL, VL, VL | VL, M, VL |
| | | | Micro-/small-hydro power | 100 | 0 | VL, VL, VL | N, N, N |
| | Fuel-based renewable electricity | Waste-to-energy | Landfills | 1 178 | 180 | VL, VL, L | VL, VL, L |
| | | | Biomass combustion | 37 270 | 154 | VL, H, VH | VL, VL, L |
| | | | Anaerobic digestion | 1 429 | 591 | VL, VL, L | VL, L, M |
| | | | Pyrolysis/Gasification | 4 348 | 2 663 | VL, L, M | VL, H, H |
| | | | Co-generation | 10 789 | 1 050 | L, M, H | M, H, H |
| | Liquid fuel | Bio-fuels | Bio-ethanol | 52 729 | 6 641 | M, H, VH | L, H, VH |
| | | | Bio-diesel | | | | |
| ENERGY GENERATION SUB-TOTAL | | | | **130 023** | **22 566** | | |
| ENERGY & RESOURCE EFFICIENCY | | Green buildings | Insulation, lighting, windows | 7 340 | 838 | L, M, M | L, M, M |
| | | | Solar water heaters | 17 621 | 1 225 | L, H, H | L, M, H |
| | | | Rain water harvesting | 1 275 | 181 | VL, VL, L | VL, VL, L |
| | | Transportation | Bus Rapid Transport | 41 641 | 350 | VH, VH, VH | H, M, L |
| | | Industrial | Energy efficient motors | -566 | 4 | VL, VL, VL | VL, VL, VL |
| | | | Mechanical insulation | 666 | 89 | VL, VL, VL | VL, VL, VL |
| ENERGY & RESOURCE EFFICIENCY SUB-TOTAL | | | | **67 977** | **2 686** | | |
| EMMISIONS AND POLLUTION MITIGATION | | Pollution control | Air pollution control | 900 | 166 | N, VL, VL | N, L, L |
| | | | Electrical vehicles | 11 428 | 10 642 | VL, L, H | N, H, VH |
| | | | Clean stoves | 2 783 | 973 | VL, VL, L | VL, L, M |
| | | | Acid mine water treatment | 361 | 0 | VL, VL, VL | N, N, N |
| | | Carbon Capture and Storage | | 251 | 0 | N, VL, VL | N, N, N |
| | | Recycling | | 15 918 | 9 016 | M, H, H | H, VH, VH |
| EMMISIONS AND POLLUTION MITIGATION SUB-TOTAL | | | | **31 641** | **20 797** | | |
| NATURAL RESOURCE MANAGEMENT | | Biodiversity conservation & eco-system restoration | | 121 553 | 0 | H, VH, VH | N, N, N |
| | | Soil & land management | | 111 373 | 0 | VH, VH, VH | N, N, N |
| NATURAL RESOURCE MANAGEMENT SUB-TOTAL | | | | **232 926** | **0** | | |
| TOTAL | | | | **462 567** | **46 049** | | |

*(Source: Green Jobs Study, 2011)*

Notes:

- VH = very high (total employment potential > 20 000 direct jobs; manufacturing employment potential > 3 000 direct jobs);
- H = high (total employment potential > 8 000 but < 20 000; manufacturing employment potential > 1 000 but < 3 000);
- M = medium (total employment potential > 3 000 but < 8 000; manufacturing employment potential > 500 but < 1 000);
- L = low (total employment potential > 1 000 but < 3 000; manufacturing employment potential > 150 but < 500);
- VL = very low (total employment potential > 0 but < 1 000; manufacturing employment potential > 0 but < 150);
- N = negligible/none (total employment potential = 0; manufacturing employment potential = 0).

Of relevance the study also notes that the largest gains are likely to be associated with operations and maintenance (O&M) activities, particularly those involved in the various natural resource management initiatives. In this regard, operations and maintenance employment linked to renewable energy generation plants will also be substantial in the longer term. The employment growth momentum related to building, construction and installation activities peaks in the medium term, largely propelled by mass transportation infrastructure, stabilising thereafter as green building methods become progressively entrenched.

In addition, as projects related to a greening economy are progressively commissioned, the potential for local manufacturing also become increasingly viable. Employment gains in manufacturing are also expected to be relatively more stable than construction activities, since the sector should continue exhibiting growth potential as new and replacement components are produced, as additional markets are penetrated and as new green technologies are introduced. Manufacturing segments with high employment potential in the long term would include suppliers of components for wind and solar farms. The study does note that a shortage of skills in certain professional fields pertinent to renewable energy generation presents a challenge that must be overcome.

The study also identifies a number of advantages associated with renewable energy with a large 'technical' generation potential. In this regard, renewable energy, such as solar and wind, does not emit carbon dioxide ($CO_2$) in generating electricity and is associated with exceptionally low lifecycle emissions. The construction period for renewable energy projects is much shorter than those of conventional power stations, while an income stream may, in certain instances, be provided to local communities through employment and land rental. The study also notes that the greenhouse gases (GHG) associated with the construction phase are offset within a short period of time compared with the project's lifespan. Renewable power therefore provides an ideal means for reaching emission reduction targets in a relatively easy manner. In addition, and of specific relevance to South Africa, renewable energy source is not dependent on water (as compared to the massive water requirements of conventional power stations), has a limited footprint and therefore does not impact on large tracts of land, poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.

Of relevance, the study also notes that renewable energy projects in rural areas create an opportunity to benefit the local and regional economy through the creation of jobs and tax revenues.

### 2.4.3 Powering the Future: Renewable Energy Roll-out in South Africa

The study notes that South Africa has higher $CO_2$ emissions per GDPppp (2002 figures) from energy and cement production than China or the USA (Letete, T et al, n.d.). Energy accounts for 83% of the total GHG emissions (excluding land use, land use change and forestry) with fuel combustion in the energy industry accounting for 65% of the energy emissions of South Africa (DEA, 2011).

Within a broader context of climate change, coal energy does not only have environmental impacts, it also has socio-economic impacts. Acid mine drainage from abandoned mines in South Africa impacts on water quality and poses the biggest threat to the country's limited water resources. Huge volumes of water are also required to wash coal and cool operating power stations. Eskom uses an estimated 10 000 litres of water per second due to its dependency on coal (Greenpeace, 2012).

The report notes that the concerns relating to whether South Africa can afford renewable energy arise out of the perception that renewable energy (RE) is expensive while fossil and nuclear technologies are cheap. The premise also ignores life cycle costing of the technologies which is favourable to renewable technologies where the sources of fuel are free or cheap.

### 2.4.4 WWF SA Renewable Energy Vision 2030

In its vision the WWF motivated for a more ambitious plan, suggesting that the IRP should provide for an 11-19% share of electricity capacity by 2030, depending on the country's growth rate over the next fifteen years. The vision is to increase renewable energy at the expense of new coal-fired and nuclear capacity. The report notes that in addition to the obvious environmental benefits of this scenario, it will enable South Africa to add flexibility to energy supply capacity on an on-demand basis.

The report notes that REIPPPP introduced in 2011, has by all accounts been highly successful in quickly and efficiently delivering clean energy to the grid. Increasingly competitive bidding rounds have led to substantial price reductions. In this regard, the study indicates that in three years, wind and solar PV have reached pricing parity with supply from new coal-fired power stations from a levelised cost of electricity (LCOE) perspective.

In bidding window 3 of August 2013, the average tariffs bid for wind and solar PV were R0,66/kWh and R0.88/kWh respectively, well below the recent estimates of R1.05/kWh for supply from the coal-fired Medupi and Kusile power stations (Papapetrou 2014).

The report also notes that the REIPPPP has several contracting rounds for new renewables supply. A robust procurement process, extension of a 20-year sovereign guarantee on the power purchase agreement (PPA) and, especially, ideal solar power conditions, have driven the investment case for RE in South Africa. In this regard, South Africa has been identified as one of the worlds' leading clean energy investment destinations (Figure 2.5).

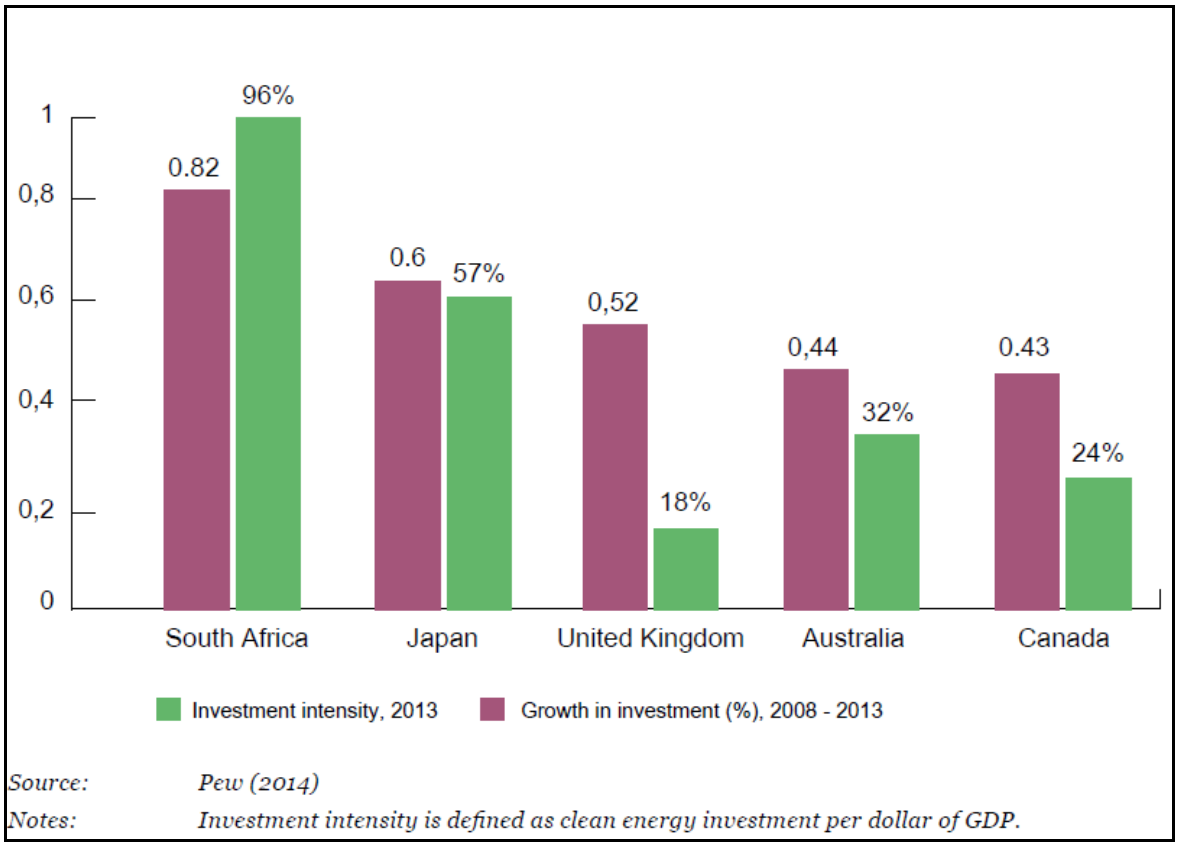



**Figure 2.5: South Africa leads as a clean energy investment destination**

The WWF study considers a low and high growth renewable energy scenario. The capital requirements for the low growth scenario are estimated at R474 billion over the period 2014-2030 (2014 Rand value), rising to R1.084 trillion in the high-growth scenario, in which 35 GW of capacity is built. Each annual round of purchasing 2 200 MW of RE capacity would cost approximately R77 billion in 2014 Rand value terms. In relative economic terms, this equates to 2% of the GDP per annum or approximately one quarter of Government's planned annual investment in infrastructure over the medium term. In the low economic growth scenario, which is arguably the more realistic one, the average annual new liability over the period is approximately R40 billion.

The study also points out that infrastructure spend is more beneficial than other government expenditure due to the infrastructure multiplier effect. This refers to the beneficial impact of infrastructure on economic growth in both the short term, resulting from expansion in aggregate demand, as well as in the longer term (six to eight years) due to enhanced productive capacity in the economy. A recent USA study on highway expenditure revealed the infrastructure multiplier to be a factor of two on average, and greater during economic downturns (Leduc & Wilson 2013). This means that one dollar spent on infrastructure raises GDP by two dollars. If the same were to hold true, as similar analysis suggests it would (Kumo 2012, Ngandu et al 2010), this indicates that the construction of renewable energy plants could be a valuable economic growth driver at a time when fears of recession abound.

The report concludes that the WWF is optimistic that South Africa can achieve a much more promising clean energy future than current plans allow for. With an

excellent solar resource and several good wind-producing pockets, the country is an ideal candidate for a renewable energy revolution.

The report indicates that the levelised cost of producing renewable energy already competes favourably with the three main alternatives, namely coal, gas and nuclear. In addition, renewable energy would contribute to a more climate-resilient future and insulate South Africa from dependence on expensive and unreliable fuel sources priced in dollars. Critical from a planning perspective, the report notes that renewable energy can also provide added flexibly on an 'as needed' basis, as electricity demand grows. This is vital in a highly uncertain environment.

### 2.4.5 The impact of the green economy on jobs in South Africa

The paper notes that greening the economy is particularly important in South Africa for two basic reasons: (1) the exceptional level of unemployment that the country is experiencing and (2) the high carbon impact of the economy.

In terms of employment, the paper refers to the IDC *Green Jobs R*eport (2011). In summary, the short-term (next 2 years)[13] estimate of total net employment potential is 98 000 jobs, and the long-term (next 8 years) employment potential is 462 567 jobs. Natural resource management is predicted to lead to the greatest number of these at 232 926 long-term jobs. Green energy generation is estimated to produce 130 023 long-term jobs, with energy and resource efficiency measures adding another 67 977 long-term jobs.

The paper notes that the Green Jobs Report was prepared by seventeen primary researchers from three prominent organisations, namely the IDC, the Development Bank of South Africa, and Trade and Industrial Policy Strategies. Many role players from other organisations were also consulted, including the World Wide Fund for Nature, the Green Building Council, the Economic Development Department and private companies involved in green industries.

Despite questions surrounding the employment estimates contained in the Green Jobs Report, green economic activity does appear to generate more local jobs than fossil-fuel-based industries. Some of the estimates also indicate the potential for significant employment. The paper concludes that the figures represent a promising starting point that warrants further research and policy involvement in greening the economy in South Africa.

### 2.4.6 The potential for local community benefits

In her thesis, Tait[14] notes that the distributed nature of renewable energy generation can induce a more geographically dispersed pattern of development. As a result, RE sites can be highly suited to rural locations with otherwise poor potential to attract local inward investment therefore enabling to target particularly vulnerable areas.

In her conclusion, Tait notes that the thesis has found positive evidence for the establishment of community benefit schemes in the wind sector in South Africa. These benefits would also apply to solar projects. The BBBEE requirements for

[13] Note, the Green Jobs study was prepared in 2011 and therefore predates the REIPPPP.
[14] The potential for local community benefits from wind farms in South Africa, Louise Tait (2012), Master's Thesis, Energy Research Centre University of Cape Town. Similar benefits are also likely to be associated with solar energy projects.

developers as set out in the DoE's IPPPP for renewables is the primary driver for such schemes. The procurement programme, in keeping with the objective of maximising the economic development potential from this new sector, includes a specific focus on local communities in which wind farms are located.

The procurement programme, typical of all Government tendering processes, includes a BBBEE scorecard on which renewable energy projects are evaluated. However, the renewables scorecard appears to play an important part in a renewed focus on the broad-based Aspects of the legislation, as enforced by a recent national review of the BBBEE Act. In this regard, the renewables scorecard includes specifications for local communities in respect of broad-based ownership schemes, socio--economic development and enterprise development contributions. This approach to legislating social responsibilities of business in all sectors definitely has a South African flavour, borne out of the political history of the country and the imperatives for social transformation laid out in the constitution.

While Tait notes that it is still early days for the development of this sector and one cannot determine the impact that such benefit schemes may have, it is clear though that targeted development expenditure will be directed to multiple rural communities and there seems to be a strong potential to deliver socio-economic benefits.

# SECTION 3: OVERVIEW OF STUDY AREA

## 3.1 INTRODUCTION

Section 3 provides a baseline description of the study area with regard to:

- The administrative context.
- Provincial context.
- Overview of district and local municipalities.
- Site and the surrounding land uses.

## 3.2 ADMINISTRATIVE CONTEXT

The study area is located within the Renosterberg Local Municipality (RLM), which falls within the Pixley ka Seme District Municipality (PKSDM) in the Northern Cape Province (Figure 3.1). The PKSDM is made up of eight category B local municipalities which include Emthanjeni, Kareeberg, Thembelihle, Renosterberg, Siyathemba, Ubuntu, Siyancuma and Umsobomvu municipalities. De Aar is the administrative seat of the PKSDM. The administrative seat of the RLM is Petrusville.


*Source: SA municipalities website*

**Figure 3.1: Location of the Renosterberg Local Municipality within the Pixley Ka Seme District Municipality**

## 3.3 PROVINCIAL CONTEXT[15]

The proposed site located in the Northern Cape Province, which is the largest province in South Africa and covers an area of 361 830 km$^2$ and, constitutes approximately 30% of South Africa. The province is divided into five district municipalities (DM), namely, Frances Baard, Karoo, Namakwa, Pixley Ka Seme and ZF Mgcawu District Municipality (known before 1 July 2013 as Siyanda DM). The site itself is located in the Pixley Ka Seme DM.

***Population***
Despite having the largest surface area, the Northern Cape has the smallest population of 1 193 780 (Community Household Survey, 2016) or 2.2% of the population of South Africa. Of the five districts, Frances Baard has the largest population (32.5%), followed by ZF Mgcawu District Municipality (21.2%), John Taolo Gaetsewe (20.3%), Pixley ka Seme (16.4%) and Namakwa (9.7%). The majority of the population in the Northern Cape Province are Black African (48.1%), followed by Coloureds (43.7%) and Whites (7.7%).

In terms of age, 36.5% of the Northern Cape population is between 15 and 34 years old, which is the highest age distribution, followed by 29.2% of those aged 35–64 years, while only 6.6% comprised those aged 65 years and older. Similarly, this pattern is also seen across all districts in the province. The district profile shows that the highest proportions of persons aged 15–34 years were recorded in Pixley Ka Seme, ZF Mgcawu and John Taolo Gaetsewe districts. The figures for these three districts were also above the provincial average of 36.5%. The proportion of persons aged 65 years and older was higher in Namakwa (9.5%) and Frances Baard (8.2%).

***Education***
Based on the information contained in the NCPSDF the average adult education attainment levels in the Northern Cape are lower than the adult education attainment levels of South Africa as a whole. Approximately 19.7% of the Northern Cape adults have no schooling in comparison to South Africa's 18.1%. The Northern Cape has the second lowest percentage of adult individuals (5.5%) that obtained a tertiary education in South Africa. The LED Strategy for the Northern Cape indicates that Pixley ka Seme has the lowest adult education attainment levels in the Northern Cape with 27.3% of the adult population having no form of schooling, whilst John Taolo Gaetsewe is second with 25.4% having no schooling. The highest number of the adult population with tertiary education (6.4%) is located in Frances Baard.

The Northern Cape also has the smallest portion (11.1%) of highly skilled formal employees in South Africa, while Gauteng has the highest (14.3%). Linked to this the Northern Cape has the second largest portion of semi and unskilled formal employees in the country. A lack of skilled people often results in both the public and the private sector being unable to implement planned growth strategies and achieve the desired productivity, service delivery and service quality (NCSDF, 2012).

[15] The information in this section is based on the Northern Cape Provincial Growth and Development Strategy 2004-2014. This document does not include 2011 Census Data. Where possible data from the 2011 Census and 2016 Community Household Survey has been used to update the information.

***Economic development***

Over the past 8 years there has been little to no variance in the Human Development Index (HDI) figures for the Northern Cape, indicating no increase or decrease in the overall standard of living[16]. This trend is unlikely to change in the foreseeable future, mainly due to the marginal economic base of the poorer areas, and the consolidation of the economic base in the relatively better-off areas. It is important to note that the HDI for the Northern Cape (0.55) is substantially below the South African figure of 0.72. The HDI of 0.55 displays a pattern of semi-development, and there is a definite inequality between the different population groups, with the Whites having a higher development lifestyle than the African or Coloured groups.

The percentage of Northern Cape people living below the poverty line has decreased from 40% in 1995 to 27% in 2011, while the poverty gap has decreased from 11% in 1995 to 8% in 2011 (Figure 3.2). The goal set by the province is to decrease the percentage of people living below the poverty line to 20% by 2015 (NCSDF, 2012). The alleviation of poverty is one of the key challenges for economic development. Higher levels of economic growth are a key challenge for poverty eradication. Investment in people is pivotal to the eradication of poverty and inequality. Investment in people is also, to a large extent, about delivering social and economic infrastructure for education, welfare, health, housing, as well as transport and bulk infrastructure.

[16] The Human Development Index (HDI) was developed by the United Nations Development Programme (UNDP) based on the philosophy that the goal of development was to ensure that individuals live long, informed and comfortable lives. The HDI consists of three components: Longevity, which is measured by life expectancy at birth; Educational attainment, which is measured by two education variables, namely adult literacy and combined gross primary, secondary and tertiary enrolment ratio, and; Income, which is measured by gross domestic product (GDP) per capita. Performance in each dimension is expressed as a value between 0 and 1, and the HDI index gives an internationally accepted measure of the wellness (quality of life) of the population of the area under consideration. The closer the HDI is to 1.0, the higher the level of "living condition". For example, Sweden has an index of 0.91 defined as high, South Africa at 0.72 is defined as middle and Lesotho at 0.47 is defined as low.

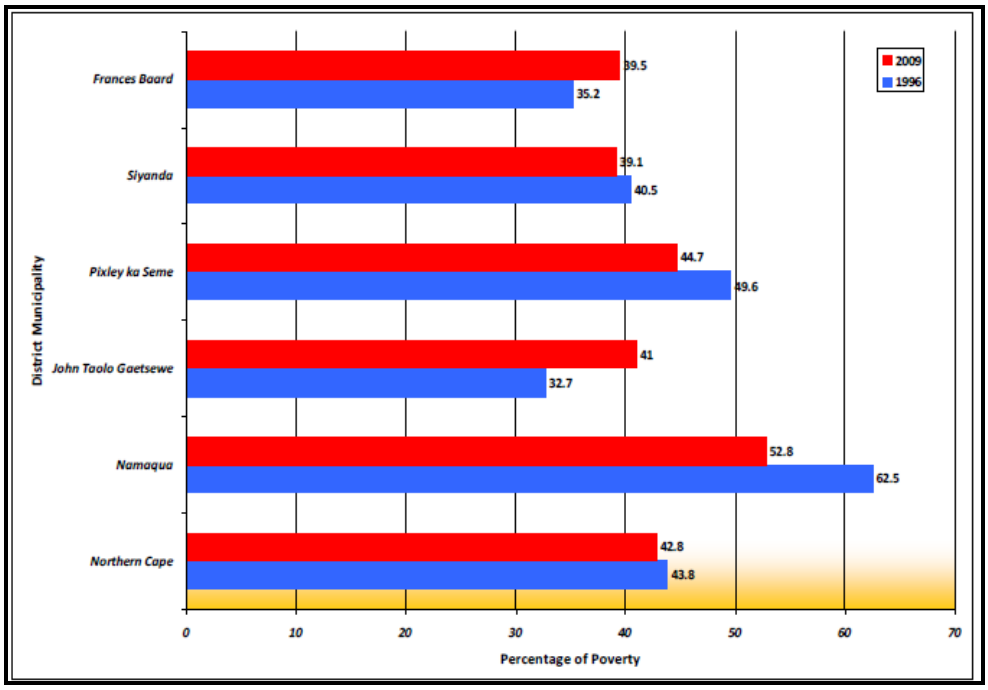



**Figure 3.2: Percentage of people living in poverty in the Northern Cape (Source: Global Insight, 2009 as cited in the PGDS, July 2011)[17].**

In terms of per capita income, the Northern Cape Province has the third highest per capita income of all nine provinces, however, income distribution is extremely skewed, with a high percentage of the population living in extreme poverty. The measure used in the PGDS document to measure poverty is the percentage of people living below the poverty line or breadline is used[18].

***Economic sectors***

The Northern Cape economy has shown significant recovery since 2000/2001 when it had a negative economic growth rate of -1.5% (LED Strategy). The provincial economy reached a peak of 3.7% in 2003/2004 and remained the lowest of all provinces. The Northern Cape is the smallest contributing province to South Africa's economy (only 2% to South Africa GDP per region in 2007).

The mining sector is the largest contributor to the provincial GDP, contributing 28.9% to the GDP in 2002 and 27.6% in 2008. The mining sector is also important at a national level. In this regard, the Northern Cape produces approximately 37% of South Africa's diamond output, 44% of its zinc, 70% of its silver, 84% of its iron-ore, 93% of its lead and 99% if its manganese.

Agriculture and agri-processing sectors are also key economic sectors. Approximately 2% of the province is used for crop farming, mainly under irrigation in the Orange River Valley and Vaalharts Irrigation Scheme. Approximately 96% of the land is used for stock farming, including beef cattle and sheep or goats, as well as game farming. The agricultural sector contributed 5.8% to the Northern Cape

[17] Siyanda DM is now called the ZF Mgcawu DM.

[18] In terms of the poverty line, a person is considered poor if his or her consumption or income level falls below some minimum level necessary to meet basic needs. The minimum level is usually called the poverty line. In South Africa the poverty income level is set at R800/month for an individual or R 3 200 per month for a household of four.

GDP per region in 2007 which was approximately R1.3 billion, and it employs approximately 19.5% of the total formally employed individuals (NCSDF, 2012). The sector is experiencing significant growth in value-added activities, including game-farming. Food production and processing for the local and export market is also growing significantly.

The main agricultural produce of the Northern Cape include:

- High-value horticultural products such as table grapes, sultanas and wine grapes, dates, nuts, cotton, fodder, and cereal crops are grown along the Orange River.
- Wheat, fruit, groundnuts, maize, and cotton in the Vaalharts irrigation scheme in the vicinity of Hartswater and Jan Kempdorp.
- Vegetables and cereal crops at the confluence of the Vaal River and the Orange Rivers in the vicinity of Douglas.
- Wool, mohair, karakul, Karoo lamb, ostrich meat and leather, and venison throughout most of the province.

Economic development in the Northern Cape is hampered by the vastness of the area and the remoteness of its communities in rural areas. Development is also hampered by the low education and skills levels in the province. As a result, unemployment in the Northern Cape presents a major challenge.

***Employment***

According to Statistics South Africa Labour (2012) the community and social services sector is the largest employer in the province at 29%, followed by the agricultural sector (16.5%), wholesale and retail trade (14%), finance (8%), manufacturing (6%) and mining (6%), etc. (Figure 3.3).

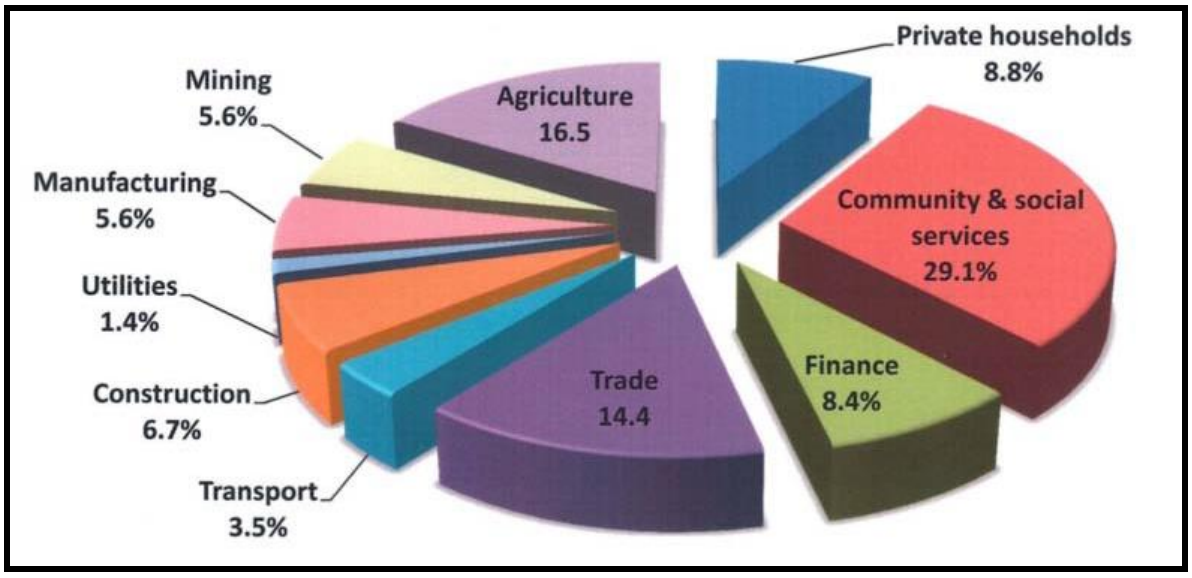



**Figure 3.3: Employment by Economic Sector and Industry (Source: Statistics South Africa 2012).**

## 3.4 MUNICIPAL OVERVIEW

***Population***

The population of the RLM in 2016 was 11 818. The RLM is therefore a sparsely populated municipality. Of this total, 37% were under the age of 18, 56.8% were between 18 and 64, and the remaining 6.1% were 65 and older. The RLM therefore has a relatively large young population. This creates challenges in terms of creating employment opportunities. In terms of race groups, Coloureds made up 57% of the population, followed by Black Africans (32.8%) and Whites (9.8%). The main first language spoken in the RLM was Afrikaans (69.9%), followed by IsiXhosa (26.3%) and Sesotho (1%).

The high percentage of young people in the RLM means that a large percentage of the population is dependent on a smaller productive sector. The dependency ratio is the ratio of non-economically active dependents (usually people younger than 15 or older than 64) to the working age population group (15-64). The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates reduced revenue for local authorities to meet the growing demand for services. The national dependency ratio in 2011 was 52.7%, similar to that of the Northern Cape Province (55.7%). The dependency ratio for the RLM (2011) was 64%. The traditional approach is based on people younger than 15 or older than 64. The 2016 information provides information for the age group under 18. The total number of people falling within this age group will therefore be higher than the 0-15 age group. However, most people between the age of 15 and 17 are not economically active (i.e., they are likely to be at school).

Using information on people under the age of 18 is therefore likely to represent a more accurate reflection of the dependency ratio. Based on these figures, the dependency ratio for the RLM in 2016 was 75.8%. This figure is significantly higher than the national and provincial levels in 2011 (52.7% and 55.7% respectively). The higher dependency ratio reflects the limited employment opportunities in the area and represent a significant risk to the district and local municipality. The high dependency ratio also highlights the importance to maximising local employment opportunities and the key role played by training and skills development programmes.

***Households and house types***

Based on the information from the 2016 Community Survey there were a total of 3 563 households in the RLM. Most of the households reside in formal houses (71.4%). The figure for the RLM is lower than the district (78.1%) and Provincial (74.4%) figures. Approximately 14.7% of the households in the RLM reside in shacks and 7.5% in backyard flats. A relatively high percentage of the households therefore live in informal structures.

Based on the information from the 2016 Community Household Survey 34.4% of the households in the RLM are headed by females. The figure for RLM was lower than the District and Provincial figures of 37% and 39% respectively. The high number of female-headed households at the local municipal reflects the lack on formal employment and economic opportunities in the RLM. As a result, job seekers from the RLM need to leave the areas to seek work in the larger centres. The majority of the job seekers are likely to be males. This is due to traditional rural patriarchal societies where the role of the women is usually linked to maintaining

the house and raising the children, while the men tend to be the ones that migrate to other areas in search of employment.

***Household income***

Based on the data from the 2011 Census, 11.7% of the population of the RLM had no formal income, 3.8% earned less than R4 800, 6.3% earned between R5 000 and R10 000 per annum, 23.8% between R10 000 and R20 000 per annum and 23.4% between R20 000 and R40 000 per annum (2011). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ R40 000 per annum). Based on this measure, in the region of 70% of the households in the RLM live close to or below the poverty line. This figure is higher than the provincial level of 62.9%. The low-income levels reflect the limited employment opportunities in the area and dependence on the agricultural sector. This is also reflected in the high unemployment rates.

The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the RLM. This in turn impacts on the ability of the RLM to maintain and provide services.

***Employment***

The official unemployment figure in 2011 for the RLM was 14.3%. The figures also indicate that the majority of the population are not economically active, namely 41.8%. These figures are similar to the official unemployment rate for the Northern Cape Province (14.5%) and Pixley ka Seme District (14.8%). This reflects the limited employment opportunities in the area, which in turn are reflected in the low income and high poverty levels. Unemployment Rate in South Africa averaged 26.32% from 2000 until 2021, reaching an all-time high of 34.90 % in the third quarter of 2021 (StatSA). Even more concerning, the Youth Unemployment Rate in South Africa averaged 54.21% from 2013 until 2021, reaching an all-time high of 64.40 % in the second quarter of 2021. The current rates in the RLM are therefore likely to be significantly higher than the 2011 rates. These rates will also have been exacerbated by the impact of COVID-19 pandemic.

***Education***

In terms of education levels, the percentage of the population over 20 years of age in the RLM with no schooling was 11.2% in 2011, compared to 7.9% for the Northern Cape Province and 11.9% for the district. The percentage of the population over the age of 20 with matric was 33.6%, which was significantly higher that the provincial and district figures of 29.1% and 25.3% respectively. Only 1.4% and 2% of the population over the age of 20 years in the RLM had an undergraduate and postgraduate qualification, respectively. Despite the higher matric qualification rate, the relatively poor education levels in the RLM pose potential challenge for economic development.

## 3.5 MUNICIPAL SERVICES

***Access to electricity***
Based on the information from the 2016 Community Survey 91.6% of households in the RLM had access to electricity. Of this total 65.6% had inhouse prepaid meters and 24.2% have conventional in-house meters.

***Access to water***
Based on the information from the 2016 Community Survey 91.9% of households were supplied by a regional or local service provider, while 7.5% relied on their own supply, which reflects the rural nature of the municipality. The provincial and district figures for water provided by a service provider were 88.6% and 90.7% respectively.

***Sanitation***
Based on the information from the 2016 Community Survey, 89.8% of households have access to flush toilets, while 7.4% had not access to access to toilet facilities. The figures in terms of access to flush toilets are higher than provincial (71.4%) and District (82.8%) figures. For Ward 6, 72.7% of households had access to flush toilets and 7.2% had no access to toilets. Approximately 16% relied on pit latrines.

***Refuse collection***
Based on the information from the 2016 Community Survey, 54.7% of households have their refuse collected on a regular basis by a local authority or private company, while 25.2% relied on communal dumps, 8.1% use their own dumps, and 9.4% are not serviced. The provincial and district figures for refuse collection provided by a service provider on a regular basis were 64.9% and 78.1% respectively. The figures for the RLM are therefore lower that the district and provincial service levels.

## 3.6 HEALTH AND COMMUNITY FACILITIES

The PKSDM is served by 3 District Hospitals, 8 Community Health Centres, 28 Primary Health Care Clinics, 4 satellite clinics and 1 mobile clinic, distributed over the district. The RLM has 1 District Hospital and 6 Primary Health Care clinics. There are no community health centres within RLM that provide a 24hour service. A new hospital was built in De Aar and was opened in 2017. The Central Karoo Hospital serves as the referral hospital for the district. Minor operations are performed at the facility. Specialists visit the district on a monthly basis from Kimberley Hospital Complex. In terms of education the RLM has 16 schools of which 13 are no-fee schools. The RLM also has libraries.

## 3.7 ECONOMIC OVERVIEW

***Agriculture***
Agriculture is the key economic sector in the PKSDM and RLM. Many of the towns within the district municipal area function mainly as agricultural service centres, with the level of services provided at the centres to a large extent reliable on the intensity of the farming practices in the surrounding area. Despite the largely semi-arid and arid environment in the district, the fertile land that lies alongside the Orange, Vaal and Riet Rivers supports the production of some of the country's finest quality agricultural products, including grapes and vegetables. The main livestock farming in the region include cattle, sheep, and goat farming. Game

breeding has also been identified as one of the opportunities which could be linked with the tourism sector for Game reserves and hunting activities. However, despite the key role played by agriculture there is limited value adding to the farming products within the district and the area is prone to droughts and climate change.

***Mining***
The main deposits in Pixley ka Seme include alluvial diamond mining along the Orange River and various semi-precious stones, such as tiger-eye and zinc deposits. The region also has various saltpans for the potential of salt production. Uranium deposits also occur in the district.

***Tourism***
The tourism sector in the district contributes 15.6% to the provincial gross value added (GVA). The municipalities Emthanjeni, Kareeberg, Umsobomvu and Siyancuma municipalities are the biggest contributors to the provincial gross value added (GVA). The PKSDM IDP notes that the tourism opportunities in the district will increase due to the Karoo Array Telescope (KAT), a project being driven at a national level. Of relevance, the PKSDM notes that care needs to be taken with developments that have the potential to negatively impact on the Karoo landscapes.

***Renewable energy***
Of key relevance the PKSDM IDP identifies renewable energy as key economic sector and refers to the substantial socio-economic development (SED) and enterprise development (ED) contributions leveraged by the IPPPP commitments. The IDP notes that the towns of Prieska and Carnarvon have in recent years changed character from small rural towns to potentially regional hubs as a result of investments in renewable energy generation and the Square Kilometre Array (SKA) radio telescope project, respectively.

## 3.8 OVERVIEW OF STUDY AREA

### 3.8.1 General context

The Kudu 11 PV project is one of 12 Kudu PV projects being concurrently proposed (separate applications) and is located approximately 30 km[19] northwest and 27 km southeast of the small towns of Philipstown and Petrusville respectively in the south-eastern Northern Cape Province (NCP) (Figure 3.4). Petrusville and Philipstown are the largest towns in the Renosterberg Local Municipality (RLM). De Aar (Emthanjeni LM) , located approximately 50 km to the south west the site, is the nearest large town. The nearest higher order service centres are Kimberley (~170 km to the north-northeast) and Bloemfontein (~220 km to the northeast).

[19] All distances linear.

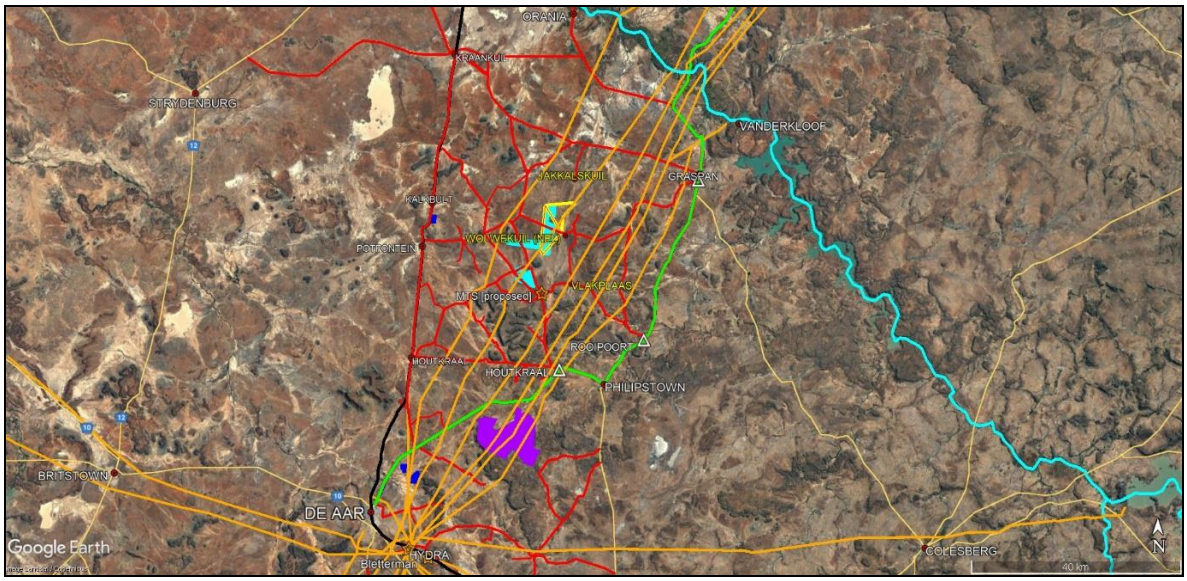



**Figure 3.4: Kudu 11 PV site properties (yellow outlines) in relation to other proposed Kudu 1-12 PV sites (light blue fill), settlements, provincial boundaries (light blue lines), existing transmission lines (orange), the R48 (green) and study area gravel road network (red), railway line (black) and operational REFs (dark blue fill).**

The study area (approximately 8 150 hectares (ha)) for all the proposed Kudu Solar Facilities is the full extent of the eight affected farm properties on which the proposed PV Facilities are planned to be constructed. These farm properties are listed below, along with the associated Surveyor General (SG) Codes:

- Remaining Extent of the Farm Bas Berg No. 88 (C05700000000008800000).
- Remaining Extent of Portion 3 of the Farm Bas Berg No. 88 (C05700000000008800003).
- Portion 4 (Portion of Portion 3) of the Farm Bas Berg No. 88 (C05700000000008800004).
- Remaining Extent of Portion 2 (Middel Plaats) (a Portion of Portion 1) of the Farm Grasspan No. 40 (C05700000000004000002).
- Remaining Extent of the Farm Annex Wolve Kuil No. 41 (C05700000000004100000).
- Portion 1 (Wolve Kuil West) of the Farm Annex Wolve Kuil No. 41 (C05700000000004100001).
- Portion 2 of the Farm Wolve Kuil No. 43 (C05700000000004300002).
- Remaining Extent of the Farm Wolve Kuilen No. 42 (C05700000000004200000).

Note that the farm names listed above are extracted from the title deeds, and that all reference to these farm portions throughout this report refer to it as such

The study area is primarily accessed off the R48 via a network of intersecting public gravel roads. The R48 links Petrusville to De Aar via Philipstown. The road currently carries significant ore truck traffic and stretches of the road are in a poor condition. The key intersecting public gravel roads providing access to the study area (from north to south) are the Graspan-, Rooipoort- and Houtkraal Roads (Photograph 3.1). The relevant roads are connected by a network of further gravel roads. Many properties are accessible (albeit via detours) by more than on road.


**Photograph 3.1: Intersection of R48 (Petrusville road) and Rooipoort public gravel road.**

The study area is located on the Great Escarpment in the arid Central Karoo region. Annual rainfall is around 300 mm, and the area is prone to droughts. The landscape is general flat, punctuated by small ranges of koppies and low mountains (Photograph 3.2). The veld consists of karroid scrub on plains and shrubland on the slopes of koppies. The scrub is characterized by the predominance of grasses in good rainfall years, increasing the risk of veld fires. The landscape is essentially treeless, with trees confined to ephemeral drainage courses and farmyards.

**Photograph 3.2: Veld on Basberg to the south of the site.**

The study area properties are used primarily for farming livestock, predominantly sheep (Photograph 3.3). The area is a wool farming area. Carrying capacities are modest, around 3 ha per sheep.[20] Most operations rely on networks of boreholes and watering points. No significant cropping activities are associated with the study area, although a few livestock operations grow modest quantities of irrigated fodder for own use. Economic farming units in the study area are large, typically consisting of several properties. Some farmers lease additional land. The study area settlement is consequently sparse, and mainly concentrated on a few base farms, typically near public roads. Labourers typically live on the base properties. Caretaker staff reside on a few secondary properties. Farmsteads and labourers' houses on several properties have become redundant and are no longer inhabited.

[20] https://gis.elsenburg.com/apps/cfm/#

**Photograph 3.3: Sheep and Black wildebeest on Wolwekuil (42/1)**

Game occurs on most study area properties. Several properties offer annual (winter) hunting opportunities. Trophy hunting in the Petrusville-Philipstown area is currently only associated with mixed livestock operations based on Wolwekuil (XXXX), Vlakplaas and Jakkalskuil. Each of these properties offer accommodation for hunting parties. Jakkalskuil is the only operation primarily focused on international hunters. No safari tourism is associated with any of these three operations. No farm stay accommodation or other tourism is associated with the study area. No protected natural areas are located in or in significant proximity of the study area.

The study area is traversed by a broad northeast-southwest -aligned transmission line corridor between Eskom's large Perseus (Dealesville) and Hydra (De Aar) substations. The corridor measures around 25 km in width and accommodates 7 lines in effectively 6 alignments. Most study area landowners are affected by at least one line (Photograph 3.4).

**Photograph 3.4: Transmission line crossing the road between Tafelkop and Wolwekuil (42/RE) west of the PV 10 site, Basberg (mountain) in the background**

### 3.8.2 Site and adjacent properties

The Kudu 11 PV site is proposed on portions of two properties, namely Annexe Wolve Kuil 41/1 and Wolwe Kuil 43/2. The site properties border onto 10 properties (Figure 3.5). Figure 3.5 also illustrates some of the other nearby proposed projects, such as the concurrently proposed Crossroads PV Phase 1 project, which is not the subject of this assessment, and thus outside of this current EIA process for the proposed Kudu Solar Facilities.

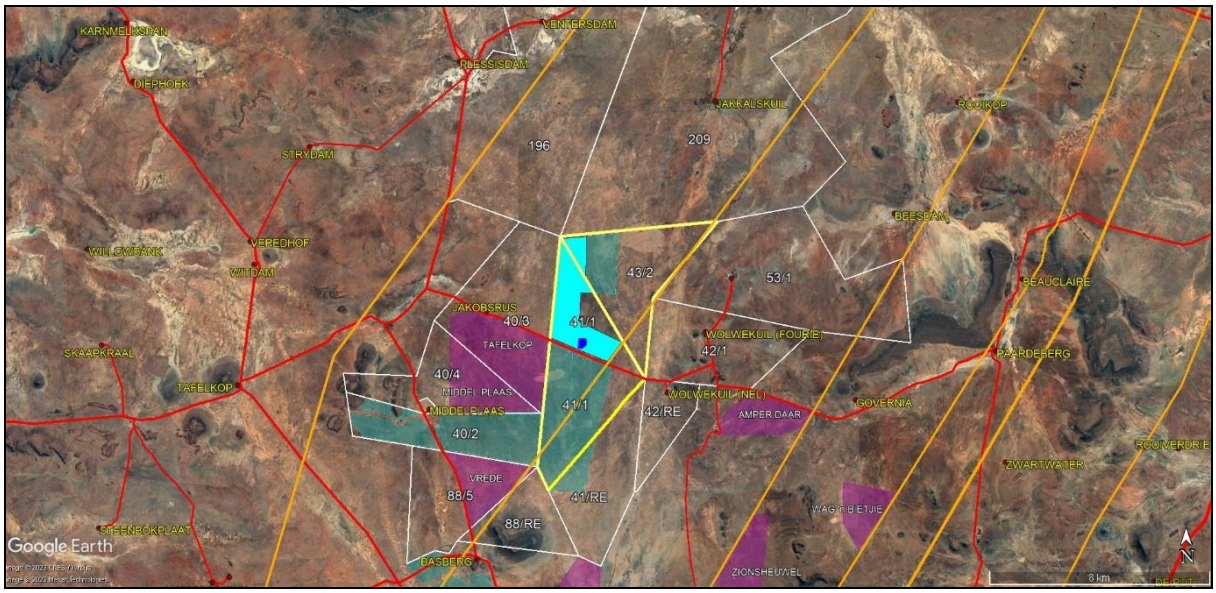



**Figure 3.5: Kudu 11 PV site (bold light blue fill), project substation (dark blue fill), and site properties (bold yellow outlines) in relation to adjacent properties (white outlines), proposed Kudu access points (red triangles), other Kudu PV projects (light blue fill), concurrently proposed Crossroads PV Phase 1 sites[21] (pink fill), existing transmission lines (orange), and the study area existing road network (red).**

The site properties as well as adjacent Grass Pan 40/2, Annexe Wolve Kuil 41/RE, and Wolve Kuilen 42/RE are owned by XXXX[22] (Table 3.1). XXXX operation is based on Wolve Kuilen 42/RE (Wolwekuil) (Photograph 3.5). Two labourer households also reside on Wolwekuil. The remaining 7 adjacent properties belong to 6 landowners, namely XXXX, XXXX, XXXX, XXXX, and XXXX - with XXXX accounting for 2 properties. XXXX and XXXX are not based in the study area. The XXXX and XXXX properties are leased out to local farmers. XXXX is based on nearby Tafelkop (Tafel Kop 39/RE), XXXX on adjacent Jakkalskuil 209 (Jakkalskuil), and XXXX and XXXX on adjacent Wolve Kuilen 42/RE (Wolwekuil) and near-adjacent Bas Berg 88/1 (Vrede), respectively.

[21] Sites for Crossroads Phases 2 and 3 have not been finalized yet. Only Crossroads Phase 1 is currently being assessed concurrently (separate developers, separate processes) with the Kudu projects. Please refer to Figure 3.7. for an overview of historic, current, and envisaged REF projects in the broader study area.

[22] Note that the names and surnames of the landowners have been replaced by 'XXXX' in this document in order to comply with the POPI Act.

**Table 3.1: Overview of Kudu 11 site property and adjacent properties (site, then clockwise from north)**

| PROPERTY | OWNER[23] | LAND USE[24] | RES[25] [km] | COMMENT[26] |
|---|---|---|---|---|
| Annexe Wolve Kuil 41/1 | XXXX | Livestock | n.a. | 1 x 765 kV [existing]; Proposed Kudu 8-11 sites |
| Wolwe Kuil 43/2 | XXXX | Livestock | n.a. | 1 x 765 kV [existing]; Proposed Kudu 11 and 12 PV |
| Farm 196 | XXXX | Livestock; Trophy hunting | Ventersdam (uninhabited) | 1 x 765 kV [existing]; PV 11 site 80 m from boundary; |
| Jakkalskuil 209 | XXXX | Livestock; Trophy hunting | Jakkalskuil [6.8; 9.8] | 1 x 765 kV [existing]; PV 11 site 80 m from boundary; |
| Wolve Kuilen 42/1 | XXXX | Livestock; Trophy hunting | Wolwekuil [3; 4.3] | 1 x 765 kV [existing] |
| Wolve Kuilen 42/RE | XXXX | Livestock | Wolwekuil [2.5; 3.5] | |
| Annexe Wolve Kuil 41/RE | XXXX | Livestock | n.a. | Kudu 8 PV site; 1 x 765 kV [existing] |
| Bas Berg 88/RE | XXXX | Livestock | n.a. | 1 x 765 kV [existing]; Proposed Kudu 1 and 2 PVs |
| Bas Berg 88/5 | XXXX | Livestock | n.a. | 1 x 765 kV [existing]; Proposed Vrede PV (part of the Crossroads PV Development) |
| Grass Pan 40/2 | XXXX | Livestock | n.a. | 1 x 765 kV [existing]; Proposed Kudu 6 and 7 PV |
| Grass Pan 40/4 | XXXX | Livestock; Trophy hunting | n.a. | PV 11 site 2.3 km from boundary; Long lease to Jakkalskuil owner (brother); Middelplaas PV site (part of the Crossroads PV Development) |
| Grass Pan 40/3 | XXXX | Livestock | Jakobsrus (uninhabited) | Proposed Tafelkop PV (part of the Crossroads PV Development) |

[23] Shading indicates owner directly affected by either Crossroads PV Phase 1 or ABO Kudu suite projects.
[24] Shading indicates potentially sensitive receptor.
[25] Shading indicates inhabited dwellings within 5 km of the PV site and substation, resp.
[26] Shading indicates properties on which REFs are currently proposed.

**Photograph 3.5: Farm yard on Wolwekuil (42/RE, XXXX), seen from the entrance road.**

Of the relevant 12 properties, permanently inhabited dwellings are only located on Jakkalskuil 209, Wolve Kuilen 42/RE (XXXX) and 42/1 (XXXX) (Photograph 3.6). All three serve as base farms. The dwellings on Ventersdam (196) and Jakobsrus (40/3) are no longer inhabitred (Photograph 3.7).

**Photograph 3.6: Irrigated fodder cropping area and labourers' houses on Wolwekuil 42/1.**

**Photograph 3.7: Uninhabited farmstead on Grass Pan 40/3 (Jakobsrus).**

All the site and adjacent properties are used for livestock farming. Springbok on the XXXX properties is hunted commercially for meat once a year. In addition, trophy hunting operations are associated with two site-adjacent operations, namely those of XXXX (Jakkalskuil, but including Grass Pan 40/4 leased from XXXX) and XXXX (Wolwekuil). Neither of the operations offer safari or game watching facilities. Accommodation facilities of hunting parties are located on the relevant farmyards. Only Jakkalskuil is focused on the international trophy hunting market. The Karoo

('African') sense of place is a key anchoring attraction. The combined livestock/ game Jakkalskuil operation provides full time employment to 10 workers. Seven labourer households reside on Jakkalskuil.

The site properties as well as 7 adjacent ones are currently affected by transmission line infrastructure. Apart from XXXX, all affected landowners are affected by other current PV proposals on one or more of their properties. One of the site properties, 41/1 is also proposed to accommodate Kudu 8-10 PVs, and the other 43/2, PV 12. Six of the 10 adjacent properties are proposed to accommodate Kudu or Crossroads PVs, namely Grass Pan 40/4 (Middelplaas PV, XXXX), Grass Pan 40/2 (Kudu 6 and 7 PV, XXXX), Annexe Wolve Kuil 41/RE (Kudu 8 PV, XXXX), Bas Berg 88/RE (Kudu 1 and 2 PV, XXXX), Grass Pan 40/3 (Tafelkop PV, XXXX), and Bas Berg 88/5 (Vrede PV, XXXX).

### 3.8.3 Relationship to receptors

The site property is used for grazing (sheep). The Kudu PV 11 site would occupy approximately 17.1% (506 ha) of the combined site properties (~ 2 954 ha) and approximately 9% of XXXX larger Wolwekuil farming operation (~5 646 ha). Kudu 6-12 PV would occupy approximately 44.4% (2 506 ha) of the combined XXXX properties.

The only permanently inhabited dwellings located within a 5 km distance of the site are associated with Wolve Kuilen 42/RE (Wolwekuil, 2.5 km), the base farm of the site owner, XXXX, and Wolwe Kuilen 42/1 (Wolwekuil, 3.5 km), the base farm of XXXX. No dwellings are located within 3 km of the proposed project substation site.

The only potentially sensitive land use receptor is associated with the internationally-focused trophy hunting on Grass Pan 40/4, Farm 196, and Jakkalskuil 209 (Jakkalskuil operation). The Kudu 11 is located approximately 80 m to the south of the boundaries of Farm 196 and Jakkalskuil 209. The Jakkalskuil property portions in closest proximity to the Kudu 11 PV site consists of plains veld and are not considered sensitive by the owner of Jakkalskuil (XXXX, pers. comm). The XXXX operation is not deemed visually sensitive by the owner. No accommodation or other tourism facilities are associated with the immediate study area.

The proposed project study area / preferred site can be accessed via various existing main roads and unnamed farm gravel roads (Figure 3.6). Note that these are not alternatives in terms of the EIA Process, but only options investigated by the Project Applicant and traffic specialist):

- Access Route Option 1:
  - Route A: Along TR3801, DR3093, and DR3096;
  - Route B: Along TR3801, DR3093 and DR3084;
- Access Route Option 2 (Figure 2.10):
  - Route A: Along MR790, DR3093 and DR3084;
  - Route B: Along MR790 and DR3093;
  - Route C: Along MR790, DR3093 and DR3096;
- Access Route Option 3:
  - Route A: Along TR3801, TR3802, and DR3096;
  - Route B: Along TR3801, TR3802, DR3096 and DR3093; and
  - Route C: Along TR3801, TR3802, DR3096, DR3093 and DR3084.

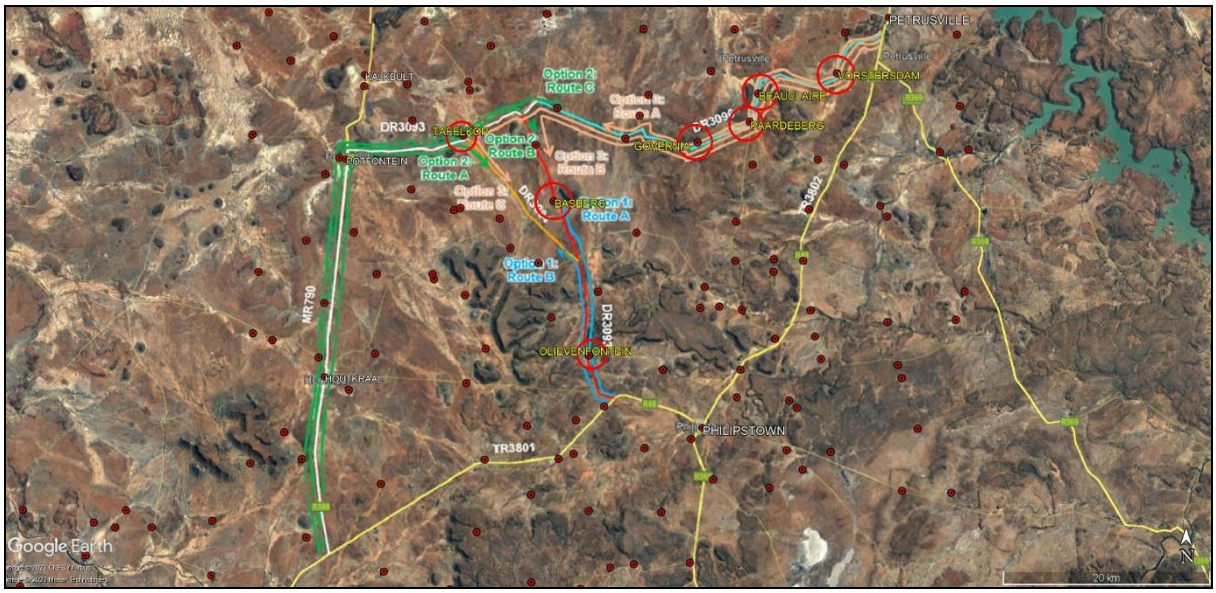



**Figure 3.6: Access Route Options (Source: Traffic Impact Assessment for the proposed Kudu Solar Facilities, Sturgeon Consulting, 2023). Red dots indicate dwellings recorded on the relevant 1: 50 000 map rasters; red circles indicate inhabited dwellings <500 m of the road.**

Inhabited farmyards located within 500 m of proposed routes are associated with Option 2 A and B (Tafelkop) and Option 3 A and 3 B (Vorstersdam, Beauclaire, Paardeberg, Gouvernia and Wolwekuil 42/RE). With the exception of Gouvernia and Wolwekuil 42/RE, inhabited dwellings on the relevant properties are located within 100 m of the roads. Option 1 would be located within 500 m of inhabited caretaker labourer's dwellings on Olievenfontein (1A and 1B) and Basberg (1A). The farmsteads on the properties are however not inhabited.

### 3.8.4 Other renewable energy facilities

The Kudu 11 PV site is not located within a Renewable Energy Development Zone (REDZ). The DFF&E's Renewable Energy website indicates historic clustering around and north of De Aar. Historic proposals within a 30 km radius of the centre of the PV site are also concentrated around Kalkbult along the De Aar-Kimberley railway line to the NW of the site, and to the south of Philipstown SE of the site (Figure 3.7).

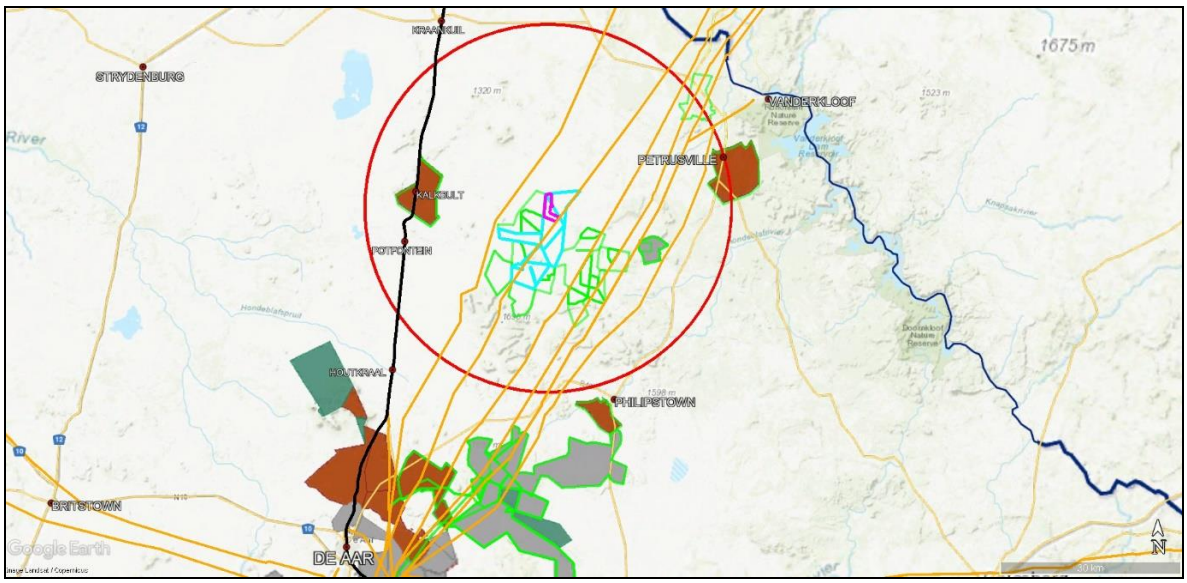



**Figure 3.7: Historic REF applications within a 30 km radius (red circle) of the centre of the Kudu 11 PV site (pink outline). Also indicated are the Kudu PV project site properties (light blue); other historic, current and envisaged REF projects (affected property outlines, green); the De Aar-Kimberley railway line (black), and existing transmission lines (orange) (Source: DFFE, CSIR).**

Only three operational REFs are located within this 30 km radius, namely the Kalkbult PV SEF adjacent to the railway line approximately 20 km NW of the site, and the Long Yuan/ De Aar Phase 1 and Phase 2 WEFs approximately 34 km to the south of the site. The De Aar WEF is located on elevated terrain. Aviation lights are visible at night on most of the R48 between Petrusville and De Aar. As indicated, the Kudu 11 PV project is one of 12 Kudu PV projects currently proposed in the Petrusville-Philipstown area west of the R48. Figure 3.7 reflects REF projects of varying status. Key active projects in the immediate study area include Crossroads Phases 1-3 PV. As indicated, Crossroads Energy is concurrently proposing 9 PV projects in the study area (Crossroads Phase 1 PV). Two more Crossroads Phases (not yet in assessment stage) are envisaged by the relevant developer.

# SECTION 4: OVERVIEW OF KEY SOCIAL ISSUES

## 4.1 INTRODUCTION

Section 4 provides an assessment of the key social issues identified during the study. The identification of key issues was based on:

- Review of project related information.
- Review of key policy and planning documents.
- Site visit to the study area.
- Interviews with key stakeholders.
- Experience with similar projects.

The assessment section is divided into the following sections:

- Assessment of compatibility with relevant policy and planning context ("planning fit").
- Assessment of social issues associated with the construction phase.
- Assessment of social issues associated with the operation phase.
- Assessment of decommissioning phase.
- Assessment of the "no development" alternative.
- Assessment of cumulative impacts.

From a stakeholder engagement perspective, comments related to socio-economic impacts associated with the proposed project were raised by Interested and Affected Parties during the review period of the Draft EIA Report. These comments are similar to those submitted and considered during the Scoping Phase, and therefore similar responses apply (as captured in Appendix F.11 of the Final EIA Report). Concerns were raised about the potential benefits that the proposed Kudu Solar Facilities will have on the farming community in the surrounding region (Benefits to the Farming Community); queries on the socio-economic benefits of the development for farmers and their employees in the greater region, as well as the equitability of involving only two landowners in the proposed developments; not distributing the benefits compared to other proposed projects; cognisance of the perceived negative realities of the project to the social and socio-economic impact and challenges of the Bo-Karoo and its inhabitants; and loss of grazing land. Responses have been provided in Appendix H.7 of the Final EIA Report.

## 4.2 ASSESSMENT OF POLICY AND PLANNING FIT

The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The PKSDM Spatial Development Framework (SDF) and Integrated Development Plan (IDP) also support the development of renewable energy. The development of the proposed SEF is therefore supported by key policy and planning documents.

## 4.3 CONSTRUCTION PHASE SOCIO-ECONOMIC IMPACTS

**Potential positive impacts**

- Creation of employment and business opportunities, and opportunity for skills development and on-site training.

**Potential negative impacts**

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of job-seekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles.
- Impact on productive farmland.

### 4.3.1 Creation of local employment, skills development, training, and business opportunities

The construction phase will extend over a period of approximately 12 to 18 months and create in the region of 300 employment opportunities. Members from the local communities in the area, specifically De Aar, would be in a position to qualify for most of the low skilled and semi-skilled employment opportunities. Most of these employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. Based on information from similar projects the total wage bill will be in the region of R 35 million (2023 Rand values). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area.

Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. The capital expenditure associated with the construction phase will be approximately R 2.5-3 billion (2023 Rand value).

Due the lack of diversification in the local economy the potential for local companies is likely to be limited. The majority of benefits are therefore likely to accrue to contractors and engineering companies based outside the RLM and ELM. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site.

The hospitality industry in the area will also benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

**Table 4.1: Impact assessment of employment and business creation opportunities during the construction phase**

| |
|---|
| **Nature:** Creation of employment and business opportunities during the construction phase |

| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
|---|---|---|---|---|
| **Status** | Positive | Low | Moderate | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Likely | | | |
| **Reversibility** | N/A | | | |
| **Irreplaceability** | N/A | | | |
| **Can impact be enhanced?** | Yes | | | |

**Enhancement:**
**Employment**

- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Before the construction phase commences the proponent should meet with representatives from the RLM and ELM to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase.
- The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

**Business**

- The proponent should liaise with the RLM and ELM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work.

Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

**Assessment of No-Go option:**
There is no impact as the current status quo would be maintained.

### 4.3.2 Impact of construction workers on local communities

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks.

This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use.
- An increase in crime levels.
- The loss of girlfriends and/or wives to construction workers.
- An increase in teenage and unwanted pregnancies.
- An increase in prostitution.
- An increase in sexually transmitted diseases (STDs), including HIV.

The objective will be to source as many of the low and semi-skilled workers locally. These workers will be from the local community and form part of the local family and social networks. This will reduce the risk and mitigate the potential impacts on the local community. However, based on experience with renewable energy projects in the area the potential for local employment, specifically for semi- and skilled workers, is likely to be limited. The majority of semi and skilled workers will therefore need to be accommodated in the nearby towns of Philipstown, Petrusville and De Aar.

The total number of construction workers employed, and duration of the construction phase will depend on the timing and phasing of the construction of the Kudu PV SEF Cluster. This will have a bearing on the potential impact on local communities and services. This issue is discussed under cumulative impacts. The assessment below relates to a single PV SEF.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. However, given the nature of construction projects, it is not possible to totally avoid these potential impacts at an individual or family level.

**Table 4.2: Assessment of impact of the presence of construction workers in the area on local communities**

<table>
<tr><td colspan="5">Nature: Potential impacts on family structures and social networks associated with the presence of construction workers</td></tr>
<tr><td colspan="2">Impact Criteria</td><td>Significance Without Enhancement</td><td>Significance With Enhancement</td><td>Confidence</td></tr>
<tr><td>Status</td><td>Negative</td><td rowspan="7">Very Low</td><td rowspan="7">Very Low</td><td rowspan="7">High</td></tr>
<tr><td>Spatial Extent</td><td>Regional</td></tr>
<tr><td>Duration</td><td>Medium Term</td></tr>
<tr><td>Consequence</td><td>Slight</td></tr>
<tr><td>Probability</td><td>Unlikely</td></tr>
<tr><td>Reversibility</td><td>Moderate</td></tr>
<tr><td>Irreplaceability</td><td>Low</td></tr>
<tr><td>Can impact be mitigated?</td><td colspan="4">Yes</td></tr>
<tr><td colspan="5">Mitigation:<br>• Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.<br>• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to</td></tr>
</table>

and during the construction phase.
- The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents.
- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.
- The proponent should consider the option of establishing a Monitoring Committee (MC) for the construction phase that include representatives from local landowners, farming associations, and the local municipality. This MC should be established prior to commencement of the construction phase and form part of the SEP.
- The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP.
- The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP.
- The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site.
- The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end.
- No construction workers, except for security personnel, should be permitted to stay over-night on the site.

**Assessment of No-Go option**
There is no impact as the current status quo would be maintained.

### 4.3.3 Influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed project on its own does not constitute a large construction project, the establishment of a number of renewable energy projects in the area may attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the way in which they conduct themselves can impact on the local community. The main areas of concern associated with the influx of job seekers include:

- Impacts on existing social networks and community structures.
- Competition for housing, specifically low-cost housing.
- Competition for scarce jobs.
- Increase in incidences of crime.

These issues are similar to the concerns associated with the presence of construction workers and are discussed in Section 4.3.1. The potential for economically motivated in-migration and subsequent labour stranding is likely to be negligible. This is due to the isolated location of the area and the limited economic and employment opportunities in the nearby towns of Philipstown, Petrusville and De Aar.

The potential for an influx of job seekers may also be affected by the timing and phasing of the timing and phasing of the construction of the Kudu PV SEF Cluster.

This issue is discussed under cumulative impacts. The assessment below relates to a single PV SEF.

**Table 4.3: Assessment of impact of job seekers on local communities**

| **Nature:** Potential impacts on family structures, social networks and community services associated with the influx of job seekers | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Negative | Very Low | Very Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Slight | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | Moderate | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be mitigated?** | Yes | | | |
| **Mitigation:**<br>• Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.<br>• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.<br>• The proponent, in consultation with the LM, should investigate the option of establishing a Monitoring Committee (MC) to monitor and identify potential problems that may arise due to the influx of job seekers to the area.<br>• The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities.<br>• The proponent should implement a policy that no employment will be available at the gate. | | | | |

**Assessment of No-Go option**
There is no impact as the current status quo would be maintained.

### 4.3.4 Risk to safety, livestock, and farm infrastructure

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famers and farm workers in the vicinity of the site. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged, or stock theft linked either directly or indirectly to the presence of construction workers on the site. The potential risks to farmers and farming operations was identified as an issue by local landowners interviewed.

The potential risks (safety, livestock, and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction workers on and off the site during the construction phase.

**Table 4.4: Assessment of risk to safety, livestock, and damage to farm infrastructure**

| **Nature:** Potential risk to farmers and farm workers, livestock and damage to farm infrastructure associated with the presence and activities of construction workers on site | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Low | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Replaceable | | | |
| **Can impact be mitigated?** | Yes | | | |

**Mitigation:**

- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property as a result of the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- All farm gates must be closed after passing through.
- Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site.
- The proponent should establish a MC and CoC for workers (see above).
- The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to project construction workers. This should be contained in the CoC to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below).
- The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to damage to farm infrastructure, stock theft and poaching etc.
- The Environmental Management Programme (EMPr) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
- Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the CoC, specifically consequences of stock theft and trespassing on adjacent farms.
- Contractors appointed by the proponent must ensure that construction workers who are found guilty (by the courts) of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

**Assessment of No-Go option**
There is no impact as the current status quo would be maintained.

### 4.3.5 Increased risk of grass fires

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could, in turn pose, a threat to livestock, crops, wildlife and farm infrastructure. The potential risk of grass fires will be higher during the dry, windy winter months from May to October. The impacts will be largely local and can be effectively mitigated.

The potential risk of grass fires and the impact on grazing and farming operations was raised as a concern by local farmers.

**Table 4.5: Assessment of impact of increased risk of grass fires**

| **Nature:** Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Low | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Replaceable | | | |
| **Can impact be mitigated?** | Yes | | | |
| **Mitigation:**<br>• Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.<br>• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.<br>• The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property as a result of the construction phase will be compensated for. The agreement should be signed before the construction phase commences.<br>• Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas.<br>• Smoking on site should be confined to designated areas.<br>• Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months.<br>• Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle and fire extinguishers placed at designated locations across the site.<br>• Contractor should provide fire-fighting training to selected construction staff.<br>• No construction staff, with the exception of security staff, to be accommodated on site | | | | |

overnight.
- As per the conditions of the Code of Conduct, in the event of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused by the project to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.3.6 Nuisance impacts associated with construction related activities

Construction related activities, including the movement of heavy construction vehicles of and on the site, has the potential to create dust, noise and safety impacts and damage roads. The impacts will be largely local and can be effectively mitigated. The number of potentially sensitive social receptors, such as farmsteads, will also be low due to the sparse settlement patterns and small number of farmsteads in the area.

Damage to local public and internal farm roads was raised as concern by local farmers and will need to be addressed during the construction phase. Local landowners also indicated that dust generated by the construction traffic associated with the establishment of the Kalkbult SEF along the De Aar-Kimberley railway line impacted on the veld.

**Table 4.6**: **Assessment of the impacts associated with construction related activities**

| **Nature:** Potential noise, dust and safety impacts associated with construction related activities | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Low | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Replaceable | | | |
| **Can impact be mitigated?** | Yes | | | |
| **Mitigation:**<br>• Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.<br>• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.<br>• Timing of construction activities should be planned to avoid / minimise impact on key farming activities.<br>• The proponent should establish a MC to monitor the construction phase and the implementation of the recommended mitigation measures. The MC should be established before the construction phase commences, and should include key stakeholders, including | | | | |

representatives from local farmers and the contractor(s). The MC should also address issues associated with damage to roads and other construction related impacts.
- Ongoing communication with landowners and road users during construction period. This should be outlined in the SEP.
- The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads.
- Implementation of a road maintenance programme throughout the construction phase to ensure that the affected private roads are maintained in a good condition and repaired once the construction phase is completed (for roads where the developer/contractor has legal mandate to undertake such maintenance).
- Repair of all affected road portions at the end of construction period where required (for roads where the developer/contractor has legal mandate to undertake such repairs). In the event of damage to public roads affected by construction traffic the proponent should engage with the relevant road authorities to ensure that damage is repaired before the operational phase commences.
- Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers.
- All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.3.7 Impacts associated with loss of farmland

The activities associated with the construction phase and establishment of the proposed project and associated infrastructure will result in the disturbance and loss of land available for grazing. The impact on farmland associated with the construction phase can be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. In addition, the landowner will be compensated for the loss of land.

The owner of the PV 6-12 sites, XXXX, indicated that he had no concerns with the layouts and the associated impact on land available for grazing. Approximately 44.4% of the XXXX properties would be occupied by the PV 6-12 sites, with PV 8 (19%) and PV 11 (17%) occupying the largest areas, While XXXX did not raise any concerns the loss of productive grazing should be noted. In this regard the general concerns raised by affected landowners pertained to the Kudu SEFs related to the loss of grazing areas and the impact that this would have on farming activities in an area where there is limited land to buy and or lease.

**Table 4.7: Assessment of impact on farmland due to construction related activities**

| **Nature:** The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the project etc. will damage farmlands and result in a loss of farmlands for grazing. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Low | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Medium Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Likely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Replaceable | | | |
| **Can impact be mitigated?** | Yes | | | |

**Mitigation:**

- The loss of high-quality agricultural land should be avoided and or minimised by careful planning of the final layout of the proposed SEF facility. The recommendations of the agricultural / soil assessment should be implemented.
- Affected landowners should be consulted about the timing of construction related activities in advance.
- The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be included in the EMPr.
- The implementation of the Rehabilitation Programme should be monitored by the ECO.

**Assessment of No-Go option**

There is no impact as it maintains the current status quo.

## 4.4 OPERATIONAL PHASE SOCIAL IMPACTS

**Potential positive impacts**

- The establishment of infrastructure to improve energy security and support the renewable sector.
- Creation of employment opportunities.
- Benefits to the affected landowners.
- Benefits associated with the socio-economic contributions to community development.

**Potential negative impacts**

- Visual impacts and associated impacts on sense of place.

- Impact on property values.
- Impact on tourism.

### 4.4.1 Improve energy security and support the renewable energy sector

The primary goal of the proposed project is to improve energy security in South Africa by generating additional energy. The proposed PV SEF also reduces the carbon footprint associated with energy generation. The project should therefore be viewed within the context of the South Africa's current reliance on coal powered energy to meet the majority of its energy needs, and secondly, within the context of the success of the REIPPPP.

***Improved energy security***
South Africa's energy crisis, which started in 2007 and is ongoing, has resulted in widespread rolling blackouts (referred to as load shedding) due to supply shortfalls. The load shedding has had a significant impact on all sectors of the economy and on investor confidence. The mining and manufacturing sector have been severely impacted and will continue to be impacted until such time as there is a reliable supply to energy. The Minister of Mineral Resources and Energy, Gwede Mantashe, indicated in February 2023 that the cost of load shedding was estimated at R1 billion a day [27]. The South African Reserve Bank indicated in February 2023 that stage 3 and stage 6 loadshedding cost the South African economy between R204 million and R899 million a day.[28]

A survey of 3 984 small business owners in 2019 found that 44% said that they had been severely affected by load shedding with 85% stating that it had reduced their revenue, with 40% of small businesses losing 20% or more or revenue during due to load shedding period[29].

***Impact of a coal powered economy***
As highlighted in Section 2 of this report, the Green Jobs study (2011) notes that South Africa has one of the most carbon-intensive economies in the world, thus making the greening of the electricity mix a national imperative. The study notes that renewable energy provides an ideal means for reaching emission reduction targets in a relatively easy manner. In addition, and of specific relevance to South Africa renewable energy is not as dependent on water compared to the massive water requirements of conventional power stations, has a limited footprint, and therefore does not impact on large tracts of land, poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.

The Greenpeace Report (powering the future: Renewable Energy Roll-out in South Africa, 2013), also notes that within a broader context of climate change, coal energy does not only have environmental impacts, but it also has socio-economic impacts. These include acid mine drainage from abandoned mines in South Africa and the risk this poses on the country's limited water resources.

[27] https://www.citizen.co.za/news/load-shedding-cost-economy-billion/
[28] https://businesstech.co.za/news/energy/662515/stage-6-load-shedding-costs-south-africa-r900-million-a-day-sarb/
[29] "How does load shedding affect small business in SA?". The Yoco Small Business Pulse (3: Q1 2019):

***Benefits associated with REIPPPP***

The overview of the IPPPP (December 2021) indicates that the REIPPPP has attracted R42 billion in foreign investment and financing in the seven bid windows (BW1 – BW4). This is almost double the inward FDI attracted into South Africa during 2015 (R22.6 billion). In terms of local equity shareholding, 52% (R31.4 billion) of the total equity shareholding (R61 billion) was held by South African's across BW1 to BW4, 1S2 and 1S2. This equates to substantially more than the 40% requirement. Foreign equity amounts to R 29.5 billion and contributes 49% to total equity. As far as Broad Based Black Economic Empowerment is concerned, Black South Africans own, on average, 34% of projects that have reached financial close, which is higher than the 30%

In terms of employment, to date, a total of 63 291 job years[30] have been created for South African citizens, of which 48 110 job years were in construction and 15 182 in operations. By the end of December 2021, 85 projects had been completed and moved in to operation. These projects created 44 172 job years of employment, compared to the anticipated 30 488. This represented 45% more than planned. The REIPPPP has therefore created significant employment opportunities for black South African citizens and local communities beyond planned targets. This highlights the importance of the programme in terms of employment equity and the creation of more equal societies.

**Table 4.8: Improve energy security and support the renewable sector**

| **Nature:** Development of infrastructure to improve energy security and support renewable sector | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Positive | Moderate | Moderate | High |
| **Spatial Extent** | National | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Very Likely | | | |
| **Reversibility** | N/A | | | |
| **Irreplaceability** | N/A | | | |
| **Can impact be Enhanced?** | Yes | | | |
| **Enhancement:**<br>• Maximise the number of employment opportunities for local community members.<br>• Implement training and skills development programs for members from the local community.<br>• Maximise opportunities for local content and procurement. | | | | |

**Assessment of No-Go option**

There is no impact as it maintains the current status quo.

[30] The equivalent of a full-time employment opportunity for one person for one year

### 4.4.2 Creation of employment opportunities

The proposed development of a single PV SEF will create in the region of 16 full time employment opportunities during the operational phase, of which 70% will be unskilled, 25% semi-skilled, and 5% skilled. Based on similar projects the annual operating budget will be in the region of R35 million (2022 Rand values), including wages.

**Table 4.9: Assessment of employment and business creation opportunities**

| **Nature:** Creation of employment and business opportunities associated with the operational phase | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Positive | Low | Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Likely | | | |
| **Reversibility** | N/A | | | |
| **Irreplaceability** | N/A | | | |
| **Can impact be enhanced?** | Yes | | | |
| **Enhancement:**<br>The enhancement measures listed in Section 4.3.1, i.e., to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition, the proponent should investigate providing training and skills development to enable locally based service providers to provide the required services for the operational phase. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.4.3 Generate income for affected landowners

The proponent will enter into rental agreements with the affected landowners for the use of the land for the establishment of the proposed PV SEF. In terms of the rental agreement the affected landowner will be paid an annual amount dependent upon the area affected. The additional income will reduce the risk to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as fuel, feed etc. Given the low carrying capacity of the veld the additional income represents a significant benefit for the affected landowner.

However, a concern was raised that the Kudu projects benefit too few landowners (2 as opposed to 6 to 9 for the Crossroads Phase 1 Cluster). The potential benefits were therefore spread out amongst the local farming community. The Kudu projects will however create a number of broader socio-economic opportunities as discussed below.

**Table 4.10: Assessment of benefits associated with income generated for the affected land owner(s)**

| **Nature:** The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed etc. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Positive | Low | Moderate | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Very Likely | | | |
| **Reversibility** | N/A | | | |
| **Irreplaceability** | N/A | | | |
| **Can impact be Enhanced?** | Yes | | | |
| **Enhancement:**<br>• Implement agreements with affected landowners.<br>• The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed PV SEF facility. The recommendations of the agricultural / soil assessment should be implemented. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.4.4 Benefits associated with the socio-economic development contributions

The REIPPPP has been designed not only to procure energy but has also been structured to contribute to the broader national development objectives of job creation, social upliftment and broadening of economic ownership. Socio-economic development (SED) contributions are an important focus of the REIPPPP and are aimed at ensuring that local communities benefit directly from the investments attracted into the area. These contributions are linked to Community Trusts and accrue over the project operation life and, in so doing, create an opportunity to generate a steady revenue stream over an extended period. This revenue can be used to fund development initiatives in the area and support the local community. The long-term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area.

**Table 4.11: Assessment of benefits associated with socio-economic development contributions**

| **Nature:** Benefits associated with support for local communities from SED contributions. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Positive | Moderate | High | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Very Likely | | | |
| **Reversibility** | N/A | | | |
| **Irreplaceability** | N/A | | | |
| **Can impact be Enhanced?** | Yes | | | |
| **Enhancement:**<br>• The RLM or PKSDM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the RLM or PKSDM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager, where possible.<br>• Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community.<br>• Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the REF plant. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo. However, the potential opportunity costs in terms of the supporting the social and economic development in the area would be lost. This would also represent a negative impact.

### 4.4.5 Visual impact and impact on sense of place

The proposed PV SEF has the potential to impact on the area's existing rural sense of place. Based on an initial assessment of the location the potential impact on the areas sense of place associated with a single PV SEF is likely to be limited. The Visual Impact Assessment (VIA) undertaken for Kudu PV11 by Oberholzer and Lawson (May 2023) has assigned a **low** overall impact significance to the proposed facility during the both the construction and operational phases, both before and after mitigation. The main impact is related to change in character in the rural area.

The affected landowner, XXXX, did not raise any concerns relating to potential impact on sense of place.

**Table 4.12: Visual impact and impact on sense of place**

| **Nature:** Visual impact associated with the proposed facility and associated infrastructure and the potential impact on the areas rural sense of place. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Low | Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>• The recommendations contained in the VIA should also be implemented. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.4.6 Potential impact on property values

The potential visual impacts associated with the proposed PV SEF have the potential to impact on property values. Based on the results of a literature review undertaken for wind farms (for comparative purposes), the potential impact on property values in rural areas is likely to be limited. In this regard a study undertaken in Australia in 2016 (Urbis Pty Ltd) found that:

- Appropriately located wind farms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values.
- There is limited available sales data to make a conclusive finding relating to value impacts on residential or lifestyle properties located close to wind farm turbines, noting that wind farms in New South Wales (Australia) have been constructed in predominantly rural areas.

The impact of SEFs on property values is likely to be lower than the impact of WEFs due to the reduced visual impact. The impact of the proposed PV SEF on property values is therefore likely to be low. None of the local landowners in the area raised concerns about the impact on property values.

**Table 4.13: Assessment of potential impact on property values and operations**

| **Nature:** Potential impact of the SEF on property values. This is usually linked to the visual impact associated with the proposed facility and associated infrastructure and the potential impact on the areas rural sense of place. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Low | Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Very Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>The recommendations contained in the VIA should also be implemented. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

### 4.4.7 Potential impact on tourism

The potential visual impacts associated with the PV SEF have the potential to impact on tourism facilities and tourism in the area. Based on the findings of the literature review there is limited evidence to suggest that the proposed SEF would impact on the tourism in the PKSDM and RLM at a local and regional level. At a local level there are a limited number of tourism facilities located in the study area. Based on the findings of the site visit there are no local tourism facilities in the areas that would be impacted. The limited number of facilities are also likely to benefit from providing accommodation to contractors and workers during both the construction and operational phase.

The only potentially sensitive land use receptor is associated with the internationally focused trophy hunting on Grass Pan 40/4, Farm 196, and Jakkalskuil 209 (Jakkalskuil operation). The Kudu 11 PV site does not physically border onto any of these properties. The owner of the Jakkalskuil property portions indicated that Kudu 11 PV site would not impact on the hunting activities on the property (XXXX, pers. comm).

**Table 4.14: Impact on tourism in the region**

| **Nature:** Potential impact of SEF on local tourism. This is usually linked to the visual impact associated with the proposed facility and associated infrastructure and the potential impact on the areas rural sense of place. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Low | Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Very Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>The recommendations contained in the VIA should also be implemented. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

## 4.5 ASSESSMENT OF DECOMMISSIONING PHASE

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 25 years post commissioning. The decommissioning phase is therefore likely to create additional construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

Given the relatively small number of people employed during the operational phase (~ 16), the social impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative). Decommissioning will also create temporary employment opportunities, which would represent a positive temporary impact. The significance would be Low with enhancement due to limited opportunities and short duration.

**Table 4.15: Impact of decommissioning**

| **Nature:** Social impacts associated with retrenchment including loss of jobs, and source of income. Decommissioning will also create temporary employment opportunities, which would represent a positive temporary impact | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Low | High |
| **Spatial Extent** | Local | | | |
| **Duration** | Short Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Likely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>• The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned.<br>• All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning.<br>• Revenue generated from the sale of scrap metal during decommissioning should be allocated to aid in funding closure and rehabilitation of disturbed areas. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

## 4.6 CUMULATIVE IMPACT ON SENSE OF PLACE

The potential cumulative impacts on the area's sense of place will be largely linked to potential visual impacts. In this regard the Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. These issues are also likely to be relevant to solar facilities and associated infrastructure. The relevant issues identified by Scottish Natural Heritage study include:

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one renewable energy facility and the associated

infrastructure at a time, but if each successive stretch of the road is dominated by views of renewable energy facilities, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, July 2010).

As indicated above, the potential impact of a single PV SEF and associated infrastructure on the areas sense of place is likely to be limited. However, the establishment of 12 PV SEFs associated with the Kudu PV SEF Cluster will create cumulative impacts on the area's sense of place. The findings of the Visual Impact Assessment (VIA) undertaken for Kudu 11 PV by Oberholzer and Lawson (May 2023) found that the significance of the cumulative impact of the 12 Kudu projects was **moderate** seen in combination with other projects proposed in the area. The VIA however noted that proposed similar facilities on adjacent properties would reduce the visual sensitivity of the Kudu 11 PV site as the area would be seen as a node for solar energy.

**Table 4.16: Cumulative impacts on sense of place and the landscape**

| **Nature:** Visual impacts associated with the establishment of more than one SEF and the potential impact on the area's rural sense of place and character of the landscape. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Moderate | Moderate | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Likely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>The recommendations contained in the VIA should be implemented. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

## 4.7 CUMULATIVE IMPACT ON LOCAL SERVICES AND ACCOMMODATION

The establishment of a number of PV SEFs (up to 12) has the potential to place pressure on local services and accommodation, specifically during the construction phase. The objective will be to source as many low and semi-skilled workers for the construction phase from the RLM and ELM. This will reduce the pressure on local services and accommodation and the nearby towns of Philipstown, Petrusville and De Aar. The total number of construction workers that required accommodation will depend on the timing and phasing of the construction of the individual PV SEFs associated with the Kudu PV Cluster. Based on the findings of the site visit there is limited accommodation available in Philipstown and Petrusville. Accommodation is available in De Aar and the town has experience with the construction of renewable energy facilities. However, there is unlikely to be sufficient accommodation in De Aar and the surrounding towns if the construction phase of 3 or more renewable

energy facilities overlaps. This issue will need to be addressed in the planning of the construction phase.

However, the potential impact should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of the proposed facility and associated renewable energy projects in the RLM and ELM. These benefits will create opportunities for investment in the RLM and ELM., including the opportunity to up-grade and expand existing services and the construction of new houses. Socio-economic development (SED) contributions also represent an important focus of the REIPPPP and is aimed at ensuring that the build programme secures sustainable value for the country and enables local communities to benefit directly from the investments attracted into the area. The SED contributions will extend over a period of 20-25 years and provide revenue that can be used by the RLM and ELM to invest in up-grading local services where required. It should also be noted that it is the function of national, provincial, and local government to address the needs created by development and provide the required services. The additional demand for services and accommodation created by the establishment of renewable energy projects should therefore be addressed in the Integrated Development Planning process undertaken by the RLM and ELM.

**Table 4.17: Cumulative impacts on local services**

| **Nature:** The establishment of a number of renewable energy facilities and associated projects, such as the proposed SEF, in the RLM has the potential to place pressure on local services, specifically medical, education and accommodation. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Mitigation** | **Significance With Mitigation** | **Confidence** |
| **Status** | Negative | Low | Low | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Moderate | | | |
| **Probability** | Unlikely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Mitigation:**<br>The proponent should liaise with the RLM and ELM to address potential impacts on local services. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

## 4.8 CUMULATIVE IMPACT ON LOCAL ECONOMY

In addition to the potential negative impacts, the establishment of 12 PV SEFs and associated infrastructure will also create several socio-economic opportunities for the RLM and ELM. The positive cumulative opportunities include creation of employment, skills development and training opportunities, and downstream business opportunities.

The review of the REIPPPP (December 2021) indicates that the SED contributions associated with 85 operational projects has amounted to R 1.8 billion to date. In terms of Enterprise Development (ED), R 7.2 billion has been committed for BW1-4. Assuming an equal distribution of revenue over the 20-year project operational life, enterprise development contributions would be R358 million per annum. Of the total commitment, R5.6 billion is specifically committed directly within the local communities where the IPPs operate, contributing significantly to local enterprise development. Up until the end of December 2021 a total of R 504.1 million had already been made to the local communities located in the vicinity of the 68 operating IPPs. This represents 94% of the total R537.9 million enterprise development contributions made to date.

The potential cumulative benefits for the local and regional economy are therefore associated with both the construction and operational phase of renewable energy projects and associated infrastructure and extend over a period of 20-25 years. However, steps must be taken to maximise employment opportunities for members from the local communities in the area and support skills development and training programmes.

**Table 4.18: Cumulative impacts on local economy**

| **Nature:** The establishment of renewable energy facilities and associated projects, such as the SEF, in the RLM will create employment, skills development and training opportunities, creation of downstream business opportunities. | | | | |
|---|---|---|---|---|
| **Impact Criteria** | | **Significance Without Enhancement** | **Significance With Enhancement** | **Confidence** |
| **Status** | Positive | Moderate | Moderate | High |
| **Spatial Extent** | Regional | | | |
| **Duration** | Long Term | | | |
| **Consequence** | Substantial | | | |
| **Probability** | Likely | | | |
| **Reversibility** | High | | | |
| **Irreplaceability** | Low | | | |
| **Can impact be Mitigated?** | Yes | | | |
| **Enhancement:**<br>The proponent should liaise with the RLM and ELM to identify potential opportunities for the local economy and businesses. | | | | |

**Assessment of No-Go option**
There is no impact as it maintains the current status quo.

## 4.9 ASSESSMENT OF NO-DEVELOPMENT OPTION

The primary goal of the proposed project is to assist in providing additional capacity to Eskom to assist in addressing the current energy supply constraints. The project also aims to reduce the carbon footprint associated with energy generation. As indicated above, energy supply constraints and the associated load shedding have had a significant impact on the economic development of the South African economy. South Africa also relies on coal-powered energy to meet more than 90% of its energy needs. South Africa is therefore one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions.

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement is current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost.

**Table 4.19: Assessment of no-development option**

<table>
<tr><td colspan="5">Nature: The no-development option would result in the lost opportunity for South Africa to improve energy security and assist to support with the development of clean, renewable energy.</td></tr>
<tr><td colspan="2">Impact Criteria</td><td>Significance Without Mitigation31</td><td>Significance With Enhancement32</td><td>Confidence</td></tr>
<tr><td>Status</td><td>Negative / Positive</td><td rowspan="8">Moderate (-)</td><td rowspan="8">Moderate (+)</td><td rowspan="8">High</td></tr>
<tr><td>Spatial Extent</td><td>National</td></tr>
<tr><td>Duration</td><td>Long Term</td></tr>
<tr><td>Consequence</td><td>Substantial</td></tr>
<tr><td>Probability</td><td>Likely</td></tr>
<tr><td>Reversibility</td><td>N/A</td></tr>
<tr><td>Irreplaceability</td><td>N/A</td></tr>
<tr><td>Can impact be Enhanced?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="5">Enhancement:<br>The proposed SEF should be developed, and the mitigation and enhancement measures identified in the SIA and other specialist studies should be implemented.</td></tr>
</table>

31 Assumes project is not developed
32 Assumes project is developed

## 4.10 ASSESSMENT OF BESS

The proposed BESS site is not located within significant proximity to any social receptors. The study area is very sparsely populated. No inhabited dwellings are located within 2 km of the site. The proposed site is therefore suitable from a social impact assessment point of view. Both proposed technology options (Redox flow and Lithium ion) are acceptable from a Social Assessment perspective. Please also refer to the High-Level Safety, Health and Environment Risk Assessment contained in the EIA report.

# SECTION 5: KEY FINDINGS AND RECOMMENDATIONS

## 5.1 INTRODUCTION

Section 5 lists the key findings of the study and recommendations. These findings are based on:

- A review of key planning and policy documents pertaining to the area.
- A review of social and economic issues associated with similar developments.
- Site visit and interviews with key stakeholders
- A review of relevant literature on social and economic impacts.
- The experience of the authors with other renewable energy projects in the Northern Cape Province.

## 5.2 SUMMARY OF KEY FINDINGS

The key findings of the study are summarised under the following sections:

- Fit with policy and planning.
- Construction phase impacts.
- Operational phase impacts.
- Cumulative Impacts.
- Decommissioning phase impacts.
- No-development option.

### 5.2.1 Policy and planning issues

The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The PKSDM Spatial Development Framework (SDF) and Integrated Development Plan (IDP) also support the development of renewable energy. The development of the proposed SEF is therefore supported by key policy and planning documents.

### 5.2.2 Construction phase impacts

The key social issues associated with the construction phase include:

**Potential positive impacts**

- Creation of employment and business opportunities, and the opportunity for skills development and on-site training.

The construction phase is expected to extend over a period of 12 to 18 months and create approximately 300 employment opportunities. The total wage bill for the construction phase is estimated to be in the region of R 35 million (2023 Rand value). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area and the RLM and ELM.

Members from the local communities in De Aar, Phillipstown and Petrusville may potentially qualify for low skilled and semi-skilled and some skilled employment opportunities. Most of these employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills to local employment targets the benefits for members from the local communities may be limited. In addition, the low education and skills levels in the area may also hamper potential opportunities for local communities.

The capital expenditure associated with the construction phase will be approximately R 2.5-3 billion (2023 Rand value). This will create opportunities for local companies and the regional and local economy. Due the lack of diversification in the local economy the potential for local companies is likely to be limited. The majority of benefits are therefore likely to accrue to contractors and engineering companies based outside the RLM and ELM. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site.

**Potential negative impacts**

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of job seekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Noise, dust, and safety impacts of construction related activities and vehicles.
- Impact on productive farmland.

The findings of the SIA indicate that the significance of all the potential negative impacts with mitigation are likely to be **Low Negative**. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. Table 5.1 summarises the significance of the impacts associated with the construction phase.

**Table 5.1: Summary of social impacts during construction phase**

| Impact | Significance No Mitigation/Enhancement | Significance With Mitigation/Enhancement |
|---|---|---|
| **Creation of employment and business opportunities** | Medium (+) | Medium (+) |
| **Presence of construction workers and potential impacts on family structures and social networks** | Medium (-) | Low (-) |
| **Influx of job seekers** | Low (-) | Low (-) |
| **Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers** | Medium (-) | Low (-) |
| **Increased risk of grass fires** | Medium (-) | Low (-) |
| **Impact of heavy vehicles and construction activities** | Medium (-) | Low (-) |
| **Loss of farmland** | Medium (-) | Low (-) |

### 5.2.3 Operational phase impacts

**Potential positive impacts**
- Establishment of infrastructure to improve energy security and support renewable sector.
- Creation of employment opportunities.
- Benefits associated with socio-economic contributions to community development.
- Benefits for local landowners.

The proposed project will supplement South Africa's energy and assist to improve energy security. In addition, it will also reduce the country's reliance on coal as an energy source. This represents a positive social benefit.

**Potential negative impacts**
- Visual impacts and associated impacts on sense of place.
- Potential impact on property values.
- Potential impact on tourism.

The findings of the SIA indicate that the significance of all the potential negative impacts with the exception of visual impacts will be **Low Negative** with mitigation. The majority of potential negative impacts can therefore be effectively mitigated. The significance of the impacts associated with the operational phase are summarised in Table 5.2.

**Table 5.2: Summary of social impacts during operational phase**

| Impact | Significance No Mitigation/Enhancement | Significance With Mitigation/Enhancement |
|---|---|---|
| **Establishment of infrastructure to improve energy security and support renewable sector** | High (+) | High (+) |
| **Creation of employment and business opportunities during maintenance** | Low (+) | Medium (+) |
| **Benefits associated with socio-economic contributions to community development** | Medium (+) | High (+) |
| **Benefits for landowners** | Low (+) | High (+) |
| **Visual impact and impact on sense of place** | Low (-) | Low (-) |
| **Impact on property values** | Low (-) | Low (-) |
| **Impact on tourism** | Low (-) | Low (-) |

### 5.2.4 Assessment of cumulative impacts

***Cumulative impact on sense of place***
The establishment of the proposed PV SEF and other renewable energy facilities in the area will create the potential for combined and sequential visibility impacts. This impact is rated as **Moderate Negative**.

***Cumulative impact on local services and accommodation***
The significance of this impact with effective mitigation was rated as **Low Negative**.

***Cumulative impact on local economy***
The significance of this impact with enhancement was rated as **Moderate Positive**.

### 5.2.5 Decommissioning phase

Given the moderate number of people employed during the operational phase (~ 16), the potential negative social impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be **Low Negative**.

### 5.2.6 Assessment of no-development option

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the

world, this would represent a significant negative social cost. The No-Development option is not supported by the findings of the SIA.

### 5.2.7 Assessment of BESS

Based on the findings of the SIA the proposed BESS site and both technology alternatives are suitable from a social impact assessment point of view.

## 5.3 CONCLUSIONS

The findings of the SIA indicate that the proposed Kudu PV 11 SEF will result in several social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phases. The project will also create economic development opportunities for the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as **High Positive**. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

The findings also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be **Low Negative** with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented.

**Statement and reasoned opinion**

The establishment of the proposed Kudu PV 11 SEF and associated infrastructure is therefore supported by the findings of the SIA.

# ANNEXURE A

## INTERVIEWS

- XXXX (telephonic 2023-03-29). Vlakplaas.
- XXXX (2023-03-24). Jakkalskuil, Ventersdam.
- XXXX (2023-03-24). Ruspoort.
- XXXX (2023-03-24). Wolwekuil.
- XXXX (telephonic 2023-03-16). Basberg.
- XXXX (2023-03-23). Wolwekuil.
- XXXX (2023-03-23). Tafelkop.
- XXXX (2023-03-23). Bokkraal.
- XXXX (2023-03-23). Vrede.

## REFERENCES


- National Energy Act (2008).
- White Paper on the Energy Policy of the Republic of South Africa (December 1998).
- White Paper on Renewable Energy (November 2003).
- Integrated Resource Plan (IRP) for South Africa (2019).
- National Infrastructure Plan (NIP) (2012 and 2021).
- National Development Plan (2011).
- Northern Cape Provincial Growth and Development Strategy (2004-2014).
- Northern Cape Climate Change Response Strategy.
- Northern Cape Spatial Development Framework (2012).
- Northern Cape Province Green Document (2017/2018).
- Pixley ka Seme District Municipality Integrated Development Plan (2019-2020).
- Pixley ka Seme District Municipality Spatial Development Framework (2017).
- Emthanjeni Local Municipality Integrated Development Plan (2021-2022).
- Renosterberg Local Municipality Integrated Development Plan (2017-2022).

# ANNEXURE B

## METHODOLOGY FOR THE ASSESSMENT OF POTENTIAL IMPACTS

*The impact assessment includes:*

- *the nature, status, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

*Terminology used in impact assessment can overlap. To avoid ambiguity, please note the following clarifications (that are based on NEMA and the EIA Regulations):*

- *The term environment is understood to have a broad interpretation that includes both the natural (biophysical) environment and the socio-economic environment. The term socio-ecological system is also used to describe the natural and socio-economic environment and the interactions amongst these components.*
- *Significance = Consequence x Probability, which means that significance is equivalent to risk.*
- *The impact can have a positive or negative status. The significance of a negative impact may be called a risk, and the significance of a positive impact may be called an opportunity.*

*The following principles are to underpin the application of this methodology:*

- *Transparent and repeatable process - specialists are to describe the thresholds and limits they apply in their assessment, wherever possible.*
- *Adapt parameters to context (where justified) – the methodology proposes some thresholds (e.g. for spatial extent, in Step 3 below), however, if the nature of the impact requires a different definition of the categories of spatial extent, then this can be provided and described.*
- *Combination of a quantitative and qualitative assessment – where possible, specialists are to provide quantitative assessments (e.g. areas of habitat affected, decibels of noise, number of jobs), however, it is recognised that not all impacts can be quantified, and then qualitative assessments are to be provided.*

*As per the DFFE Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:*

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective*

*impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

*The impact assessment methodology includes the aspects described below.*

- ***Step 1**: **Nature** of impact/risk - The type of effect that a proposed activity will have on the environment.*

- ***Step 2**: **Status** - Whether the impact/risk on the overall environment will be:*
  - *Positive - environment overall will benefit from the impact/risk;*
  - *Negative - environment overall will be adversely affected by the impact/risk; or*
  - *Neutral - environment overall not be affected.*

- ***Step 3**: **Qualitatively** determine the **consequence** of the impact/risk by identifying the **a) SPATIAL EXTENT; b) DURATION; c) REVERSIBILITY; AND d) IRREPLACEABILITY**.*

  - ***A) Spatial extent** – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

  - ***B) Duration** – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

  - ***C) Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
    - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
    - *Moderate reversibility of impacts;*
    - *Low reversibility of impacts; or*
    - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

  - ***D) Irreplaceability** of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
    - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
    - *Moderate irreplaceability of resources;*

- *Low irreplaceability of resources; or*
- *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

*Some of the criteria are quantitative (e.g. spatial extent and duration) and some may be described in a quantitative or qualitative manner (e.g. reversibility and irreplaceability). The specialist then combines these criteria in a qualitative manner to determine the* ***consequence****.*

*The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a reduction in population or occupied area in relation to Species of Conservation Concern (SCC) status, ranging from slight consequence for defined areas of Least Concern, to extreme consequence for defined areas that are Critically Endangered. For example, from a social perspective, a slight consequence could refer to small and manageable impacts, or impacts on small sections of the community; a moderate consequence could refer to impacts which affect the bulk of the local population negatively or may produce a net negative impact on the community; and an extreme consequence could refer to impacts which could result in social or political violence or institutional collapse.*

- ***Consequence*** *– The anticipated consequence of the risk/impact is generally defined as follows:*
  - *Extreme (extreme alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they permanently cease);*
  - *Severe (severe alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease);*
  - *Substantial (substantial alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease;*
  - *Moderate (notable alteration of natural or socio-economic systems, patterns or processes, i.e. where the natural or socio-economic environment continues to function but in a modified manner; or*
  - *Slight (negligible and transient alteration of natural or socio-economic systems, patterns or processes, i.e. where natural systems/environmental or socio-economic functions, patterns, or processes are not affected in a measurable manner, or if affected, that effect is transient and the system recovers).*

- ***Step 4****: Rate the* ***probability*** *of the impact/risk using the criteria below:*

  - ***Probability*** *– The probability of the impact/risk occurring:*
    - *Extremely unlikely (little to no chance of occurring);*
    - *Very unlikely (<30% chance of occurring);*
    - *Unlikely (30-50% chance of occurring)*
    - *Likely (51 – 90% chance of occurring); or*
    - *Very Likely (>90% chance of occurring regardless of prevention measures).*

- ***Step 5****: Use both the* ***consequence*** *and* ***probability*** *to determine the* ***significance*** *of the identified impact/risk (qualitatively as shown in Figure 1). Significance definitions and rankings are provided below:*

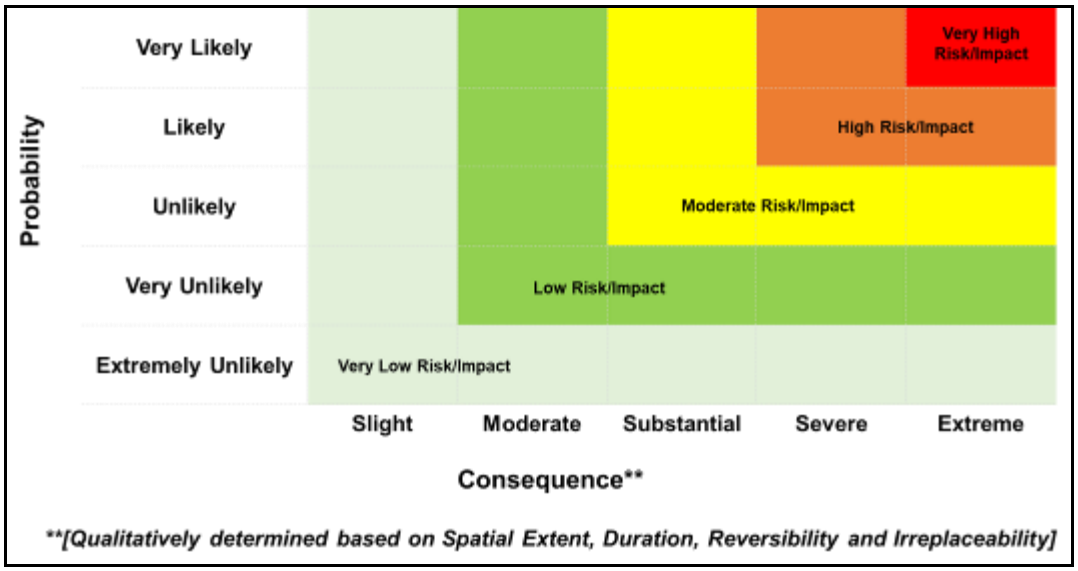



***Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.***

- ***Significance*** *– Will the impact cause a notable alteration of the environment?*
  - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
  - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
  - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

*With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:*

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

*The specialists must provide a written supporting motivation of the assessment ratings provided.*

- ***Step 6****: Determine the* ***Confidence Level*** *– The degree of confidence in predictions based on available information and specialist knowledge:*
  - *Low;*
  - *Medium; or*
  - *High.*

# ANNEXURE C


## *Tony Barbour*
## *ENVIRONMENTAL CONSULTING AND RESEARCH*

10 Firs Avenue, Claremont, 7708, South Africa
(Tel) 27-21-761 2355 - (Fax) 27-21-761 2355 - (Cell) 082 600 8266
(E-Mail) tbarbour@telkomsa.net


Tony Barbour's has 26 years' experience in the field of environmental consulting and management. His experience includes working for ten years as a consultant in the private sector followed by four years at the University of Cape Town's Environmental Evaluation Unit. He has worked as an independent consultant since 2004, with a key focus on Social Impact Assessment. His other areas of interest include Strategic Environmental Assessment and review work.

**EDUCATION**

- BSc (Geology and Economics) Rhodes (1984);
- B Economics (Honours) Rhodes (1985);
- MSc (Environmental Science), University of Cape Town (1992)

**EMPLOYMENT RECORD**

- Independent Consultant: November 2004 – current;
- University of Cape Town: August 1996-October 2004**:** Environmental Evaluation Unit (EEU), University of Cape Town. Senior Environmental Consultant and Researcher;
- Private sector: 1991-August 2000: 1991-1996**:** Ninham Shand Consulting (Now Aurecon, Cape Town). Senior Environmental Scientist; 1996-August 2000: Steffen, Robertson and Kirsten (SRK Consulting) – Associate Director, Manager Environmental Section, SRK Cape Town.

**LECTURING**

- University of Cape Town: Resource Economics; SEA and EIA (1991-2004);
- University of Cape Town: Social Impact Assessment (2004-current);
- Cape Technikon: Resource Economics and Waste Management (1994-1998);
- Peninsula Technikon: Resource Economics and Waste Management (1996-1998).

**RELEVANT EXPERIENCE AND EXPERTISE**

Tony Barbour has undertaken in the region of 260 SIA's, including SIA's for infrastructure projects, dams, pipelines, and roads. All of the SIAs include interacting with and liaising with affected communities. In addition, he is the author of the Guidelines for undertaking SIA's as part of the EIA process commissioned by the Western Cape Provincial Environmental Authorities in 2007. These guidelines have been used throughout South Africa.

Tony was also the project manager for a study commissioned in 2005 by the then South African Department of Water Affairs and Forestry for the development of a Social Assessment and Development Framework. The aim of the framework was to enable the Department of Water Affairs and Forestry to identify, assess and manage social impacts associated with large infrastructure projects, such as dams. The study also included the development of guidelines for Social Impact Assessment, Conflict Management, Relocation and Resettlement and Monitoring and Evaluation.

Countries with work experience include South Africa, Namibia, Angola, Botswana, Zambia, Lesotho, Swaziland, Ghana, Senegal, Nigeria, Mozambique, Mauritius, Kenya, Ethiopia, Oman, South Sudan, Sudan and Armenia.

# ANNEXURE D

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

**Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Tony Barbour Environmental Consulting | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | 4 | Percentage Procurement recognition | 100% |
| Specialist name: | Tony Barbour | | | |
| Specialist Qualifications: | BEcon (Hons). MSc (Environmental Science) | | | |
| Professional affiliation/registration: | IAIA | | | |
| Physical address: | 10 Firs Avenue, Claremont | | | |
| Postal address: | 10 Firs Avenue, Claremont | | | |
| Postal code: | 7708 | Cell: | 082 600 8266 | |
| Telephone: | 021-7971361 | Fax: | | |
| E-mail: | tony@tonybarbour.co.za, tbarbour@telkomsa.net | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Tony Barbour, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Tony Barbour Environmental Consulting

Name of Company:

4 July 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

**3. UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Tony Barbour, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Tony Barbour Environmental Consulting
Name of Company

4 July 2023
Date

7736040 02
MR SA/FE
Signature of the Commissioner of Oaths

4 July 2023
Date

SUID-AFRIKAANSE POLISIEDIENS
ARGIEWE
2023 -07- 04
ARCHIVES
CLAREMONT K.P. / C.P.
SOUTH AFRICAN POLICE SERVICE

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

**Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
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0001

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Email: EIAAdmin@environment.gov.za

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | freelance (for Tony Barbour Environmental) | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | n.a | Percentage Procurement recognition | n.a. |
| Specialist name: | Schalk van der Merwe | | | |
| Specialist Qualifications: | MPhil (Environmental science) | | | |
| Professional affiliation/registration: | none | | | |
| Physical address: | 12 Glen Alpine, Davenport Rd, Uredenaey | | | |
| Postal address: | | | | |
| Postal code: | 7001 | Cell: | 082 0800 521 | |
| Telephone: | 08 021 401 4579 | Fax: | | |
| E-mail: | lilah@mweb.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Schalk van der Merwe, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

(freelance)
Name of Company:

2023-05-25
Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

**3. UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Schalk van der Merwe, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

TBEL (freelance tor)
Name of Company

2023-05-24
Date

Signature of the Commissioner of Oaths

2023/05/24
Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
CAPE TOWN CENTRAL
2023 -05- 24
CAPE TOWN CENTRAL
COMMUNITY SERVICE CENTRE
SOUTH AFRICAN POLICE SERVICE

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

# CHAPTER 14:
# Traffic Impact Assessment

CSIR
Touching lives through innovation

# TRAFFIC ENGINEERING SPECIALIST ASSESSMENT:

# Scoping and Environmental Impact Assessment (EIA) Process for the Proposed Development of a Solar Photovoltaic Facility (Kudu Solar Facility 11) and associated infrastructure, near De Aar, Northern Cape Province

| *Report prepared for:* | *Report prepared by:* |
|---|---|
| CSIR – Environmental Management Services<br>P O Box 320<br>Stellenbosch<br>7599<br>South Africa | Sturgeon Consulting<br><br>7 Waterberg Crescent, Clara Anna Fontein<br>Durbanville<br>7550<br>South Africa |

Version 1: March 2023

# EXECUTIVE SUMMARY

The purpose of the Traffic Engineering Impact Assessment of the proposed Kudu Solar Photovoltaic (PV) Facility 11 is to investigate the transport implications associated with the abnormal load vehicles transporting components, construction material, equipment and labourers to the site during the construction, operational and decommissioning phases of the project.

The construction phase will primarily consist of the removal of vegetation, excavation for infrastructure, the establishment of a laydown area for equipment, the transportation of materials and equipment to site and the construction of the solar field and additional infrastructure. The operational phase of the project is expected to be approximately 20 years and will primarily consist of the generation and supply of electricity from the proposed solar facility, the cleaning of the solar panels and the maintenance of the solar field and infrastructure. The purpose of the decommissioning phase is to return the land to its original condition before construction.

During the proposed project, the construction site will need to be accessed by single-unit trucks transporting building materials, double axel trucks transporting 40 foot long containers containing the solar panels, frames and inverters, minibus taxis and buses transporting labourers and abnormal load trucks transporting the transformers.

The report proposed three different access routes to the site and the preferred route was identified as the route between the Port of Ngqura and the site. The preferred haulage route is approximately 545 km and follows the N2 from the Port and then turns north onto the N10 to De Aar. From De Aar, the R48 can be taken east up to the access point of the site. Various provincial roads can provide access to the site via the R48 (Trunk Road 38/1 and Trunk Road 38/02). The preferred access is from the surfaced Divisional Road 3093 (DR3093), located along the R48, approximately 45km north-east of De Aar. This access will provide direct access from a surfaced road and sufficient shoulder sight distances (SSD) are available.

Access Route Option 1 will require the removal of the existing island at the TR38/01 and DR3093 intersection to accommodate the turning movements of the abnormal load vehicles. For Access Route Option 2, widening of the intersection at TR38/01 and MR790 will be required (the widening will exceed 6 m at certain points) and the widening of the MR790/DR3093 intersection by approximately 60m$^2$ and widening of the DR3093/DR3084 intersection by 170m$^2$ (the widening will exceed 6 m at certain points) will also be required. Access Route Option 3 will require the widening of the intersection at TR38/02 and DR3096 (the widening will exceed 4 m at certain points) and localised widening will be required along DR3096 at two locations (approximately 56m$^2$ and 50m$^2$).

Temporary SANRAL counting stations indicated the Average Daily Traffic (ADT) as approximately 62 vehicles (two-way) along DR3093 and approximately 8 vehicles (two-way) along Divisional Road 3084 (DR3084) per day in 2011. These numbers indicate that there are extremely low volumes of traffic along these roads in the vicinity of the site. Permanent SANRAL traffic counting stations, Station

13730 and Station 13731, are located along the R389 and the R48, respectively. The traffic information for 2021 indicated that the R389 carries an ADT of 626 vpd (two-way) and the R48 carries and ADT of 866 vpd (two-way). The R389 and the R48 both operate 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, operational and decommissioning phases of the project. During the construction phase it is expected that trips will be generated by the transportation of materials and equipment, the transportation of labourers and the transportation of water for construction and dust control purposes. It was determined that a total of **58 daily trips (two-way)** will be generated by the proposed Solar PV Facility. During the decommissioning phase it is expected that the same number of trips will be generated as during the construction phase. During the operational phase it is expected that trips will be generated by the transportation of maintenance equipment, the transportation of labourers and the transportation of water for the cleaning of the solar panels and dust control purposes. It was determined that a total of **16 daily trips (two-way)** will be generated by the proposed Solar PV Facility.

Potential transport and traffic related impacts were identified for the different phases of the project. During the construction and decommissioning phases potential impacts include congestion and delays on the surrounding road network (very low impact significance), the impact on traffic safety and an increase in accidents (moderate impact significance), change in the quality of the surface conditions of the road (very low impact significance), dust pollution (low impact significance) and noise pollution (low impact significance). During the operational phase the traffic generated will have an insignificant impact on the surrounding road network.

To further mitigate the effects of the expected daily traffic impact on the existing road network during the construction and decommissioning phases it is proposed that delivery times be staggered and the transportation of labourers trips be scheduled outside of peak hours where possible, speed control by means of a stop-and-go be implemented within the construction site along with ensuring all vehicles are roadworthy, visible, adequately marked and operated by a licenced operator, regular maintenance of the internal farm access road and dust control be implemented on gravel roads within the construction site. If the mitigation measures are implemented the construction phase will have an overall low to very low impact significance, the operational phase will have an insignificant impact and the decommissioning phase will have a low to very low impact significance, similar to the construction phase.

It is very unlikely that all 12 Kudu PV projects will occur at the same time and construction will most likely be staggered based on project and site-specific aspects. However, the potential cumulative traffic impact related to the construction and decommissioning phases were investigated in this report. The cumulative traffic impact related to the operational phase can still be regarded as insignificant. If the mitigations are implemented the construction phase will have an overall low to very low impact significance, the operational phase will have an insignificant impact and the decommissioning phase will have a low to very low impact significance.

No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed project. Provided that the recommendations provided in this report are adhered to, the proposed development of the Solar PV facility can be supported from a traffic engineering perspective.

## TABLES



## FIGURES


| Abbreviations | |
|---|---|
| ADT | Average Daily Traffic |
| EIA | Environmental Impact Assessment |
| BA | Basic Assessment |
| DEA | Department of Environmental Affairs |
| PV | Photovoltaic |
| TIS | Traffic Impact Study |
| vph | Vehicles per Hour |
| COTO | Committee of Transport Officials |
| AMP | Access Management Plan |
| RCAM | Road Classification and Access Management Manual |
| LOS | Level of Service |
| AM | Morning |
| PM | Afternoon |
| SEF | Solar Energy Facility |

# 14. TRAFFIC IMPACT ASSESSMENT

This chapter includes the Traffic Engineering Impact Assessment Specialist Assessment that was prepared by Sturgeon Consulting as part of the Scoping and Environmental Impact Assessment (EIA) Process for the proposed development of the Kudu Solar Facility 11 and associated infrastructure, near De-Aar, Northern Cape Province.

## 14.1 Introduction

### 14.1.1 Scope, Purpose and Objectives of this Specialist Report

ABO Wind is intending to develop a Solar Photovoltaic (PV) cluster, located to the northeast of De Aar in the Northern Cape Province, as shown in Figure 14-1. The project will entail the proposed development of 12 Solar PV facilities and associated electrical infrastructure. Each PV facility will have an estimated capacity ranging from up to 50 MWac to 350 MWac. This Traffic Impact Assessment (TIA) focuses on the Traffic Impact associated with Kudu Solar Facility 11, although the cumulative impact of all 12 Solar PV facilities will also be considered.

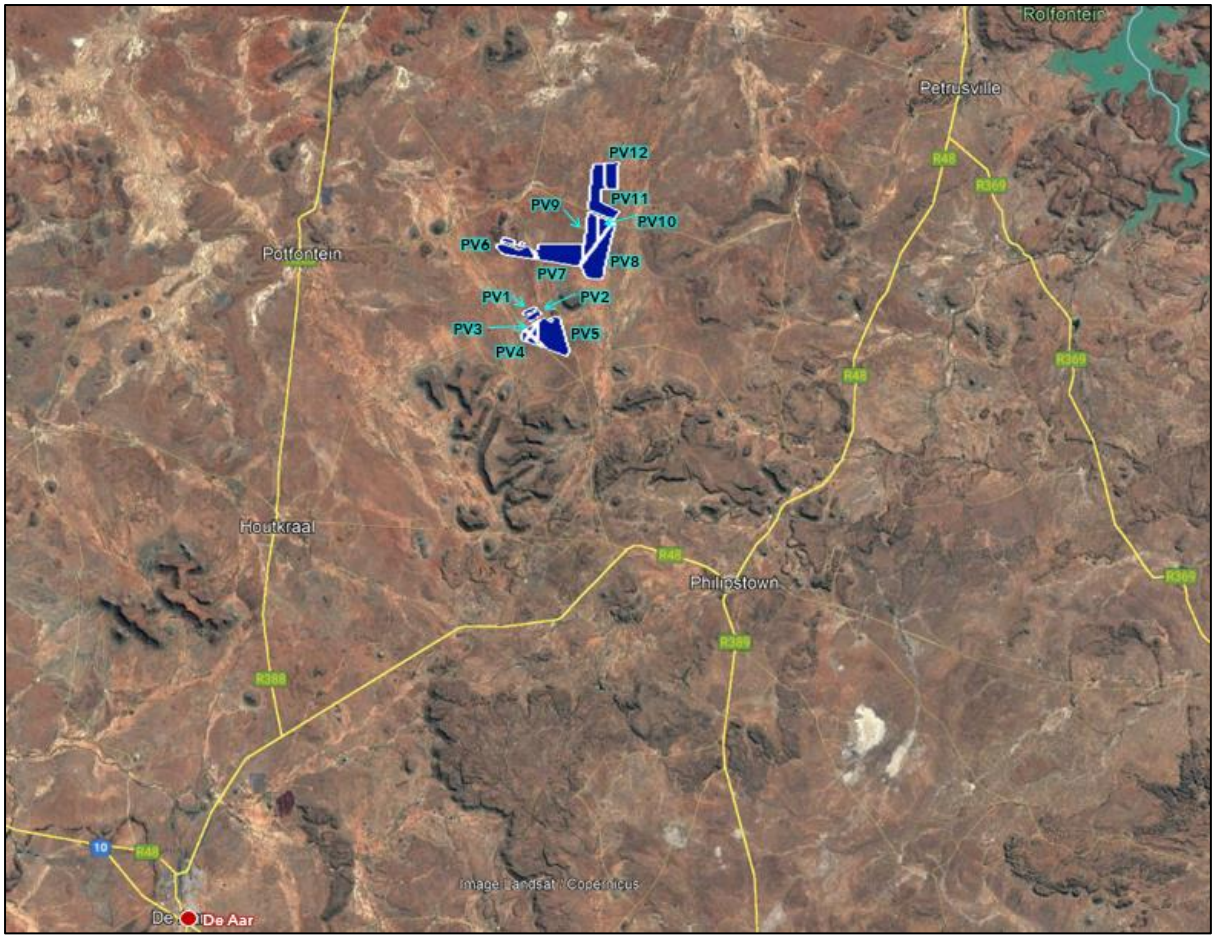


**Figure 14-1: Locality Plan**

The scope of the Traffic Engineering Impact Assessment is to 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 and operational phases.

The report identifies the preferred access route to the site, comments on the condition of the existing roads in the vicinity of the site and identifies possible access points to the site.

The primary purpose of this Traffic Engineering Impact Assessment is therefore to provide a specialist assessment of potential traffic related impacts in accordance with the requirements of Appendix 6 of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations (as amended).

Separate reports have been compiled for each PV facility. This chapter only addresses Kudu Solar Facility 11 (hereafter referred to as the "Kudu Solar Facility 11" or "proposed project").

### 14.1.2 Details of Specialist

This specialist assessment has been undertaken by Annebet Krige of Sturgeon Consulting (Pty) Ltd, Traffic Engineering and Transport Planning Specialists. Annebet Krige is registered with the Engineering Council of South Africa with Registration Number 20150161 in the field of Traffic Engineering. A curriculum vitae is included in Appendix A of this specialist input report.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist input report.

### 14.1.3 Terms of Reference

The Terms of Reference for the TIA include:

- Extent of the traffic study and study area, including a description of the traffic and transportation context of the study area, focusing on aspects that are potentially affected by the proposed project;
- Site Observations by undertaking a site visit to gather relevant information in terms of access, road conditions etc. and to confirm if there are any aspects that need to be considered in the layout planning;
- Proposed development description in relation to traffic related impacts;
- Describe the baseline transport and traffic condition of the study area, as well as identified traffic features and potential traffic disturbances of the local area;
- Existing and Future Road Planning;
- Existing traffic volumes on external road network;
- Access Assessment;
- Acceptability from a traffic safety point of view of the location of the access route(s) to the proposed facility;
- Trip generation of the proposed development during Construction, Operation and Decommissioning;
- A description of assumptions and limitations;

- Consideration of the project layout;
- Determine the national and local haulage routes between port of entry/manufacturer and site;
- Assessment of freight requirements and permitting needed for abnormal loads;
- Risk posed by construction and operational vehicles;
- Consider traffic issues such as impact on the road network, congestion etc.;
- Impact assessment of the potential direct, indirect and cumulative impacts of the proposed development on the receiving environment from a traffic perspective;
- Based on existing volumes of traffic, recommendations for mitigations measures for traffic impacts where relevant;
- Determine mitigation and/or management measures, which could be implemented to as far as possible, reduce the effect of negative impacts and enhance the effect of positive impacts. Identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts for inclusion in the Environmental Management Programme (EMPr);
- Identification of any additional protocols, licensing and/or permitting requirements that are relevant to the project and the implications thereof;
- A reasoned opinion indicating the acceptability of the proposed development and a recommendation if the development should go ahead or not.

## 14.2 Approach and Methodology

The report assesses possible access routes for the haulage of imported materials, the road network surrounding the proposed facility, possible access options and the traffic impact of the proposed facility on the surrounding road network in the vicinity of the site during the Construction, Operational and Decommissioning phases of the project.

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

- Site visit:
  - 23 and 24 March 2022.
  - Review of project background information.
  - Literature review and internet research.
- Access Routes and Access Point Assessment:
  - Evaluation of proposed access configurations.
  - Assessment of potential access roads.
- Traffic Impact:
  - Assessment of typical trip generation during the Construction, Operation and Decommissioning phases of the project.
  - Assessment of potential traffic impacts.
- Liaison with Applicant and/or project team.
- Preparation of report and figures.

### 14.2.1 Information Sources

The main information sources used for this Traffic Engineering Impact Assessment are listed below:

| Data / Information | Source | Date | Type | Description |
|---|---|---|---|---|
| TMH 16 Volume 1 South African Traffic Impact and Site Traffic Assessment Manual | Committee of Transport Officials | August 2012 | Manual | Requirements for Traffic Impact Studies in South Africa. |
| National Road Traffic Act, 1996 (Act No. 93 of 1996) | Department of Transport | 1996 | Government Gazette | To provide for road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith. |
| Amendment of the National Road Traffic Regulations | Department of Transport | 2014 | Government Notice | Regulations to the National Road Traffic Act, 1996 (Act No. 93 of 1996) |
| TRH 11: Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles | Department of Transport | August 2009 | Government Notice | Description of abnormal loads and vehicle configurations and methods to determine road pavement damage |

| Data / Information | Source | Date | Type | Description |
|---|---|---|---|---|
| TRH 11: Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other events on Public Roads | Committee of State Road Authorities | March 2000 | Report | Rules and Conditions which apply to the transport of abnormal loads and vehicles on public roads. |

In addition to the above, the following Information was also used:

- Project Information provided by the Environmental Assessment Practitioner (EAP) and Applicant;
- Google Earth files provided by the EAP and Applicant;
- Google Earth Satellite Imagery;
- Information gathered during the site visit; and
- Project research of all available information.

### 14.2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions, knowledge gaps and limitations apply:

- The study is based on information supplied by the Applicant (ABO Wind) and the Environmental Consultants (CSIR);
- Haulage and access will be limited to existing surfaced national and provincial and gravel roads;
- The internal farm roads within the boundary of the PV Facility will not be included in this study;
- Construction materials are to be sourced and transported from local manufacturers where possible;
- All imported materials are to be transported from the nearest, most viable port of entry;
- Maximum vertical height clearance along the haulage route is 5.2m for abnormal loads.
- The power lines that will be constructed to facilitate grid connection, and the associated Main Transmission Substation and 400 KV Loop-in-Loop-Out (LILO) are subjected to separate Basic Assessment and/or Standard Registration Processes, and do not require a Traffic Impact Assessment.

### 14.2.3 Consultation Processes Undertaken

Due to the significance of the traffic related impact, no specific consultation processes were deemed necessary or undertaken for this specialist assessment.

## 14.3 Description of Project Aspects relevant to Traffic Engineering Assessment

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

- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

### 14.3.1 Construction Phase

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

- Removal of vegetation for the proposed infrastructure, where necessary, within the approved development footprint to facilitate the construction and/or establishment of infrastructure. Note that vegetation is planned to be trimmed within the PV array area (and not removed completely);
- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Stockpiling of topsoil and cleared vegetation, where necessary (except for the PV array);
- Creation of employment opportunities and associated transport of employees to and from site;
- Transportation of material and equipment to site; and
- Construction of the solar field and additional infrastructure.

### 14.3.2 Operational Phase

The following activities will occur during the operational phase:

- The generation of electricity from the proposed solar facility and supply of electricity;
- Cleaning of panels and maintenance of the solar field and infrastructure.
- During the life span of the project (approximately 20 years), on-going cleaning and maintenance will be required on a scheduled basis.

### 14.3.3 Decommissioning Phase

The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise (i.e. if the actual solar facility becomes outdated or the land needs to be used for other purposes), the decommissioning procedures will be undertaken and the site will be rehabilitated and returned to its pre-construction state.

### 14.3.4 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.

- Solar panels, frames and inverters are to be transported in 40 foot long containers (which have exterior dimensions of 12.19 m long x 2.44 m wide x 2.59 m high) on double axle trucks within the road freight limitations of South Africa.
- Workers from the surrounding area will be transported by taxi (mini-bus)/bus/shuttle 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.

## 14.4 Baseline Environmental Description

### 14.4.1 Study Area Definition

The study area for the proposed Kudu Solar Facilities 1 to 12 is the full extent of the eight affected farm properties on which the proposed PV Facilities will be constructed. The full extent of these properties has been assessed in this study in order to identify environmental sensitivities and no-go areas. The total **study area** for Kudu Solar Facilities 1 to 12 is approximately 8 150 hectares (ha).

At the commencement of this Scoping and EIA Process, the **Original Scoping Buildable Areas**, which fall within the study area, were identified by the Project Developer following the completion of high-level environmental screening based on the Screening Tool.

Following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the **Revised Scoping Buildable Areas**. The **Revised Scoping Buildable Areas** were used to inform the design of the layout and further assessed during this EIA Phase of the project in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The development footprint is where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

### 14.4.2 General Description – Existing Road Network

The proposed Kudu Solar PV 11 facility will be located to the north-east of De Aar in the Northern Cape as shown in Figure 14-2.


**Figure 14-2: Proposed Kudu Solar PV11 Facility**

### *14.4.2.1 Haulage of Imported Materials*

There are three options for the haulage of imported materials to the proposed PV facility as shown in the figures below. The preferred option will be the route from the Port of Ngqura as shown in Figure 14-3. The route is approximately 545 km and follows the N2 from the Port and then turns north onto the N10 to De Aar. From De Aar, the R48 can be taken east up to the access point to the sites.

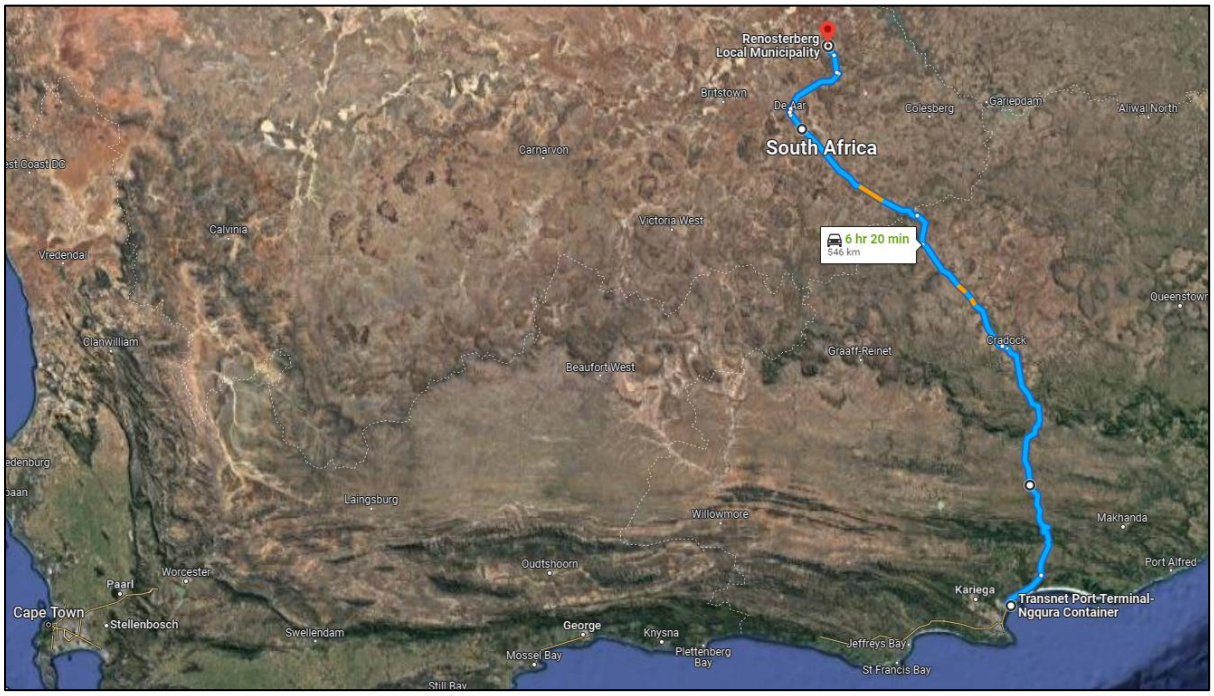


**Figure 14-3: Preferred Route**

The first alternative option will be the route from the Port of Cape Town as shown in Figure 14-4 by the blue line. This route is approximately 825 km and follows the N1 from the Cape Town Harbour and then turns north at Three Sisters onto the N12 to Britstown and then turns east towards De Aar. From De Aar, the R48 can be taken east up to the access point to the sites.


**Figure 14-4: Proposed Route: Alternative 1**

The second alternative option will be the route from the Port of Saldanha as shown in Figure 14-5 by the blue line. This route is approximately 845 km and follows the N7 from the Port and then turns east past Calvinia and Britstown to De Aar. From De Aar, the R48 can be taken east up to the access point to the sites.


**Figure 14-5: Proposed Route: Alternative 2**

It should be noted that the above-mentioned route alternatives will all need to navigate through intersections, over and underneath bridges and other road structures, across railway lines and also along mountain passes. It is critical that the abnormal load vehicles can move safely and without obstruction along these routes. It is however anticipated that this is achievable, considering other solar facilities in the vicinity of the proposed site.

#### *14.4.2.2 Main Roads in the Vicinity of the Site*

The main roads in the vicinity of the Kudu Solar PV 11 facility is shown in Table 14-1 and Figure 14-6. Table 14-1 also provides details with regards to the controlling and maintaining road authority, width of the road and whether the road is a gravel or surfaced (tarred) road.

**Table 14-1: Main Roads in the Vicinity of the Site**

| Road Name | Road Authority | Road Width | Gravel / Surfaced |
|---|---|---|---|
| Divisional Road 3084 (DR 3084) | Northern Cape Provincial Government | Between ± 6.0m and ± 7.5m | Gravel |
| Divisional Road 3093 (DR 3093) | Northern Cape Provincial Government | Between ± 6.0m and ± 8.0m | Gravel |
| Trunk Road 38/1 (TR 38/01) (R48) | Northern Cape Provincial Government | ± 6.2m blacktop and ± 2.5m gravel shoulders along both sides of the road | Surfaced |
| Main Road 790 (MR 790) (R388) | Northern Cape Provincial Government | ± 8.0m | Gravel |
| Divisional Road 3096 (DR 3096) | Northern Cape Provincial Government | Between ± 6.5m and ± 8.0m | Gravel |
| Trunk Road 38/02 (TR 38/02) (R48) | Northern Cape Provincial Government | ± 6.6m blacktop and ± 5m and more gravel shoulders along both sides of the road | Surfaced |

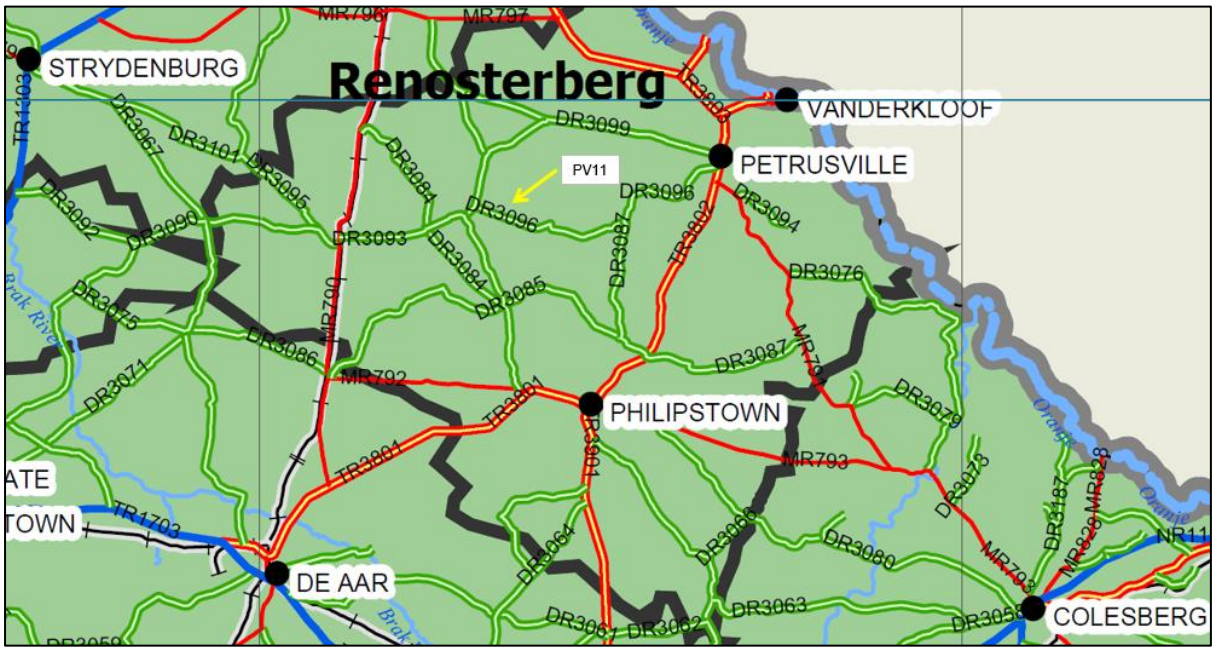


**Figure 14-6: Main Roads in the Vicinity of the Site**

### *14.4.2.3 Main Access Considerations*

As indicated in the previous paragraph, various existing provincial gravel roads from the R48 (Trunk Road 38/1 and Trunk Road 38/02) can provide access to the site. This can be seen in Figure 14-7 below.


**Figure 14-7: Proposed Kudu Solar PV Facility Gravel Roads**

The potential main access roads to the proposed facility as shown in Figure 14-7 and Figure 14-8 are:

- Access Route Option 1:
  - Route A: Along TR38/01, DR3093, and DR3096
  - Route B: Along TR38/01, DR3093 and DR3084
- Access Route Option 2:
  - Route A: Along MR790, DR3093 and DR3084
  - Route B: Along MR790 and DR3093
  - Route C: Along MR790, DR3093 and DR3096
- Access Route Option 3:
  - Route A: Along TR38/01, TR38/02, and DR3096
  - Route B: Along TR38/01, TR38/02, DR3096 and DR3093
  - Route C: Along TR38/01, TR38/02, DR3096, DR3093 and DR3084

Please also refer to Table 14-2 for an indication of all potential access roads.

**Table 14-2: Potential Access Roads**

| Access Option | Proposed Access Roads | Main access point from the closest surfaced road | Description of Applicability to the Kudu PV Project | Applicable to Kudu Solar Facility 11? |
|---|---|---|---|---|
| Access Route Option 1 | Route A: Along TR3801, DR3093, and DR3096 | Intersection of the TR3801 and DR3093 | This will provide access to all the proposed Kudu Solar Facilities. Alternatively, once the internal roads are constructed at Kudu Solar Facility 5, it can also be used to access Kudu Solar Facilities 1 to 4. Furthermore, once the internal roads are constructed at Kudu Solar Facility 7, it can also be used to access Kudu Solar Facilities 8 to 12. | Yes |
| | Route B: Along TR3801, DR3093 and DR3084 | Intersection of the TR3801 and DR3093 | This will provide access to the proposed Kudu Solar Facilities 1 to 5. | No |
| Access Route Option 2 | Route A: Along MR790, DR3093 and DR3084 | Intersection of the TR3801 and MR790 | This will provide access to the proposed Kudu Solar Facilities 1 to 5. | No |
| | Route B: Along MR790 and DR3093 | Intersection of the TR3801 and MR790 | This will provide access to the proposed Kudu Solar Facilities 5, 6 and 7. | No |
| | Route C: Along MR790, DR3093 and DR3096 | Intersection of the TR3801 and MR790 | This will provide access to the proposed Kudu Solar Facilities 8, 9, 10, 11 and 12. Alternatively, once the internal roads are constructed at Kudu Solar Facility 7, it can also be used to access Kudu Solar Facilities 8 to 12. | Yes |
| Access Route Option 3 | Route A: Along TR3801, TR3802, and DR3096 | Intersection of the TR3802 and DR3096 | This will provide access to the proposed Kudu Solar Facilities 8, 9, 10, 11 and 12. | Yes |
| | Route B: Along TR3801, TR3802, DR3096 and DR3093 | Intersection of the TR3802 and DR3096 | This will provide access to the proposed Kudu Solar Facilities 5, 6 and 7. Alternatively, once the internal roads are constructed at Kudu Solar Facility 8 to 10, it can also be used to access Kudu Solar Facilities 6 to 7. | No |
| | Route C: Along TR3801, TR3802, DR3096, DR3093 and DR3084 | Intersection of the TR3802 and DR3096 | This will provide access to the proposed Kudu Solar Facilities 1 to 5. | No |