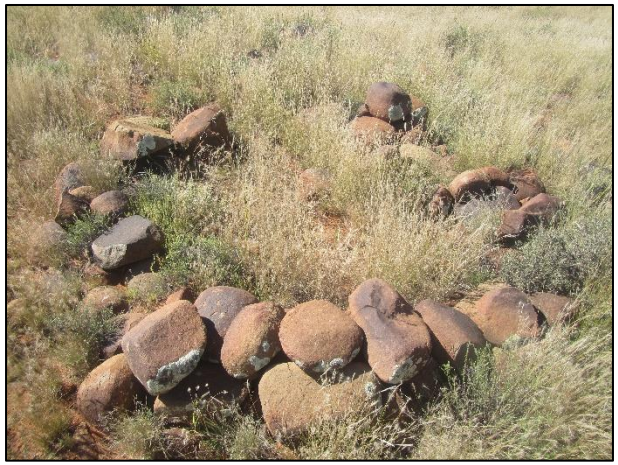
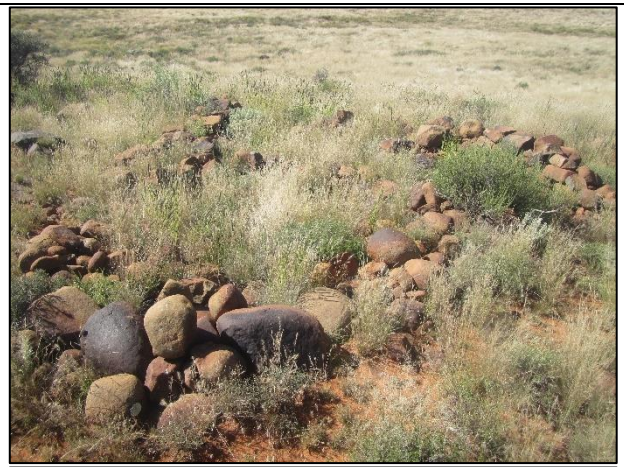
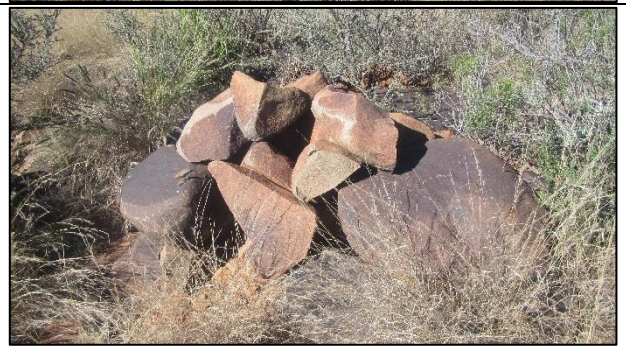
				
962	S30 08 23.9 E24 24 12.8	An isolated dolerite rock that looks like it has been used as a lower grindstone. The surface is lightly concave which presumably invited this use.		Very low GPC
963	S30 09 03.6 E24 23 16.6	Light scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC
964A	S30 09 14.1 E24 23 25.6			Medium

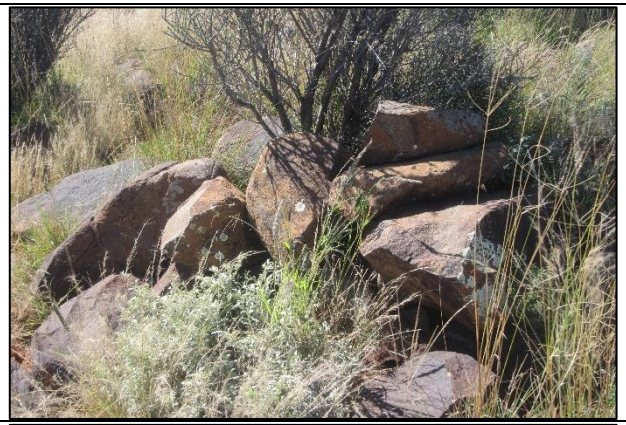
964B	S30 09 14.9 E24 23 25.6	These waypoints are the four corners of a U-shaped kraal located on the northern foot of a prominent hill. The open side of the kraal faces downhill and the entire structure is 33 m by 33 m. It is heavily overgrown with grass.		GPA
964C	S30 09 15.2 E24 23 24.5			
964D	S30 09 14.2 E24 23 24.4			
965	S30 09 16.3 E24 23 25.8	These waypoints represent the corners of two adjoining rectangular stone-walled kraals. The whole feature has ends of about 21 m (north) and 26 m (south), while its sides measure 50 m (west)and 44 m (east). The shared wall in the middle is 26 m long.		Medium GPA
965B	S30 09 16.1 E24 23 26.5			
965C	S30 09 16.8 E24 23 26.9			
965D	S30 09 17.1 E24 23 26.0			
965E	S30 09 17.8 E24 23 26.4			
965F	S30 09 17.4 E24 23 27.2			

966	S30 09 15.5 E24 23 25.8	There are two stone-walled features here. One is a small, circular feature less than 2 m across (photograph below), while the other has two enclosures with the whole feature being about 5 m across (photographs at right). They are assumed to relate to farming activities and are located just north of the kraal at waypoint 965. 	 	Medium GPA

967	S30 09 17.5 E24 23 25.4	Two stone-walled enclosures of about 2 m diameter each.		Medium GPA
968	S30 09 18.2 E24 23 25.0	A small stone cairn with two fragments of dark bottle glass alongside it.		Medium GPA
969	S30 09 18.9 E24 23 25.0	A small stone cairn. Feature apparently related to the ABW.		Medium GPA

970	S30 09 19.6 E24 23 25.1	A small stone cairn. Feature apparently related to the ABW.		Medium GPA
971	S30 09 19.7 E24 23 25.1	An elongated pile of stones. Feature apparently related to the ABW.		Medium GPA
972	S30 09 20.1 E24 23 25.4	A small stone cairn on a flat dolerite outcrop. Feature apparently related to the ABW.		Medium GPA

973	S30 09 20.6 E24 23 25.2	An elongated pile of stones. Feature apparently related to the ABW.		Medium GPA
974	S30 09 21.0 E24 23 25.2	An elongated pile of stones. Feature apparently related to the ABW.		Medium GPA
975	S30 09 21.2 E24 23 25.5	A small stone cairn. Feature apparently related to the ABW.		Medium GPA

976	S30 09 21.2 E24 23 25.1	A small stone cairn. Feature apparently related to the ABW.		Medium GPA
977	S30 09 21.7 E24 23 25.1	A small stone cairn. Feature apparently related to the ABW.		Medium GPA
978	S30 09 19.1 E24 23 15.0	The overgrown and much degraded remains of an earthen walled dam with a few stones present on the ground at 978 and a slight earth		Very low GPC
978B	S30 09 18.5 E24 23 14.2			

978C	S30 09 19.7 E24 23 13.3	mound present at 978B and 978C. The earth mound has no doubt eroded flat.		
979	S30 09 18.9 E24 23 15.0	Light scatter of moderately well-patinated MSA hornfels flaked stone artefacts.		Very low GPC
980	S30 09 48.7 E24 22 15.6	A row of gum trees with other older trees and a corrugated iron reservoir nearby. Part of the cultural landscape.		Low
981	S30 09 45.7 E24 22 17.3	Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC

982	S30 11 08.7 E24 21 35.8	Some trees and a reservoir. Part of the cultural landscape.		Low
983	S30 11 22.8 E24 18 16.7	A large farm outbuilding and two ruined labourers' cottages that are likely more than 60 years old. They are on Portion 5 of Grass Pan 40, outside the study area. There is also one more recent cottage. These are on a neighbouring farm and were not visited.		Medium
984	S30 11 09.9 E24 23 47.8	Light scatter of well-patinated hornfels MSA flakes as well as a few less patinated ones and some quite fresh ones. The latter are LSA. The artefacts are located in an eroded area with plenty of hornfels gravel at the foot of a dolerite hill.		Very low GPC

985	S30 11 10.5 E24 23 53.6	The poorly preserved remains of a stone-walled kraal measuring about 18 m by 37 m and located on the foot of a dolerite hill. Although the site was not examined in detail, some glass, ceramics and metal fragments were seen.		Low GPB
986	S30 11 11.3 E24 23 55.5	This is the foundation of a small (presumably) house made of dolerite rocks but with a brick and cement portion built on to the southern side. It is located very closer to the kraal at waypoint 985. Although the site was not examined in detail, some glass, ceramics and metal fragments were seen.		Medium GPA

987	S30 11 08.2 E24 23 56.3	A scraped engraving on top of a dolerite hill. It looks quite recent and relatively casually done. It might be lettering but it is not possible to be sure of this.		Very low GPC
988	S30 11 07.5 E24 23 55.9	A circular enclosure of about 3.5 m by 2.5 m located on the summit of a dolerite hill. It is just a low wall of informally piled stones. No associated artefacts seen so cannot tell if this is historical or precolonial.		Low GPB

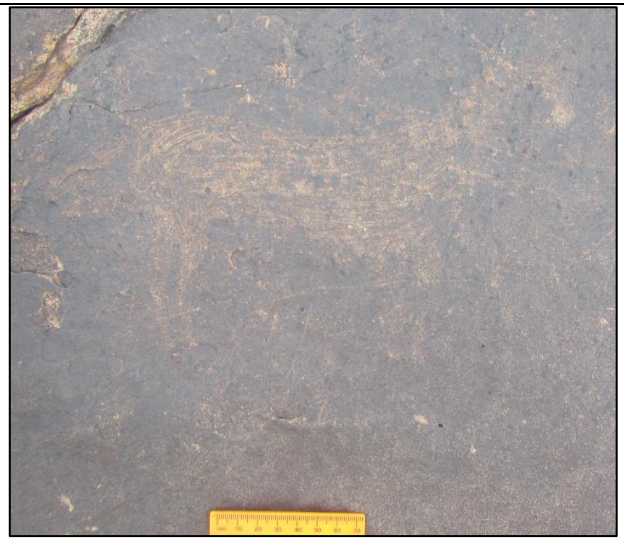
989	S30 11 07.2 E24 23 55.8	A circular enclosure of about 1 m diameter located on the summit of a dolerite hill. It looks like informally piled stones but could also be badly tumbled. The walling is far more substantial than that at waypoint 988 No associated artefacts seen so cannot tell if this is historical or precolonial.		Low GPB
990	S30 11 10.1 E24 24 00.2	Ephemeral scatter of well-patinated hornfels MSA flakes as well as some quite fresh ones. The latter are LSA. The artefacts are located in an eroded area with plenty of hornfels gravel at the foot of a dolerite hill.		Very low GPC
991	S30 12 03.3 E24 23 13.1	Some gum trees and a reservoir. Part of the cultural landscape.		Low
992	S30 11 15.1 E24 23 30.6	A rectangular earthen feature measuring 18 m by 24 m. It is barely visible on the ground but is clear on aerial photography. It may have been a low dam but there are no stones on the walls and no wind pump nearby.		Very low GPC

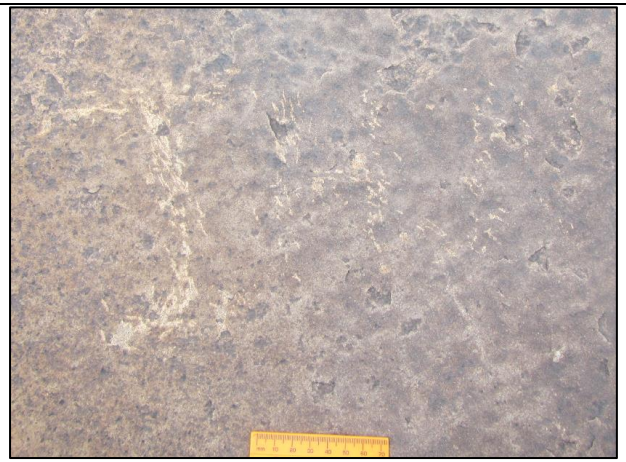
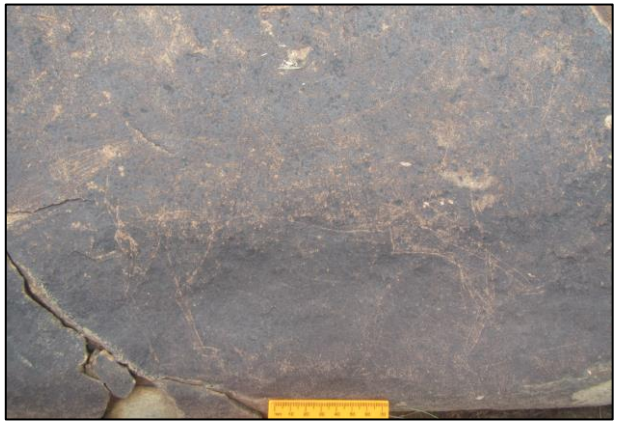
993	S30 11 10.7 E24 23 30.0	This is a scatter of patinated MSA hornfels artefacts in a disturbed area. There are heavily patinated and somewhat less patinated artefacts indicating hat not all come from the same time.		Very low GPC
994	S30 11 20.6 E24 21 49.2	An ephemeral scatter of well-patinated MSA hornfels artefacts located in the jeep track below powerlines.		Very low GPC
995	S30 11 48.6 E24 21 23.7	An ephemeral scatter of well-patinated MSA hornfels artefacts located in the jeep track below powerlines.		Very low GPC
996	S30 11 49.9 E24 21 59.1	Some gum and Karee trees and a reservoir. Part of the cultural landscape.		Low
997	S30 11 47.4 E24 22 01.2	An ephemeral scatter of well-patinated MSA hornfels artefacts located in a denuded area.		Very low GPC

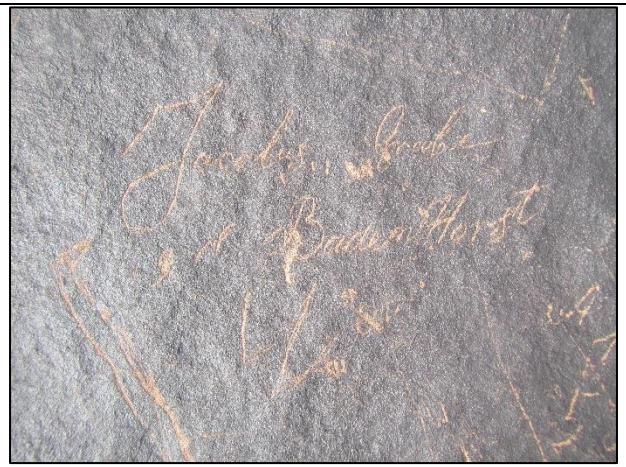
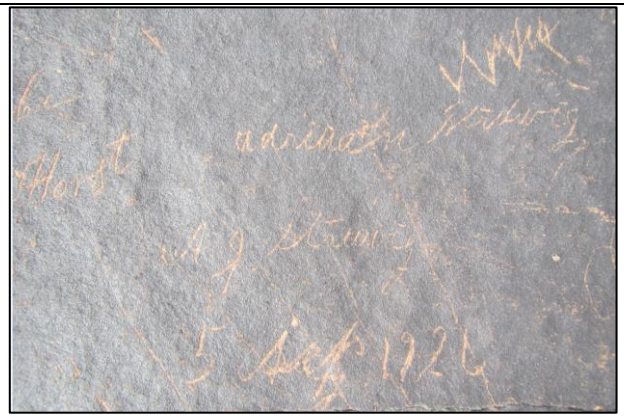
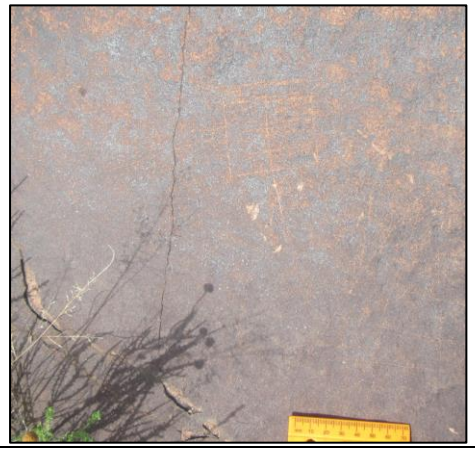
998	S30 11 29.7 E24 22 52.1	This is an area with windrows as well as a fruit orchard (quince, prickly pear and probably peach trees) as well as a grove of Soutbos. There is a stone-lined dam (marked as waypoint 999) and some wind pumps and a corrugated iron reservoir. Part of the cultural landscape.		Low
999	S30 11 28.2 E24 22 50.6	This is the stone-lined dam noted under waypoint 998.		
1000	S30 11 18.4 E24 22 07.5	Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC
1001	S30 13 01.1 E24 21 55.9	Some trees, a corrugated iron reservoir and a wind pump. Part of the cultural landscape.		Low
1002	S30 13 32.8 E24 22 02.6	Some trees and a reservoir. Part of the cultural landscape.		Low
1003	S30 13 55.1 E24 21 30.5	An old prickly pear orchard located very far from any farm buildings. Part of the cultural landscape.		Low

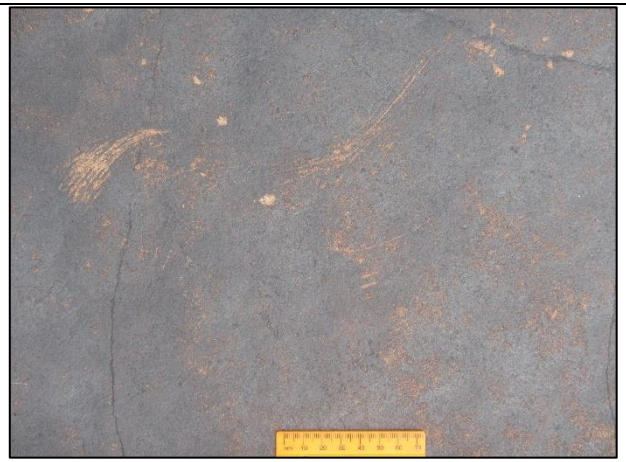
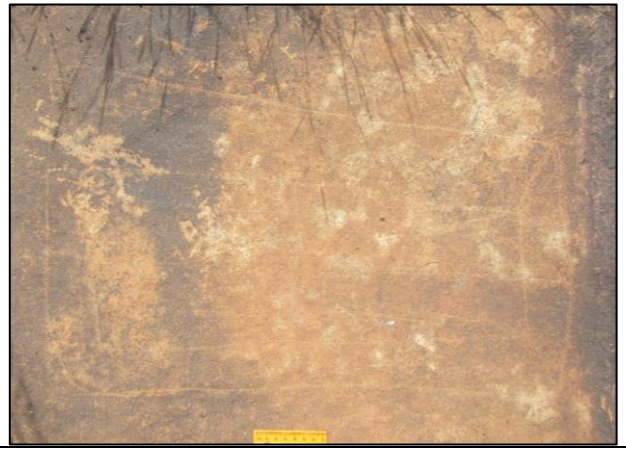
1004	S30 13 52.7 E24 20 48.4	A light scatter of fresh hornfels flaked stone artefacts and some ostrich eggshell fragments at the northern foot of a dolerite hill (Basberg). It cannot be determined how extensive the scatter is due to the dense grass but it might stretch much further than was evident. These finds were in a pathway.		Low GPB
1005	S30 12 01.4 E24 20 19.0	Some trees, a corrugated iron reservoir and a wind pump. Part of the cultural landscape.		Low
1006	S30 11 53.4 E24 19 44.3	A cluster of gum trees. Part of the cultural landscape.		Low
1007	S30 11 33.2 E24 18 22.3	A farmstead on Portion 5 of Grass Pan 40, outside the study area. It was not visited. The house looks to be early 20th century.		High
1008	S30 14 30.9 E24 19 35.9	The oldest-looking of a set of three different labourers' cottages. It is in poor condition and is probably early-mid-20th century.		Low

1009	S30 17 32.6 E24 20 50.6	Mixed age hornfels artefacts exposed along the edge of a borrow it. Some artefacts were seen to have some calcrete adhering and the patination varied from well-patinated red to only lightly patinated grey.		Very low GPC
1010	S30 16 13.1 E24 19 54.9	Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC
1011	S30 16 10.6 E24 19 41.7	Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC
1012	S30 16 15.8 E24 19 04.5	Some gum trees, a corrugated iron reservoir and a wind pump. Part of the cultural landscape.		Low
1013	S30 15 28.9 E24 19 35.7	Some trees, a corrugated iron reservoir and a wind pump. Part of the cultural landscape.		Low

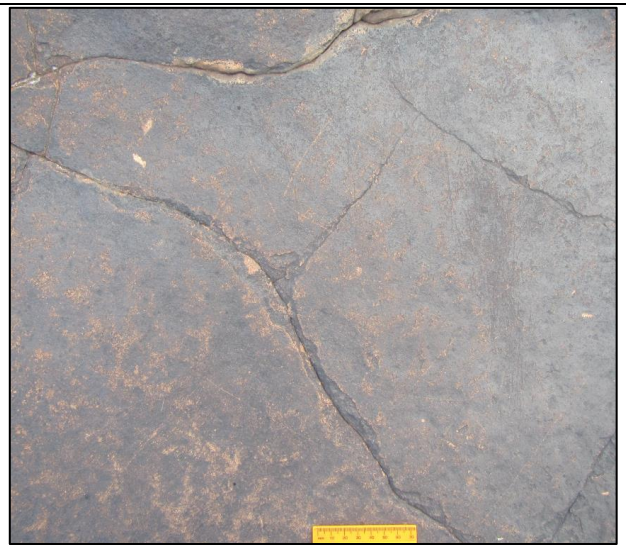
1014	S30 15 21.0 E24 20 07.6	A large willow tree, a corrugated iron reservoir and a wind pump. Part of the cultural landscape.		Low
1015	S30 14 35.8 E24 19 46.5	An earthen-walled dam with a few stones along its crest at one point.		Very low
1016	S30 14 36.0 E24 19 49.5	An area of 25 m diameter on a low dolerite hill with many historical/recent engravings. They include indistinguishable scratches and motifs, horses, ostriches and writing. One rock has the date “5 Sep 1926” and the name “Jacobus Grabe (likely) Badenhorst” in cursive writing. It also has “E. ROBINSON” and a large stylised ostrich scratched on it. Another rock has two ostriches, one with a shaded body, while two others have stylised horses scratched on them. The site has been allocated a grade despite the date of 1926, since it is easily possible that the engravings were made over a long period of time and some may be older than 100 years. Either way, the site demonstrates a connection with intangible heritage through its continuation of the engraving tradition. The same applies to all the rock engravings recorded below.		Medium-High IIIB

				
1017	S30 14 37.1 E24 19 50.9	This is another area on the same low hill as waypoint 1016 but it is about 10 m in diameter. It includes a checkered motif made in a cross shape with some squares having an X in them, along with several other geometric and indeterminate scratched motifs. 		Medium GPA

1018	S30 14 38.1 E24 19 51.3	This is another area on the same low hill as waypoint 1016 but it is about 5 m in diameter. The engravings here include a stylised horse which is somewhat patinated and could be older than the rest, a geometric motif similar to a Nine Men's Morris board, a set of three columns of 8, 9 and 10 short lines respectively, and some indeterminate scratches/motifs. 	 	Medium-High IIIB

1019	S30 14 38.8 E24 19 51.5	Further along the same hill as waypoint 1016, a very lightly scratched stylised horse with several other indeterminate very light scratches over and around it.		Medium GPA
1020	S30 14 39.8 E24 19 52.7	Further along the same hill as waypoint 1016, an indeterminate scratched geometric motif.		Low GPB

1021	S30 14 40.3 E24 19 52.7	Further along the same hill as waypoint 1016, an indeterminate scratched motif.		Low GPB
1022	S30 14 38.7 E24 19 48.9	Various scratched rocks with one image being an animal with the top of its body drawn far higher than it should be. 		Low GPB

1023	S30 14 27.5 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.	 	Medium-High

		 		
1024	S30 14 27.7 E24 19 24.4			

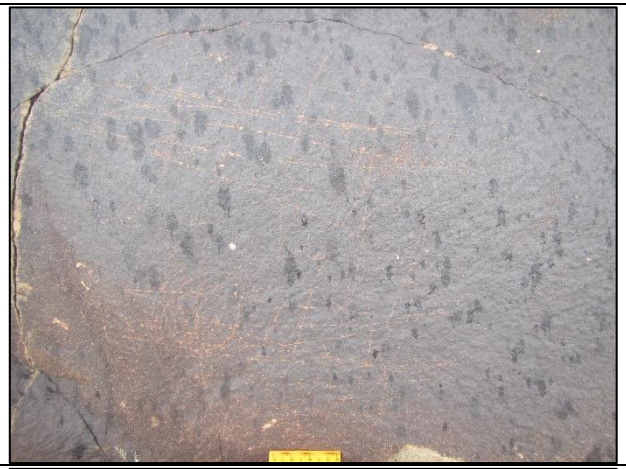
1024B	S30 14 28.1 E24 19 23.5	A large ash and rubbish midden measuring about 35 m long and about 10-20 m wide. It is on sloping ground. The waypoints are near each end. There is plenty of glass and ceramics as well as various types of metal (iron, copper and a grey metal, possibly pewter) and much bone. 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. 	   	Medium-High IIIB

			 	
Waypoints 1025-1033 are all on the hill immediately behind (south of) the Basberg farm house.				
1025	S30 14 28.2 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 GPA

1026	S30 14 29.6 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.	 	Medium GPA

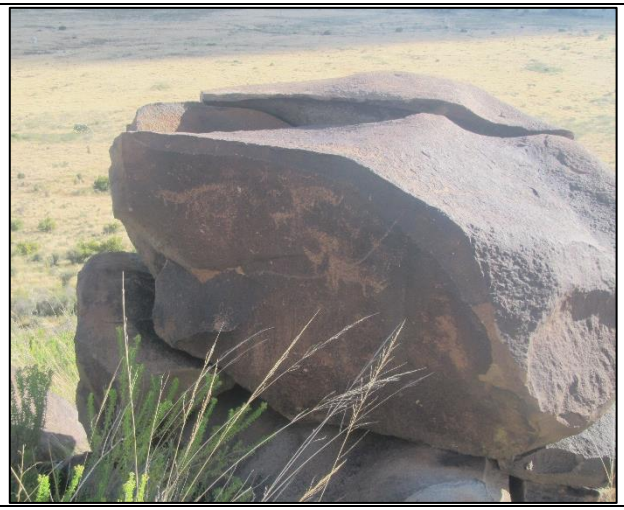
				
1027	S30 14 31.5 E24 19 25.3	A rock at the top of the hill with some indeterminate historical scratches on it.		Very low GPC
1028	S30 14 31.5 E24 19 26.4	A rock with various indeterminate motifs as well as a fair bit of writing. Among the writing can be seen a date of “25 MAY ‘30” and another with “5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

1029	S30 14 31.1 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. 		Medium GPA
1030	S30 14 31.6 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 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 E24 19 28.5	A rock at the top of the hill with some indeterminate historical scratches on it.		Very low GPC

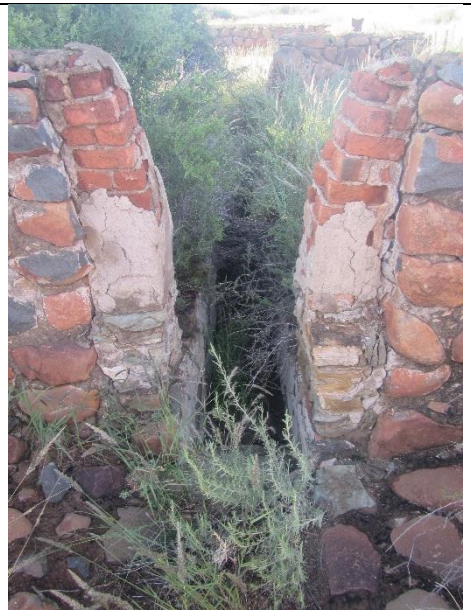
1033	S30 14 31.7 E24 19 28.5	A rock on the side of the hill with an indeterminate geometric historical motif on it.		Very low GPC
1034	S30 14 30.6 E24 19 32.3	A dolerite cobble and cement kraal with an adjoining shed. The cement is fairly modern so likely early-mid-20th century.		Medium
1035	S30 15 01.9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

1037	S30 14 25.7 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 GPC
1038	S30 14 26.7 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 IIIA

				
1039	S30 14 28.5 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 GPB
1040	S30 14 32.1 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 GPC

1041	S30 14 35.0 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 IIIB
1042	S30 14 35.5 E24 19 20.2	A rock at the top of the hill with a ground patch and some scratches on it.		Very low GPC
1043	S30 14 36.2 E24 19 20.8	A rock at the top of the hill with a ground patch on it.		Very low GPC
1044	S30 14 37.8 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 IIIA

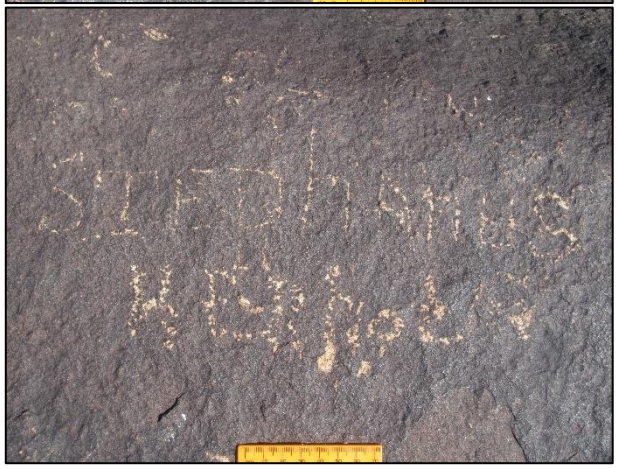
		 		
1045	S30 14 38.5 E24 19 21.9	A rock at the top of the hill with a ground patch on it.		Very low GPC
1046	S30 14 40.2 E24 19 22.1	A rock at the top of the hill with a ground patch and two pecked areas on it.		Very low GPC

1047	S30 14 42.2 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 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 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. 		Low

1050	S30 14 26.2 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 E24 17 46.9	An early-mid-20th 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 GPB

1052	S30 11 48.4 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 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 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 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		Medium GPA
1054B	S30 11 47.1 E24 17 48.2			
1054C	S30 11 46.8 E24 17 48.1			

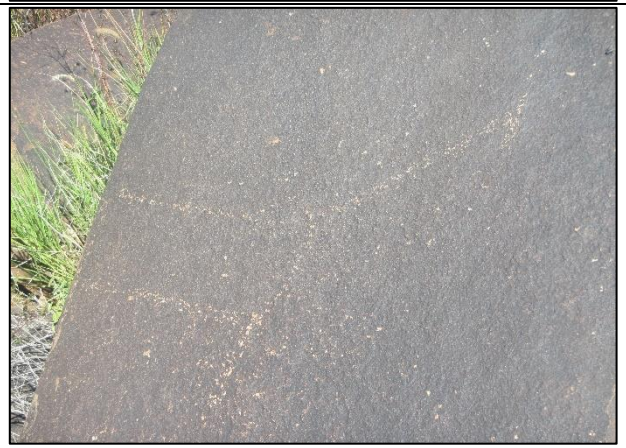
1054D	S30 11 48.0 E24 17 44.9	fence line and the shape of the entire feature (shown by white circles at right) suggests another indeterminate function. 		
1055	S30 11 46.7 E24 17 48.6	A long feature of about 22 m with the southern part being about 3 m wide and made of bricks (though no in situ bricks could be seen) and the northern part being 5 m wide and of stone.		Medium GPA
1056	S30 11 46.2 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 GPA

1057	S30 11 46.4 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.  	 	Medium-High IIIB

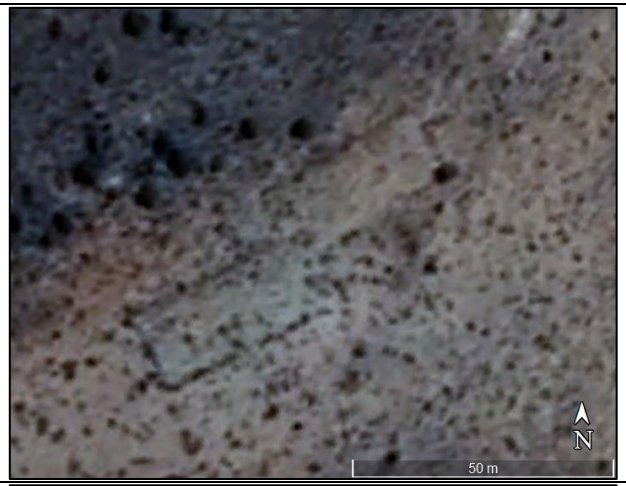
1058	S30 11 49.6 E24 17 40.0	A cluster of trees, a corrugated iron reservoir, a wind pump and some wire enclosures. Part of the cultural landscape, but directly associated with the historical farm complex.		Medium
1059	S30 11 41.7 E24 17 38.2	A rock with scratched writing on it. Among other things, it 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 IIIB
1060	S30 11 31.2 E24 17 16.8	Ephemeral scatter of well-patinated hornfels MSA flakes located in an eroded area.		Very low GPC
1061	S30 11 42.8 E24 17 03.1	Three ground rocks on a dolerite outcrop.		Very low GPC

1062	S30 11 42.0 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 GPC
1063	S30 11 41.4 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 GPB
1064	S30 11 40.8 E24 17 04.1	There are several ground rocks on a dolerite outcrop here.		Very low GPC
1065	S30 11 40.1 E24 17 04.5	One ground rock on a dolerite outcrop.		Very low GPC
1066	S30 11 56.8 E24 17 22.8	A small beacon of dolerite rocks on a small dolerite outcrop.		Very low GPC

1067	S30 11 54.0 E24 17 36.5	A 400 m long berm runs from northwest to southeast. Its function could not be ascertained.		Very low GPC
1067B	S30 12 02.0 E24 17 48.1			
1068	S30 11 51.8 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 GPB
1069	S30 11 51.2 E24 17 47.2	This is a concrete plinth that seems like the foundation for a pump. It is likely mid-20th century in age.		Very low GPC
1070	S30 11 51.5 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 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 GPC

1072	S30 14 18.1 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
1073	S30 14 33.1 E24 19 34.0	Two boulders with pecked and scraped engravings of animals. They look historical/recent. 		Low GPB

1074	S30 14 33.4 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. 		Low GPB
1075 1075B 1076	S30 18 07.5 E24 21 27.3 S30 18 08.0 E24 21 28.4 S30 18 08.6 E24 21 29.8	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.		Medium GPA

				
1077	S30 18 14.2 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 GPA
1077B	S30 18 14.6 E24 21 28.9			
1077C	S30 18 15.4 E24 21 29.3			
1077D	S30 18 15.0 E24 21 30.2			
1077E	S30 18 15.8 E24 21 28.0			
1077F	S30 18 15.4 E24 21 27.8			
1078	S30 18 25.1 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 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 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 PV1 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 12), a labourer's cottage was added at Middelplaas Noord (Portion 5 of Grass Pan 40) since 1968 (Figure 13), but Basberg (on Portion 3 of Basberg 88) is no different now than it was in 1974 (Figure 14). Notable at Wolwekuil (on Remainder of Wolwe Kuilen 42) are the two enclosures made from *Agave americana* plants (Figure 12). 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 15 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.

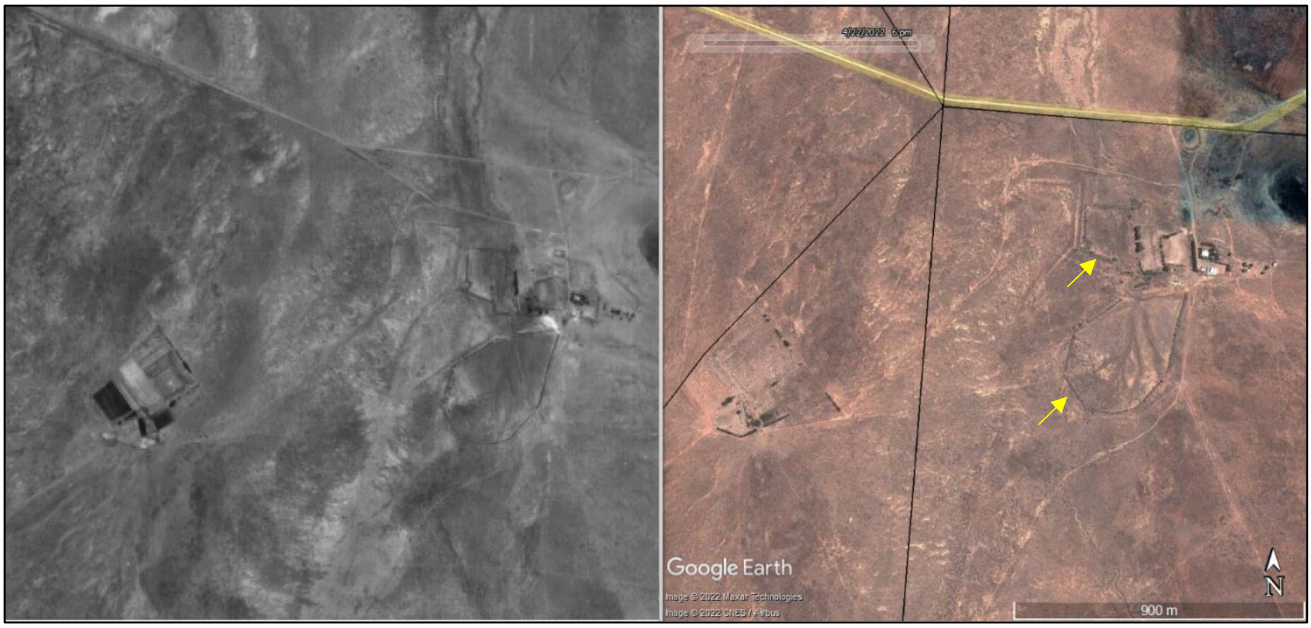


Figure 12: *1968 (611_012_00356) and modern (Google Earth) views of the Wolwekuil farm complex (on Remainder of Wolwe Kuilen 42). Three structures are visible in the main complex (waypoint 947) and the orchard and fields to the southwest (on Remainder of Annex Wolwe Kuilen 41) were in use (waypoints 998 & 999). At the farmstead there are two enclosures of Agave plants that predate 1968 (yellow arrows).*

Figure 13: *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 14: *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 (waypoints 1008, 1023 & 1034).*

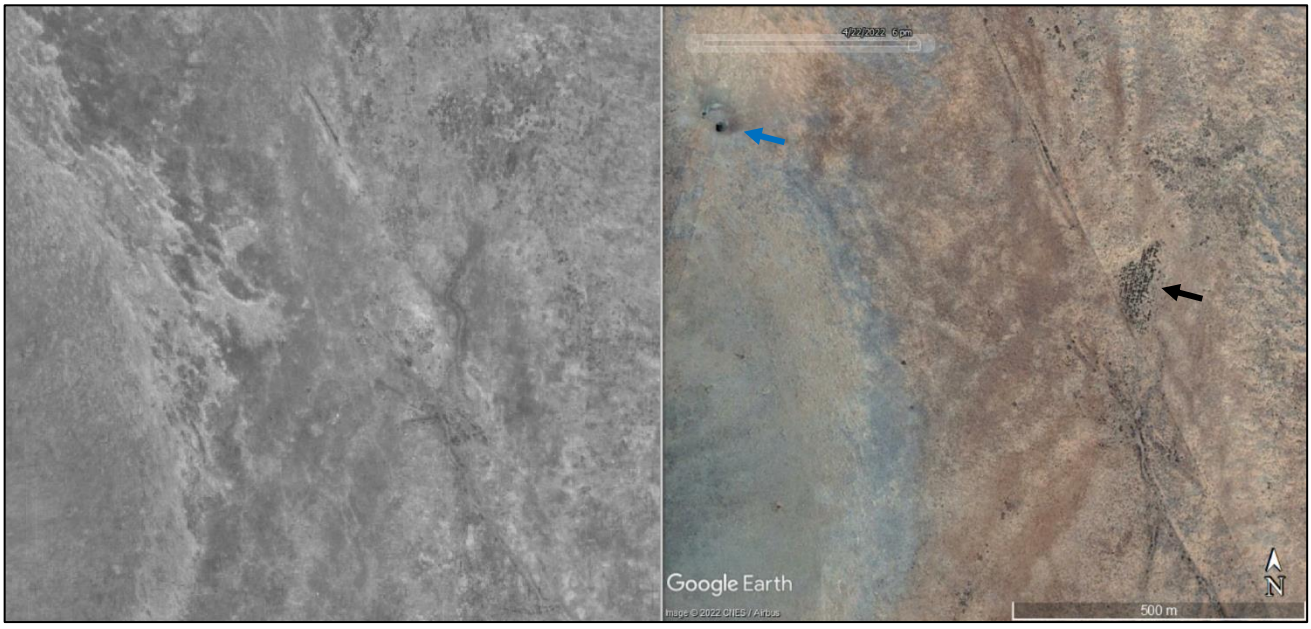


Figure 15: *1974 (738_025_12972) and modern (Google Earth) views showing the location of a prickly pear orchard (black arrow) planted since 1974 on the remainder of Annex Wolwe Kuilen 41. The water point (blue arrow) on Basberg 88/rem also post-dates 1974.*

5.4.2. Site visit

The only 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. Some of the livestock watering points 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 PV1 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 16 and 17). 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 PV1 footprint.

Figure 16: *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 and are illustrated here as an example.*

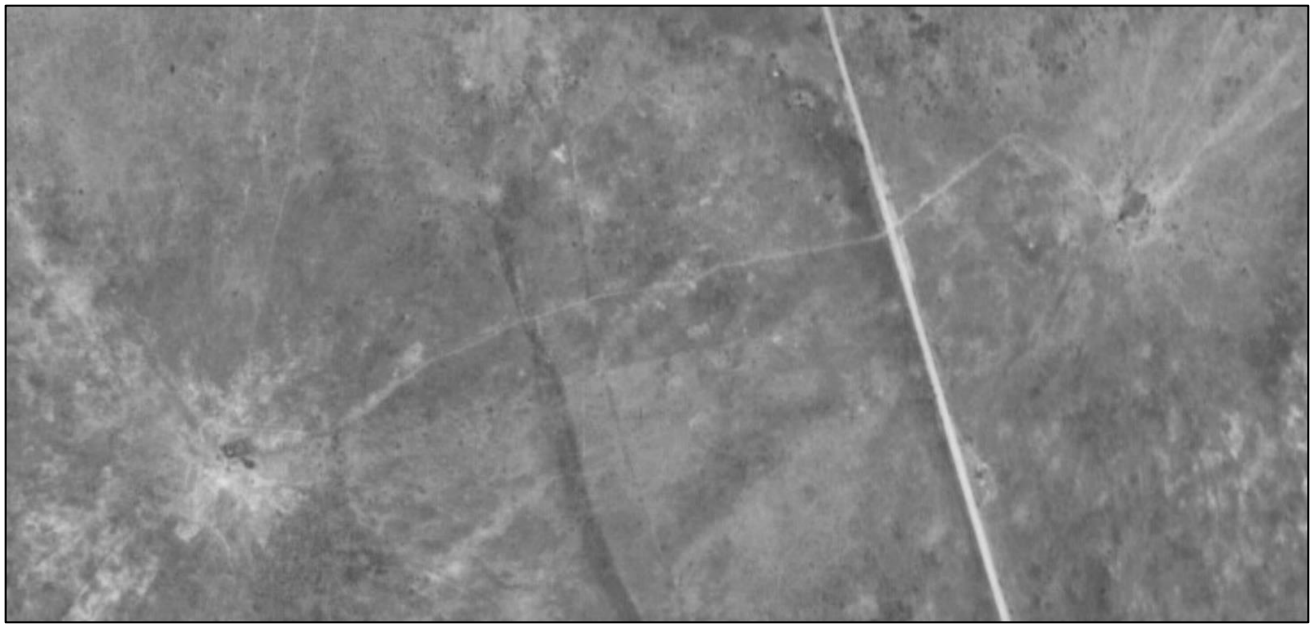


Figure 17: *1974 (738_026_13055) view of two watering points on Portion 3 of Basberg 88. The western one is within PV5 and is illustrated here as an example.*

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 18 in relation to the proposed Kudu PV1 footprint.

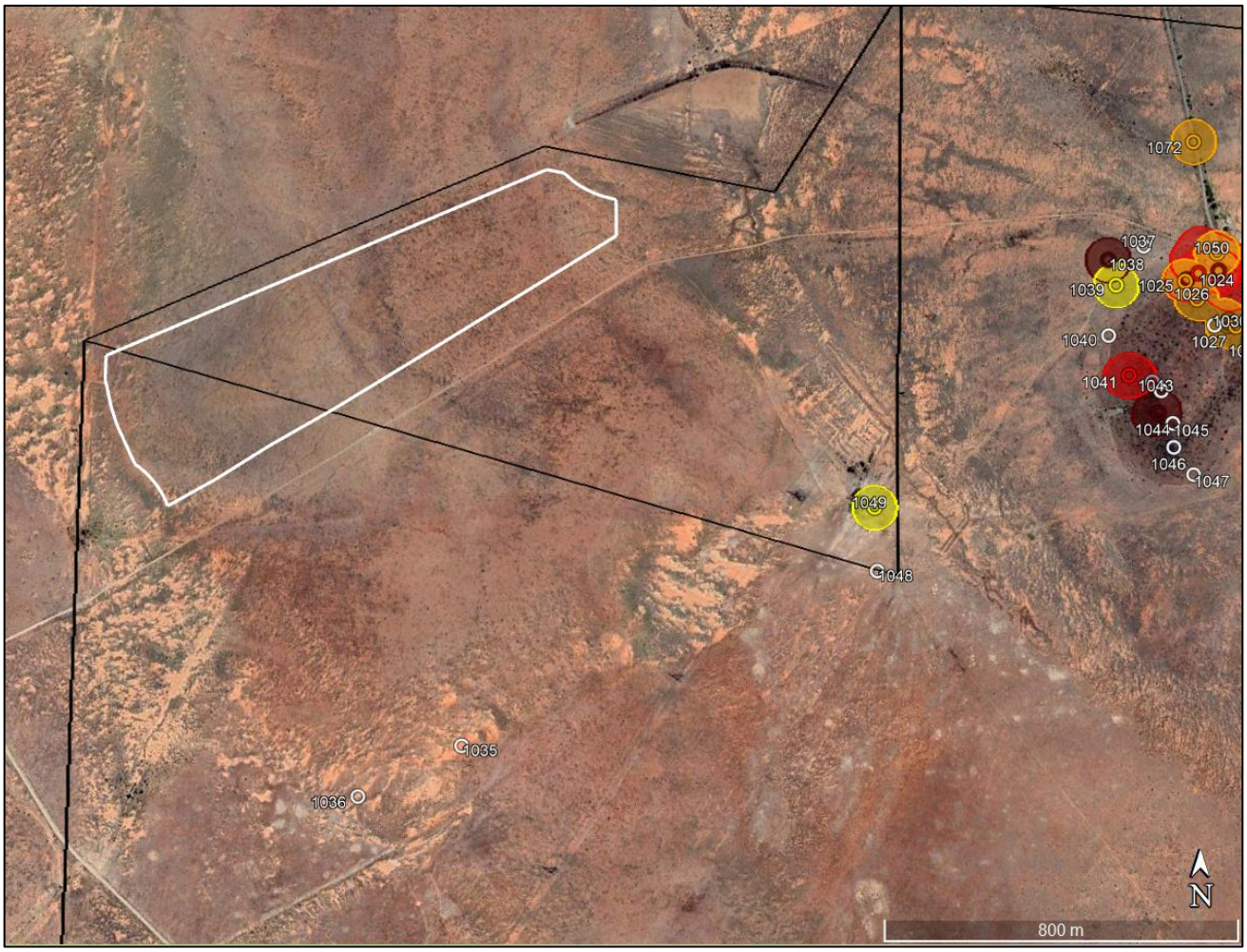


Figure 18: *Map of heritage resources occurring in and around the PV1 study area. They are mapped with 50 m buffers (dark red symbols = IIIA, red = IIIB, orange = GPS, yellow = GPB), but GPC resources are not buffered (white symbols).*

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 - 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 - 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 - 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 - Paint buildings in earthy colours to reduce contrast - 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 - 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) - 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 - Minimise cut-and-fill and landscape scarring in general - Avoid construction on slopes and high ground - 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 - 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 - Place ancillary infrastructure in less prominent areas - 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 19 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 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 12/12/20/2463/1/2 12/12/20/2463/1/A2 12/12/20/2463/1/AM3 12/12/20/2463/1/AM4 12/12/20/2463/1/AM5	Onshore Wind	140	Approved and Preferred Bidder (Operational)	Longyuan Mulilo De Aar 2 North Wind Energy Facility Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility The Wind Energy Facility (North and South) situated on the Plateau Near De Aar, Northern Cape Province
12/12/20/2463/2 12/12/20/2463/2/AM2	Onshore Wind	100	Approved and Preferred Bidder (Operational)	Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility The Wind Energy Facility (North and South) Situated On The Plateau Near De Aar, Northern Cape Province
14/12/16/3/3/1/1166 14/12/16/3/3/1/1166/AM3 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 Aar 2 North Wind Energy Facility (WEF) to the Hydra Substation in De Aar, Northern Cape

DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE
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 14/12/16/3/3/2/278/1 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 14/12/16/3/3/2/564/AM1 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 14/12/16/3/3/2/2245 14/12/16/3/3/2/2246 14/12/16/3/3/2/2247 14/12/16/3/3/2/2248 14/12/16/3/3/2/2249 14/12/16/3/3/2/2250 14/12/16/3/3/2/2251 14/12/16/3/3/2/2252 14/12/16/3/3/2/2253 14/12/16/3/3/2/2254 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
N/A	Transmission Line	220	Existing Power Line	HYDRA ROODEKUIL 2
N/A	Transmission Line	132	Existing Power Line	HYDRA ROODEKUIL 1

DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE
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 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 Cape Corridor Phase 2: Zeus - Hydra 765kV Integration
N/A	Transmission Line	765	Planned Power Line	Perseus to Gamma 2nd 765 kV line Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line

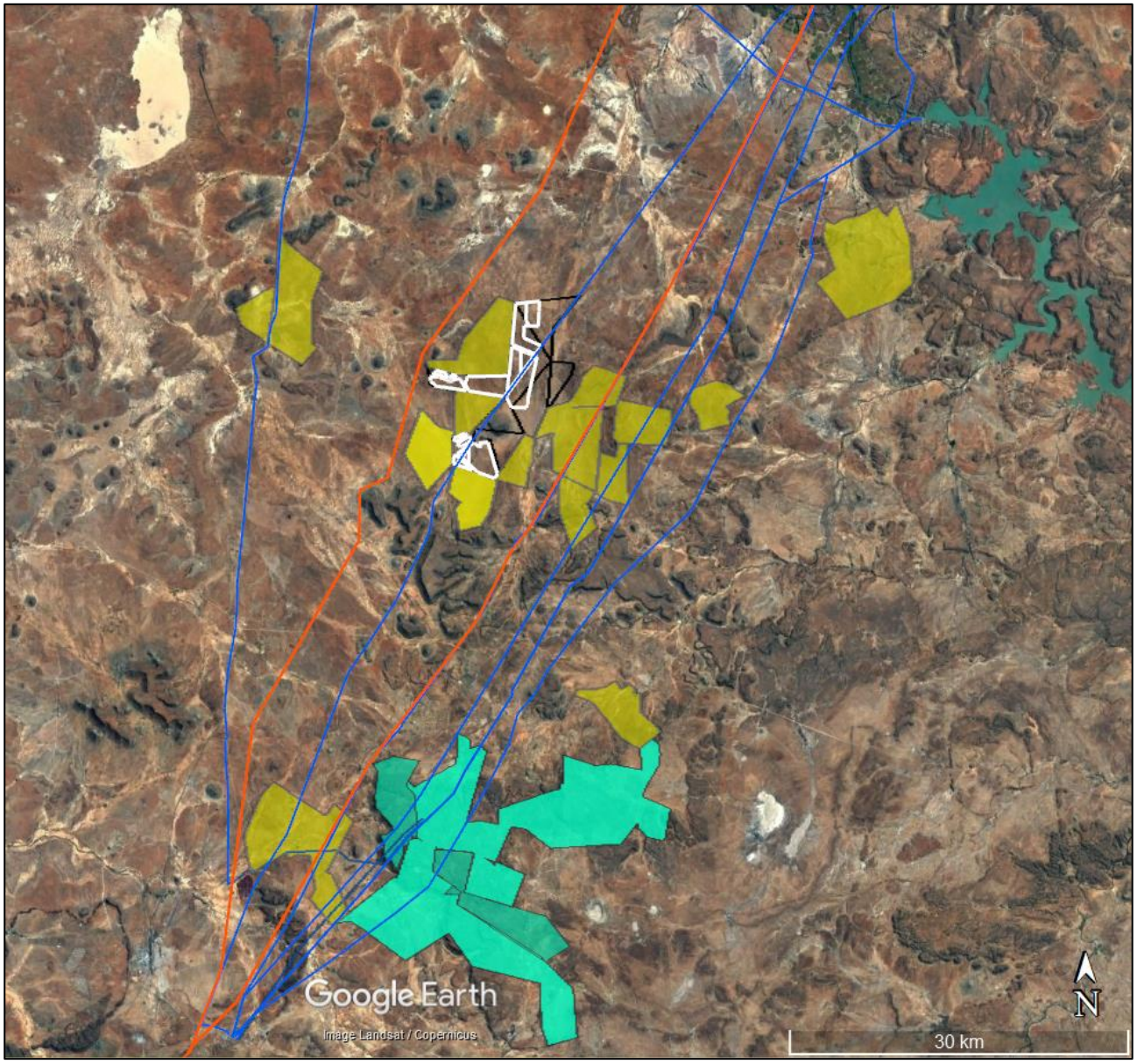


Figure 19: *Map showing renewable energy facilities (operational and proposed) in the vicinity of the Kudu study area. Kudu land parcels shown in white.*

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 programme (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 and	Once off	Project Developer

		downlighting to reduce night-time light pollution.	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 PV1 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 PV1 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 PV1 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 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.

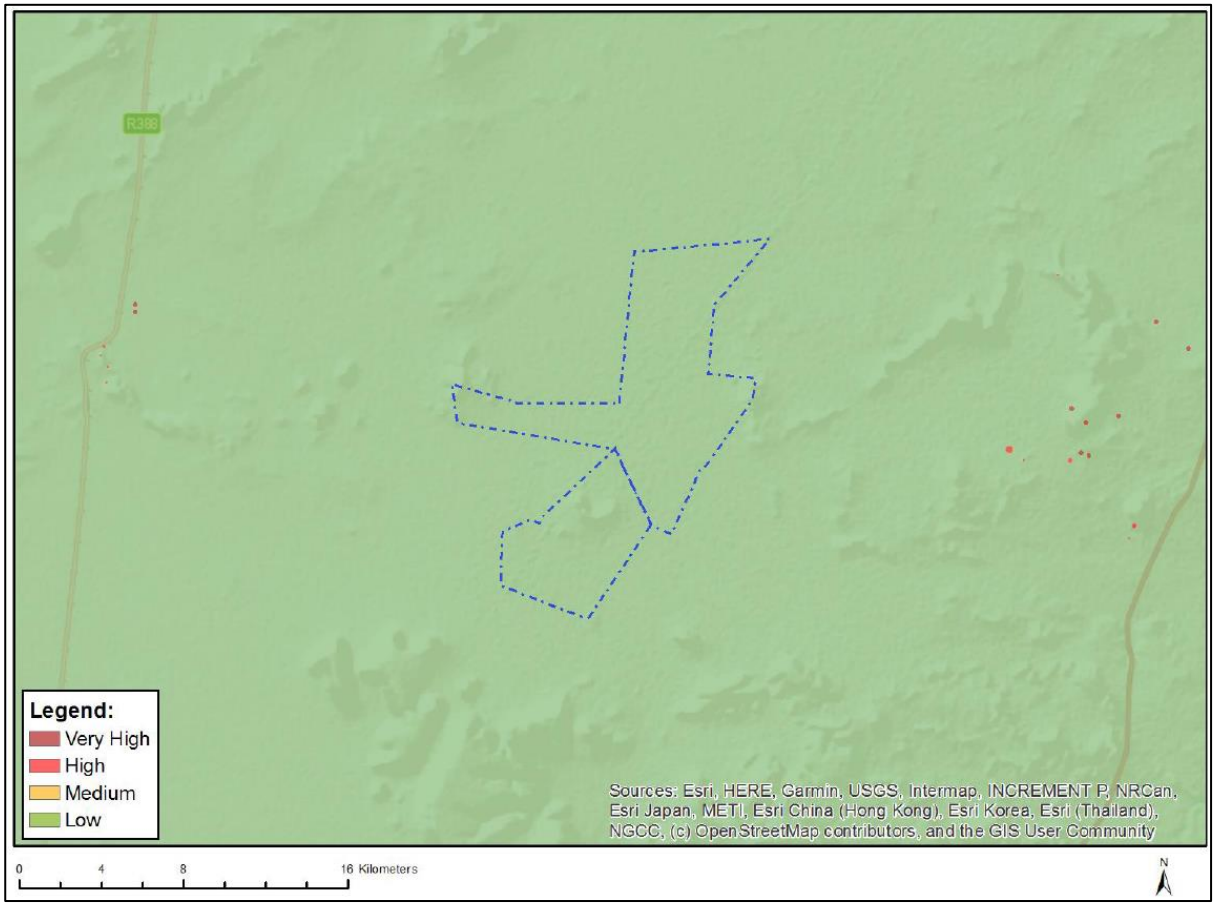
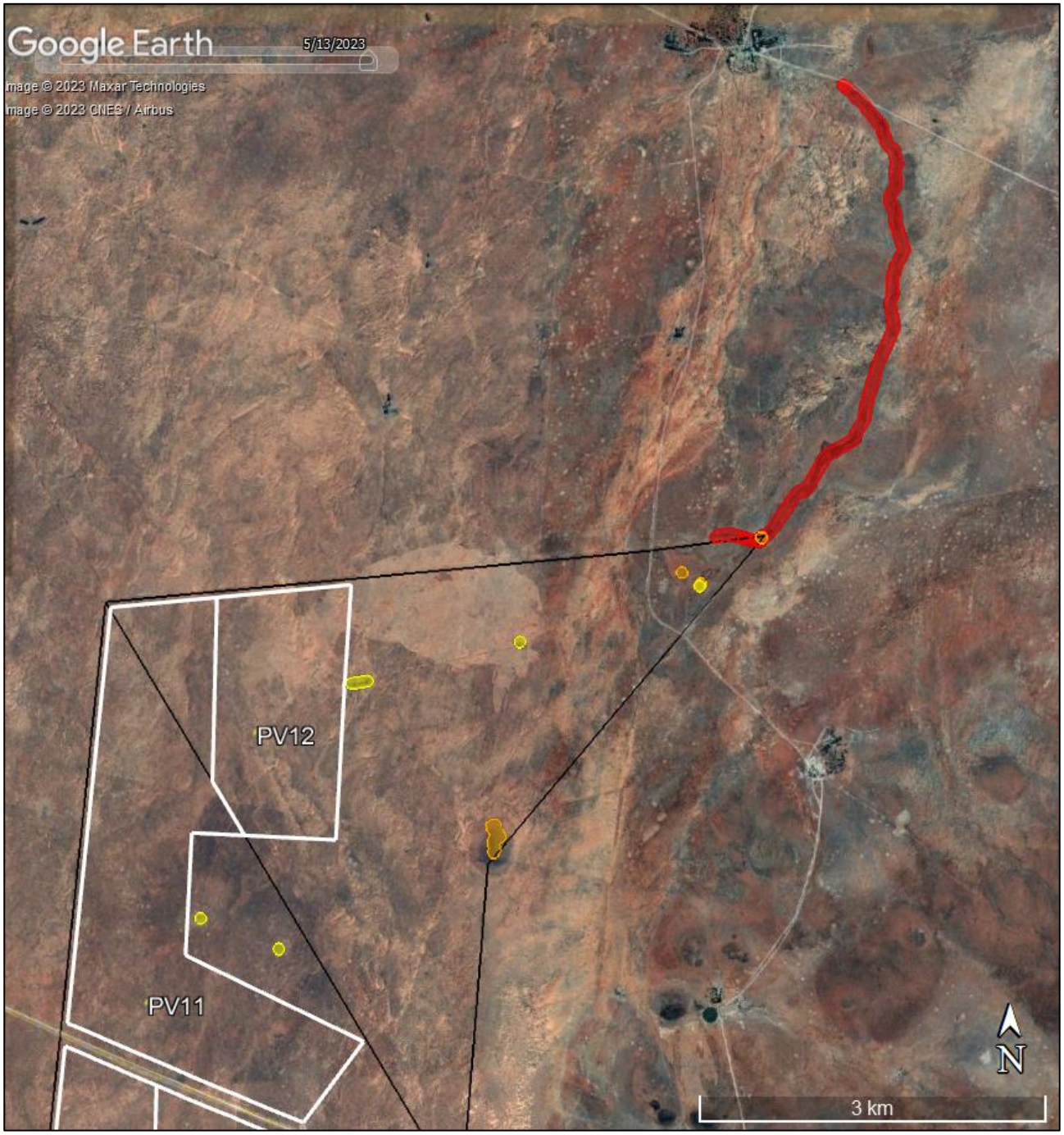


Figure A2.1: *Screening tool map of archaeological and heritage sensitivity.*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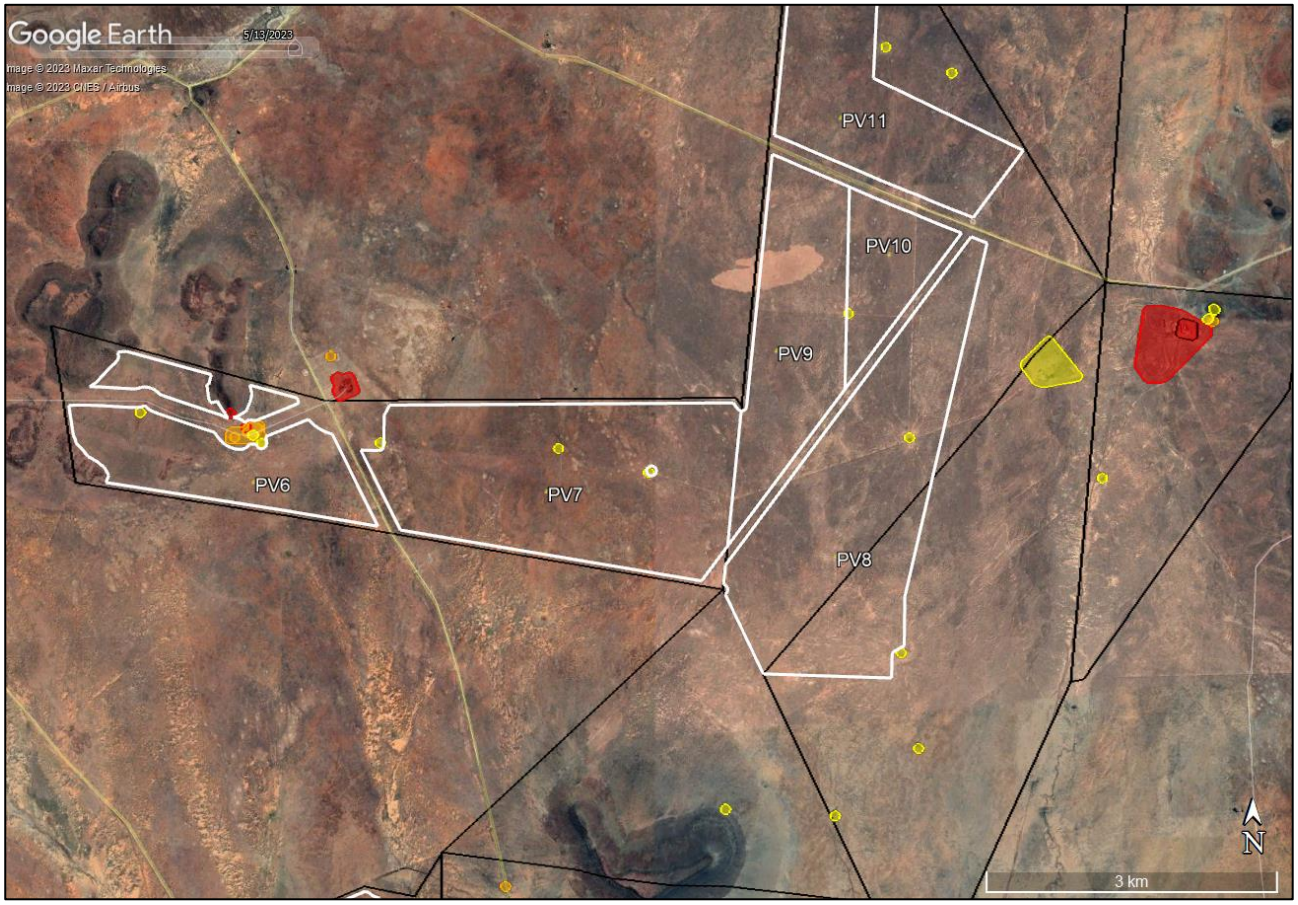
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Google Earth
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Image © 2023 Maxar Technologies
Image © 2023 CNES / Airbus
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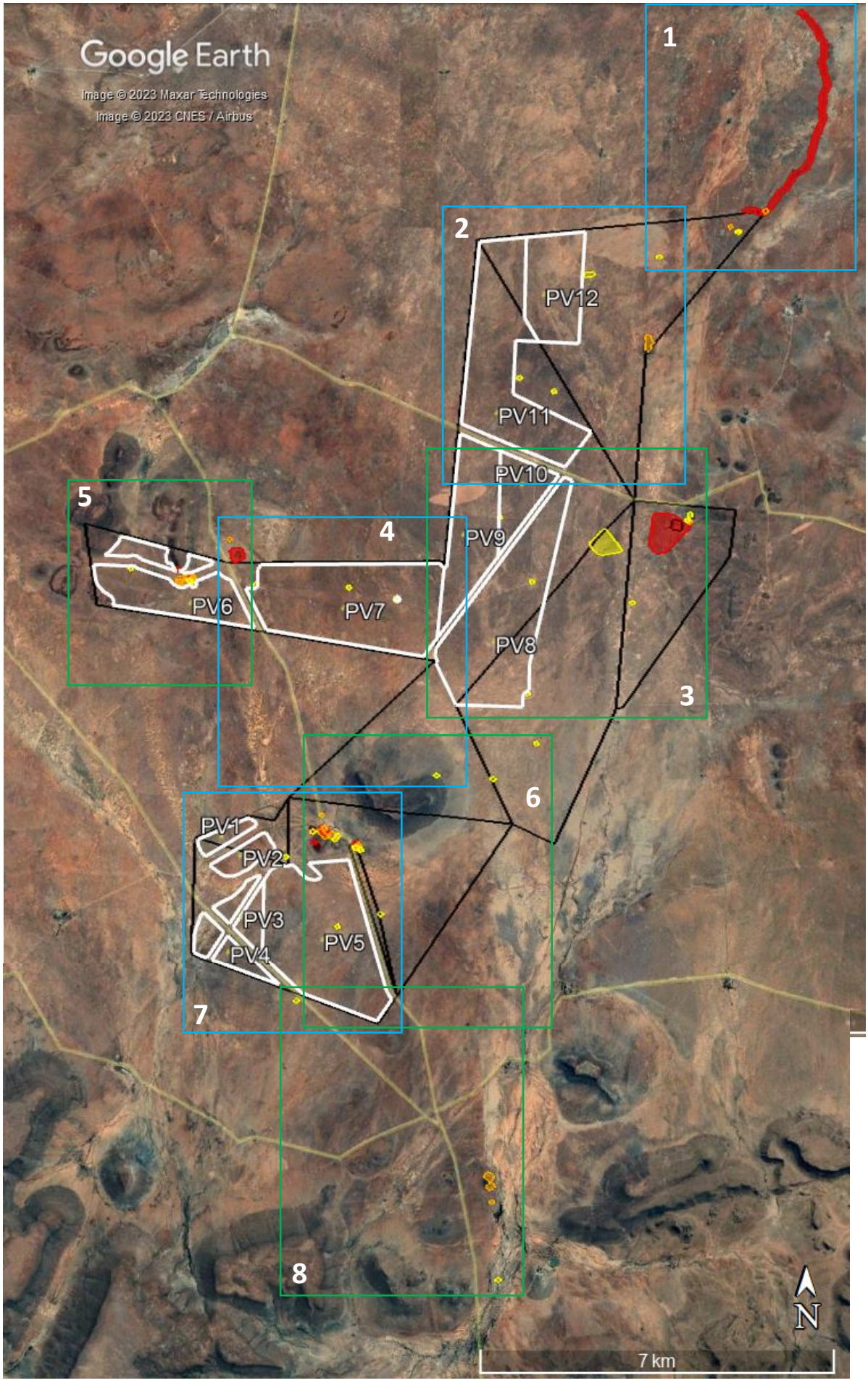
APPENDIX 3 – Mapping

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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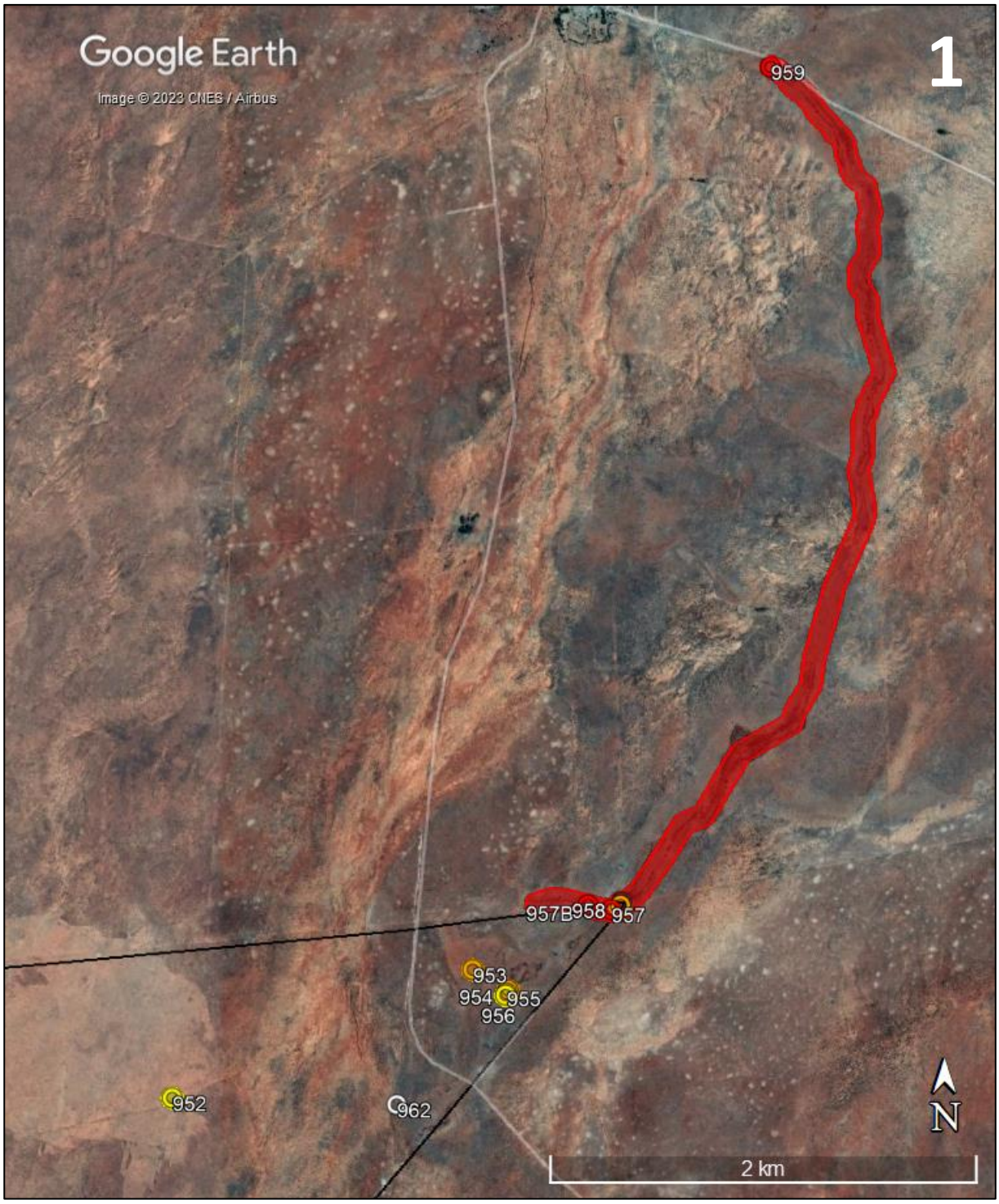

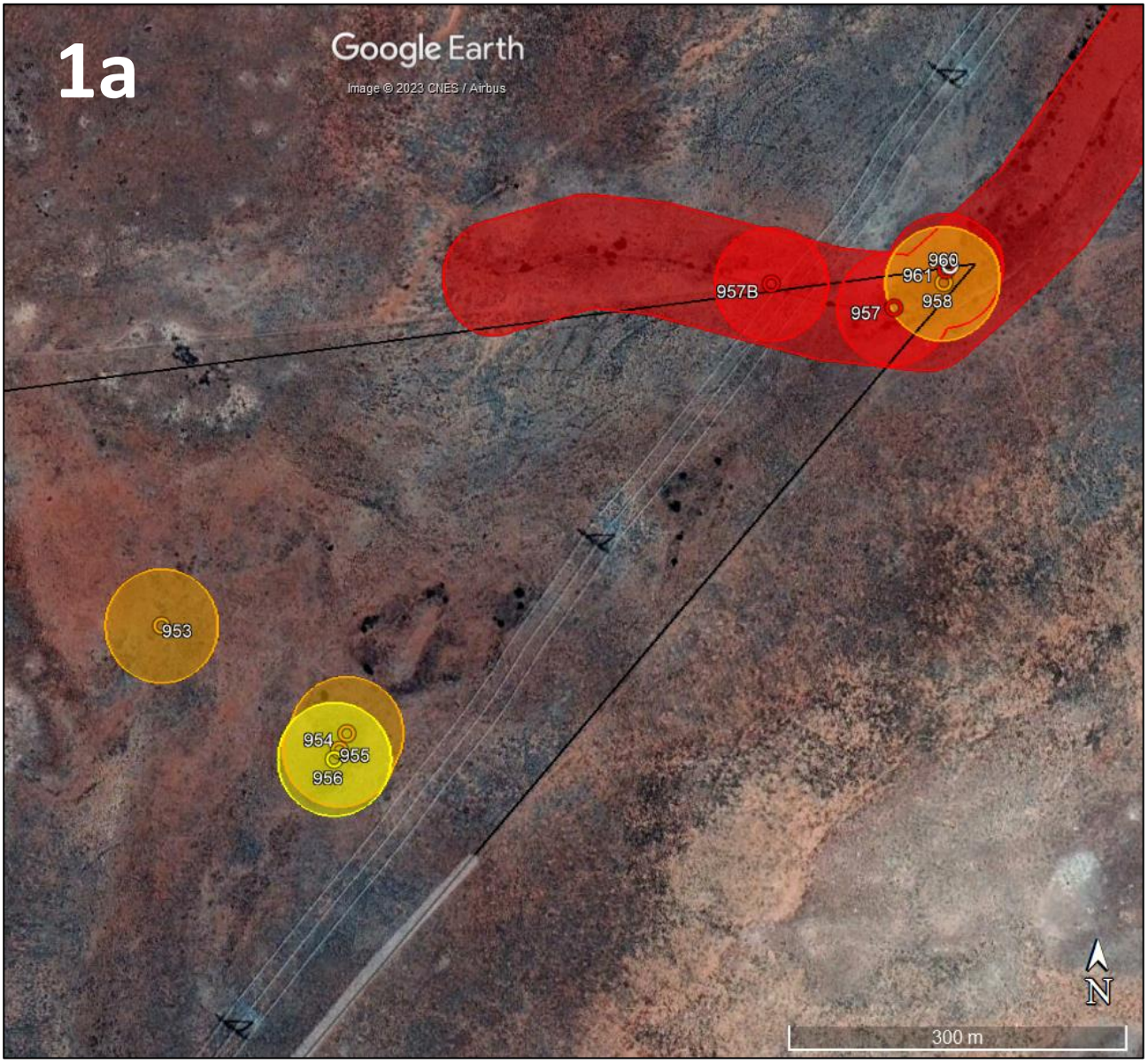
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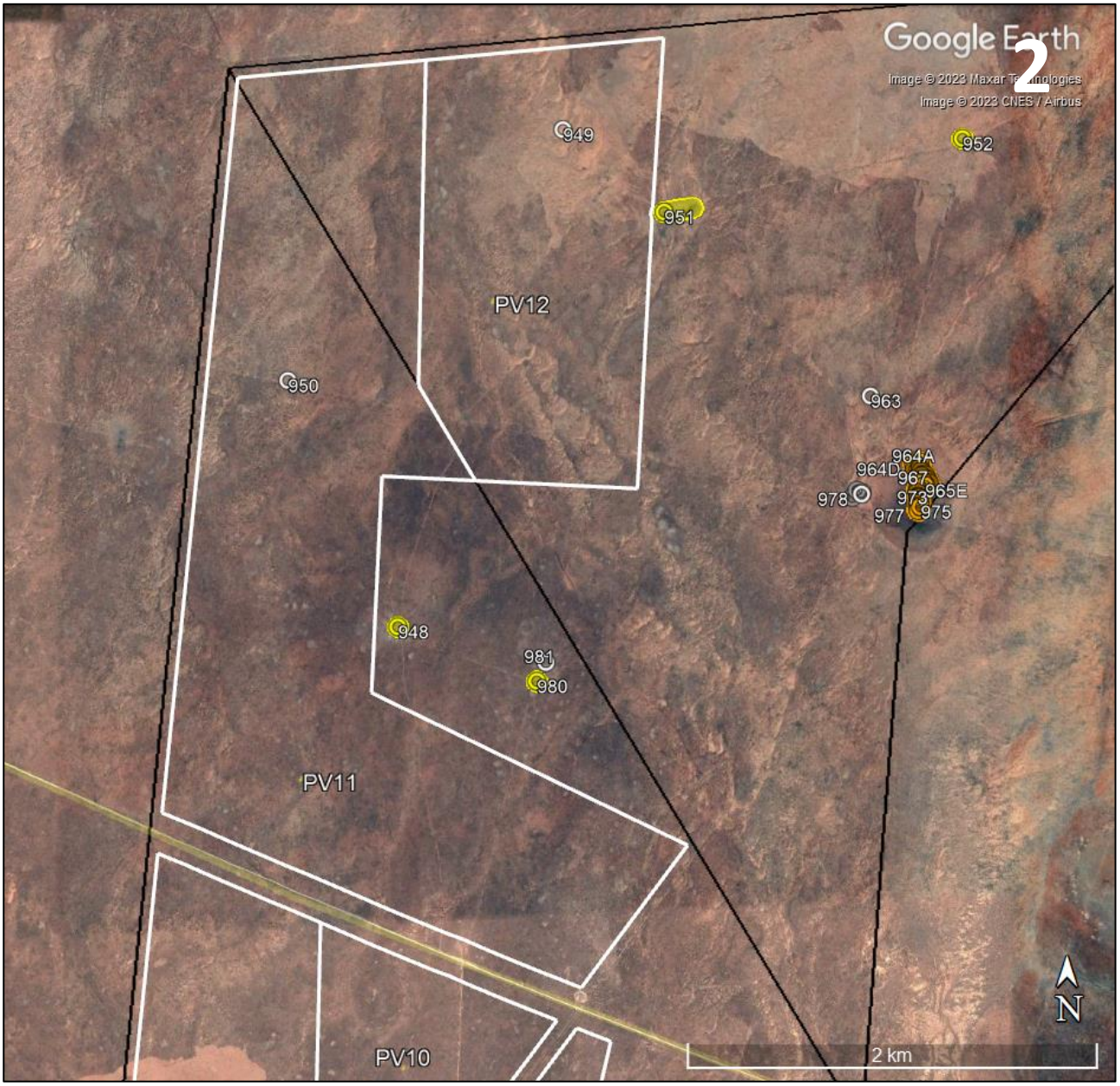
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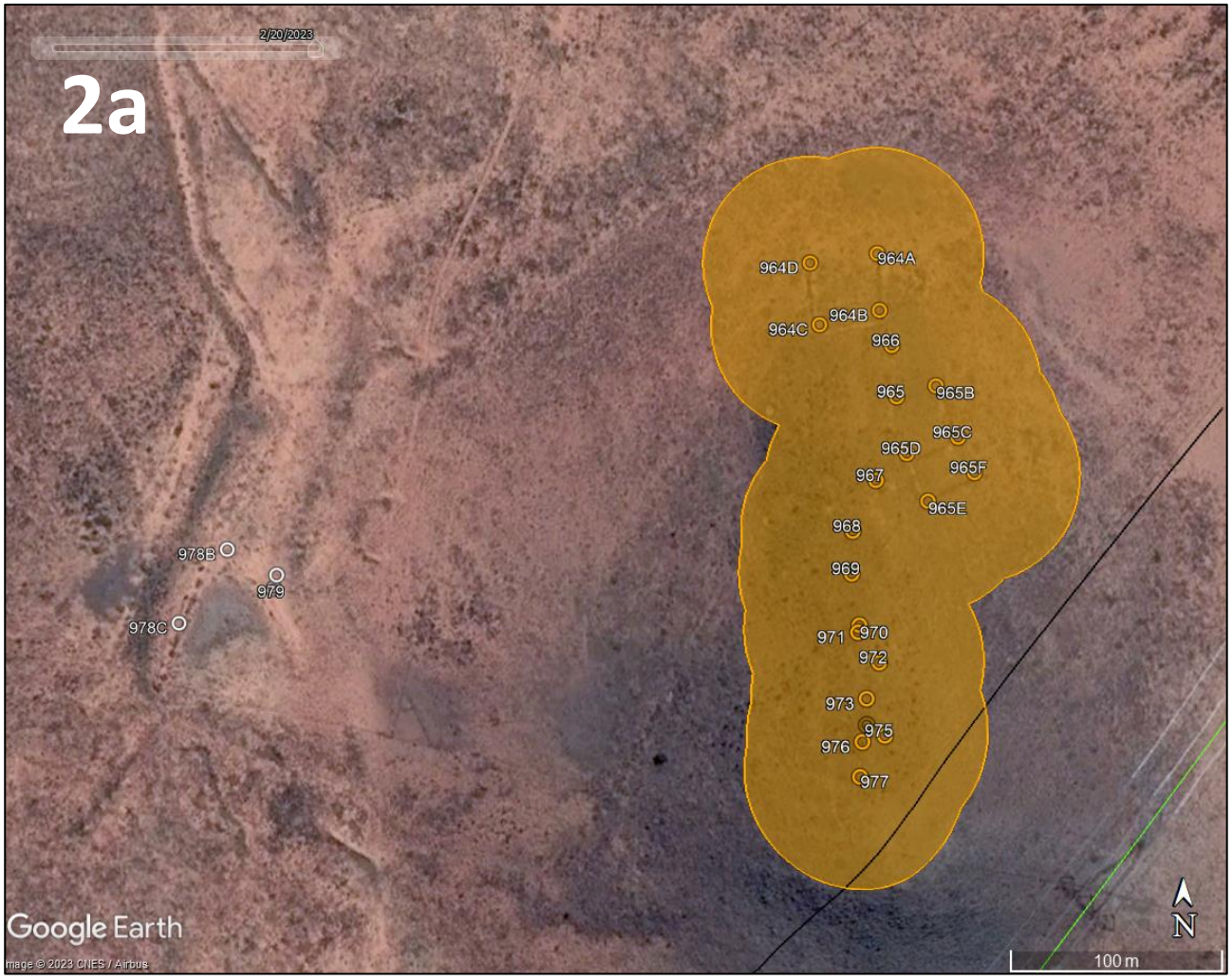
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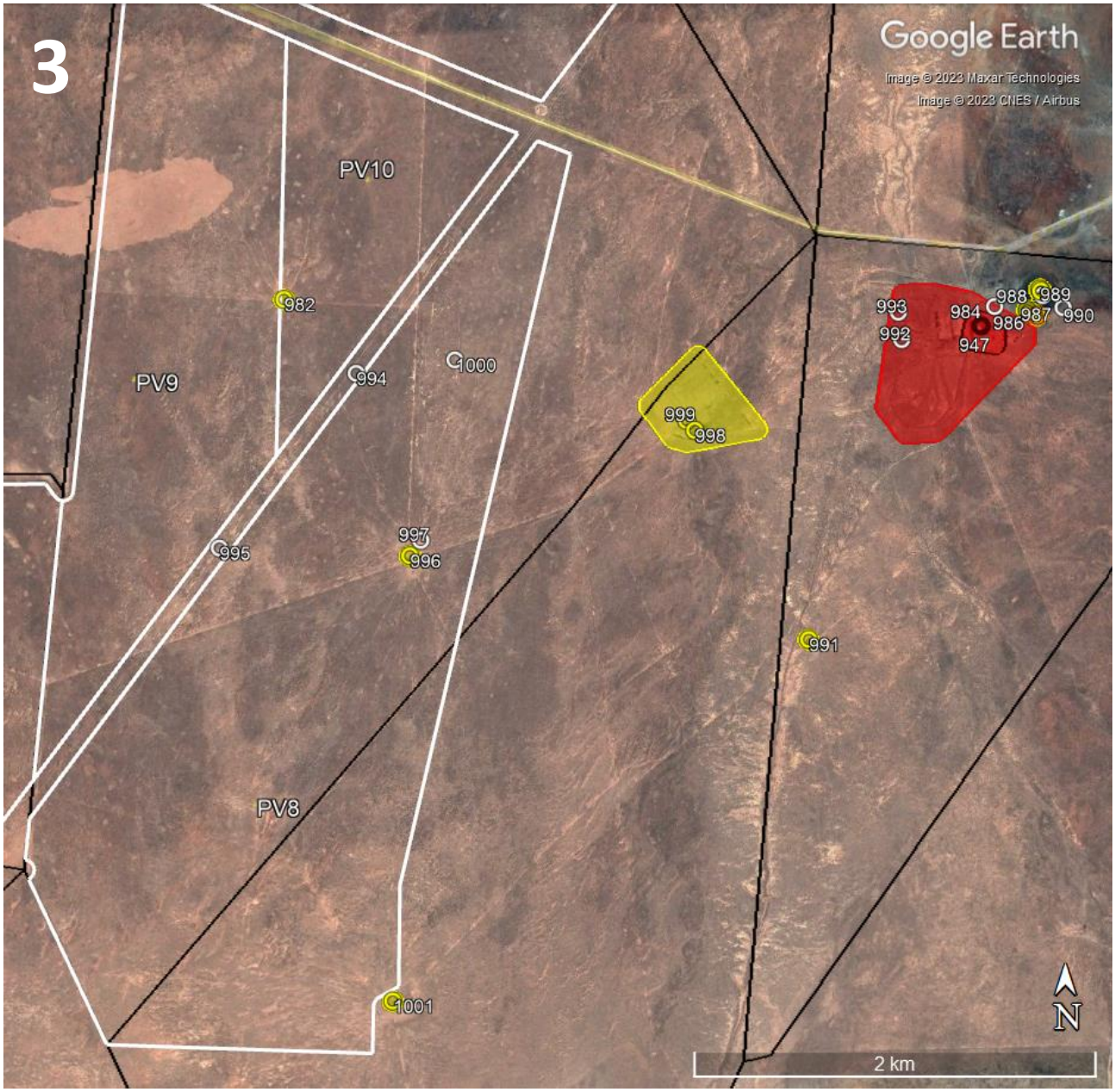
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Image © 2023 Maxar Technologies
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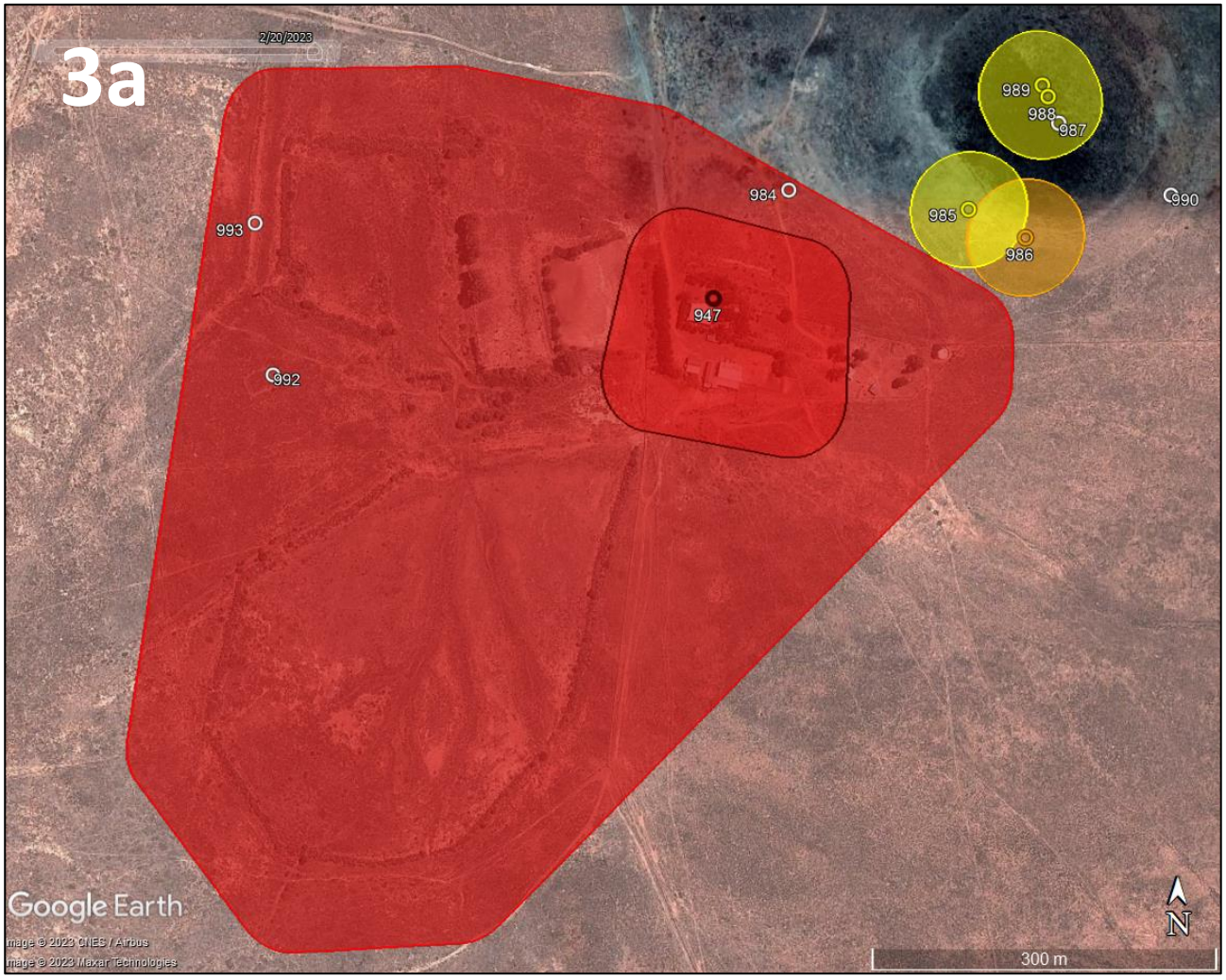
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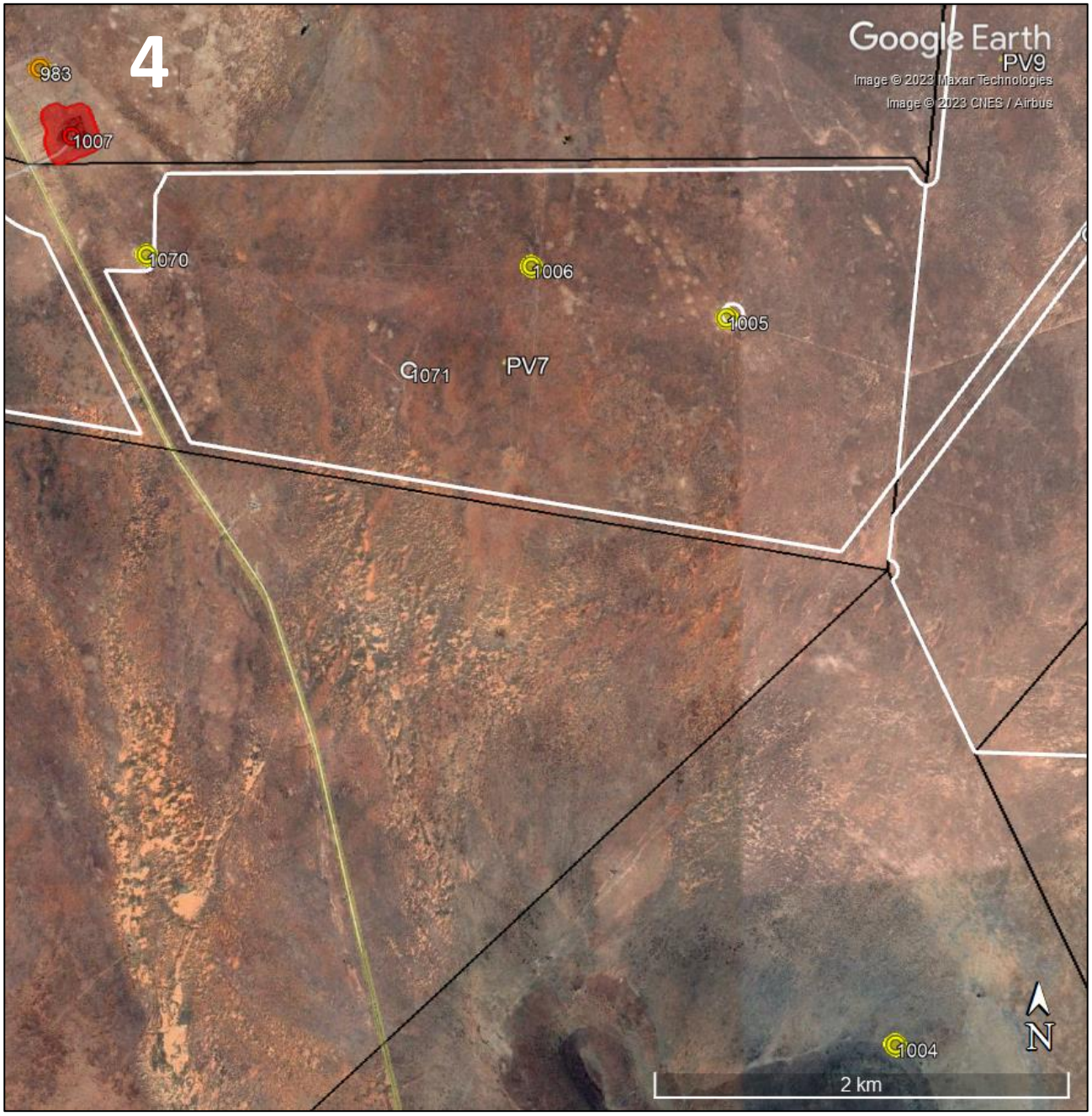
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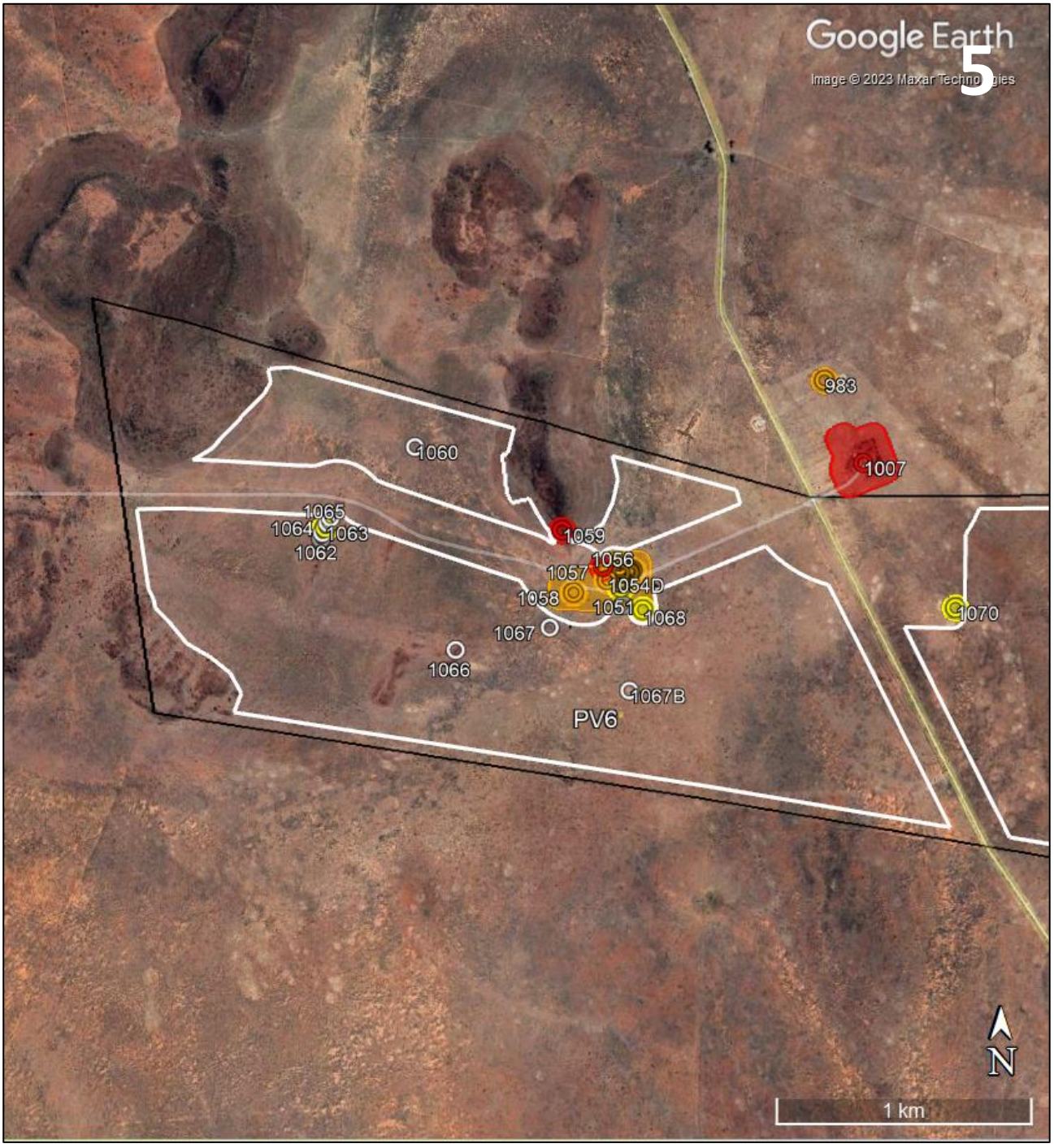
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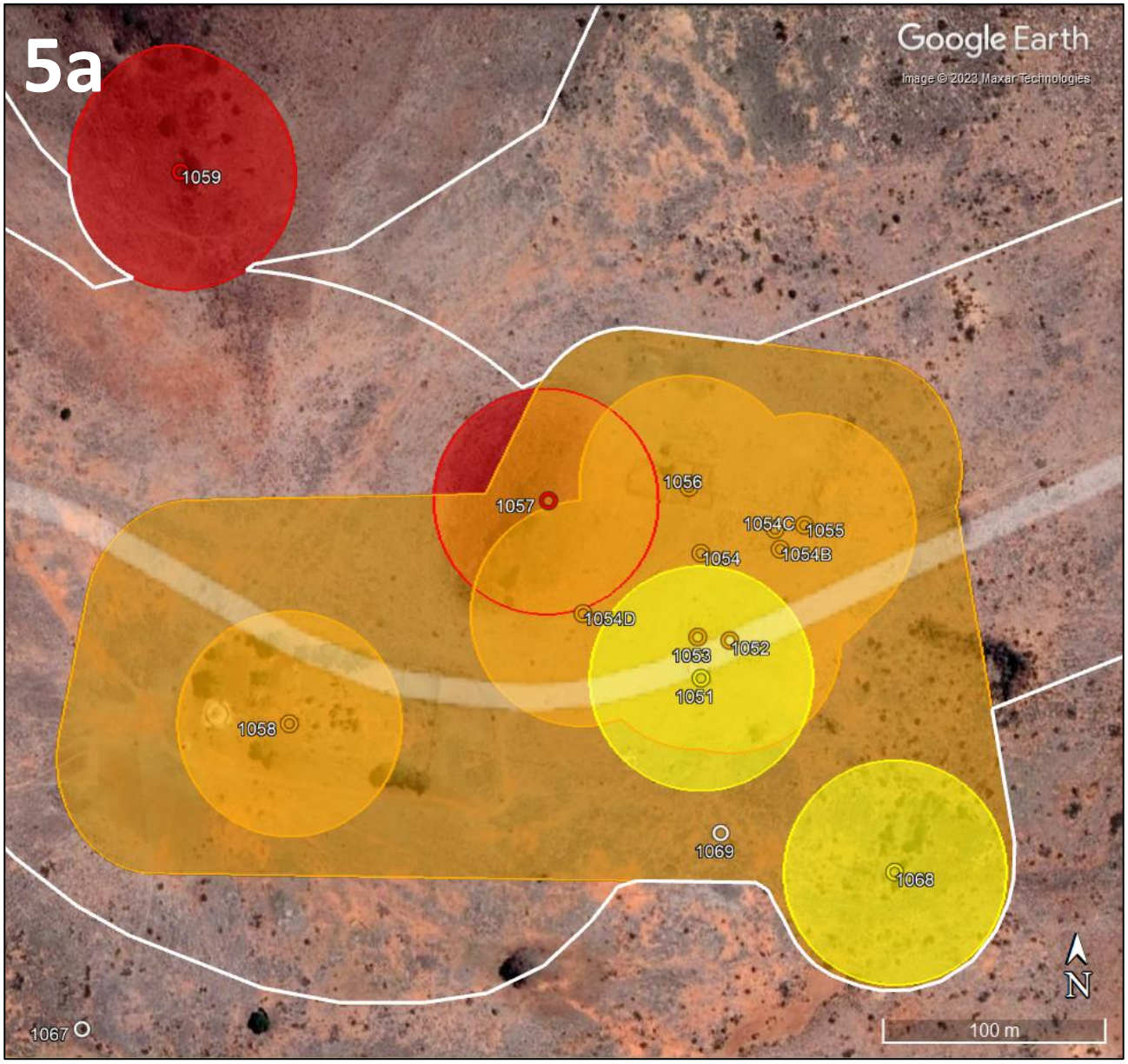
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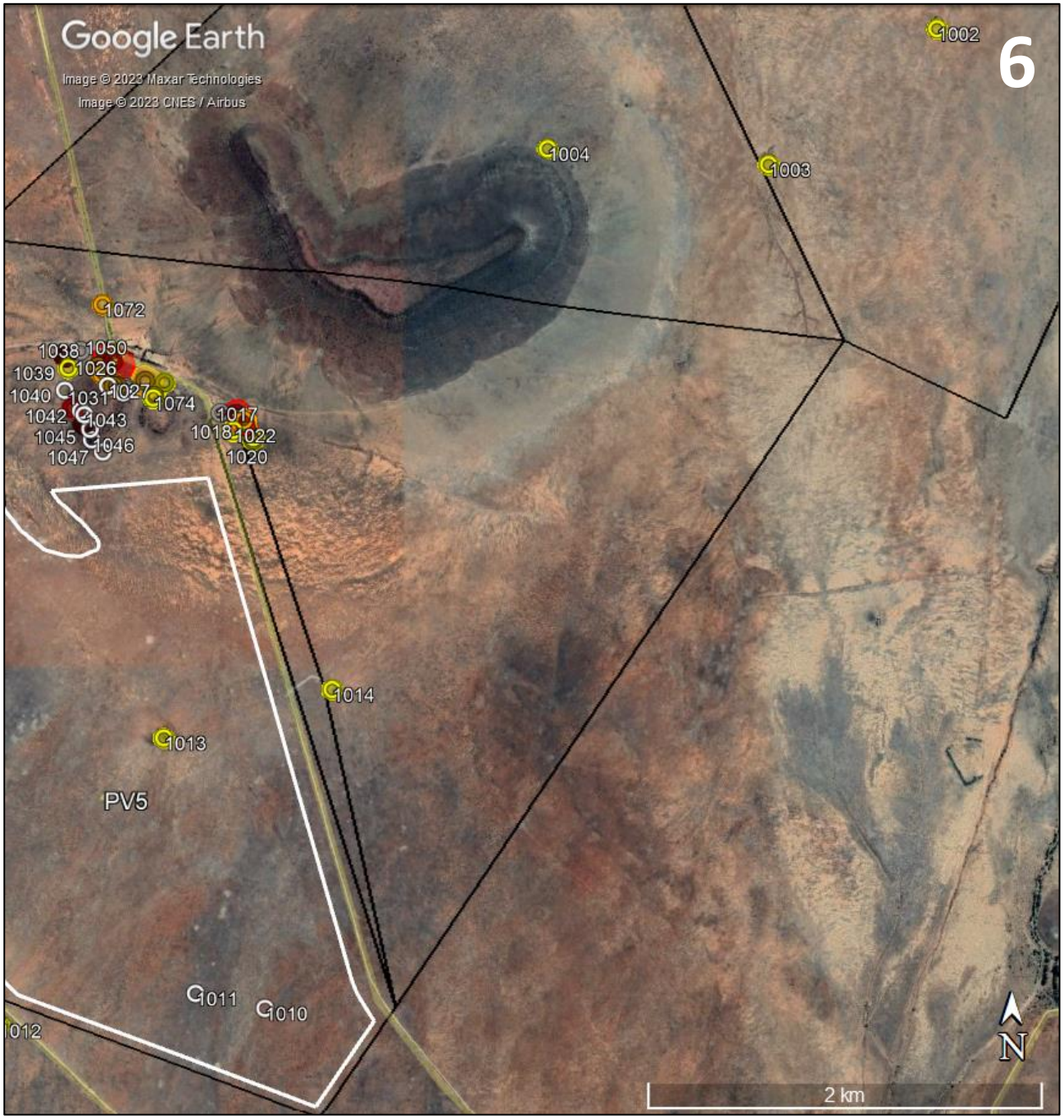
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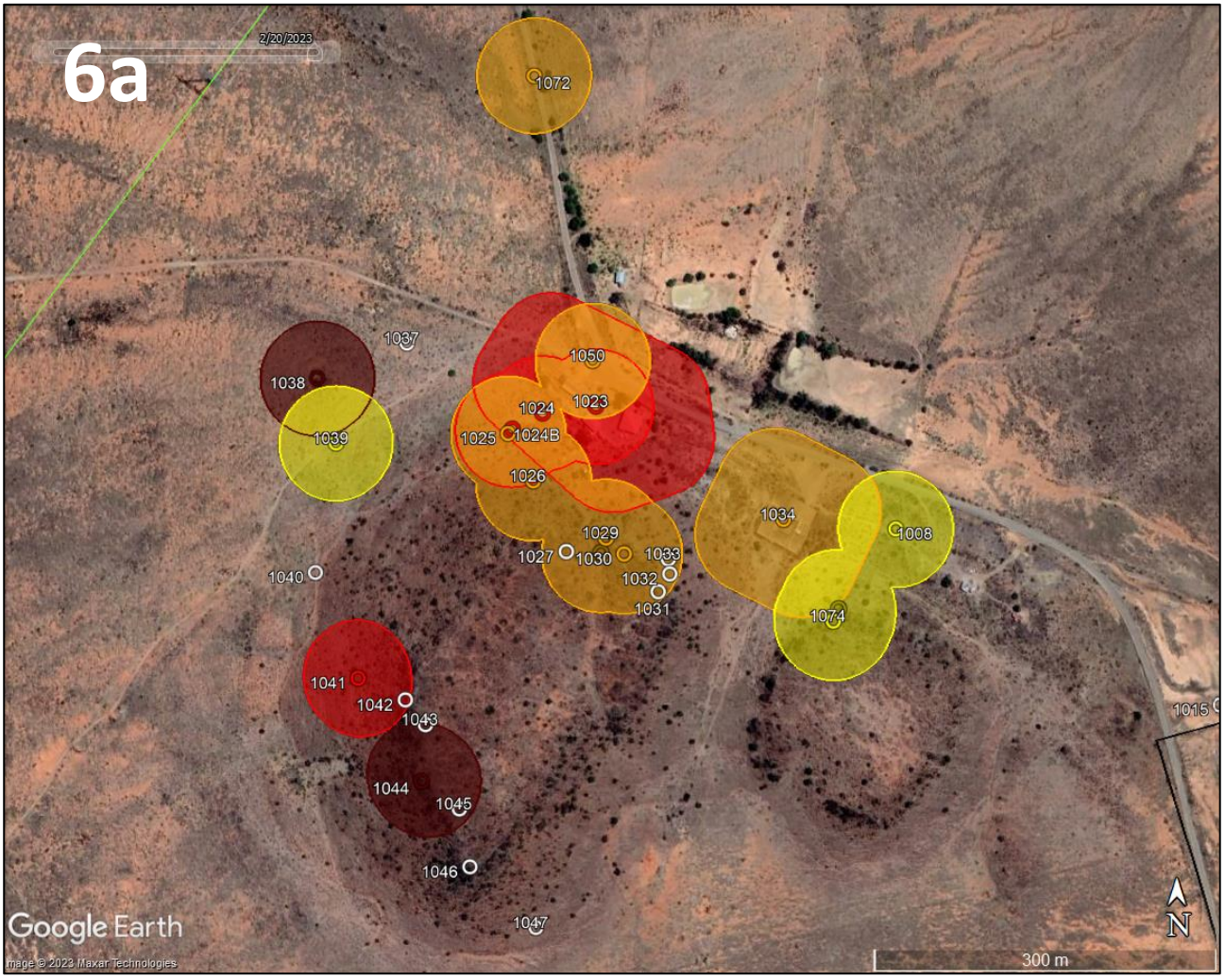
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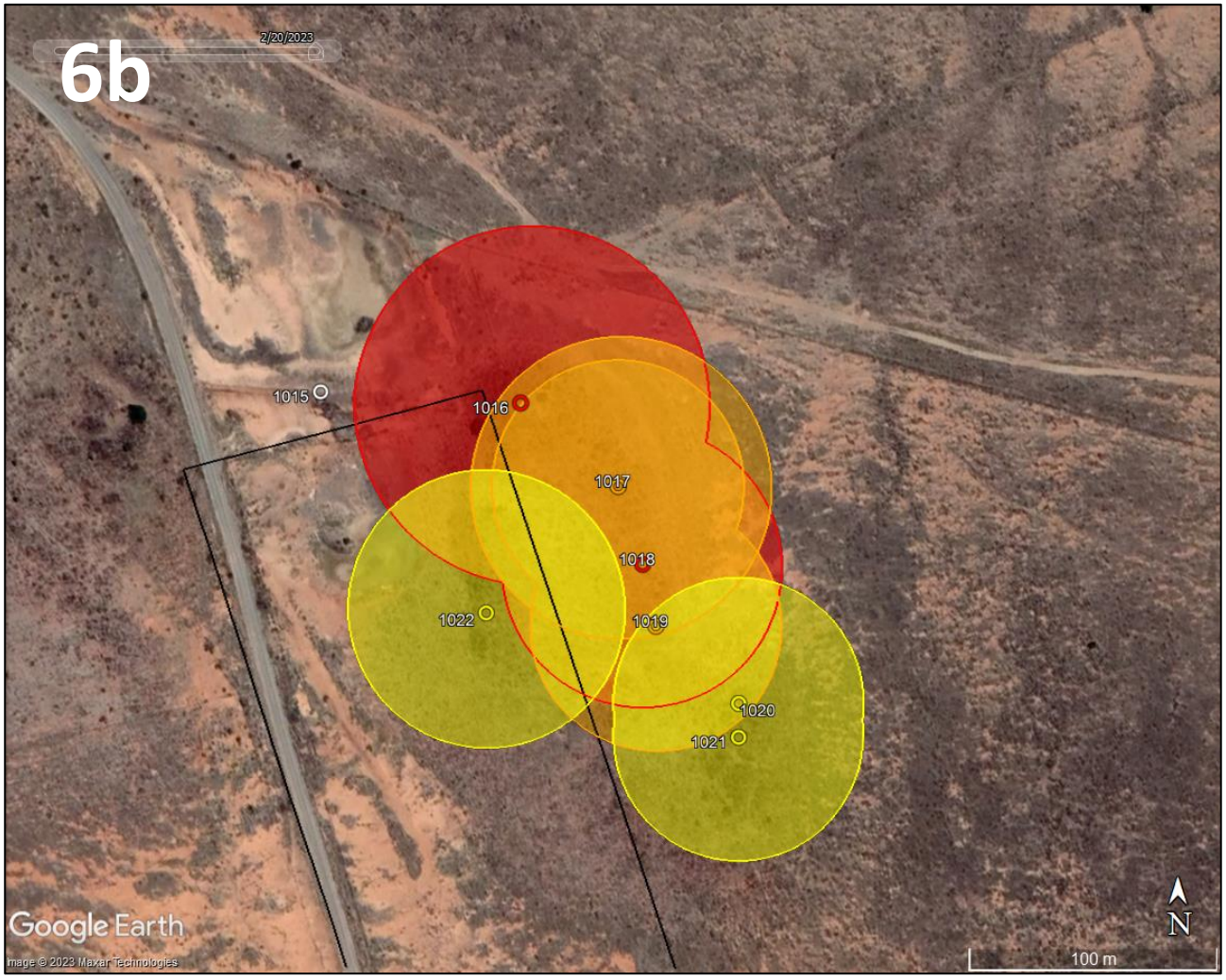
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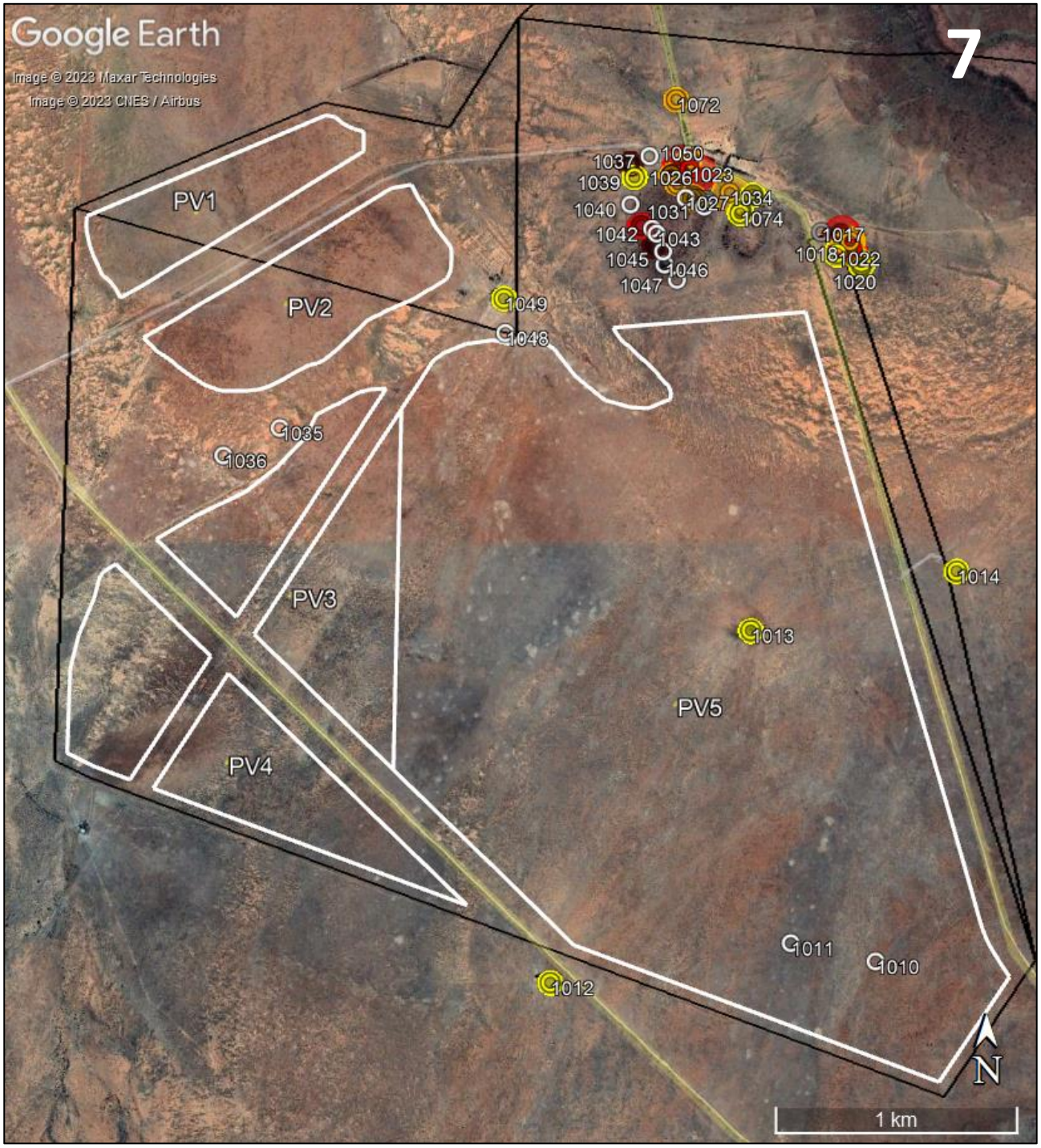
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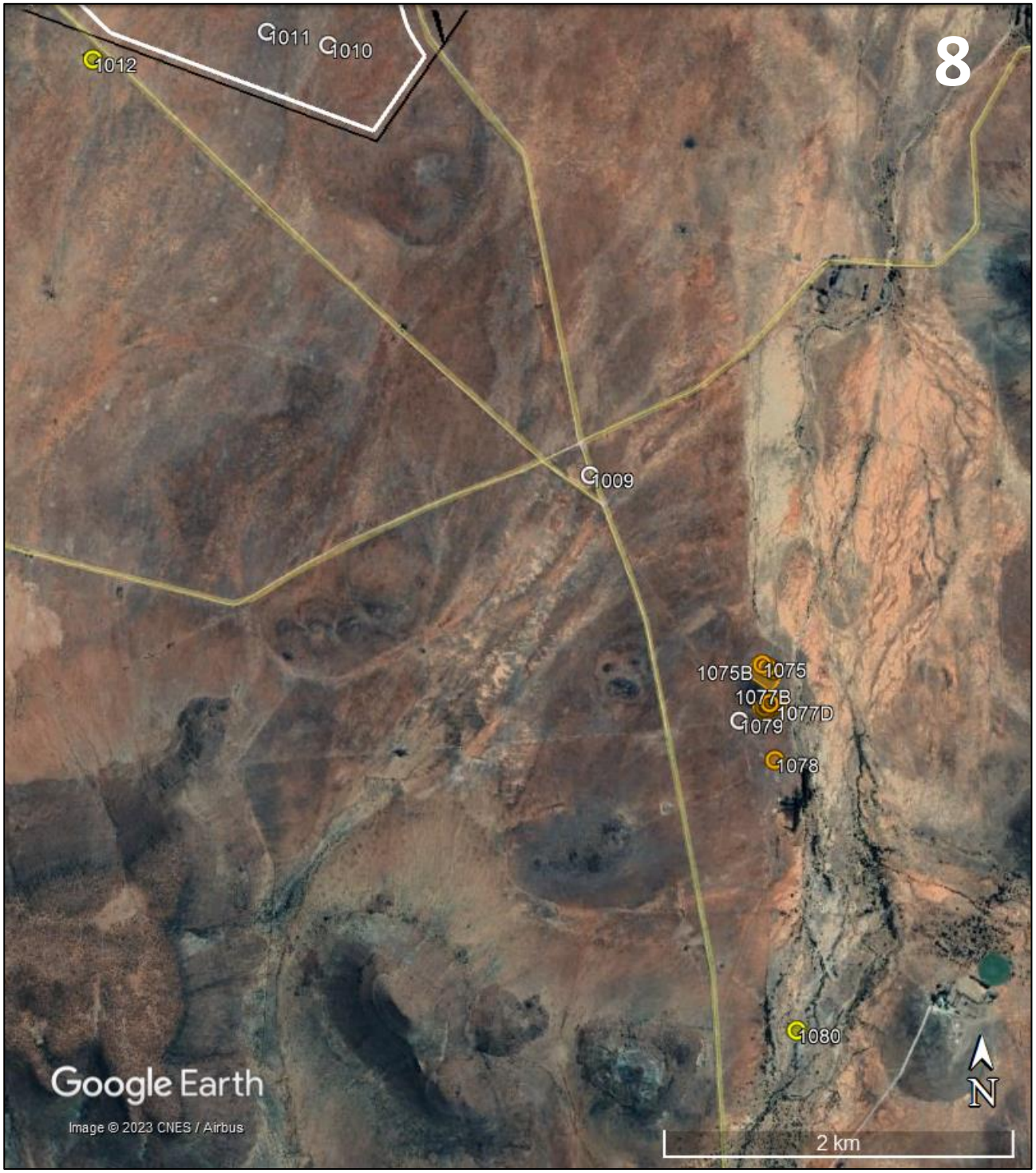
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2 km

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

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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) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV2	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV3	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV4	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV5	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV6	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV7	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV8	Tierberg Formation (Ecca Group)	**LOW** **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) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV10	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV11	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**
PV12	Tierberg Formation (Ecca Group) Late Caenozoic superficial sediments (alluvium, calcrete hardpans, soils, eluvial surface gravels)	**LOW** **LOW**	**NONE**	**Application of Chance Fossil Finds Protocol during Construction Phase**

CONTENTS

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.

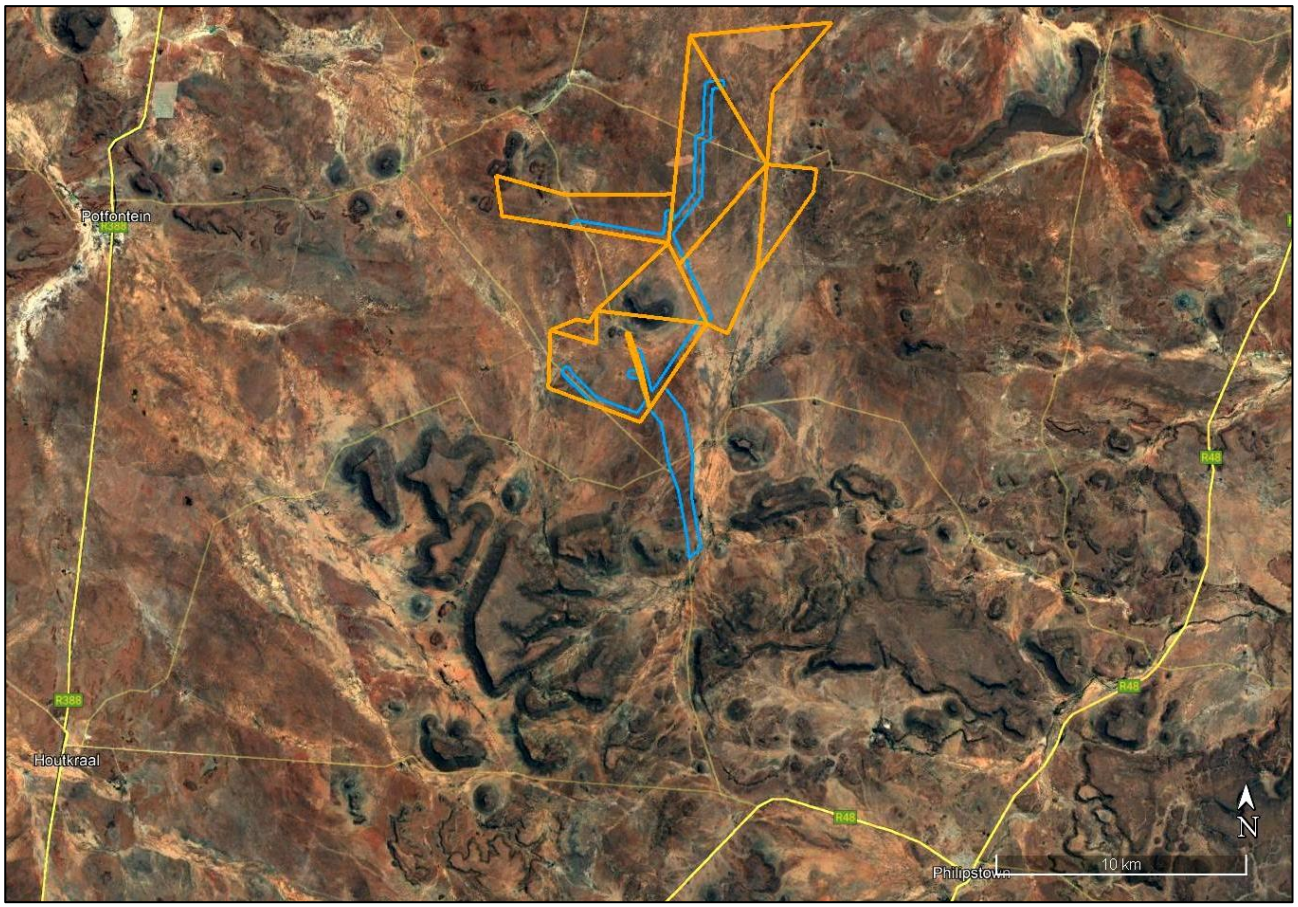

Figure 1: Google Earth© satellite image showing the project study area (orange polygon) for the proposed Kudu Solar PV Facilities near Philipstown, Pixley Ka Seme District, Northern Cape Province. Corridors for the various grid connection route options are shown in blue, including a 400 kV Loop-In-Loop-Out (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.

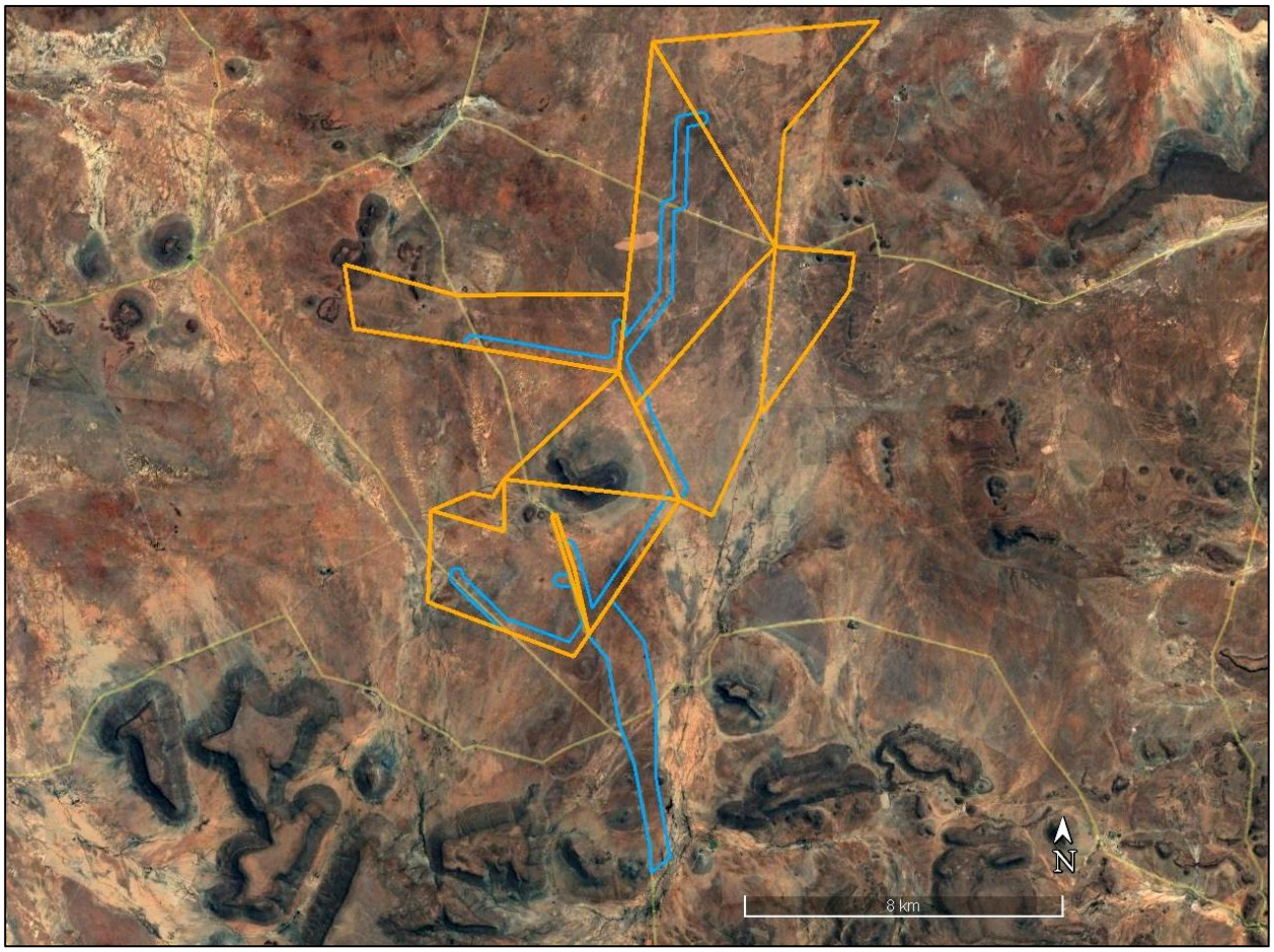

Figure 2: More detailed Google Earth© satellite image of the Kudu Solar PV cluster project area and associated EGI project area (blue polygon). Most of the project area features low relief, grassy terrain with very little or no bedrock exposure.

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.

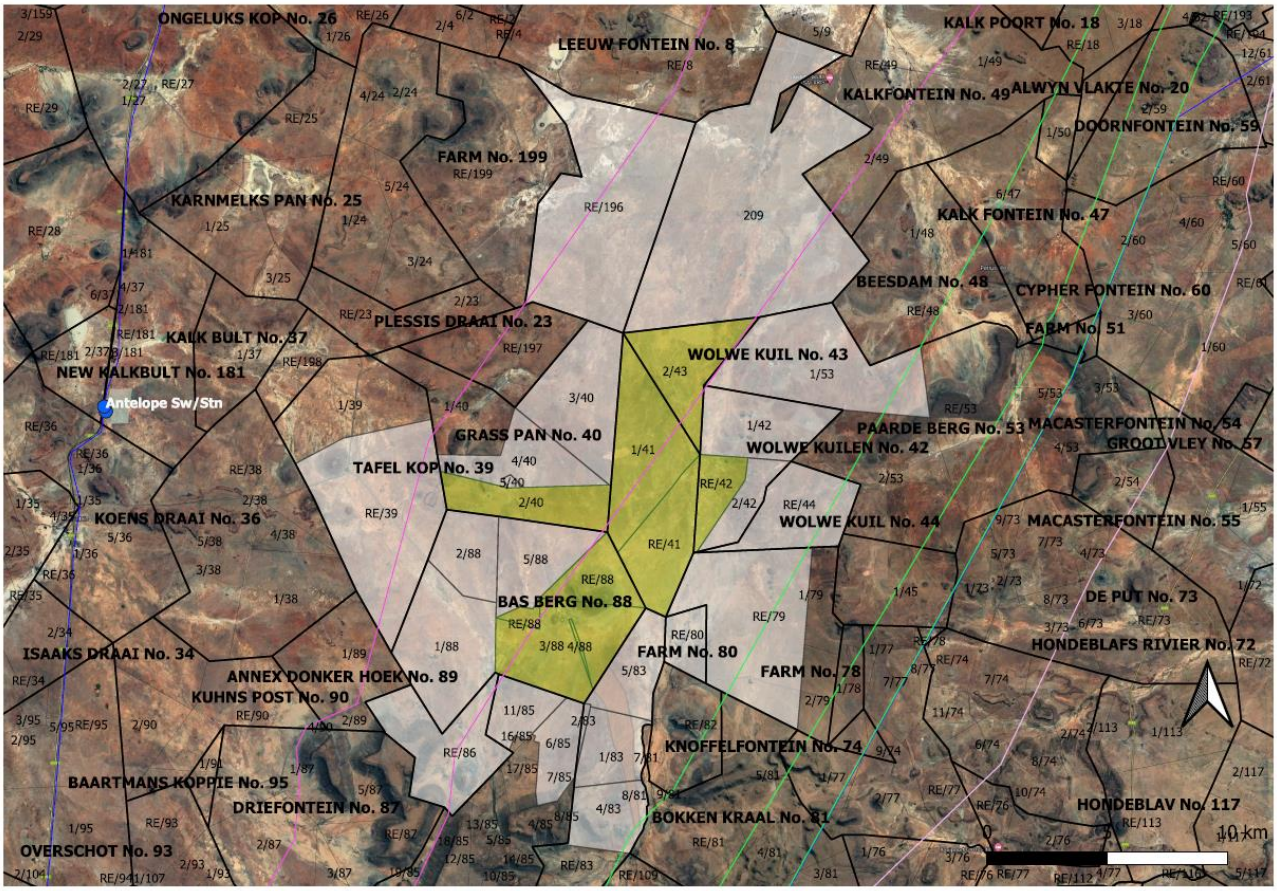

Figure 3: Overlay on satellite image showing the component land parcels concerned with the Kudu solar renewable energy project near De Aar (Image provided by the CSIR).

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.

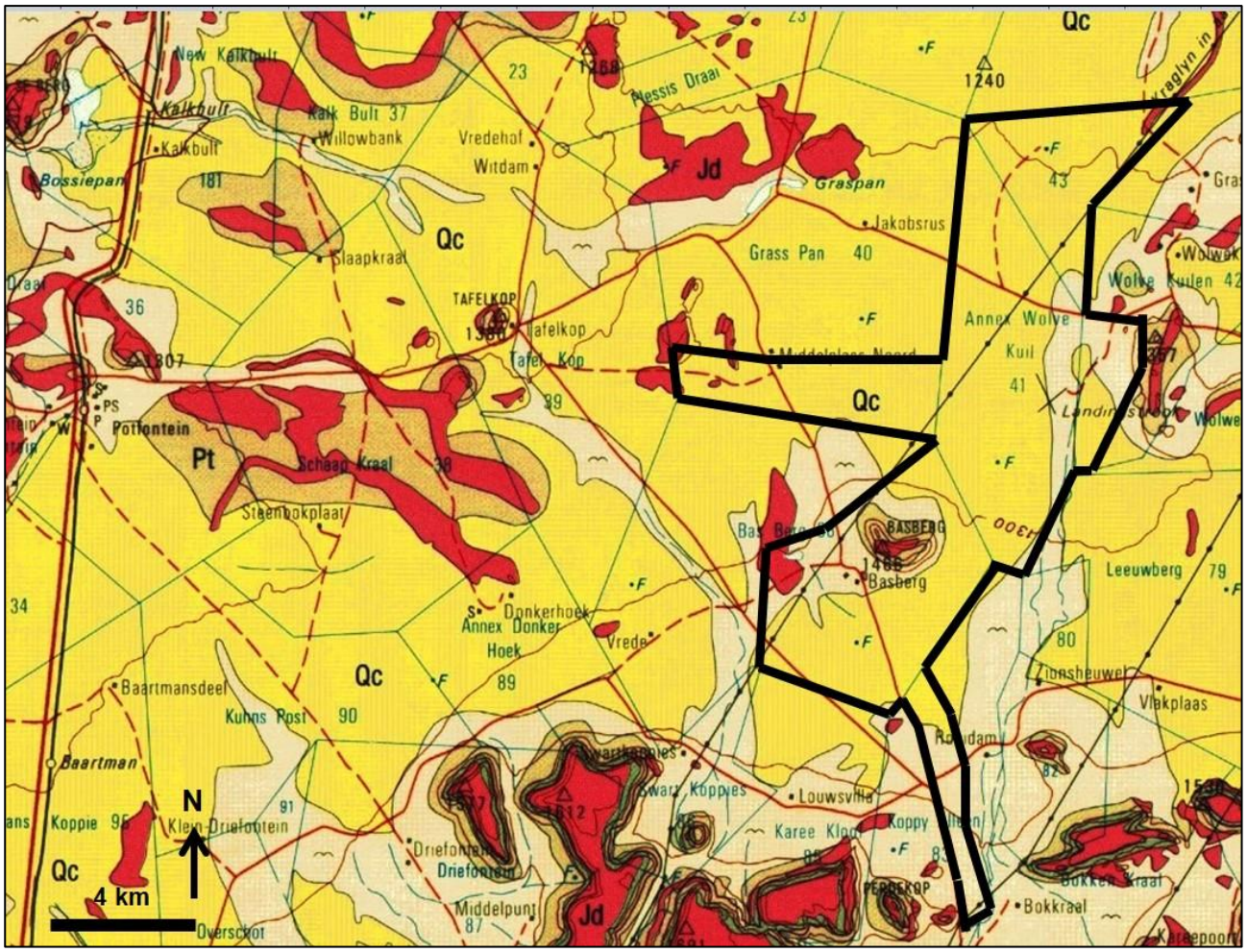

Figure 7: Extract from 1: 250 000 geology map 3024 Colesberg (Council for Geoscience, Pretoria) showing the project study area for the proposed Kudu solar facilities and associated infrastructure (including EGI corridor) near Philipstown and De Aar, Pixley Ka Seme District, Northern Cape (black polygon).
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.

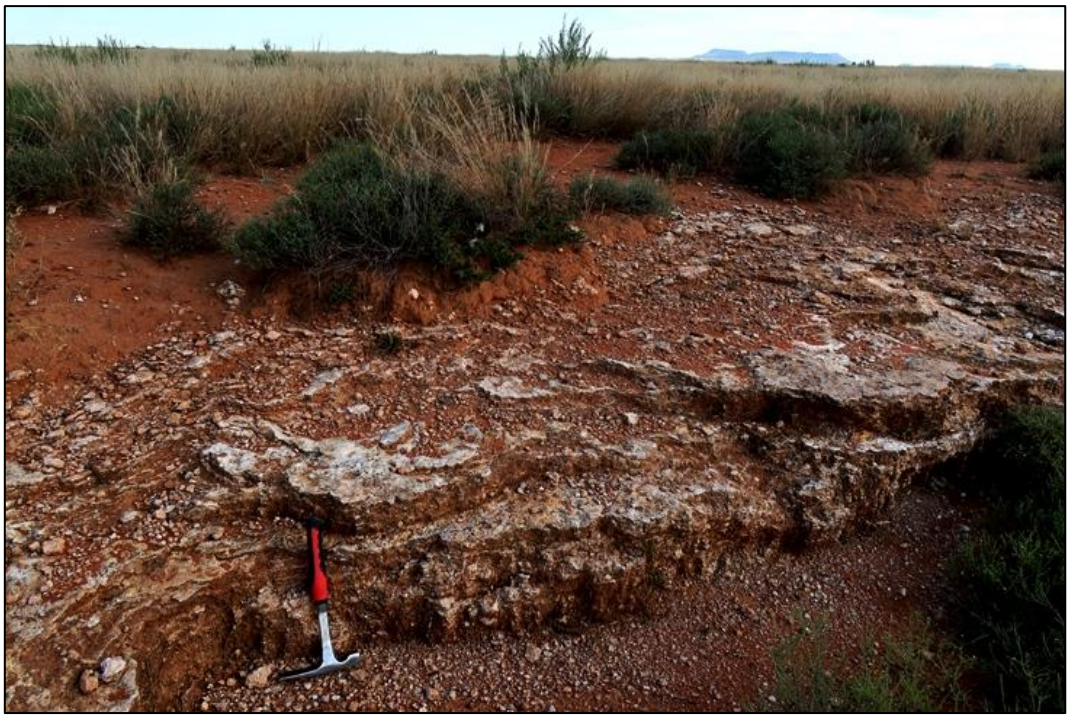

Figure 22: Heavily calcretised, orange-brown cover sands overlying weathered Tierberg Formation bedrocks on the margins of a borrow pit on Farm Wolwe Kuilen 1/42, just north of Wolwekuil farmstead on Farm Wolwe Kuilen RE/42 (See Figure 12) (hammer = 30 cm).

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.

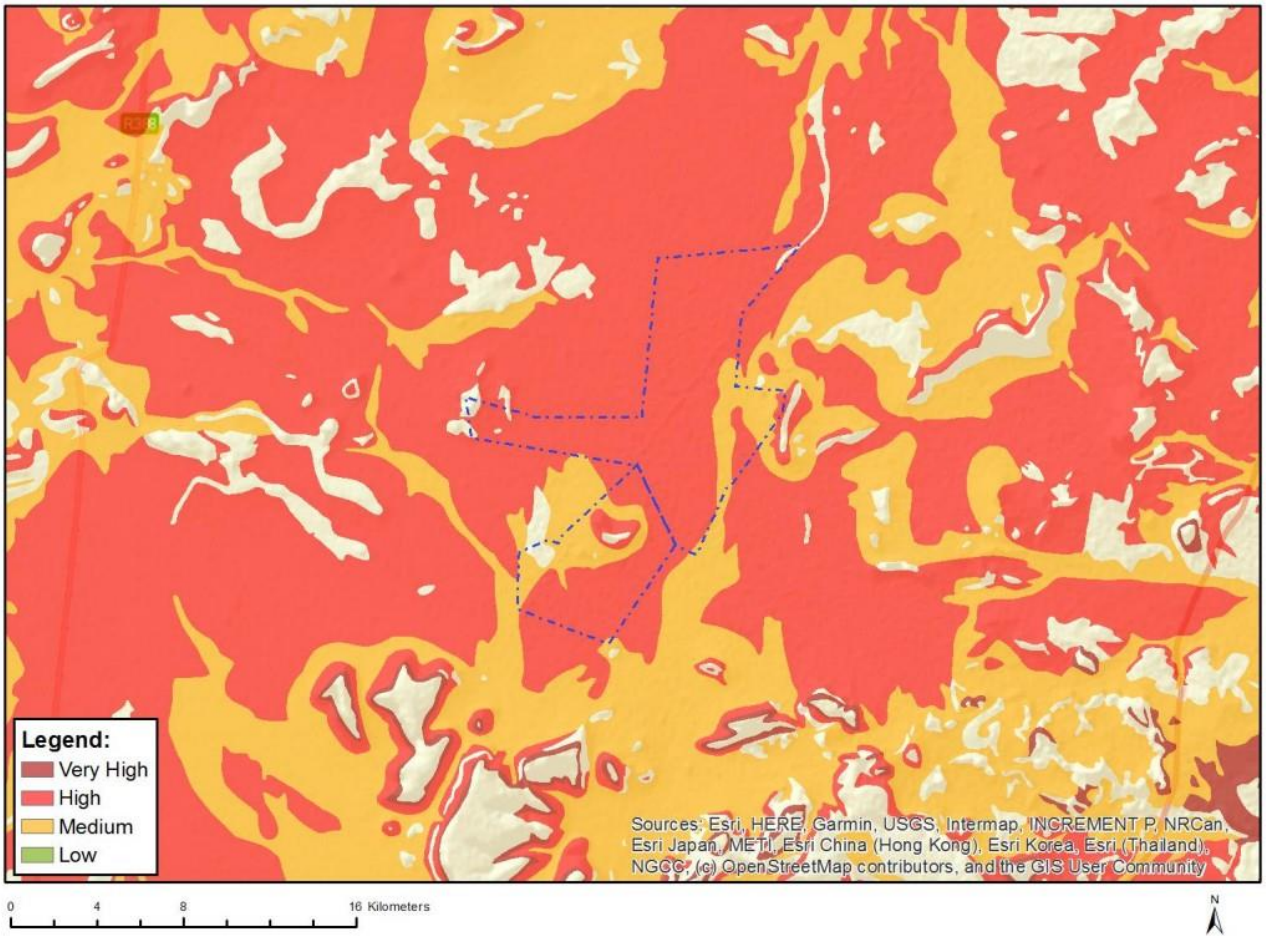

Figure 32: Palaeontological sensitivity map for the Kudu solar facility project area near De Aar, Northern Cape (blue dotted polygon), abstracted from the DFFE Screening Report prepared by the CSIR (February 2022[4]). The outcrop area of the Tierberg Formation is assigned a High palaeosensitivity, Late 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

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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 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.
Potential for concentrations of mammalian fossil remains (bones, teeth, horncores), trace fossils, non-marine molluscs in association with calcrete hardpans.
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:
Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
Context – describe position of fossils within stratigraphy (rock layering), depth below surface
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</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

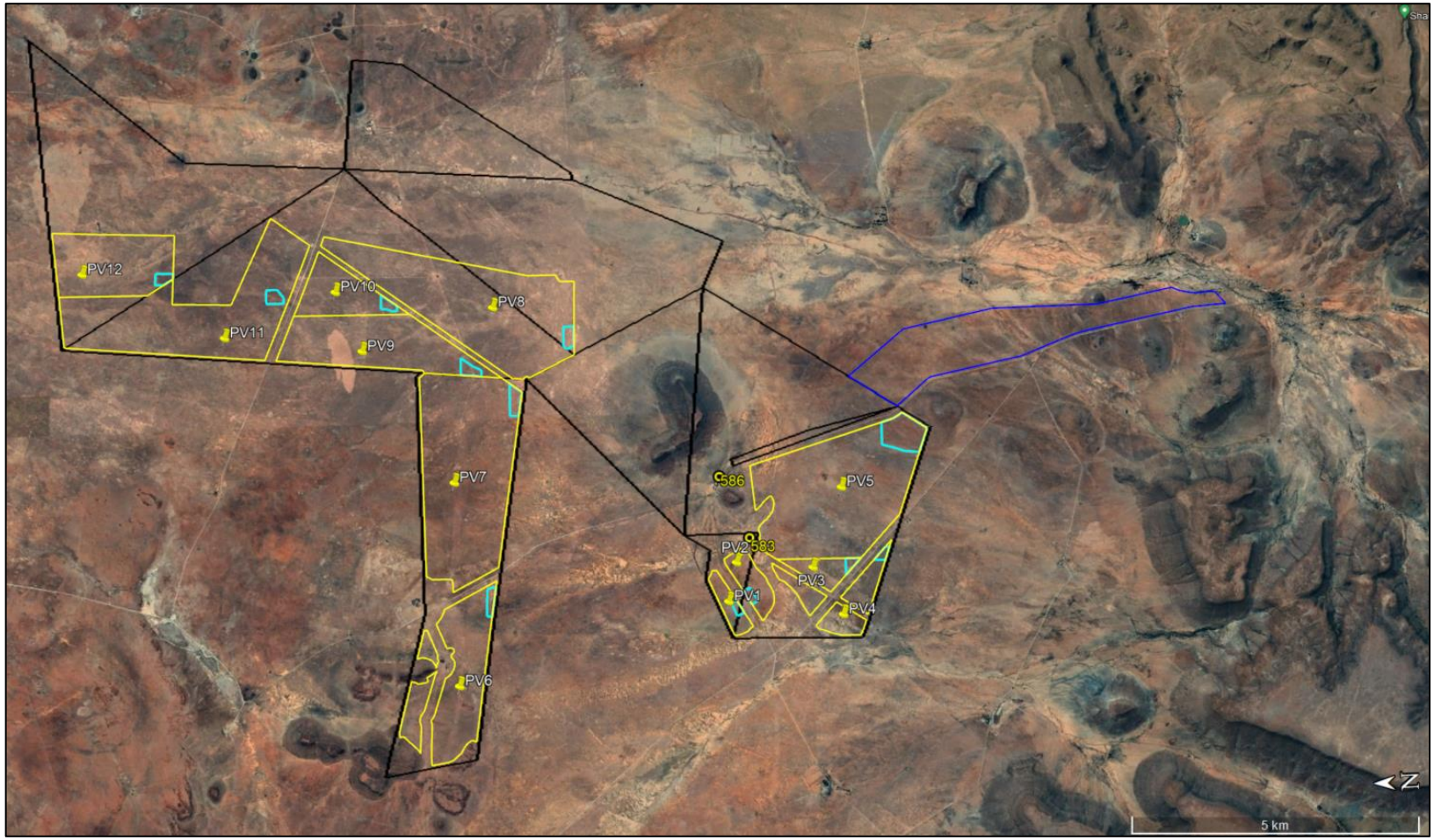

Figure A3.1: Google Earth© satellite image showing the project area for the Kudu Solar Photovoltaic Facilities and associated infrastructure near Philipstown and De Aar, Northern Cape (black and blue polygons) as well as the buildable area/development footprint for each PV project (yellow polygon) and 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.