

BIODIVERSITY ASSESSMENT (Rev. 1)

VERNEUJKPAN TRUST AGRICULTURAL DEVELOPMENT, KAKAMAS

THE PROPOSED DEVELOPMENT OF AN ADDITIONAL ±200 HA OF AGRICULTURAL LAND ON FARMS 1763, 2372 & 2363 KAKAMAS, KAKAMAS SOUTH SETTLEMENT, KHAI !GARIB LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE.



01 April 2020

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SUMMARY - MAIN CONCLUSIONS

VEGETATION TYPE	Bushmanland Arid Grassland				
	Bushmanland Arid Grassland is not considered a threatened vegetation type, with more than 99% remaining. However only 4% is formally conserved (Augrabies Falls National Park). Further conservation options must thus be investigated. 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 NCCBA maps were used to guide the identification of potential significant sites.				
VEGETATION ENCOUNTERED	Bushmanland Arid Grassland is generally described as sparsely vegetated (semi-desert) low shrubland dominated by white grasses (<i>Stipagrostis</i> species) on gently sloping or irregular plains, which can, in years of abundant rainfall, have rich displays of annual herbs. In this case "typical" Bushmanland Arid Grassland was observed as one moved away from the larger river systems (e.g. the Hartbees River) (e.g. proposed development sites 1, 2, 3 and 9. Next to the Hartbees River the deeper sandy soils (together with better availability of water) the vegetation is transformed into sparse woodland dominated by magnificent trees like <i>Vachellia</i> erioloba, <i>Euclea pseudebenus, Ziziphus mucronata</i> and <i>Tamarix usneoides</i> (e.g. proposed development sites $4 - 8$ and $10 - 11$).				
	Three plant communities were encountered namely:				
	 A sparse (semi-desert type) low shrubland with grasses sometimes present (that will be more prominent and even dominating after rain) on the open undulating plains. 				
	 A denser and higher riparian vegetation was encountered next to the watercourses. The more pronounce these water courses the more established the riparian zone became. 				
	 Sparse woodland dominated by magnificent trees was encountered in the deeper sandy soils next to the Hartbees River. 				
	Because of the arid nature of the region (and the unpredictability of rainfall) the carrying capacity of the veld is very low and much of the natural veld has suffered from incorrect grazing or overgrazing practices since the early 19 th century (after farms became fenced).				
CONSERVATION PRIORITY AREAS	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). According to the Northern Cape Critical Biodiversity Areas (2016), all of the proposed sites fall within a CBA (critical biodiversity area). The proposed development will have a permanent impact on a CBA.				
	None of the sites will impact on any recognised centre of endemism.				
CONNECTIVITY	The proposed permanent impact on 200 ha of land will have an impact on connectivity (within a CBA). However, for the most part the impacts are located next to existing agricultural land and will link up with these features. The existing agricultural footprint will enlarge, but in the larger scheme of things the additional impact on connectivity will not be significant larger and even after the proposed development connectivity will remain good.				
LAND-USE	Land use is primarily focused on agriculture, with macadamia and lucerne, production the dominant land use and livestock grazing a secondary land use. The possible impact on socio-economic activities is likely to be positive, as the treated water will be used for beneficial irrigation and result in more job opportunities.				
PROTECTED PLANT	The following protected or endangered species was encountered / expected:				
SPECIES	• No red-listed species (Heading 4.6.1).				

- No NEM: BA protected plants (Heading 4.6.2).
- Three (3) NFA protected trees were encountered namely: *Boscia albitrunca, Euclea pseudebenus & Vachellia erioloba*. (Heading 4.6.3)
- Six (6) NCNCA protected plant species were encountered, but more can be expected (e.g. annual herbs which only shows after good rains) (Heading 4.6.4).

A number of protected plant species were observed, most notably the potential impact on nationally protected tree species like *Vachellia erioloba*, *Euclea pseudebenus* and *Boscia albitrunca*. However, the sites were specifically chosen to minimise the impact on water courses and the protected tree species (while still utilising the best available agricultural land). As a result many of the trees observed already falls outside of the proposed footprints. The owner has also committed (confirmed by previous development practices on this property) to the protection of all significant indigenous trees (even if they remain within agricultural land). Non-the-less, it is expected that a number of smaller *Boscia foetida* species and provincially protected species will be impacted.

WATER COURSES ANDPlease note that a separate freshwater report (Watsan Africa, 2019) was commissioned for
this development. As a result this report will not address potential impacts on watercourses
or wetlands, but only focus on the vegetation within the riparian zone.

 MAIN CONCLUSION
 The proposed development will result in the permanent transformation of approximately 200ha of natural veld to intensive agriculture. According to the impact assessment given in Table 10, with good environmental control, the development is likely to result in a Medium/Low impact on the environment.

With the correct mitigation it is considered highly unlikely that the proposed development will contributed 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 SINCE IT IS UNLIKELY TO RESULT IN IRREVERSIBLE ENVIRONMENTAL IMPACT.

The development is likely to result in potential significant beneficial socio-economic gain, while the no-go option will not contribute significantly to national or provincial conservation targets.

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 en 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:

27 June 2019

Date:

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1. INTRODUCTION

Kakamas is a small town founded in 1898 and located in the Kai !Garib Municipality of the Northern Cape province of South Africa, on the banks of the Orange River. It originated as at a place where the Orange River could be relatively easily crossed (and was first known as Bassonsdrif). In 1898 a proper settlement was established and under the auspices of the Dutch Reformed Church the area was developed as an agricultural spot. It became a municipality in 1954. The name Kakamas was originally given to a drift that was known as Takemas or T'Kakamas since 1779. The name means "place of the raging cow". The economy of this town is based on farming, and thanks to irrigation from the Orange River farmers from the Kakamas area are now prime exporters of table grapes peaches, dried fruit, raisins, oranges and dates (https://en.wikipedia.org/wiki/Kakamas).

Verneujkpan Trust is a relative large agricultural unit, consisting out of various farm portions, located approximately 8 km west of Kakamas (Kakamas South Settlement). The owner is considering the development of a further 200 ha of agricultural land on Ervin 1763, 2372 and 2363 (approximately 50 000 ha in size), which will be irrigated with treated water from the new Kakamas Waste Water Treatment Works (developed by the local Municipality, but which will be located on land owned by Verneujkpan Trust). A number of pockets of land, of varying sizes, have been earmarked for development across the three Plots. These pockets had been chosen firstly because of suitability in terms of agriculture, but also took into account potential environmental constrains like water courses and protected trees. Much of the proposed land is located on previously disturbed areas or areas that are heavily grazed. The sites are located to the west, and adjacent to the Hartbees River. The proposed development will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). EnviroAfrica was appointed to perform the NEMA EIA application. The new development will be located in veld still supporting natural veld and PB Consult was appointed to conduct a botanical assessment of the larger property.

Only one vegetation type is expected, namely Bushmanland Arid Grassland (considered "Least Threatened" in terms of the National list of ecosystems that are threatened and in need of protection). As with almost all areas in the Northern Cape the site is criss-crossed by the normal ephemeral drainage lines, but some larger water courses were also encountered. These drainage lines are often associated with slightly larger shrubs and small trees that are only found in the vicinity of these water courses.

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

The town of Kakamas is located on the banks of the Orange River and along the N14, about 80 km west of Upington within the Kai !Garib Local Municipality (ZF Mgcawu District Municipality) of the Northern Cape Province (Figure 1).



Figure 1: Map showing the location of Kakamas in the Northern Cape Province

Figure 2 gives an indication of the areas already developed within the properties as well as the portions of land proposed for the new development(s). The yellow areas in Figure 2 are existing Macadamia nuts. The green circles represent existing pivots irrigation areas, while the red areas indicate the proposed new developments namely:

- 1 Represents a potential new 19.8 ha area on heavily grazed virgin land;
- 2 Represents a potential new 17.13 ha area overlapping old ostrich camps (disturbed land);
- 3 Represents a potential new 8.4 ha area, relatively undisturbed and on deeper sandy soils;
- 4 Represents a potential new 5.7 ha area, relatively undisturbed and on deeper sandy soils;
- 5 Represents a potential new 4.5 ha area, relatively undisturbed and on deeper sandy soils;
- 6 Represents a potential new 7.5 ha area, heavily grazed and on deeper sandy soils;
- 7 Represents a potential new 10.8 ha area, heavily grazed and on deeper sandy soils;
- 8 Represents a potential new 8.4 ha area, overlapping an area previously disturbed;
- 9 Represents a potential new 12.4 ha area of natural veld showing a number of physical disturbances.
- 10 Represents a potential new 6 ha area located within an area mostly covered in alien invasive plant species (e.g. Prosopis species);
- 11 Represents a potential new 11.78 ha area located within an already disturbed area (previously cultivated).



Figure 2: The proposed new development areas (red) as well as existing Macadamia nuts (yellow) and pivots (green)

2.2. <u>CLIMATE</u>

All regions with a rainfall of less than 400 mm per year are regarded as arid. This area normally receives about 106 mm of rain per year (the climate is therefore regarded as arid to very arid). Kakamas normally receives about 134 mm of rain per year, with rainfall largely in late summer/early autumn (major peak) and very variable from year to year. It receives the lowest rainfall (3 mm) in June and the highest (27 mm) in March.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	27.3	26.4	24.4	21.1	16	13.1	12.2	14.5	17.3	20.9	23.5	26.3
Min. Temperature (°C)	18.9	18.3	16.7	12.8	7.8	4.6	3.7	5.4	8.1	11.6	14.3	17.2
Max. Temperature (°C)	35.7	34.5	32.2	29.5	24.3	21.7	20.8	23.6	26.5	30.3	32.8	35.4
Avg. Temperature (*F)	81.1	79.5	75.9	70.0	60.8	55.6	54.0	58.1	63.1	69.6	74.3	79.3
Min. Temperature (°F)	66.0	64,9	62.1	55.0	46.0	40.3	38.7	41.7	46.6	52.9	57.7	63.0
Max. Temperature (*F)	96.3	94.1	90.0	85.1	75.7	71.1	69.4	74.5	79.7	86.5	91.0	95.7
Precipitation / Rainfall	17	21	27	17	9	3	4	3	3	7	13	10
(mm)												

Table 1: Average rainfall and temperatures at Kakamas (https://en.climate-data.org/location/911655/)

The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Kakamas range from 20°C in July to 35°C in January. The region is the coldest during July with temperatures as low as 3.7°C on average during the night (<u>www.saexplorer.co.za</u>). Table 1 gives a summary of temperatures and rainfall recorded at Kakamas (<u>https://en.climate-data.org/location/911655/</u>).

2.3. <u>GEOLOGY AND SOILS</u>

According to Mucina & Rutherford (2006), the geology is dominated by mudstones and shales of the Ecca Group (Prince Albert and Volksrust Formations) and Dwyka tillites, both of the early Karoo age. About 20% of rock outcrops are formed by Jurassic intrusive dolerite sheets and dykes. The soils (Refer to Figure 3) are described as soils with minimal development, usually shallow on hard or weathering rock, Glenrosa and Mispah forms, with lime generally present in the entire landscape (Fc land type) and, to a lesser extent, red-yellow apedal, freely drained soils with a high base status and usually <15% clay (Ah and Ai land types) are also found. The salt content in these soils is very high. Lime is generally present in part or most of the landscape.



Figure 3: National soils map the area covered by the proposed new development

2.4. <u>TOPOGRAPHY</u>

The most significant feature of the Verneujkpan properties, influencing topography is the Hartbees River that runs almost through the middle of the property (form south to north) as it drains towards the Orange River. From the western boundary of the property (Area 1 in Figure 2), elevation drops from approximately 699 m to about 657 m (at the Hartbees River) over a distance of just more than 3 km, with a maximum slope of 2.4% and an average slope of only 0.5%. Similarly the slope from south to north (just west of the Hartbees River), the elevation again only drops about 30m in 4,4 km with an average slope of only 0.4%.

In general aspect is not expected to have any significant influence on the vegetation. The main environmental feature that might influence vegetation will be geographical features such as water courses and rocky outcrops. As is typical of this part of the Northern Cape, small drainage lines tends to criss-cross the landscape and although the proposed sites were located to minimise the impact on these features, some of the smaller drainage lines will be impacted. In terms of vegetation, most of these drainage lines are probably not significant, apart from the larger indigenous trees that is often associated with such drainage lines and which in turns can support its own localized ecological habitat.

3. EVALUATION METHOD

Desktop studies and two site visits were performed to evaluate the proposed sites in terms of potential impacts on biodiversity and to make recommendations on potential alternative sites where necessary. The site visits was conducted during August 2018 and February of 2019. The timing of the site visit was reasonable in that essentially all perennial plants were identifiable. However, because of the lack of recent rains many of the bulb and annual plant species were not yet in flower or identifiable. The author has now done a number of botanical assessments in and around Kakamas (some of them on this same property) and is confident that a fairly good understanding of the biodiversity status in the area 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, including rivers, streams or wetlands, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).



Figure 4: Google overview, showing the proposed development sites and the physical routes inspected (yellow lines).

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 <u>concentrated in many local centres of endemism</u>.

The Kakamas 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) only one broad vegetation type is expected in the proposed area and its immediate vicinity, namely **Bushmanland Arid Grassland**. More than 99% of this vegetation still remains, but only 4% is formally conserved (Augrabies Falls National Park). According to the National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), Bushmanland Arid Grassland, remains classified as *Least Threatened*.

According to Mucina and Rutherford (20016), Bushmanland Arid Grassland is found in the Northern Cape Province spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the north-west this vegetation unit borders on desert vegetation (north-west of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. Altitude varies from 600 - 1200 m.



Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the larger area and expected vegetation

4.1. THE VEGETATION IN CONTEXT

Bushmanland Arid Grassland is part of the Nama-Karoo Biome, which is a large <u>arid landlocked</u> 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 <u>no effect of the ameliorating influences of the oceans</u>. <u>Rainfall is low and unreliable</u>, peaking in March. <u>Droughts are unpredictable and often prolonged</u>. <u>Summers</u> <u>are hot and winters cold</u> with temperature extremes ranging from -5°C in winter to 43°C in summer. However, <u>rainfall intensity can be high</u> (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 <u>potential for soil erosion</u>. In semi-arid environments such as the Nama-Karoo, <u>nutrients</u> <u>are generally located near the soil surface</u>, making it vulnerable to sheet erosion (Mucina *et. al.*, 2006).

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

4.2. 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.

• <u>Critical biodiversity areas (CBA's)</u> 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.

• <u>Ecological support areas (ESA's)</u> 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.

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).

The 2016 Northern Cape Critical Biodiversity Areas (NCCBA) gives both aquatic and terrestrial Critical Biodiversity Areas (CBAs) and ecological support areas for the Northern Cape.

According to the NCCBA (Refer to Figure 6) all of the proposed sites will fall within a terrestrial critical biodiversity area. Unfortunately, there are no alternative areas on this property that will not impact on the CBA.



Figure 6: The Northern Cape Critical Biodiversity Areas (2016) showing larger area of the proposed development footprint

4.3. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development does not impact on any recognised centre of endemism. The Gariep Centre is located to the north (quite a distance away) associated with Augrabies, Pella and Onseepkans along the border of South Africa and Namibia, while the Griqualand West Centre of Endemism starts to the east of Upington Northern Cape Province (Van Wyk & Smith, 2001).

The proposed Kakamas site does not fall within any recognised centre of endemism.

4.4. VEGETATION ENCOUNTERED

Bushmanland Arid Grassland is generally described as sparsely vegetated (semi-desert) low shrubland dominated by whit grasses (Stipagrostis species) on gently sloping or irregular plains, which can, in years of abundant rainfall, have rich displays of annual herbs. In this case "typical" Bushmanland Arid Grassland was observed as one moved away from the larger river systems (e.g. the Hartbees River) (e.g. proposed development sites 1, 2, 3 and 9. Next to the Hartbees River the deeper sandy soils (together with better availability of water) the vegetation is transformed into sparse woodland dominated by magnificent trees like *Vachellia* erioloba, *Euclea pseudebenus, Ziziphus mucronata* and *Tamarix usneoides* (e.g. proposed development sites 4 - 8 and 10 - 11).

Three plant communities were encountered namely:

• A sparse (semi-desert type) low shrubland with grasses sometimes present (that will be more prominent and even dominating after rain) on the open undulating plains (Refer to the proposed development sites 1-3 and 9).

- A denser and higher riparian vegetation was encountered next to the watercourses. The more pronounce these water courses the more established the riparian zone became.
- Sparse woodland dominated by magnificent trees was encountered in the deeper sandy soils next to the Hartbees River.

Because of the arid nature of the region (and the unpredictability of rainfall) the carrying capacity of the veld is very low and much of the natural veld has suffered from incorrect grazing or overgrazing practices since the early 19th century (after farms became fenced).

4.4.1. Vegetation: Site 1

Site 1 is located on the western edge of the larger study area (Refer to Figure 2) the furthest away from the Hartbees River. The proposed site can be described as a low undulating plain, demarcated by small seasonal water courses. The water courses are associated with a definite riparian zone of medium to large shrubs to tall trees at its northern boundary. The layout of the proposed site aims to minimise the impact on these water courses and will not impose on the riparian zone (note that in Figure 7 it seems as if the site overlaps riparian zones, but this is due to inaccuracies between the mapping systems).



Figure 7: Proposed site 1 (19.8 ha) located within seasonal streams (and protected trees encountered)

The vegetation encountered can be described as a low sparse shrubland (Photo 1), which is most likely to be dominated by a dense grassy layer after good rains. At the time of the study the grassy layer was, however, almost absent. The shrub layer was mostly dominated by the succulent *Mesembryanthemum coriarium* (*=Psilocaulon coriarium*), but also included species like *Acanthopsis disperma* (Halfmensie), Aptosimum spinescens, *Anacampseros papyracea*, *Blepharis mitrata*, *Boscia albitrunca* (occasionally), *B. foetida* (about 20 individuals), *Cynanchum viminale*, *Justicia australis* (*=Monechma genistifolium*), *Justicia incana*, *Kewa salsoloides* (*=Hypertelis salsoloides*), *Kleinia longiflora*, *Lycium cinereum*, *Parkinsonia africana*, *Rhigozum trichotomum*, *Rogeria longiflora*, *Caroxylon cf. aphyllum*, *Senegalia mellifera* and the aerial hemiparasite *Tapinanthus oleifolius*.



Photo 1: Looking from east to west over the proposed development site 1. Note the sparse shrub layer and absence of grasses (drought).

The riparian vegetation (Photo 2) associated with the small seasonal streams surrounding the proposed development site was for the most part dominated by *Senegalia mellifera* (Swarthaak) with the following species also commonly found namely, *Asparagus* cf. *cooperi, Boscia albitrunca, B. foetida, Justicia australis, Kleinia longifolia, Lasiopogon micropoides, Lessertia macrostachya, Lycium cinereum, Parkinsonia africana, Stipagrostis namaquensis, Rhigozum trichotomum, Thesium lineatum, Vachellia erioloba , Viscum capense (within the Lycium) and Ziziphus mucronata*.



Photo 2: Seasonal water course to the southwest of the proposed site 1. Note the dominance by *Senegalia mellifera* and the presence of the tall grass, *Stipagrostis namaquensis*.

4.4.1.1. PROTECTED TREES ENCOUNTERED

A number of *Vachellia erioloba* as well as *Boscia foetida* trees were encountered within or very near to the site (Refer to Figure 7). Fortunately, none of these should have to be removed.

No.	Species name	Coordinates	Comments	Recommendations
125 B albi	Boscia albitrunca	S28° 47' 40.3" E20° 31' 32.7"	Tall (2.5 m) mature tree	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
126 A erio	Vachellia erioloba	S28° 47' 37.8" E20° 31' 36.1"	Medium (3m) mature tree	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
127 B albi	Boscia albitrunca	S28° 47' 37.6" E20° 31' 39.9"	Young (2m) shrub	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
128 A erio	Vachellia erioloba	S28° 47' 36.9" E20° 31' 42.1"	Mature (>6 m) tree	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.

No.	Species name	Coordinates	Comments	Recommendations
129 A erio	Vachellia erioloba	S28° 47' 36.3" E20° 31' 45.4"	Medium (4-5m) tree in poor condition	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
131 B albi	Boscia albitrunca	S28° 47' 39.5" E20° 31' 46.0"	Mature (2.5m) tree in good condition	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.



Photo 3: One of the larger *Vachellia erioloba* trees encountered (outside of the footprint) to the northeast of the site.

4.4.2. Vegetation: Site 2 & 3 and 9

The vegetation encountered on site 2, 3 and 9 is similar to that found at site 1 with the following differences. Most of the proposed site 2 will be located on and area previously used for raising ostrich chicks (Figure 8 & Photo 4). As a result the sites are heavily degraded and almost devoid of any vegetation. However, the original vegetation (from the remaining and surroundings) would have been the same as that of site 1.



Photo 4: Site 2: Looking from south to north over the proposed site 2 (with site 3 in the background). Note the general degradation and the old ostrich chick camps to the right of the picture.

Site 2, like site 1 and 3 was mostly dominated by *Mesembryanthemum coriarium (=Psilocaulon coriarium)*, in combination with *Rhigozum trichotomum* and *Senegalia mellifera* (Photo 4). However, there were also patches dominated by *Caroxylon cf. aphyllum* in combination with *Senegalia mellifera* (Photo 5).



Photo 5: Site 3: Looking north over site 3. Note the dominance of *Caroxylon cf. aphyllum* in the foreground.

Between site 2, 3, 4 and 5, a rocky area was encountered, with a number of small rocky outcrops. Since this area is not considered for development it was not investigated as part of this study (Refer to the open section in (Figure 8 underneath).



Figure 8: Google image showing the proposed site and 3 (note the old ostrich camps in site 2)



Photo 6: Site 3: Looking north over site 3. Note the dominance of *Mesembryanthemum coriarium* (*=Psilocaulon coriarium*) in the foreground with *Senegalia mellifera* and *Parkinsonia africana* in the background.

The vegetation cover of the proposed site 3 was mostly much higher than that of site 1, but the species were and species composition was generally the same. However, 4 protected trees (one of which was dead) were encounter within the site, and a further 3 just to the north-east of the site (Refer to Table 3).



Photo 7: Site 9: Looking west to east over site 9. Note the small *Boscia albitrunca* to the right of the picture as well as the low vegetation cover.

The proposed site 9 (Photo 7), was generally much degraded, with a low cover of natural veld left. The remaining vegetation was dominated by *Rhigozum trichotomum, Mesembryanthemum coriarium (=Psilocaulon coriarium)* and *Senegalia mellifera*. Three *Boscia albitrunca* trees were also observed in this site (Refer to Table 3).

4.4.2.1. PROTECTED TREES ENCOUNTERED

The following protected tree species were encountered in or near to the proposed new sites 2, 3 & 9.

No.	Species name	Coordinates	Comments	Recommendations
132 V erio	Vachellia erioloba	S28° 47' 40.7" E20° 32' 28.9"	Medium (4m) tree.	<mark>Do not disturb</mark> : Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
133 V erio	Vachellia erioloba	S28° 47' 41.9" E20° 32' 28.1"	Young (2.4m) tree.	Do not disturb if possible
134 V erio	Vachellia erioloba	S28° 47' 41.6" E20° 32' 26.9"	Dead tree	Can be removed with permit.
135 V erio	Vachellia erioloba	S28° 47' 40.8" E20° 32' 25.6"	Mature (4.5m) tree.	<mark>Do not disturb</mark> : Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
136 V erio	Vachellia erioloba	S28° 47' 35.3" E20° 32' 41.4"	Medium (4m) tree (outside footprint)	<mark>Do not disturb</mark> if possible

Table 3: List and location of	protected tree species encountered	near the proposed site 2.3	& 9 locations
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No.	Species name	Coordinates	Comments	Recommendations
137 V erio	Vachellia erioloba	S28° 47' 35.6" E20° 32' 42.9"	Medium (4m) tree (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
139 V erio	Vachellia erioloba	S28° 47' 36.4" E20° 32' 45.1"	Mature (6-7m) tree (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
165 B albi	Boscia albitrunca	S28° 49' 09.2" E20° 33' 11.0"	Small tree in poor condition.	Do not disturb if possible
166 B albi	Boscia albitrunca	S28° 49' 07.9" E20° 33' 16.1"	Small tree (<1.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
167 B albi	Boscia albitrunca	S28° 49' 06.8" E20° 33' 18.1"	Medium tree (2m).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.

4.4.3. Vegetation: Remaining sites (4-8 & 10-11)

The remaining areas identified for potential development is all located in the deeper sandy soils in the old floodplains of the Hartbees River. The vegetation can be described as sparse woodland, dominated by magnificent *Vachellia erioloba* (Camel thorn) trees in its top stratum. The lower shrub layer was either dominated by *Senegalia mellifera* in combination with *Caroxylon cf. aphyllum* or *Senegalia mellifera* in combination with *Mesembryanthemum coriarium* or sometimes by the hardy and ecologically important grass, *Stipagrostis namaquensis*.

Other plants observed, in between the open tree canopy, includes: the tall shrubs *Lycium cinereum* and *Lycium bosciifolium*, *Ozoroa dispar* (occasionally), scattered individuals of the small tree *Parkinsonia africana*, the small trees *Senegalia mellifera*, the smaller shrubs, *Augea capensis*, *Caroxylon cf. aphyllum*, *Chascanum garipense*, *Grielum humifusum*, *Justicia australis*, *Kleinia longifolia*, *Mesembryanthemum coriarium*, *Stoeberia arborea*, *Tetraena retrofracta*, *Thesium lineatum* and *Tribulus terrestris* (*dubbeltjie*).



Figure 9: Google image showing Site 4 & 5 (green arrows) and protected trees in its vicinity

The vegetation in the proposed site 4 & 5 are very much as described as above, apart from the fact that the *Vachellia erioloba* tree layer is not well established (soils probably too shallow) and they are only found near the seasonal water course that runs between the sites (and which will be protected as part of the seasonal stream). The protected trees encountered (Refer to Figure 9 and Table 4) will not be harmed.



Photo 8: Typical vegetation encountered in site 4 & 5.

The vegetation encountered in site 6 & 7 confirms to the description given at the beginning of this section, with scattered individuals of *Vachellia erioloba*, and even the occasional *Euclea pseudebenus* and *Tamarix usneoides* encountered (Figure 10 and Photo 9).



Figure 10: Google image showing site 6 & 7 and the protected trees encountered

Although site 6 and 7 (Photo 9) were chosen to minimise the impact on seasonal water courses, a number of larger protected trees are still located within the proposed agricultural areas. Please note that the owner has indicated that he would like to protect all significant indigenous trees (as he has done in all his other developments on this farm) by incorporating them into his fields without removing them (Refer to Photo 10).



Photo 9: Looking north from site 7 towards site 6. Note the *Vachellia erioloba* trees within the site.



Photo 10: Existing macadamia orchards with Vachellia erioloba trees still standing within (arrows)

The remaining vegetation of site 8 also confirms to the description for this area, with the occasional *Vachellia erioloba* encountered. Please note that a large portion of this site has already been cultivated.

The proposed site 10 (Photo 11 & 12) refers to an area that has been impacted by many construction related activities in the past, which might include sand mining river protection actions. Apart from the poor physical state it is also characterised by dense stands of *Prosopis* trees. Again the most significant aspect of this area is the remaining protected tree species.



Photo 11: Looking from east to west over Site 10. Note the poor state of the soil and the remaining *Vachellia erioloba* trees in the background.



Photo 12: Looking from west to east (towards the Hartbees River) over Site 10. Note the denser stand of trees in the background, which include *Tamarix usneoides* and invasive alien *Prosopis* trees.

The proposed site 11 (Photo 13) was most likely ploughed in times past and presently only supports hardy pioneer species like *Caroxylon* cf. *aphyllum* (=*Salsola aphylla*), *Mesembryanthemum coriarium* (=*Psilocaulon coriarium*), *Mesembryanthemum guerichianum* and *Stoeberia arborea*.



Photo 13: Looking from south to north over site 11. Note the disturbed nature of the site and the dominance by one hardy pioneer species (*Stoeberia arborea* in this photo).

4.4.3.1. PROTECTED TREES ENCOUNTERED

The following protected tree species were encountered in or near to the proposed new sites 2, 3 & 9.

No.	Species name	Coordinates	Comments	Recommendations
140 B albi	Boscia albitrunca	S28° 47' 34.4" E20° 32' 50.5"	Tree in poor condition.	Do not disturb if possible
141 B albi	Boscia albitrunca	S28° 47' 34.9" E20° 32' 48.8"	Patch of trees (outside footprint).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
142 V erio	Vachellia erioloba	S28° 47' 35.2" E20° 32' 49.5"	Mature (10m) tree (outside footprint).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
143 V erio	Vachellia erioloba	S28° 47' 36.2" E20° 32' 51.1"	Mature (10m) tree (outside footprint).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
144 V erio	Vachellia erioloba	S28° 47' 36.5" E20° 32' 50.8"	Mature (9m) tree (outside footprint).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
145 V erio	Vachellia erioloba	S28° 47' 36.5" E20° 32' 49.2"	Mature (4m) tree (outside footprint).	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
146 V erio	Vachellia erioloba	S28° 47' 52.6" E20° 32' 51.0"	Mature tree (6m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.

 Table 4: List and location of protected tree species encountered near the proposed site 2, 3 & 9 locations

No.	Species name	Coordinates	Comments	Recommendations
147 V erio	Vachellia erioloba	S28° 47' 54.4" E20° 32' 50.0"	Young tree (4m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
148 V erio	Vachellia erioloba	S28° 47' 58.6" E20° 32' 50.2"	Young tree (3.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
149 V erio	Vachellia erioloba	S28° 47' 59.4" E20° 32' 55.3"	Mature tree (5.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
150 V erio	Vachellia erioloba	S28° 48' 08.0" E20° 32' 56.0"	Mature (2.5) (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
151 V erio	Vachellia erioloba	S28° 48' 08.3" E20° 32' 54.1"	Mature (6m) (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
152 V erio	Vachellia erioloba	S28° 48' 08.5" E20° 32' 55.0"	Mature (4.5) (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
153 E pseu	Euclea pseudebenus	S28° 48' 09.0" E20° 32' 55.2"	Young tree (outside footprint)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
154 V erio	Vachellia erioloba	S28° 48' 10.8" E20° 32' 54.7"	Mature (4m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
155 V erio	Vachellia erioloba	S28° 48' 09.6" E20° 32' 55.9"	Young (2.2m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
156 V erio	Vachellia erioloba	S28° 48' 14.8" E20° 32' 57.4"	Young (4.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
157 V erio	Vachellia erioloba	S28° 48' 18.1" E20° 32' 57.6"	Mature (5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
158 V erio	Vachellia erioloba	S28° 48' 18.5" E20° 33' 01.0"	Mature (5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
159 V erio	Vachellia erioloba	S28° 48' 21.1" E20° 33' 01.1"	Magnificent tree (7m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
160 V erio	Vachellia erioloba	S28° 48' 45.6" E20° 32' 59.4"	Mature (4.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
161 V erio	Vachellia erioloba	S28° 48' 44.8" E20° 32' 58.4"	Dead tree	
162 V erio	Vachellia erioloba	S28° 48' 44.8" E20° 32' 57.4"	Mature (8-10m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
163 V erio	Vachellia erioloba	S28° 48' 47.3" E20° 33' 02.5"	Mature (5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
164 V erio	Vachellia erioloba	S28° 48' 47.9" E20° 33' 01.7"	Mature (5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
168 V erio	Vachellia erioloba	S28° 48' 35.3" E20° 33' 17.9"	Tree in poor condition (3.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
169 V erio	Vachellia erioloba	S28° 48' 36.9" E20° 33' 17.6"	Mature (2.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
170 V erio	Vachellia erioloba	S28° 48' 36.9" E20° 33' 16.4"	Dead tree	
171 V erio	Vachellia erioloba	S28° 48' 37.3" E20° 33' 14.6"	Mature (6m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
172 V erio	Vachellia erioloba	S28° 48' 36.4" E20° 33' 14.8"	3 Trees: 2 dead, 1 young (2.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
173 V erio	Vachellia erioloba	S28° 48' 35.2" E20° 33' 12.2"	Mature (4.5)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
174 V erio	Vachellia erioloba	S28° 48' 35.0" E20° 33' 11.9"	Mature (6m)	Do not disturb: Avoid coming nearer than

No.	Species name	Coordinates	Comments	Recommendations
				1 m of the canopy (or drip line) of any tree.
175 V erio	Vachellia erioloba	S28° 48' 33.6" E20° 33' 10.5"	Mature (5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
176 V erio	Vachellia erioloba	S28° 48' 32.6" E20° 33' 10.5"	Clump of 7 trees	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
177 V erio	Vachellia erioloba	S28° 48' 32.6" E20° 33' 12.9"	Dead tree	
178 V erio	Vachellia erioloba	S28° 48' 33.0" E20° 33' 13.8"	Mature (6m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
179 V erio	Vachellia erioloba	S28° 48' 33.6" E20° 33' 14.3"	Mature (4.5)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.
180 V erio	Vachellia erioloba	S28° 46' 52.7" E20° 32' 49.0"	Mature (4.5m)	Do not disturb: Avoid coming nearer than 1 m of the canopy (or drip line) of any tree.

4.5. FLORA ENCOUNTERED

It is expected that because of the timing of the site visit a number of annuals would have been missed, some of whom might be protected in terms of the Northern Cape Nature Conservation Act (NCNCA), Act, 9 of 2009 (especially referring to species of the Aizoaceae family).

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
1.	Acanthopsis disperma	ACANTHACEAE	LC	
2.	Aptosimum spinescens	SCROPHULARIACEAE	LC	
3.	Aristida congesta	POACEAE	LC	
4.	Asparagus cf. cooperi	ASPARAGACEAE		
5.	Augea capensis	ZYGOPHYLLACEAE	LC	
6.	Anacampseros papyracea	ANACAMPSEROTACEAE		
7.	Blepharis mitrata	ACANTHACEAE	LC	
8.	Boscia albitrunca	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)
9.	Boscia foetida	BRASSICACEAE (CAPPARACEAE)	LC NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
10.	Caroxylon cf. aphyllum (=Salsola aphylla)	AMARANTHACEAE	LC	
11.	Chascanum garipense	VERBENACEAE	LC	
12.	Cynanchum viminale (=Sarcostemma viminale)	APOCYNACEAE	NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
13.	Euclea pseudebenus	EBENACEAE	LC NFA protected species	
14.	Grielum humifusum	NEURADACEAE	LC	
15.	Justicia australis (=Monechma genistifolium)	ACANTHACEAE	LC	
16.	Justicia incana (=Monechma incanum)	ACANTHACEAE		
17.	Kewa salsoloides (=Hypertelis salsoloides)	MOLLUGINACEAE		
18.	Kleinia longiflora	ASTERACEAE	LC	
19.	Lasiopogon micropoides	ASTERACEAE		

Table 5: List of species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
20.	Lessertia macrostachya	FABACEAE		
21.	Lycium bosciifolium	SOLANACEAE	LC	
22.	Lycium cinereum	SOLANACEAE	LC	
23.	Mesembryanthemum coriarium	AIZOACEAE	LC	
	(=Psilocaulon coriarium)		Protected in terms of schedule 2 of the NCNCA	Apply for a NCNCA Flora permit (DENC)
24.	Mesembryanthemum guerichianum	AIZOACEAE	LC	
			Protected in terms of schedule 2 of the NCNCA	Apply for a NCNCA Flora permit (DENC)
25.	Ozoroa dispar	ANACARDIACEAE	LC	
26.	Parkinsonia africana	FABACEAE	LC	
27.	Phragmites australis			
28.	Prosopis species	FABACEAE	Alien invasive plant species	
29.	Rhigozum trichotomum	BIGONACEAE	LC	
30.	Rogeria longiflora	PEDALIACEAE	LC	
31.	Schmidtia kalihariensis	POACEAE	LC	
32.	Senegalia mellifera (=Acacia mellifera)	FABACEAE	LC	
33.	Stipagrostis namaquensis	POACEAE	LC	
34.	Stipagrostis uniplumis	POACEAE	LC	
35.	Stoeberia arborea	AIZOACEAE	LC	
			Protected in terms of schedule 2 of the NCNCA	
36.	Tamarix usneoides	TAMARICACEAE	LC	
37.	Tapinanthus oleifolius	LORANTHACEAE	LC	
38.	Tetraena retrofracta (=Zygophyllum retrofractum)	ZYGOPHYLLACEAE	LC	
39.	Thesium lineatum	SANTALACEAE	LC	
40.	Tribulus terrestris	ZYGOPHYLLACEAE	LC	
41.	Vachellia erioloba	FABACEAE	LC NFA protected species	Apply for a NFA Tree permit (DAFF)
42.	Viscum capense	SANTALACEAE	LC	
43.	Ziziphus mucronata	RHAMNACEAE	LC	

4.6. <u>THREATENED AND PROTECTED PLANT SPECIES</u>

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 during the study (Refer to Table 5).

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 species protected in terms of NEM: BA 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).

• Three (3) species protected in terms of the NFA was observed (Refer to Table 6).

NO.	SPECIES NAME	COMMENTS	1
1.	Boscia albitrunca	Occasionally found throughout the terrain,	All mature individuals larger than 4m to be
	Sheppard's tree	Refer to Table 2-4 for their locations	protected.
2.	Euclea pseudebenus	Encountered occasionally (Site 6).	All individuals should be protected.
	Ebony Quarry / Wild-ebony		
3.	Vachellia erioloba Camel Thorn	Commonly found throughout the footprint and surroundings. Refer to Table 2-4 for	All individuals larger than 6m must be protected.
		their locations.	Only dead trees may be removed (with the necessary approvals). All efforts should be made to minimise the impact on these trees, no matter size or general condition.

 Table 6: Plant species protected in terms of the NFA encountered within the study area

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.

NO.	SPECIES NAME	COMMENTS	1
1.	Boscia albitrunca Schedule 2 protected	Occasionally observed.	Preferably not to be disturbed: The few larger individuals should be easy to avoid. However a few smaller individuals might be impacted. A NFA permit will be required as well as a NCNCA permit.
2.	Boscia foetida Schedule 2 protected	Commonly observed. However, they were mostly stumped or small species.	Search & rescue: Individuals within footprint to be transplanted to surrounding area.
3.	Cynanchum viminale Schedule 2 protected	Occasionally observed.	Larger Cynanchum plants are expected to transplant poorly. Species protection through topsoil conservation.
4.	Mesembryanthemum coriarium Schedule 2 protected	This plant is weedy a disturbance indicator occasionally observed.	No special measures needed, this is a weedy pioneer species.
5.	Mesembryanthemum guerichianum Schedule 2 protected	This plant is weedy a disturbance indicator occasionally observed.	No special measures needed, this is a weedy pioneer species.
6.	Stoeberia arborea Schedule 2 protected	Commonly found in disturbed areas	No special measures needed, this is a weedy pioneer species.

Table 7: Plant species protected in terms of the NCNCA encountered within the study area

5. FAUNA AND AVI-FAUNA

Because of its aridity and unpredictable rainfall patterns, the Nama-Karoo region favours free moving herbivores such as ostrich and springbok nomadic birds and invertebrates with variable dormancy cued by rain. Plant defence against herbivores and seed adaption for dispersal by mammals are relatively uncommon, except along rivers and seasonal pans, suggesting the transient nature of herbivores, except near water where they would have lingered longer. However, since the 19th century the vast herds of migratory ungulates indigenous to this biome have been almost completely replaced by domestic stock. Once farmers started fencing their properties into camps (following the Fencing Act of 1912), stock numbers were dramatically increased with dire consequences to plant diversity. Grazing during and immediately after droughts periods is regarded as a major cause of detrimental change in vegetation composition and were ultimately responsible for the decline of large numbers of palatable plants (Mucina *et. al.*, 2006).

In terms of status, very little of the Nama-Karoo has been transformed and the dominant land use is farming with small stock, cattle and game. Farms are fenced, but generally large, having a low grazing capacity. The biggest threat to this vegetation remains domestic livestock grazing pressure. Grazing by livestock particularly during the summer growing season, reduces the perennial grass component, while prolonged droughts kill a high proportion of perennial plants, rapidly changing vegetation composition in favour of short-lived species with soil stored seed banks. Overgrazing after drought periods can delay vegetation recovery, which will worsen the effect of subsequent droughts.

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 site visit. The location of the study area (agricultural land), the current land-use (livestock grazing), and the adjacent farming practices (including wild game hunting) would all have contributed to a disturbance factor. It is considered highly unlikely that a

true reflection of potential game species can still be encountered on the property. 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 would have been eradicated by farmers in fear of their livestock. Because of the long-term impact of human settlement on the larger areas a comprehensive faunal survey is not deemed necessary.

5.1. <u>Mammals</u>

The nearby Augrabies Falls National Park still supports an impressive diversity of larger antelope and other mammal species. However, it is highly unlikely that any of this larger game will still frequent or even visit the proposed footprint or its immediate surroundings (because of its location). Smaller game and other mammal species that may potentially still be found in this area can include the following (deducted from the list of species in the Augrabies Falls National Park: *Orycteropus afer* (Aardvark), *Pedetes capensis* (Springhare), *Phacochoerus africanus* (Common warthog), *Raphicerus campestris* (Steenbok), *Sylvicapra grimmia* (Common duiker) *Suricata suricatta* (Suricate), *Xerus inauris* (Southern African ground squirrel) and *Canis mesomelas* (Black-backed jackal). However of all the potential species listed above only the ground squirrel, steenbok droppings and one hare was observed on site.

5.2. AVI-FAUNA

This area can potentially attract a great number of bird species like Cape Buntings Cape Wagtail, Cape Southern Masked Weaver, Cinnamon-Breasted Buntings Common Waxbill, Karoo Robin-Chats, Pale Winged Starlings, Pied Wagtail, Red Eyed Bulbuls, Rock Hyraxes, Swallow-Tailed Bee Eaters and White Throated Canaries. Near permanent rivers Alpine Swifts, Bradfield's Swifts, Brown-Throated Martins, Cape Robin-Chats, Common Moorhen Orange-River White-eyes, Rock Martins, Red-Eyed Bulbuls, White-Backed Mousebirds, and Lesser Swamp-Warblers may be observed. The removal of a large number of large indigenous trees, may certainly impact on some of these species, but since the proposed footprint is actually relatively small the impact is unlikely to be significant.

5.3. <u>REPTILE & AMPHIBIANS</u>

No 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 grassland and preying on avifauna and small mammal species. 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
 - o Threatened or protected ecosystems
 - Special habitats
 - Corridors and or conservancy networks
- Significant species
 - o Threatened or endangered species
 - o 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 8**Error! Reference source not found.**).

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

Table 8: 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.

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.

Table 9: Categories used to describe significance rating (adjusted from DEAT, 2002)

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 taken into account.

- Location: The proposed new development areas are distributed on agricultural land belonging to the applicant. The various sites have been placed to minimise impact on significant water courses as well as on protected tree species and natural veld. However, most of the areas are still placed on natural veld in relative good condition (although past grazing practices would have impacted the vegetation composition over time). Agricultural development in this semi-desert area is mostly restricted by the availability of irrigation water, since the soils are mostly suitable and the vegetation seldom vulnerable or endangered. In this case the landowner will utilise treated effluent water from the new Kakamas WWTW for irrigation of crops.
- Activity: Water from the Kakamas WWTW (when in full operation) will yield treated effluent for the irrigation of approximately 200 ha of crops. The landowner is thus looking do develop a further 150 200 ha of land to add to his existing agricultural areas (in order to ensure beneficial use of the treated effluent). The proposed development will thus result in the permanent transformation of approximately 200 ha of natural vegetation (Bushmanland Arid Grassland) in relative good condition.
- <u>Geology & Soils</u>: No special features such as water courses, wetlands, true quarts patches or heuweltjies were observed in or near to the larger footprint area that may result in specialised plant habitat (rainfall in this area is too unpredictable to result in true quartz vegetation). However, the deeper soils associate with the historical floodplains near the Hartbees River, as well as the seasonal water courses has resulted in a much higher concentration of indigenous tree species (some of which are protected species), especially *Vachellia erioloba*. Please note that a separate soil study was conducted by Agrimotion (2018).
- Land use and cover: Land use is primarily focused on agriculture, with macadamia and lucerne, production the dominant land use and livestock grazing a secondary land use. The possible impact on socio-economic activities is likely to be positive, as the treated water will be used for beneficial irrigation and result in more job opportunities.
- <u>Vegetation status</u>: Bushmanland Arid Grassland is not considered a threatened vegetation type, with more than 99% remaining. However only 4% is formally conserved (Augrabies Falls National Park). Further conservation options must thus be investigated. The most significant aspect of this vegetation is the presence of a number of protected tree species in or near to the proposed footprints.
- <u>Conservation priority areas</u>: 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). According to the Northern Cape Critical Biodiversity Areas (2016), all of the proposed sites fall within a CBA (critical biodiversity area). The proposed development will have a permanent impact on a CBA. None of the sites will impact on any recognised centre of endemism.
- <u>Connectivity</u>: The proposed permanent impact on 200 ha of land will have an impact on connectivity (within a CBA). However, for the most part the impacts are located next to existing agricultural land and will link up with these features. The existing agricultural footprint will enlarge, but in the larger scheme of things the additional impact on connectivity will not be significant larger and even after the proposed development connectivity will remain good.
- <u>Watercourses and wetlands</u>: Please note that a separate freshwater report (Watsan Africa, 2019) was commissioned for this development. As a result this report will not address potential impacts on watercourses or wetlands, but only focus on the vegetation within the riparian zone.

- **Protected or endangered plant species**: A number of protected plant species were observed, most notably the potential impact on nationally protected tree species like *Vachellia erioloba*, *Euclea pseudebenus* and *Boscia albitrunca*. However, the sites were specifically chosen to minimise the impact on water courses and the protected tree species (while still utilising the best available agricultural land). As a result many of the trees observed already falls outside of the proposed footprints. The owner has also committed (confirmed by previous development practices on this property) to the protection of all significant indigenous trees (even if they remain within agricultural land). Non-the-less, it is expected that a number of smaller *Boscia foetida* species and provincially protected species will be impacted.
- <u>Invasive alien species</u>: For most of the property, only the occasional Prosopis trees were observed. However, near the Hartbees River dense stands of Prosopis were observed. Special care must be taken with their removal in order to ensure that they do not re-sprout.
- <u>Veld fires</u>: According to the National Veldfire risk classification (March 2010), Bushmanland Arid Grassland falls within an area with a Low fire risk classification. However, veld fire risk must be considered during construction.

7.1. IMPACT ASSESSMENT

The following table 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.

Impact assessment										
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion		
Geology & soils: Potential impact on special habitats (e.g. true quartz or	Without mitigation	3	4	5	3	3	45	No special habitats observed, but a number of protected tree species associated with deeper sandy soils along the Hartbees River and other water courses.		
"heuweltjies")	With mitigation	3	2	2	2	2	24	Protect all significant indigenous tree species (even if it has to be incorporated within the development).		
	-					-	-			
Landuse and cover: Potential impact on socio-economic	Without mitigation	3	4	5	2	2	39	Permanent transformation of approximately 200ha of natural veld to agriculture (area used for livestock grazing) on the landowner s land.		
activities.	With mitigation	3	2	4	1	1	24	Potential beneficial socio-economic impact (job opportunities).		
Vegetation status: Loss of vulnerable or endangered	Without mitigation	3	4	5	3	3	45	Permanent transformation of 200ha of slightly disturbed Bushmanland Arid Grassland (Least Threatened).		
vegetation and associated habitat.	With mitigation	3	2	2	2	2	24	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.		
Conservation priority: Potential impact on	Without mitigation	4	4	5	3	3	60	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.		
protected areas, CBA's, ESA's or Centre's of Endemism.	With mitigation	4	2	4	2	2	40	Minimise the disturbance footprint during construction through good environmental control during construction. Protect all significant indigenous trees.		
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	3	4	5	3	3	45	200 ha on natural veld will be compromised. Fortunately, it will link with the existing disturbance footprint and should not compromise overall connectivity.		

Table 10: Impact assessment associated with the proposed activity

Impact assessment										
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion		
	With mitigation	3	2	2	2	2	24	Minimise the disturbance footprint during construction through good environmental control during construction. Protect all significant indigenous trees.		
Watercourses and wetlands: Potential impact on	Without mitigation						0	N/a (Refer to the Freshwater specialist report. Watsan Africa, 2019).		
natural water courses and it's ecological support areas.	With mitigation						0			
	1									
endangered plant species:	Without mitigation	4	4	5	3	3	60	A number of protected species were observed, most notably a number of nationally protected tree species.		
Potential impact on threatened or protected plant species.	With mitigation	4	2	4	1	2	36	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.		
Invasive alien plant species: Potential invasive plant infestation as	Without mitigation	4	3	4	3	3	52	For most of the property, only the occasional Prosopis trees were observed. However, near the Hartbees River dense stands of Prosopis were observed.		
a result of the activities.	With mitigation	4	1	2	1	1	20	Special care must be taken during their removal (in order to avoid re-sprouting).		
	1									
Veld fire risk: Potential risk of veld fires as a result	Without mitigation	1	2	3	3	2	10	Veld fire risk low.		
of the activities.	With mitigation	1	1	1	1	1	4	Address fire danger throughout construction.		
	_		_		-	-				
Cumulative impacts: Cumulative impact	Without mitigation	4	4	5	3	3	60	Permanent transformation of approximately 200ha of natural veld for agriculture (which is likely to lead to job opportunities).		
associated with proposed activity.	With mitigation	4	2	4	2	2	40	Refer to all the mitigation recommendations above.		
The "No-Go" option: Potential impact	Without mitigation	3	2	2	1	1	18	No impact on natural veld or protected plant species, but also no social gain.		
associated with the No-Go alternative.	With mitigation						0			

According Table 10, the main impacts associated with the proposed development will be the potential impacts associated with conservation priority areas (the site falling within a proposed CBA) and protected and endangered plant species (national and provincially protected species), especially protected tree species, which can results in a Medium/High impact.

The <u>cumulative impact is also expected to be Medium/High</u> and it is important that mitigation measures are implemented in order to reduce the potential environmental impact to a potential Medium/Low significance.

8. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development will result in the permanent transformation of approximately 200ha of natural veld to intensive agriculture. According to the impact assessment given in Table 10, with good environmental control, the development is likely to result in a Medium/Low impact on the environment.

With the correct mitigation it is considered highly unlikely that the proposed development will contributed 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.

Having evaluated the proposed site and its immediate surroundings, it is unlikely that the proposed development will lead to any significant impact on the botanical features as a result of its placement as long as the following impact minimisation recommendations are implemented.

8.1. GENERAL MITIGATION MEASURES TO BE IMPLEMENTED

- 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.
- An application must be made to DENC for a flora permit in terms of the NCNCA with regards to impacts on species protected in terms of the act.
- Conservation of Nationally protected tree species (Refer to Table 2 Table 4 & Table 6):
 - **Vachellia erioloba** (Trees taller than 6m): No tree larger than 6m may be removed or damaged. Development footprints must stay at least further than 1 m of the canopy (or drip line) of any such tree.
 - **Vachellia erioloba** (Trees smaller than 6m): All mature trees should be protected where-ever possible and removal may only be considered as a last resort (with approval in terms of the NFA). Immature trees (<3m) should also be protected, if possible, but may be considered for removal (with approval in terms of the NFA). Dead trees can be removed (with approval in terms of the NFA).
 - **Boscia albitrunca**: All mature trees in good condition should be protected and removal may only be considered as a last resort. Small immature trees or badly damaged trees may be considered for removal (with approval in terms of the NFA).
 - **Euclea pseudebenus**: Only a few wild-ebony trees were observed. They should be protected (even if they have to be incorporated within the agricultural land. Development footprints must stay at least further than 1 m of the canopy (or drip line) of any such tree.
 - An application must be made to Department of Forestry and Fisheries for a permit in terms of the NFA with regards to impacts on species protected in terms of the act.
- Conservation of provincially protected plant species (NCNCA):
 - Search & rescue operation must be implemented for individual plants that might be impacted as recommended in Table 7.
 - An application must be made to DENC for a flora permit in terms of the NCNCA with regards to impacts on species protected in terms of the act.

- Access must be limited to routes approved by the ECO.
- Before any work is done the site and access routes must be clearly demarcated (with the aim at minimal width/smallest footprint). The demarcation must include the total footprint necessary to execute the work, but must aim at minimum disturbance.
- Lay-down areas or construction sites must be located within already disturbed areas or areas of low ecological value and must be pre-approved by the ECO.
- Special attention must be given to alien and invasive control within the construction footprint. All alien invasive species within the footprint and at least 5 m to the side of the footprint must be removed responsibly.
 - Care must be taken with the eradication method to ensure that the removal does not impact or lead to additional impacts (e.g. spreading of the AIP due to incorrect eradication methods);
 - Care must be taken to dispose of alien plant material responsibly.
- Indiscriminate clearing of any area outside of the construction footprint must be avoided.
- All areas impacted as a result of construction must be rehabilitated on completion of the project.
 - This includes the removal of all excavated material, spoil and rocks, all construction related material and all waste material.
 - It also included replacing the topsoil back on top of the excavation as well as shaping the area to represent the original shape of the environment.
- 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.
 - All rubble and rubbish should be collected and removed from the site to a suitable registered waste disposal site.

9. REFERENCES

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