1 Description of the Affected Environment and any Trends

A brief description of the biophysical and social environment that comprises the study area will follow.

1.1 Physical Environment

1.1.1 Climate

Although the Northern Cape is mainly semi desert, the western areas of the Northern Cape, including Namaqualand, a small section of the Green Kalahari and Calvinia, Nieuwoudville and Loeriesfontein in the Karoo fall into the winter rainfall area from April to September. The eastern summer rainfall areas experience thunderstorms that resonate across the wide plains and powerful bolts of lightning puncture the earth. The Northern Cape's weather is typical of desert and semi desert areas. This is a large dry region of fluctuating temperatures and varying topographies. The annual rainfall is sparse, only 50 to 400 mm per annum. In January, afternoon temperatures usually range from 34 to 40ºC. In 1939 an all time high of 47.8ºC was recorded at the Orange River. Summer temperatures often top the 40ºC mark. Winter days are warm. The onset of night bringing dew and frost to supplement the low rainfall of the region. Sutherland in the Karoo is one of the coldest towns in South Africa. It's average minimum is -6ºC. In winter snow often blankets the surrounding mountains.
The average climatic information (obtained from the South African Weather Service) is detailed in Table 1 below (http://www.weathersa.co.za/Climat/Climstats/UpingtonStats.jsp).

Table 1. Average climatic data from the Upington weather station (28º24'S; 21º16'E, 836m in elevation) for the period 1961-1990.

Month	Temperature (ºC)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with > 1mm	Highest 24 Hour Rainfall (mm)
January	42	36	20	10	24	4	33
February	42	34	20	9	35	6	59
March	41	32	18	5	37	6	46
April	38	28	13	2	26	5	52
May	34	24	8	-2	10	2	26
June	29	21	5	-5	4	2	13
July	29	21	4	-6	2	1	7
August	33	23	6	-7	4	1	40
September	39	27	9	-2	4	2	19
October	40	30	13	2	9	3	22
November	41	33	16	5	17	3	51
December	43	35	19	6	17	4	42
Year	**43**	**29**	**13**	**-7**	**189**	**37**	**59**

Due to the uniformity of the topography it is not anticipated that the area will be significantly affected by localised micro-climates.

1.1.2 Geology

According to the council for Geosciences (http://www.geoscience.org.za/upington/geology.htm) the simplified geology of the Upington region consists of the Namaqualand Metamorphic Province.

This province includes a group of schistose and gneissic metasedimentary, metavolcanic and intrusive rock types in an area along the Orange River from Prieska in the east which is bordered by the Kaapvaal Craton, to the Atlantic coast in the west. To the north and to the south the province is overlain by younger sequences like the Nama Group and the Karoo Supergroup.

Statutory mapping programmes in recent years have concentrated the attention of the Northern Cape Unit on the Namaqualand Metamorphic Complex. Due to the complex history of intense deformation and metamorphism, many aspects concerning the province are still controversial and revision of stratigraphic correlations and genetic models is an ongoing process.

The province comprises supracrustal rocks that have been intensely deformed and metamorphosed, and a wide variety of intrusive rock types which are predominantly granitic. Metamorphism that has reached granulite facies, as well as deformation by folding and fluxion in a plastic state during metamorphism, characterise especially the western and central parts of this province.

Rocks of the Brulpan Group structurally overlie the Olifantshoek Supergroup. They comprise a succession of highly folded schists, with minor greenstone and quartzite. The western margin of the Kaapvaal Craton is marked by three volcano-sedimentary successions; the 1300 Ma old Wilgenhoutsdrif and Arachap Groups and the undeformed 1100 Ma old Koras Group.

The northern part of the eastern boundary zone is intensely deformed by east-directed folding and thrusting, and is metamorphosed to lower greenschist facies. The boundary between the Namaqualand Metamorphic Province and the Kaapvaal Craton is characterized by a number of normal, reverse and wrench faults as well as a sharp transition in the grade of metamorphism and the tectonic pattern.

The floor to the Namaqualand Metamorphic Province has not been recognised (although some investigators in the past have claimed the recognition of such a floor). The volcanic Orange River Group in the Vioolsdrif area with its related intrusives of the Vioolsdrif batholith, are dated between 2 000 to 1 800 million years. Many rock types in the province are dated at

around 1 200 million years, which most likely do not display their true age but rather the age of metamorphic resetting of the radiometric clock by extreme metamorphic conditions. The end of the Namaqua orogenesis is marked by intrusion of the mafic Koperberg Suite (1 100 Ma), as well as the formation of the pegmatite belt, which is dated at around 1 000 million years.

1.1.3 Soils

As can be seen on the broad soil pattern map (Figure 1), the study area comprises a number of broad soil patterns. These various broad soil patterns are listed in Table 2 below, along with their chief limitations.

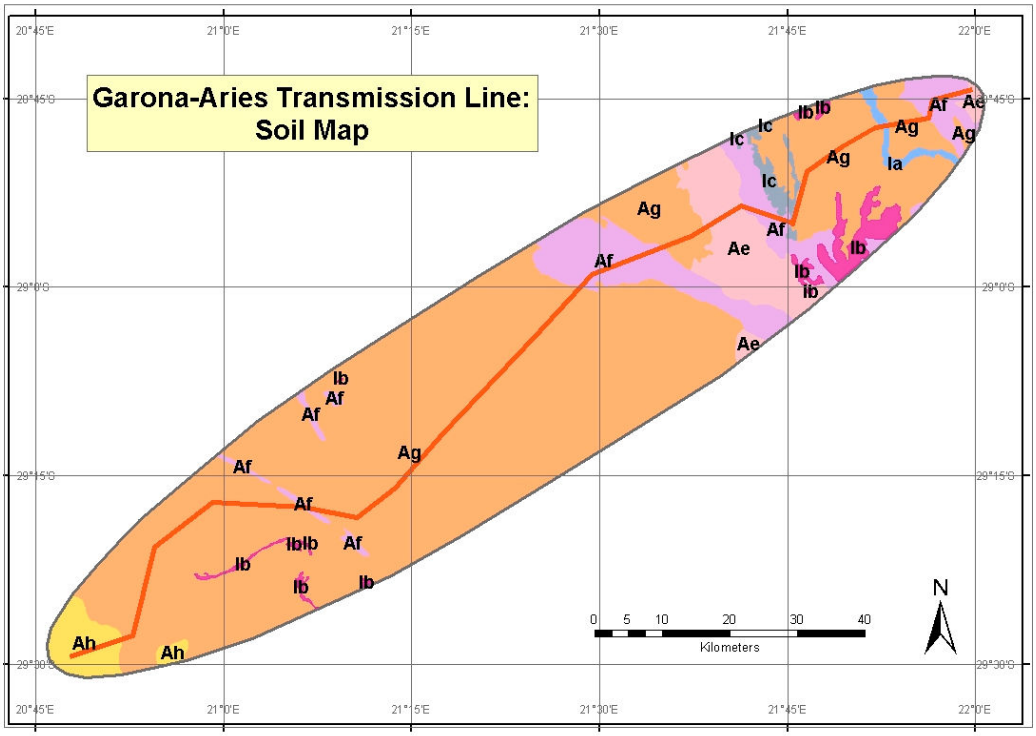


Figure 1: Soil map for the study area.

It is important to bear in mind that, due to the scale of the land type survey, and the fact that the land types have been further combined, the broad soil pattern deals only with the ***dominant*** soil(s) occurring, and that significant areas of different soils can, and will occur within each land type and within each broad soil pattern zone.

Table 2: Broad soil patterns occurring in the Aries-Garona study area.

Map Symbol	General dominant soil characteristics	Soil limitations
Ae	Red, freely-drained soils with high base status, occasionally calcareous. Dominant soils: *Hutton*	Restricted soil depth in places

Af	Red, freely-drained sandy soils with high base status, including dunes; occasionally calcareous. Dominant soils: *Hutton*	Restricted soil depth in places; Excessively freely-drained
Ag	Shallow, red soils with high base status, occasionally calcareous. Dominant soils: *Hutton, Mispah*	Shallow soils, often stony/rocky.
Ah	Red and yellow, freely-drained sandy soils with high base status, occasionally calcareous. Dominant soils: *Hutton, Clovelly*	Restricted soil depth in places; Excessively freely-drained
Ia	Alluvial soils close to Gariep River. Variable textures. Dominant soils: *Dundee, Oakleaf*	Occasional flooding
Ib	Dominantly rocky areas, often with steep slopes. Dominant soils: *Glenrosa, Mispah* Usually little soil is present	Little soil available
Ic	Dominantly very rocky areas, often with steep slopes. Dominant soils: *Glenrosa, Mispah* Usually very little soil is present	Very little soil available

In general, most of the area has red, shallow to very shallow, often calcareous soils on rock. There are small areas of deeper red and yellow soils in the south-west as well as a larger area of deeper red soils (some with dunes) in the north-east.

The various broad soil patterns will have different **dominant** potential as far as farming systems and types of agriculture are concerned (although this will obviously vary with slope angle and soil depth). These are summarized below:

Ae: Moderate to high potential soils, support most types of agriculture ***where rainfall is sufficient***
Af: Low potential soils, support little agriculture where dunes are present.
Ag: Low potential soils, support only grazing due to shallow soils
Ah: Moderate to high potential soils, support most types of agriculture ***where rainfall is sufficient***
Ia: High potential soils near river, support most types of agriculture **where irrigated**
Ib: Very rocky, usually steep. Only supports grazing at best.
Ic: Very rocky, usually steep. Usually not enough soil for vegetation for grazing.

Soil Capability

This involves dividing land into one of eight classes of ***soil*** capability, whereby Classes I-IV are arable and Classes V-VIII are non-arable. This is done by allocating a number of defined terrain/soil factors (flooding hazard and erosion hazard) and soil factors (soil depth, soil

texture, internal drainage, mechanical limitations, other soil properties) to an area of land, according to the table below.

Table 3: Terrain, soil and climate factors constituting soil capability classes I to VIII

TERRAIN/SOIL FACTORS		SOIL FACTORS					SOIL CAPA-BILITY CLASS
Flooding hazard	Erosion hazard	Soil depth	Soil texture	Internal drainage	Mech. limitations	Other soil Props.	
F1, F2	E1; E5	D1	T1	W2	MB0	P1	I
F1-F3	E1-E2; E5	D1, D2	T1, T2	W2, W3	MB0	P2	II
F1-F4	E1-E3; E5	D1-D3	T1-T3	W1-W4	MB0-MB1	P2	III
F1-F4	E1-E4; E5	D1-D4	T1-T3	W1-W4	MB0-MB1	P2	IV
F1-F5	E1-E5	D1-D4	T1-T3	W1-W5	MB0-MB1	P2	V
F1-F5	E1-E6	D1-D4	T1-T3	W1-W5	MB2-MB3	P2	VI
F1-F5	E1-E7	D4-D5	T1-T3	W1-W5	MB2-MB4	P2	VII
F1-F5	E1-E8	D4-D5	T1-T3	W1-W5	MB2-MB4	P2	VIII

The table should be applied from the top downwards. To qualify as soil capability Class I, for example, a polygon must have the following assigned to it: either F1 or F2; E1or E5; D1; T1; W2; MB0 and P1. If not, the polygon is tested for subsequent rows until it qualifies.
Each entry for each land type was tested against the above criteria, and the percentages of each land type with each soil capability class were calculated. The **dominant** soil capability class of each land type was determined and this distribution appears on the map. This classification **excludes** climate factors, so areas with soils of arable capability may well occur in zones with unfavourable climatic factors for agriculture.

Land Capability
Once the soil capability determination per land type is done as in Table 3 above, a combined climatic factor (Schoeman *et al*, 2000) is applied, according to Table 4 below. In this way, the combination of ***soil*** capability class and climate class produces the ***land*** capability class.

Table 4: Terrain, soil and climate factors constituting land capability classes I to VIII

SOIL CAPABILITY CLASS	CLIMATE CLASS	LAND CAPABILITY CLASS
I	C1	I
I, II	C1, C2	II
I-III	C1-C3	III
I-IV	C1-C4	IV
I-V	C1-C5	V

I-VI	C1-C5	VI
I-VII	C1-C6	VII
I-VIII	C1-C6	VIII

Table 4 should also only be applied from the top downwards. The land capability class is determined by the lowest of the soil capability and the climate class.

The final land capability map of the route thus divides the area, per land type, into one of eight classes of **dominant** land capability, whereby Classes I-IV are arable and Classes V-VIII are non-arable (in fact, no land types with **dominant** land capability class I were encountered, although smaller areas of land capability class I will certainly occur within several of the individual land types).

If one compares the maps showing broad soil pattern and land capability, it can be seen that the harsh climate of the area (200 mm rainfall per year, hot temperatures) is the main restricting factor for agriculture in the study area, no matter how favourable the soils might otherwise be. The entire area is classed as Land Capability Class VII or VIII, due almost entirely to the shallow soils and dry climate (refer to Figure 2).

The only area with agricultural possibilities is the zone of alluvial soils along the Gariep River, where irrigation might be applied.

Note: It should be borne in mind that the scope of this investigation was to provide a broad overview of the proposed route. If more specific information is required about a portion of the route, or about some critical area, it can be the subject of a separate investigation, either using existing land type information or, if required, an *ad hoc* soil investigation.

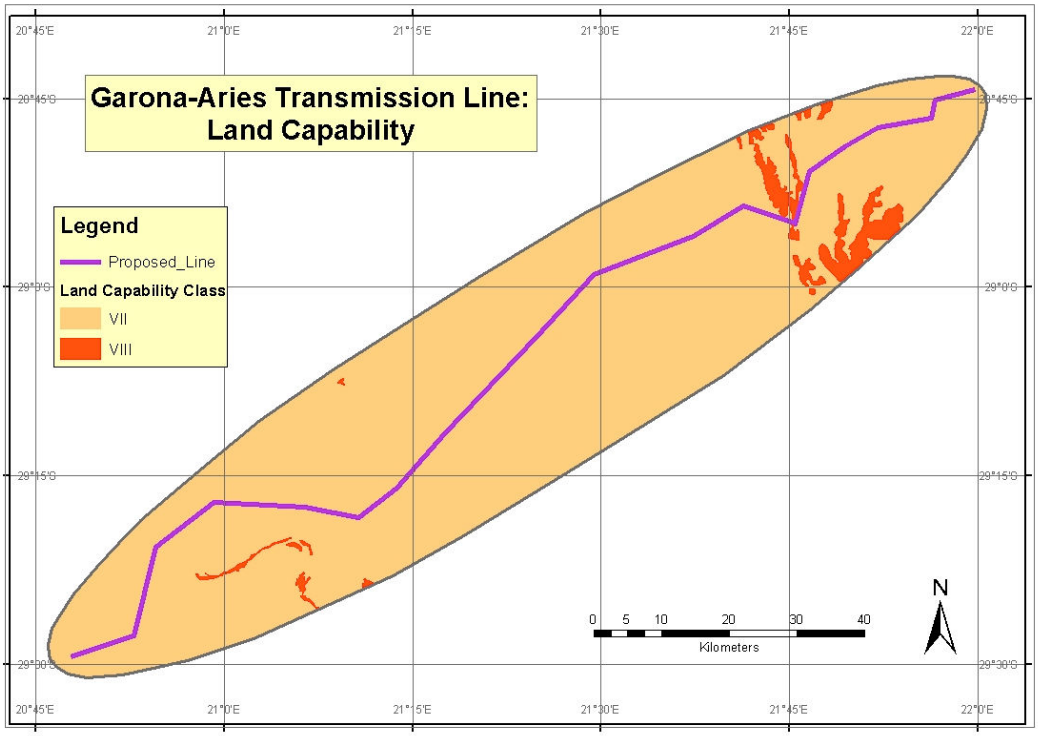


Figure 2: Land capability map for the study area.

1.1.4 Hydrology

1.1.4.1 Surface water

The major surface water hydrological features within the study area consist of the perennial Orange River in the northern section (travelling past the town of Groblershoop), numerous non-perennial pans and drainage lines scattered all over the site, as well as the non-perennial Hartbeesrivier in the southern section (travelling past the town of Kenhardt). The proposed transmission power line will need to cross both of these rivers.

Due to the nature of the proposed development (i.e. a transmission power line) it is not anticipated that major impacts will occur on these hydrological features. The avifaunal specialist has raised the concern regarding aquatic bird species in the vicinity of the Orange River crossing. Measures have been proposed to mitigate this possible impact.

1.1.4.2 Geohydrology

Geohydrology is not anticipated to be of concern with regards to this development.

1.1.5 Topography, Land Use and Land Cover

Due to the linear nature of the proposed power line, there are a variety of topographical features that make up the study area. The majority of the topography consists of a flat,

sparsely vegetated landscape as can be seen in Figure 3 below. Within the study area, there exist farmsteads, rivers, power lines, a railway line, rocky outcrops, hills, sand dunes and vineyards. These features are by no means the predominant landscape feature as the study area consists of approximately 3652 km^2.

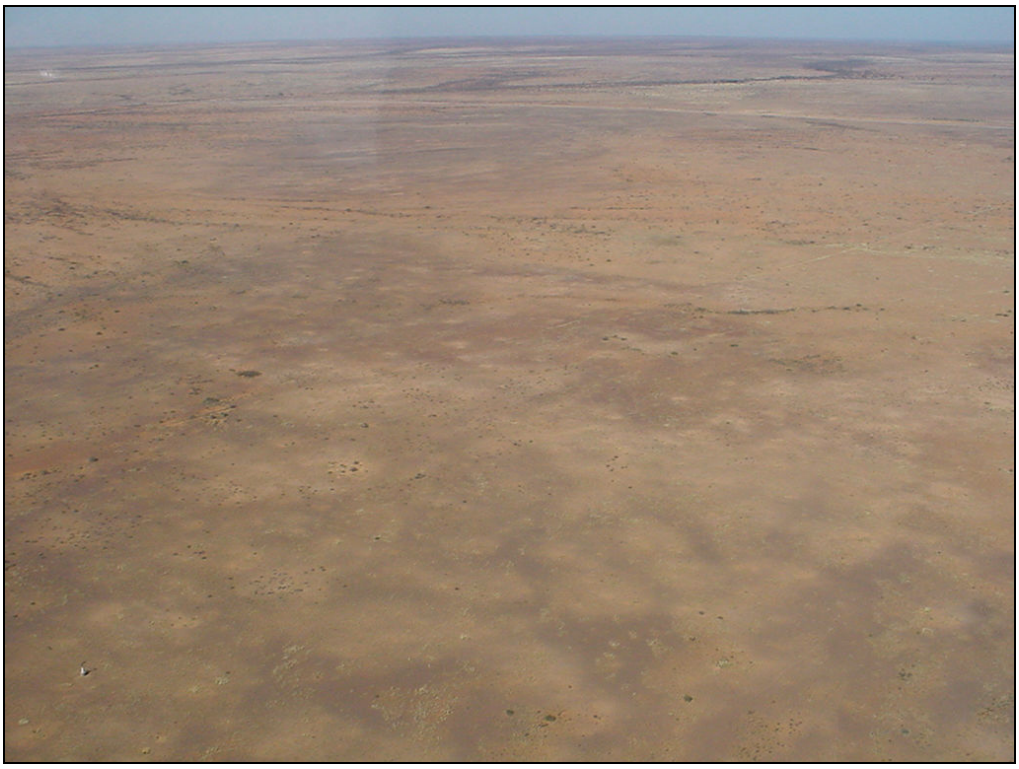


Figure 3. An aerial view of the general topography of the study area (sparsely vegetated, flat landscape).

A Spoornet railway line (Figure 4 and Figure 5) spans the length of the study area (refer to map in Appendix 2). The ideal positioning of the power line would be as near to the railway line as possible due to the existing access road adjacent to the railway line as well as minimising the visual impact of the power line by inserting it in an already visually "polluted" area. A minimum buffer zone of 300 m is required between the railway line and the power line.

The majority of the study area consists of a very flat topography. The only hilly terrain occurs in the north-eastern section (Figure 6 and Figure 7) which the power line will need to traverse. Alternatives routes in this area have been recommended.

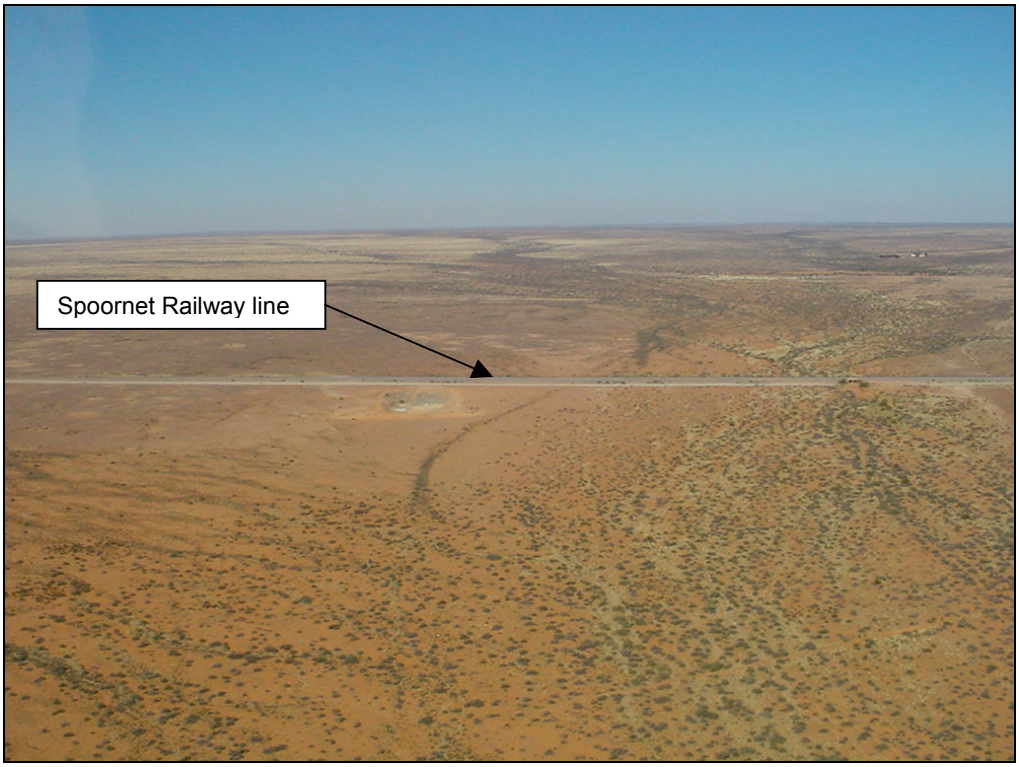


Figure 4. An aerial view of the railway line located within the study area.

Figure 5. A southerly view along the railway line showing the adjacent service road.

Figure 6. An aerial view of the mountainous region in the north-eastern section of the study area (Neus se Berg).

Figure 7. A ground view of the mountainous region (Neus se Berg) in the north-eastern section of the study area.

The main topographical obstacle that the power line will need to traverse is the area around Groblershoop and the Orange River. This area is dominated by vineyards along the banks of the Orange River (Figure 8 and Figure 9) with numerous farmsteads along the bank of the river. A 55m wide servitude strip will be negotiated with the affected farmer/s and this land will still be available for agricultural purposes although the pylons may provide restrictions in certain instances (i.e. the pylons will restrict the movements of large irrigation structures and structures taller than 3m under the power line).

The power line will be required to traverse the Orange River and all possible options for the location have been investigated in detail. Currently, the most viable option is for the power line to cross the river in the location of the railway crossing (Figure 10). This location should result in the least visual concern to the surrounding residents. The service road adjacent to the railway line can also be used for routine servicing of the power line and thus no additional roads would need to be constructed in this area.

Figure 8. An aerial view of the Orange River with associated vineyards and the town of Groblershoop in the far ground.

Figure 9. An aerial view of the Orange River. Note the vineyards along the southern bank of the river.

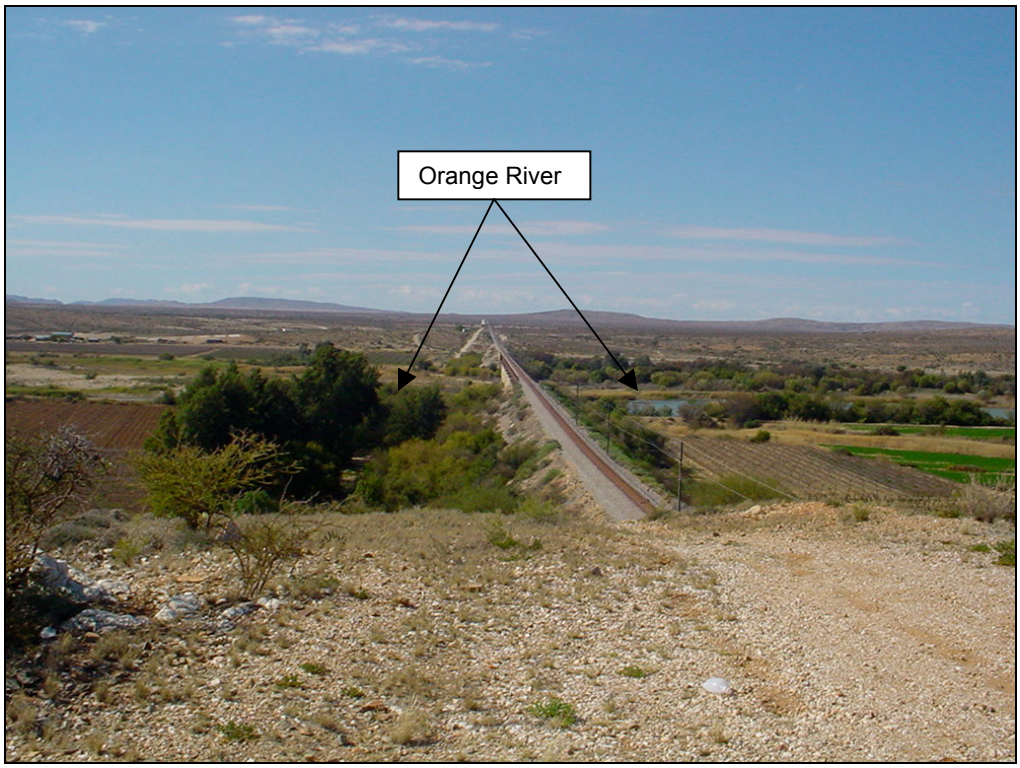


Figure 10. The proposed crossing of the transmission power line across the Orange River is on the eastern side of the bridge.

1.2 Biological Environment

1.2.1 General Ecology

The general ecology of the study area was assessed by a specialist ecologist (David Hoare Consulting) to determine the existing ecological status as well as to identify and map sensitive areas. The detailed ecological report can be found in Appendix 5 of this EIR.

The study area falls within Orange River Nama-Karoo, extending slightly into Bushmanland Nama-Karoo and Karroid Kalahari Bushveld (Low & Rebelo, 1998). According to the most recent vegetation map of South Africa (Mucina & Rutherford 2005), this area includes a number of vegetation types, the most common of which is Bushmanland Arid Grassland, but also including small amounts of Gordonia Duneveld, Lower Orange Broken Veld, Lower Gariep Alluvial Vegetation, Bushmanland Vloere, Kalahari Karroid Shrubland and Bushmanland Basin Shrubland. Orange River Nama-Karoo covers a surface area of approximately 53 000 km^2 within South Africa, only about 1.5% of which is currently conserved (Low & Rebelo, 1998). Orange River Nama-Karoo is characterized by the presence of the species, *Aloe dichotoma, Euphorbia avasmontana, E. gregaria, Acacia mellifera, Rhigozum trichotomum, Boscia albitrunca, B. foetida, Stipagrostis uniplumis* (dominant on the plains, especially after good rains)*, Tamarix usneoides* and *Ziziphus mucronata*.

Acocks (1953) describes this area as Orange River Broken Veld, extending just into Arid Karoo in the south-west and Kalahari Thornveld in the north-east. According to Acocks (1988), there are three variations of Orange River Broken Veld, the typical one occurring in the study area. Typical Orange River Broken Veld occurs on a variety of rocks in close proximity (within 50 km) to the permanently flowing Orange River. Typical tree and shrub species include *Aloe dichotoma*, *Euphorbia avasmontana*, *Sarcostemma viminale*, *Acacia mellifera*, *Acacia karroo*, *Acacia erioloba*, *Rhus lancea*, *Rhus laevigata*, *Rhus burchellii*, *Tarchonanthus camphoratus*, *Phaeoptilum spinosum*, *Ziziphus mucronata*, *Rhigozum trichotomum*, *Rhigozum obovatum, Lycium oxycarpum*, *Ehrhertia rigida*, *Boscia albitrunca, Cadaba aphylla*, *Putterlickia pyracantha*, *Nymania capensis*, *Ficus ingens, Olea europea* subsp. *africana* and *Grewia flava*. There is a rich though sparse flora of smaller plants as well as a number of important grasses, including *Aristida diffusa*, *Digitaria erianthe*, *Cenchrus ciliaris*, *Cymbopogon plurinodis*, *Enneapogon scaber*, *Enneapogon scoparius*, *Eragrostis nindensis*, *Eragrostis curvula*, *Eragrostis lehmanniana*, *Fingerhuthia africana*, *Eustachys*

paspaloides, *Panicum stapfianum*, *Sporobolus fimbriatus*, *Oropetium capense* and *Tricholaena capensis*.

This part of the Karoo Biome has not been studied in detail recently and the only information comes from the original study by Acocks (1988). The study area falls primarily within the Af and Ag land-types, a land-type being an area that is uniform with respect to terrain form, soil patterns and climate (Land Type Survey Staff 1985), with some Ah, Ia and Ic land-type in places. The study area enters the Griqualand West Centre of Plant Endemism (van Wyk & Smith 2001) close to Groblershoop, where it includes the Orange River. It is also close to the Orange Centre of Plant Endemism (van Wyk & Smith 2001) to the west. The features of potential sensitivity include the Griqualand West Centre as well as the Orange River and its tributaries.

1.2.2 Flora

Most of the study area consists of untransformed natural vegetation. Vegetation type names and descriptions given below follow those given in Mucina et al. (in press), supplemented by additional data collected during the field survey.

1.2.2.1 Vegetation of the study area

Bushmanland Arid Grassland

This is the most common vegetation in the study area. It occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses, including *Stipagrostis ciliata*, *Aristida adscensionis*, *Aristida congesta*, *Enneapogon desvauxii*, *Eragrostis nindensis*, *Schmidtia kalahariensis* and *Stipagrostis obtusa*. In some years after good rains there are abundant displays of annual herbs (Mucina et al. in press).

There are no known endemics in this vegetation (Mucina et al. in press). At a national scale this vegetation type has been transformed only a small amount and 27% is conserved in Augrabies Falls National Park; it is not therefore considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a LOW sensitivity to disturbance by the proposed development taking the following into consideration:

1. the vegetation structure is low and sparse and therefore will not be affected by overhead power lines.

2. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, but this is insignificant relative to the untransformed extent of the vegetation type
3. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including the Beaked Blind Snake, Sclater's Lark and Ludwig's Bustard;
4. the vegetation contains endemics belonging to the Griqualand West or Orange Centres of Endemism (van Wyk & Smith 2001), namely *Aizoon asbestinum*, *Maerua gilgii*, *Ruschia muricata* and *Aloe gariepensis*.
5. the vegetation contains the protected tree species, *Acacia erioloba, Acacia haematoxylon* and *Boscia albitrunca*.

Despite the low sensitivity rating, localised features may need to be considered, e.g. the location of populations of the protected tree species.

Lower Orange Broken Veld

This consists of sparse vegetation dominated by shrubs and dwarf shrubs, with annuals conspicuous, especially in spring, and perennial grasses and herbs occurring in low amounts. On the slopes of koppies groups of widely scattered low trees such as *Aloe dichotoma* occur and in the sandy soils of foot slopes *Acacia mellifera* occurs.

Known endemics in this vegetation include the tall shrub *Caesalpinia bracteata* and the succulent shrub *Ruschia pungens* (Mucina et al. in press). At a national scale this vegetation type has been transformed only a small amount and is also conserved in Augrabies Falls National Park. It is not considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a HIGH sensitivity to disturbance by the proposed development for the following reasons:

1. the vegetation structure is medium and sparse and therefore could be affected by overhead power lines.
2. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, but this is insignificant relative to the untransformed extent of the vegetation type
3. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including the Black Spitting Cobra and the Beaked Blind Snake, as well as the sensitive plant species, *Hoodia gordonii and Aloe dichotoma* subsp. *dichotoma*.

4. two endemic plant species are found in this vegetation type;
5. the vegetation contains endemics belonging to the Griqualand West or Orange Centres of Endemism (van Wyk & Smith 2001), namely.*Digitaria polyphylla* and *Crassula corallina* subsp. *macrorrhiza*

Kalahari Karroid Shrubland

This vegetation only occurs around the site of the north-eastern extreme of the proposed power line; otherwise it will not be affected. It is a low karroid shrubland occurring on flat gravel plains. Dominant species include the small trees, *Acacia mellifera*, *Parkinsonia africana* and *Boscia foetida*, the tall shrub, *Rhigozum trichotomum*, the low shrubs, *Hermannia spinosa* and *Phaeoptilum spinosum*, the herbs, *Dicoma capensis*, *Chamaesyce inaequilatera* and *Limeum aethiopicum*, and the grasses, *Aristida adscensionis*, *Enneapogon desvauxii*, *E. scaber*, *Stipagrostis obtusa* and *Aristida congesta*.

There are no known endemics in this vegetation, but the grass *Dinebria retroflexa* has its south-western distribution limit in this vegetation type in this area (Mucina et al. in press). At a national scale this vegetation type has been transformed only a small amount, but it contains the preferred routes of many roads and about a quarter of the vegetation type is invaded by *Prosopis* sp. Although only a small amount is conserved in Augrabies Falls National Park, it is not considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a LOW sensitivity to disturbance by the proposed development for the following reasons:

1. the vegetation structure is low and sparse and therefore will not be affected by overhead power lines;
2. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, but this is insignificant relative to the untransformed extent of the vegetation type;
3. only a small amount of this vegetation type will be affected by the proposed power line;
4. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including Ludwig's Bustard.

Bushmanland Basin Shrubland

This vegetation only occurs around the site of the south-western extreme of the proposed power line, Kenhardt representing the northern extreme of the distribution of this vegetation, otherwise it will not be affected. It is a dwarf shrubland occurring on irregular plains dominated by sturdy, sometimes spinescent and succulent dwarf shrubs, grasses (mostly

Stipagrostis) and, in years with good rains, some annuals (Mucina et al. in press). Dominant species include the tall shrubs, *Lycium cinereum* and *Rhigozum trichotomum*, the low shrubs, *Aptosimum spinescens*, *Hermannia spinosa*, *Zygophyllum microphyllum* and *Pentzia spinescens*, the succulent shrubs, *Salsola tuberculata*, the herb, *Leysera tenella*, and the grasses, *Aristida adscensionis*, *Enneapogon desvauxii*, *Stipagrostis obtusa* and *Stipagrostis ciliata*. This vegetation contains within it a number of endorheic pans and river channels. Known endemics in this vegetation include the herb, *Cromidon minutum*, *Ornithogalum bicornutum* and *O. ovatum* subsp. *oliverorum* (Mucina et al. in press). At a national scale this vegetation type has not been transformed, but there are scattered invasions by *Prosopis* sp. (Mucina et al. in press). Although none of this vegetation is conserved, it is not considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a MEDIUM sensitivity to disturbance by the proposed development for the following reasons:

1. the vegetation structure is low and sparse and therefore will not be affected by overhead power lines;
2. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, but this is insignificant relative to the untransformed extent of the vegetation type;
3. only a small amount of this vegetation type will be affected by the proposed power line;
4. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including Sclater's Lark.
5. the vegetation contains endemics belonging to the Orange Centre of Endemism (van Wyk & Smith 2001), namely.*Aloe striata* subsp. *karasbergensis*;
6. the vegetation contains species that are endmic to the unit.

Bushmanland Vloere

This vegetation occurs in patches throughout the study area in the flat areas in pans and the broad bottoms of seasonal rivers. Often the centre of the pan or the river drainage channel itself are devoid of vegetation. It is a loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, in combination with a mixture of non-succulent dwarf shrubs of Nama Karoo origin. In places loose thickets of *Parkinsonia africana, Lebeckia lineariifolia* and *Acacia karroo* can be found as well (Mucina et al. in press). There are no known endemics in this vegetation type, although a current taxonomic revision of some plant families may result in some South African representatives of the genus *Salsola*,

one of the most important generic components of vegetation of Bushmanland, becoming recognised as endemics (Mucina et al. in press). At a national scale this vegetation type has not been transformed, but there are scattered invasions by *Prosopis* sp. (Mucina et al. in press). Although none of this vegetation is conserved, it is not considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a LOW sensitivity to disturbance by the proposed development taking the following factors into consideration:

1. the vegetation structure is relatively low and sparse and therefore will not be affected by overhead power lines;
2. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, but this is insignificant relative to the untransformed extent of the vegetation type;
3. only a small amount of this vegetation type will be affected by the proposed power line;
4. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including the Black Spitting Cobra, Kori Bustard and perhaps Sclater's Lark, as well as the sensitive plant species, *Hoodia gordonii*, but all of these species also occur in other habitats;
5. no endemic plant species occur here;
6. the vegetation type is widespread beyond the boundaries of the current study area, has not been transformed to a great extent and is not considered to be threatened at a national scale.

Gordonia Duneveld

This vegetation type occurs in bands running through the study area, often close to ridges. It consists of loose to partially stabilized sand dunes with very sparse vegetation that often only occurs at the footslopes.

There are no known endemics in this vegetation type (Mucina et al. in press). At a national scale this vegetation type has not been transformed (Mucina et al. in press). Although none of this vegetation is conserved, it is not considered to be a threatened vegetation type (Mucina et al. in press). From a natural vegetation perspective this vegetation is considered to have a MEDIUM sensitivity to disturbance by the proposed development for the following reasons:

1. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including the Beaked Blind Snake, as well as the sensitive

plant species *Hoodia gordonii*, *Pterothrix tecta*, *Vahlia capensis* subsp*. ellipticifolia* and *Brachiaria dura* var. *pilosa*.

2. the vegetation contains the protected tree species (according to the National Forests Act of 1998, Act 84 of 1998), *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca*.

Lower Gariep Alluvial Vegetation

This vegetation occurs on flat alluvial terraces and riverine islands. The vegetation consists of a complex of riparian thickets dominated by *Ziziphus mucronata, Euclea pseudebenus* and *Tamarix usneoides*), reed beds with *Phragmites australis* and flooded grasslands and herblands along sand banks and terraces within and along the river (Mucina et al. in press). It is found as two strips in the north-west and north-east edges of the study area.

There are no known endemics in this vegetation type (Mucina et al. in press). Little of this vegetation is conserved and it is highly transformed by cultivation (approximately 50%). It is considered to be a threatened vegetation type (Mucina et al. in press) classified on a national scale as Endangered (Driver et al. 2005) with only about 6% conserved. From a natural vegetation perspective this vegetation is considered to have a HIGH sensitivity to disturbance by the proposed development taking the following factors into consideration:

1. the vegetation structure is of intermediate height and relatively dense and therefore may be affected by overhead power lines;
2. the vegetation type is Endangered on a national scale;
3. pylons, access roads and disturbance due to construction may cause some local disturbance and/or transformation, which may be significant relative to the untransformed extent of the vegetation type;
4. only a small amount of this vegetation type will be affected by the proposed power line;
5. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including the Kori Bustard,
6. no endemic plant species occur here.

Flora of entire study area

All plant species found during the survey are listed in Appendix 2 of the ecological report (refer to Appendix 5). Due to the fact that the fieldwork component of this survey lacked seasonal coverage, the species list provided is unlikely to be comprehensive, but nevertheless provides a good indication of the species diversity and composition of the study area. From historical data, a total of 553 species are known to occur in the study area.

Figure 11 below shows a general sensitivity map of the study area and surrounding areas. The numerous vegetation types (as detailed in the paragraphs above) have been assessed for sensitivity to the proposed power line and these sensitivities have been rated as “High”, “Medium” and “Low” by the ecological specialist.

The north-eastern section of the study area contains the majority of the highly sensitive vegetation types (Lower Gariep Alluvial Vegetation and Lower Gariep Broken Veld). As can be seen in

Figure 11, the sensitive vegetation surrounding the study area is extensive and hence routing the power line around this vegetation type is not feasible.

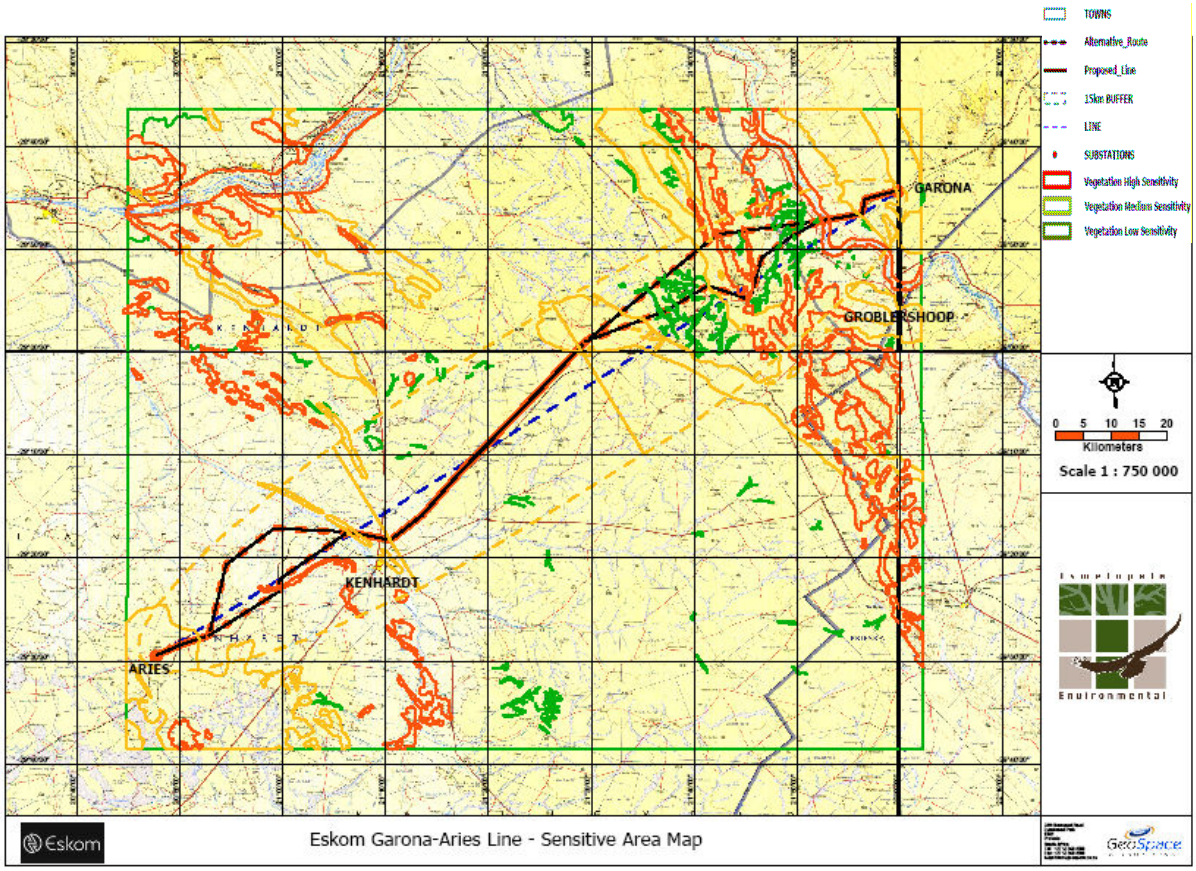


Figure 11. Sensitive vegetation units within and surrounding the study area.

Red List Plant Species and other plant species of special concern

No Red List plant species were recorded in the field during the current survey. Historical records of Red List plant species were consulted in order to determine the likelihood of any such species occurring in the study area.

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated was obtained from the South African National Biodiversity Institute. There were 8

species recorded in the quarter degree grids that include the study area that were listed in the Red List of southern African plants (Hilton-Taylor, 1996). One of these is currently considered to be threatened, namely *Aloe dichotoma* subsp. *dichotoma*, classified as Vulnerable. In the study area, this species is found on rocky outcrops, which fall within the vegetation type Lower Orange Broken Veld. A further four species are considered to be of some conservation concern due to declining populations, lack of information or due to the fact that they are naturally rare, including *Hoodia gordonii*, *Brachiaria dura* var *pilosa*, *Pterothrix tecta* and *Vahlia capensis* subsp. *ellipticifolia*. The succulent *Hoodia gordonii* has been recorded during previous vegetation studies undertaken in the area and therefore has a high chance of occurring in the study area. It is also considered to be an Orange Centre of Endemism near-endemic species (see below). It is found in a number of habitats, including within Gordonia Duneveld, Lower Orange Broken Veld and Bushmanland Vloere. The remaining species, *Brachiaria dura* var. *pilosa*, *Vahlia capensis* subsp. *ellipticifolia* and *Pterothrix tecta* have been previously recorded in dune sand or between dunes and are therefore most likely to occur in Gordonia Duneveld vegetation.

It is clear from the quantity and quality of data for the study area that this general geographic region is poorly known. There are few taxonomic collections and relatively little floristic information for the area (van Wyk & Smith 2001). There are 13 species listed as being endemic or near-endemic succulents for the nearby Griqualand West Centre of Endemism (van Wyk & Smith 2001). Only one of these, *Aizoon asbestinum*, has been recorded in the current study area, found throughout the study are in Bushmanland Arid Grassland. A number of non-succulent species are also endemic / near-endemic to the Griqualand West Centre of Endemism (van Wyk & Smith 2001). One of these, *Digitaria polyphylla*, has been recorded just outside the study area in Lower Orange Broken Veld. There are over 400 succulent species listed as being endemic or near-endemics for the nearby Orange Centre of Endemism as well as a long list of non-succulents (van Wyk & Smith 2001). Seven of these have been recorded in the current study area, namely *Aloe gariepensis*, *Aloe striata* subsp. *karasbergensis*, *Crassula corallina* subsp. *macrorrhiza*, *Hoodia gordonii*, *Maerua gilgii*, *Ruschia muricata* and *Sarcocaulon patersonii*. *Aloe gariepensis*, *Ruschia muricata* and *Maerua gilgii* are found in Bushmanland Arid Grassland, *Aloe striata* subsp. *karasbergensis* is found in Bushmanland Basin shrubland, *Crassula corallina* subsp. *macrorrhiza* is found in Lower Orange Broken Veld. *Sarcocaulon patersonii* is found in a variety of vegetation types, including Bushmanland Vloere, Lower Orange Broken Veld, Bushmanland Arid Grassland,

Bushmanland Basin shrubland and, in one instance, in Gordonia Duneveld. The Orange Centre is centred along the Orange River and includes part of Acocks's Orange River Broken Veld, thus promoting the extension of species ranges further inland of the Centre into parts of the current study area. Areas associated with calcareous soils and heavy metals are likely to have high numbers of species of restricted distribution, the probability high that there are unknown species from these sites.

Tree species that have been recorded in the study area that are protected in terms of the National Forests Act of 1998 (Act 84 of 1998) are *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca*. The tree *Acacia erioloba* occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands (mostly Bushmanland Arid Grassland and Gordonia Duneveld), *Acacia haematoxylon* on deep Kalahari sand between dunes or along dry watercourses (Bushmanland Arid Grassland and Gordonia Duneveld) and *Boscia albitrunca* in semi-desert areas and bushveld, often on termitaria, but common on sandy to loamy soils and calcrete soils (mostly Bushmanland Arid Grassland, but also found in Gordonia Duneveld). *Acacia erioloba* is relatively common in the study area, whereas *Acacia haematoxylon* and *Boscia albitrunca* occur more sparsely.

1.2.3 Fauna

No species of threatened animals were recorded during this survey. Four reptiles and amphibians, nine birds and no threatened mammal species have a geographical distribution and habitat preference which coincides with that of the study area. The Lesser Kestrel, Secretary Bird, Peregrine Falcon, Desert Mountain Adder and Giant Bullfrog have a low chance of occurring on the site, due to the fact that their geographical range is marginal to the study area or the preferred habitat of these species is not available or uncommon in the study area. The species with a medium to high chance of occurring in the study area are discussed in more detail below.

Black Spitting Cobra (Rare)

The Black Spitting Cobra occurs in rocky terrain in arid areas, on rocky outcrops and in dry watercourses. It has been previously recorded in the study area and is, therefore, likely to occur in available habitats. The proposed power line is unlikely to have a significant negative impact on the global conservation status of this species.

Beaked Blind Snake (Peripheral)

The Beaked Blind Snake is not well-known. It occurs in arid areas in the Northern Cape, including the study area, and probably burrows in hard ground. It occurs in the Augrabies Falls National Park and is protected by Provincial Ordinance. The proposed power line is unlikely to have a significant negative impact on the global conservation status of this species

Black Harrier

The Black Harrier occurs in open grassland, scrub, semi-desert and mountain areas and is endemic to southern Africa, mostly in South Africa. It is reliant on private farmland and is vulnerable to changing land use. It is not reported to be affected by power lines (Barnes 2000) and the proposed power line is therefore unlikely to have a negative impact on the conservation status of this species.

Kori Bustard

The Kori Bustard occurs in dry savanna and moist to semi-arid woodland in South Africa. Threats to this species include habitat destruction, agriculture, bush encroachment, hunting, collision with overhead transmission power lines and poisoning (Barnes 2000). In the study area the Kori Bustard favours tree-lined watercourses, but this habitat is becoming less favourable due to being invaded by alien *Prosopis* spp. (Barnes 2000). The proposed power line may have an impact on this species due to increased collisions.

Martial Eagle

The Martial Eagle is widespread and tolerates a wide variety of vegetation types. It relies on tall trees and/or electricity pylons to provide nesting sites. The main threats to this species are direct persecution (shooting & trapping), poisoning and drowning in sheer-walled reservoirs, especially in the arid Northern Cape. Lesser threats include electrocution on electricity structures and collision with overhead power lines. The proposed power line may therefore have an impact on this species due to increased collisions.

Ludwig's Bustard

Ludwig's Bustard occurs in open plains of the semi-arid Karoo (Barnes 2000). They are highly susceptible to collisions with overhead power lines and telephone wires, the single most important threat to this species. The proposed power line is therefore likely to have a significant impact on local populations of this species.

Lanner Falcon

The Lanner Falcon occurs in a wide range of habitats, usually avoiding thick forests (Sinclair 1988). There is a high incidence of fatalities and injuries in this species due to collisions with

overhead power lines and fences. The proposed power line is therefore likely to have a significant impact on local populations of this species.

Sclater's Lark

Sclater's Lark occurs in gravelly or stony, semi-desert plains with stunted Karoo scrub (Sinclair 1988). It is endemic to southern Africa and the current study area is at the centre of its known distribution range. Populations in the Bushmanland area are considered to be relatively sedentary and return to the same nesting patch each year (Barnes 2000). The proposed power line may therefore have an impact on this species if electricity pylons affect nesting sites.

Invertebrates

Most invertebrate groups are very poorly known and also considered to be extremely species rich – approximately 70% of species, including plants and animals, are invertebrates. The Animal Kingdom consists of 11 phyla, of which invertebrates comprise 10 of these, 4 of which are wholly marine (Rothschild 1965). In many cases, especially with insects (Phylum Arthropoda, Class Insecta), it is almost impossible to have specimens identified to beyond family level. This makes evaluation of threatened status very difficult and is usually only possible for better-known groups, such as butterflies. No official published threatened species lists exist for any invertebrates. An aggravating circumstance in the current study area, is that it is generally poorly known for all groups of organisms. The current study therefore only considers a single well-known group – the butterflies.

Of 54 species of butterfly that have a geographical range that includes the study area (out of a total of 666 for South Africa), only 3 have a slightly restricted range. None are rare or truly restricted and, in the absence of a threatened species list for butterflies, it is assumed that none are threatened.

1.2.4 Avifauna

The Endangered Wildlife Trust undertook a detailed investigation of the possible effects the transmission power line would have on the natural populations of birds in the study area. His complete report can be found in Appendix 4 of this EIR.

Whilst much of the bird species distribution in the study area can be explained in terms of the above broad vegetation description (based on the quarter degree squares), there are many differences in bird species distribution and density that correspond to differences in habitat at the micro level. These "bird micro habitats" are evident at a much smaller spatial scale than

the broader vegetation types or biomes and are determined by factors such as land use, vegetation and manmade infrastructure. They can largely only be identified through a combination of field investigation and experience and it is therefore extremely important to visit the study area first hand (as was undertaken).

The following bird microhabitats were identified during the field investigation:

Arable lands

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. In this study area, this is particularly the case, as the remainder of the landscape is so arid and devoid of surface water or greenery of any type.

The only arable lands in this study area are along the Orange River, almost all under irrigation and as such most definitely represent almost the only source of “green” and moisture in this landscape for much of the year. Whilst some crops are more suitable than others for birds, most of these lands are under a rotational system whereby at some point in the year or over several years a crop will be planted that is suitable to birds. The exception to this is the vineyards, which are obviously a long lived crop that is unlikely to change for a long time. Since the vineyards are interspersed with other crops types, the entire arable area along the river is considered extremely sensitive from a bird perspective.

Bird species likely to make use of these areas include the White and Abdim’s Stork, and various non Red Data species such as geese, water birds, Helmeted Guineafowl and many others.

Plains or flats – including wetlands

These areas are conspicuously flat and may hold water in places after rainfall events. Drainage lines and river courses generally bisect the plains, and sometimes these drainage lines have been dammed. Large bare patches of partially exposed soil are often evident. In this study area, the plains are often bisected by wetland systems.

From a bird collision perspective, the plains or flat areas are important for a number of reasons: they are often surrounded by ridges or kopjes, which are higher and form a dark background, against which the earth wires of a power line are obscured; many collision

sensitive species such as bustards prefer these areas. Studies on existing 400kV power lines elsewhere in the Karoo found almost all carcasses of birds (Ludwig's Bustards and Blue Cranes) had collided with the lines on these flat areas (Smallie & van Rooyen, 2003).

Rocky ridges/kopje

These areas are extremely rocky and are usually derived from dolerite. In this area of the Karoo, the koppies are relatively small in size. Extensive populations of Quiver Trees (*Aloe dichotoma* var*. dichotoma*) occur on these koppies, particularly just south of Kenhardt.

In terms of collision these areas are much less important that the plains. However these koppies form an important habitat for species such as the Black Eagle. It has been shown elsewhere in the Karoo that both Black and Martial Eagles favour breeding on or adjacent to these ridges (Smallie & van Rooyen 2003). Further, a number of collisions of Black Eagles have been reported in the past, on power lines crossing ridges, most likely due to this species habit of hunting low along the rock line on these ridges.

The proposed alignment should avoid crossing koppies entirely. Potential options include, passing through a narrow gap in the ridge just south of Groblershoop ("Neus se Berg"). This is not anticipated to be a particularly sensitive area since it is adjacent to the road, and disturbance levels are likely to be relatively high.

Rivers/drainage lines

Most rivers in southern Africa are in the east and extreme south, in the higher rainfall areas. Thirteen species of water bird are mostly restricted to riverine habitat in southern Africa. The map distribution of these species correlates with the river courses in southern Africa.

In this arid Karoo/Kalahari landscape, although the watercourses seldom contain water, these systems are important, as they have a different vegetation composition to the remainder of the plains, often including woody species such as *Acacia spp.* These drainage lines also serve as important flight paths for many bird species even when dry.

Dams

Many thousands of earthen and other dams exist in the southern African landscape. Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. These include the African Fish Eagle, pelicans, darters and cormorants. Many species from these families occur in this study area.

Most importantly, in this arid landscape, dams are used as roost sites by some bird species. This has serious implications for their interaction with power lines, as the birds would then leave the roost in the early morning during low light conditions, and arrive at the roost in the late evening, again during low light conditions. During these conditions, the earth wires of a power line are almost invisible and the chance of collision is much greater.

The current proposed alignment does not pass close to any dams within the study area and thus no alternative routes have been proposed in this regard, however a few small dams do exist in the study area and must be considered if the alignment changes at all.

Bushland and thicket

As discussed above, this occurs mainly along drainage lines and watercourses, and also on the ridges and broken ground. It is clear that bushlands and thickets are in the minority in this area.

Bird species likely to make use of these areas include the Martial Eagle, Kori Bustard and Secretary bird.

1.2.4.1 Bird species present in the study area

Table 2 of the Specialist Avifaunal Report (refer to Appendix 4) shows the Red Data bird species reported for each quarter degree square in the study area (Harrison *et al* 1997). The report rates are essentially a percentage of the number of counts conducted in the square that recorded that particular species. A total of 8 (3 Vulnerable and 5 Near-threatened) Red Data species have been recorded, and the White and Abdim's Stork have been included here as they are internationally protected under the Bonn Convention on Migratory Species. Of these 10 species, all except one, the Sclater's Lark, are known to interact directly with power line infrastructure. All of the 10 species, including the Sclater's Lark could potentially be impacted on through habitat destruction and disturbance.

Of particular concern for this study are the species known to be vulnerable to collision with overhead cables namely the Kori and Ludwig's Bustard, Secretarybird, Greater Flamingo, and the 3 storks species, namely Black, Abdim's and White Stork. Both bustard species have been fairly well recorded in the study area, whilst the storks have only been recorded in 2921AC.

It must be stressed again that the squares in this study area have not been well counted during the data collection phase of the Atlas of southern African Birds Project (Harrison *et al* 1997). Many of the report rates must therefore be viewed with some caution, and it is possible that some species were missed altogether. One glaring example is that the White

Stork has not been recorded in 2821DD, the square through which the Orange River flows. One would certainly expect to find White Storks along the river in the arable lands, particularly the Lucerne lands that exist. Despite the uncertainty regarding the species lists and report rates, the assessment of impacts and the proposed mitigation measures are unlikely to be affected since fortunately most sensitive areas are sensitive due to the presence of more than one species. For example, this study will recommend the marking of the earth wires on the section of line crossing the Orange River due to the abundance of non Red Data water bird species in this area. If in fact White Storks do occur there (contrary to the data) they will obviously also be safeguarded by the proposed mitigation.

Another species that will interact with the proposed power line in a slightly different manner is the Sociable Weaver, which is known to make use of electrical and telephonic infrastructure for nesting substrate. These nests can become massive and place a large weight on the pole. Numerous nests were seen in this study area, particularly from just south of Groblershoop to the Garona Substation. Whilst this nesting poses no threat to the Sociable Weaver, it has been speculated that it may compromise the structural integrity of towers in some extreme cases. The nests also pose a fire risk as they consist of a huge amount of very dry material. Interestingly, in other areas these nests have been seen to be used for nesting by Pygmy Falcons, and larger raptors have been seen to nest on top of these nests.

1.3 Social Environment

The proposed alignments will fall within two municipalities namely the Kai!Garib Local Municipality and the !Kheis Local Municipality. Both these municipalities fall within the Siyanda District Municipality (www.**demarcation**.org.za/municprofiles2003/about.html).

The majority of the population in the area is Coloured people, followed by Black people and White people. The population in both areas has increased since 1996, but not significantly. The population density fluctuates during the year due to the influx of seasonal workers active in the agricultural sector. This is a concern, since many seasonal workers eventually settle in the area, and there is a high rate of unemployment in the area. The majority of the population in both areas are in the economically active age bracket between 15 and 64. There is a relatively high dependency rate – children and the elderly who are not economically active, and this is exasperated by the high level of unemployment

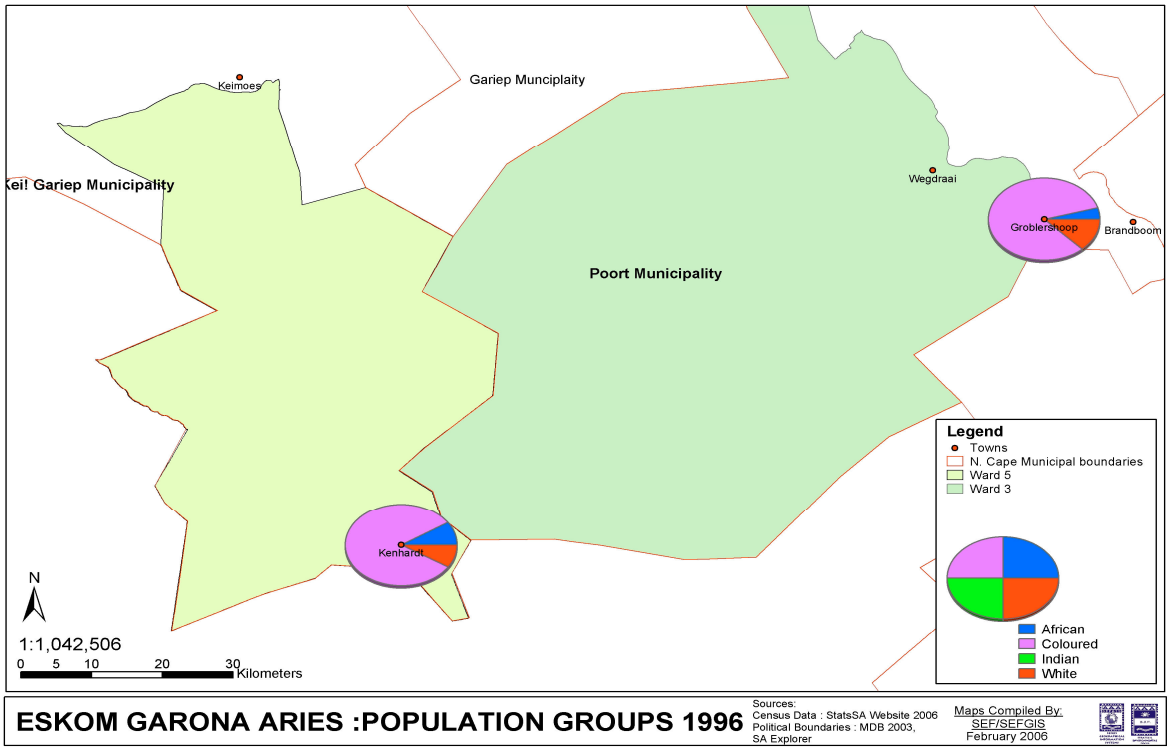


Figure 12. Population of Kai!Garib and !Kheis Municipalities 1996.

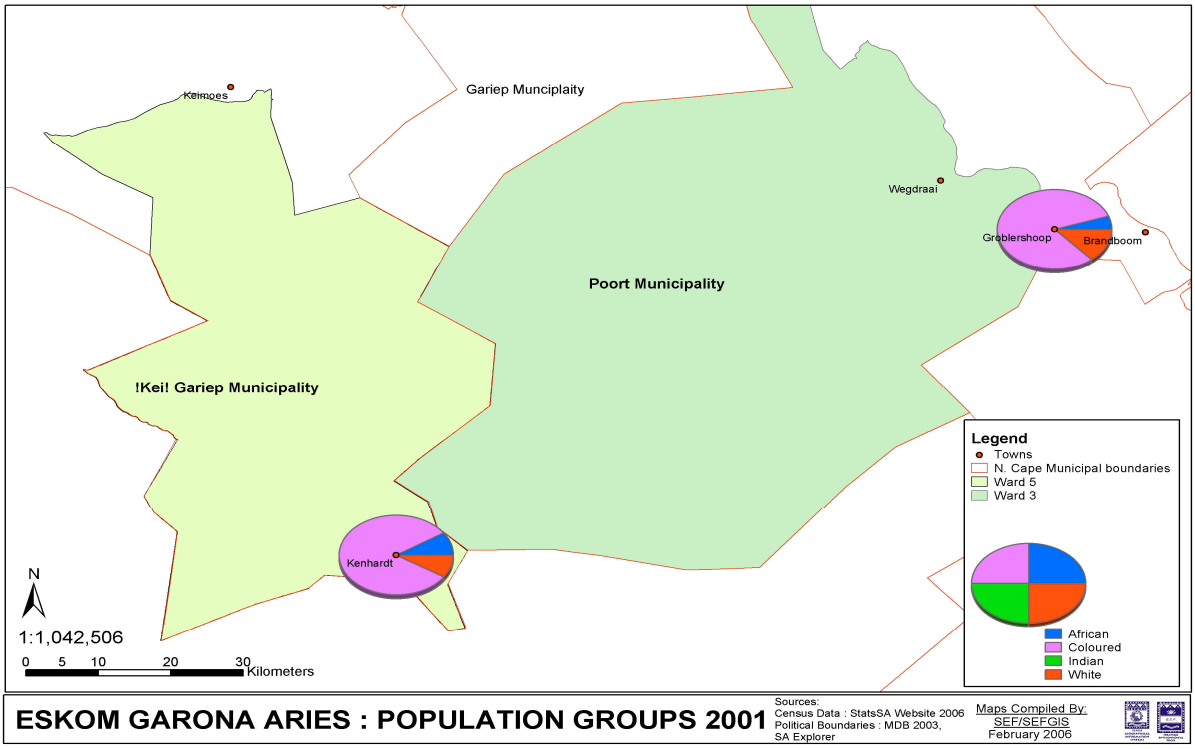


Figure 13. Population of Kai!Garib and !Kheis Municipalities 2001.

The educational profile for the area is poor. There was no significant change in the educational profiles between 1996 and 2001. The majority of the population have some primary and secondary education, but there are also a significant number that have received no schooling. There is an indication that the skills levels in the area are limited to very basic and manual skills.

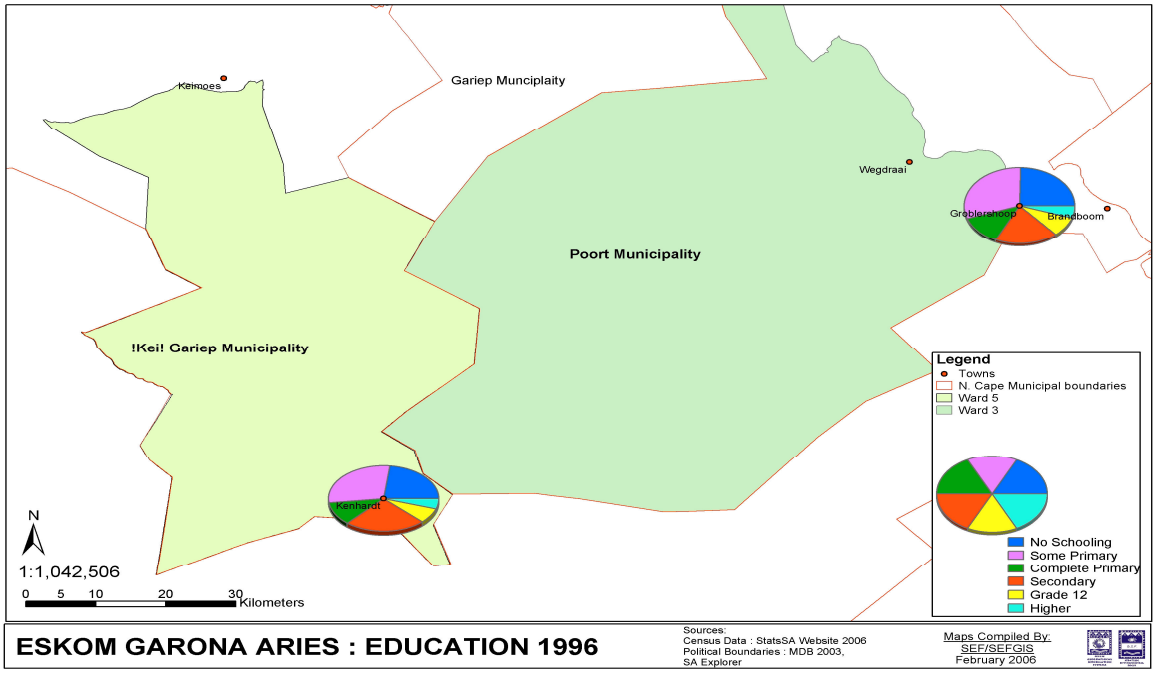


Figure 14. Kai!Garib and !Kheis highest education 1996.

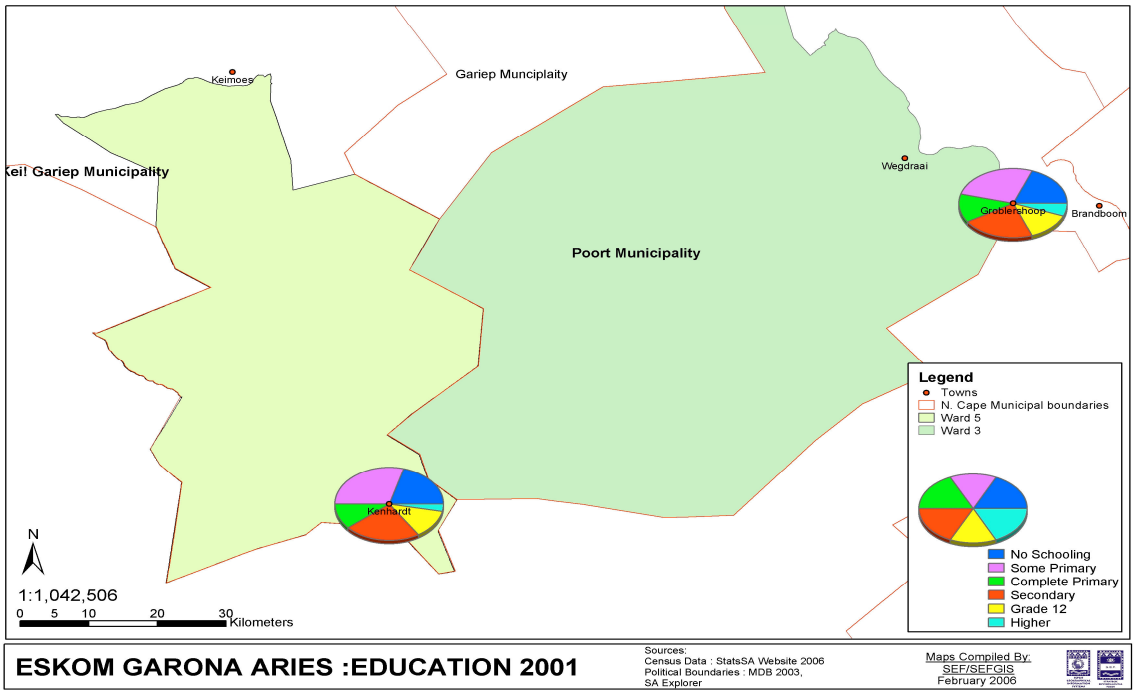


Figure 15. Kai!Garib and !Kheis highest education 2001.

The major economic activities in the region are based on agriculture, which makes it vulnerable to setbacks in the specific commodities. Livestock and grapes are the main commercial farming produce. A number of emerging farmers farm with sheep and goats. Farmers closer to Groblershoop cultivate a number of crops e.g. cotton, corn, wheat, tomatoes, peanuts, musk melons and pumpkins under irrigation, but grapes for the export and sultana market remain the main produce. The professional sector is not well represented and according to the IDP's of both municipalities there is a lack of skills development and capacity within the district. Although the tourism sector has not yet reached its full potential, tourism ventures like game farms and farm stay holidays are

becoming increasingly popular in the area. There are also a number of natural and cultural attractions in the area. A large number of households in the area have no or very low income. This indicates that these people need to survive under very poor economic conditions, and have limited buying power, which would reflect negatively on the payment of services. Like elsewhere in the country, the gap between rich and poor is very big.

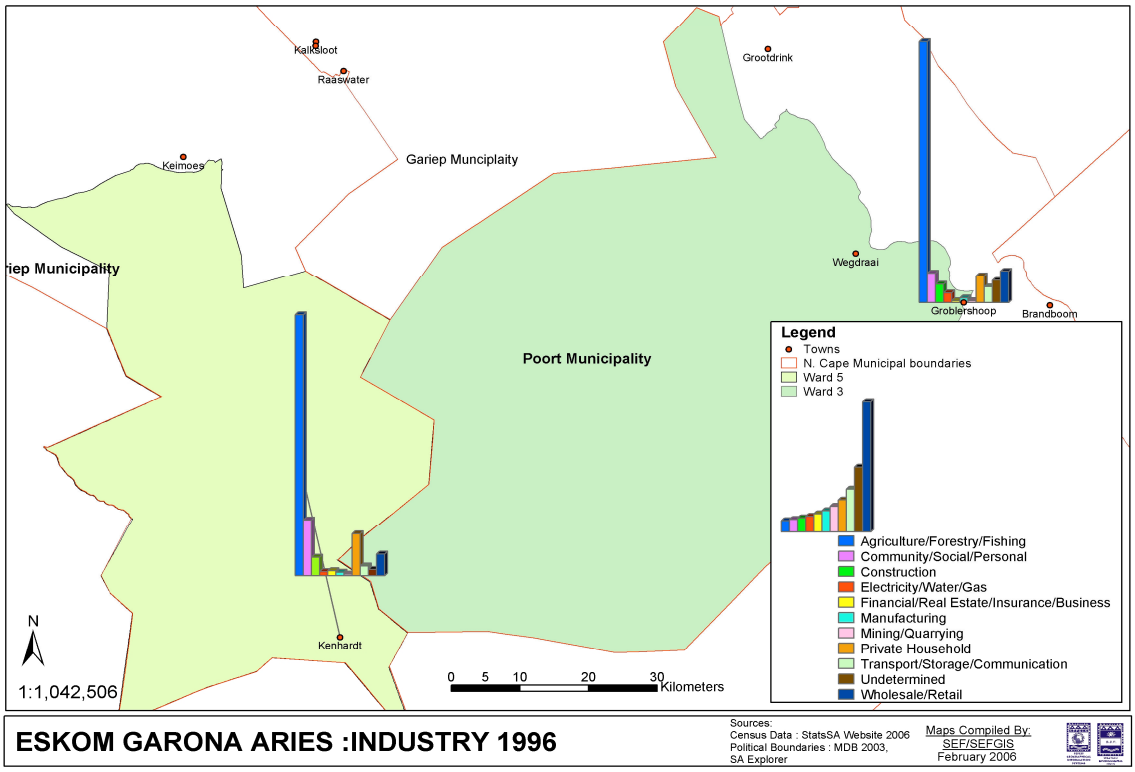


Figure 16. Kai!Garib and !Kheis Industries, 1996.

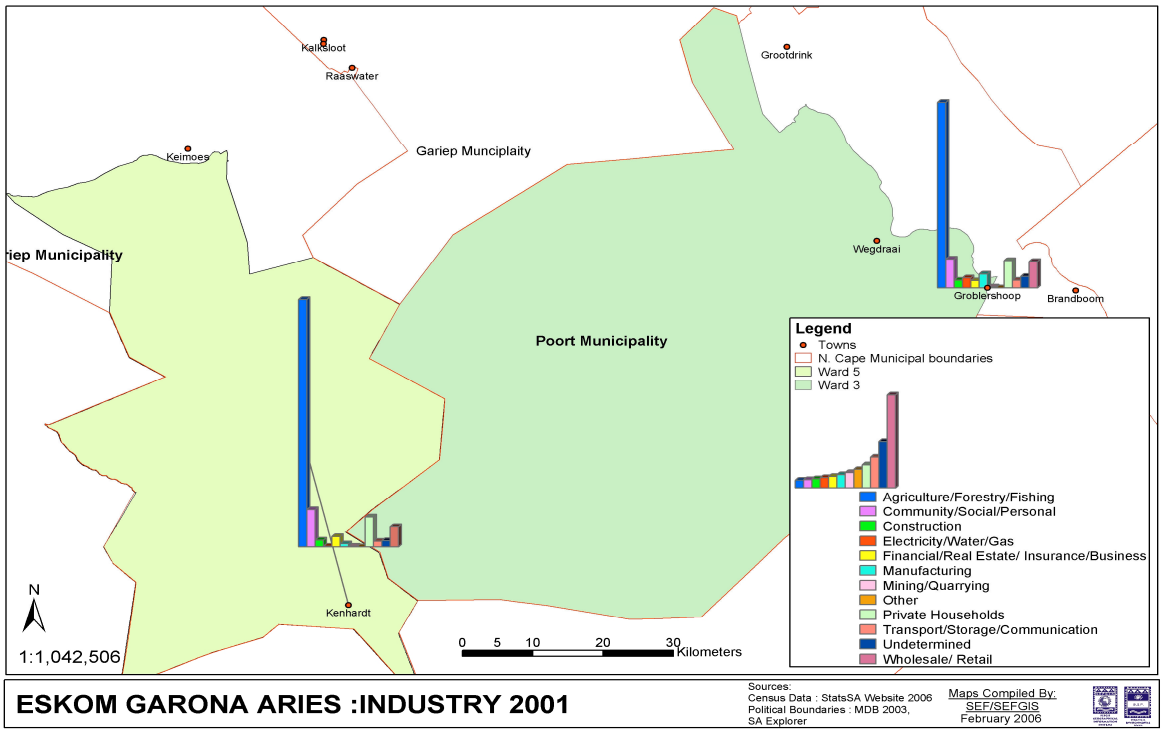


Figure 17. Kai!Garib and !Kheis Industries, 2001.

The number of traditional and informal dwellings has slightly subsided since 1996. The number of people living within such structures remains a concern. The migration of farm workers to the towns and seasonal nature of available labour opportunities might play a role in the number of informal dwellings. The IDP's identified a need for low cost housing, as a number of households do not have their own accommodation and share premises and facilities with family or friends.

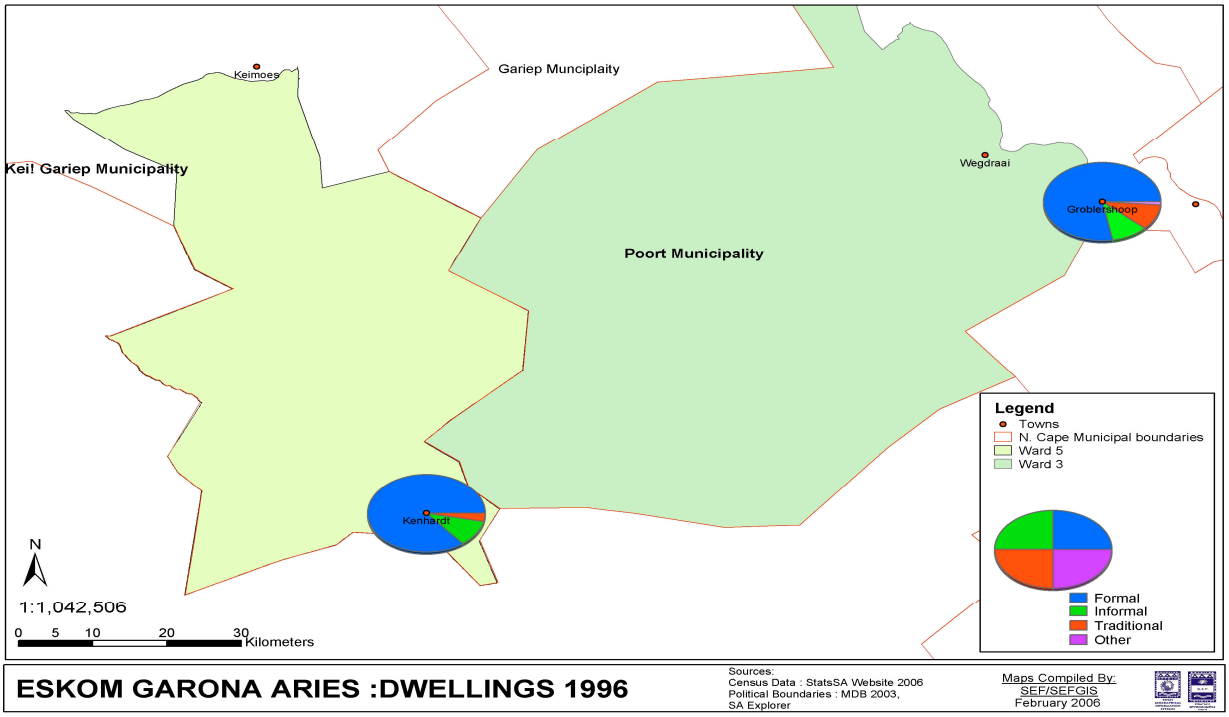


Figure 18. Dwelling types, 1996.

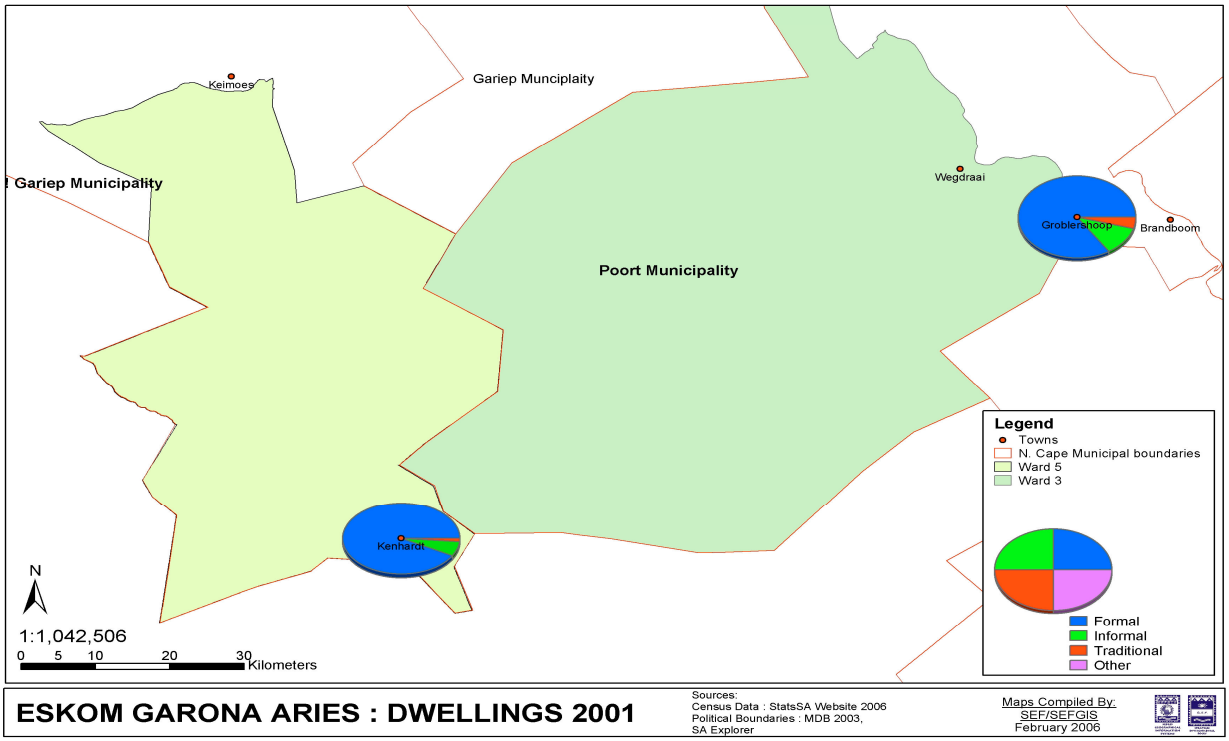
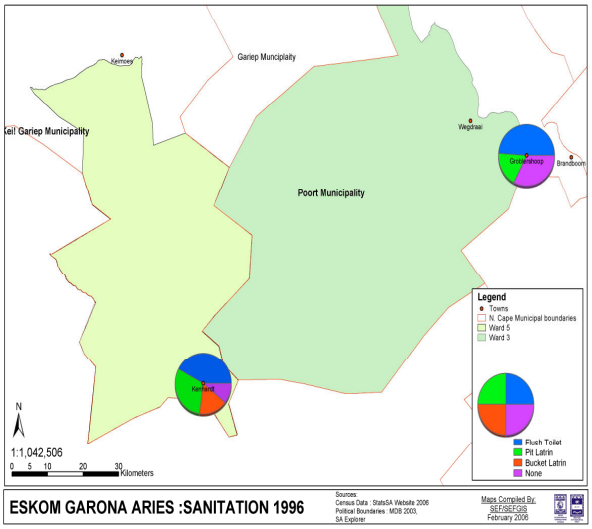
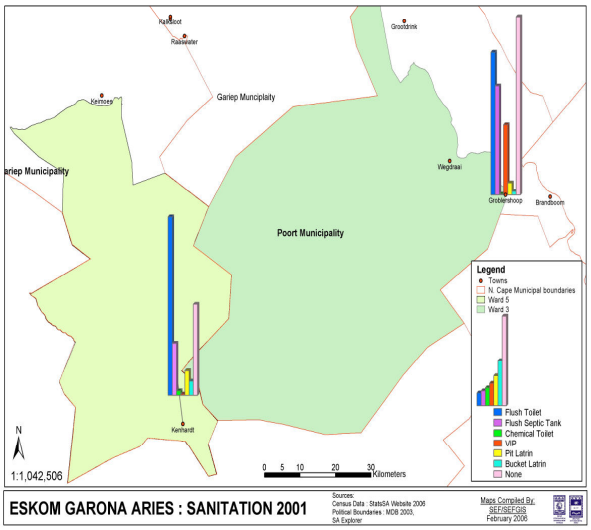
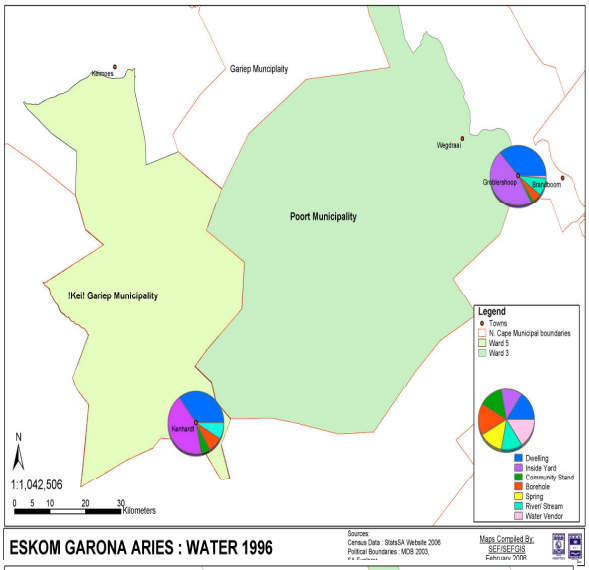


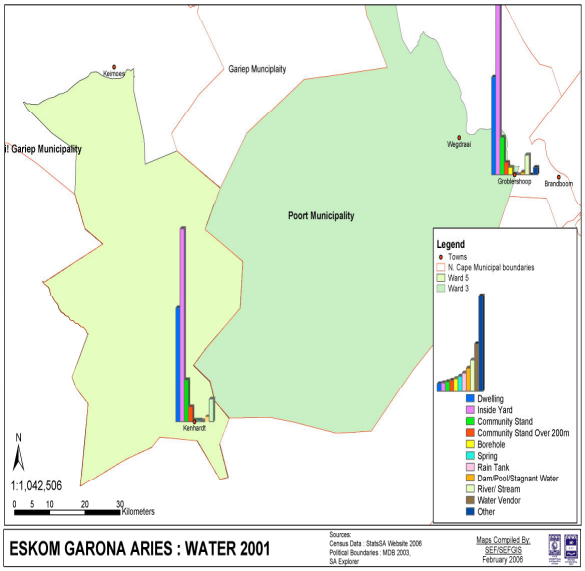
Figure 19. Dwelling types, 2001.

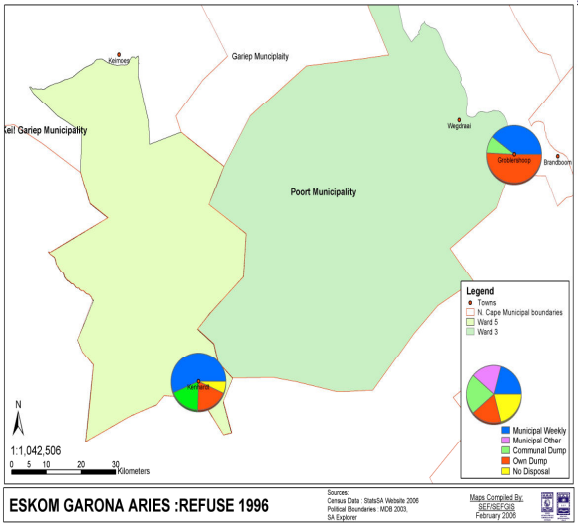
Services like sanitation, water and municipal refuse removal are mainly restricted to urban areas. There was an improvement since 1996, but many programmes put in place by the government and municipalities to address issues have not been completed yet. A number of residents have access to services, but are unable to use it because of the lack of paying power.











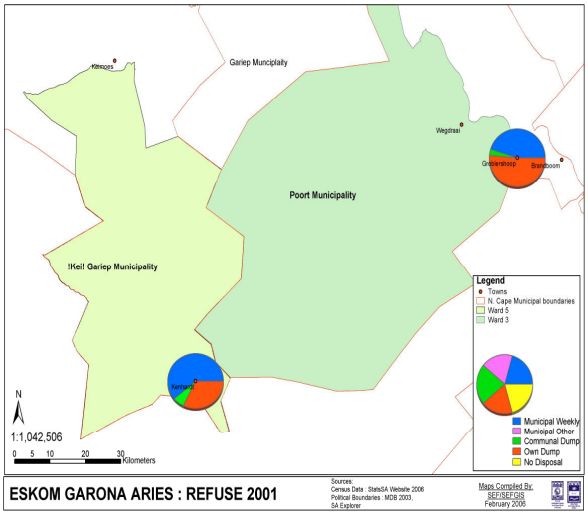


Figure 20. Services, 1996, 2001.

Since 1996 there was an increase in basic electricity supply. The most households utilize electricity for lighting, cooking and heating. The remaining households rely on candles for lightning and paraffin for cooking.

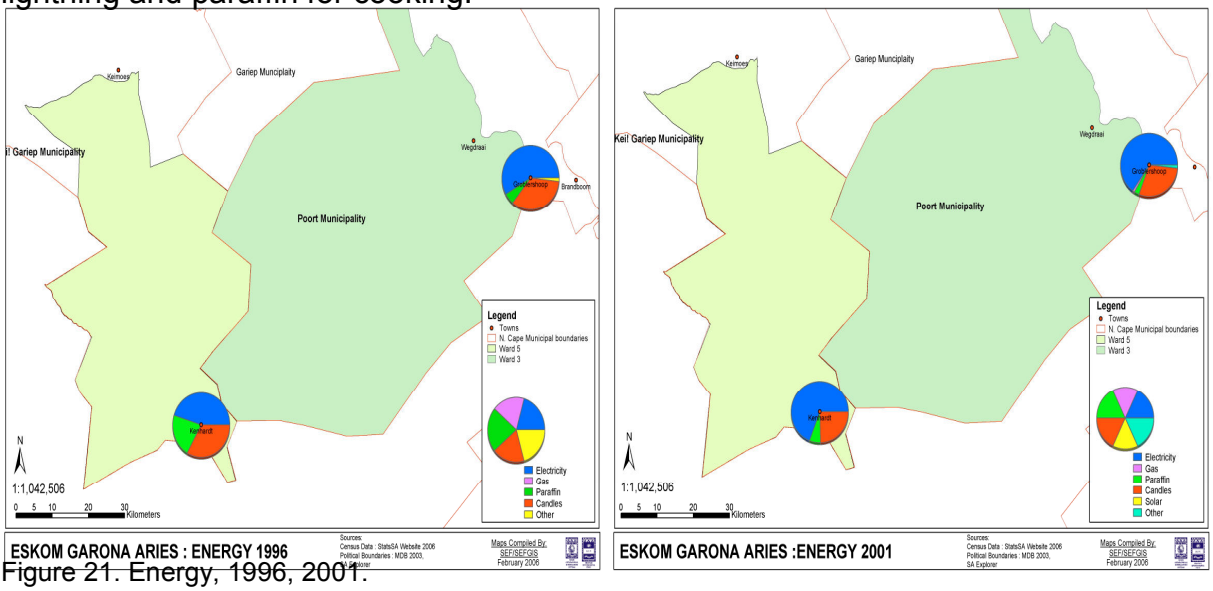


Figure 21. Energy, 1996, 2001.

1.4 Historical Environment

Dr. David Morris of the McGregor Museum located in Kimberly undertook a desktop survey supported by limited field inspection of the route of the proposed transmission power line from Aries to Garona. The complete Heritage Impact Assessment (HIA) report can be found in Appendix 6 of this EIR.

The archaeology of the Northern Cape is rich and varied, covering long spans of human history. The Karoo is particularly bountiful. Concerning Stone Age sites here, C.G. Sampson has observed: “It is a great and spectacular history when compared to any other place in the world” (Sampson 1985). Some areas are richer than others, and not all sites are equally significant. Heritage impact assessments are a means to facilitate development while ensuring that what should be conserved is saved from destruction, or adequately mitigated and/or managed.

The HIA report also provides background information on the archaeology of the wider region against which observations along the servitude may be assessed. Detailed assessment and

recommendations can only be made once the exact route including tower positions is known and areas of higher sensitivity inspected.

1.4.1 Archaeological resources in the Karoo

The significance of sites encountered in the study area may be assessed against previous research in the region and subcontinent. Humphreys' evaluation remains true, that "*the amount of archaeological research that has been undertaken in the Karoo is in no way proportional to its importance in terms of area in South Africa*" (1987:117; refer to HIA report – Appendix 6)). The region's remoteness from research institutions accounts for this.

The area has probably been relatively marginal to human settlement for most of its history, yet it is in fact exceptionally rich in terms of Stone Age sites and rock art, as relatively few but important studies have shown.

Sparse as previous studies have been, the information to hand (in this case from the Seekoei Valley specifically) enabled Sampson (1985:107; refer to HIA report – Appendix 6) to declare that:

"The South African central plateau is unique in the world...in that it supported large numbers of non-farming people who were also prolific makers of stone tools until very recent times. A brief comparison of surveys conducted elsewhere in the world reveals promptly and unambiguously that South Africa is richer in Stone Age remains than any other place on earth."

Against this background, any and every conservation effort is significant.

1.4.2 Relevant observations

From the Groblershoop end of the study area, the route of the line crosses areas of Aeolian sand dune. The crests of dunes not infrequently were favoured activity/dwelling locales in Later Stone Age times and it is possible that traces of these activities may be found there. The approaches to the Orange River are also areas of potentially higher archaeological visibility.

The proposed power line traverses the plain south westwards from the Orange River to a poort through the Nous se Berg: minimal traces of archaeological materials were noted alongside the road that runs near to the route of the line. West of the poort there is again an area of red dunes that may have been a focus of past habitation, but beyond the dunes at Kleinbegin only very sparse surface traces of Stone Age material were noted.

From here the terrain towards the vicinity of Kenhardt is relatively uniform, with the route of the line traversing plains with shallow soils and occasional leegtes (shallow depressions, non-perennial water courses). Archaeological sites are known to occur in this kind of terrain, for example Later Stone Age sites documented at Arbeidsvreug to the south and Middle Stone Age material at Kalkgaten to the north. In pan depressions there could well be preservation of ancient bone, such as at Bundu near Marydale.

Isolated inselbergs and rocky outcrops in the region are known to have been a focus of past human activity and both finger paintings and rock engravings are known to occur on some of them. None appears to be directly on the route of the line.

Northwest of Kenhardt the line traverses the Hartebeest River, the vicinity of which may have slightly higher archaeological visibility. The northern and southern alternative routes were inspected where they cross roads: in neither instance was there anything more than an extremely low density of stone tools.

In the vicinity of Olywen Kolk and Klein Zwart Bast, the farms at the south western most end of the proposed line, the terrain is characterized by Dwyka tillite, known to be a favoured source of raw materials in Earlier Stone Age times. In the vicinity of the Aries substation, indeed, several artifacts were noted amidst the strewn stones that typify the surfaces here. Inspection of the proposed tower positions may reveal further sites. A detailed investigation of the pylon positions will be undertaken by a qualified archaeologist following the EIA once these positions are known.