Biodiversity and Wetland Baseline and Impact Assessment for Portion 17, Boegoesberg

Groblershoop, Northern Cape Province

CLIENT

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Report Name	**Biodiversity and Wetland Baseline and Impact Assessment Portion 17, Boegoesberg**
Submitted to	**EP3 Environmental**
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Report Writer	**Martinus Erasmus**  Martinus Erasmus (Cand Sci Nat) obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting basic assessments and assisting specialists in the field during his studies since 2015.
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Report Reviewer	**Andrew Husted**  Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2014 (as amended). We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.

DECLARATION

I, Ivan Baker, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence and is punishable in terms of Section 24F of the Act.

Ivan Baker

Wetland Ecologist

The Biodiversity Company

June 2019

DECLARATION

I, Martinus Erasmus, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence and is punishable in terms of Section 24F of the Act.

Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

June 2019

Table of Contents

Tables

Figures

1 Introduction

The Biodiversity Company was commissioned to conduct a biodiversity (fauna and flora) baseline and impact assessment, as part of the environmental authorisation processes for the proposed commercial development project. The project is referred to as Portion 17 of Boegoesberg. The proposed development includes a mixed-use commercial development, this is to include office space, garages, and car parks.

An initial site visit was conducted on the 31st of May and the 1st of June 2019. This assessment would constitute a dry season survey. This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed activity.

2 Project Area

The project area is located approximately 1 km north-west of Groblershoop, Northern Cape Province, South Africa (Figure 1). The general land uses surrounding the project area includes residential areas, commercial areas as well as grazing. The 500 m regulated area surrounding the project area is split by the N10 with the Orange River located approximately 1 km north of the project area

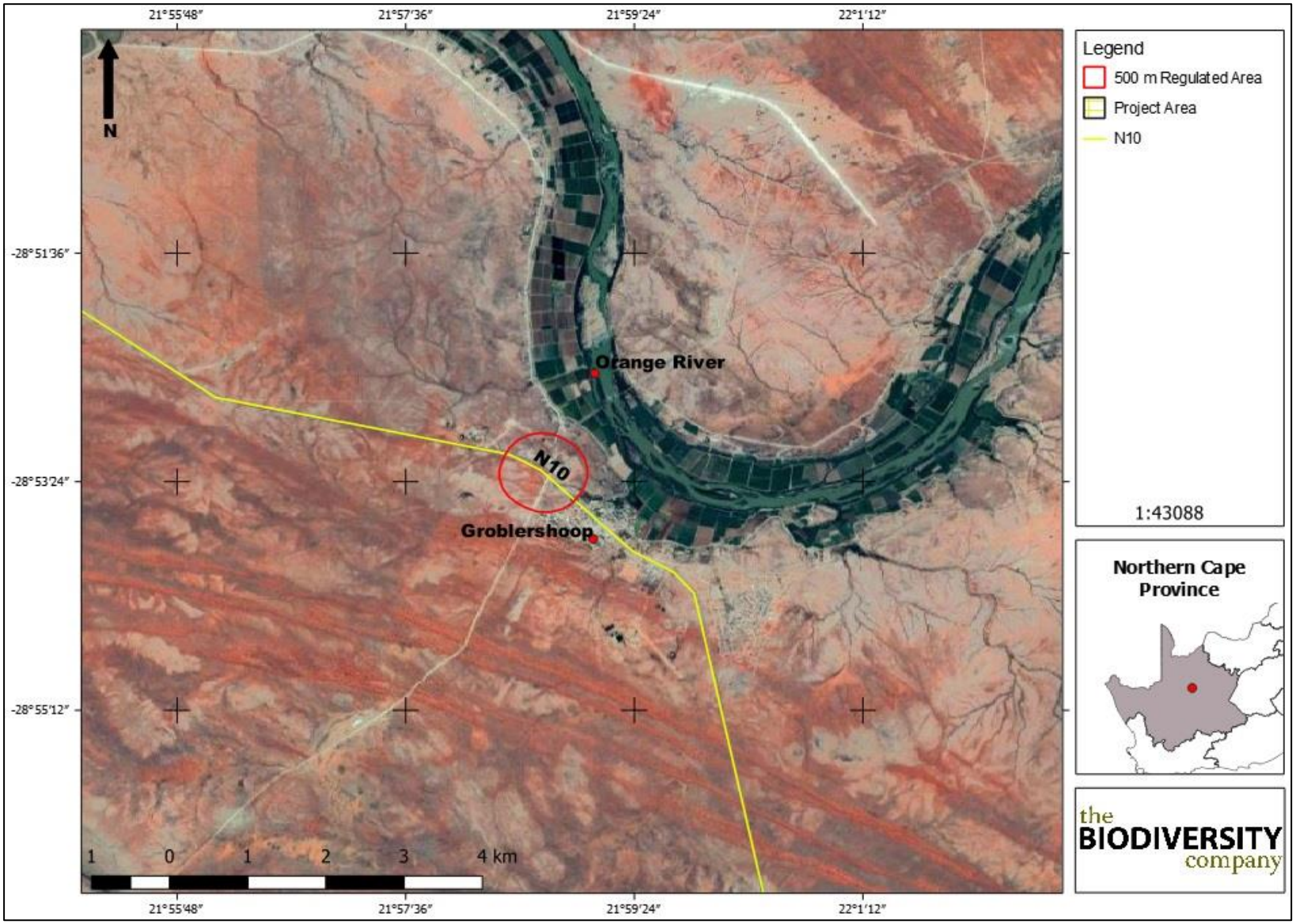

Figure 1:The general location of the proposed project area

3 Scope of Work

The Terms of Reference (ToR) included the following:

- Desktop description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity) that occur in the project area, and the manner in which these sensitive receptors may be affected by the activity;
- Identify 'significant' ecological, botanical and faunal features within the proposed development areas;
- Identification of conservation significant habitats around the project area which might be impacted by the proposed development;
- Site visit to verify desktop information;
- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Implementation of WET-Health for determination of Present Ecological State (PES) of wetland areas;
- Implementation of WET-EcoServices for determination of ecosystem services for the wetland areas;
- Determine the Environmental Importance and Sensitivity (EIS) of wetland systems;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application;
- Provide a map to identify sensitive receptors in the project area, based on available maps, database information & site visit verification;
- Suggest mitigation and rehabilitation measures to prevent or reduce the impacts; and
- Recommend the extent and type of monitoring that needs to be undertaken.

4 Limitations

The following limitations should be noted for the study:

- As per the scope of work, the fieldwork component of the assessment comprised of one assessment only, which was conducted during the dry season only, due to the seasonality of the survey, many morphological features used to identify plants, such as inflorescences, were absent or limited;
- This study has not assessed any temporal trends for the respective seasons;

- Only wetlands that were likely to be impacted upon by proposed development activities were assessed in the field. Wetlands located within a 500 m radius of the infrastructure but not in a position within the landscape to be measurably affected by the developments were not considered as part of this assessment;
- Areas characterised by external wetland indicators have been the focus for this study. Areas lacking these characteristics, i.e. disturbed areas, sport fields etc. have not been focussed on;
- Only wetlands have been delineated. Riparian areas and drainage lines have only been ground truthed to establish whether or not signs of wetlands are present and not delineated;
- Part of the project area is covered in residential/commercial land use, which limits access in these areas;
- Some of the delineated wetlands are characterised by artificial water inputs, which provides difficulties in identifying hydromorphic soils;
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side; and
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

5 Methodologies

5.1 Biodiversity Assessment

5.1.1 Geographic Information Systems (GIS) Mapping

Existing data layers were incorporated into GIS software to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina *et al.,* 2006); and
- Important Bird Areas 2015 – BirdLife South Africa (vector geospatial dataset).

Field surveys were conducted to confirm (or refute) the presence of species identified in the desktop assessment. The specialist disciplines completed for this study included:

- Botanical;
- Fauna (mammals and avifauna); and
- Herpetology (reptiles and amphibians).

Brief descriptions of the standardised methodologies applied in each of the specialist disciplines are provided below. More detailed descriptions of survey methodologies are available upon request.

5.1.2 Botanical Assessment

The botanical study encompassed an assessment of all the vegetation units and habitat types within the project area. The focus was on an ecological assessment of habitat types as well as identification of any Red Data species within the known distribution of the project area. Due to the survey being conducted in the dry season this represented a severe limitation to the number of species identified. Furthermore, much of the project area had been recently burnt which further limited the identification of floral species. The methodology included the following survey techniques:

- Sensitivity analysis based on available remaining natural structural habitat; and
- Identification of expected floral red-data species (desktop analysis).

5.1.3 Literature Study

A literature review was conducted as part of the desktop study to identify the potential habitats present within the project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree square (QDS) resolution.

The Red List of South African Plants website (SANBI, 2017) was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- A Field Guide to Wild Flowers (Pooley, 1998);
- Guide to Grasses of Southern Africa (Van Oudtshoorn, 1999);
- Orchids of South Africa (Johnson & Bytebier, 2015);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Medicinal Plants of South Africa (Van Wyk *et al.,* 2013);
- Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016); and
- Identification Guide to Southern African Grasses. An identification manual with keys, descriptions and distributions. (Fish *et al.,* 2015).

Additional information regarding ecosystems, vegetation types, and species of conservation concern (SCC) included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2012); and
- Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2016).

5.1.4 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists;
- Compilation of identified species lists;
- Identification of any Red Data or species of conservation concern (SCC) present or potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance.

The field survey component of the study utilised a variety of sampling techniques including, but not limited to, the following:

- Visual observations;
- Identification of tracks and signs; and
- Utilization of local knowledge.

Habitat types sampled included pristine, disturbed and semi-disturbed zones, drainage lines and wetlands.

Mammal distribution data were obtained from the following information sources:

- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- Bats of Southern and Central Africa (Monadjem *et al.,* 2010);
- The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za) (EWT, 2016);
- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za); and
- A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013).

5.1.5 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the project area was also conducted. The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.);
- Visual searches - typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. May include walking transects or using binoculars to view the species from a distance without the animal being disturbed;

- Amphibians – many of the survey techniques listed above will be able to detect species of amphibians. Over and above these techniques, vocalisation sampling techniques are often the best to detect the presence of amphibians as each species has a distinct call;
- Opportunistic sampling - reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken in order to augment the standard sampling procedures described above. This will include talking to local people and staff at the site and reviewing photographs of reptiles and amphibians that the other biodiversity specialists may come across while on site.

Herpetofauna distributional data was obtained from the following information sources:

- South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates *et al.,* 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Animal Demography Unit (ADU) - FrogMAP (frogmap.adu.org.za);
- Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner *et al.,* 2004); and
- Ensuring a future for South Africa's frogs (Measey, 2011).

5.1.6 Dry Season Fieldwork

The dry season fieldwork and sample sites were placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork.

The focus of the fieldwork was therefore to maximise coverage and navigate to each target site in the field in order to perform a rapid vegetation and ecological habitat assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with proposed development areas.

At each sample site notes were made regarding current impacts (e.g. rubbish dumping, erosion etc.), subjective recording of dominant vegetation species and any sensitive features (e.g. wetlands, outcrops etc.). In addition, opportunistic observations were made while navigating through the project area. Effort was made to cover all the different habitat types within the limits of time and access. The geographic location of sample sites and site coverage are shown under the Results section.

5.2 Wetland Assessment

5.2.1 Wetland Desktop assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- The topographical river line data set;
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- The National Freshwater Ecosystem Priority Areas (Nel *et al.,* 2011); and
- Contour data (5m).

5.2.2 Wetland Identification and Mapping

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

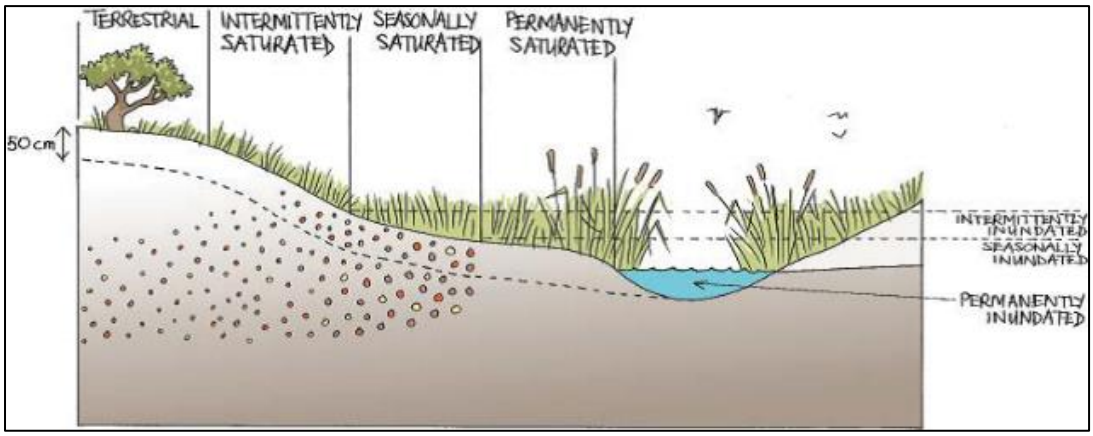

Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al., 2013)

5.2.3 Wetland Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

5.2.4 Wetland Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al.,* 2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 1).

Table 1: Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

5.2.5 Determining the Present Ecological Status of wetlands

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual

activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 2.

Table 2: The Present Ecological Status categories (Macfarlane et al., 2008)

Impact Category	Description	Impact Score Range	PES
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

5.2.6 Determining the Ecological Importance and Sensitivity of Wetlands

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3 (Rountree *et al.,* 2012).

Table 3: Description of Ecological Importance and Sensitivity categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

5.2.1 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the

hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

5.2.1 Determining Buffer Requirements

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

6 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems (Table 4). The list below, although extensive, may not be exhaustive and other legislation, policies and guidelines may apply in addition to those listed below. Legislation relevant to wetlands is provided below Table 4.

Table 4: A list of key legislative requirements relevant to biodiversity and conservation in the Northern Cape

INTERNATIONAL	Convention on Biological Diversity (CBD, 1993) The United Nations Framework Convention on Climate Change (UNFCC,1994) The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973) The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
NATIONAL	Constitution of the Republic of South Africa (Act No. 108 of 2006) The National Environmental Management Act (NEMA) (Act No. 107 of 1998) The National Environmental Management Protected Areas Act (Act No. 57 of 2003) The National Environmental Management Biodiversity Act (Act No. 10 of 2004) The National Environmental Management: Waste Act, 2008 (Act 59 of 2008); The Environment Conservation Act (Act No. 73 of 1989) National Environmental Management Air Quality Act (No. 39 of 2004) National Protected Areas Expansion Strategy (NPAES) Natural Scientific Professions Act (Act No. 27 of 2003) National Biodiversity Framework (NBF, 2009) National Forest Act (Act No. 84 of 1998) National Veld and Forest Fire Act (101 of 1998) National Water Act, 1998 (Act 36 of 1998) National Freshwater Ecosystem Priority Areas (NFEPA's) National Spatial Biodiversity Assessment (NSBA) World Heritage Convention Act (Act No. 49 of 1999) National Heritage Resources Act, 1999 (Act 25 of 1999) Municipal Systems Act (Act No. 32 of 2000) Alien and Invasive Species Regulations, 2014 South Africa's National Biodiversity Strategy and Action Plan (NBSAP) Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) Sustainable Utilisation of Agricultural Resources (Draft Legislation). White Paper on Biodiversity
PROVINCIAL	Northern Cape Planning and Development Act no. 7 of 1998 Northern Cape Nature Conservation act no. 9 of 2009

7 Desktop Spatial Assessment

The following features describes the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental

authority and SANBI. The desktop analysis and their relevance to this project are listed in Table 5.

Table 5: Desktop spatial features examined.

Desktop Information Considered	Relevant/Not relevant	Section
Land Use	Relevant: description included	7.1
Soils and Geology	Quaternary sediments (calcrete and sand) with some contribution of the Kalahari Group's pre-Pleistocene sediments in the east.	7.2
Climate	Rainfall periods peak between February and April with a minor peak in November.	7.3
Conservation Plan	Falls in a CBA2 area	7.4
Ecosystem Threat Status	Falls within a *LT* ecosystem	7.5.1
Ecosystem Protection Level	Falls in a *not protected* ecosystem	7.5.2
Protected Areas	Not Relevant approximately 68 km to the closes protected area: Witsand	-
Important Bird and Biodiversity Areas	Irrelevant approximately 180km to closes IBA: Augrabies Falls National Park	-
NFEPA Wetlands	No NFEPA wetlands have been identified within the 500 m regulated area.	-
Topographical River Line Data	Desktop dataset indicated the presence of various non-perennial river lines within the project area	7.5
Flow Paths	A large drainage line is located immediately south of the project area. A sequence of drainage features is present directly within the project area which have been formed by sporadic runoff. These systems have not been classified as wetlands and are therefore not deemed to be sensitive.	7.6
Inland Water Areas	According to the topographical "Inland Water Areas" data set, no watercourses are present within the 500 m regulated area.	-
Mining and Biodiversity Guidelines	Irrelevant: no mining component	-

7.1 Land Use

The land uses surrounding the project area consists of mainly build-up areas of the town Groblershoop. The following infrastructure exists in the project area and surrounds:

- Power lines;
- Urban dwellings;
- Main road; and
- Telephone lines.

7.2 Soils and Geology

The land type covering the 500 m regulated area has been determined to be the Ag 4 land type (Land Type Survey Staff, 1972 - 2006). This land type is characterised by freely drained

Red or Yellow-Brown Apedal soils with red soils being dominant. These soils are characterised by a high base status and is likely to be deeper than 300 mm deep.

The geology of the region is characterised by quaternary sediments (calcrete and sand) with some contribution of the Kalahari Group's pre-Pleistocene sediments in the east of the NKb 4 vegetation type. The surface typically is covered by red sands deeper than 300 mm which is likely to form dunes.

7.3 Climate

Rainfall periods peak between February and April with a minor peak in November. The mean annual precipitation ranges from 70 to 110 mm (Figure 3).

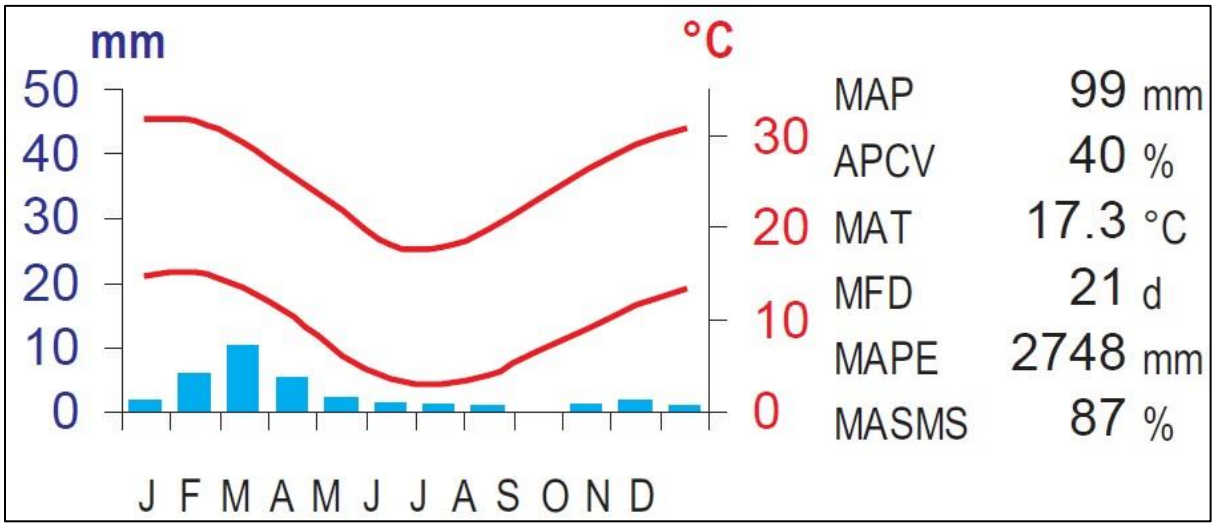

Figure 3: Climate for the project area (Mucina & Rutherford, 2006).

7.4 The Northern Cape Biodiversity Sector Plan

7.4.1 Aim and objectives

The Northern Cape Department of Environment and Nature Conservation has developed the Northern Cape CBA Map which identifies biodiversity priority areas for the province, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These biodiversity priority areas, 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.

The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated.

The Northern Cape CBA Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. These include the:

- Namakwa District Biodiversity Sector Plan;
- Cape Fine-Scale Plan (only the extent of the areas in the Northern Cape i.e. Bokkeveld and Nieuwoudvillei); and
- Richtersveld Municipality Biodiversity Assessment.

The Northern Cape CBA Map depicts sites which were assigned to the following CBA categories based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity patterns and ecological processes:

- Critical Biodiversity Area 1 (CBA1);
- Critical Biodiversity Area 2 (CBA2);
- ESA;
- Other Natural Area (ONA); and
- Protected Area (PA).

CBAs are terrestrial and aquatic 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. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (BGIS, 2017).

ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (BGIS, 2017).

The project area as a whole fall in a CBA 2 area. Based on the field assessment the area is still in a natural condition with limited impacts.

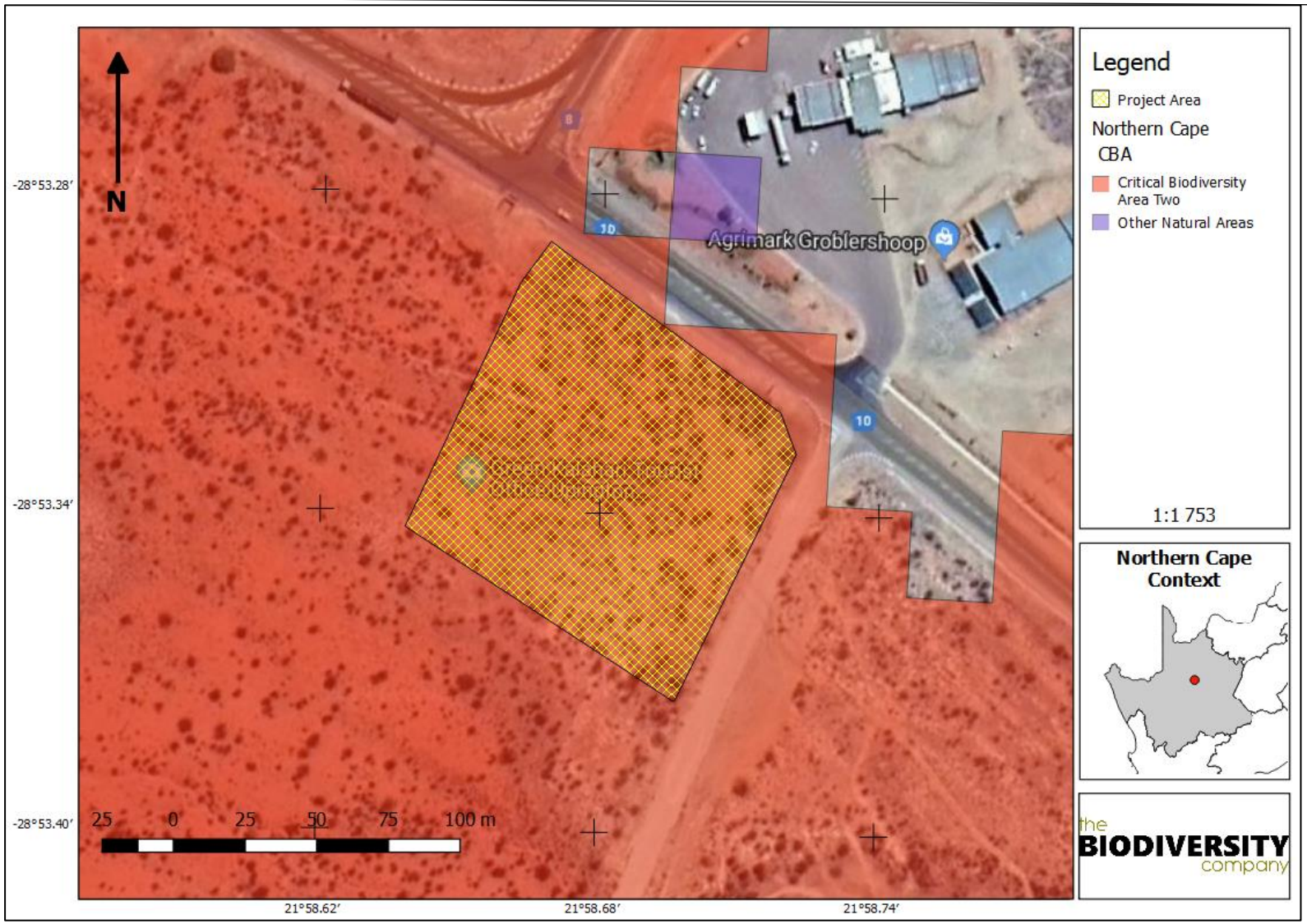

Figure 4: The project area superimposed on the Northern Cape C-plan (2017)

7.5 National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as a collaboration between the SANBI, the DEA and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Driver *et al*., 2011).

The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors (Driver *et al*., 2011).

The two headline indicators assessed in the NBA are *ecosystem threat status* and *ecosystem protection level* (Driver *et al*., 2011).

7.5.1 Ecosystem Threat Status

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver *et al.,* 2011).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Driver *et al.,* 2011).

The project area was superimposed on the terrestrial ecosystem threat status (Figure 5). As seen in this figure the project area falls across one ecosystem which is listed as LT.

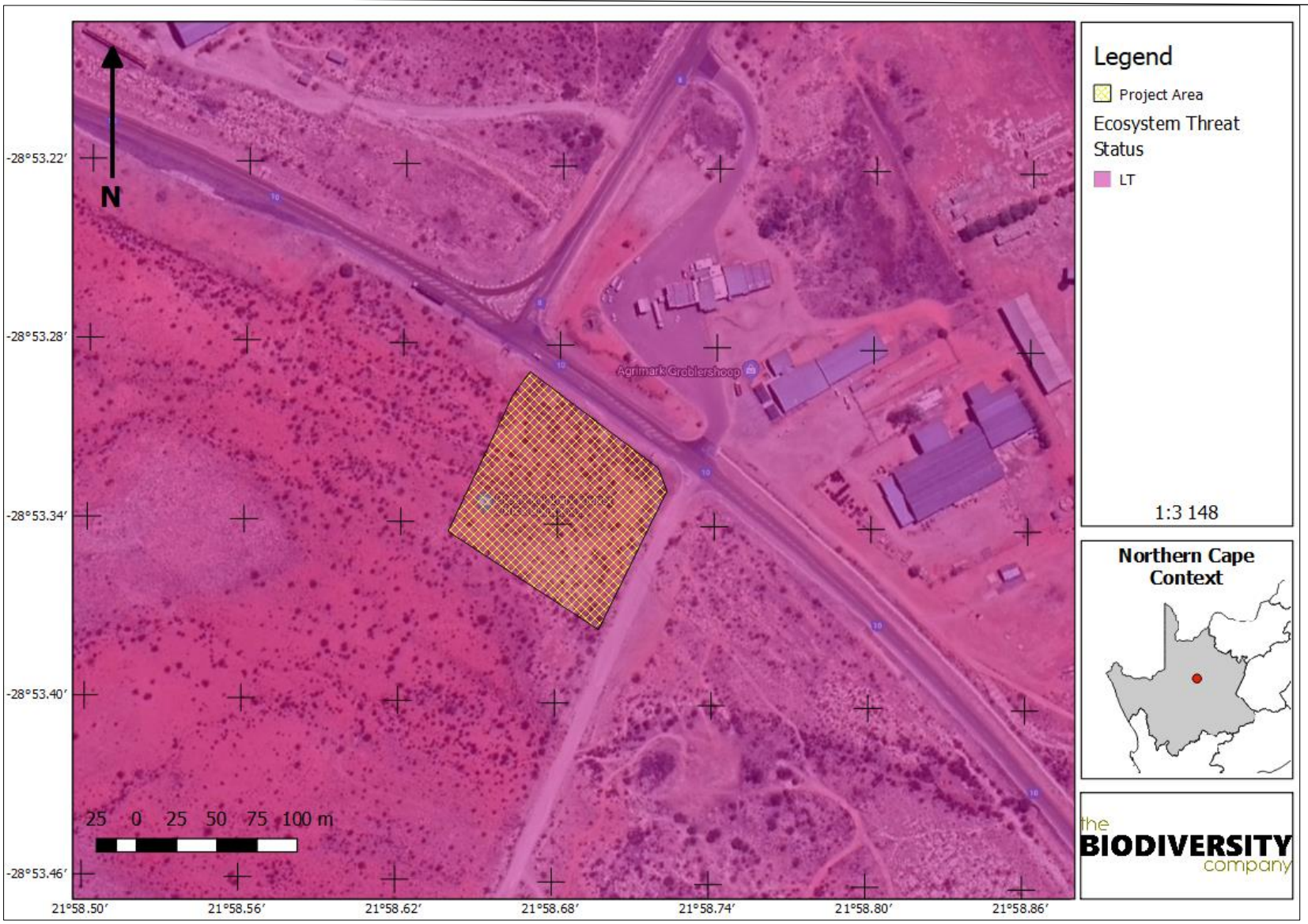

Figure 5: The project area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2012)

7.5.2 Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver *et al.,* 2011).

The project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 6). Based on this the terrestrial ecosystems associated with the proposed project area are rated as *not protected*. This means that these ecosystem types (and associated habitats) are not protected anywhere in the country (such as in nationally protected areas).

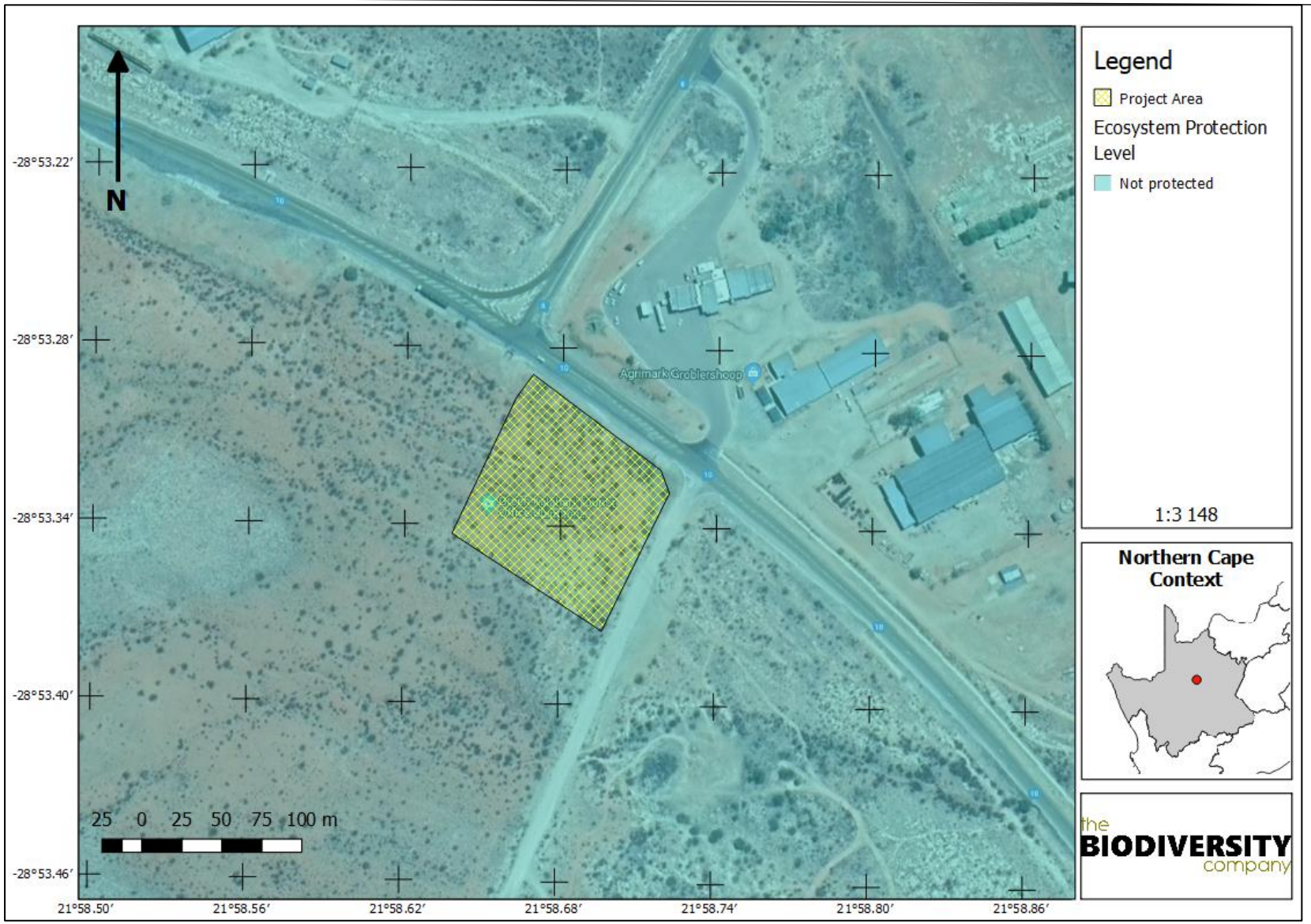

Figure 6: The project area showing the level of protection of terrestrial ecosystems (NBA, 2012)

7.6 Topographical River Line Data

The topographical river line data layer from the “2821” quarter degree square was used during the desktop assessment to determine any additional areas that might indicate potential wet areas. This desktop dataset indicated the presence of various non-perennial river lines within the project area (Figure 7).

7.7 Flow Paths

SAGA software was used to determine any additional flow paths within the 500 m regulated area. One main system is located within the middle of the regulation area, flowing from south to north with another flow paths identified south-east of the project area (Figure 7). During the site assessment, it was determined that the Topographical River Line data set is more accurate than the Flow Path data set created with SAGA. The Topographical River Line data set was therefore rather used throughout this report to determine the position and extent of drainage features.

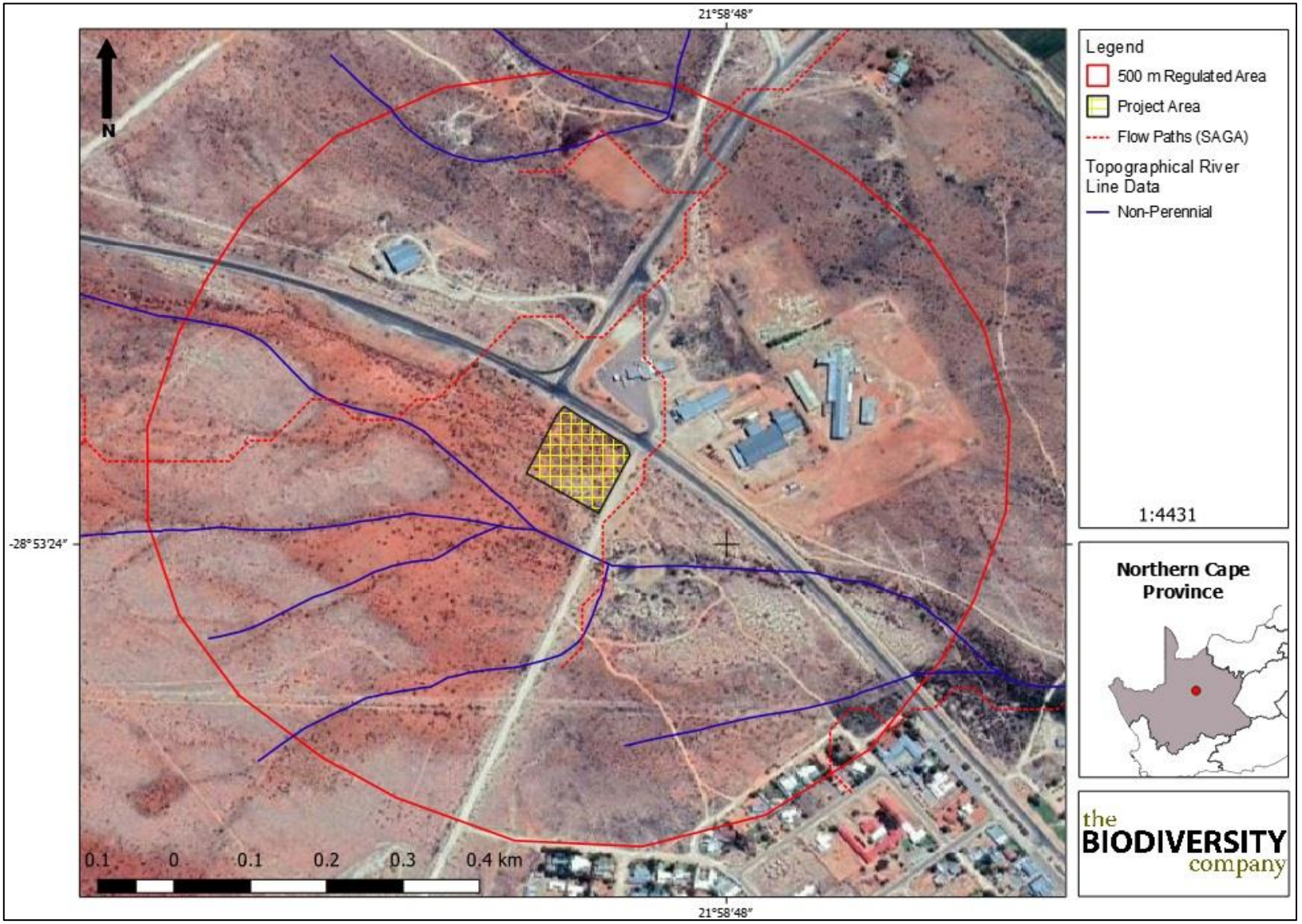

Figure 7: Topographical river lines and flow paths (SAGA)

8 Results & Discussion

8.1 Biodiversity Assessment

8.1.1 Desktop Assessment

8.1.1.1 Vegetation Assessment

The project area falls within the Nama Karroo Biome. This biome is found in the central plateau of the western half of South Africa. The geology underlying the biome is varied, as the distribution of this biome is determined primarily by rainfall. The rain falls in summer, and varies between 100 and 520mm per year. This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs (SANBI, 2019).

The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. Most of the grasses are of the C4 type and, like the shrubs, are deciduous in response to rainfall events (SANBI, 2019).

8.1.1.2 Vegetation Types

The succulent karoo biome comprises many different vegetation types. The project area is situated across one vegetation type; Bushmanland Arid Grassland vegetation type, according to Mucina & Rutherford (2006) (Figure 8).

Figure 8: The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018)

8.1.1.3 Bushmanland Arid Grassland

The Bushmanland Arid Grassland consists of extensive to irregular plains on a slightly sloping plateau. It is sparsely vegetated by grasslands, mainly dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe'. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected (Mucina & Rutherford, 2006).

8.1.1.3.1 Important Plant Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Bushmanland Arid Grassland.

Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *Enneapogon desvauxii* (d), *Eragrostis nindensis* (d), *Schmidtia kalahariensis* (d), *Stipagrostis ciliata* (d), *S. obtusa* (d), *Cenchrus ciliaris*, *Enneapogon scaber*, *Eragrostis annulata*[E], *E. porosa*[E], *E. procumbens*, *Panicum lanipes*[E], *Setaria verticillata*[E], *Sporobolus nervosus*, *Stipagrostis brevifolia*[W], *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*[E].

Small Trees: *Acacia mellifera* subsp. *detinens*[E], *Boscia foetida* subsp. *foetida*.

Tall Shrubs: *Lycium cinereum* (d), *Rhigozum trichotomum* (d), *Cadaba aphylla*, *Parkinsonia africana*.

Low Shrubs: *Aptosimum spinescens* (d), *Hermannia spinosa* (d), *Pentzia spinescens* (d), *Aizoon asbestinum*[E], *A. schellenbergii*[E], *Aptosimum elongatum*, *A. lineare*[E], *A. marlothii*[E], *Barleria rigida*, *Berkheya annectens*, *Blepharis mitrata*, *Eriocephalus ambiguus*, *E. spinescens*, *Limeum aethiopicum*, *Lophiocarpus polystachyus*, *Monechma incanum*, *M. spartioides*, *Pentzia pinnatisecta*, *Phaeoptilum spinosum*[E], *Polygala seminuda*, *Pteronia leucoclada*, *P. mucronata*, *P. sordida*, *Rosenia humilis*, *Senecio niveus*, *Sericocoma avolans*, *Solanum capense*, *Talinum arnotii*[E], *Tetragonia arbuscula*, *Zygophyllum microphyllum*.

Succulent Shrubs: *Kleinia longiflora*, *Lycium bosciifolium*, *Salsola tuberculata*, *S. glabrescens*.

Herbs: *Acanthopsis hoffmannseggiana*, *Aizoon canariense*, *Amaranthus praetermissus*, *Barleria lichtensteiniana*[E], *Chamaesyce inaequilatera*, *Dicoma capensis*, *Indigastrum argyraeum*, *Lotononis platycarpa*, *Sesamum capense*, *Tribulus pterophorus*, *T. terrestris*, *Vahlia capensis*.

Succulent Herbs: *Gisekia pharnacioides*[E], *Psilocaulon coriarium*, *Trianthema parvifolia*.

Geophytic Herb: *Moraea venenata*.

8.1.1.3.2 Biogeographically Important Taxa

Succulent Herb: *Tridentea dwequensis*.

8.1.1.3.3 Endemic Taxa

Succulent Shrubs: *Dinteranthus pole-evansii*, *Larryleachia dinteri*, *L. marlothii*, *Ruschia kenhardtensis*.

Herbs: *Lotononis oligocephala*, *Nemesia maxii.*

8.1.1.3.4 Conservation Status of the Vegetation Type

According to Mucina and Rutherford (2006), this vegetation type is classified as least Threatened. The national target for conservation protection for this vegetation types is 21%, with only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. The risk of erosion in this vegetation type is very low (60%) and low (33%).

8.1.1.4 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 172 plant species are expected to occur in the project area. Figure 9 shows the extent of the grid that was used to compile the expected species list based on the Plants of Southern Africa (BODATSA-POSA, 2016) database. The full list of expected plant species is provided in Appendix A.

Of the 172-plant species, one (1) species are listed as being Species of Conservation Concern (SCC) (Table 6).

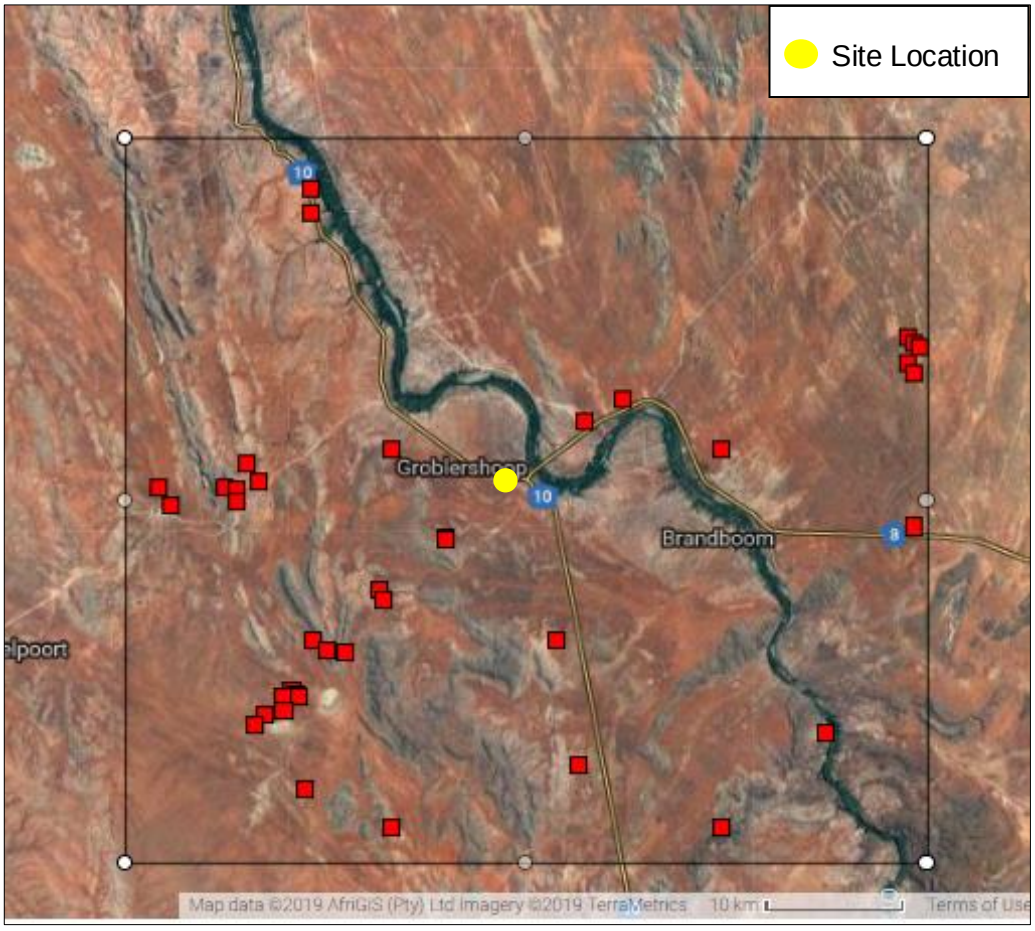

Figure 9: Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016)

Table 6: Plant SCC expected to occur in the project area

Family	Taxon	Author	IUCN	Ecology	Likelihood of Occurrence
Asphodelaceae	*Aloidendron dichotomum*	(Masson) Klopper & Gideon F.Sm.	VU	Indigenous; Endemic	Low

Aloidendron dichotomum (Quiver tree) is a distinctive aloe tree, with smooth branches, which are covered with a thin layer of whitish powder that helps to reflect away the hot sun's rays. This tree is often found in rocky areas in arid parts known as the Namaqualand and Bushmanland. The likelihood of this species occurring in the project area is low, due to the lack of suitable rocky habitat.

8.1.1.5 Faunal Assessment

8.1.1.5.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 173 bird species are expected to occur in the vicinity of the project area (pentads 2845_2150; 2845_2155; 2845_2200; 2850_2150; 2850_2155; 2850_2200; 2855_2150; 2855_2155; 2855_2200). The full list of potential bird species is provided in Appendix B.

Of the expected bird species, six (6) species are listed as SCC either on a regional scale or international scale (Table 7). The SCC include the following:

- Two (2) species that are listed as VU on a regional basis; and
- Four (4) species that are listed as NT on a regional basis.

Table 7: List of bird species of regional or global conservation importance that are expected to occur in pentads 2845_2150; 2845_2155; 2845_2200; 2850_2150; 2850_2155; 2850_2200; 2855_2150; 2855_2155; 2855_2200 (SABAP2, 2019, ESKOM, 2015; IUCN, 2017).

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Anthus crenatus	Pipit, African Rock	NT	LC	Moderate
Aquila verreauxii	Eagle, Verreaux's	VU	LC	Low
Ardeotis kori	Bustard, Kori	NT	NT	Low
Ciconia abdimii	Stork, Abdim's	NT	LC	Low
Eupodotis vigorsii	Korhaan, Karoo	NT	LC	Low
Falco biarmicus	Falcon, Lanner	VU	LC	Moderate

Anthus crenatus (African Rock Pipit) is endemic to South Africa and Lesotho (IUCN, 2017). They are classed as NT after undergoing a decline in habitat of 34% in the last 10 years (IUCN, 2017). The species is associated with rocky habitats that has abundant shrub and grassy areas. The lack of suitable rocky areas decreases the likelihood of finding this species in the project area.

Aquila verreauxii (Verreaux's Eagle) is listed as VU on a regional scale and LC on a global scale. This species is locally persecuted in southern Africa where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Where hyraxes are hunted for food and skins, eagle populations have declined (IUCN, 2017). Based on the lack of suitable habitat and the absence of prey items, the likelihood of occurrence of this species at the project site is rated as low.

Ardeotis kori (Kori Bustard) is listed as NT both on a regional and global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with high voltage power lines are a major threat to this species in the Karoo of South Africa (IUCN, 2007). The habitat at the project site is suitable for this species their likelihood of occurrence is lowered by the proximity to the urban developments.

Ciconia abdimii (Abdim's Stork) is listed as NT on a local scale and the species is known to be found in open grassland and savanna woodland often near water but also in semi-arid areas, gathering beside pools and water-holes. They tend to roost in trees or cliffs (IUCN, 2017). The absence of suitable water sources in the project area decreases the likelihood of occurrence.

Eupodotis vigorsii (Karoo Korhaan) is listed as NT on a regional scale and as LC on a global scale. This species has a very large range, and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km^2 combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). The likelihood of the species occurring in the project area is rated as low due to the proximity to urban development.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. As these prey species are present in the project area the likelihood of occurrence is rated as moderate.

8.1.1.5.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 57 mammal species that could be expected to occur within the vicinity of the project area (Appendix C). Of these species, 4 are medium to large conservation dependant species, such as *Ceratotherium simum* (Southern White Rhinoceros) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the project area and are removed from the expected SCC list. They are however still included in Appendix C.

Of the remaining 53 small to medium sized mammal species, seven (7) are listed as being of conservation concern on a regional or global basis (Table 8).

The list of potential species includes:

- Three (3) that are listed as VU on a regional basis; and
- Three (3) that are listed as NT on a regional scale (Table 4).

Table 8: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Aonyx capensis	Cape Clawless Otter	NT	NT	Low
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT	Low
Felis nigripes	Black-footed Cat	VU	VU	Low
Panthera pardus	Leopard	VU	VU	Low
Parotomys littledalei	Littledale's Whistling Rat	NT	LC	Moderate
Rhinolophus denti	Dent's Horseshoe Bat	NT	LC	
Smutsia temminckii	Temminck's Ground Pangolin	VU	VU	

Aonyx capensis (Cape Clawless Otter) is the most widely distributed otter species in Africa (IUCN, 2017). This species is predominantly aquatic, and it is seldom found far from water. Based on the absence of a perennial river within the project area, the likelihood of occurrence of this species occurring in the project area is considered to be low.

Eidolon helvum (African Straw-coloured Fruit Bat) is listed as LC on a regional scale and NT on a global scale. This species has been recorded from a very wide range of habitats across the lowland rainforest and savanna zones of Africa (IUCN, 2017). Although considered to be widespread and abundant across its range, certain populations are decreasing due to severe deforestation, hunting for food and medicinal use (IUCN, 2017). This species is known to form large roosts and colonies numbering in the thousands to even millions of individuals (IUCN, 2017). No colonies of this species are known to occur in the project area or in the immediate vicinity and, although individuals may occasionally be recorded, it is not expected to be resident within the project area and therefore it's likelihood of occurrence is rated as low.

Felis nigripes (Black-footed Cat) is endemic to the arid regions of southern Africa. This species is naturally rare, has cryptic colouring is small in size and is nocturnal. These factors have contributed to a lack of information on this species. Given that the highest densities of this species have been recorded in the more arid Karoo region of South Africa, the habitat in the project area can be considered to be optimal for the species, however, due to the shy nature of this species and the proximity to the urban development the likelihood of occurrence is rated as low.

Panthera pardus (Leopard) has a wide distributional range across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range (IUCN, 2017). Impacts that have contributed to the decline in populations of this species include continued persecution by farmers, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting (IUCN, 2017). Although known to occur and persist outside of formally protected areas, the densities in these areas are considered to be low. The likelihood of occurrence in the project area which is in such close proximity to an urban area, and where they are likely to be persecuted, is regarded as low.

Parotomys littledalei (Littledale's Whistling Rat) is listed as NT on a regional scale. This diurnal species occurs in shrubland and is dependent on ground cover. Littledale's Whistling Rat is herbivorous only, feeding on fresh plant material, including annuals, succulent perennials, non-succulent perennials, and grasses. The presence of some ground cover increases their likelihood of occurrence in the project area.

Rhinolophus denti (Dent's Horseshoe Bat) is listed as NT regionally and is typically associated with savanna habitats. Populations are largely dependent on caves, abandoned mines and similar habitats for roosting (IUCN, 2007). Due to the lack of such habitat at the project site, the likelihood of occurrence is low.

Smutsia temminckii (Temminck's Ground Pangolin) is a predominantly solitary, terrestrial species that inhabits mainly savanna woodland in low-lying regions with moderate to dense scrub where average annual rainfall is between 250 mm and 1,400 mm (IUCN, 2017). The species is eaten as bushmeat to various extents across its range (e.g. South Africa, Zimbabwe, Namibia, Mozambique, Tanzania). Of greater threat is overexploitation for body parts and scales which have superstitious value and are used for medicinal purposes (IUCN, 2017). The likelihood of occurrence of this species in the project area is low due the fact that the adjacent urban development would lead to disturbances of this sensitive species.

8.1.1.5.3 Herpetofauna (Reptiles & Amphibians)

8.1.1.5.3.1 Reptiles

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2017) 46 reptile species are expected to occur in the project area (Appendix D). No reptile of SCC is expected to be present in the project area.

8.1.1.5.3.2 Amphibians

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2017) twelve (12) amphibian species are expected to occur in the project area (Appendix E).

One (1) amphibian species of conservation concern could be present in the project area according to the above-mentioned sources (Table 9).

Table 9: Amphibian species of conservation concern which may occur in the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Low

The Giant Bull Frog (*Pyxicephalus adspersus*) is listed as NT on a regional scale. It is a species of drier savannahs. It is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary waters in pools, pans and ditches (IUCN, 2017). The likelihood of occurrence is rated as low due to the lack of suitable water sources such as pans or wetlands which forms a crucial part of their lifecycle.

8.1.2 Field Survey

During the surveys the floral and faunal communities within the project development footprint were assessed. The project area was ground-truthed on foot, which included spot checks in pre-selected areas to validate desktop data. Photographs were recorded during the site visits and some are provided in this section of the report. All site photographs are available on request.

8.1.2.1 Habitat Assessment

One habitat type was delineated for this assessment, namely: Dry Bushmanland grassland. The vegetation across the project area was uniform, with the same flora species found throughout. Two drainage lines are present in the project area, however the vegetation surrounding these areas does not differ from the rest of the site. The state of the area consisted of a dense to open woody component dominated by *Senegalia mellifera* with the ground cover being very low with large patches of bare soil (Figure 10).

Figure 10: Typical condition of the vegetation in the project area

8.1.2.2 Vegetation Assessment

The vegetation assessment was conducted throughout the extent of the project area. A total of 12 shrub and herbaceous plant species were recorded in the project area during the field assessment (Table 10).

Table 10:Trees, shrubs and weeds recorded at the proposed project area

Species	Threat status (SANBI, 2017)	SA Endemic	NEMBA Category
Conyza bonariensis			Category 2 NEMBA
Melia azedarach			Not Indigenous; Naturalised
Opuntia ficus-indica	LC	No	
Salsola tuberculata	LC	No	
Senegalia mellifera			NEMBA Category 2
Stipagrostis uniplumis			NEMBA Category 1b
*Vachellia haematoxylon**			NEMBA Category 1b
Lycium bosciifolium	LC	No	
Aloe falcata	LC	No	
Lycium cinereum	LC	No	
Cenchrus ciliaris	LC	No	

(*) denotes Protected tree species

8.1.2.3 Protected Tree species

According to the list of protected tree species under the National Forests Act, 1998 (Act NO.84 of 2014) in terms of section 15 (1) of the Forests Act,1998 (DAFF,2014), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate, or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence.

*Vachellia haematoxylon (*Grey Camel Thorn) was observed within the vicinity. Should the proposed development impact on these trees, then application for a relocation or destruction permit needs to be made OR to move the proposed development footprint in order to avoid the trees currently present. An example of *Vachellia haematoxylon* can be seen in Figure 11.

Figure 11: Example of the leaves and seeds of the Vachellia haematoxylon

8.1.2.4 Faunal Assessment

8.1.2.4.1 Avifauna

Twelve (12) bird species were recorded in the project area during the May-June 2019 survey based on either direct observations, vocalisations, or the presence of visual tracks & signs (Table 11) (Figure 12). The amount of birds recorded in the project area was seen as low, this is most likely due to the proximity of the project area to the urban development of Groblershoop. No SCCs were observed it is also not likely that these species are to occur in the project area.

Table 11: A list of avifaunal species recorded for the project area

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Cercotrichas paena	Scrub-robin, Kalahari	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC
Nilaus afer	Brubru	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Prinia flavicans	Prinia, Black-chested	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Tchagra australis	Tchagra, Brown-crowned	Unlisted	LC

Figure 12: Some of the avifauna recorded within the project area: A) Kalahari Scrub-Robin (Cercotrichas paena), B) Laughing Dove (Streptopelia senegalensis), C) Southern Pale-Chanting Goshawk (Melierax canorus), D) Brown crowned Tchagra (Tchagra australis) and H) House Sparrow (Passer domesticus)

8.1.2.4.2 Mammals

Overall, mammal diversity in the project area was low, with no mammal species being positively identified (Figure 13). Holes were found in the project area, however positive identifications could not be made of the residents. It can however be speculated that these holes most likely belong to rodent species.

Figure 13: Signs of mammal species present in the project area

8.1.2.4.3 Herpetofauna (Reptiles & Amphibians)

Herpetofauna diversity was considered to be low with no reptile and no amphibian species observed or recorded in the project area during the May/June survey. Based on the natural state of the habitat, the likelihood of some species being present is considered high.

8.2 Wetland Assessment

8.2.1 Wetland Identification

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. During the field survey, one depression (HGM 1) (Figure 14) was identified, which has been deemed to be formed by overland flow from a drainage channel as well as the road from Water Street and Kerk Street (Figure 15). The remainder of the drainage channel has been deemed not to be a wetland given the lack of wetland properties (hydromorphic soils and hydrophytic plants). In addition to the delineated wetland, various drainage lines (Figure 16) were identified, which is closely (but not entirely) resembled by the Topographical River Line data set (Figure 15) and was therefore used to determine the extent of drainage lines.

Figure 14: Wetlands identified within the 500 m regulated area

Signs of wetness within HGM 1 include hydrophytic vegetation, namely *Cyperus triangularis* and *Phragmites australis* (Figure 17). One soil form with hydromorphic properties has been identified within the delineated boundaries of HGM 1, namely the Glenrosa soil form. The topsoil of this soil form (Orthic A-horizon) is characterised by a high moisture content, signs of gleying as well as a high concentration of organic material, which is characteristic of a hydromorphic soil that is saturated for long periods (Figure 18).

The only impact that potentially might affect HGM 1 is that of contamination, erosion and/or an increase of water fluxes given increased run-off via the proposed development. It is the specialist's opinion that the high hydraulic conductivity, the presence of another drainage line together with the shear distance between the proposed project area and the delineated wetland eliminates any overland flow-related impacts similar to those mentioned above. The wetland identified within the 500m regulated area therefore has been excluded from this assessment, given the fact that the wetland (in the specialist's opinion) will not be affected in anyway by the proposed development. The wetland is 438 m from the proposed development with the entire distance between the wetland and the proposed project area being characterised by deep Hutton and Glenrosa soil forms which both have high hydraulic conductivities. The high hydraulic conductivity limits overland flow given the high infiltration rate, ultimately ensuring that no run-off water reaches the wetland.

In addition to high infiltration and permeability, a drainage line (labelled "A" in Figure 19) is located between the proposed project area and the delineated wetland which is expected to intercept any overland flow from the proposed project area. This drainage line itself is characterised by an excavated pit used for illegal dumping located in the middle of the drainage line (labelled "B" in Figure 19). The estimated direction of overland flow from the proposed project area is illustrated in Figure 19.

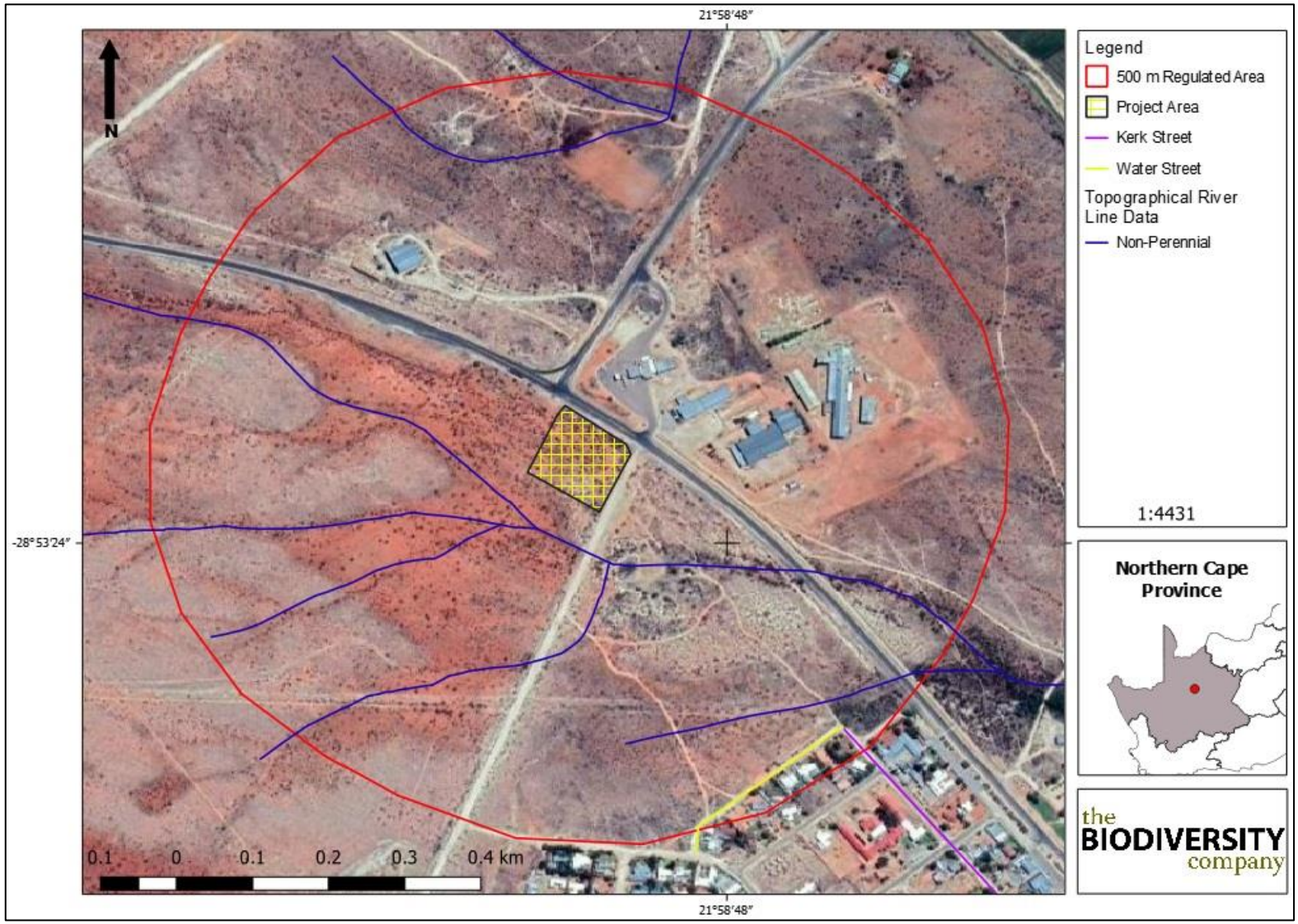

Figure 15: Sources responsible for the formation of the depression wetland

Figure 16: Examples of drainage lines within the proposed project area

Figure 17: Hydrophytes identified within the delineated wetland (HGM 1). A: Cyperus triangularis. B: Phragmites Australis

Figure 18: Glenrosa soil form characterised by signs of wetness

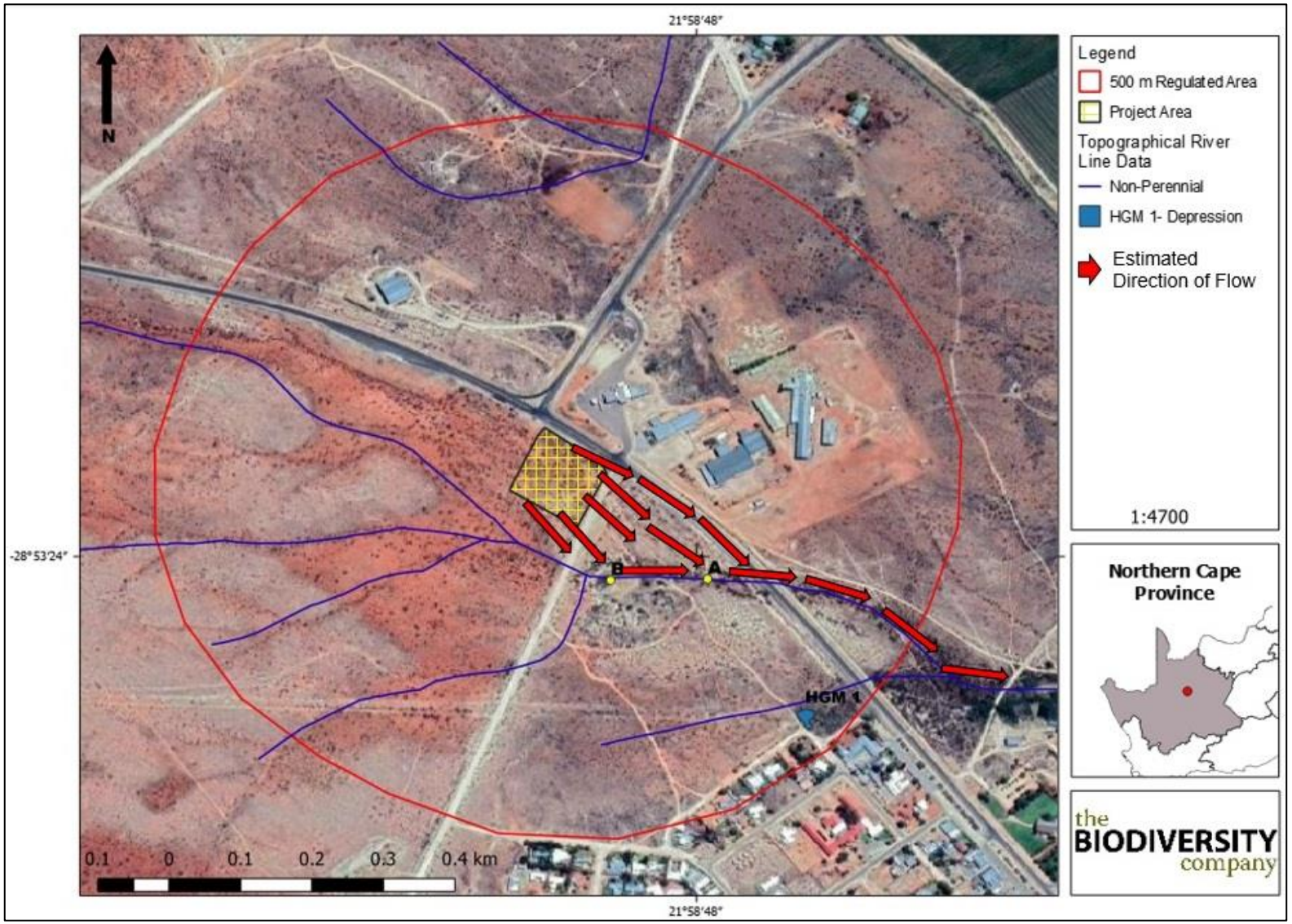

Figure 19: Estimated overland flow direction (interception by drainage line "A")

8.2.2 Drainage Lines

A series of drainage lines have been identified throughout the project area with the most significant of these being illustrated in Figure 19 (topographical river line data). A series of drainage features were identified directly within the proposed project area, ultimately indicating the potential for sensitive features in the form of wetland properties and the need for thorough assessments.

No hydrophytes or hydromorphic soil properties were identified within the identified drainage features, ultimately rendering these systems terrestrial/non-wetland areas. Given the lack of hydromorphic properties, these systems have been classified as non-sensitive. It is however the specialist's opinion that these systems are valuable in the sense that they channel high velocity overland flow to ultimately dissipate once the velocity decreases to such an extent that deep infiltration becomes dominant. Without these preferential flow paths, erosion might occur, ultimately leading to indirect impacts to other sensitive features. It therefore has been recommended (see Section 13) that a storm water management plan be completed for the proposed project to accommodate preferential overland flow.

9 Habitat Sensitivity Mapping

As per the terms of reference for the project, a GIS sensitivity map is required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area. The sensitivity scores identified during the field survey for each habitat were then visually mapped (Figure 20).

The areas given a low sensitivity are the areas that are deemed by the specialist to have been impacted upon the most, in this case it is due to the adjacent road that will lead to disturbances for both the plants and the animals (Figure 20). The area given a moderately-high sensitivity has not been impacted on by developments, animals grazing nor dumping of rubbish. The moderately- high sensitivity of the area is because of the CBA2 classification of the area and the fact that the area is still in mostly a natural state.

It is important to note that these maps do not replace any local, provincial or government legislation relating to these areas or the land use capabilities or sensitivities of these environments.

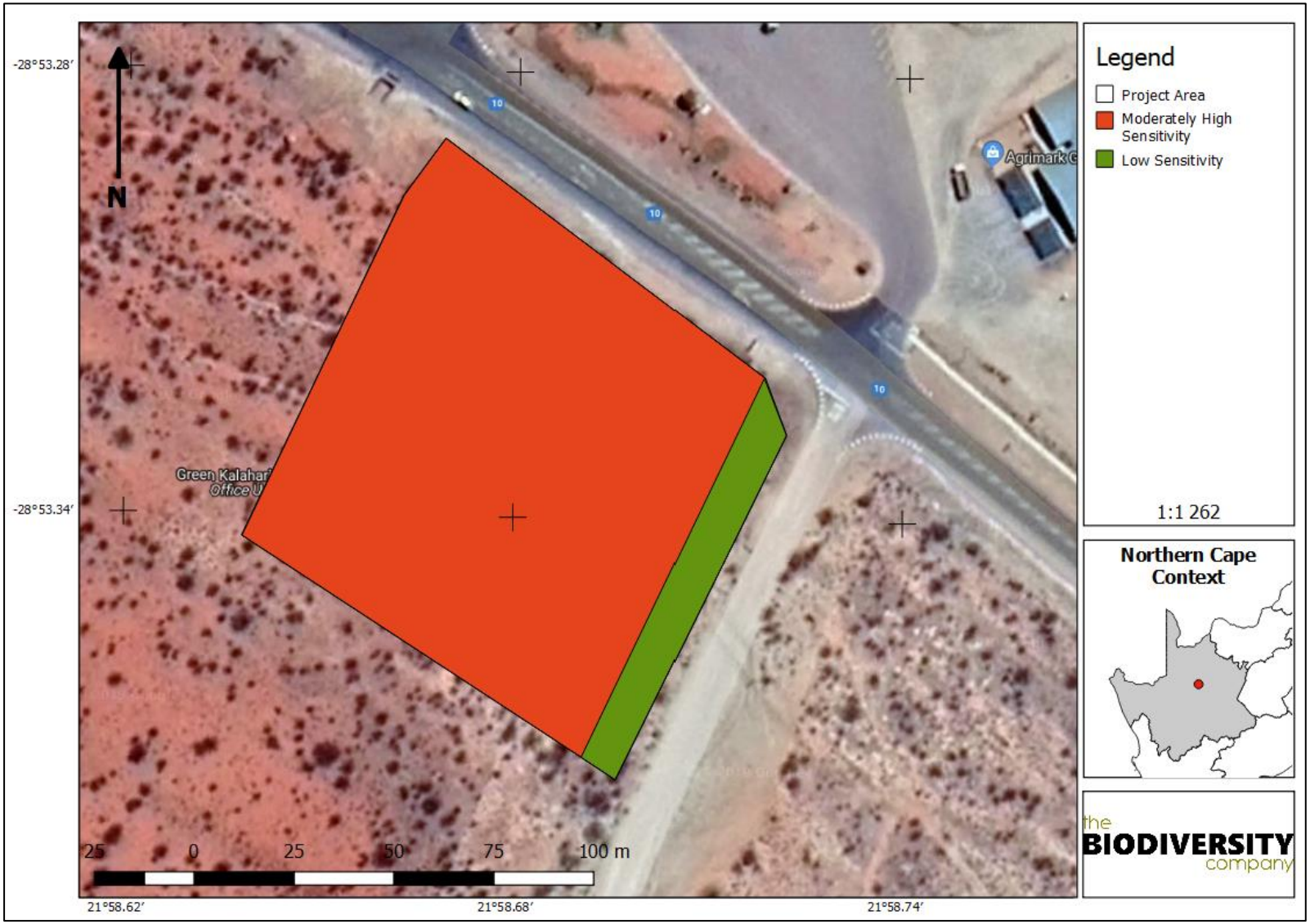

Figure 20: Habitat sensitivity map of the project area

10 Impact Assessment

Development-related activities can have significant impacts on biodiversity and ecosystem services, often causing irreversible and large-scale habitat loss across large areas or areas important for the provision of important ecosystem services.

Key impacts commonly associated with development activities are discussed below. The listed activities are merely indicative, and the proposed developments may either have additional or fewer activities depending on the circumstances. It should be noted that these categories, with associated impact descriptions is not exhaustive, and more impacts may be identified at a later stage as more information becomes available.

The significance (quantification) of potential environmental impacts has been assessed in terms of the Guideline Documentation on EIA Regulation; Department of Environmental Affairs and Tourism, 2014 (Impact Assessment Methodology, Appendix 6).

10.1 Impact Assessment Methodology

Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the project area. The relevant impacts associated with the proposed project were then subjected to a prescribed impact assessment methodology which is available on request.

10.2 Current Impacts

During the field survey, the current impacts that are having a negative impact on the area and surrounding ares were identified, and are listed below and some are shown in Figure 21;

- Dumping of rubble and litter in the project area;
- Adjacent secondary and gravel road; and
- Powerlines within the vicinity of the project area.

Figure 21: Some of the impacts identified in the project area; A) Powerlines, B) Erosion, C) Fencing, D) Rubbish, E) Dumping of building material and D) Gravel roads

10.3 Identification of Additional Potential Impacts

The proposed development is associated with the proposed mixed-use commercial development, this is to include office space, garages, and car parks. The proposed activity may lead to the loss and destruction of habitats, direct mortalities and displacement of fauna and flora.

Most of the proposed development areas are situated adjacent to areas which have been previously disturbed. The overall environment is still considered sensitive as some of the project area falls within an CBA 2. The assessment does not have an impact assessment for

the wetland as it is located more than 438m away from the site and any impacts on it due to the development are unlikely.

The potential impacts on the biodiversity associated with the various project stages are discussed below.

10.3.1 Planning Phase

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This phase of the assessment would include, amongst others, site visits of various contractors, environmental and social impact assessment and compiling of management plans. Only one minor impact was assessed regarding the planning phase:

- Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.

10.3.2 Construction Phase

The following potential impacts were considered on biodiversity (including fauna and flora) based on the clearance for infrastructure as well as disturbances such as dust, noise and erosion.

- Destruction of, and fragmentation of, portions of the vegetation community (including an area classified as a CBA2);
- Further disturbance of a habitat classified as not protected; and
- Displacement of faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration) and/or direct mortalities.

10.3.3 Operational Phase

The following potential impacts were considered on biodiversity (fauna and flora) during operational phase:

- Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in the areas that will not be paved;
- Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust);
- Introduction of pest species (e.g. rats and flies) due to the new habitats that's created in the waste containers;
- Spillage of oil and petrol from parked cars; and
- Soil erosion, due to the paved areas.

10.3.4 Decommissioning and Closure Phase

No closure and decommissioning phase were considered due to the nature of the proposed developments and the extent to which the area will be altered.

11 Assessment of Significance

The summary tables below show the significance of the various impacts, which range from moderate to low before mitigation for the construction phase portion of the project. The significance of the impact's changes to a significance of moderate or low for all listed activities following the implementation of mitigation measures and recommendations.

11.1 Planning Phase

The table below (Table 12) presents the significance of potential planning phase impacts on the terrestrial ecosystems and terrestrial biodiversity before and after implementation of mitigation measures. This aspect of the project scored low as majority of the project is desktop based, it was however considered that tests and evaluations will need to be performed on site and as such the ratings were slightly increased pre-mitigations (Table 12).

Table 12: Impact significance during the planning phase pre- and post-mitigation

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Temporary disturbance of biodiversity due to increased human presence and possible use of machinery and/or vehicles.	2	2	2	4	3		2	2	1	3	2	
	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Insignificant / ecosystem structure and function unchanged	Ecology moderately sensitive/ /important	Possible	**Absent**

11.2 Construction Phase

The tables below (Table 13) show the significance of potential construction phase impacts on floral and faunal communities before and after implementation of mitigation measures.

The habitat is sensitive due to the CBA2 and not protected status of the ecosystem. Based on the type of development where paving amongst other things will be put in, the impact on the vegetation prior to mitigations were rated as high, this was lowered to moderate should the mitigations be implemented.

The activities associated with the construction will have a moderately high impact on the fauna of the area but will decrease should the mitigation measures be followed.

Table 13: Impact significance during the construction phase pre- and post-mitigation for the commercial development

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Destruction of, and fragmentation of, portions of the vegetation community (including an area classified as a CBA2)	5	4	4	3	5		5	3	3	3	3	
	Permanent	Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Definite	**High**	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**
Further disturbance of a habitat classified as not protected	4	3	4	3	4		4	3	3	3	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**
Displacement of faunal community (including possible threatened or protected species) due	4	3	4	4	4		4	3	3	3	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / <	Great / harmful/ ecosystem structure and function	Ecology highly sensitive /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / <	Significant / ecosystem structure and function	Ecology moderately sensitive/ /important	Likely	**Moderate**

to habitat loss, disturbance (noise, dust and vibration) and/or direct mortalities.		5000ha impacted / Linear features affected < 1000m	largely altered					5000ha impacted / Linear features affected < 1000m	moderately altered			

11.3 Operational Phase

The tables below (Table 13 and Table 14) show the significance of potential operational phase impacts on floral and faunal communities before and after implementation of mitigation measures. Impacts such as the introduction of alien species as pest species such as rodents and flies will have a moderately high impact prior to mitigations due to the risk it poses for the local fauna and flora. Should mitigations such as an alien vegetation management plan and a pest control plan be compiled and implemented the risk can be lowered to moderate.

Table 14: Impact significance during the operational phase pre- and post-mitigation for the commercial development

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in the areas that will not be paved	5	3	4	4	4		5	3	3	3	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**
Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust)	5	3	3	4	4		5	2	3	3	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	Permanent	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**
Introduction of pest species (e.g. rats and flies) due to the new habitats that's created in the waste containers	5	3	4	4	4		4	2	3	3	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**

		affected < 1000m						affected < 100m				
	4	3	4	4	3		3	2	2	3	2	
Soil erosion caused by the new paved areas	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderately High**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology moderately sensitive/ /important	Possible	**Low**

12 Mitigation Measures

12.1 Mitigation Measure Objectives

The focus of mitigation measures should be to reduce the significance of potential impacts associated with the commercial development and thereby to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community (including the CBA2 area);
- Prevent the loss of the faunal community (including potentially occurring species of conservation concern) associated with these vegetation communities; and
- Limiting the construction area to the defined project areas and only impacting those areas where it is unavoidable to do so otherwise.

12.1.1 Mitigation Measures for Impacts on Vegetation Communities & CBAs

From an ecological perspective the proposed development is situated in an area that is classified as sensitive and is still in a natural condition. The likelihood does exist that SCCs might be present in the area. Prescribed mitigation and rehabilitation measures include the following:

- Construction vehicles must be restricted to existing roads and new pathways must be restricted;
- It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon and preventing movement of workers into surrounding environments;
- All laydown, storage areas etc should be restricted to within the project area;
- A qualified environmental control officer must be on site when construction begins to identify species that will be directly disturbed and to relocate fauna/flora that is found during construction (including all reptiles and amphibians);
- A storm water management plan must be put in place and implemented to reduce the likelihood of erosion;
- Dust reducing mitigation measures must be put in place and must be strictly adhered to; this will be very important during the construction phase, seeing that the area is prone to gusts of wind; and
- Compile and implement an alien vegetation management plan.

12.1.2 Mitigation Measures for Impacts on Faunal Communities

Recommended mitigation and rehabilitation measures for faunal community's hinge largely on protecting their habitats and ensuring it remains intact. The following measures are prescribed:

- Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery;

- Fauna species that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint;
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site;
- No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals; and
- Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process.

13 Recommendations

The following recommendations are applicable:

- A proper stormwater system must be incorporated into the construction and operation plans of the proposed activity;
- Rock cladding must be implemented for the drainage features to limit erosion during the interception of the relevant drainage feature; and
- All bare areas must be revegetated with indigenous vegetation to decrease the possibility of erosion.

14 Conclusion

Only one wetland system was identified within the 500 m regulated area. This wetland has been excluded from this assessment given the fact that the proposed activity poses unlikely threats towards the wetland. The distance between the wetland and the proposed activity is 438m with soil forms characterised by high infiltration covering the extent between the project area and the wetland. Additionally, a drainage feature is located between the project area and the delineated wetland, ultimately ensuring that any increased run-off from the project area be intercepted by the relevant channel instead of being channelled towards the delineated wetland.

Overall the habitat was in a good condition and has not been extensively impacted. No species of conservation concern was observed during the site visit however the likelihood of these species being present cannot be excluded. Due to the nature of the development the area will be extensively altered and in order to preserve as much of the biodiversity on the site and in the surrounding areas the mitigation measures need to be closely adhered to.

15 Impact Statement

An impact statement is required as per the NEMA EIA regulations (as amended) with regards to the proposed development.

Based on the findings of this report, and the outcomes of the field surveys, it is the opinion of the specialists that the proposed development can be favourably considered. However, should this be the start of a much larger development, the project needs to be carefully considered as the area is still in a good condition and certain sections of the surrounding habitats are still in the CBA2 state.

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PPENDIX A: *Floral species expected to occur in the project area*

Family	Taxon	Author	IUCN	Ecology
Cucurbitaceae	*Acanthosicyos naudinianus*	(Sond.) C.Jeffrey	LC	Indigenous
Apocynaceae	*Adenium oleifolium*	Stapf	LC	Indigenous; Endemic
Aizoaceae	*Aizoon burchellii*	N.E.Br.		Indigenous; Endemic
Aizoaceae	*Aizoon schellenbergii*	Adamson	LC	Indigenous
Asphodelaceae	*Aloidendron dichotomum*	(Masson) Klopper & Gideon F.Sm.	VU	Indigenous; Endemic
Amaranthaceae	*Alternanthera pungens*	Kunth		Not indigenous; Naturalised
Anacampserotaceae	*Anacampseros albissima*	Marloth		Indigenous; Endemic
Scrophulariaceae	*Aptosimum albomarginatum*	Marloth & Engl.	LC	Indigenous; Endemic
Scrophulariaceae	*Aptosimum indivisum*	Burch. ex Benth.	LC	Indigenous; Endemic
Scrophulariaceae	*Aptosimum marlothii*	(Engl.) Hiern	LC	Indigenous; Endemic
Scrophulariaceae	*Aptosimum spinescens*	(Thunb.) Emil Weber	LC	Indigenous; Endemic
Asteraceae	*Arctotis leiocarpa*	Harv.	LC	Indigenous; Endemic
Poaceae	*Aristida adscensionis*	L.	LC	Indigenous
Poaceae	*Aristida congesta subsp. congesta*	Roem. & Schult.	LC	Indigenous
Poaceae	*Aristida diffusa subsp. burkei*	Trin.	LC	Indigenous
Poaceae	*Aristida stipitata subsp. spicata*	Hack.	LC	Indigenous
Acanthaceae	*Barleria lichtensteiniana*	Nees		Indigenous; Endemic
Elatinaceae	*Bergia polyantha*	Sond.	LC	Indigenous
Asteraceae	*Berkheya spinosissima subsp. spinosissima*	(Thunb.) Willd.	LC	Indigenous; Endemic
Acanthaceae	*Blepharis mitrata*	C.B.Clarke		Indigenous; Endemic
Nyctaginaceae	*Boerhavia cordobensis*	Kuntze		Not indigenous; Naturalised
Poaceae	*Brachiaria glomerata*	(Hack.) A.Camus	LC	Indigenous; Endemic
Bryaceae	*Bryum pycnophyllum*	(Dixon) Mohamed		Indigenous
Cyperaceae	*Bulbostylis hispidula subsp. pyriformis*	(Vahl) R.W.Haines	LC	Indigenous
Capparaceae	*Cadaba aphylla*	(Thunb.) Wild	LC	Indigenous
Poaceae	*Cenchrus ciliaris*	L.	LC	Indigenous
Poaceae	*Centropodia glauca*	(Nees) Cope	LC	Indigenous
Verbenaceae	*Chascanum pinnatifidum var. pinnatifidum*	(L.f.) E.Mey.		Indigenous
Pteridaceae	*Cheilanthes deltoidea subsp. deltoidea*	Kunze	LC	Indigenous; Endemic
Poaceae	*Chloris virgata*	Sw.	LC	Indigenous
Asteraceae	*Cichorium intybus subsp. intybus*	L.		Not indigenous; Naturalised; Invasive
Cleomaceae	*Cleome angustifolia subsp. diandra*	Forssk.	LC	Indigenous
Cleomaceae	*Cleome gynandra*	L.	LC	Indigenous
Combretaceae	*Combretum erythrophyllum*	(Burch.) Sond.	LC	Indigenous
Cucurbitaceae	*Corallocarpus schinzii*	Cogn.	LC	Indigenous

Malvaceae	*Corchorus asplenifolius*	Burch.	LC	Indigenous
Crassulaceae	*Cotyledon orbiculata var. orbiculata*	L.	LC	Indigenous
Cucurbitaceae	*Cucumis africanus*	L.f.	LC	Indigenous
Fabaceae	*Cullen tomentosum*	(Thunb.) J.W.Grimes	LC	Indigenous
Poaceae	*Digitaria eriantha*	Steud.	LC	Indigenous
Poaceae	*Digitaria sp.*			
Asteraceae	*Dimorphotheca polyptera*	DC.	LC	Indigenous; Endemic
Plumbaginaceae	*Dyerophytum africanum*	(Lam.) Kuntze	LC	Indigenous; Endemic
Poaceae	*Enneapogon cenchroides*	(Licht. ex Roem. & Schult.) C.E.Hubb.	LC	Indigenous
Poaceae	*Enneapogon desvauxii*	P.Beauv.	LC	Indigenous
Poaceae	*Enneapogon scaber*	Lehm.	LC	Indigenous
Poaceae	*Eragrostis brizantha*	Nees	LC	Indigenous; Endemic
Poaceae	*Eragrostis echinochloidea*	Stapf	LC	Indigenous
Poaceae	*Eragrostis homomalla*	Nees	LC	Indigenous
Poaceae	*Eragrostis lehmanniana*	Nees		Indigenous
Poaceae	*Eragrostis lehmanniana var. lehmanniana*	Nees	LC	Indigenous
Poaceae	*Eragrostis nindensis*	Ficalho & Hiern	LC	Indigenous
Poaceae	*Eragrostis pallens*	Hack.	LC	Indigenous
Poaceae	*Eragrostis porosa*	Nees	LC	Indigenous
Poaceae	*Eragrostis procumbens*	Nees	LC	Indigenous
Poaceae	*Eragrostis pseudobtusa*	De Winter	NE	Indigenous; Endemic
Asteraceae	*Euryops chrysanthemoides*	(DC.) B.Nord.	LC	Indigenous; Endemic
Asteraceae	*Felicia hirsuta*	DC.	LC	Indigenous; Endemic
Moraceae	*Ficus cordata subsp. cordata*	Thunb.	LC	Indigenous
Poaceae	*Fingerhuthia africana*	Lehm.	LC	Indigenous; Endemic
Urticaceae	*Forsskaolea candida*	L.f.		Indigenous; Endemic
Asteraceae	*Geigeria ornativa subsp. ornativa*	O.Hoffm.	LC	Indigenous
Asteraceae	*Geigeria pectidea*	(DC.) Harv.	LC	Indigenous; Endemic
Gisekiaceae	*Gisekia africana*	(Lour.) Kuntze		Indigenous
Gisekiaceae	*Gisekia africana var. africana*	(Lour.) Kuntze	LC	Indigenous
Gisekiaceae	*Gisekia pharnaceoides var. pharnaceoides*	L.	LC	Indigenous
Neuradaceae	*Grielum sinuatum*	Licht. ex Burch.	LC	Indigenous; Endemic
Pedaliaceae	*Harpagophytum procumbens subsp. procumbens*	(Burch.) DC. ex Meisn.	NE	Indigenous
Asteraceae	*Helichrysum arenicola*	M.D.Hend.	LC	Indigenous; Endemic
Brassicaceae	*Heliophila minima*	(Stephens) Marais	LC	Indigenous; Endemic
Brassicaceae	*Heliophila trifurca*	Burch. ex DC.	LC	Indigenous; Endemic
Boraginaceae	*Heliotropium ciliatum*	Kaplan	LC	Indigenous
Malvaceae	*Hermannia abrotanoides*	Schrad.	LC	Indigenous; Endemic
Malvaceae	*Hermannia burkei*	Burtt Davy	LC	Indigenous; Endemic
Malvaceae	*Hermannia eenii*	Baker f.	LC	Indigenous

Malvaceae	*Hermannia spinosa*	E.Mey. ex Harv.	LC	Indigenous; Endemic
Malvaceae	*Hermannia tomentosa*	(Turcz.) Schinz ex Engl.	LC	Indigenous
Amaranthaceae	*Hermbstaedtia fleckii*	(Schinz) Baker & C.B.Clarke	LC	Indigenous
Malvaceae	*Hibiscus elliottiae*	Harv.	LC	Indigenous; Endemic
Asteraceae	*Hirpicium echinus*	Less.	LC	Indigenous; Endemic
Violaceae	*Hybanthus densifolius*	Engl.	LC	Indigenous; Endemic
Fabaceae	*Indigofera alternans var. alternans*	DC.	LC	Indigenous
Fabaceae	*Indigofera heterotricha*	DC.	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia integerrima*	(Benth.) Hilliard	LC	Indigenous; Endemic
Scrophulariaceae	*Jamesbrittenia tysonii*	(Hiern) Hilliard	LC	Indigenous; Endemic
Acanthaceae	*Justicia divaricata*	Licht. ex Roem. & Schult.		Indigenous
Acanthaceae	*Justicia puberula*	Immelman		Indigenous; Endemic
Acanthaceae	*Justicia spartioides*	T.Anderson		Indigenous; Endemic
Loasaceae	*Kissenia capensis*	Endl.	LC	Indigenous
Rubiaceae	*Kohautia caespitosa subsp. brachyloba*	Schnizl.	LC	Indigenous
Rubiaceae	*Kohautia cynanchica*	DC.	LC	Indigenous
Santalaceae	*Lacomucinaea lineata*	(L.f.) Nickrent & M.A.Garcia		Indigenous; Endemic
Asteraceae	*Laggera decurrens*	(Vahl) Hepper & J.R.I.Wood	LC	Indigenous
Fabaceae	*Leobordea platycarpa*	(Viv.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Lessertia frutescens subsp. frutescens*	(L.) Goldblatt & J.C.Manning	LC	Indigenous; Endemic
Fabaceae	*Lessertia pauciflora var. pauciflora*	Harv.	LC	Indigenous
Amaranthaceae	*Leucosphaera bainesii*	(Hook.f.) Gilg	LC	Indigenous
Limeaceae	*Limeum aethiopicum var. lanceolatum*	Burm.f.	NE	Indigenous; Endemic
Limeaceae	*Limeum argute-carinatum var. argute-carinatum*	Wawra ex Wawra & Peyr.	LC	Indigenous
Limeaceae	*Limeum fenestratum var. fenestratum*	(Fenzl) Heimerl	LC	Indigenous
Limeaceae	*Limeum myosotis var. myosotis*	H.Walter	LC	Indigenous
Limeaceae	*Limeum pterocarpum var. pterocarpum*	(J.Gay) Heimerl	LC	Indigenous
Limeaceae	*Limeum viscosum subsp. transvaalense*	(J.Gay) Fenzl	LC	Indigenous; Endemic
Lophiocarpaceae	*Lophiocarpus polystachyus*	Turcz.	LC	Indigenous; Endemic
Solanaceae	*Lycium cinereum*	Thunb.	LC	Indigenous; Endemic
Scrophulariaceae	*Manulea gariepina*	Benth.	LC	Indigenous; Endemic
Scrophulariaceae	*Manulea schaeferi*	Pilg.	LC	Indigenous; Endemic
Poaceae	*Melinis nerviglumis*	(Franch.) Zizka	LC	Indigenous
Poaceae	*Melinis repens subsp. grandiflora*	(Willd.) Zizka	LC	Indigenous
Fabaceae	*Melolobium sp.*			
Aizoaceae	*Mesembryanthemum articulatum*	Thunb.		Indigenous; Endemic

Aizoaceae	*Mesembryanthemum coriarium*	Burch. ex N.E.Br.		Indigenous; Endemic
Aizoaceae	*Mesembryanthemum guerichianum*	Pax	LC	Indigenous; Endemic
Aizoaceae	*Mestoklema arboriforme*	(Burch.) N.E.Br. ex Glen	LC	Indigenous; Endemic
Aizoaceae	*Mestoklema copiosum*	N.E.Br. ex Glen	LC	Indigenous; Endemic
Apocynaceae	*Microloma longitubum*	Schltr.	LC	Indigenous; Endemic
Geraniaceae	*Monsonia glauca*	R.Knuth	LC	Indigenous
Scrophulariaceae	*Nemesia sp.*			
Meliaceae	*Nymania capensis*	(Thunb.) Lindb.	LC	Indigenous; Endemic
Lamiaceae	*Ocimum americanum var. americanum*	L.	LC	Indigenous
Poaceae	*Oropetium capense*	Stapf	LC	Indigenous
Poaceae	*Panicum lanipes*	Mez	LC	Indigenous; Endemic
Scrophulariaceae	*Peliostomum leucorrhizum*	E.Mey. ex Benth.	LC	Indigenous; Endemic
Asteraceae	*Pentzia pinnatisecta*	Hutch.	LC	Indigenous; Endemic
Acanthaceae	*Petalidium aromaticum var. canescens*	Oberm.		Indigenous
Molluginaceae	*Pharnaceum brevicaule*	(DC.) Bartl.	LC	Indigenous
Polygalaceae	*Polygala leptophylla var. leptophylla*	Burch.	LC	Indigenous
Fabaceae	*Pomaria lactea*	(Schinz) B.B.Simpson & G.P.Lewis	LC	Indigenous; Endemic
Fabaceae	*Prosopis glandulosa var. glandulosa*	Torr.	NE	Not indigenous; Naturalised
Fabaceae	*Prosopis sp.*			
Fabaceae	*Prosopis velutina*	Wooton	NE	Not indigenous; Naturalised; Invasive
Fabaceae	*Ptycholobium biflorum*	(E.Mey.) Brummitt		Indigenous
Fabaceae	*Ptycholobium biflorum subsp. biflorum*	(E.Mey.) Brummitt	LC	Indigenous
Fabaceae	*Requienia sphaerosperma*	DC.	LC	Indigenous
Ricciaceae	*Riccia albornata*	O.H.Volk & Perold		Indigenous; Endemic
Zygophyllaceae	*Roepera lichtensteiniana*	(Cham.) Beier & Thulin		Indigenous; Endemic
Aizoaceae	*Ruschia sp.*			
Amaranthaceae	*Salsola glabrescens*	Burtt Davy	LC	Indigenous; Endemic
Amaranthaceae	*Salsola kali*	L.		Not indigenous; Naturalised; Invasive
Amaranthaceae	*Salsola tuberculatiformis*	Botsch.	LC	Indigenous; Endemic
Ruscaceae	*Sansevieria aethiopica*	Thunb.	LC	Indigenous
Poaceae	*Schmidtia kalahariensis*	Stent	LC	Indigenous
Poaceae	*Schmidtia pappophoroides*	Steud.	LC	Indigenous
Anacardiaceae	*Searsia pendulina*	(Jacq.) Moffett		Indigenous; Endemic
Anacardiaceae	*Searsia pyroides var. pyroides*	(Burch.) Moffett		Indigenous
Scrophulariaceae	*Selago sp.*			
Asteraceae	*Senecio consanguineus*	DC.	LC	Indigenous; Endemic
Fabaceae	*Senna italica subsp. arachoides*	Mill.	LC	Indigenous

Amaranthaceae	*Sericocoma avolans*	Fenzl	LC	Indigenous; Endemic
Pedaliaceae	*Sesamum capense*	Burm.f.	LC	Indigenous; Endemic
Brassicaceae	*Sisymbrium burchellii var. burchellii*	DC.	LC	Indigenous
Solanaceae	*Solanum capense*	L.	LC	Indigenous; Endemic
Poaceae	*Sporobolus ioclados*	(Trin.) Nees	LC	Indigenous
Poaceae	*Sporobolus nervosus*	Hochst.	LC	Indigenous
Poaceae	*Stipagrostis ciliata var. capensis*	(Desf.) De Winter	LC	Indigenous
Poaceae	*Stipagrostis namaquensis*	(Nees) De Winter	LC	Indigenous; Endemic
Poaceae	*Stipagrostis obtusa*	(Delile) Nees	LC	Indigenous
Poaceae	*Stipagrostis uniplumis var. uniplumis*	(Licht.) De Winter	LC	Indigenous
Orobanchaceae	*Striga gesnerioides*	(Willd.) Vatke	LC	Indigenous
Loranthaceae	*Tapinanthus oleifolius*	(J.C.Wendl.) Danser	LC	Indigenous
Fabaceae	*Tephrosia dregeana var. dregeana*	E.Mey.	LC	Indigenous
Zygophyllaceae	*Tetraena simplex*	(L.) Beier & Thulin		Indigenous
Poaceae	*Tragus berteronianus*	Schult.	LC	Indigenous
Poaceae	*Tragus racemosus*	(L.) All.	LC	Indigenous
Zygophyllaceae	*Tribulus cristatus*	C.Presl	LC	Indigenous; Endemic
Zygophyllaceae	*Tribulus terrestris*	L.	LC	Indigenous
Zygophyllaceae	*Tribulus zeyheri subsp. zeyheri*	Sond.	LC	Indigenous
Boraginaceae	*Trichodesma africanum*	(L.) Lehm.	LC	Indigenous
Poaceae	*Triraphis sp.*			
Alliaceae	*Tulbaghia tenuior*	K.Krause & Dinter	LC	Indigenous; Endemic
Fabaceae	*Vachellia haematoxylon*	(Willd.) Seigler & Ebinger	LC	Indigenous; Endemic
Vahliaceae	*Vahlia sp.*			

APPENDIX B*: Avifaunal species expected to occur in the project area*

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anthoscopus minutus	Penduline-tit, Cape	Unlisted	LC
Anthus cinnamomeus	Pipit, African	Unlisted	LC
Anthus crenatus	Pipit, African Rock	NT	LC
Apus affinis	Swift, Little	Unlisted	LC
Apus apus	Swift, Common	Unlisted	LC
Apus barbatus	Swift, African Black	Unlisted	LC
Apus bradfieldi	Swift, Bradfield's	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Aquila pennatus	Eagle, Booted	Unlisted	LC
Aquila verreauxii	Eagle, Verreaux's	VU	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Ardea goliath	Heron, Goliath	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardeola ralloides	Heron, Squacco	Unlisted	LC
Ardeotis kori	Bustard, Kori	NT	NT
Batis pririt	Batis, Pririt	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradornis infuscatus	Flycatcher, Chat	Unlisted	LC
Bradornis mariquensis	Flycatcher, Marico	Unlisted	LC
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Butorides striata	Heron, Green-backed	Unlisted	LC
Calandrella cinerea	Lark, Red-capped	Unlisted	LC
Calendulauda africanoides	Lark, Fawn-coloured	Unlisted	LC
Calendulauda sabota	Lark, Sabota	Unlisted	LC
Campethera abingoni	Woodpecker, Golden-tailed	Unlisted	LC
Caprimulgus rufigena	Nightjar, Rufous-cheeked	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted

Cercomela familiaris	Chat, Familiar	Unlisted	LC
Cercomela sinuata	Chat, Sickle-winged	Unlisted	LC
Cercotrichas coryphoeus	Scrub-robin, Karoo	Unlisted	LC
Cercotrichas paena	Scrub-robin, Kalahari	Unlisted	LC
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Ciconia abdimii	Stork, Abdim's	NT	LC
Cinnyris fuscus	Sunbird, Dusky	Unlisted	LC
Circaetus pectoralis	Snake-eagle, Black-chested	Unlisted	LC
Cisticola aridulus	Cisticola, Desert	Unlisted	LC
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola subruficapilla	Cisticola, Grey-backed	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Clamator jacobinus	Cuckoo, Jacobin	Unlisted	LC
Colius colius	Mousebird, White-backed	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Creatophora cinerea	Starling, Wattled	Unlisted	LC
Crithagra albogularis	White-throated Canary	LC	LC
Crithagra atrogularis	Canary, Black-throated	Unlisted	LC
Crithagra flaviventris	Canary, Yellow	Unlisted	LC
Cypsiurus parvus	Palm-swift, African	Unlisted	LC
Delichon urbicum	House-martin, Common	Unlisted	LC
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza capensis	Bunting, Cape	Unlisted	LC
Emberiza flaviventris	Bunting, Golden-breasted	Unlisted	LC
Emberiza impetuani	Bunting, Lark-like	Unlisted	LC
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC
Eremopterix verticalis	Sparrowlark, Grey-backed	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Estrilda erythronotos	Waxbill, Black-faced	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Eupodotis vigorsii	Korhaan, Karoo	NT	LC
Falco biarmicus	Falcon, Lanner	VU	LC
Falco rupicolus	Kestrel, Rock	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Glaucidium perlatum	Owlet, Pearl-spotted	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC

Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Hirundo cucullata	Swallow, Greater Striped	Unlisted	LC
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC
Hirundo fuligula	Martin, Rock	Unlisted	Unlisted
Hirundo rustica	Swallow, Barn	Unlisted	LC
Indicator minor	Honeyguide, Lesser	Unlisted	LC
Ixobrychus minutus	Bittern, Little	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius atrococcineus	Shrike, Crimson-breasted	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lanius collurio	Shrike, Red-backed	Unlisted	LC
Lanius minor	Shrike, Lesser Grey	Unlisted	LC
Lophotis ruficrista	Korhaan, Red-crested	Unlisted	LC
Malcorus pectoralis	Warbler, Rufous-eared	Unlisted	LC
Megaceryle maximus	Kingfisher, Giant	Unlisted	Unlisted
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC
Merops apiaster	Bee-eater, European	Unlisted	LC
Merops bullockoides	Bee-eater, White-fronted	Unlisted	LC
Merops hirundineus	Bee-eater, Swallow-tailed	Unlisted	LC
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Muscicapa striata	Flycatcher, Spotted	Unlisted	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Nilaus afer	Brubru	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Nycticorax nycticorax	Night-Heron, Black-crowned	Unlisted	LC
Oena capensis	Dove, Namaqua	Unlisted	LC
Oenanthe monticola	Wheatear, Mountain	Unlisted	LC
Oenanthe pileata	Wheatear, Capped	Unlisted	LC
Onychognathus nabouroup	Starling, Pale-winged	Unlisted	LC
Parisoma subcaeruleum	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
Parus cinerascens	Tit, Ashy	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Passer motitensis	Sparrow, Great	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Phalacrocorax carbo	Cormorant, White-breasted	LC	LC
Philetairus socius	Weaver, Sociable	Unlisted	LC
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Phragmacia substriata	Warbler, Namaqua	Unlisted	Unlisted
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC

Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Polihierax semitorquatus	Falcon, Pygmy	Unlisted	LC
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC
Prinia flavicans	Prinia, Black-chested	Unlisted	LC
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Rhinopomastus cyanomelas	Scimitarbill, Common	Unlisted	LC
Rhinoptilus africanus	Courser, Double-banded	Unlisted	LC
Riparia cincta	Martin, Banded	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC
Stenostira scita	Flycatcher, Fairy	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Tachymarptis melba	Swift, Alpine	Unlisted	LC
Tadorna cana	Shelduck, South African	Unlisted	LC
Tchagra australis	Tchagra, Brown-crowned	Unlisted	LC
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Tockus leucomelas	Hornbill, Southern Yellow-billed	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Turdus smithi	Thrush, Karoo	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops pallidus	White-eye, Orange River	Unlisted	LC

APPENDIX C: *Mammals species expected to occur in the project area*

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aethomys namaquensis	Namaqua rock rat	LC	LC
Antidorcas marsupialis	Sclater's Shrew	LC	LC
Aonyx capensis	Cape Clawless Otter	NT	NT
Atilax paludinosus	Water Mongoose	LC	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Caracal caracal	Caracal	LC	LC
Ceratotherium simum	White Rhinoceros	NT	NT
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Desmodillus auricularis	Short-tailed Gerbil	LC	LC
Diceros bicornis	Black Rhinoceros	EN	CR
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT
Eptesicus hottentotus	Long-tailed Serotine Bat	LC	LC
Felis nigripes	Black-footed Cat	VU	VU
Felis silvestris	African Wildcat	LC	LC
Genetta genetta	Small-spotted Genet	LC	LC
Gerbilliscus brantsii	Highveld Gerbil	LC	LC
Gerbilliscus leucogaster	Bushveld Gerbil	LC	LC
Gerbillurus paeba	Hairy-footed Gerbil	LC	LC
Herpestes pulverulentus	Cape Grey Mongoose	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC
Lepus capensis	Cape Hare	LC	LC
Lepus saxatilis	Scrub Hare	LC	LC
Macroscelides proboscideus	Round-eared elephant shrew	LC	LC
Malacothrix typica	Gerbil Mouse	LC	LC
Mastomys coucha	Multimammate Mouse	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mus musculus	House Mouse	Unlisted	LC
Neoromicia capensis	Cape Serotine Bat	LC	LC
Nycteris thebaica	Egyptian Slit-faced Bat	LC	LC
Oreotragus oreotragus	Klipspringer	LC	LC
Orycteropus afer	Aardvark	LC	LC
Oryx gazella	Gemsbok	LC	LC
Otocyon megalotis	Bat-eared Fox	LC	LC
Panthera pardus	Leopard	VU	VU
Papio ursinus	Chacma Baboon	LC	LC
Parotomys brantsii	Brants' Whistling Rat	LC	LC
Parotomys littledalei	Littledale's Whistling Rat	NT	LC
Petromyscus monticularis	Brukkaros Pygmy Rock Mouse	LC	LC

Procavia capensis	Rock Hyrax	LC	LC
Proteles cristata	Aardwolf	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rattus rattus	House Rat	Exotic (Not listed)	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	LC
Rhinolophus denti	Dent's Horseshoe Bat	NT	LC
Saccostomus campestris	Pouched Mouse	LC	LC
Smutsia temminckii	Temminck's Ground Pangolin	VU	VU
Suncus varilla	Lesser Dwarf Shrew	LC	LC
Suricata suricatta	Suricate	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC
Tragelaphus oryx	Common Eland	LC	LC
Vulpes chama	Cape Fox	LC	LC
Xerus inauris	Cape Ground Squirrel	LC	LC

APPENDIX D: *Reptile species expected to occur within the project area*

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Acontias kgalagadi kgalagadi	Kgalagadi Legless Skink	LC	Unlisted
Acontias lineatus	Striped Dwarf Legless Skink	LC	LC
Agama aculeata aculeata	Western Ground Agama	LC	Unlisted
Agama anchietae	Anchieta's Agama	LC	Unlisted
Agama atra	Southern Rock Agama	LC	LC
Bitis arietans arietans	Puff Adder	LC	Unlisted
Boaedon capensis	Brown House Snake	LC	LC
Chondrodactylus angulifer	Common Giant Gecko	LC	LC
Chondrodactylus bibronii	Bibron's Gecko	LC	Unlisted
Cordylosaurus subtessellatus	Dwarf Plated Lizard	LC	LC
Dasypeltis scabra	Rhombic Egg-eater	LC	LC
Heliobolus lugubris	Bushveld Lizard	LC	Unlisted
Karusasaurus polyzonus	Southern Karusa Lizard	LC	LC
Lycophidion capense capense	Cape Wolf Snake	LC	Unlisted
Lygodactylus bradfieldi	Bradfield's Dwarf Gecko	LC	Unlisted
Naja nigricincta woodi	Black Spitting Cobra	LC	Unlisted
Naja nivea	Cape Cobra	LC	Unlisted
Nucras tessellata	Western Sandveld Lizard	LC	Unlisted
Pachydactylus capensis	Cape Gecko	LC	Unlisted
Pachydactylus latirostris	Quartz Gecko	LC	Unlisted
Pachydactylus purcelli	Purcell's Gecko	LC	Unlisted
Pachydactylus rugosus	Common Rough Gecko	LC	Unlisted
Pachydactylus wahlbergii	Wahlberg's Kalahari gecko	Unlisted	Unlisted
Pedioplanis inornata	Plain Sand Lizard	LC	Unlisted

Pedioplanis lineoocellata lineoocellata	Spotted Sand Lizard	LC	Unlisted
Pedioplanis namaquensis	Namaqua Sand Lizard	LC	Unlisted
Philothamnus semivariegatus	Spotted Bush Snake	LC	Unlisted
Prosymna bivittata	Two-Striped Shovel-Snout	LC	Unlisted
Prosymna sundevallii	Sundevall's Shovel-snout	LC	LC
Psammobates oculifer	Serrated Tent Tortoise	LC	Unlisted
Psammobates tentorius	Tent Tortoise	LC	LC
Psammophis notostictus	Karoo Sand Snake	LC	Unlisted
Psammophis trinasalis	Fork-marked Sand Snake	LC	Unlisted
Pseudaspis cana	Mole Snake	LC	Unlisted
Ptenopus garrulus maculatus	Spotted Barking Gecko	LC	Unlisted
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	LC	Unlisted
Stigmochelys pardalis	Leopard Tortoise	LC	LC
Telescopus beetzii	Beetz's Tiger Snake	LC	Unlisted
Trachylepis occidentalis	Western Three-striped Skink	LC	Unlisted
Trachylepis sparsa	Karasburg Tree Skink	LC	Unlisted
Trachylepis spilogaster	Kalahari Tree Skink	LC	Unlisted
Trachylepis sulcata sulcata	Westren Rock Skink	LC	Unlisted
Trachylepis variegata	Variegated Skink	LC	Unlisted
Varanus albigularis albigularis	Southern Rock Monitor	LC	Unlisted
Varanus niloticus	Water Monitor	LC	Unlisted
Xenocalamus bicolor bicolor	Bicoloured Quill-snouted Snake	LC	Unlisted

APPENDIX E: *Amphibian species expected to occur within the project area*

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Amietia delalandii	Delalande's River Frog	LC	Unlisted
Amietia fuscigula	Cape River Frog	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC
Kassina senegalensis	Bubbling Kassina	LC	LC
Pyxicephalus adspersus	Giant Bullfrog	NT	LC
Sclerophrys capensis	Raucous Toad	LC	LC
Sclerophrys gutturalis	Guttural Toad	LC	LC
Sclerophrys poweri	Power's Toad	LC	LC
Tomopterna cryptotis	Tremelo Sand Frog	LC	LC
Tomopterna tandyi	Tandy's Sand Frog	LC	LC
Vandijkophrynus gariepensis	Karoo Toad	Not listed	Not listed
Xenopus laevis	Common Platanna	LC	LC