BOTANICAL SCAN & TERRESTRIAL BIODIVERSITY COMPLIANCE STATEMENT

SKA CARNARVON EXPLORATORIUM

THE PROPOSED DEVELOPMENT OF AN EXPLORATORIUM ON ERF 431, CARNARVON KAREEBERG LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE.

PREPARED FOR:

ENVIROAFRICA.

PREPARED BY:

PJJ BOTES (PRI. SCI. NAT.)

15 August 2024

22 Buitekant Street
Bredasdorp
7280

Cell: 082 921 5949
Fax: 086 611 0726
Email: peet@pbconsult.co.za

EXECUTIVE SUMMARY

The Square Kilometre Array (SKA project) is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. In South Africa the SKA and MeerKAT are radio telescopes that are currently under development in the Kareeberg and Karoo Hoogland Municipal regions near Carnarvon and Williston respectively. The SKA would like to build an Exploratorium in the town of Carnarvon, as an information centre for tourists and to foster an interest in the science behind the telescope array. The Exploratorium will be located within a study area, just over 4 ha in size, within Erf 431, located within the urban edge and just west of the Carnarvon CBD. Even though the property is surrounded by urban development, Erf 431 is still covered with natural vegetation and overlap a critical biodiversity area (CBA 1)

VEGETATION TYPE & STATUS

According to the South African vegetation map (2018) (Mucina & Rutherford, 2006), the study area would have supported Northern Upper Karoo vegetation (Figure 6), a vegetation type that is classified as "**Least Threatened**" in terms of the "*Revised List of ecosystems that are threatened and in need of protection*" (GN 47526 of 18 November 2022).

HABITAT CONDITIONS AND DIVERSITY

The study area falls within the Carnarvon urban edge, almost surrounded by build-up areas. Large parts of the footprint had already been disturbed and the remaining natural veld is considered severely degraded and subject to almost constant human activity. The site does not support any significant biophysical feature that might result in special habitats for fauna or flora.

LAND-USE

The study area is within the urban edge of Carnarvon, contains old building foundations, a soccer field and other disturbed areas. At the present it is used as a soccer field an illegal dumping area and as a shortcut between build-up areas (Refer to Figure 8).

VEGETATION ENCOUNTERED

The vegetation within the study area conforms to a very disturbed version of Northern Upper Karoo vegetation. The characteristic low shrub layer had been compromised, leaving just the occasional hardy or weedy shrub (e.g. *Lycium* species), in combination with disturbance indicator or weedy species of the Aizoaceae and Asteraceae families such as *Atriplex-*, *Tetragonia-*, *Mesembryanthemum* (= *Psilocaulon* species), *Chrysocoma* species etc. Species diversity was very low (even for Upper Karoo vegetation).

PLANT SPECIES SENSITIVITY THEME

No red-data or nationally protected plant species were observed. Although four (4) species protected in terms of the NCNCA was observed within the footprint (Table 1), they were all widespread pioneer species often considered weedy or disturbance indicator species.

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered MEDIUM SENSITIVE**, because of the potential for or encountering the following species:

- ***Tridentea virescens* (Apocynaceae)** is a widespread but rare succulent that occurs on stony ground, or hard loam in floodplains, in sporadic small subpopulations of up to six plants. The species was not observed within the study area, and it is considered highly unlikely that individuals of this species will be impacted by the development.
- Even though 4 NCNCA protected species were observed (Refer to Table 1) they were all widespread pioneer species often considered weedy or disturbance indicator species.

As a result, the plant species theme sensitivity for this project is considered **LOW SENSITIVE**.

FAUNA & AVI-FAUNA

Apart from insects, rodents and a few smaller reptile species, the site itself is not expected to support any significant remaining fauna or even avi-fauna (smaller birds might still pass through this area, and apart from birds adapted to build-up areas, it is highly unlikely that any other bird species will nest within the site due to the lack of protective habitat and constant human activity).

According to the **DFFE Screening tool report** for the site (Appendix 2), the Animal Species Theme Sensitivity is considered **LOW SENSITIVE** which is **supported by the findings of this study**.

TERRESTRIAL BIODIVERSITY SENSITIVITY THEME

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered VERY HIGH SENSITIVE**, because it will impact on a critical biodiversity area (CBA 1) as identified by the Northern Cape critical biodiversity areas maps (Figure 7)**.**

Unfortunately, there is no alternative site within the Carnarvon Urban edge that will not impact on the CBA. In this case the proposed footprint area is clearly degraded and in poor condition (surrounded by urban development). The additional impact on vegetation and connectivity will be low and no special features of botanical significance were encountered on the site and a large portion of the site was previously build-up.

As a result, the Terrestrial biodiversity theme sensitivity for this project is considered **LOW SENSITIVE**.

WATER COURSES AND WETLANDS

There are no watercourses or wetlands within the study area.

MAIN CONCLUSION

The Terrestrial biodiversity impact assessment (Table 8) aims to take all the discussion under Section 4 into account, including the scale of the project, the fact that although the site will impact on a CBA1, the vegetation is not vulnerable or endangered, no SoCC will be impacted, the site itself is already disturbed as well as all the other reasons discussed throughout this document.

According, Table 8, the main impacts associated with the proposed development will be:

- A potential Very Low impact on a CBA 1 within the urban edge of Carnarvon, supporting degraded natural veld.

It is thus considered highly 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 THE PROJECT BE APPROVED.

DETAILS OF THE AUTHOR

This is a specialist report compiled by Peet Botes from PB Consult.

COMPANY NAME: PB Consult Sole Proprietor
PHYSICAL ADDRESS: 22 Buitekant Street, Bredasdorp, 7280
CELL PHONE: +27 (82) 921 5949
EMAIL: peet@pbconsult.co.za
FAX: 086 – 611 0726

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 the company have no interest in secondary or downstream development because of the authorization of this 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. The author reserves 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 and 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:

8 August 2024

Date:

CONTENTS

LIST OF FIGURES

LIST OF PHOTOS

ABBREVIATIONS

BAR	Basic Assessment Report
CBA	Critical biodiversity area (in terms of the 2017 City of Cape Town Biodiversity Network)
DENC	Department of Environment and Nature Conservation
EA	Environmental Authorization (Record of Decision)
EAP	Environmental assessment practitioner
ECO	Environmental Control Officer
EIA	Environmental impact assessment
EMP	Environmental Management Plan or Program
EMS	Environmental management system
EN	Endangered
ESA	Ecological support area (in terms of the 2017 City of Cape Town Biodiversity Network)
LT	Least Threatened
NEMA	National Environmental Management Act, 1998 (Act no. 107 of 1998)
SoCC	Species of Conservation Concern
VU	Vulnerable

1. INTRODUCTION

The Square Kilometre Array (SKA project) is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. The SKA telescope will be co-located in Africa and in Australia. In South Africa the SKA and MeerKAT are radio telescopes that are currently under development in the Kareeberg and Karoo Hoogland Municipal regions near Carnarvon and Williston respectively. SKA will on completion consist of up to 3000 dishes and aperture arrays which will have a collective area of 1 square kilometre. It will have an unprecedented scope in observations, exceeding the image resolution quality of the Hubble Space Telescope by a factor of 50 times, whilst also having the ability to image huge areas of sky in parallel.

The SKA would like to build an Exploratorium in the town of Carnarvon, as an information centre for tourists and to foster an interest in the science behind the telescope array. The Exploratorium will be located within a study area, just over 4 ha in size, within Erf 431, located within the urban edge and just west of the Carnarvon CBD. Even though the property is surrounded by urban development, Erf 431 is still covered with natural vegetation and overlap a critical biodiversity area (CBA 1) as identified in the 2016 Northern Cape critical biodiversity areas maps (Holness & Oosthuysen, 2016).

According to the vegetation map of South Africa (2012), the development footprint may impact on Northern Upper Karoo, a vegetation type that is considered "Least Threatened" in terms of the revised national list of ecosystems that are threatened and in need of protection (2022).

The DFFE Screening tool report, identified various areas of potential environmental sensitivity, of which the following will be discussed in this report:

- The relative Animal species theme sensitivity is considered of **Low sensitivity**;
- The relative Plant species theme sensitivity is considered of **Medium sensitivity**;
- The relative Terrestrial Biodiversity theme sensitivity is considered of **Very High sensitivity**.

The site visit confirmed that the vegetation within the proposed footprint area has been severely degraded as a result of constant human activity (urban creep). The site is criss-crossed by footpaths, used as short-cuts by local inhabitants, while old foundations suggest that it previously supported several buildings. A soccer field had been established in the northeastern corner of the site (just west of End Street and it had been used for illegal dumping in places. As a result, the site itself is now highly disturbed in terms of botanical significance.

1.1. LEGISLATION GOVERNING THIS REPORT

EnviroAfrica was appointed the Department of Economic Development and Tourism (DEDaT) to facilitate the NEMA EIA application for the proposed project. PB Consult was appointed by EnviroAfrica to conduct a terrestrial biodiversity scan of the proposed footprint area.

This is a 'specialist report', compiled in terms of:

- The National Environmental Management Act, Act. 107 of 1998 (NEMA);
- The "Protocol for the Specialist Assessment and Minimum report content requirements for environmental impacts on terrestrial biodiversity" in terms of Sections 24(5)(a) and (h) and 44 of the NEMA (Government Notice No. 320 of 20 March 2020).

1.2. TERMS OF REFERENCE

The terms of reference for this appointment were to:

- Evaluate the proposed site(s) to determine whether any significant botanical or other terrestrial biodiversity features will be impacted because 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 terrestrial biodiversity 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 & APPROACH

2.1. LOCATION & LAYOUT

Carnarvon is located on the R63, about 245 km east of Calvinia in the Kareeberg Local Municipality of the Northern Cape Province. Erf 431 is located within the urban edge and just west of the Carnarvon CBD (Figure 1).

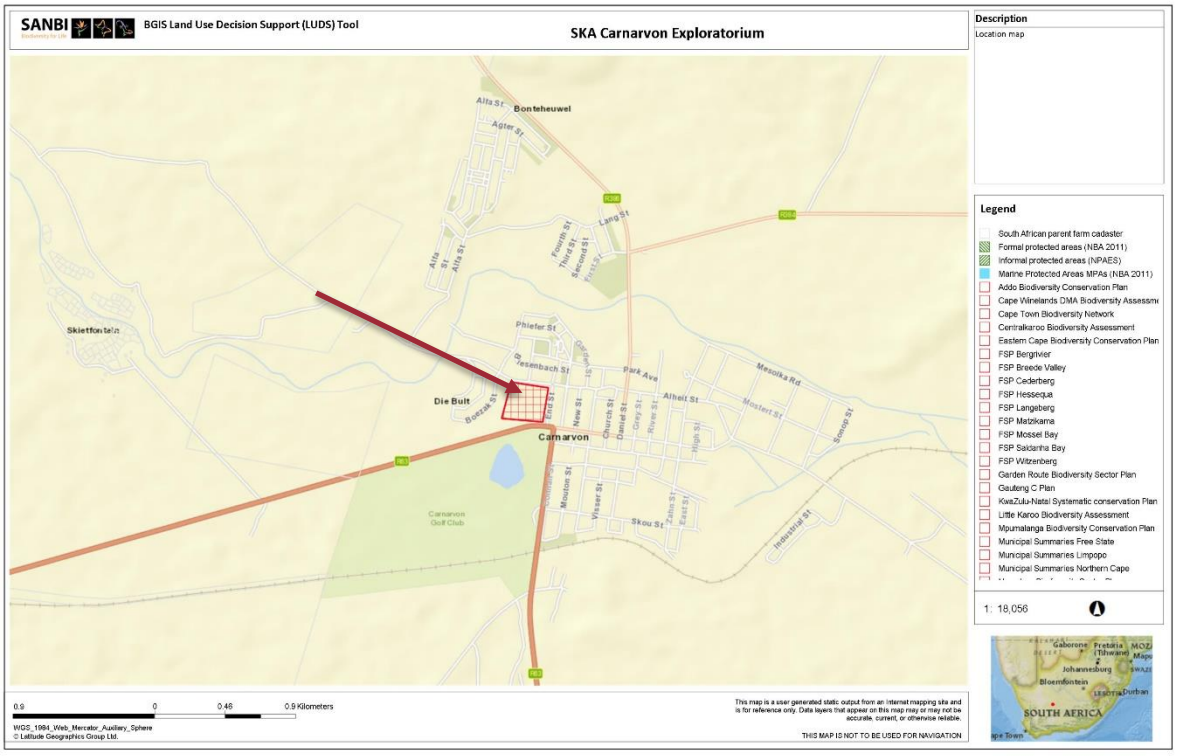


Figure 1: The location of the proposed development (indicated by the arrow) in relation to the town of Carnarvon.

The study area, within which the information centre will be located, was just over 4.5 ha in size and showed various signs of previous and existing disturbances (e.g., old building foundations, footpaths and twee-spoor tracks) (Figure 2).

Figure 2: Google image showing the study area (red) within which the information centre will be located.

2.2. ACTIVITY DESCRIPTION

Figure 3 gives an overview of the planned infrastructure that will be established as part of the SKA Carnarvon Exploratorium. Access to the site will be gained from End Street. The development will include:

1. An Observatorium
2. An Amphitheatre;
3. Accommodation / dormitories;
4. Ablutions & common areas;
5. A tensile roof structure for outdoor functions;
6. A full-size telescope;
7. Parking areas;
8. Pathways connecting the various infrastructure;
9. Botanical gardens;
10. Rock landscaping features; and
11. An Interactive play area.

Figure 3: Masterplan layout for the proposed SKA Carnarvon Exploratorium (The Creative Axis Architects)

2.3. TOPOGRAPHY GEOLOGY & SOILS

The study area is located within the Carnarvon urban edge bounded by existing streets to the west (gravel track), north (Mark Street) and east (End Street) and by the R63 to the south. The site is slightly raised in the middle forming a low flat slightly rocky centre area, which slopes gently away to the west and east.

According to the geotechnical report for the site done by Gondwana Geo Solutions (August 2023), the geology of the site is dolerite of Jurassic age which has intruded the older sedimentary rocks (mudrock and sandstone) of the Teekloof Formation of the Adelaide Subgroup, Beaufort Group. The site is covered by a relatively thin mantle of transported colluvial soils comprising of dark grey to brown silty gravelly soils, with prolific small to large dolerite boulders. Dolerite bedrock underlies this mantle of soil cover, comprising medium to slightly weathered, medium jointed rock of hard strength.

2.4. CLIMATE

Carnarvon is a small town in the heart of vast inland basin known as the Karoo, surrounded by the flat topped koppies of the Karee Mountains. It is part of the Nama-Karoo which has an essentially continental climate, little affected by the ameliorating influence of oceans. It is an arid (almost desert) biome where most of the rivers are nonperennial.

Rainfall is unreliable, falling mostly in late summer (December to April), rainfall intensity can be high (e.g., episodic thunderstorm storm events).Droughts are unpredictable and often prolonged (Mucina

et. al., 2006) (the recent drought lasted more than 7 years – Pers. Comm.).

Summers are hot during the day and cold during the night, while winters are cold with temperature extremes ranging from -5°C in winter to 43°C in summer. Figure 4 gives a summary of average temperatures and precipitation for the last 30 years (https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/ carnarvon_south-africa_1014034).

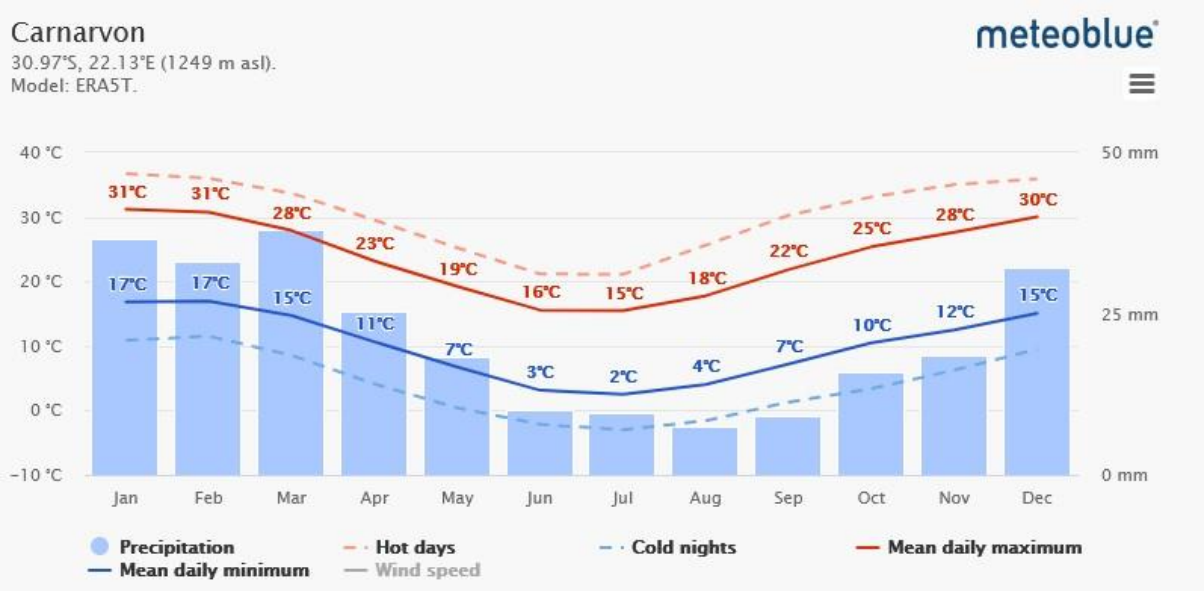


Figure 4: Average temperature and rainfall for Carnarvon (https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/carnarvon_south-africa_1014034).

2.5. APPROACH & METHODOLOGY

The first step of the study was to conduct a desktop study of the study area and its immediate surroundings. Spatial information from online databases such as SANBI BGIS and Google Earth were used to evaluate the site in terms of vegetation, obvious differences in landscape (e.g., variations in soil type, rocky outcrops etc.) or vegetation densities, which might indicate differences in plant community or species composition, critical biodiversity areas and other terrestrial biodiversity features as identified in the DEA screening tool. This information was used to prepare a study area map, which is used as a reference during the physical site visit. Plant species lists (of the expected plant species for this vegetation type) were prepared and species of special significance were flagged (for the site visit).

A one-day site visit was performed on the 11th of June 2024. The site assessment survey was conducted by walking the site and sampling the vegetation, using a modified approach, based on the Braun-Blanquet vegetation survey method (Werger, 1974). During the site visit terrestrial features- and plants of specific significance was, marked, and photographed (Figure 5). A hand-held Garmin GPSMAP 67 was used to track the sampling route and for recording waypoints of locations of specific importance. During the survey notes, and photographic records were collected. The author endeavoured to identify and locate all significant botanical features and or specific soil conditions which might indicate special botanical features (e.g., rocky outcrops or heuweltjies) and watercourses.

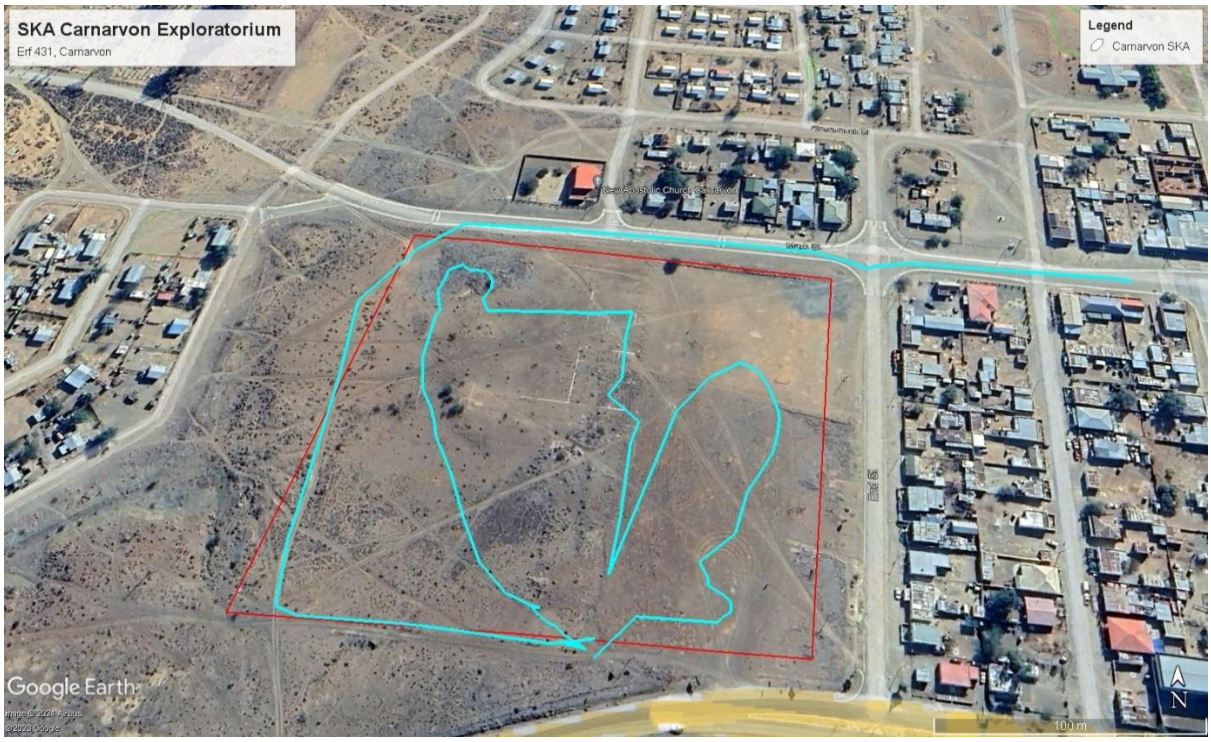


Figure 5: Google overview, showing the study area and the routes walked during the site visit.

2.5.1. ASSUMPTIONS AND UNCERTAINTIES

The findings are based on a one-day site visit (not long-term repetitive sampling), which means that it is likely that some plant species might have been missing (not visible or in flower). The timing of the site visit was reasonable as essentially all perennial plants were identifiable even though the vegetation itself was very disturbed. A good understanding of the status of the vegetation and plant species in the study areas were obtained and confidence in the findings are high. There should be no limiting factors which could significantly alter the outcome of this study. It is unlikely that a full botanical assessment will result in any additional findings that would have a significant impact on the outcome.

3. DESKTOP ASSESSMENT

3.1. BROAD-SCALE VEGETATION EXPECTED

According to the South African vegetation map (2012) (Mucina & Rutherford, 2006), the proposed development will only impact on one vegetation type, namely Northern Upper Karoo (Figure 6). Northern Upper Karoo has been classified as "**Least Threatened**" in terms of the "*Revised List of ecosystems that are threatened and in need of protection*" (GN 47526 of 18 November 2022), promulgated in terms of the National Environmental Management Biodiversity Act, Act 10 of 2004.

Mucina & Rutherford (2006) describe this vegetation as occurring in the Northern Cape and Free State Provinces: Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the

west to Philipstown, Petrusville and Petrusburg in the east. Bordered in the north by Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. A few patches occur in Griqualand West. Altitude varies mostly from 1 000–1 500 m.

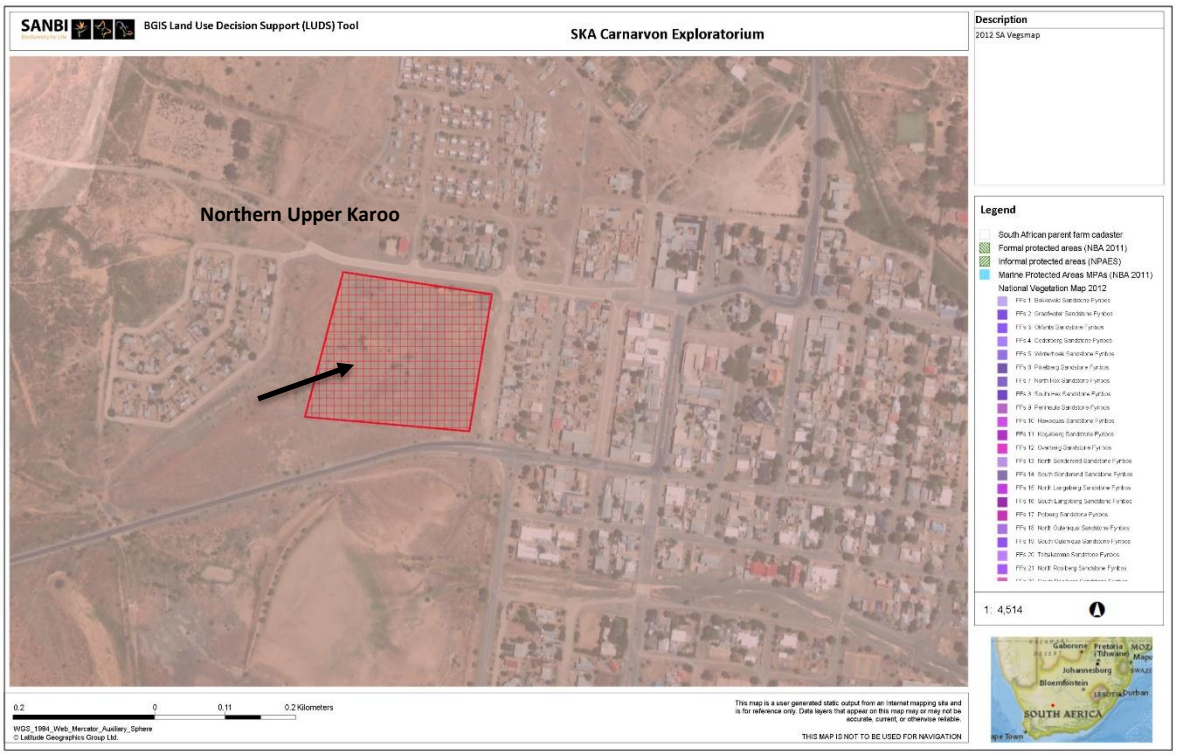


Figure 6: Vegetation map of South Africa (2012), showing the expected vegetation type (SANBI BGIS)

The vegetation is described as low shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera* subsp. *detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). It occurs on flat to gently sloping, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans.

3.2. ECOLOGICAL DRIVERS & FUNCTIONING

Northern Upper Karoo 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 hailstorm

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 to 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).

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 (because of the low carrying 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.

3.3. CRITICAL BIODIVERSITY AREAS & ECOLOGICAL CORRIDORS

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 (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 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 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.

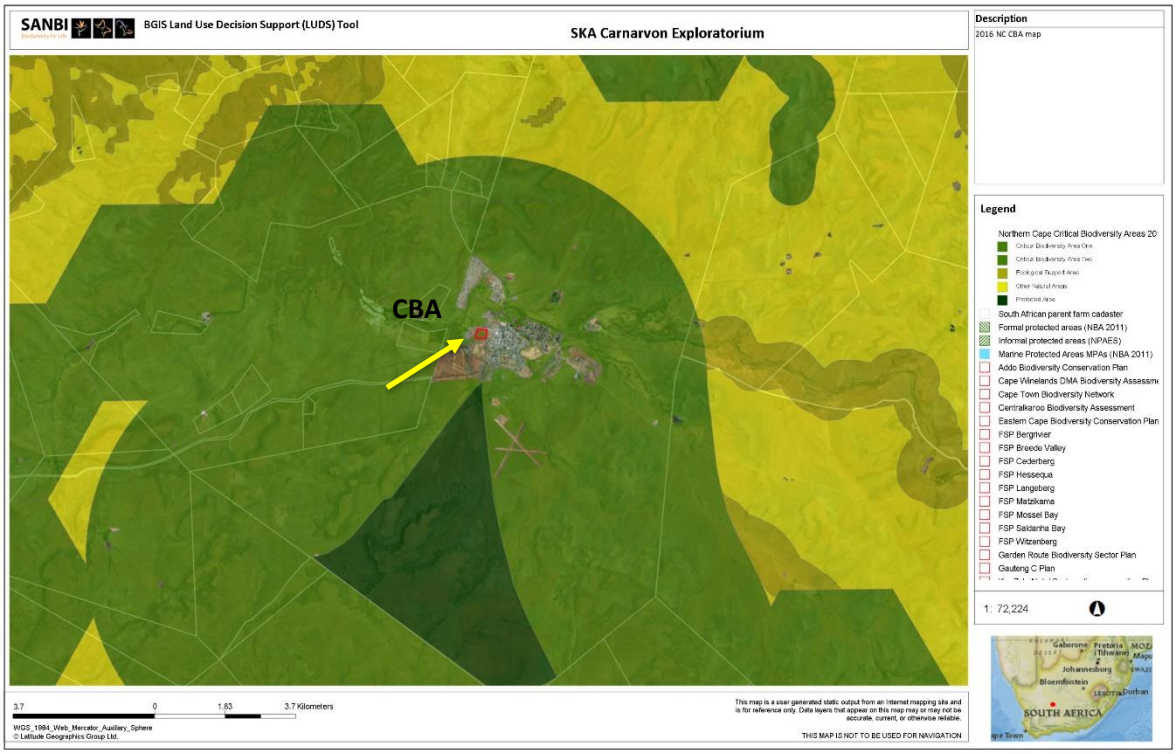


Figure 7: Northern Cape CBA map (2016) showing the study area and associated critical biodiversity areas.

According to the Northern Cape critical biodiversity areas maps, the proposed housing project will overlap a critical biodiversity area (CBA 1) as identified within the 2016 Northern Cape CBA maps (Figure 7).

Unfortunately, there is no alternative site within the Carnarvon Urban edge that will not impact on the CBA.

3.4. POTENTIAL IMPACT ON CENTERS OF ENDEMISM

According to Van Wyk & Smith (2001) the proposed development will not impact on any recognised centre of endemism. The Griqualand West Centre of is located to the north (Prieska area).

4. SITE SENSITIVITY EVALUATION

Because of its aridity and unpredictable rainfall patterns, the Nama-Karoo region would have favoured free moving herbivores such as gemsbok, 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. During the 19th century the vast herds of migratory ungulates indigenous to this biome have been replaced (almost completely) 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).

The following sensitivity evaluation is based on expected terrestrial features of significance identified through the desktop studies and personal observation made during the physical site visit.

4.1. HABITAT CONDITIONS & DIVERSITY

The whole footprint had been degraded because of its location within the Carnarvon urban edge, previous development and its current land use (soccer fields & grazing). Remaining natural veld is disturbed and the site does not support any significant biophysical feature that might result in special habitats for fauna or flora.

4.2. VEGETATION ENCOUNTERED

The vegetation within the study area conforms to a very disturbed version of Northern Upper Karoo vegetation. The characteristic low shrub layer had been compromised, leaving just the occasional hardy or weedy shrub (e.g. *Lycium* species), in combination with disturbance indicator or weedy species of the Aizoaceae and Asteraceae families such as *Atriplex*-, *Tetragonia*-, *Mesembryanthemum* (= *Psilocaulon* species), *Chrysocoma* species etc. Species diversity was very low (even for Upper Karoo vegetation).

The sensitivity map (Figure 8) gives an overview of the study area (red). Old building foundations were encountered in the middle northwestern part of the site (purple), while a soccer field (blue) had been established in the north-eastern part of the study area. The south-eastern part of the study area seems to have been cleared at some point in the past. The whole of the study area also seems to have been grazed and are cris-crossed by footpaths, while illegal dumping had taken place in some areas within the site. The disturbance are typical of what is often encountered within or on the urban edge (and in this case almost surrounded build-up areas) of small towns in this dry part of the Karoo.

About the only remaining indigenous species were a scattered hardy (often unpalatable species) such as *Lycium cinereum*, *Eriocephalus spinescens* and *Aptosimum spinescens*. Most of the other species were weedy disturbance indicator species such as *Arctotis* cf. *acaulis*, *Atriplex lindleyi* (saltbush), *Aizoon papulosum* (brakbossie), *Mesembryanthemum guerichianum* (soutslaai), the common *Mesembryanthemum splendens* (=*Phyllobolus splendens*), *Salsola kali*, a weedy *Senecio* species and

the prostrate *Tetragonia* cf. *echinata*.

Alien invasive species like *Prosopis* trees and a few individuals of the "toukaktus", *Harrisia martini* were also observed.

Photo 1: Typical vegetation cover encountered on the site. In this case the southwestern corner of the study area. *Atriplex* (saltbush) in the foreground with a few individuals of the hardy *Eriocephalus spinescens* towards the middle of picture.

Photo 2: *Prosopis* trees (alien invasive species) observed in the northern part of the site.

Photo 3: Looking from north to south from the small rocky rise in the northwestern part of the site. The larger shrubs are *Prosopis* trees.

Photo 4: Looking from west to east over the soccer field in the north-eastern corner of the site (blue in Figure 8).

Photo 5: Looking from north to south over the middle of the site. Prosopis to the right with *Atriplex* and *Salsola kali* bushes prominent in the foreground.

Photo 6: Building foundations showing in the foreground. *Prosopis* trees and the alien *Harrisia martini* (toukaktus) and illegal dumping can be observed in the middle of picture.

Photo 7: The disturbed south-eastern part of the site (yellow in Figure 8)

4.3. FLORA ENCOUNTERED

The site was very disturbed and even though the species observed are based on a one-day site visit, a good understanding of the vegetation was achieved and confidence in the findings is high. Almost all of the species encountered were either weedy (including weedy alien species) or hardy species – all of them widespread and common species. All of the species observed of the Aizoaceae family, such as *Aizoon*, *Mesembryanthemum* and *Tetragonia* observed within the footprint are protected by default by the Northern Cape Nature Conservation Act 9 of 2009 (NCNCA), but in this case they were all weedy and often disturbance indicator species (Refer to Table 1). No red-listed plant species was observed, and other than the weedy NCNCA protected species Aizoaceae, no other protected species were observed within the footprint area.

As a result, it was considered unnecessary to compile a species list.

4.4. 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, SANBI uses an amended system of categories to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

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, 2020).

- No red-listed species was observed during the study.

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.

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).

- No species protected in terms of the NFA was observed.

NCNCA Protected plant species: The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came

into effect on the 12th of December 2011, and 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).

- Four (4) species protected in terms of the NCNCA was observed within the footprint (Refer to Table 1), but they were all widespread pioneer species often considered weedy or disturbance indicator species.

Table 1: Plant species protected in terms of the NCNCA encountered within the study area.

NO.	SPECIES NAME	COMMENTS	Search & rescue recommendations
1.	*Aizoon papulosum* **Schedule 2 protected**	A prostrate herb/succulent, relatively common throughout the study area.	A widespread pioneer species, often encountered in disturbed areas. It is not vulnerable or endangered. No search & rescue needed.
2.	*Mesembryanthemum* cf. *rapaceum* (very similar looking to *rapaceum*) **Schedule 2 protected**	A low succulent shrub, occasionally observed within the study area.	A widespread pioneer species. It is not vulnerable or endangered. No search & rescue needed.
3.	*Mesembryanthemum guerichianum* **Schedule 2 protected**	Occasionally observed within the study area.	A weedy pioneer species often considered a disturbance indicator species. It is not vulnerable or endangered. No search & rescue needed.
4.	*Tetragonia cf. echinata* **Schedule 2 protected**	A prostrate succulent herb, common throughout the site.	A weedy pioneer species often encountered in degraded veld. It is not vulnerable or endangered. No search & rescue needed.

4.5. PLANT SPECIES SENSITIVITY THEME

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered MEDIUM SENSITIVE**, because of the potential for or encountering the following species:

- ***Tridentea virescens* (Apocynaceae)** is a widespread but rare succulent that occurs on stony ground, or hard loam in floodplains, in sporadic small subpopulations of up to six plants. The species was not observed within the study area, and it is considered highly unlikely that individuals of this species will be impacted by the development.
- Even though 4 NCNCA protected species were observed (Refer to Table 1) they were all widespread pioneer species often considered weedy or disturbance indicator species.

As a result, the plant species theme sensitivity for this project is considered **LOW SENSITIVE**.

4.6. ANIMAL SPECIES SENSITIVITY THEME

No fauna or avi-fauna survey was done as part of this study, but observations were made during the site visit. The study area falls within the Carnarvon urban edge, almost surrounded by build-up areas. Large parts of the footprint had already been disturbed and the remaining natural veld is considered

severely degraded and subject to almost constant human activity. Apart from insects, rodents and a few smaller reptile species, the site itself is not expected to support any significant remaining fauna or even avi-fauna (smaller birds might still pass through this area, and apart from birds adapted to build-up areas, it is highly unlikely that any other bird species will nest within the site due to the lack of protective habitat and constant human activity).

According to the **DFFE Screening tool report** for the site (Appendix 2), the Animal Species Theme Sensitivity is considered **LOW SENSITIVE** which is **supported by the findings of this study**.

4.7. TERRESTRIAL BIODIVERSITY SENSITIVITY THEME

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered VERY HIGH SENSITIVE**, because it will impact on a critical biodiversity area (CBA 1) as identified by the Northern Cape critical biodiversity areas maps (Figure 7)**.**

Unfortunately, there is no alternative site within the Carnarvon Urban edge that will not impact on the CBA. In this case the proposed footprint area is clearly degraded and in poor condition (surrounded by urban development). The additional impact on vegetation and connectivity will be low and no special features of botanical significance were encountered on the site and a large portion of the site was previously build-up.

As a result, the Terrestrial biodiversity theme sensitivity for this project is considered **LOW SENSITIVE**.

5. TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

The concept of environmental impact assessment in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA) and the Environmental Impact Assessment (EIA) was developed to identify and evaluate the nature of potential impact to determine whether an activity is likely to cause significant environmental impact on the environment. The concept of significance is at the core of impact identification, evaluation and decision making, but despite this the concept of significance and the method used for determining significance remains largely undefined and open to interpretation (DEAT, 2002).

The objective of this study was to evaluate the study area to identify significant environmental features which might be impacted by the development. The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), were used as guideline with emphasis on:

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

5.1. IMPACT ASSESSMENT METHODOLOGY

5.1.1. 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.

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

5.1.1.1. CRITERIA USED

***Conservation value*:** Conservation value refers to the intrinsic value of an attribute (e.g., an ecosystem, a vegetation type, a natural feature or a species) 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 (Refer to Table 2 for categories used).

Likelihood refers to the probability of the specific impact occurring because of the proposed activity (Refer to Table 3, for categories used).

Duration refers to the length in time during which the activity is expected to impact on the environment (Refer to Table 4).

Extent refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur (Refer to Table 5).

Severity refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur (Refer to Table 6).

Table 2: Categories used for evaluating conservation status.

CONSERVATION VALUE	
Low (1)	The attribute is transformed, degraded not sensitive (e.g., Least threatened), with unlikely possibility of species loss.
Medium/low (2)	The attribute is in good condition but not sensitive (e.g., Least threatened), with unlikely possibility of species loss.
Medium (3)	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.
Medium/high (4)	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.
High (5)	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.

Table 3: Categories used for evaluating likelihood.

LIKELHOOD	
Highly Unlikely (1)	Under normal circumstances it is almost certain that the impact will not occur.
Unlikely (2)	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.
Possible (3)	The likelihood of the impact occurring, under normal circumstances is 50/50, it may, or it may not occur.
Probable (4)	It is very likely that the impact will occur under normal circumstances.
Certain (5)	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.

Table 4: Categories used for evaluating duration.

DURATION	
Short (1)	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).
Medium/short (2)	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).
Medium (3)	Impact is medium-term and reversible with mitigation but will last for some time after construction and may require ongoing mitigation. Rehabilitation time is expected to be longer (5-15 years).
Long (4)	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 ongoing mitigation. Rehabilitation time is expected to be longer (15-50 years).
Permanent (5)	The impact is expected to be permanent.

Table 5: Categories used for evaluating extent.

EXTENT	
Site (1)	Under normal circumstances the impact will be contained within the construction footprint.
Property (2)	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.
Surrounding properties (3)	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding landowners or –users, but still within the local area (e.g., within a 50 km radius).
Regional (4)	Under normal circumstances the impact might extent to the surrounding region (e.g., within a 200 km radius), and will impact on landowners in the larger region (not only surrounding the site).
Provincial (5)	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).

Table 6: Categories used for evaluating severity.

SEVERITY	
Low (1)	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.
Medium/low (2)	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.
Medium (3)	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.
Medium/high (4)	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.
High (5)	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.

5.1.2. 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 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. 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, to determine its potential significance. The potential significance is then described in terms of the categories given in Table 7. Mitigation options are evaluated, and comparison is then made (using the same method) of potential significance before mitigation and potential significance after mitigation (to advise the EAP).

Table 7: 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 because 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 because 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 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 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 are un-mitigatable and usually result in very severe effects, beyond site boundaries, national or international.

6. IMPACT ASSESSMENT

Using the methodology described above the significance of environmental impacts associated with the proposed development were evaluated/calculated (including the expected accumulative impact as well as the No-Go option) (Refer to Table 8).

Table 8: Terrestrial biodiversity impact associated with the proposed development

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Special habitats: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	1	1	4	1	1	7	The study area is degraded and does not support any significant biophysical feature or special habitats for fauna or flora.
	With mitigation	1	1	4	1	1	7	No mitigation required.
Watercourses & Wetlands: Potential impact on natural water resources and it's ecological support areas.	Without mitigation						0	There are no watercourses or wetlands within the study area.
	With mitigation						0	
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	1	1	4	1	1	7	The study area overlaps disturbed areas (Figure 8) and falls within the urban edge of Carnarvon.
	With mitigation	1	1	4	1	1	7	The impact is expected to have a positive impact on job creation.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	1	2	4	1	1	8	The development will impact on <4ha of degraded natural veld classified as "Least Threatened".
	With mitigation	1	2	4	1	1	8	The impact on loss of vegetation is expected to be negligible.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	1	4	4	1	1	10	The development area will impact on a CBA1, within the Carnarvon urban edge (surrounded by build-up areas) supporting degraded natural veld.
	With mitigation	1	4	4	1	1	10	Because of the location and status of the veld, the impact on the CBA is likely to be acceptable (it will ensure that areas supporting better veld is not impacted).
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	1	2	4	1	1	8	The site falls within the Carnarvon urban edge (surrounded by build-up areas), an area with compromised connectivity, supporting degraded natural.
	With mitigation	1	2	4	1	1	8	Because of the location and status of the veld, the impact on connectivity will be low (and it will ensure that areas supporting better veld is not impacted).
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	1	2	4	1	1	8	No red-listed plant species was observed, but 4 species protected in terms of the NCNCA were observed (all four protected by default as part of the Aizoaceae).
	With mitigation	1	2	4	1	1	8	Refer to the discussions and recommendations in Table 1.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Fauna & Avi-fauna Potential impact on mammals, reptiles, amphibians & birds.	Without mitigation	1	1	4	1	1	7	The development will impact on <4ha of degraded natural veld within the urban edge and subject to constant human activity.
	With mitigation	1	1	4	1	1	7	Refer to the discussions under Heading 4.6.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	1	4	4	1	1	10	The transformation of about <4h of degraded natural veld (Least Concern), but within a CBA1.
	With mitigation	1	4	4	1	1	10	The main impact is associated with the CBA1.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	1	3	3	1	1	8	The No-Go alternative will not necessary mean no impact on the CBA or vegetation or connectivity, as the existing landuse will continue to degrade the natural veld.
	With mitigation							

The Terrestrial biodiversity impact assessment (Table 8) aims to take all the discussion under Section 4 into account, including the scale of the project, the fact that although the site will impact on a CBA1, the vegetation is not vulnerable or endangered, no SoCC will be impacted, the site itself is already disturbed as well as all the other reasons discussed throughout this document.

According, Table 8, the main impacts associated with the proposed development will be:

- A potential Very Low impact on a CBA 1 within the urban edge of Carnarvon, supporting degraded natural veld.

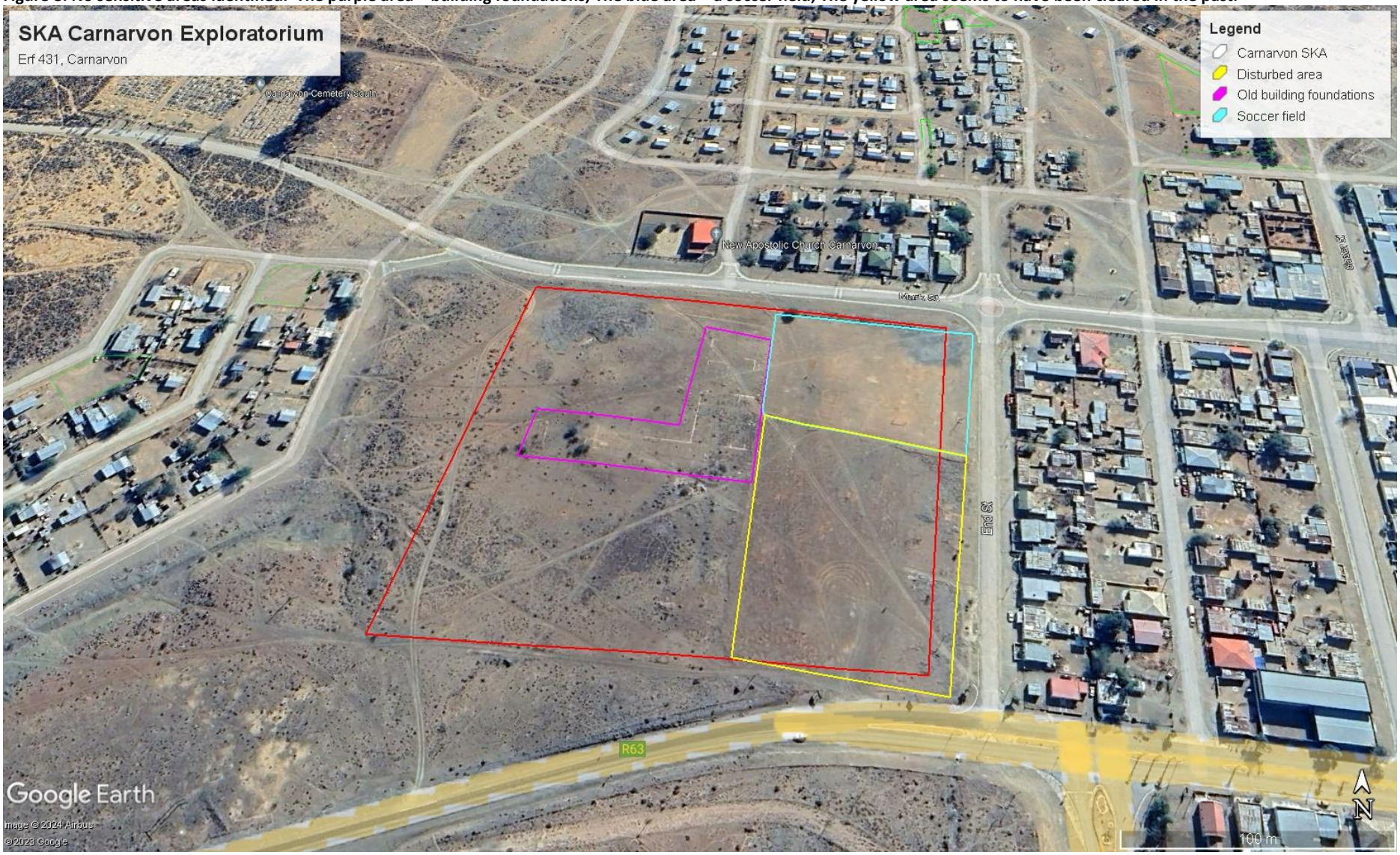
It is thus considered highly unlikely that the development will contribute significantly to any of the following:

- 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.

6.1. TERRESTRIAL BIODIVERSITY SENSITIVITY MAP

The proposed site is very homogenous in vegetation cover and landscape and already disturbed (transformed) because of illegal development. No specific sensitive area had been identified, which should be protected, mitigated, or regarded as a no-go area. As a result, no sensitivity map is included.

Figure 8: No sensitive areas identified. The purple area = building foundations; The blue area = a soccer field; The yellow area seems to have been cleared in the past.



7. RECOMMENDATIONS

The proposed development site is not considered sensitive in terms of terrestrial biodiversity and had already been transformed.

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- 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 the footprint must be clearly demarcated. The demarcation must aim at minimum footprint and minimisation of disturbance.
- All alien invasive species within the footprint and or within 10 m 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 these footprints may not be allowed.
- An integrated waste management approach must be implemented during construction.
    - Construction related general and hazardous waste may only be disposed of at approved waste disposal sites.
    - All rubble and rubbish should be collected and removed from the site to a Municipal approved waste disposal site.

8. 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.

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.

DEAT, 2002. Impact significance. Integrated Environmental Management, Information series 5. Department of Environmental Affairs and Tourism (DEAT). Pretoria.

Edwards, R. 2011. Environmental impact assessment method. Unpublished report for SiVest (Pty) Ltd. Environmental division. 9 May 2011.

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.

Low, A.B. & Rebelo, A.(T.)G. (eds.) 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.

Mannheimer, C., Maggs-Kölling, G., Kolberg, H. & Rügheimer, S. 2008. Wildflowers of the southern Namib. National Botanical Research Institute. Shumani Mills Communications. Cape Town.

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.

Skowno, A.L., Matlata, M., Slingsby, J., Kirkwood,D., Raimondo, D.C., Von Staden, L., Holness, S.D., Lotter, M., Pence, G Daniels, F., Driver, A., Desmet, P.G., Dayaram, A. 2019b. Terrestrial ecosystem threat status assessment 2018 – comparison with 2011 assessment for provincial agencies. National Biodiversity Assessment 2018 Technical Report. South African National Biodiversity Institute, Pretoria.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019a. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6370

South African National Biodiversity Institute. 2018. Vegetation map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2018.

South African National Biodiversity Institute. 2020. Statistics: Red List of South African Plants version 2020.1. Downloaded from Redlist.sanbi.org on 2023/01/17

Van Rooyen, N., & Van Rooyen G. 2019. Flowering plants of the southern Kalahari. First edition. Novus Print, a division of Novus Holdings. Somerset West.

Van Wyk, A.E., & Smith, G.F. 2001. Regions of floristic endemism in South Africa. A review with emphasis on succulents. Umdaus press. Hatfield.

Werger, M.J.A. 1974. On concepts and techniques applied in the Zürich-Montpellier method of vegetation survey. Bothalia 11, 3: 309-323.

APPENDIX 1: CURRICULUM VITAE – P.J.J. BOTES

Curriculum Vitae: Peet JJ Botes

Address: 22 Buitekant Street, Bredasdorp, 7280; **Cell**: 082 921 5949

Nationality:	South African
ID No.:	670329 5028 081
Language:	Afrikaans / English
Profession:	Environmental Consultant & Auditing
Specializations:	Botanical & Biodiversity Impact Assessments
	Environmental Compliance Audits
	Environmental Impact Assessment
	Environmental Management Systems
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 Botanical, Environmental and Ecological Scientist 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 Enviroscientific, 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-, infrastructure 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): Paballelo 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): Zypherfontein Dam Biodiversity & Botanical Scan. Proposed construction of a new irrigation dam on Portions 1, 3, 5 & 6 of the Farm Zypherfontein 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 Rheeboksfontein 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, Upington, 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): Kamiesberg 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 Wastewater 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 Plaaitje 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.

Botes, P. 2020(a): Gamakor & Noodkamp Low cost housing – Botanical Assessment of the proposed formalization of the Gamakor and Noodkamp housing development on the remainder and portion 128 of the Farm Kousas No. 459 and Ervin 1470, 1474 and 1480, Gordonia road, Keimoes. Kai !Gariep Local Municipality, Northern Cape Province. 6 February 2020.

Botes, P. 2020(b): Feldspar Prospecting & Mining, Farm Rozynen Bosch 104, Kakamas. Botanical assessment of the proposed prospecting and mining activities on Portion 5 of The Farm Rozynen Bosch No. 104, Kakamas, Khai !Garib Local Municipality, Northern Cape Province. 12 February 2020.

Botes, P. 2020(c): Boegoeberg housing project – Botanical assessment of the proposed formalization and development of 550 new erven on the remainders of farms 142 & 144 and Plot 1890, Boegoeberg settlement, !Kheis Local Municipality, Northern Cape Province. 1 July 2020.

Botes, P. 2020(d): Komaggas Bulk Water supply upgrade – Botanical assessment of the proposed upgrade of the existing Buffelsrivier to Komaggas BWS system, Rem. of Farm 200, Nama Khoi Local Municipality, Northern Cape Province. 8 July 2020.

Botes, P. 2020(e): Grootdrink housing project – Botanical assessment of the proposed formalization and development of 370 new erven on Erf 131, Grootdrink and Plot 2627, Boegoeberg Settlement, next to Grootdrink, !Kheis Local Municipality, Northern Cape Province. 14 July 2020.

Botes, P. 2020(f): Opwag housing project – Botanical assessment of the proposed formalization and development of 730 new erven on Plot 2642, Boegoeberg Settlement and Farm Boegoeberg Settlement NO.48/16, Opwag, !Kheis Local Municipality, Northern Cape Province. 16 July 2020.

Botes, P. 2020(g): Wegdraai housing project – Botanical assessment of the Proposed formalization and development of 360 new erven on Erven 1, 45 & 47, Wegdraai, !Kheis Local Municipality, Northern Cape Province. 17 July 2020.

Botes, P. 2020(h): Topline (Saalskop) housing project – Botanical assessment of the pproposed formalization and development of 248 new erven on Erven 1, 16, 87, Saalskop & Plot 2777, Boegoeberg Settlement, Topline, !Kheis Local Municipality, Northern Cape Province. 18 July 2020.

Botes, P. 2020(i): Gariep housing project – Botanical assessment of the proposed formalization and development of 135 new erven on Plot 113, Gariep Settlement, !Kheis Local Municipality, Northern Cape Province. 20 July 2020.

APPENDIX 2: DEA SCREENING REPORT