

4 DESCRIPTION OF THE BASELINE ENVIRONMENT

4.1 Introduction

According to section 28(e) of the NEMA Regulations, this section includes a description of the baseline environment that may be affected by the proposed Upington Solar Park. The baseline information will assist the reader in understanding the receiving environment in terms of the biophysical, social, economic and cultural aspects.

4.2 Study Area in Regional Context

4.2.1 Locality

The study area falls within the Northern Cape Province 10km west of Upington on the remaining extent of Farm Klipkraal 451 which is owned by the //Khara Hais Local Municipality. The site boundaries are formed by a railway line to the south, the national road (N10) to the north, the farm Olyfenhoutsdrift to the west and Upington town to the east. A railway line bisects the portion of land and a 132kV overhead power line is situated close to the southern boundary. The portion of the farm where the Solar Park development is proposed covers an area of approximately 5011 hectares. The actual footprint, development, for the Solar Park (will be confirmed during the EIA Phase) will be smaller than the total extent of the site (5011 ha). This is due to various technologies selected during feasibility and the Geotechnical study findings that will be used for the development. It is envisaged that the different solar technologies and the associated infrastructure will be within the boundaries of the Klipkraal site.

The proposed site falls with Ward 11 and 13 of the //Khara Hais Local Municipality which has its administrative centre in Upington. The //Khara Hais Local Municipality is one of 8 local municipalities that are located within the //Khara Hais Local Municipality and within the ZF Mgcawu District Municipality (formerly Siyanda). The site can be accessed via the N10 (to the north of the farm) and N14 (to the south of the farm).

The area is bordered to the north by Namibia, to the west by Namakwa District Municipality, to the south east by the Pixley Ka Seme District Municipality.

4.3 Description of the Baseline Environment

4.3.1 Topography

The study area is characterised by Dune Hills and Lowlands in the northern part and Extremely Irregular Plains in the south, sloping towards the Orange River in a south-eastern direction. The site is situated close to the Orange River sandy flood plains. The study area has a slightly sloping plateau with rolling Kalahari red sand dunes in the east (north-west trending dunes as indicated in **Figure 4.1**) which varies in height from 3 – 6m with an approximate spacing of 30 – 100m apart from each other. Small, scattered calcrete rocky outcrops occur in isolated areas. The site is generally flat to gently

undulating and lies at a height of approximately 800-900 metres above sea level. The predominant slope of the site is from the north to the south which is at an average gradient of 1:180 or 0.56%. Refer to **Appendix L** for the Uppington Solar Park slope map.

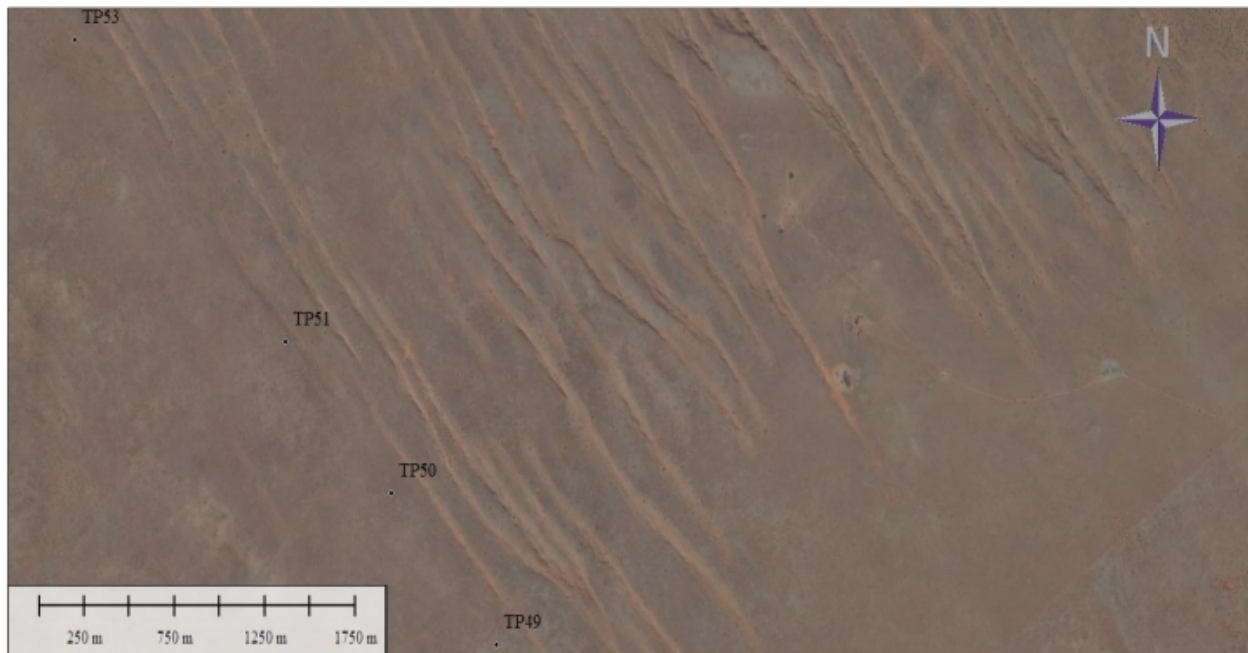


Figure 4.1: Typical dunes striking North West in the eastern portion of the site.

4.3.2 Climate

The climate of the study area can be regarded as warm to hot with rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is 175 mm, of which 142 mm, or 81%, falls from November to April. Rainfall is erratic, both locally and seasonally. The average evaporation is 2 375 mm per year, peaking at 11.2 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 35.0°C and 18.7°C for January to 20.8°C and 3.3°C for July respectively. The extreme high temperature that has been recorded is 43°C and the extreme low -7.9°C. Frost occurs most years on 6 days on average between mid-June and mid-August.

The average monthly rainfall data for Uppington extracted from the South African Weather Service is shown in **Figure 4.2**.

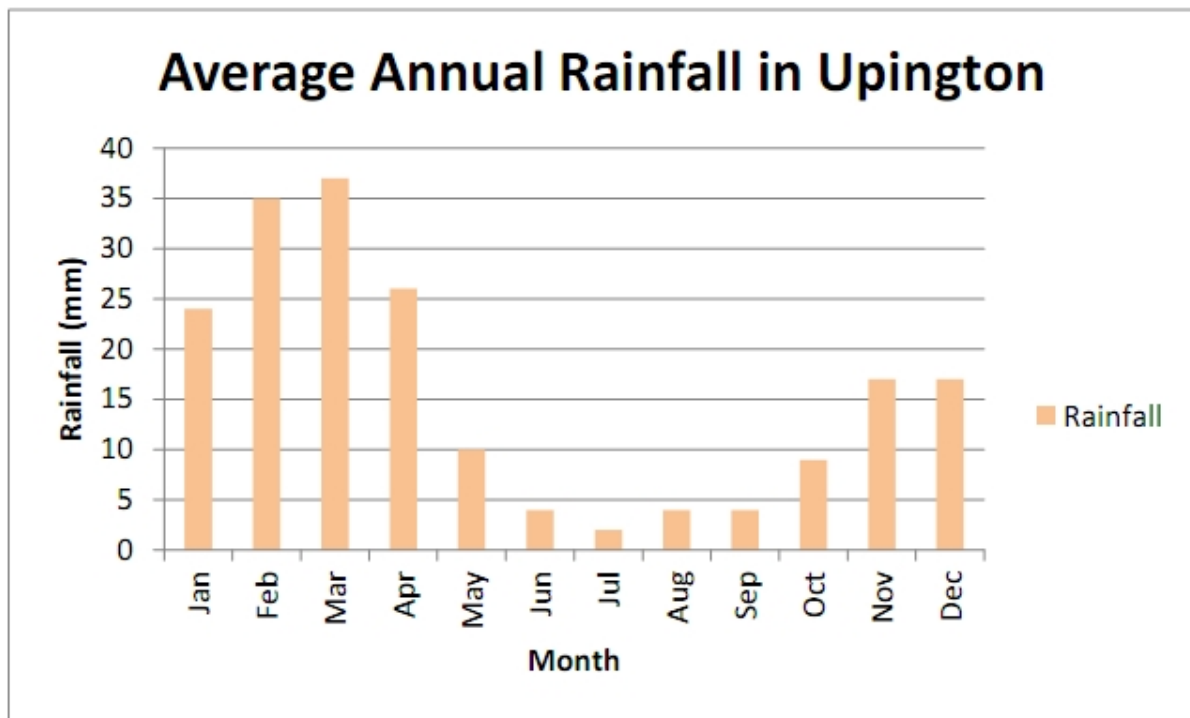


Figure 4.1: Average annual rainfall in Upington (Source: South African Weather Service).

4.3.3 Geology

The site is covered by the Quaternary aged Gordonia Formation of the Kalahari Group, located within the Kalahari Basin. The geology comprises wind-blown sands with dunes of the Gordonia Formation, Kalahari Group (Geological Survey, 1988). Soils are red-yellow soils which are derived from iron oxide. In addition to the Gordonia Formation, Tertiary aged calcrete and Mokolian aged granite also occur in the area. The granites in the southern section of the site are described as unfoliated, granophyric, granite porphyry. The granites in the northern section are described as mesocratic, fine grained and weakly foliated (layering in metamorphic rocks).

Groundwater in the area is primarily stored in fractures, fissures and other secondary features in the underlying pre-Cambrian aged metamorphic rocks (ESKOM, 2007). Groundwater abstraction over the majority of the area is restricted to wind pumps for stock watering, each estimated to deliver less than 0.1 litres per second. According to the Department of Water Affairs (DWA), the water level in farm Olyvenhoutsdrift 2 km west of the proposed site area ranges from 39.3 to 50 metres below ground level (ESKOM, 2007). The groundwater chemistry reveals that the water is predominantly brackish and with pH values ranging from neutral to alkaline. Previous work in the area suggests that ground water level is expected to be in the order of 20 m below ground level. The presence of calcrete or calcretised soil and rock horizons is however indicative of historically variable shallow water regime and a perched water table can be expected in a wet rainy season.

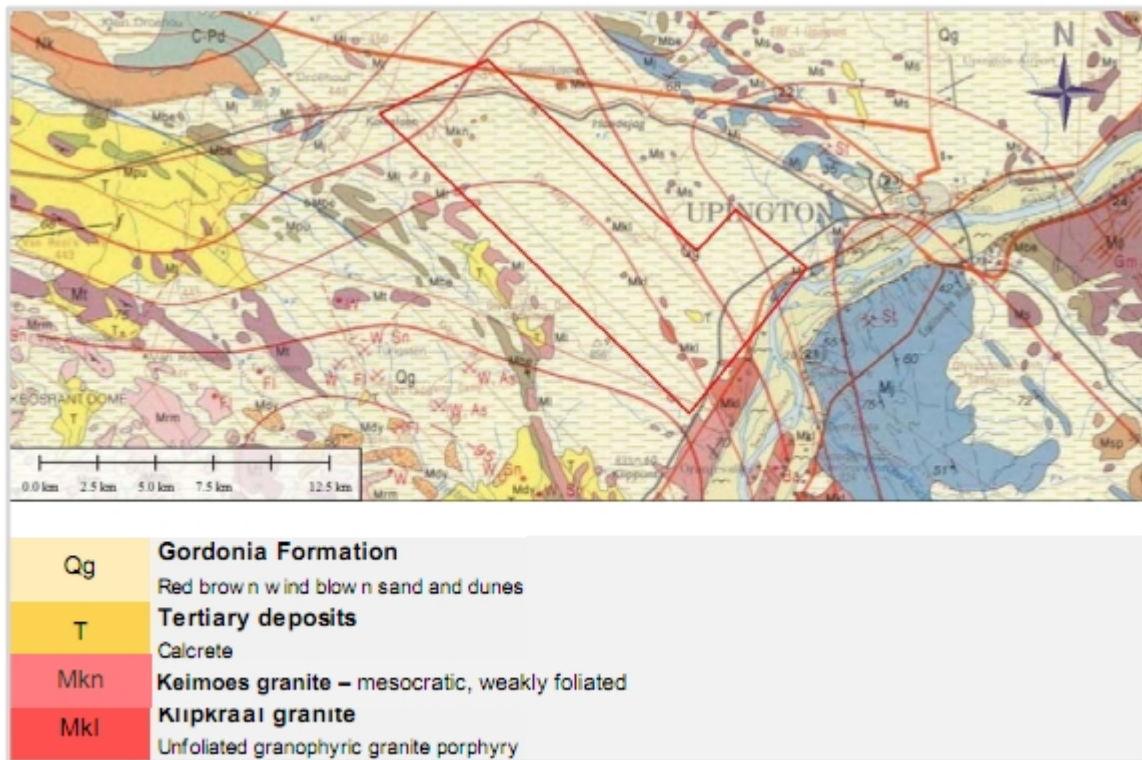


Figure 4.3: The geological map of Upington (Source: adapted from map 2820 Council for Geoscience).

4.3.4 Soil and Agricultural potential

Much of the study area comprises red, sandy soils, with wind-blown sands (dunes) especially prevalent in the north (land type Af8). Some of the soils in the southern part (land type Ae10) are shallow to very shallow, although there are some deep soils. A summary of the dominant soil characteristics of each land type is given in **Table 4.1**. The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in **bold** type. The dominant soil classes indicate a low agricultural potential in the study area.

Table 4.1: Land types occurring (with soils in order of dominance)

Land Type	Depth (mm)	Dominant soils	Percent of land type	Characteristics	Agricultural Potential (%)
Ae10	450-1000	Hutton 33/34	42%	Red, sandy soils, occasionally on hardpan calcrete	High:0.0 Mod: 47.0 Low: 53.0
	100-250	Mispah 22	40%	Red-brown, sandy topsoils on hard rock and calcrete	
Af8	300-1200+	Hutton 31/30	64%	Red, sandy soils on hard rock and calcrete	High:0.0 Mod: 35.0 Low: 65.0
	300-900	Hutton 33/34	35%	Red, loamy sand soils on hard rock and calcrete	

Based on test pits that were excavated by the geotechnical team from Aurecon in 2013 and sampled, the soils were analysed as having between 4 and 8% clay on average, with depths to underlying calcrete and rock varying from less than 0.5 m to over 3 m.

The very low rainfall in the area means that the only means of cultivation would be by irrigation. There are no visible agricultural fields and or irrigation systems on site the only irrigation occurs along the Gariep River, to the south of the area. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit (ARC-ISCW, 2004).

4.3.5 Natural Vegetation

According to the national vegetation map (Mucina & Rutherford 2006), two vegetation types were identified within the boundaries of the site. (Kalahari Karroid Shrubland and Gordonia Duneveld) Other vegetation types in the broader area do not occur within this site is captured in **Table 4.2**. In terms of the conservation status of the various vegetation types in the area, only Lower Gariep Alluvial Vegetation is of concern and is listed as Endangered. This vegetation type is however associated with the alluvium along the Orange River and would not be impacted by the current proposed development due to the distance from the river itself.

Table 4.2: Vegetation types that occur within (green) or near the Upington Solar Park site with their basic conservation statics and status according to the National List of Threatened Ecosystems (2011) and Mucina & Rutherford (2006).

Name	Extent km ²	Remaining	Conservation Target	Protected	Status
Kalahari Karroid Shrubland	8284	99.2%	21%	0.1%	Least threatened
Gordonia Duneveld	36772	99.8%	16%	14.2%	Least threatened
Lower Gariep Alluvial Vegetation	752	50.3%	31%	5.8%	Endangered
Lower Gariep Broken Veld	4538	99.5%	21%	3.9%	Least threatened
Bushmanland Arid Grassland	45479	99.4%	21%	0.4%	Least threatened

National Vegetation Types

Within the area affected by the proposed development, two vegetation types occur, namely Kalahari Karroid Shrubland and Gordonia Duneveld (**Figure 4.4**). Both Kalahari Karroid Shrubland and Gordonia Duneveld are classified as Least Threatened. 99% of these vegetation types on site are still in a pristine state (untransformed). (**Table 4.2**). Kalahari Karroid Shrubland is not protected within formal conservation areas (only 0.1% protected), while Gordonia Duneveld is moderately protected. Mucina & Rutherford

(2006), list no endemic species from either Kalahari Karroid Shrubland or Gordonia Duneveld. The biogeographically important and endemic species known from these vegetation types tend to be widespread within the vegetation type itself and local-level impacts are not likely to be of significance for any of these vegetation types or species concerned. Gordonia Duneveld is widely distributed and is among the most extensive vegetation types in South Africa while Kalahari Karroid Shrubland is less extensive, but represents a transitional vegetation type between the northern Nama Karoo and Kalahari (Savannah) vegetation types.

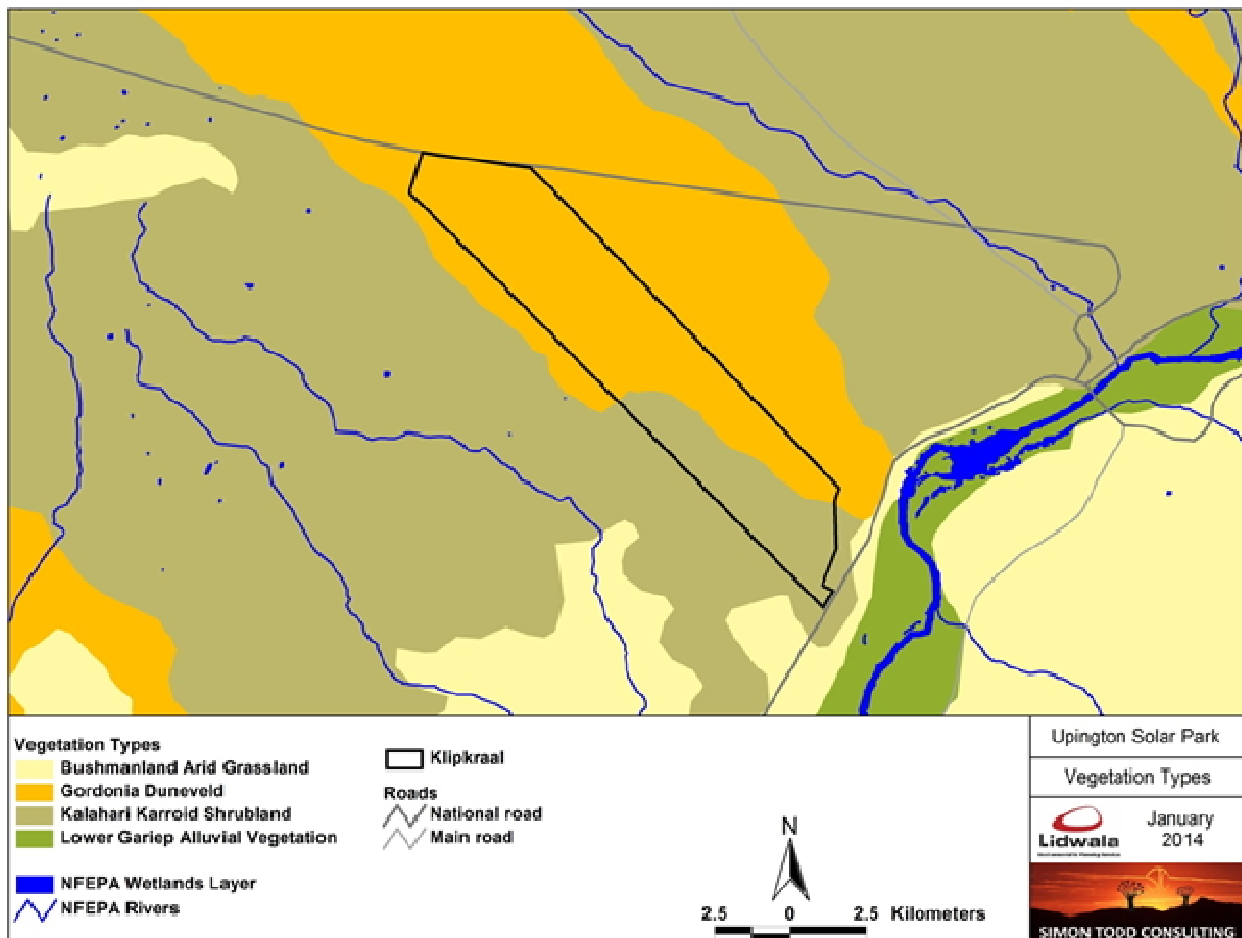


Figure 4.4: Broad-scale overview of the vegetation in and around the Upington Solar Park. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006).

Vegetation Composition

In this section a brief description of the two vegetation types and habitat within the study area is given. Other pertinent characteristics and species of conservation concern that may be associated with each vegetation type are also described. A map of the various habitats described is provided at the end of the section in **Figure 4.8**.

Kalahari Karroid Shrubland

Species commonly observed within the areas of Kalahari Karroid Shrubland include shrubs such as *Leucosphaera bainesii*, *Hermannia spinosa*, *Monoechma genistifolium*, *Salsola rabieana*, *Aptosimum albomarginatum*, *A.spinecens*, *Kleinia longiflora*, *Limeum argute-carinatum*, *Phyllanthus maderaspatensis*, *Zygophyllum dregeanum* and grasses such as *Stipagrostis anomala*, *S.ciliata*, *S.uniplumis*, *S.hochstetteriana* and *Schmidtia kalariensis*. The proportion of shrubs in this vegetation type is usually related to soil depth and texture, with the proportion of grass increasing as the soils become deeper or more sandy. As such there are likely to be many parts of the site which are transitional with Gordonia Duneveld or even contain elements of Bushmanland Arid Grassland. The southern part of the site is likely to be mosaic of these different elements related to fine-scale changes in soil depth and landscape position. Within this vegetation unit, species of conservation concern that are often present include *Adenium oleifolium*, *Aloe claviflora* and *Hoodia gordonii*. *Aloe claviflora* and *Adenium oleifolium* can be confirmed present, and *Boophone disticha* was also observed during the site visit, but no *Hoodia gordonii* was observed. The protected species confirmed present are widespread and have healthy populations outside of the development area and any impact on these species would not compromise the local or regional populations of these species in a significant manner. Trees are less abundant within this vegetation type and large tracts of the site on this vegetation type are more or less devoid of trees, with only the occasional individual of the provincially protected species *Boscia foetida* present.



Figure 4.5: An area of shallow soils on calcrete dominated by low shrubs such as *Monechma genistifolium*, *Erioccephalus ambiguous* and *Pentzia spinescens*. The transition to deeper soils and more grassy vegetation can be seen in the background.

Gordonia Duneveld

Although the majority of the site is classified as Gordonia Duneveld, this vegetation type consists of several different habitats. The most obvious of which are the dunes and the inter-dune areas. The dunes and areas of deep sand are usually dominated by species such as *Crotalaria orientalis*, *Stipagrostis amabilis*, *Centropodia glauca*, *Acacia haematoxylon* and various forbs. The inter-dune slacks are usually dominated by grasses or *Rhigozum trichotomum* depending on the substrate conditions as well as the history of

land use. Other common species associated with the areas of Gordonia Duneveld include trees such as *Parkinsonia africana*, *Boscia foetida*, *Boscia albitrunca* and *Acacia erioloba*, shrubs such as *Phaeoptilum spinosum*, *Rhigozum trichotomum*, and *Lycium bosciifolium*, grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.amabilis*, *Schmidtia kalahariensis*, and forbs such as *Senna italica*, *Tribulis pterophorus*, *Hermannia tomentosa* and *Requienia sphaerosperma*. Species of conservation concern associated with this habitat include the nationally protected trees *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca*. The density of these trees at the site does is not particularly high, however the extent of the development is relatively large and the total number of affected individuals is likely to number several hundred trees.



Figure 4.6: Gordonia Duneveld, left near the northern boundary of the site near the N10 and right towards the southern extent of the site. In the left image the dune crest can be seen with *Centropodia glauca* the dominant grass and *Acacia haematoxylon* in the distance. In the right image, the dunes are dominated by *Stipagrostis amabilis*, *Stipagrostis uniplumis*, *Crotalaria spartioides* and *Lycium hirsutum*, while in the distance between the dunes some individuals of *Boscia albitrunca* are also visible.

Listed and Protected Plant Species

According to the SANBI SIBIS database, 286 indigenous plant species have been recorded from the quarter degree squares 2820 BD, DB and 2821 AC and CA. Probably only about half of this number would occur within the site. The list includes 7 species of conservation concern as listed below in **Table 4.3**. Of those on the list only *Acacia erioloba* can be confirmed present, but *Harpagophytum procumbens* and *Boophone disticha* were also observed to be present at the site. Apart from the red-data listed species, there are also additional species present which are either protected under the National Forests Act such as *Boscia albitrunca* and *Acacia haematoxylon* or protected under the Northern Cape Nature Conservation Act of 2009, which includes *Boscia foetida*, all *Mesembryanthemaceae*, all species within the *Euphorbiaceae*, *Oxalidaceae*, *Iridaceae*, all species within the genera *Nemesia* and *Jamesbrittenia*. DAFF and DENC may request that an offset be implemented if large numbers of protected species are impacted by the

development. Such an impact is likely to stem from an impact to *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca* which are relatively abundant.

Table 4.3. Listed species which may occur within the Upington Solar Park site, including their International Union for Conservation of Nature (IUCN) status and the likelihood that they occur at the site.

Family	Species	IUCN Status	Likelihood
ASPHODELACEAE	<i>Aloe dichotoma</i>	VU	Low
MESEMBRYANTHEMACEAE	<i>Dinteranthus wilmotianus</i>	NT	Low
AMARYLLIDACEAE	<i>Crinum bulbispermum</i>	Declining	Low
FABACEAE	<i>Acacia erioloba</i>	Declining	Confirmed
APOCYNACEAE	<i>Hoodia gordonii</i>	DDD	High
ASTERACEAE	<i>Felicia deserti</i>	DDD	High
ASTERACEAE	<i>Senecio glutinarius</i>	DDT	Low

Critical Biodiversity Areas & Broad-Scale Ecological Processes

No fine-scale conservation planning has been conducted for the region and as a result, no Critical Biodiversity Areas have been defined for the study area. In terms of other broad-scale planning processes, the site does not fall within a National Protected Areas Expansion Strategy Focus Area (NPAES), indicating that the area has not been identified as an area of exceptional biodiversity or of significance for the long-term maintenance of broad-scale ecological processes and climate change buffering within the region. The development would however contribute to cumulative impacts in the area, which are becoming increasingly large given the concentration of renewable energy facilities in the immediate area (**Figure 4.7**). This includes the Abengoa Khi Solar One CSP facility under construction southwest of the site, an approved CSP facility on Van Roois Vley northwest of the site as well as several other proposed solar energy facilities still in process. The concentration of development within the area will increase the fragmentation of the landscape and impact landscape connectivity.

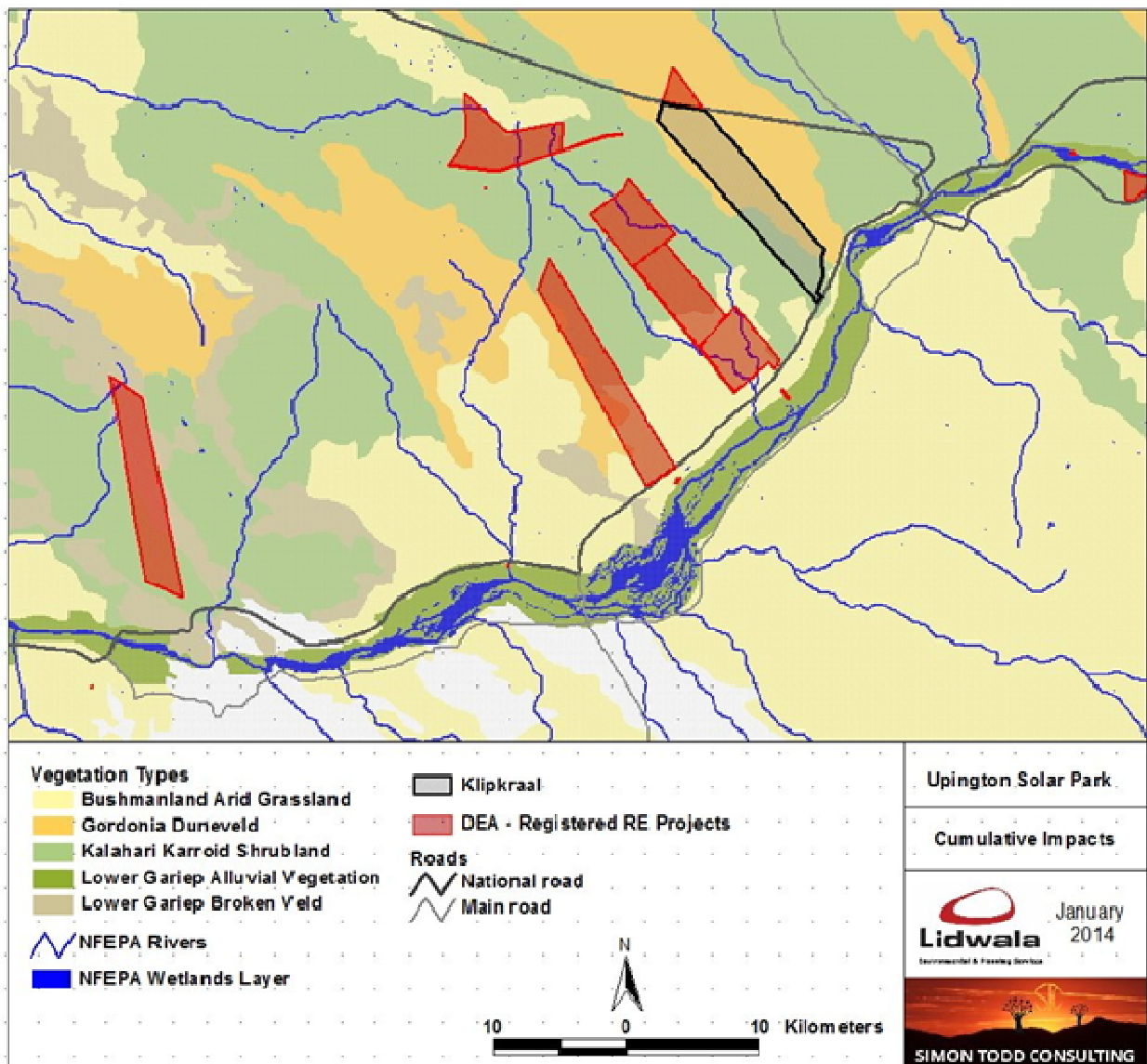


Figure 4.7 Map of the DEA-registered projects in the vicinity of the Klip Kraal site, as at December 2012.

4.3.6 Animal Life

Mammals

The site falls within the distribution range of 46 terrestrial mammals, indicating that the mammalian diversity at the site is of moderate potential. The site is however relatively homogenous in terms of the variety of habitats present and the overall mammalian diversity at the site is likely to be significantly lower than the richness of the broader area. Of particular relevance is the lack of rocky hills or outcrops at the site which would preclude a variety of species from the site.

Three listed terrestrial mammals may occur at the site, the Honey Badger *Mellivora capensis* (Endangered), Brown Hyaena *Hyaena brunnea* (Near Threatened) and Black-footed cat *Felis nigripes* (Vulnerable). While it is possible that all three listed species occur

at the site, it is least likely that the Brown Hyaena *Hyaena brunnea* is present as this species is often purposely or inadvertently persecuted within farming areas. As these species have a wide national distribution, the development would not create a significant extent of habitat loss for these species.

The site lies within the distribution range of 6 bat species, indicating that the richness of bats at the site is probably quite low. Bat activity is probably focused along the Orange River, where there is ample food as well as an abundance of natural and artificial shelter. The lack of wetlands and large drainage lines away from the Orange River suggests that bat activity patterns within the site are likely to be low.

Reptiles and Amphibians

According to the Southern African Reptile Conservation Assessment (SARCA) database, 39 reptile species are known from the area suggesting that the reptile diversity within the site is likely to be moderate to low. As there are no significant rocky outcrops at the site, only species associated with sandy substrates or trees are likely to be present. Species observed in the vicinity include the Namaqua Mountain Gecko *Pachydactylus montanus*, Spotted Sand Lizard *Pedioplanis lineocellata* and Spotted Desert Lizard *Meroles suborbitalis*, but a relatively wide variety of reptile species can be expected to occur at the site including various skinks, agamas and barking geckos. No Red Data Book (RDB) listed reptile species are known from the area and there do not appear to be any broad habitats at the site which would be of high significance for reptiles.

The site lies within the distribution range of 10 amphibian species. The only listed species which may occur at the site is the Giant Bullfrog *Pyxicephalus adspersus* which is listed as Near Threatened. Due to the aridity of the site and the lack of natural perennial water sources at the site amphibian abundance at the site is likely to be low.

4.3.7 Avifauna

According to the South African Bird Atlas Project (SABAP) 1 and 2 data sets, 190 bird species are known from the broad area surrounding the site. This includes 7 IUCN listed species (**Table 4.4**), all of which except for the Black Stork are likely to occur at the site. During the site visit, several Kori Bustard were observed at the site as well as a pair of Secretary Birds, which are listed as Near Threatened and have not been recorded by SABAP within the area before. Most larger birds within arid areas are nomadic and make large movements according to rainfall or seasonal drivers of food availability and as such, these species are not likely to be at the site on a permanent basis but would use the site during favourable conditions such as was the case during the site visit.

Apart from the listed species which may occur at the site, a number of large Sociable Weaver nests were observed within the site. These are considered significant as apart from the large number of birds living in the nests, there is a lot of other biodiversity associated with the nests as they are used by other birds as nesting sites and also attract a variety of predators. The nests are usually within large trees, mostly *Acacia erioloba*,

which also attract a lot of fauna which like Tree Rats make use of the trees as habitat or are attracted to the shade or the pods produced by the trees. While there are a relatively large number of *Acacia erioloba* trees present at the site, most are relatively young and large specimens with Weaver nests are not that common and are considered point sensitivities.

Table 4.4. Listed bird species known to occur in the vicinity of the proposed Upington Solar Park site, according to the SABAP 1 and 2 databases, and their risk of collision with or electrocution from power line infrastructure.

Species	Common Name	Status	Collision	Electrocution
<i>Falco biarmicus</i>	Lanner Falcon	NT	High	Moderate
<i>Falco naumanni</i>	Lesser Kestrel	VU	High	Moderate
<i>Ciconia nigra</i>	Black Stork	NT	High	
<i>Falco peregrinus</i>	Peregrine Falcon	NT	High	Moderate
<i>Ardeotis kori</i>	Kori Bustard	VU	High	
<i>Neotis ludwigii</i>	Ludwig's Bustard	VU	High	
<i>Polemaetus bellicosus</i>	Martial Eagle	VU	Moderate	High

4.3.8 Pans (Ecological Habitat)

Although there are no pans mapped within the study area by the National Freshwater Ecosystem Priority Areas (NFEPA) 2011 database, satellite imagery and ground-truthing during the site visit revealed that a number of relatively small pans are present within the site. Most of these pans had water present during the site visit and had a variety of fauna associated with them. Karoo Toads as well as a number of different temporary water crustaceans such as Tadpole Shrimps, Fairy Shrimps and Clam Shrimps were observed breeding in the pans. These pans are focus areas for animal activity despite their distance from the Orange River and a number of water-associated mammals including Cape Clawless Otter and Water Mongoose were observed to be using these areas. Due to their ecological significance, the pans are considered sensitive and as such rock pans are a rare feature in the landscape. The large pan which lies to the southeast of the Eskom Gordonias-Oasis 132kV line is identified as the most important pan at the site. This pan consists of several pools each with different characteristics and faunal assemblages (**Figure 4.9**).

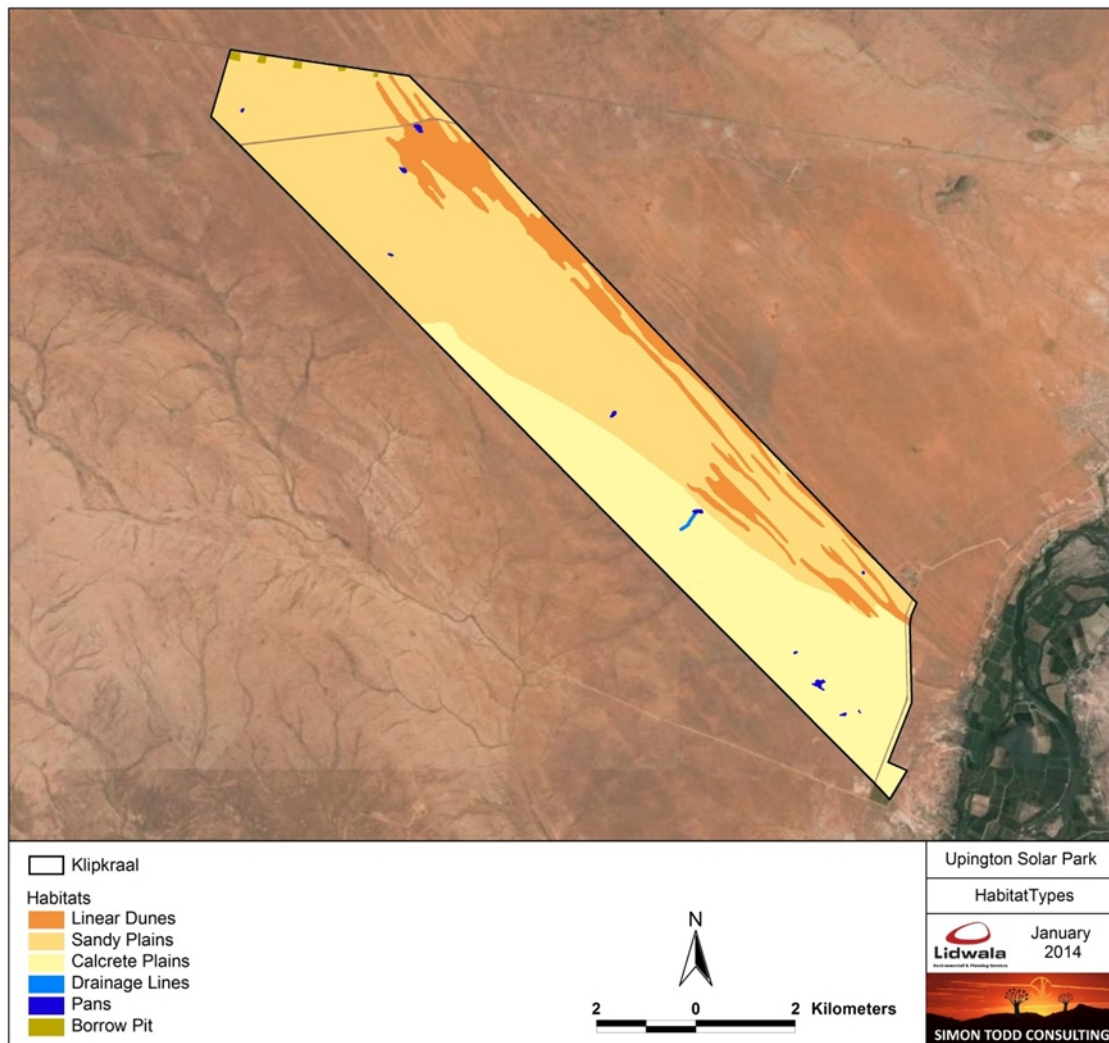


Figure 4.8 Habitat map of the Klip Kraal site. Numerous small pans are also scattered across the site.



Figure 4.9 The large pan which occurs near the Eskom 132kV line which traverses the site. The pan consists of a small basin with exposed bedrock and a number of small pools with associated wetland fauna and flora.

4.3.9 Surface Water

Quaternary Catchment

The study area falls within the Lower Gariep River sub-basin, which comprises of the Gariep River that flows from the confluence with the Vaal River at Douglas and to the Gariep River Mouth. Major rivers that contribute to the flow in the Gariep include the Ongers and Sak rivers from the Northern Karoo; the Kuruman and Molopo rivers from the Northern part of the Northern Cape and the southern part of Botswana and the Fish River from Namibia. The proposed site is located within the quaternary catchment D37F. The area is dominated by ephemeral drainage lines. Ephemeral drainage lines are drainage lines or sometimes even large rivers that will carry water for only a brief period of time normally after a large rainfall event. Higher densities of vegetation may be supported by groundwater reserves below the drainage lines although the soil does not remain saturated for long enough to support specially adapted flora. The potential runoff from the site flows in a westerly to a southerly direction. The drainage lines flow towards the Gariep River.

Background Water Quality

From the numerous studies, investigations and monitoring information that is available on the subject, the following water quality issues are summarised for this quaternary catchment D37F:

- The aquatic resources within this quaternary catchment have been highly affected by bed modification due to sedimentation and the Neusberg weir in the catchment.
- Significant flow modifications have taken place due to the effects of water abstraction and urban runoff from surrounding farming practices.
- High impacts have occurred as a result of introduced in-stream biota with special mention of the fish *Cyprinus carpio*.
- Impact due to inundation from the Neusberg weir is high.
- Riparian zones and stream bank conditions are considered to be moderately impacted due to alien vegetation encroachment.
- An impact on the aquatic community, due to altered water quality, is deemed to affect the catchment to a moderate degree due to the effects of general urban and rural runoff as well as agricultural effluent discharge.

General water quality can be considered fair although some variation from the expected natural condition is deemed likely. The impact on water quality is deemed likely to come from both industrial and urban activities as far upstream as Mpumalanga and Gauteng as well as impacts from agricultural runoff into the Vaal and Gariep Rivers. There is also an indication of salts inflow, most likely due to erosion from agricultural lands entering the system. The aquatic communities of the system are however intact with more sensitive aquatic macro-invertebrate and fish populations still present and as such as much as the

system is considered to be tolerant, it must also be considered to be sensitive to impacts that occur on the system (Scientific Aquatic Services CC, 2012)

Background Water Quantity

The Orange River Integrated Water Resources Management Plan (2007) indicated that the Mean Annual Runoff (MAR) is 420 million m³/a for the lower orange catchment. There are no well-developed drainage lines on the site, which can be ascribed to the sandy substrate and low slope which allows for a high infiltration rate and very little runoff. Although some small drainage lines were mapped within the study area on the Surveyor General maps these cannot be confirmed present based on the site visit. A single small drainage line running into one of the small pans can be confirmed at present (**Figure 4.8**). Based on the site visit, the drainage lines mapped on the 1:50 000 topographic sheets for the area are also not apparent in terms of riparian zone indicators and therefore are not considered sensitive and at least from a vegetation perspective (riparian zone) do not need to be avoided (Todd, 2014).

The Geotechnical study conducted by Aurecon as part of the feasibility study referred to that a 1:100 year floodline to be determined in the next phase of the geotechnical study.

Water Authority

The Department of Water Affairs act as the Regional Water Authority and their offices are located in Upington. The //Khara Hais Local Municipality is the appointed Water Service Provider who is responsible to supply potable water to the Upington municipal area and they are also considered in terms of supply of water to the Solar Park.

Other watercourses

Numerous pans (**Figure 4.8**) were observed on site during a recent site inspection which was not apparent on NFEPA (2011) or satellite imagery. These pans have a shallow soil depth with bedrock just underneath. It is likely that these were not picked up by the NFEPA as these are rock pans which do not generate a characteristic signature as with clay pans. The ecology study (Todd, 2014) indicated that these pans are considered sensitive and a rare feature in this landscape.

4.3.10 Heritage

The cultural landscape qualities of the region essentially consist of two components. The first is a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. The second component is an urban landscape dating to the colonial period and which can also be linked to the rural colonial landscape.

Cultural Landscape

The rural landscape was always sparsely populated and only in a few areas such as in the vicinity of sustainable water sources or through the application of specific economic strategies (irrigation systems), that people succeeded to occupy a section of the region for any length of time.

Very little research has been done on the Stone Age archaeology of the larger region and only a few published papers and studies are available. The most significant contribution is that of P Beaumont and D Morris, both of the McGregor Museum, as well as a number of other researchers e.g. Humphreys, Lange, Rudner & Rudner and Parsons. Archaeological sites in this area predominantly date to the Stone Age as early farmer communities, also referred to as Iron Age communities, did not settle this far west (Humphreys 1976). Occupation of the larger region took place since the Early Stone Age, with occurrences of Middle Stone Age more frequent than the Early Stone Age. However, it is mostly during the Later Stone Age when population density increased. Later, with the arrival of stock herders this increased even more, resulting in competition for resources such as access to water and shelter. Settlement mostly took place at small hills where rock shelters might occur or in the vicinity of the Orange River. The type of heritage sites encountered in the region are settlement sites, e.g. those studied by Parsons (2008), burial sites on the banks of the Orange River (Morris 1995), rock paintings and engraving sites south and northwest of Upington (Rudner & Rudner 1986; Lange 2006) and stone quarries (van Schalkwyk 2010).

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

Not many farmsteads occur in the region as most of the original farms were very large, requiring few of these to be developed. However, in the vicinity of the river, with the development of intensive irrigation farming, many farmsteads and other features were developed. These were usually adapted to accommodate the specific farming requirements of the specialised agricultural activities. Others are more transient, belonging to sheep herders who either look after their own small flocks or those of more wealthy farmers who, as is the situation in this particular case, rent large tracts of land.

Apart from the formal cemeteries that occur in municipal areas (towns or villages), some quite informal, i.e. without fencing, can be expected to occur anywhere. Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important 'documents' linking people directly by name to the land.

Urban Landscape

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony and who visited the town in 1884. An irrigation canal was started by Rev Schröder in 1883 and was completed in 1885. By 1884 there were already 77 irrigation farms. Nowadays, it is disputed that Schröder was the original builder of the canal, and it is claimed that he only carried on with an idea that was started by a local inhabitant by the name of Abraham September.

In the town of Upington approximately 10 buildings and features are listed as provincial heritage sites or are viewed to be of conservation worthy status. In addition, a number of cemeteries are also located in various places around the town.

Identified sites: Stone Age

Two pans were identified in the study area. The southern one (site No. 1: S 28.50736 and E 21.45792) is quite large, covering an area of at least 100 x 50 metres and is located on a granite outcrop that is being exposed by a non-perennial stream that passes over it. As the rocks help to retain the water, it is possibly the only open water in the region for quite a while after the rains. This would result in people visiting the pan, not only for water but possibly also to hunt game that might come to drink water. The tools identified date to the Later stone and contain cores and flakes. The density of the tools is estimated to be approximately 1/5m².

Site No. 2 (S 28.15132 and E 21.11451) is located further north. Here there is no outcrop to retain the water, but the streambed probably carries some water in the rainy season, making it attractive for people to visit the area. The identified material consists of three tools dating to the Middle Stone Age and therefore the overall density is viewed to be very low, probably less than 1/20m². All the tools were made from quartzite. **Figure 4.9** indicate site No.1 and **Figure 4.10** and example of the flakes found in the study area.



Figure 4.10 Example of the flakes found in the study area

Identified sites: Iron Age and historic period

No sites, features or objects dating to the Iron Age or historic period were identified in the study areas.

4.3.11 Nature of the current visual environment

Status of the study area

The proposed site is zoned as agricultural and undetermined land. The site boundaries are formed by a railway line to the south, the national road (N10) to the north, the farm Olyfenhoutsdrift to the west and Upington town to the east.

The most common land use in the area is agriculture and therefore the existing site still presents remnants of this. The land is fenced off in camps and contains concrete dams and human shelters, possibly used by farm workers. A railway line bisects the portion of land and an overhead power line is present close to the southern boundary.

The site of the proposed Solar Park is situated close to the Orange River sandy flood plains. Topographically this area has a slightly sloping plateau with rolling Kalahari red sand dunes which varies in height from 3 – 6m from trough to crest with an approximate spacing of 30 – 100m apart from each other. Small, scattered calcrete rocky outcrops occur in isolated regions with shallow dry riverbeds cutting through the landscape. Soils are red – yellow apedal soils which stand in contrast to the Kalahari khaki grasses. The slope gradient map indicates the uniform topography of the site, please refer to **Appendix L**.

Generally the natural landscape consists of grass covered parallel dunes and lower lying flat areas which mainly consists of thorny trees and dwarf shrubs scattered sparsely over the landscape. There are also localised open patches where no vegetation is growing. There are very few natural large trees in the study area and these are restricted to positions where water naturally collects.

Land Use Character

The floodplains along the Orange River are intensively cultivated for production of grapes, raisins, dates, citrus, maize, vegetables and lucern. Extensive farms are present towards the north and west and intensive farms are present from the south and south east of the study area, the latter adding value to the overall vista. The large farms lying towards the north and west is as a result of the low carry capacity of the area and the intensity of the farm practices is very low. Farmsteads, surrounded by trees, can be expected to occur in isolated instances. The remoteness of the landscape adds to a particular sense of place.

The proposed site was previously used for cattle grazing. A municipal refuge area is located directly next to the site and vacant areas are found directly east of the site. Two

railway lines intersects the site, one passing along the southern end of the site, the second roughly 1km below the northern edge, running in an east west direction. An abundant borrow pit has been identified to the north east of the site, close to the entrance of the site leading to the N14. **Figure 4.11** includes a photo plate of the general landscape.

A preliminary viewshed analysis (refer to **Appendix H**) was used to determine the visibility of the proposed development. The visibility of the project is the geographic area from which the project will be visible. This is considered the zone of theoretical visibility as it assumes a straight line between contours. The actual visibility might be lower because of screening by existing trees and buildings. The viewshed analysis indicates that two of the three solar power towers have a 100% visibility and one has a 98% visibility based on a radius of 7km.



Figure 4.11: Photo plate of the general landscape

4.3.12 Social Environment

The proposed project will be constructed within the //Khara Hais Local Municipality (KHLM) which is located in the Northern Cape province of South Africa along the N10 and N14 route and forms part of the Z.F Mgcawu District Municipality (former Siyanda District Municipality). Adjacent to the KHLM and also within the ZF Mgcawu District Municipality (ZFMDM) is the !Kheis Local Municipality and the Kai !Garib Local Municipality. The KHLM's municipality seat is in the town of Upington. There are 8 smaller rural which include; Lambrechtsdrift, Karos, Leerkrans, Leseding, Raaswater, Sesbrugge, Klippunt, and Kalksloot. The inhabitants of these settlements are mainly reliant on agricultural activities for their daily living. Upington is the main town of the //Khara Hais Municipality and has, since its inception, been the hub of activities in the region. The Municipal area is approximately 344 446 ha and is categorised as a Rural Municipality.

According to the //Khara Hais Local Municipality IDP Upington has a number of broad descriptions and perceptions, including:

- Portal to Namibia and
- Frontier to the Kalahari and Kgalagadi Transfrontier Park.
- Oasis in the desert.
- Agricultural hub of the Northern Cape.
- Portal to the Kalahari's hunting grounds.

According to Statistics 2011, the population of KHLM is 93 494 with slightly more females, 47 447 than males, 46 047. This could be attributed to the males going outside the municipality in search of employment opportunities. A large number of the municipal population are Coloureds at 60 947 in comparison to the lowest population group of Indians/Asians at 623. About 40, 5% of municipal households are headed by females and about 0,4% are headed by children.

The local population has a youthful age structure and the immediate significance of this young age structure is that the population will grow rapidly in future and this implies a future high growth rate in the labour force. At present the local economy is unable to provide sufficient employment opportunities to meet the needs of the economically active population. A youthful population structure also implies a relatively higher dependency ratio.

Economic Activities

The KHLM has a so-called "dual economy". This is because the informal economies in the rural areas, townships and agriculture form part of the one economy and the more "advanced" sectors of the economy such as banking, manufacturing, government services and trade form another part of the economy. Agriculture accounts for the largest

percentage share of all sectors within the KHLM, followed by the electricity and finance sectors.

The natural resource base and economy does not have the capacity to support the total population, forcing the labour force to seek employment opportunities outside of the Municipality (e.g. Kimberley). Furthermore low levels of income obtained in the area imply low levels of buying power and, therefore, few opportunities for related activities such as trade. This in turn also supports the leakage of buying power in that the higher income groups tend to buy elsewhere. The manufacturing sector is currently not doing well in the KHLM according the IDP.

Agriculture

Agricultural activities take up portions of land abutting the Orange River in the Municipality. The Agricultural sector is important to the local economy and therefore represents an emerging strength for the Municipality. Agriculture creates further opportunities for expansion as well as the development of linkages with other sectors of the economy creating further opportunities for job creation.

The largest dried vine fruit processing and packaging plant (SAD Vine Fruit (Pty) Ltd) in South Africa is based in Upington which is served by six intake depots located in Groblershoop, Mylpaal, Louisvalebweg, Keimoes, Kakamas and Vredendal. The Orange River Wine Cellars Co-Op which is based in Upington is the second largest wine making co-operative in the world and has wine cellars in Groblershoop, Grootdrink, Upington, Keimoes and Kakamas. The co-operative was established in 1965 and has over 740 members. About 445 members produce grape juice and the remainder wine. At present most of the wine is produced for the local South African market.

Game farming

Game farming is well established and contributes significantly to the economy of the area. Game farming products include eco-tourism, hunting, rearing of game for the production of venison and game breeding for the sale of live animals. In places game farms occur in large-scale conservancies. There is significant potential to expand tourism within the game farming especially if it is focussed on the development of high quality specialised niche markets.

Tourism

The employment/ unemployment statistics of the Municipality are taken from the census 2011 provincial/municipal report. Unemployment refers to the statistics of those individuals who are actively looking for a job but are not in any type of paid employment. In general unemployment is higher amongst black communities as compared to White. This suggests that there is still a need to empower Black Communities.

Upington is well situated as a base for exploration of the region and has an outstanding infrastructure in the form of accommodation. Various areas are classified as nature conservation areas. Spitskop Nature Reserve lies 13km north of Upington. This nature

reserve, of approximately 6000 hectares, supports gemsbok, zebra, springbok, ostrich, eland, blue wildebeest, as well as smaller game and can be viewed from a circular route running through the park. There are a variety of routes and distances winding through the KHLM area for hikers. Other nature areas within the jurisdiction of //Khara Hais are Gariiep Lodge and Uizip. The Kalahari Oranje Museum Complex has the status of a regional and provincial museum. It conserves cultural items and is exhibited as a community focus point.

The following features are declared under the national monument act and are tourist attractions:

- Donkey Monument;
- Camel and Rider Statue;
- D. Date Palm Avenue (Planted in 1935 at the Eiland Holiday Resort, there are over 200 palms, measuring a distance of 1 041 meters, making it the longest palm avenue in the southern hemisphere);
- Oranjerivier Wine Cellars (The largest in the country and the second largest in the world);
- Scotty Smith's Grave (The Robin Hood of)the Northern Cape;
- 405 Philani Street in Paballelo;
- The home of the Reverend Schröder;
- Roman Catholic Church in Le Roux Street (still in use);
- NG Mother Community in Schroder Street (still in use);
- Hortentia water mill; and
- Missionary complex in Schröder Street (building is being used as a museum).

Unemployment Status

Employment rates are higher for males than for females. In 2011, 24748 persons from the economically active group, e.g. between 15 and 65 years, were employed while 7034 were unemployed (**Table 4.3**). The unemployment rate in the economic active group is approximately 22.1 %. Agriculture is respectively the biggest employer in the KHLM.

Table 4.5: Distribution of the population aged between 15 and 64 years by employment status – 2001 and 2011 in the //Khara-Hais local municipality (Statistic SA, 2011).

Employed		Unemployed		Unemployment Rate	
2001	2011	2001	2011	2001	2011
19 207	24748	9 893	7034	34.0	22.1