EIA REPORT

On contract research for

SiVEST

SOIL INFORMATION FOR PROPOSED ALETTA WIND ENERGY FACILITY, NEAR COPPERTON, NORTHERN CAPE

By

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Report No. GW/A/2016/26

January 2017

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DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
November 2016

CONTENTS **Page**

1.	TERMS OF REFERENCE	4
2.	SITE CHARACTERISTICS	5
2.1	Location	5
2.2	Terrain	6
2.3	Climate	6
2.4	Parent Material	6
3.	METHODOLOGY - SOILS	6
4.	SOIL PATTERN	7
4.1	Agricultural Potential	9
5.	IMPACTS	11
5.1	Review of similar projects	12
5.2	Cumulative impacts	13
5.3	Comparison of alternatives	15
6.	CONCLUSION	15
	REFERENCES	15
	APPENDIX: PHOTOS	

1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by SiVEST to undertake a soil investigation near Copperton, in the Northern Cape Province. The objectives of the study are;

- To verify all existing soil information by means of field observation and to produce a soil map of the specified area as well as

- To assess broad agricultural potential and the impacts thereon.

This report covers the proposed **Aletta Wind Energy Facility**.

2. SITE CHARACTERISTICS

2.1 Location

An area was investigated lying approximately 20 km to the east of the town of Copperton on the farm Drielingspan 101. The area lies between 29° 52′ and 30° 02′ S and between 22° 27′ and 22° 35′ E.

The study area is shown by the black line on Figure 1.

2.2 Terrain

The area lies at a height of approximately 1 100 to 1 150 metres above sea level, with very gentle (<2%) slopes), although several small rocky kopjes occur in places, especially in the north.

Only a few non-perennial drainageways are present in the vicinity but some small pans also occur.

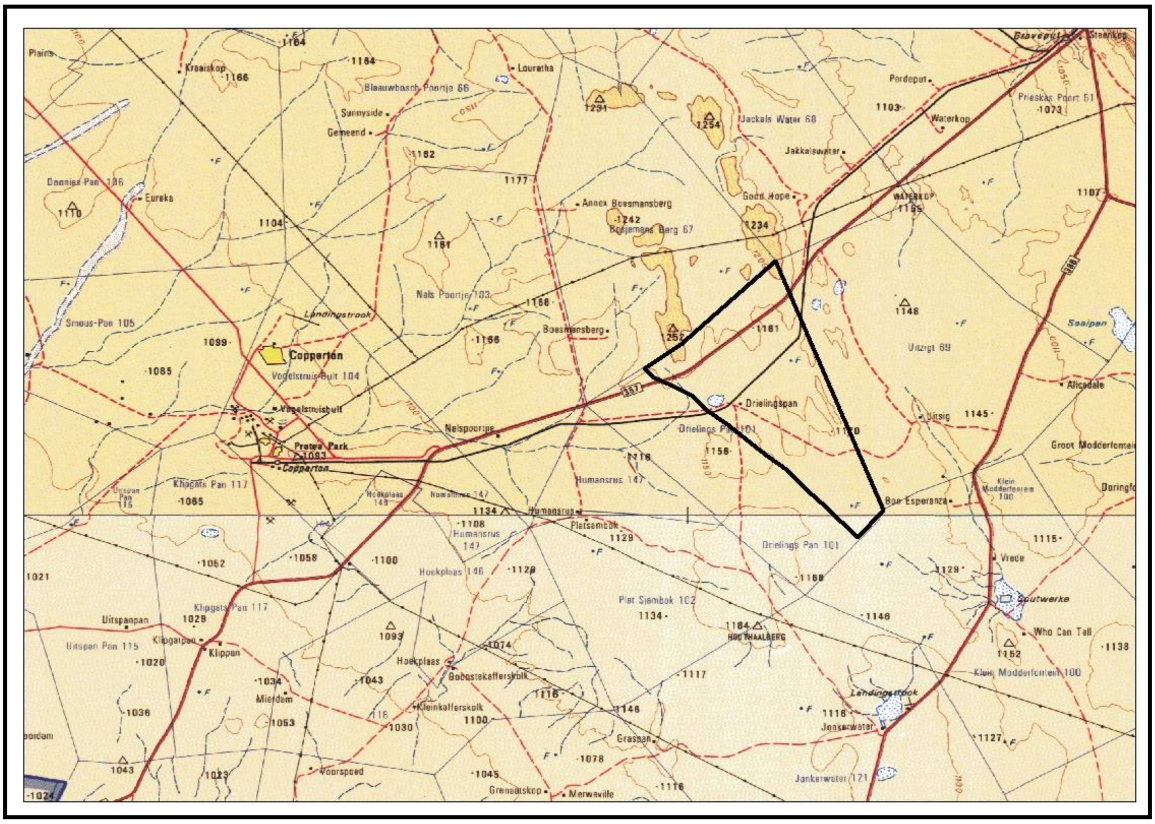

Figure 1 Locality map

2.3 Climate

The climate of the study area (Monnik & Malherbe, 2005) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 198 mm, of which 138 mm, or 69%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 100 mm per year, peaking at over 8.5 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.6ºC and 11.8ºC for January to 15.9ºC and 1.0ºC for July respectively. The extreme high temperature that has been recorded is over 42ºC and the extreme low –10.0ºC. Frost occurs most years on 30-40 days on average between early May and mid-September.

2.4 Parent Material

The geology of the area comprises quartzite of the Uitdraai Formation, Olifantshoek sequence (Geological Survey, 1977).

The distribution of the geological units in the area is shown in Figure 2.

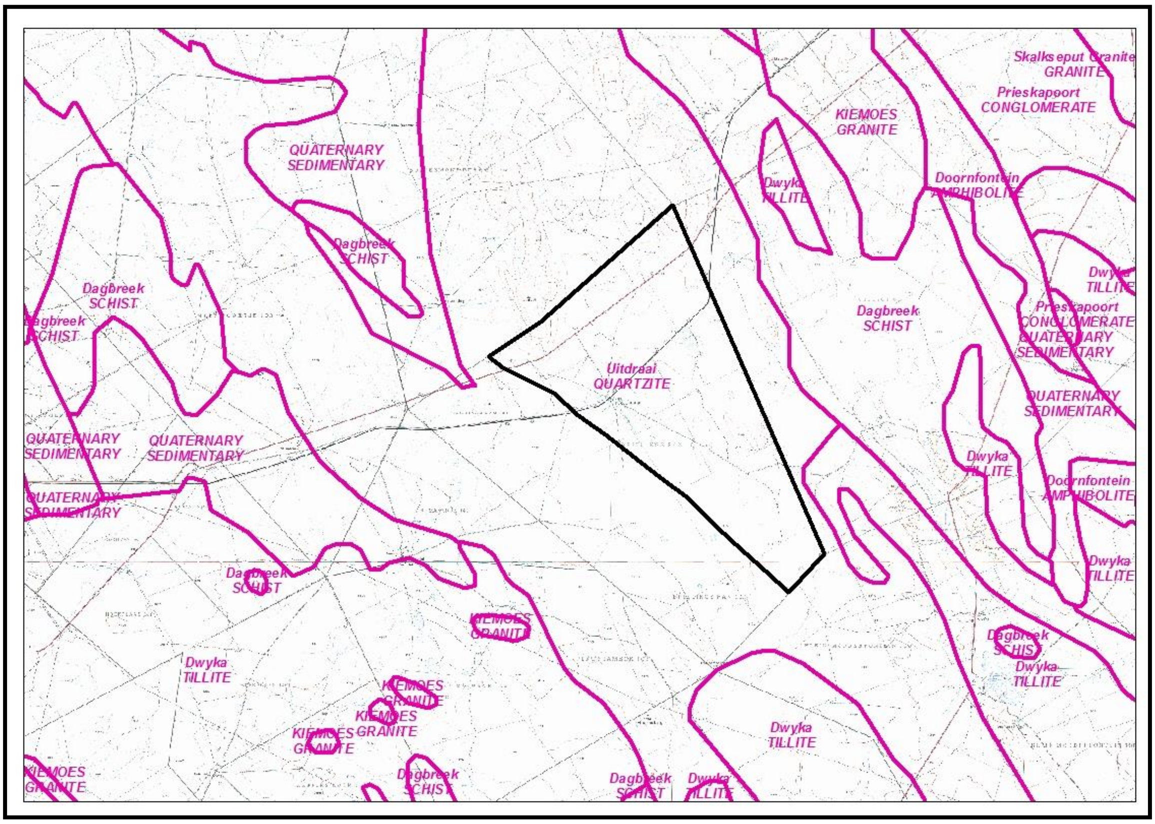

Figure 2 Geology

3. METHODOLOGY - SOILS

For the scoping report, existing soil information was obtained from the map sheets 2922 Prieska and 3022 Britstown (Bruce & Geers, 2005) from the national Land Type Survey, published at 1:250 000 scale.

For this study, a field visit was made, on 9th to 11th November 2016, to carry out a ground truthing exercise and to confirm the soils occurring.

A reconnaissance field investigation was carried out and randomly placed soil observations were made throughout the study area, using a hand soil auger to verify the dominant soil forms and soil depths. The soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991) and a very broad soil map was compiled. Also see photos (F1–F6) taken in the area. A general soil description of the map units is given in **Table 1** and a list of soil observations in **Table 2.**

4. SOIL PATTERN

Lithosols (Coega soil form, 50–150 mm depth) and a shallow phase (<300 mm depth) of the Plooysburg soil form along with patches of slightly deeper (300–600 mm) Plooysburg and some Garies soils underlain by calcrete, dominates the survey area. Sporadic dorbank and rock outcrops also occur. This distribution is shown on Figure 3.

Table 1 Soil Legend

General Soil Description					
Map unit	**Dominant Soil form/family > 80%**		**Subdominant Soil form/family < 20%**	**Effective depth (mm)**	**General Description**
	Taxonomic System	Binomial System			
Cg1	Cg1000, Cg2000	Ms12, Ms22	Py1000, Ms1100	50-150	Very shallow, stony, reddish-brown, fine-grained, sandy Coega (Cg) soils underlain by calcrete. Patches of deeper, sandy Plooysburg (Py) soils (100–300 mm) occur throughout the area. With sporadic occurrences of rock outcrops and Mispah soils (< 150 mm)
Py1	Py1000, Py2000,	Hu33	Cg1000, Hu3100 Ms1100	150-300	Shallow, reddish-brown, fine-grained, sandy Plooysburg (Py) and occasional Coega (Cg) soils with underlying calcrete or rock. Sporadic patches of deeper, sandy Plooysburg (Py) soils (300–600 mm) occur throughout the area.
Py2	Py1000 Py2000 Gr1000	Hu33 Hu36	Cg1000, Cg2000	300-800	Shallow to moderately deep, reddish-brown, fine-grained, sandy Plooysburg (Py) soils underlain by calcrete and occasionally dorbank.
R	Rock Ms1100	Ms10	Cg1000 Py1000	<150	Very stony, shallow soils on hillslopes.

Figure 3 Semi-detailed soil map, Aletta WEF study area

Randomly selected soil observations were made throughout the area and are listed in Table 2.

Table 2 Soil observations

Obs. No.	**Soil form/ family**	**Soil depth (mm)**	**Depth Limiting material**	**Latitude (Deg.)**	**Longitude (Deg.)**	**Comment**
O36	Py1000	600	Calcrete	-29,87273821	22,43423223	
O37	Py2000	450	Calcrete	-29,86648866	22,43274629	
O38	Py1000	200	Calcrete	-29,85975095	22,43111551	
O39	Py1000	300	Calcrete	-29,84983751	22,42873907	
O40	R	100	Rock	-29,84272429	22,42699564	Stony
O41	Py1000	150	Calcrete	-29,83821281	22,42790222	
O42	Py1000	200	Calcrete	-29,82918450	22,43055761	
O43	Py1000	250	Calcrete	-29,81214174	22,43546069	
O44	Py1000	450	Calcrete	-29,83134636	22,42023110	
O45	Py1000	400	Calcrete	-29,82554742	22,41110623	
O46	Py1000	200	Calcrete	-29,86014792	22,42032766	Cg 10% in vicinity
O47	Py1000	150	Calcrete	-29,85971876	22,41500616	Cg 40% in vicinity
O48	Py1000	200	Calcrete	-29,86251899	22,40524292	Stony, Cg 40% in vicinity
O49	Py1000	350	Calcrete	-29,86154803	22,39977121	Cg 60% in vicinity
O50	Py1000	250	Calcrete	-29,84434434	22,40363359	Stony
O51	Cg1000	150	Calcrete	-29,84433361	22,40064025	Stony
O52	Cg1000	100	Calcrete	-29,84162458	22,40081191	Stony, Py 20% in vicinity
O53	Py1000	600	Calcrete	-29,84160312	22,40393400	
O54	Cg1000	100	Calcrete	-29,86590394	22,38688588	Stony
O55	Cg2000	100	Calcrete	-29,87459966	22,38455236	Stony
O56	Cg2000	50	Calcrete	-29,87458357	22,38143563	Py10% in vicinity
O57	Cg2000	100	Calcrete	-29,87721213	22,38149464	Py10% in vicinity
O58	Cg1000	100	Calcrete	-29,87728723	22,38458991	
O59	Py1000	280	Calcrete	-29,87774857	22,39061415	
O60	Py1000	300	Calcrete	-29,88922306	22,39424050	
O61	Gr2000	400	Dorbank	-29,89792415	22,39612877	
O62	Cg2000	50	Calcrete	-29,89114353	22,39148319	Stony
O63	Cg1000	100	Calcrete	-29,88372453	22,38624215	Stony
O64	Py1000	100	Calcrete	-29,88066145	22,37795949	Stony
O65	Py1000	150	Calcrete	-29,88028594	22,37252533	Cg 30% in vicinity
O66	Cg1000	100	Calcrete	-29,87908431	22,35738158	Stony, Py 20% in vicinity

4.1 Agricultural Potential

The agricultural potential for this area corresponds with the initial findings in the scoping report. Thus, an overall low potential for irrigation for map units Cg1, Cg2, Py1 with a low to moderate irrigation potential for map unit Py2, consisting of gravelly Plooysburg and Hutton soils, with soil depth 300-800 mm onto rock.

Virtually all of the study area comprises shallow, often calcareous soils with rock outcrops, as can be seen from the information contained in Table 2 and the photos in the Appendix.

Coupled with these shallow soils, the very low rainfall in the area (Section 2.3) means that the only means of cultivation would be by irrigation and the Google Earth image of the area (Figure 4) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

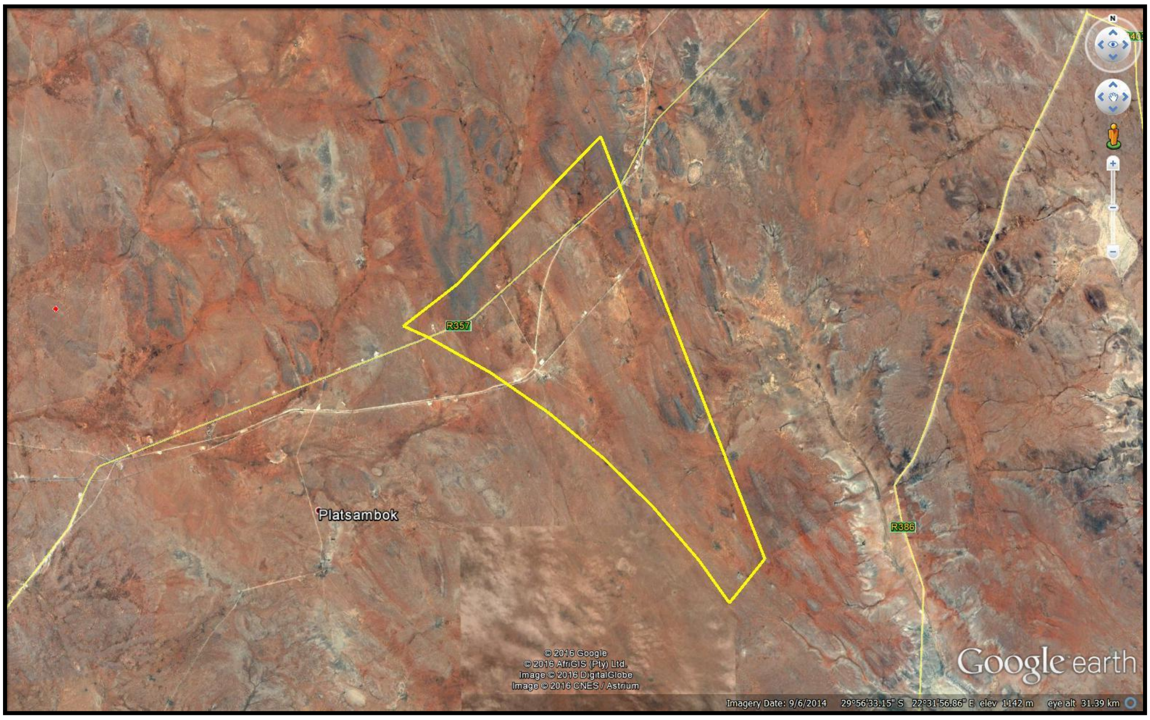

Figure 4 Google Earth image of study area

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004).

5.1 Land Use

The land use in the area is dominantly "shrubland and low fynbos" with some small areas of "bare rock and soil (natural)" as classified by the National Land Cover (Thompson, 1999). As previously mentioned, there are no areas of cultivation that were identified, only a few small, isolated areas of "Improved grassland". This is confirmed by the photos in the Appendix.

5. IMPACTS

Two main impacts are possible. The first deals with the unavailability of land for agriculture due to the fact that a wind energy generating facility is to be established, while the second impact refers to the possibility that construction of such a facility will lead to disturbance of the topsoil and surface vegetation cover, so that erosion of topsoil by wind action will increase.

Table 3a Rating of impacts (Loss of Agricultural Potential)

IMPACT TABLE FORMAT		
Environmental Parameter	*Soil resource*	
Impact	***Loss of agriculturally productive land***	
Extent (E)	*Site*	
Probability (P)	*Possible*	
Reversibility (R)	*Completely reversible*	
Irreplaceable loss of resources (I)	*Marginal*	
Duration (D)	*Medium term*	
Cumulative effect (C)	*Low*	
Intensity/magnitude (M)	*Medium, mainly due to low prevailing agricultural potential of area*	
Significance Rating	*(E+P+R+I+D+C) x M*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	**1**	**1**
Probability	**2**	**2**
Reversibility	**2**	**2**
Irreplaceable loss	**1**	**1**
Duration	**2**	**2**
Cumulative effect	**2**	**2**
Intensity/magnitude	**2**	**2**
Significance rating	**-20 (low negative)**	**-20 (low negative)**
Mitigation measures	*These would include: ensuring that the minimum area possible is set aside for the project infrastructure, so that the natural vegetation is undisturbed and grazing of livestock can continue on site post-construction.*	

Table 3b Rating of impacts (Wind erosion potential)

IMPACT TABLE FORMAT		
Environmental Parameter	*Soil resource*	
Impact	***Increased erosion of topsoil by wind***	
Extent (E)	*Local area*	
Probability (P)	*Probable*	
Reversibility (R)	*Partly reversible*	
Irreplaceable loss of resources (I)	*Marginal*	
Duration (D)	*Medium term*	
Cumulative effect (C)	*Medium, as wind-blown sediments can travel long distances*	
Intensity/magnitude (M)	*Potentially high, due to the dry climate and sandy nature of many of the topsoils in the area*	
Significance Rating	*(E+P+R+I+D+C) x M*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	**2**	**1**
Probability	**3**	**2**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**3**	**2**
Cumulative effect	**3**	**2**
Intensity/magnitude	**3**	**2**
Significance rating	**-45 (medium negative)**	**-18 (low negative)**
Mitigation measures	*Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish.*	

5.1 Review of similar projects

A significant number of other renewable energy projects in the vicinity of the Aletta site are planned or have been applied for. Projects for which reporting information could be obtained include Humansrus (CEAP Consultants, 2015), Garob (Savannah Environmental, 2012), Klipgatspan (Aurecon, 2011), Mierdam (SiVest, 2012) and Helena (SiVest, 2015).

A study of the soil-related aspects for these projects has confirmed that the potential impacts as listed in this report are the most important for the surrounding area. In addition, the mitigation measures listed here are in broad agreement with the other specialists' findings, so that there is nothing that has been omitted that would make a significant difference to the findings given here. The prevailing low potential was addressed by all reports, and the need to protect the soil resource form possible erosion is also a priority finding in all instances.

5.2 Cumulative impacts

There are a considerable number of other power generation projects proposed for the immediate area near Copperton and Prieska. The prevailing agricultural potential is low to very low, so there will be little or no cumulative impact in that regard. However, regarding wind erosion, there is a definite possible cumulative impact regarding potential topsoil removal by wind erosion on one site, which could then be blown for a considerable distance across other sites (see Table 4).

It is difficult to quantify any effects, or spatial extent of possible wind erosion, as any effects would be site-specific, as well as being significantly influenced by wind speed and direction. However, the mitigation requirement that all project managers maintain continuous contact in order to minimize such effects, would be the most important consideration.

Table 4 Rating of cumulative impacts

IMPACT TABLE FORMAT		
Environmental Parameter	*Soil resource*	
Cumulative Impact	***Increased erosion of topsoil by wind***	
Extent (E)	*Local area*	
Probability (P)	*Probable*	
Reversibility (R)	*Partly reversible*	
Irreplaceable loss of resources (I)	*Marginal*	
Duration (D)	*Medium term*	
Cumulative effect (C)	*Medium, as wind-blown sediments can travel long distances*	
Intensity/magnitude (M)	*Potentially high, due to the dry climate and sandy nature of many of the topsoils in the area*	
Significance Rating	*(E+P+R+I+D+C) x M*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	**2**	**1**
Probability	**3**	**2**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**3**	**2**
Cumulative effect	**3**	**2**
Intensity/magnitude	**3**	**2**
Significance rating	**-45 (medium negative)**	**-18 (low negative)**
Mitigation measures	*Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish. In addition, regular communication between responsible officials at all sites in the vicinity is essential. Regular monitoring (at least monthly during any construction phase and approximately six-monthly thereafter is strongly recommended to pick up any potential problems before they arise.*	

5.3 Comparison of Alternatives

Two potential sites were proposed regarding positions of the substation and other infrastructure. However, there are no sensitive areas in the study area and the natural resources are very similar, so there will be no specific difference between the two sites.

Table 5 Comparative Assessment of Alternatives – Aletta WEF

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION AND O & M BUILDING ALTERNATIVES		
Option 1	No Preference	Low prevailing agricultural potential
Option 2	No Preference	Low prevailing agricultural potential

6. CONCLUSION

Due to the occurrence of shallow soils, coupled with the extremely hot and dry nature of the climate, there are no significant impacts from the project, and mitigation measures are proposed in Table 3 and 4 above.

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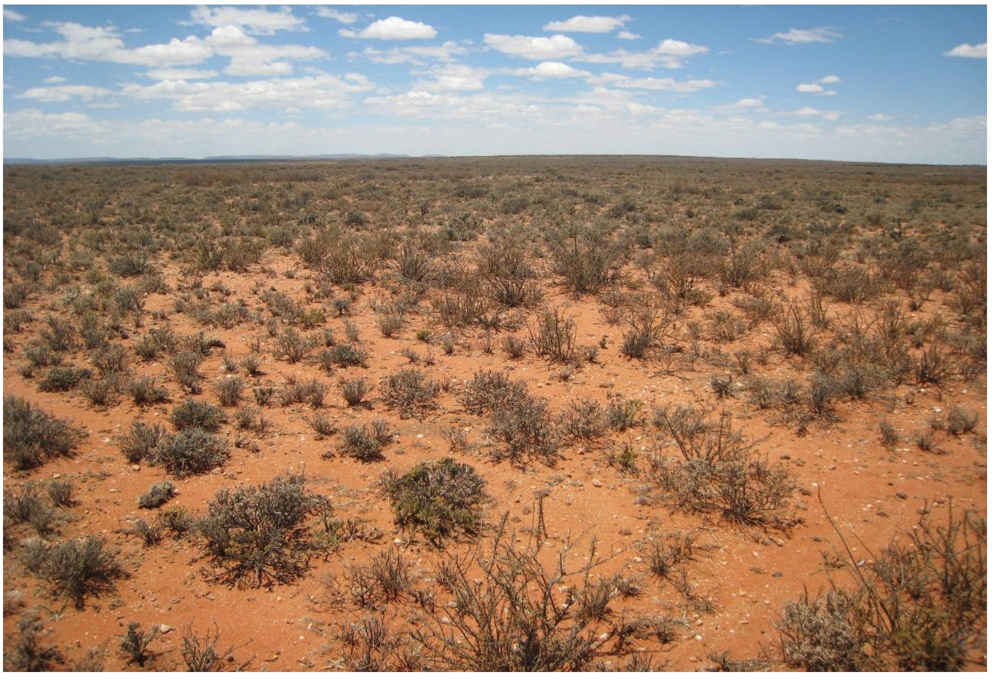
APPENDIX:

PHOTOS

PHOTOS TAKEN IN STUDY AREA

Map unit Cg1 (Obs. O6, Aletta SS1 Alternative, looking east)



Map unit Py1 (Obs. O11, Aletta SS2 Alternative, looking east)