

BOTANICAL ASSESSMENT

(with biodiversity inputs)

GROBLERSHOOP HOUSING PROJECT

PROPOSED FORMALIZATION AND DEVELOPMENT OF 1 500 NEW ERVEN ON PORTION 16 OF THE FARM BOEGOEBERG, SETTLEMENT NO 48, GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE



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EXECUTIVE SUMMARY

VEGETATION TYPE	Bushmanland Arid Grassland and Gordonia Duneveld Both these vegetation types are classified as “Least Threatened” (GN 1002, December 2011) although statutory conservation targets have not yet been met.
VEGETATION ENCOUNTERED	The activity is expected to result in a permanent transformation of approximately 95 ha of land, of which approximately 60 - 70% is still covered by indigenous vegetation in good condition. However, the site includes various areas already degraded or disturbed (e.g. illegal dumping sites, old sewerage ponds and an area where sewerage is running through the veld from a potentially broken pipeline). The northern and north-eastern corner of the site (nearest to Groblershoop) was covered by a low white grass dominated sparse shrubland typically found on shallow soils on weathering rock (often calcrete or quartz). Although the Northern Cape is in the midst of a severe drought, the effect of recent rains can be seen in the display of grasses. The remainder of the property was characterised by red sandy soils that varied in depth, but also showed outcrops of calcrete scattered throughout.
CONSERVATION PRIORITY AREAS	According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA. The site will not impact on any recognised centre of endemism.
CONNECTIVITY	The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.
LAND-USE	The footprint is on municipal land in close proximity to the town of Groblershoop. Portions of the footprint is heavily disturbed as a result of illegal dumping, old ponds (e.g. sewerage works) and other physical disturbances. Although the area is grazed by livestock from the local community most of the footprint still supports indigenous vegetation in good condition.
PROTECTED PLANT SPECIES	The most significant botanical aspect of this site is the presence of a 14 protected Sheppard trees (<i>Boscia albitrunca</i>), some of which were in excellent condition (refer to Table 2). A number of Northern Cape Nature Conservation Act, protected species were also observed (Refer to Table 3).
FAUNA & AVI-FAUNA	The current land-use and the relative poor status of large portions of the site all contributes to a disturbance factor, which is likely to have driven most wild animals away from this area. Smaller game is still expected (albeit in very low numbers) but it is considered highly unlikely that any large game remains in this area. This in turn would have affected the food chain and ultimately the density of tertiary predators, particularly mammals and larger birds of prey, while smaller predators and scavengers such as jackal and caracal are eradicated by local land users and stock farmers in fear of their livestock. Due to long-term impacts associated with human settlements, compounded by the proximity of the proposed development areas to the urban edge, a comprehensive faunal

survey is not deemed necessary.

MAIN CONCLUSION

The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 95 ha of land, of which approximately 60 - 70% is still covered by indigenous vegetation in good condition. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, 14 protected Sheppard trees (*Boscia albitrunca*), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.

According to the impact assessment given in Table 6 the development is likely to result in a relative **Medium-Low** impact, which can be reduced to a **Low** impact with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity.

WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, WITH THE PROPOSED MITIGATION ACTIONS.

NO-GO OPTION

The No-Go option is not likely to result in a “no-impact” scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site (illegal dumping & construction activities).

There is also an urgent need for the establishment of additional residential erven in the !Kheis Municipality, which is likely to outweigh the No-Go option.

INDEPENDENCE & CONDITIONS

PB Consult is an independent entity with no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Mr Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTR and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity environmental legal compliance audits.

During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes NEMA EIA applications, environmental management plans for various industries, environmental compliance audits, environmental control work as well as more than 70 biodiversity & botanical specialist studies.

Towards the end of 2017, Mr Botes started his own small environmental consulting business focusing on biodiversity & botanical assessments, biodiversity management plans and environmental compliance audits.

Mr Botes is a registered Professional Botanical, Environmental and Ecological Scientists at SACNASP (South African Council for Natural Scientific Professions) as required in terms of Section 18(1)(a) of the Natural Scientific Professions Act, 2003, since 2005.

DECLARATION OF INDEPENDENCE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Petrus, Jacobus, Johannes Botes, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, as amended, and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 13 of GN No. R. 326.

Note: The terms of reference must be attached.



Signature of the specialist:

PB Consult (Sole Proprietor)

Name of company:

14 January 2021

Date:

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1. INTRODUCTION

There is an urgent need for the establishment of additional residential erven in the sub-economical market in the !Kheis Local Municipality. Seven towns have been identified for the proposed development of a number of new erven at each town. They are:

- Boegoeberg: 550 erven;
- Gariep: 135 erven;
- Groblershoop: 1500 erven;
- Grootdrink: 370 erven;
- Opwag: 730 erven;
- Topline: 248 erven; and
- Wegdraai: 360 erven.

Macroplan has been appointed by the Barzani Group (on behalf of COGHSTA) as Town and Regional Planners to manage the town planning process in terms of SPLUMA (Act 16 of 2013).

The proposed project will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). As result EnviroAfrica was appointed to perform the NEMA EIA application and PB Consult was appointed to conduct a botanical assessment of the proposed sites, which, although disturbed in some areas, still supports natural vegetation.

This report refers to the proposed development of approximately 1 500 new erven on a 95 ha of Municipal land, just south of Groblershoop.

The proposed land may support two vegetation types namely, namely Bushveld Arid Grassland and Gordonia Duneveld (both considered “Least Threatened” in terms of the National list of ecosystems that are threatened and in need of protection). Desktop studies suggest that portions of the footprint may be disturbed, or subject to disturbance as a result of its proximity to the adjacent urban development, but it also showed that the site falls within a terrestrial critical biodiversity area (CBA1) as identified in the 2017 Northern Cape Biodiversity Spatial Plan.

1.1. TERMS OF REFERENCE

The terms of reference for this appointment were to:

- Evaluate the proposed site(s) in order to determine whether any significant botanical features will be impacted as a result of the proposed development.
- Determine and record the position of any plant species of special significance (e.g. protected tree species, or rare or endangered plant species) that should be avoided or that may require “search & rescue” intervention.
- Locate and record sensitive areas from a botanical perspective within the proposed development footprint that may be interpreted as obstacles to the proposed development.
- Make recommendations on impact minimization should it be required
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

2. STUDY AREA

2.1. LOCATION & LAYOUT

Groblershoop is located on the N10 between Upington (117 km to the north) and Prieska (132 km to the south), in the !Kheis Local Municipality of the Northern Cape Province (Figure 1). The proposed new erven will be located to the south of Groblershoop, west of the N10 (just west of the Stutterheim settlement) on Portion 16 of the Farm Boegoeberg, Settlement no. 48 (GPS Coordinates 28°54'32.64"S; 21°59'47.71"E).

Figure 1: Map showing the location of Groblershoop in relation to Upington in the Northern Cape Province

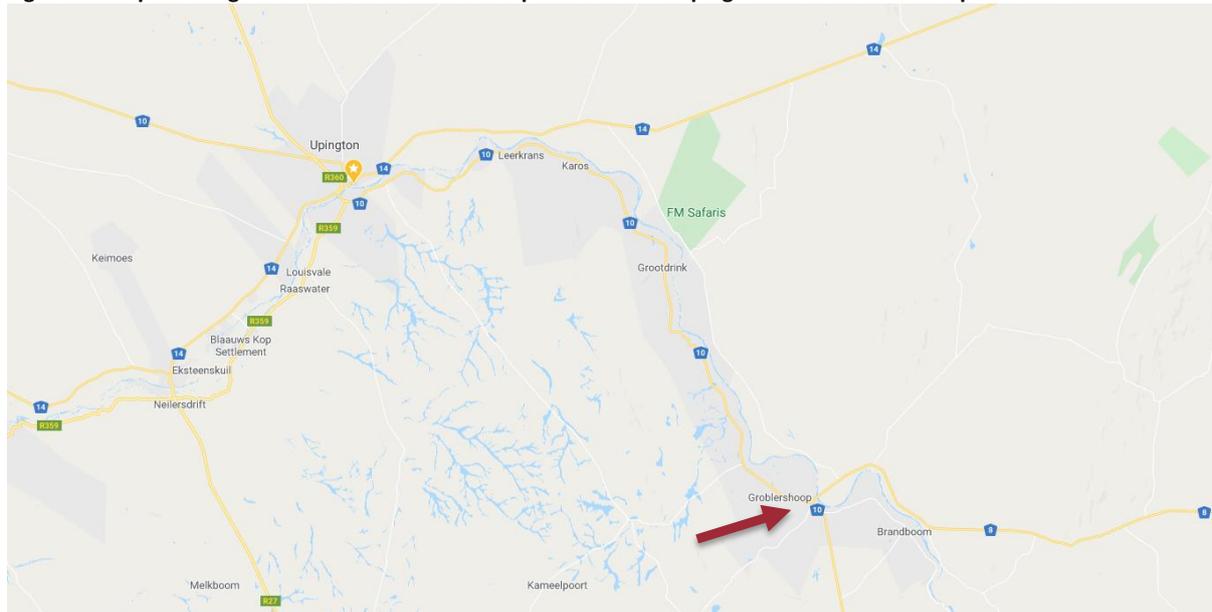
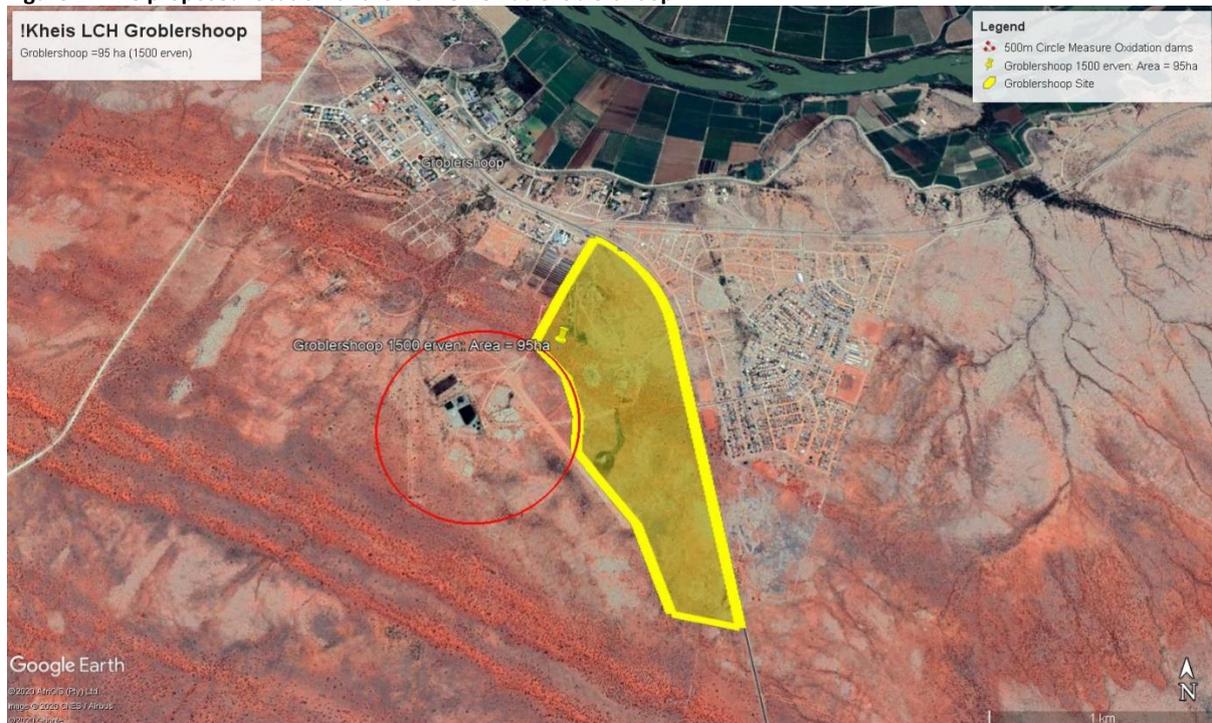


Figure 2: The proposed location of the new erven at Groblershoop



2.2. CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Groblershoop receives less than a 100 mm of rain per year, mainly in mid-summer December to March the highest (40 mm) in February/March, with its lowest rainfall (0 mm) during winter (June to August). It is also important to note that rainfall can be highly erratic and can vary significantly per annum on any specific location. Daily temperatures vary from 23°C – 37°C during the hot summer months (December / January) and drops down to between 8°C - 17°C during the colder winter months (June – July) (www.worldweatheronline.com). Also refer to Heading 4.1.1 & 4.1.2.

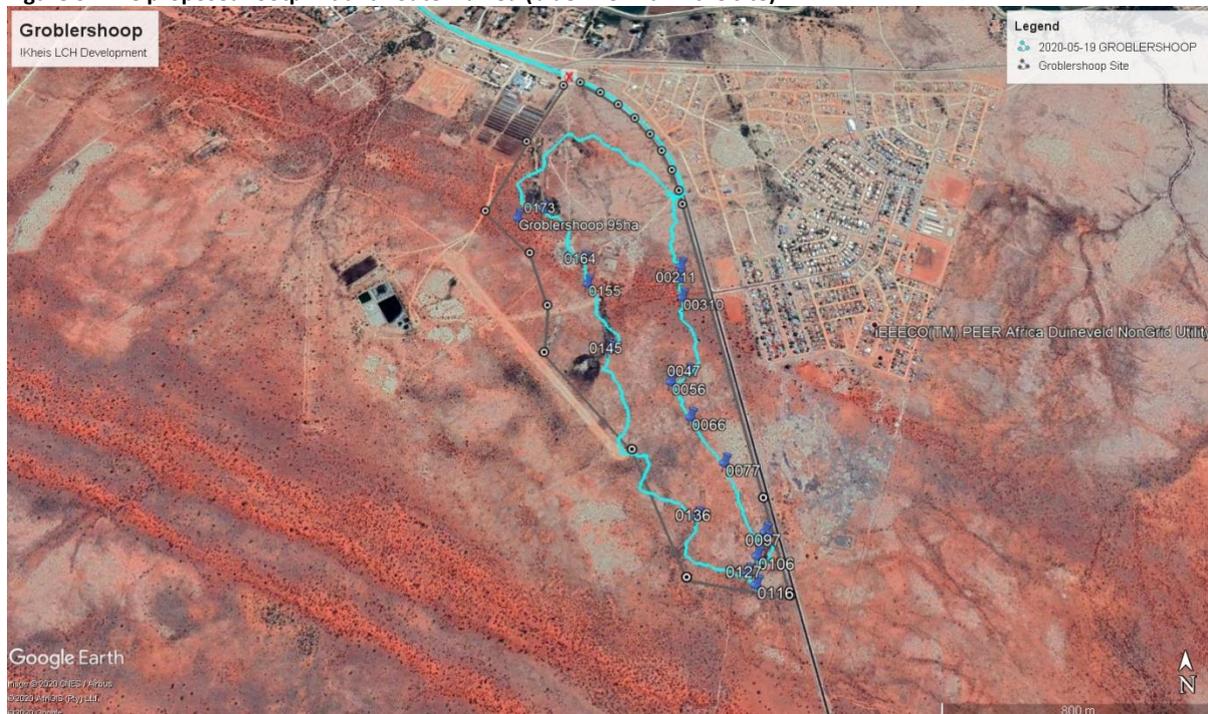
2.3. TOPOGRAPHY & SOILS

The proposed Groblershoop town extension is located on slightly irregular plains with a slight slope towards the east (towards the Orange River). The soils varies from shallow soils with calcrete outcrops in the areas covered by Bushmanland Arid Grassland to areas covered by deeper red sandy soils (the southern portion of the proposed site).

3. EVALUATION METHOD

Desktop studies coupled with a site visit were performed. The site visit was conducted on the 19th of May 2020. The timing of the site visit was reasonable in that, even though the veld was very dry, almost all perennial plants were identifiable. It must be noted that the Northern Cape is currently experiencing one of its worst drought periods in a long time, and although some summer rains had fallen (deducted from the presence of a number of grass species) it was not yet enough to really trigger a display of annual herbs.

Figure 3: The proposed footprint and route walked (blue line within the site)



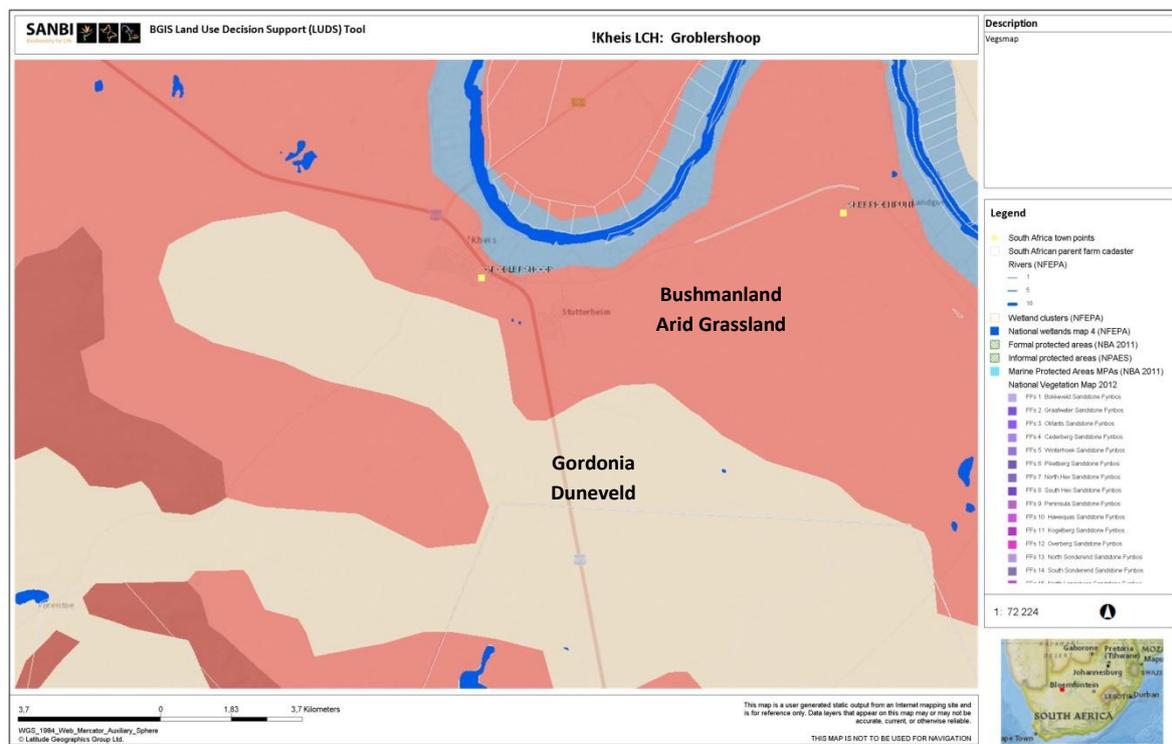
However, the author is confident that a fairly good understanding of the biodiversity status of the site was obtained. The survey was conducted by walking the site and examining, marking and photographing any area of interest. Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

4. THE VEGETATION

The Northern Cape contains about 3500 plant species in 135 families and 724 genera, with about 25% of this flora endemic to the region. It is also home to an exceptionally high level of insect and reptile endemism, with new species still being discovered. However, it must be noted that this remarkable diversity is not distributed evenly throughout the region, but is concentrated in many local centres of endemism. The Karoo used to support millions of antelope, mainly springbuck, but also numerous other larger antelope (and other grazing animal). These animals roamed the vast plains of the Karoo, utilizing different selections of plants and allowing for long “rest” periods as they move around, and as a result preventing overgrazing (Shearing, 1994).

The Groblershoop area would be classified as a desert region. In accordance with the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated in the 2012 beta version) two broad vegetation types may be expected in the vicinity of the proposed footprint, namely **Bushmanland Arid Grassland** and **Gordonia Duneveld** (Figure 4). Both these vegetation types are classified as “Least Threatened” (GN 1002, December 2011) although statutory conservation targets have not yet been met.

Figure 4: Vegetation map of South Africa (2012 beta 2 version), showing the expected vegetation types



4.1. THE VEGETATION IN CONTEXT

4.1.1. Nama-Karoo Biome

Bushmanland Arid Grassland is part of the Nama-Karoo Biome, which is a large arid landlocked region on the central plateau of the western half of South Africa, extending into Namibia. It is flanked by the Succulent Karoo to the west and south, desert to the northwest, arid Kalahari Savanna to the north, Grassland to the northeast, Albany Thicket to the southeast and small parts of Fynbos to the south. In South Africa, only the Desert Biome has a higher variability in annual rainfall and only the Kalahari Savanna greater extremes in temperature. The Nama-Karoo receives most of its rainfall in summer, especially in late summer (Mucina *et. al.*, 2006).

Climate is essentially continental and with almost no effect of the ameliorating influences of the oceans. Rainfall is low and unreliable, peaking in March. Droughts are unpredictable and often prolonged. Summers are hot and winters cold with temperature extremes ranging from -5°C in winter to 43°C in summer. However, rainfall intensity can be high (e.g. episodic thunderstorm and hail storm events). This coupled with the generally low vegetation cover associated with aridity and grazing pressure by domestic stock over the last two centuries, raises the potential for soil erosion. In semi-arid environments such as the Nama-Karoo, nutrients are generally located near the soil surface, making it vulnerable to sheet erosion (Mucina *et. al.*, 2006).

In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulent dominance (as in the Succulent Karoo). It is also too dry in summer for dominance by perennial grasses alone and the soils generally too shallow and rainfall too low for dominance by trees. But soil type, soil depth and local differences in moisture availability can cause abrupt changes in vegetation structure and composition (e.g. small drainage lines support more plant species than surrounding plains) (Mucina *et. al.*, 2006).

4.1.2. **Gordonia Duneveld**

Gordonia Duneveld is part of the Eastern Kalahari Bushveld Bioregion, which is a sub-bioregion for the Savanna Biome. The Savanna Biome is the most widespread Biome in Africa and also occupies most of the far-northern part of the Northern Cape, including the Kalahari Duneveld. According to Rutherford *et. al.* (2006), the Savanna in South Africa has a low species to area ratio, and become even lower in the southern Kalahari part of the biome (with a sharply decreasing diversity of trees from east to west). On the other hand, Savanna is well known for its diversity of mammals. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulents to dominate (like in the Succulent Karoo), while summers are too dry for dominance by perennial grasses alone, and the soils are generally too shallow and rainfall too low for trees.

Most Savanna has an herbaceous layer dominated by grass species and discontinuous to sometimes very open tree layer. In many Savanna areas in southern Africa the term bushveld is appropriate since the woody component does often not form a distinct layer but rather presents an irregular series of interlocking, often low, canopies with openings and sometimes little distinction between all shrubs and trees. The woody component is important to animals and can determine available browse, can form impenetrable barriers or determine available shade and protection against predators or scavengers. There is often excellent correlation between vegetation patterns and soil types, but rainfall gradients can result in large floristic variation even on similar substrates.

Kimberley Thornveld vegetation occurs in the North West, Free State and Northern Cape Provinces: Most of the Kimberley, Hartswater, Bloemhof and Hoopstad Districts as well as substantial parts of the Warrenton, Christiana, Taung, Boshof and to some extent the Barkley West District at altitudes varying between 1050m – 1400m (Mucina & Rutherford, 2006).

4.2. **VEGETATION ENCOUNTERED**

The proposed development footprint is about 95 ha in size. The site includes various areas already degraded or disturbed, this include a number of illegal dumping sites, an area which seems to contain old sewerage ponds and an area where sewerage is running through the veld from a potentially broken pipeline.

4.2.1. Existing disturbance footprint

Figure 5 gives an overview of the disturbed areas, which includes;

- (Area 1) An area of general disturbance (physical disturbances like excavations, dumping etc.), about 6 ha in size, marked by the blue polygon (Photo 1 & Photo 2);
- (Area 2) Old ponds (probably old sewage ponds), about 1.2 ha in size, marked by one of the red polygons (Photo 3);
- (Area 3) A second set of old ponds (probably old sewerage ponds), about 2.7 ha in size;
- (Area 4) An illegal dumping site (Photo 4);
- (Area 5) An area covered by raw sewerage running through the veld (seemingly a pipe had been broken by excavations, which now releases raw sewerage into the veld) (Photo 5 & Photo 6);
- (Area 6) A small man-made dam (Photo 7).

Figure 5: An overview of the site, showing most significant disturbed areas



Photo 1: A photo showing some of the disturbance (both physical and illegal dumping encountered in area 1.



Photo 2: Another photo taken in the disturbance area marked by Area 1 in Figure 5. This area was also characterized by significant *Prosopis* infestation.



Photo 3: One of the old ponds encountered in Area 2. These ponds seem to represent old sewerage works.



Photo 4: A photo showing the illegal dumping site marked by Area 3 in Figure 5.



Photo 5: A picture showing the sewerage spill marked by area 5 in Figure 5.



Photo 6: An excavated area, that seems to have resulted in the raw sewerage leakage shown in Photo 5, above.



Photo 7: A small dam encountered at the south-eastern corner of the site. Note the larger trees associated with the dam wall.



Photo 8: One of the interesting sightings was these rectangles demarcated by *Aloe claviflora* plants harvested in the surrounding veld. It turns out that these are potential erven that has been demarcated by local residents for constructing their dwellings.

4.2.2. Shallow soils with calcrete outcrops

The northern and north-eastern corner of the site (nearest to Groblershoop) was covered by a low white grass dominated sparse shrubland typically found on shallow soils on weathering rock (often calcrete or quartz). Although the Northern Cape are in the midst of a severe drought (the last 5 – 7 years), the effect of recent rains can be seen in the display of grasses and even the shrub layer encountered. However, the rain was apparently not yet enough to trigger a display of annual herbaceous species. Bulb species were also rarely observed.

The vegetation varied from an open grassland dominated by white grasses to a sparse low (<0.5 m) shrubland dominated by the white stemmed *Justicia australis* (= *Monechma*) in combination with *Tetraena decumbens*, *Salsola zeyheri*, *Tetraena microcarpa* (Photo 9 & Photo 10). Dense stands of *Aloe claviflora* were often encountered, in fact they are so common that the local people uses them to demarcate erven (Photo 8). The following plants were also observed scattered throughout the small (“verneuk halfmense”) *Acanthopsis disperma*, the common *Aptosimum spinescens*, *Barleria lichtensteiniana*, *Boscia albitrunca*, patches of *Cynanchum viminale*, the nine-awned grass *Enneapogon cenchroides*, *Euphorbia gariepina*, and occasionally the smaller *Euphorbia spinea*, *Geigeria ornativa*, *Justicia incana*, *Kleinia longiflora*, *Lacomucinaea lineata* (=

Thesium lineatum), *Leucosphaera bainesii*, *Lycium cinereum*, *Rhigozum trichotomum*, *Senegalia mellifera* (occasionally) and the creeping *Trianthema parvifolia*. In the disturbed northern corner of the site, the vegetation was often dominated by dense stands of the alien *Prosopis* tree (Refer to Photo 1 & Photo 2).



Photo 9: Typical low shrubland dominated by white grasses as encountered to the north and north eastern corner of the site. Note the *Justicia australis* and *Tetraena decumbens* in the foreground.



Photo 10: Another picture showing new erven being demarcated by *Aloe claviflora*.

4.2.3. Deeper (red) sandy soils

The remainder of the property was characterised by red sandy soils that varied in depth, but also showed outcrops of calcrete scattered throughout. At the higher lying western boundary of the site (near area 5 in Figure 5) even quartzite was exposed in small patches. The vegetation varied depending on the depth of the sand, Deeper sandy soils was characterized by denser and larger stands of small trees like *Senegalia mellifera* and larger shrubs like *Phaeoptilum spinosum*, *Lycium cinereum* and *Rhigozum trichotomum* (e.g. Photo 11).



Photo 11: Vegetation encountered in deeper sandy soils. Note the *Rhigozum trichotomum* in the foreground, with *Senegalia mellifera* and a small *Boscia albitrunca* in the back ground.

By far the largest portion of the site was covered by varying depths of red sandy soils covered by a transitional form of vegetation between duneveld and arid grassland (Photo 12). The plant species seems to overlap between the two vegetation types (depending on the soil depth and occurrence of calcrete) and many of the species encountered on the shallow rocky soils, where also encountered on the deeper sandy soils, but the structural composition were very different with the plants normally denser and larger the deeper the sands (Photo 11).



Photo 12: The Groblershoop sport fields, indicating the proposed location for the small balancing reservoir.

Plant species encountered included the following: The small *Acanthopsis hoffmannseggiana*, *Aizoon burchellii*, *Aloe claviflora*, *Aptosimum spinescens*, *Asparagus cf. capensis*, *Asparagus* species, *Boscia albitrunca*, patches of *Cynanchum viminale*, *Euphorbia gariepina*, *Euphorbia braunsii*, *Euphorbia spinea*, *Galenia africana*, *Geigeria ornativa*, *Justicia incana*, *Kleinia longiflora*, *Lacomucinaea lineata* (= *Thesium lineatum*), *Leucosphaera bainesii*, *Lycium cinereum*, the climbing balsam pear, *Momordica balsamina*, *Phaeoptilum spinosum*, the common *Rhigozum trichotomum*, *Rogeria longiflora*, the spiny *Ruschia divaricata*, *Salsola kali*, *Salsola zeyheri*, *Senegalia mellifera*, *Tapinanthus oleifolius* and *Ziziphus mucronata*.



Photo 13: The Groblershoop sport fields, indicating the proposed location for the small balancing reservoir.

The most significant feature encountered were a number of beautiful and well protected Sheppard trees (*Boscia albitrunca*) scattered throughout the site (refer to Table 2).

4.3. CRITICAL BIODIVERSITY AREAS MAPS

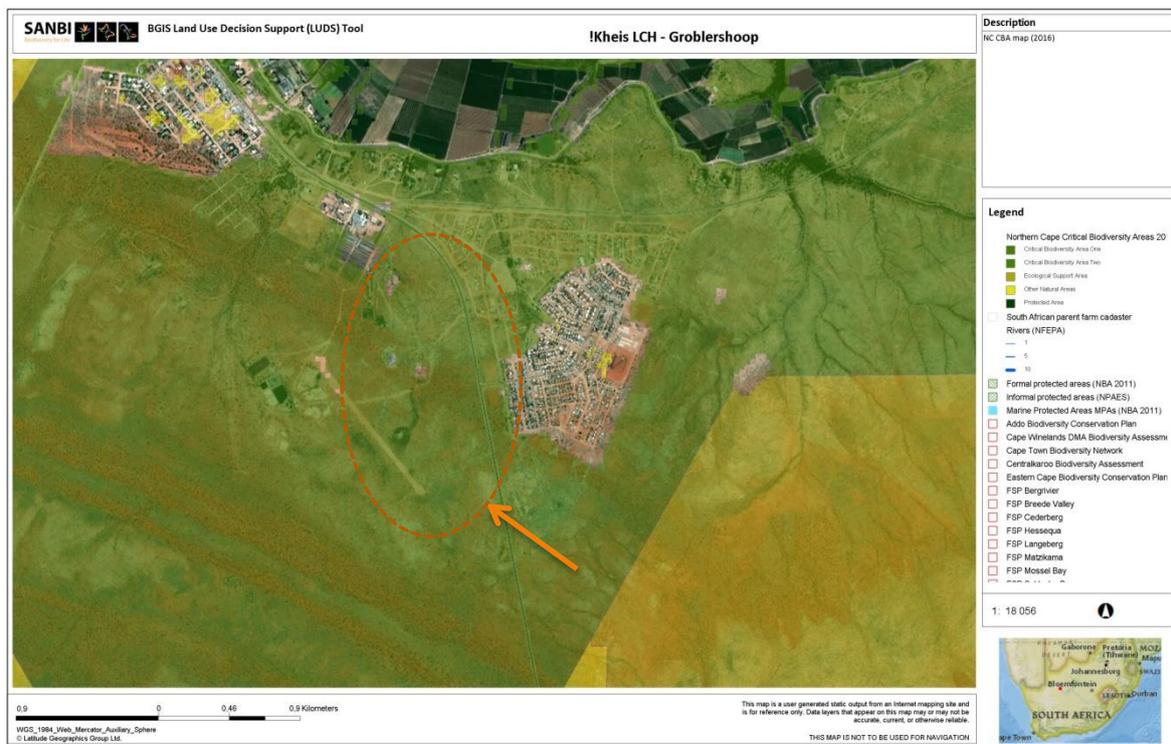
The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole (Holness & Oosthuysen, 2016). The 2016 Northern Cape

Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province (including the Namakwa District Biodiversity Sector Plan, 2008). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.
- **Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

Figure 6: The Northern Cape Critical Biodiversity Areas Map (2016) showing the proposed development



From a land-use planning perspective it is useful to think of the difference between CBA's and ESA's in terms of where in the landscape the biodiversity impact of any land-use activity action is most significant:

- For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).
- For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity).

According to the Northern Cape CBA map (Figure 6), the proposed development will overlap both a **terrestrial CBA**. However, it must be noted that large portions of the proposed site is already disturbed, and that there is no real alternative site within the Municipal town boundaries that is not located within the CBA.

4.4. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development will not impact on any recognised centre of endemism (Van Wyk & Smith, 2001).

4.5. FLORA ENCOUNTERED

Table 2 gives a list of the plant species encountered during this study. Because of the limitations (timing and a single site visit as well as the drought) it is likely that a number of annuals might have been missed.

Table 1: List of indigenous species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
1.	<i>Acanthopsis disperma</i>	ACANTHACEAE	LC	
2.	<i>Acanthopsis hoffmannseggiana</i>	ACANTHACEAE	LC	
3.	<i>Aizoon burchellii</i>	AIZOACEAE	Not evaluated NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
4.	<i>Aloe claviflora</i>	ASPODELACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
5.	<i>Aptosimum spinescens</i>	SCROPHULARIACEAE	LC	
6.	<i>Aristida adscensionis</i>	POACEAE	LC	
7.	<i>Aristida congesta</i>	POACEAE	LC	
8.	<i>Asparagus cf. capensis</i>	ASPARAGACEAE	LC	
9.	<i>Asparagus species</i>	ASPARAGACEAE	LC	
10.	<i>Barleria lichtensteiniana</i>	ACANTHACEAE	LC	
11.	<i>Boscia albitrunca</i>	BRASSICACEAE (CAPPARACEAE)	LC NFA protected species NCNCA, Schedule 2 Protected (all species of Boscia)	Apply for a NFA Tree permit (DAFF) Apply for a NCNCA Flora permit (DENC)
12.	<i>Cynanchum viminale (=Sarcostemma viminale)</i>	APOCYNACEAE	LC NCNCA, Schedule 2 Protected	Apply for a NCNCA Flora permit (DENC)

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
			(all species in this Family)	
13.	<i>Enneapogon cenchroides</i>	POACEAE	LC	
14.	<i>Euphorbia braunsii</i>	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
15.	<i>Euphorbia gariepina</i>	EUPHORBIACEAE	NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
16.	<i>Euphorbia spinea</i>	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
17.	<i>Galenia africana</i>	AIZOACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
18.	<i>Geigeria ornativa</i>	ASTERACEAE	LC	
19.	<i>Justicia australis</i> (=Monechma <i>genistifolium</i>)	ACANTHACEAE	LC	
20.	<i>Justicia incana</i> (=Monechma <i>incanum</i>)	ACANTHACEAE	LC	
21.	<i>Kleinia longiflora</i>	ASTERACEAE	LC	
22.	<i>Lacomucinaea lineata</i> (=Thesium <i>lineatum</i>)	SANTALACEAE	LC	
23.	<i>Leucosphaera bainesii</i>	AMARANTHACEAE	LC	
24.	<i>Lycium cinereum</i>	SOLANACEAE	LC	
25.	<i>Momordica balsamina</i>	CUCURBITACEAE	LC	
26.	<i>Parkinsonia africana</i>	FABACEAE	LC	
27.	<i>Phaeoptilum spinosum</i>	NYCTAGINACEAE	LC	
28.	<i>Prosopis</i> species	FABACEAE	Alien invasive plant species	
29.	<i>Rhigozum trichotomum</i>	BIGONACEAE	LC	
30.	<i>Rogeria longiflora</i>	PEDALIACEAE	LC	
31.	<i>Ruschia divaricata</i>	AIZOACEAE	Protected in terms of schedule 2 of the NCNCA	Apply for a NCNCA Flora permit (DENC)
32.	<i>Salsola kali</i>	AMARANTHACEAE	Naturalised invasive	1b
33.	<i>Salsola zeyheri</i>	AMARANTHACEAE	LC	
34.	<i>Senegalia mellifera</i> (=Acacia <i>mellifera</i>)	FABACEAE	LC	
35.	<i>Stipagrostis</i> species	POACEAE	LC	
36.	<i>Stipagrostis uniplumis</i>	POACEAE	LC	
37.	<i>Tapinanthus oleifolius</i>	LORANTHACEAE	LC	
38.	<i>Tetraena decumbens</i> (=Zygophyllum <i>decumbens</i>)	ZYGOPHYLLACEAE	LC	
39.	<i>Tetraena microcarpa</i> (=Zygophyllum <i>microcarpum</i>)	ZYGOPHYLLACEAE	LC	
40.	<i>Tetraena simplex</i> (=Zygophyllum <i>simplex</i>)	ZYGOPHYLLACEAE	LC	
41.	<i>Trianthena parvifolia</i>	AIZOACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	
42.	<i>Ziziphus mucronata</i>	RHAMNACEAE	LC	

4.6. THREATENED AND PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora. Major threats to the South African flora are identified in terms of the number of plant taxa Red-Listed as threatened with extinction

as a result of threats like, habitat loss (e.g. infrastructure development, urban expansion, crop cultivation and mines), invasive alien plant infestation (e.g. outcompeting indigenous plant species), habitat degradation (e.g. overgrazing, inappropriate fire management etc.), unsustainable harvesting, demographic factors, pollution, loss of pollinators or dispersers, climate change and natural disasters (e.g. such as droughts and floods). South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. However, due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction, but may nonetheless be of high conservation importance. As a result a SANBI uses an amended system of categories in order to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

In the Northern Cape, species of conservation concern are also protected in terms of national and provincial legislation, namely:

- The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the “Lists of critically endangered, endangered, vulnerable and protected species” (GN. R. 152 of 23 February 2007).
- National Forest Act, Act 84 of 1998, provides for the protection of forests as well as specific tree species through the “List of protected tree species” (GN 908 of 21 November 2014).
- Northern Cape Nature Conservation Act, Act of 2009, provides for the protection of “specially protected species” (Schedule 1), “protected species” (Schedule 2) and “common indigenous species” (Schedule 3).

4.6.1. Red list of South African plant species

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa’s indigenous plants (SANBI, 2015).

- **No red-listed species** was observed.

4.6.2. NEM: BA protected plant species

The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the “Lists of critically endangered, endangered, vulnerable and protected species” (GN. R. 152 of 23 February 2007).

- **No NEM: BA protected species** was observed.

4.6.3. NFA Protected plant species

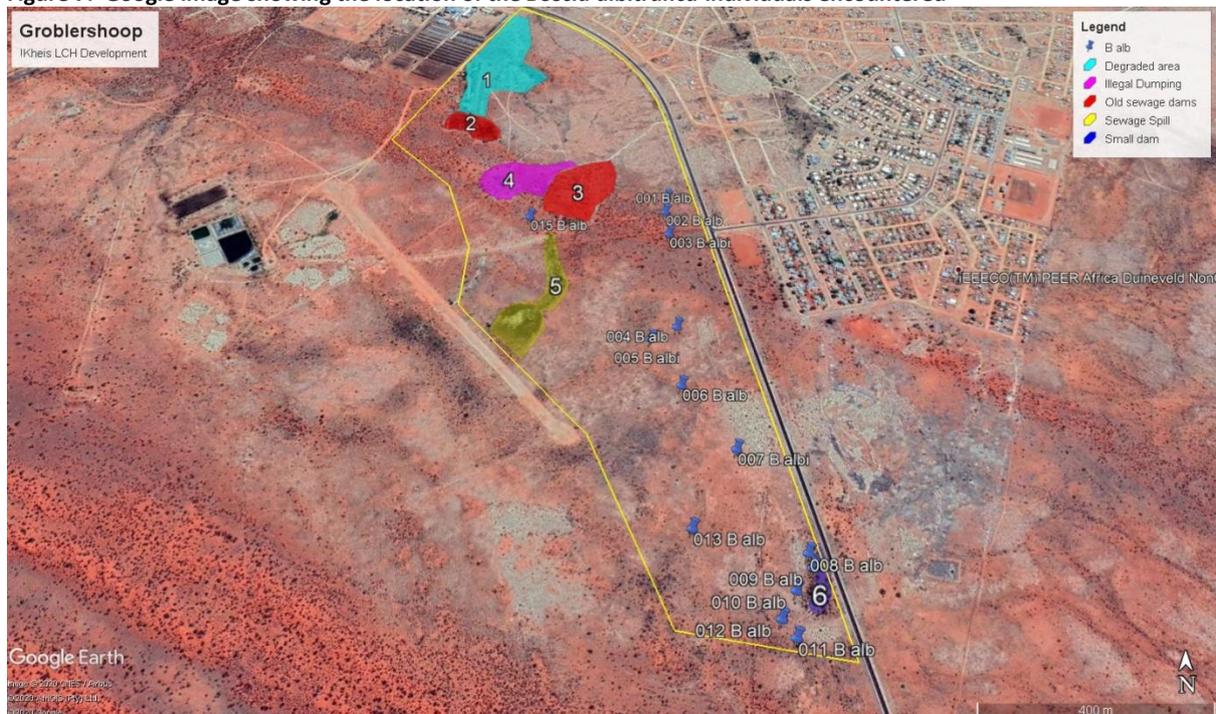
The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (as updated).

- **One species protected in terms of the NFA** was observed, namely ***Boscia albitrunca***. The following table give locations for each tree as well as recommendations for impact minimisation.

Table 2: Location of NFA protected trees observed within or near the footprint

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
001 B alb	<i>Boscia albitrunca</i> S28° 54' 33.4" E21° 59' 54.2"	Small shrub in poor condition (1.4 m tall)	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
002 B alb	<i>Boscia albitrunca</i> S28° 54' 35.1" E21° 59' 54.0"	Medium size tree, poor condition (1.8 m tall)	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
003 B alb	<i>Boscia albitrunca</i> S28° 54' 37.5" E21° 59' 54.2"	Medium size tree in poor condition (2.1 m tall).	A NFA permit as well as a NCNCA permit will be required for removal of this plant.

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
004 B alb	<i>Boscia albitrunca</i> S28° 54' 46.8" E21° 59' 54.5"	Magnificent tree (2.3 m tall).	Do not disturb, if possible. A NFA permit as well as a NCNCA permit will be required for removal of this plant.
005 B alb	<i>Boscia albitrunca</i> S28° 54' 47.9" E21° 59' 52.3"	Magnificent tree (4 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.
006 B alb	<i>Boscia albitrunca</i> S28° 54' 52.1" E21° 59' 54.6"	Small tree in poor condition (1.4 m tall).	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
007 B alb	<i>Boscia albitrunca</i> S28° 54' 57.4" E21° 59' 58.4"	Medium size tree in good condition (2.4 m tall).	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
008 B alb	<i>Boscia albitrunca</i> S28° 55' 05.0" E22° 00' 02.6"	Magnificent tree (3.2 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.
009 B alb	<i>Boscia albitrunca</i> S28° 55' 06.0" E22° 00' 02.8"	Magnificent tree (3 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.
010 B alb	<i>Boscia albitrunca</i> S28° 55' 07.4" E22° 00' 01.5"	Medium tree (3 m tall).	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
011 B alb	<i>Boscia albitrunca</i> S28° 55' 10.4" E22° 00' 01.1"	Magnificent tree (5 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.
012 B alb	<i>Boscia albitrunca</i> S28° 55' 09.2" E22° 00' 00.3"	Medium tree (2.1 m tall).	A NFA permit as well as a NCNCA permit will be required for removal of this plant.
013 B alb	<i>Boscia albitrunca</i> S28° 55' 03.2" E21° 59' 54.7"	Magnificent tree (5.5 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.
015 B alb	<i>Boscia albitrunca</i> S28° 54' 35.6" E21° 59' 42.0"	Medium tree (3.5 m tall).	Do not disturb, if possible A NFA permit as well as a NCNCA permit will be required for removal of this plant.

Figure 7: Google image showing the location of the *Boscia albitrunca* individuals encountered

4.6.4. NCNCA protected plant species

The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, and also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. NB. Please note that all indigenous plant species are protected in terms of Schedule 3 of this act (e.g. any work within a road reserve).

- The following species protected in terms of the NCNCA were encountered. Recommendations on impact minimisation also included.

Table 3: Plant species protected in terms of the NCNCA encountered within the study area

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
1.	<i>Aizoon burchellii</i> Schedule 2 protected	Occasionally observed in deeper sandy areas.	Species protection through topsoil conservation.
2.	<i>Aloe claviflora</i> Schedule 2 protected	Very common in the north eastern part of the property.	Very common plant in this area.
3.	<i>Boscia albitrunca</i> Schedule 2 protected	Refer to Table 2.	
4.	<i>Cynanchum viminale</i> Schedule 2 protected	Occasionally observed within the footprint.	Larger <i>Cynanchum</i> plants are expected to transplant poorly. Species protection through topsoil conservation.
5.	<i>Euphorbia braunsii</i> Schedule 2 protected		Search & rescue: Occasionally observed. Individuals within footprint to be transplanted to surrounding area.
6.	<i>Euphorbia gariiepina</i> Schedule 2 protected		Very common plant in this area. Species protection through topsoil conservation.
7.	<i>Euphorbia spinea</i> Schedule 2 protected		Very common plant in this area. Species protection through topsoil conservation.
8.	<i>Galenia africana</i> Schedule 2 protected	This plant is weedy a disturbance indicator and commonly found in Erf 1654.	No special measures needed, this is a weedy pioneer species.
9.	<i>Ruschia divaricata</i> Schedule 2 protected		Very common plant in this area. Species protection through topsoil conservation.
10.	<i>Trianthema parvifolia</i> Schedule 2 protected		A common plant. Species protection through topsoil conservation.

5. FAUNA AND AVI-FAUNA

Please note that no fauna or avi-fauna screening was done as part of this study and the following notes are just observations with regards to status of the study area and observations made during the botanical site visit. The proposed site borders (almost surrounding) the existing town of Groblershoop where current land-uses include illegal dumping and livestock grazing. The vegetation associated can be classified as disturbed due to on-going human-induced activities (i.e. trampling, overgrazing, illegal dumping, and transformation of land leading to erosion).



Faunal diversity changes through space and time and are directly influenced by anthropogenic activities, including animal husbandry (i.e. overgrazing by livestock) and human settlements (e.g. transformation of land) (Tilman et al., 1997; Chapin *et al.*, 2000). The major large-scale disturbance to the Nama Karoo ecosystem has been the change in grazing. Previously a variety of indigenous migratory ungulates

with a broad range of grazing habits would have migrated through the land, but now domestic sheep and goats with much more selective grazing habits are confined within farm boundaries (Skead, 1982). This change in the grazing regime is thought to be responsible for alterations in both plant species composition and cover, which ultimately influence ecosystem functioning (Roux & Theron, 1986). Heavily disturbed Karoo veld seldom recovers within one lifetime (Esler *et al.*, 2006). Direct impacts are typically associated with urban land expansion, leading to land cover changes (and consequent loss of natural areas) and edge effects, whereas indirect impacts include impacts associated with the generation of waste (e.g. general or sewage) and its management (McDonald *et al.*, 2020). Edge effects have diverse impacts on biodiversity and ecological functioning (Razafindratsima *et al.*, 2018). The current land-use, the adjacent farming practices and the relative poor status of large portions of the site all contributes to a disturbance factor, which is likely to have driven most wild animals away from this area. Smaller game is still expected (albeit in very low numbers) but it is considered highly unlikely that any large game remains in this area. This in turn would have affected the food chain and ultimately the density of tertiary predators, particularly mammals and larger birds of prey, while smaller predators and scavengers such as jackal and caracal are eradicated by local land users and stock farmers in fear of their livestock. Due to long-term impacts associated with human settlements, compounded by the proximity of the proposed development areas to the urban edge, a comprehensive faunal survey is not deemed necessary.

5.1. MAMMALS

The fauna of the Nama Karoo is relatively species-poor (Vernon, 1999). Although not remarkably rich in species or endemism, the flora and fauna of the Nama-Karoo region are impressively adapted to its climatic extremes. There are few strict endemics, as most animals have extended their ranges into the Karoo from adjacent biomes. Only the small Visagie's golden mole (*Chrysochloris visagiei*) is strictly endemic to the eco-region. Five other small mammals are near-endemic, Grant's rock mouse (*Aethomys granti*), Shortridge's rat (*Thallomys shortridgei*), the riverine rabbit (*Bunolagus monticularis*), *Gerbillurus vullinus* and *Petromyscus*

monticularis of which riverine rabbit is the most vulnerable (Hilton-Taylor, 2000). The quagga, (*Equus quagga*) a Nama Karoo near-endemic, was hunted to extinction in the 19th Century (Skinner & Smithers, 1990).

The nearby Witsand Nature Reserve still supports an impressive diversity of larger antelope and other mammal species, such *Antidorcas marsupialis* (Springbuck), *Oryx gazelle* (Gemsbok or Oryx), *Raphicerus campestris* (Steenbok), *Sylvicapra grimmia* (Grey Duiker), *Alcelaphus buselaphus* (Red hartebeest), *Xerus inauris* (Southern African ground squirrel), *Suricata suricatta* (Meerkat), *Hystrix cristata* (Porcupine), *Proteles cristata* (Aardwolf), *Orycteropus afer* (Aardvark), *Manis temminckii* (Ground Pangolin), *Otocyon megalotis* (Bat-eared fox), *Vulpes chama* (Cape fox), *Genetta tigrina* (Cape genet) and *Pedetes capensis* (Springhare) (Mthombeni, 2019). The Witsand Nature Reserve falls within the Savanna Biome (of which elements are found in the study area, although most of the area is covered by Nama-Karoo) and as a result the species occurring at Witsand will not give a true reflection of the expected game for this area. However, it should give an indication of potential fauna for the larger area.

The Kgalagadi Transfrontier Park (approximately 250km) and Tswalu Kalahari Reserve (approximately 144km) are the closest protected areas with similar vegetation. Mammalian species present in these reserves include, but are not limited to the African Striped Weasel, African Wild Cat, African Wild Dog (Painted Wolf) Antbear (Aardvark), Bat-Eared Fox, Black-Backed Jackal, Black-Tailed Tree Rat, Blue Wildebeest, Brant's Whistling Rat, Brown Hyena, Bushveld Elephant-Shrew, Cape Golden Mole, Cape Hare, Cape Serotine Bat, Caracal, Chacma Baboon, Cheetah, Common Mole Rat, Damara Mole Rat, Desert Musk Shrew, Egyptian Free-Tailed Bat, Egyptian Slit-Faced Bat, Eland, Gemsbok, Giraffe, Grass Climbing Mouse, Grey Duiker, Ground Squirrel, Hairy-Footed Gerbil, Highveld Gerbil, Honey Badger, Kudu, Large-Eared Mouse, Leopard, Lion, Namaqua Rock Mouse, Pangolin, Porcupine, Pouched Mouse, Pygmy Mouse, Red Hartebeest Round-Eared Elephant Shrew, Short-Tailed Gerbil, Silver (Cape) Fox, Slender Mongoose, Small Spotted Cat, Small-Spotted Genet, South African Hedgehog, Spotted Hyena, Springbok, Springhare Steenbok, Striped Mouse Striped Polecat, Suricate, Vervet Monkey, Warthog, Woosnam's Desert Rat, and Yellow Mongoose (<https://www.sanparks.org/parks/kgalagadi/conservation/ff/mammals.php>) / (<https://tswalu.com/wp-content/uploads/2019/07/Tswalu-Information-Guide-2019.pdf>).

Although smaller mammals like genet, ground squirrel and mice is still expected (occasional burrow holes were observed) it is considered highly unlikely that larger game or even smaller game like duiker will frequent or remain in the proposed footprint because of its proximity to the surrounding town extensions and constant human presence.

5.2. AVI-FAUNA

Among birds in the Nama-Karoo, the ferruginous lark (*Certhilauda burra*) and Sclater's lark (*Spizocorys sclateri*) are strictly endemic, while the following five species are near-endemic: Karoo chat (*Cercomela schlegelii*), tractrac chat (*Cercomela tractrac*), red lark (*Certhilauda burra*), Karoo scrub robin (*Cercotrichas coryphaeus*), red-headed cisticola (*Cisticola subruficapillus*), and the Namaqua prinia (*Phragmacia substriata*). Other characteristic species of the Nama Karoo which are regarded as "Vulnerable" in South Africa are tawny (*Aquila rapax*) and martial (*Polemaetus bellicosus*) eagles, African marsh harrier (*Circus ranivorus*), lesser kestrel (*Falco naumanni*), blue crane (*Anthropoides paradiseus*), kori (*Ardeotis kori*) and Ludwig's (*Neotis ludwigii*) bustards, and the red lark (Dean *et al.*, 1991; McCann, 2000; Barnes, 2000).

The nearby Witsand Nature Reserve is regarded as a great birding site, with its dunes and dense woodland and Savanna, offering all the typical arid Savanna birds, as well as species that prefer denser woodland. These include Melba Finch, Black-cheeked and Violet-eared Waxbills, Yellow-billed Hornbill, Lappet-faced Vulture and, in wet years, Monotonous Lark ([www.capebirdingroute.org/Kalahari Witsand NR](http://www.capebirdingroute.org/Kalahari_Witsand_NR)).

Avi-fauna diversity and numbers is expected to be much higher at Witsand than in the study area, although some elements of Savanna were encountered in the study area (but most of the area was covered by Nama-Karoo vegetation). Although Nama-Karoo vegetation can potentially attract a number of bird species, the disturbed vegetation cover (associated with the proposed site), is likely to result in a low avifaunal diversity, as avifaunal diversity is directly influenced by land cover (Lepczyk *et al.*, 2017).

Smaller birds were observed but no larger birds or birds of prey were encountered during the site visit. Because of the location (next to the existing settlement) the proposed footprint enlargement is not expected to have any significant impact on the surrounding bird populations, especially if larger trees next to the seasonal drainage lines are protected.

5.3. REPTILE & AMPHIBIANS

The Nama-Karoo reptile fauna contains at least 10 species that are regarded as near-endemic, but only a few are potentially confined to this region, which includes the Karoo dwarf chameleon (*Bradypodion karrooicum*) and Boulenger's Padloper (*Homopus boulengeri*). Many of the endemics, and some of the other species present, are relicts of past drier epochs when desert and Savanna biomes expanded to link up with similar biomes in northeast Africa (Werger, 1978). This arid corridor enabled flora and fauna to move between the two regions. Many discontinuous populations of the same species, genera and families with representatives in each region indicate that the corridor formed many times, most recently about 18,000 years ago. Among the fauna to exhibit this interrupted distribution are the bat-eared fox, olive toad (*Bufo garmani*), and fawn-coloured and sabota larks (*Mirafra africanoides*, *M. sabota*) (Vernon, 1999).

Apart from the occasional lizard no other reptile or amphibian species were observed during the site survey. The project footprint may provide habitat for a number of reptile species, but they would most likely be terrestrial species adapted to the dry Nama-Karoo. No amphibian species are likely to occur due to a lack of aquatic and wetland habitat in the proposed footprint.

6. IMPACT ASSESSMENT METHOD

The objective of this study was to evaluate the botanical diversity of the property area in order to identify significant environmental features which might have been impacted as a result of the development. The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al.*, 2005), were used to evaluate the botanical significance of the property with emphasis on:

- Significant ecosystems
 - Threatened or protected ecosystems
 - Special habitats
 - Corridors and or conservancy networks
- Significant species
 - Threatened or endangered species
 - Protected species

6.1. DETERMINING SIGNIFICANCE

Determining impact significance from predictions of the nature of the impact has been a source of debate and will remain a source of debate. The author used a combination of scaling and weighting methods to determine significance based on a simple formula. The formula used is based on the method proposed by Edwards (2011). However, the criteria used were adjusted to suite its use for botanical assessment. In this document significance rating was evaluated using the following criteria (Refer to Table 4).

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (Edwards 2011)

Table 4: Categories and criteria used for the evaluation of the significance of a potential impact

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
CONSERVATION VALUE Refers to the intrinsic value of an attribute or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and fragmentation or its value in terms of the protection of habitat or species	The attribute is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with unlikely possibility of species loss.	The attribute is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare & endangered species.	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.
LIKELIHOOD Refers to the probability of the specific impact occurring as a result of the proposed activity	Under normal circumstances it is almost certain that the impact will not occur.	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.	The likelihood of the impact occurring, under normal circumstances is 50/50, it may or it may not occur.	It is very likely that the impact will occur under normal circumstances.	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.
DURATION Refers to the length in time during which the activity is expected to impact on the environment.	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).	Impact is medium-term and reversible with mitigation, but will last for some time after construction and may require on-going mitigation. Rehabilitation time is expected to be longer (5-15 years).	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and is likely to require on-going mitigation. Rehabilitation time is expected to be longer (15-50 years).	The impact is expected to be permanent.
EXTENT Refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur.	Under normal circumstances the impact will be contained within the construction footprint.	Under normal circumstances the impact might extent outside of the construction site (e.g. within a 2 km radius), but will not affect surrounding properties.	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding land owners or – users, but still within the local area (e.g. within a 50 km radius).	Under normal circumstances the impact might extent to the surrounding region (e.g. within a 200 km radius), and will regional land owners or –users.	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).
SEVERITY Refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur.	It is expected that the impact will have little or no affect (barely perceptible) on the integrity of the surrounding environment. Rehabilitation not needed or easily achieved.	It is expected that the impact will have a perceptible impact on the surrounding environment, but it will maintain its function, even if slightly modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have an impact on the surrounding environment, but it will maintain its function, even if moderately modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have a severe impact on the surrounding environment. Functioning may be severely impaired and may temporarily cease. Rehabilitation will be needed to restore system integrity.	It is expected that the impact will have a very severe to permanent impact on the surrounding environment. Functioning irreversibly impaired. Rehabilitation often impossible or unfeasible due to cost.

6.2. SIGNIFICANCE CATEGORIES

The formal NEMA EIA application process was developed to assess the significance of impacts on the surrounding environment (including socio-economic factors), associated with any specific development proposal in order to allow the competent authority to make informed decisions. Specialist studies must advise the environmental assessment practitioner (EAP) on the significance of impacts in his field of specialty. In order to do this, the specialist must identify all potentially significant environmental impacts, predict the nature of the impact and evaluate the significance of that impact should it occur. Potential significant impacts are evaluated, using the method described above, in order to determine its potential significance. The potential significance is then described in terms of the categories given in Table 5.

Table 5: Categories used to describe significance rating (adjusted from DEAT, 2002)

SIGNIFICANCE	DESCRIPTION
Insignificant or Positive (4-22)	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or the impact may be positive.
Low (23-36)	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium Low (37-45)	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Social, cultural and economic activities can continue unchanged, or impacts may have medium to short term effects on the social and/or natural environment within site boundaries.
Medium (46-55)	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. Social, cultural and economic activities of communities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long term effect on the social and/or natural environment, within site boundary.
Medium high (56-63)	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. Social, cultural and economic activities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long-term effect on the social and/or natural environment, beyond site boundary within local area.
High (64-79)	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted and may come to a halt. These impacts will usually result in long-term change to the social and/or natural environment, beyond site boundaries, regional or widespread.
Unacceptable (80-100)	An impact of the highest order possible. There is no possible mitigation that could offset the impact. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

7. DISCUSSING BOTANICAL SENSITIVITY

The aim of impact assessment is to determine the vulnerability of a habitat to a specific impact. In order to do so, the sensitivity of the habitat should be determined by identifying and assessing the most significant environmental aspects of the site against the potential impact(s). For this development the following biodiversity aspects was considered:

- **Location:** The proposed development footprint is located on Municipal property, adjacent to existing town developments. Portions of the footprint had already been degraded as a result of past practices.
- **Activity:** The proposed activity is expected to result in a permanent transformation of approximately 95 ha of land, of which approximately 60 - 70% is still covered by indigenous vegetation in good condition.
- **Geology & Soils:** No special features such as true quartz patches or heuweltjies were observed in or near to the larger footprint area that may result in specialised plant habitat.
- **Land use and cover:** The footprint is on municipal land in close proximity to the town of Groblershoop. Portions of the footprint is heavily disturbed as a result of illegal dumping, old ponds (e.g. sewerage works) and other physical disturbances. Although the area is grazed by livestock from the local community most of the footprint still supports indigenous vegetation in good condition.
- **Vegetation status:** The vegetation is not considered a threatened vegetation type, but conservation targets have not yet been met.
- **Conservation priority areas:** According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA. The site will not impact on any recognised centre of endemism.
- **Connectivity:** The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.
- **Watercourses and wetlands:** Not evaluated in this study as a separate freshwater impact assessment has been commissioned as part of the NEMA EIA process.
- **Protected or endangered plant species:** The most significant botanical aspect of this site is the presence of a 14 protected Sheppard trees (*Boscia albitrunca*), some of which were in excellent condition (refer to Table 2). A number of Northern Cape Nature Conservation Act, protected species were also observed (Refer to Table 3).
- **Alien and Invasive Plant species:** A number of *Prosopis* trees were observed, with denser stands in the northern portion of the property. These plants should be removed responsibly before development commence.

7.1. IMPACT ASSESSMENT

Table 6 rates the significance of environmental impacts associated with the proposed development. It also evaluates the expected accumulative effect of the proposed development as well as the No-Go option.

Table 6: Impact assessment associated with the proposed development

Impact assessment								
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion
Geology & soils: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	2	1	5	2	1	18	No special habitats observed.
	With mitigation	2	1	3	1	1	12	Protect all significant indigenous tree species (even if it has to be incorporated within the development).
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	3	5	2	2	24	Permanent transformation of approximately 95ha of indigenous vegetation used for grazing to housing.
	With mitigation	2	2	3	1	1	14	Potential beneficial socio-economic impact (much needed housing project).
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	3	5	3	3	28	Permanent transformation of 95 ha of slightly disturbed Bushmanland Arid Grassland (Least Threatened).
	With mitigation	2	2	3	2	2	18	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	5	3	3	42	The development will impact on a proposed CBA. However, there is no alternative location on the property that will not impact on the same CBA.
	With mitigation	2	2	3	2	2	18	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	2	3	5	3	3	28	The transformation will destroy connectivity within the site, but will not result in a significant impact on the surrounding area, where connectivity is still excellent
	With mitigation	2	2	3	2	2	18	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Watercourses and wetlands: Potential impact on natural water courses and its ecological support areas.	Without mitigation						0	N/a (Refer to the Freshwater specialist report).
	With mitigation						0	
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	3	3	5	3	3	42	A number of protected species were observed, most notably a number of nationally protected tree species.
	With mitigation	2	2	3	1	2	16	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation	3	3	4	3	3	39	For most of the property, only the occasional Prosopis trees were observed. However, towards the northern portions of the site, denser stands were observed.
	With mitigation	2	1	2	1	1	10	Special care must be taken during their removal (in order to avoid re-sprouting).

Impact assessment								
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion
Veld fire risk: Potential risk of veld fires as a result of the activities.	Without mitigation	1	2	3	3	2	10	Veld fire risk low.
	With mitigation	1	1	1	1	1	4	Address fire danger throughout construction.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	3	5	3	3	42	Permanent transformation of approximately 95 ha of natural veld for urban development.
	With mitigation	2	2	3	2	2	18	Refer to all the mitigation recommendations above.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	3	4	2	3	36	Slow degradation of natural veld as a result of illegal dumping, physical disturbances and grazing practices.
	With mitigation						0	

According Table 6, the main impacts associated with the proposed development will be:

- The transformation of 95 ha of indigenous vegetation within a proposed CBA; and
- The potential impact on a number of nationally protected trees as well as provincially protected plant species.

However, there is no logical alternative site, located on Municipal land that will not impact on the same CBA. In this case, about 30 – 40% of the proposed footprint is already impacted as result of urban related activities of the past and present.

The No-Go option is not likely to result in a “no-impact” scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site (illegal dumping & construction activities).

The cumulative impact (even without mitigation) is expected to be relatively **Medium-Low**, but this can be reduced to **Low or Very Low** through mitigation.

8. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 95 ha of land, of which approximately 60 - 70% is still covered by indigenous vegetation in good condition. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, 14 protected Sheppard trees (*Boscia albitrunca*), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.

According to the impact assessment given in Table 6 the development is likely to result in a relative **Medium-Low** impact, which can be reduced to a **Low** impact with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity.

8.1. MITIGATION ACTIONS

The following mitigation actions should be implemented to ensure that the proposed development does not pose a significant threat to the environment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must include the recommendations made in this report.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and any other conditions pertaining to specialist studies.
- **Before any work is done** protected tree species must be marked and demarcated (Refer to Table 2).
- **Before any work is done** search & rescue as discussed in Table 3 must be completed.
- Lay-down areas or construction sites must be located within the construction footprint.
- No clearing of any area outside of the construction footprint may be allowed.
- All waste that had been illegally dumped within the footprint must be removed to a Municipal approved waste disposal site.
- An integrated waste management approach must be implemented during construction.
 - Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
- Alien invasive *Prosopis* plants within the footprint (and immediate surroundings) must be removed in a responsible way (to ensure against regrowth).

9. REFERENCES

- Acocks, J.P.H. 1953.** Veld types of South Africa. *Mem. Bot. Surv. S. Afr.* No. 28: 1-192.
- Anon, 2008.** Guideline regarding the determination of bioregions and the preparation and publication of Bioregional Plans. April 2008. Government Notice No. 291 of 16 March 2009.
- Barnes, K.N. 2000.** Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg, South Africa. In www.worldwildlife.org/ecoregions/at1314.
- Chapin III, F.S., Zavaleta, E.S., Eviner, V.T., Naylor, R.L., Vitousek, P.M., Reynolds, H.L., Hooper, D.U., Lavorel, S., Sala, O.E., Hobbie, S.E. & Mack, M.C., 2000.** Consequences of changing biodiversity. *Nature*, 405(6783), pp.234-242.
- De Villiers C.C., Driver, A., Brownlie, S., Clark, B., Day, E.G., Euston-Brown, D.I.W., Helme, N.A., Holmes, P.M., Job, N. & Rebelo, A.B. 2005.** Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.
- Dean, W.R.J., Milton, S.J., Watkeys, M.K. & Hockey, P.A.R. 1991.** Distribution, habitat preference and conservation status of the Red Lark *Certhilauda burra* in Cape Province, South Africa. *Biological Conservation* 58: 257-274. In www.worldwildlife.org/ecoregions/at1314.
- DEAT, 2002.** Impact significance. Integrated Environmental Management, Information series 5. Department of Environmental Affairs and Tourism (DEAT). Pretoria.
- Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012.** National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria
- Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J.L., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005.** National spatial biodiversity assessment 2004: priorities for biodiversity conservation in South Africa. *Strelitzia*, 17. South African National Biodiversity Institute, Pretoria.
- Edwards, R. 2011.** Environmental impact assessment method. Unpublished report for SiVest (Pty) Ltd. Environmental division. 9 May 2011.
- Eslar, K.J., Milton, S.J. & Dean, W.R. (Red).** Karooveld – Ekologie en bestuur. Briza publications, Pretoria.
- Hilton-Taylor, C. 2000.** The IUCN red list of threatened species. IUCN, Gland, Switzerland and Cambridge, United Kingdom.
- Holness, S. & Oosthuysen, E. 2016.** Critical Biodiversity Areas of the Northern Cape: Technical Report. Available from the Biodiversity GIS website at <http://bgis.sanbi.org/project.asp>
- Le Roux, A. 2015.** Wild flowers of Namaqualand. A botanical society guide. Fourth revised edition. Struik Nature. Cape Town.
- Lepczyk, C.A., La Sorte, F.A., Aronson, M.F., Goddard, M.A., MacGregor-Fors, I., Nilon, C.H. and Warren, P.S., 2017.** Global patterns and drivers of urban bird diversity. In "*Ecology and conservation of birds in urban environments*" (pp. 13-33). Springer, Cham.
- Low, A.B. & Rebelo, A.(T.)G. (eds.) 1996.** *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.
- Manning, J. 2008.** Namaqualand Eco Guide. Briza Publications. Pretoria
- McCann, K. 2000.** Blue Crane (*Anthropoides paradiseus*). Pages 92-94 in K.N. Barnes, editor. The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg, South Africa. In www.worldwildlife.org/ecoregions/at1314.
- McDonald, R.I., Mansur, A.V., Ascensão, F., Crossman, K., Elmquist, T., Gonzalez, A., Güneralp, B., Haase, D., Hamann, M., Hillel, O. and Huang, K., 2020.** Research gaps in knowledge of the impact of urban growth on biodiversity. *Nature Sustainability*, 3(1), pp.16-24.
- Mthombeni, T.F. 2019.** Vegetation classification of the Witsand Nature Reserve, Northern Cape Province,

- South Africa. Submitted in fulfilment of the requirements in respect of the Magister Scientiae. Department of Plant Sciences, University of the Free State. January 2019.
- Mucina, L. & Rutherford, M.C. (eds.) 2006.** The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- Mucina, L., Rutherford, M.C., Palmer, A.R., Milton, S.J., Scott, L., Lloyd, J.W., Van der Merwe, B., Hoare, D.B., Bezuidenhout, H., Vlok, J.H.J., Euston-Brown, D.I.W., Powrie, L.W. and Dold, A.P. 2006.** Nama-Karoo Biome. In Mucina, L. & Rutherford, M.C. 2006. (Eds.). *The Vegetation of South Africa. Lesotho & Swaziland. Strelitzia* 19. South African National Biodiversity Institute, Pretoria. Pp. 325 – 347.
- NDBSP. 2008.** Namakwa District Biodiversity Sector Plan. A report compiled for the Namaqualand District Municipality in order to ensure that biodiversity information can be accessed and utilized by local municipalities within the Namakwa District Municipality (NDM) to inform land use planning and development as well as decision making processes within the NDM.
- Pool-Starvliet, R. 2017.** Northern Cape Biodiversity Spatial Plan Handbook. Biodiversity GIS Home. <http://bgis.sanbi.org>.
- Razafindratsima, O.H., Brown, K.A., Carvalho, F., Johnson, S.E., Wright, P.C. and Dunham, A.E., 2018.** Edge effects on components of diversity and above-ground biomass in a tropical rainforest. *Journal of applied ecology*, 55(2), pp.977-985.
- Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004.** South Africa National Spatial Biodiversity Assessment 2004: Technical report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.
- Roux, P.W., and G.K. Theron. 1986.** Vegetation change in the Karoo biome. In R. M. Cowling and P. W. Roux, editors. *The Karoo biome: a preliminary synthesis. Part 2 - Vegetation and history.* South African National Scientific Programmes Report No. 142.
- Shearing, D. 1994.** Karoo. *South African Wild Flower Guide* 6. Botanical Society of South Africa. Kirstenbosch.
- Skead, C.J. 1982.** Historical mammal incidence in the Cape Province Vol 1: The western and northern Cape. Department Nature and Environmental Conservation, Cape Town. In www.worldwildlife.org/ecoregions/at1314.
- Skinner, J.D., and R.H.N. Smithers. 1990.** The mammals of the southern African subregion. University of Pretoria, Pretoria.
- South African National Biodiversity Institute. 2006.** South African National Botanical Institute: Biodiversity GIS Home. <http://bgis.sanbi.org> (as updated).
- South African National Biodiversity Institute. 2012.** Vegetation map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012.
- South African National Biodiversity Institute. 2015.** Statistics: Red List of South African Plants version (as updated). Downloaded from Redlist.sanbi.org on 2017/06/15.
- Van Wyk, A.E., & Smith, G.F. 2001.** Regions of floristic endemism in South Africa. A review with emphasis on succulents. Umdaus press. Hatfield.
- Vernon, C.J. 1999.** Biogeography, endemism and diversity of animals in the Karoo. Pages 57-78 in W.R.J. Dean and S.J. Milton, editors. *The Karoo. Ecological patterns and processes.* Cambridge University Press, Cambridge. In www.worldwildlife.org/ecoregions/at1314.
- Werger, M.J.A. 1978.** Biogeographical divisions of southern Africa. Pages 231-99 in M.J.A. Werger and W. Junk, editors. *Biogeography and ecology of southern Africa. The Hague.* In www.worldwildlife.org/ecoregions/at1314.

APPENDIX 1: COMPLIANCE WITH APPENDIX 6 OF GN. NO. 982 (4 DECEMBER 2014)

Specialist reports

1. A specialist report prepared in terms of these regulations must contain -	
	Refer to:
a) Details of –	
(i) The specialist who prepared the report; and	Refer to Page ii & Appendix 2
(ii) The expertise of the specialist to compile a specialist report including a curriculum vitae;	Refer to Appendix 2
b) A declaration that the specialist is independent in a form as may be specified by the competent authority;	Refer to Page ii
c) An indication of the scope of, and the purpose for which the report was prepared;	Refer to Heading 1.1
d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Refer to Heading 3
e) A description of the methodology adopted in preparing the report or carrying out the specialist process inclusive of equipment and modelling used;	Refer to Heading 3
f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructures, inclusive of a site plan identifying site alternatives;	Refer to Headings 4.1, 4.2, 4.3, 4.4, 4.6.
g) An identification of any areas to be avoided, including buffers;	Refer to Figure 7
h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Figure 7
i) A description of any assumptions made and any uncertainties or gaps of knowledge;	Refer to Heading 3
j) A description of the findings and potential implications of such findings on the impact of the proposed activity, [including identified alternatives on the environment] or activities;	Refer to Heading 7
k) Any mitigation measures for inclusion in the EMPr;	Refer to Heading 8.1
l) Any conditions for inclusion in the environmental authorization;	None
m) Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Refer to Heading 8.1
n) A reasoned opinion -	
(i) [as to] whether the proposed activity, activities or portions thereof should be authorized;	Refer to the "Main conclusion" within the executive summary (Page i)
(iA) regarding the acceptability of the proposed activity or activities; and	
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable the closure plan;	Refer to Heading 8.1
o) A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/a
p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/a
q) Any information requested by the competent authority.	N/a
2. Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

Curriculum Vitae: Peet JJ Botes

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Profession:	Environmental Consultant & Auditing
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Qualifications:	BSc (Botany & Zoology), with Nature Conservation III & IV as extra subjects; Dept. of Natural Sciences, Stellenbosch University 1989. Hons. BSc (Plant Ecology), Stellenbosch University, 1989 More than 20 years of experience in the Environmental Management Field (Since 1997 to present).
Professional affiliation:	Registered Professional <u>Botanical, Environmental and Ecological Scientist</u> at SACNASP (South African Council for Natural Scientific Professions) since 2005.
SACNAP Reg. No.:	400184/05

BRIEF RESUME OF RELEVANT EXPERIENCE

1997-2005: Employed by the Overberg Test Range (a Division of Denel), responsible for managing the environmental department of OTB, developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

2005-2010: Joined Enviroscentific, as an independent environmental consultant specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and

strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with EnviroScientific he performed more than 400 biodiversity and environmental legal compliance audits.

2010-2017: Joined EnviroAfrica, as an independent Environmental Assessment Practitioner and Biodiversity Specialist, responsible for Environmental Impact Assessments, Biodiversity & Botanical specialist reports and Environmental Compliance Audits. During this time Mr Botes compiled more than 70 specialist Biodiversity & Botanical impact assessment reports ranging from agricultural-, pipelines- and solar developments.

2017-Present: Establish a small independent consultancy (PB Consult) specialising in Environmental Audits, Biodiversity and Botanical specialist studies as well as Environmental Impact Assessment.

LIST OF MOST RELEVANT BOTANICAL & BIODIVERSITY STUDIES

- Botes, P. 2007: Botanical assessment. Schaapkraal, Erf 644, Mitchell's Plain. A preliminary assessment of the vegetation in terms of the Fynbos Forum: Ecosystem guidelines. 13 November 2007.
- Botes, P. 2008: Botanical assessment. Schaapkraal Erf 1129, Cape Town. A preliminary assessment of the vegetation using the Fynbos Forum Terms of Reference: Ecosystem guidelines for environmental Assessment in the Northern Cape. 20 July 2008.
- Botes, P. 2010(a): Botanical assessment. Proposed subdivision of Erf 902, 34 Eskom Street, Napier. A Botanical scan and an assessment of the natural vegetation of the site to assess to what degree the site contributes towards conservation targets for the ecosystem. 15 September 2010.
- Botes, P. 2010(b): Botanical assessment. Proposed Loeriesfontein low cost housing project. A preliminary Botanical Assessment of the natural veld with regards to the proposed low cost housing project in/adjacent to Loeriesfontein, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 10 August 2010.
- Botes, P. 2010(c): Botanical assessment: Proposed Sparrenberg dam, on Sparrenberg Farm, Ceres. . A Botanical scan and an assessment of the natural vegetation of the site. 15 September 2010.
- Botes, P. 2011: Botanical scan. Proposed Cathbert development on the Farm Wolfe Kloof, Paarl (Revised). A botanical scan of Portion 2 of the Farm Wolfe Kloof No. 966 (Cathbert) with regards to the proposed Cathbert Development, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 28 September 2011.
- Botes, P. 2012(a): Proposed Danielskuil Keren Energy Holdings Solar Facility on Erf 753, Danielskuil. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 17 March 2012.
- Botes, P. 2012(b): Proposed Disselfontein Keren Energy Holdings Solar Facility on Farm Disselfontein no. 77, Hopetown. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
- Botes, P. 2012(c): Proposed Kakamas Keren Energy Holdings Solar Facility on Remainder of the Farm 666, Kakamas. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 March 2012.
- Botes, P. 2012(d): Proposed Keimoes Keren Energy Holdings Solar Facility at Keimoes. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 9 March 2012.
- Botes, P. 2012(e): Proposed Leeu-Gamka Keren Energy Holdings Solar Facility on Portion 40 of the Farm Kruidfontein no. 33, Prince Albert. A Biodiversity Assessment (with botanical input) taking

into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.

- Botes, P. 2012(f): Proposed Mount Roper Keren Energy Holdings Solar Facility on Farm 321, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
- Botes, P. 2012(g): Proposed Whitebank Keren Energy Holdings Solar Facility on Farm no. 379, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.
- Botes, P. 2012(h): Proposed Vanrhynsdorp Keren Energy Holdings Solar Facility on Farm Duinen Farm no. 258, Vanrhynsdorp. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 April 2012.
- Botes, P. 2012(i): Askham (Kameelduin) proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). 1 November 2012.
- Botes, P. 2013(a): Groot Mier proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(b): Loubos proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(c): Noenieput proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(d): Rietfontein proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(e): Welkom proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(f): Zyperfontein Dam Biodiversity & Botanical Scan. Proposed construction of a new irrigation dam on Portions 1, 3, 5 & 6 of the Farm Zyperfontein No. 66, Vanrhynsdorp (Northern Cape) and a scan of the proposed associated agricultural enlargement. September 2013.
- Botes, P. 2013(g): Onseepkans Canal: Repair and upgrade of the Onseepkans Water Supply and Flood Protection Infrastructure, Northern Cape. A Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). August 2013.
- Botes, P. 2013(h): Biodiversity scoping assessment with regards to a Jetty Construction On Erf 327, Malagas (Matjiespoort). 24 October 2013.
- Botes, P. 2013(i): Jacobsbaai pump station and rising main (Saldanha Bay Municipality). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 30 October 2013.
- Botes, P. 2014(a): Brandvlei Bulk Water Supply: Proposed construction of a 51 km new bulk water supply pipeline (replacing the existing pipeline) from Romanskolk Reservoir to the Brandvlei Reservoir, Brandvlei (Northern Cape Province). A preliminary Biodiversity & Botanical scan

in order to identify significant environmental features (and to identify the need for additional studies if required). 24 February 2014.

- Botes, P. & McDonald Dr. D. 2014: Loeriesfontein Bulk Water Supply: Proposed construction of a new bulk water supply pipeline and associated infrastructure from the farm Rheeboekfontein to Loeriesfontein Reservoir, Loeriesfontein. Botanical scan of the proposed route to determine the possible impact on vegetation and plant species. 30 May 2014.
- Botes, P. 2014(b): Kalahari-East Water Supply Scheme Extension: Phase 1. Proposed extension of the Kalahari-East Water Supply Scheme and associated infrastructure to the Mier Municipality, ZF Mgcawu District Municipality, Mier Local Municipality (Northern Cape Province). Biodiversity & Botanical scan of the proposed route to determine the possible impact on biodiversity with emphasis on vegetation and plant species. 1 July 2014.
- Botes, P. 2014(c): The proposed Freudenberg Farm Homestead, Farm no. 419/0, Tulbagh (Wolseley Area). A Botanical scan of possible remaining natural veld on the property. 26 August 2014.
- Botes, P. 2014(d): Postmasburg WWTW: Proposed relocation of the Postmasburg wastewater treatment works and associated infrastructure, ZF Mgcawu District Municipality, Tsantsabane Local Municipality (Northern Cape Province). Biodiversity and botanical scan of the proposed pipeline route and WWTW site. 30 October 2014.
- Botes, P. 2015(a): Jacobsbaai pump station and rising main (Saldanha Bay Municipality) (Revision). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 21 January 2015.
- Botes, P. 2015(b): Steenkampspan proving ground. Proposed establishment of a high speed proving (& associated infrastructure) on the farm Steenkampspan (No. 419/6), Upington, ZF Mgcawu (Siyanda) District Municipality, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 20 February 2015.
- Botes, P. 2015(c): Proposed Bredasdorp Feedlot, Portion 10 of Farm 159, Bredasdorp, Cape Agulhas Municipality, Northern Cape Province. A Botanical scan of the area that will be impacted. 28 July 2015.
- Botes, P. 2016(a): OWK Raisin processing facility, Blaauwskop Settlement, Erf 151, Kenhardt, Northern Cape Province. A Botanical scan of the proposed footprint. 26 May 2016.
- Botes, P. 2016(b): Onseepkans Agricultural development. The proposed development of ±250 ha of new agricultural land at Onseepkans, Northern Cape Province. Biodiversity and Botanical Scan. January 2016.
- Botes, P. 2016(c): Henkries Mega-Agripark development. The proposed development of ±150 ha of high potential agricultural land at Henkries, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 28 February 2016.
- Botes, P. 2016(d): Proposed Namaqualand Regional Water Supply Scheme high priority bulk water supply infrastructure upgrades from Okiep to Concordia and Corolusberg. Biodiversity Assessment of the proposed footprint. March 2016.
- Botes, P. 2017: The proposed new Namaqua N7 Truck Stop on Portion 62 of the Farm Biesjesfontein No. 218, Springbok, Northern Cape Province. Botanical scan of the proposed footprint. 10 July 2017.
- Botes, P. 2018(a): Kamieskroon Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Kamiesberg, Northern Cape Province. Botanical scan of the proposed footprint. 20 February 2018
- Botes, P. 2018(b): Rooifontein Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Rooifontein, Northern Cape Province. Botanical scan of the proposed footprint. 23 February 2018

- Botes, P. 2018(c): Paulshoek Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Paulshoek, Northern Cape Province. Botanical scan of the proposed footprint. 27 March 2018.
- Botes, P. 2018(d): Kakamas Waste Water Treatment Works Upgrade – Construction of a new WWTW and rising main, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 1 August 2018.
- Botes, P. 2018(e): Kakamas Bulk Water Supply – New bulk water supply line for Kakamas, Lutzburg & Cillie, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 4 August 2018.
- Botes, P. 2018(f): Wagenboom Weir & Pipeline – Construction of a new pipeline and weir with the Snel River, Breede River Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 7 August 2018.
- Botes, P. 2018(g): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2018(h): Tripple D farm agricultural development – Development of a further 60 ha of vineyards, Erf 1178, Kakamas, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2018(i): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2019(a): Lethabo Park Extension – Proposed extension of Lethabo Park (Housing Development) on the remainder of the Farm Roodepan No. 70, Erf 17725 and Erf 15089, Roodepan Kimberley. Sol Plaaitye Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint (with biodiversity inputs). 15 May 2019.
- Botes, P. 2019(b): Verneujkpan Trust agricultural development – The proposed development of an additional ±250 ha of agricultural land on Farms 1763, 2372 & 2363, Kakamas, Northern Cape Province. 27 June 2019.