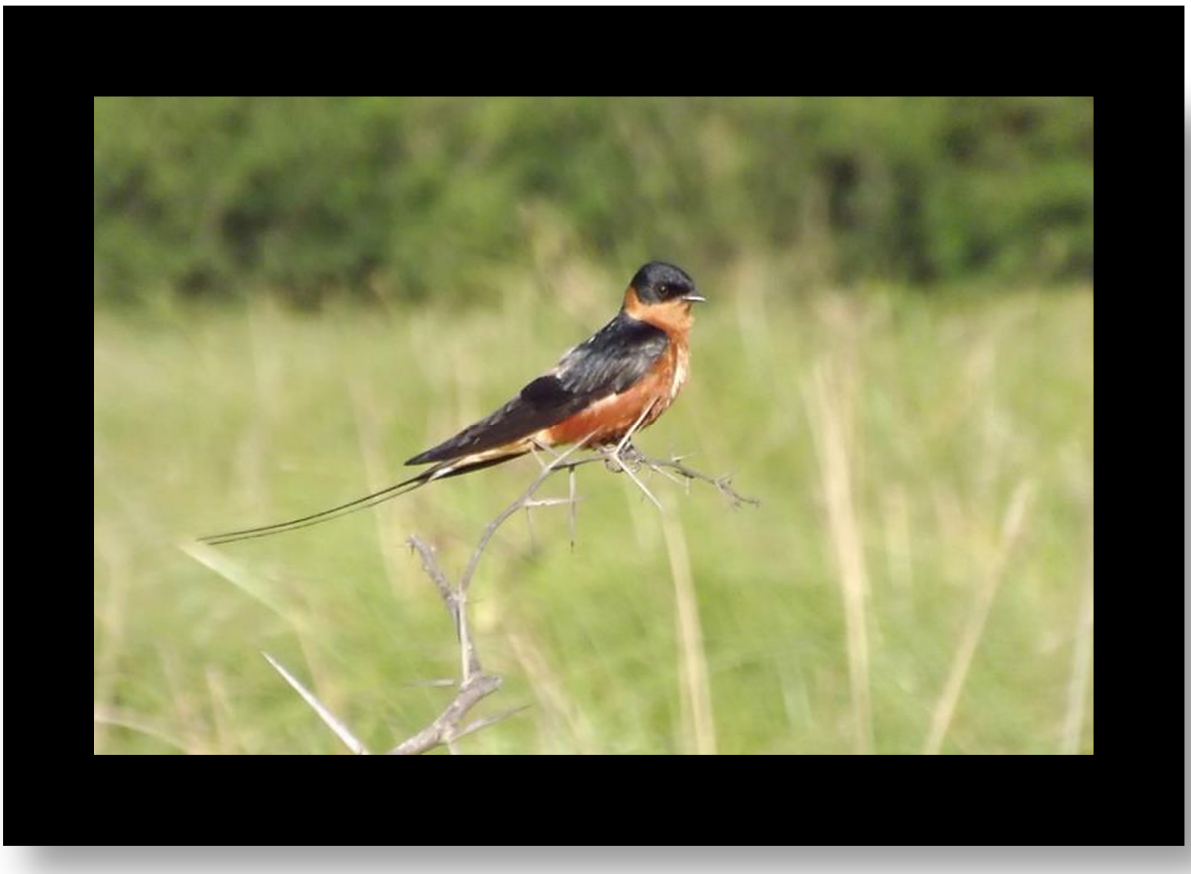
Ecological Assessment

EIA Report

Richards Bay Combined Cycle (CCPP) Power Plant and associated infrastructure near Richards Bay, KwaZulu-Natal Province
(Ref nr: SE1655)



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CONDITIONS OF THIS REPORT

Even though every care is taken to ensure the accuracy of this report, ecological assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and animal migrations.

Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. The assessment team can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive.

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EXECUTIVE SUMMARY

Rautenbach Biodiversity Consulting was appointed by Savannah Environmental (Pty) Ltd to provide specialist input in terms of the EIA Regulations (2014), as amended on 07 April 2017, for the proposed development of a combined cycle gas turbine power plant and associated infrastructure on a site near Richards Bay, KwaZulu-Natal Province.

The Richards Bay Combined Cycle Power Plant (CCPP) will involve the construction of a gas-fired power station which will provide mid-merit[1] power supply to the electricity grid. The weekly mid-merit power supply will be between a range of 20% to 70% of the total electricity supply produced by the Richards Bay CCPP.

The power station will have an installed capacity of up to 3 000MW, to be operated on natural gas, with diesel as a back-up fuel. The natural gas is to be supplied by potential gas suppliers via a gas pipeline to the CCPP from the supply take-off point at the Richards Bay Harbour.

The Liquefied Natural Gas (LNG) terminal infrastructure at the port and the gas supply pipeline to the boundary fence of the Richards Bay CCPP does not form part of the scope of this assessment as this project focuses only on the footprint activities inside Eskom's boundary fence on site 1D of the Richards Bay Industrial Development Zone (IDZ).

The following general conclusions were drawn upon completion of the environmental impact assessment:

NATIONAL LEVEL CONSERVATION PRIORITIES

- ***Protected Areas and other Conservation Areas***

The proposed development is not expected to have an impact on existing protected areas within the region.

- ***National Threatened Ecosystems***

The project site falls within the '**Critically Endangered**' Kwambonambi Hygrophilous Grassland ecosystem.

- ***Sensitive Aquatic Ecosystems***

The National Freshwater Ecosystem Priority Areas (NFEPA) project highlights four natural, Indian Ocean Coastal Belt wetlands with wetland conditions of AB (i.e. percentage natural cover $\geq$ 75 %, therefore in natural or good condition), and NFEPA rankings of 2 (wetlands with the majority of its area within a sub-quaternary catchment that has sightings or breeding areas for threatened wattled cranes, grey crowned cranes and blue cranes) to be on the project site (Figure 8; Nel *et al.*, 2011).

Nontheless, three wetlands have already been impacted on by past disturbance during the construction of a railway line and its associated service road, which resulted in the fragmentation of these sensitive aquatic ecosystems.

PROVINCIAL AND DISTRICT LEVEL CONSERVATION PRIORITIES

- ***Provincial Level Conservation Priorities***

Most of the proposed development footprint on the project site falls into an area classified as 'Biodiversity areas', and still considered to be of biodiversity value even though it has not been identified as CBA areas. A small area of the proposed development footprint to the southwest falls within a Critical Biodiversity Area (CBA type 3; KZNSCP 2012; Figure 9A).

- ***District Level Conservation Priorities***

[1] Mid-merit electricity generation capacity refers to the generation of electricity which is adjusted according to the fluctuations in demand in the national grid.

Most of the project site, including the entire development footprint falls within a CBA: Irreplaceable area (Figure 9B). Land-use management objectives for these areas include limited to no biodiversity loss in order to maintain these areas in a natural state, thus the proposed land-use activities are not compatible with the aims of the land-use objectives of CBA: Irreplaceable areas (KZNBSP 2014; Nel *et al*., 2011).

MUNICIPAL LEVEL CONSERVATION PRIORITIES

The project site falls within a High Impact Industry zone, with designated conservation areas present to the northwest and southeast.

REGIONAL CONNECTIVITY

On a local scale, connectivity between natural habitats and ecosystems has already been severely compromised by high levels of infrastructural developments resulting in only small fragmented pockets of natural and/or semi-natural habitat remaining in most instances. Thus, from a biodiversity perspective, connectivity of natural habitat on the project site with natural habitats adjacent to the project site is poor.

VEGETATION

- ***Regional Vegetation Classification***

Most of the project site falls within the '**Endangered**' Maputaland Wooded Grassland vegetation type, with low lying areas extending into the '**Vulnerable**' Subtropical Freshwater Wetlands vegetation type.

Summary of flora species of conservation concern recorded from the project site:

	THREATENED SPECIES	PROVINCIALLY PROTECTED SPECIES	SPECIES PROTECTED BY THE NATIONAL FOREST ACT (No. 84 of 1998)	ENDEMIC SPECIES
Observed		• *Sclerocarya birrea* • *Hyphaene coriacea* • *Trichilia emetica* • *Ficus trichopoda* • All species from the Family ASPARAGACEAE • All species from the Family ASPHODELACEAE • All species from the Family ORCHIDACEAE	• *Sclerocarya birrea* • *Ficus trichopoda*	• *Hyphaene coriacea* • *Helichrysum auriceps* • *Lobelia coronopifolia* • *Eulophia angolensis*
Potential occurrence	22 species (Table 9)			

FAUNA

Summary of SCC (Species of Conservation Concern) fauna species recorded from the project site:

	THREATENED SPECIES	PROVINCIALLY PROTECTED SPECIES	ENDEMIC/NEAR ENDEMIC SPECIES	SENSITIVE SPECIES	RANGE RESTRICTED SPECIES
MAMMALS					

Observed	*Crocidura mariquensis* (NT)	-	-	-	
Potential occurrence	-	-	-	-	
	Scotoecus albofuscus (NT)	*Nycteris hispida*		*Chlorocebus pygerythrus*	
REPTILES					
Observed	-	-	-	-	-
Potential occurrence	-	-	-	-	-
FROGS					
Observed	*Hemisus guttatus* (VU)				*Hyperolius microps*
Potential occurrence	• *Cacosternum striatum* (DD) • *Breviceps sopranus* (DD)				
BIRDS					
Observed		• *Egretta alba* • *Ardea melanocephala* • *Actophilornis africanus* • *Ciconia episcopus* • *Glareola pratincola*	*Zosterops virens*		
Potential occurrence	*Balearica regulorum* (EN)	Fifteen species (Table 16)	*Sigelus silens*		

LOCAL SENSITIVITIES

From a vegetation perspective the sensitivities relating to the proposed development include the presence of:

- Provincially protected species, endemic species and species protected under the Natural Forest Act. The removal/destruction of tree species would require permit authorisation;
- The potential presence of several Threatened flora species;
- Wetland vegetation over portions of the project site.

From a fauna perspective, the sensitivities relating to the proposed development are the presence of:

- *C. mariquensis* (NT) and *H.guttatus* (VU) in wetland areas;
- The potential presence of *B. regulorum* (EN);
- The presence of provincially protected bird species.

From a conservation planning perspective, the sensitivities are:

- The siting of the proposed development in an ecosystem categorized as 'Critically Endangered';
- The siting of the proposed development in vegetation types broadly categorised as 'Vulnerable' and 'Endangered', although one must concede that the area is already disturbed by historical and current impacts with only the wetland areas remaining in a relatively natural state.
- The siting of the proposed development amongst two conservation areas, which will have a significant negative effect on local movement and dispersal patterns between the conservation areas.

RECOMMENDATIONS

The highly transformed nature of the habitats in the majority of the project site resulting from historical and current disturbances, coupled to its isolated nature with regards to adjacent vegetation communities means that there should

be no objections to this proposed development on areas historically covered by the Maputaland Wooded Grassland major vegetation type. What natural vegetation remains is highly disturbed by past impacts relating to the construction of linear infrastructure on surrounding areas, deforestation of wooded areas and grazing pressure which is contributing to the invasion of *Helichrysum krausii* and *Dichrostachys cinerea* on large portions of the project site.

Wetland areas, although fragmented, appeared to be in a better condition, with 28% of species identified, recognised by Mucina & Rutherford (2006) as important floristic components of the Subtropical Freshwater Wetland major vegetation type.

The biodiversity offset area located to the north of the project site does not offer suitable habitat to wetland dependent fauna species, thus the availability of alternative biodiversity offset areas with similar habitat structure and ecological functioning are currently being investigated to fully compensate for the loss of wetland areas on the project site.

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ACRONYMS AND ABBREVIATIONS

ADU	Animal Demography Unit
BGIS	Biodiversity GIS (SANBI)
CBA	Critical Biodiversity Areas
CCPP	Combined Cycle Power Plant
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DWAF	Department of Water Affairs and Forestry
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
eKZNw	Ezemvelo KZN Wildlife
ESA	Ecological support area
GIS	Geographic information system
GPS	Global positioning system
ha	hectares
IAPs	Alien and invasive plants

IBA	Important Bird Areas
IUCN	International Union for Conservation of Nature
KZNBSP	KwaZulu-Natal Biodiversity Sector Plan
KZNSCP	KwaZulu-Natal Systematic Conservation Plan
KZNEBPA	KwaZulu-Natal Environmental, Biodiversity and Protected Areas Management Bill, 2014
LUDS	Land Use Decision Support
masl.	meters above sea level
mm	millimeters
NBA	National Biodiversity Assessment
NEMBA	National Environmental Biodiversity Act
NPAES	National Protected Areas Expansion Strategy
QDGS	Quarter degree grid square
SABAP	South African Bird Atlas Project
SANBI	South African Biodiversity Institute
SARCA	South African Reptile Conservation Assessment
SCC	Species of Conservation Concern

GLOSSARY OF TERMS

Cyperoid	Resembling, allied to, or belonging to the plant-genus *Cyperus* or the family CYPERACEAE.
Endemic	A plant or animal native or restricted to a certain place.
Ephemeral	Lasting for only a very short time.
Epihydate	A plant with leaves and/or stems floating on the surface of the water but not rising above the water, roots penetrating the substrate.
Geophyte	A perennial plant with an underground food storage organ such as a bulb, tuber, corm or rhizome.
Geoxylic suffritices	plants with enlarged, woody structures growing beneath the surface of the ground.
Graminoid	herbaceous plant with a grass-like morphology.
Herpetofauna	for the purpose of this report, herpetofauna will refer to reptiles and frogs only.
Hydrophyte	A plant which grows only in or on water.
Hygrophilous	A plant growing in damp conditions.
Hyperhydate	An emergent plant, with leaves and/or stems emerging well beyond the water surface, roots penetrating the substrate.
Macrophytic	A macrophyte is an aquatic plant growing in or near water and is either emergent, or floating.
NPAES focus areas	Large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, thereby making it suitable for the creation or expansion of large protected areas in the future.
Pentad	Five minutes of latitude by five minutes of longitude. One QDS comprise of nine pentads.
Quarter degree grid square	The division of longitude and latitude degree square cells into smaller units.
Riparian	Plant communities characterized by hydrophilic plants located along water courses/wetlands.
Succulent	A plant which accumulates water in fleshy, water-storing stems, leaves or roots; juicy,

fleshy in reference to texture or appearance.

INVESTIGATOR DETAILS AND DECLARATION OF INDEPENDENCE

Document title	Richards Bay Combined Cycle Power Plant (CCPP) and associated infrastructure near Richards Bay, KwaZulu-Natal Province. (Ref nr: SE1655)
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I, Anita Rautenbach (7103180154085) declare that I:

- Am committed to biodiversity conservation, but concomitantly recognize the need for economic development;
- Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them;
- Am subcontracted as a specialist consultant by Savannah Environmental (Pty) Ltd to undertake an ecological EIA assessment for the proposed development of a 3000MW Combined Cycle Power Plant (CCPP) in Richards Bay, KwaZulu-Natal Province;
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed;
- Have not and will not engage in conflicting interests in the undertaking of the activity;
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2014;
- The intellectual property in this report will only be transferred to the client (the party/company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognize that written consent of the client will be required for me to release any part of this report to third parties.

A. Rautenbach (Pr. Sci. Nat) Date: 20 February 2019

1. INTRODUCTION

Rautenbach Biodiversity Consulting was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological EIA assessment for the proposed development of a 3000MW Combined Cycle Power Plant (CCPP) on Erven 4/11376 and 2/11376 (hereafter referred to as the 'project site') in Richards Bay, KwaZulu-Natal (KZN) Province.

Primarily this report focuses on the identification of ecological sensitive areas, and the reigning status of flora and fauna species currently occurring or likely to occur on the project site, and whose conservation status should be considered in the final decision-making process. Special attention is paid to the qualitative and quantitative habitat conditions for Red Listed and protected species deemed present, and mitigation measures are proposed to ameliorate the effect of the proposed development.

This assessment is in accordance with the 2014 EIA Regulations, as amended (GNR 324 – 327, Department of Environmental Affairs, 7 April 2017) emanating from Chapter 5 of the National Environmental Management Act (Act No. 107 of 1998).

2. PROJECT DESCRIPTION

The Richards Bay Combined Cycle Power Plant (CCPP) involves the construction of a gas-fired power station which will provide mid-merit[2] power supply to the electricity grid. The weekly mid-merit power supply will be between a range of 20% to 70% of the total electricity supply produced by the Richards Bay CCPP. The power station will have an installed capacity of up to 3 000MW, to be operated on natural gas, with diesel as a back-up fuel. The natural gas is to be supplied by potential gas suppliers via a gas pipeline to the CCPP from the supply take-off point at the Richards Bay Harbour.

The Liquefied Natural Gas (LNG) terminal infrastructure at the port and the gas supply pipeline to the boundary fence of the Richards Bay CCPP does not form part of the scope of this assessment as this project focuses only on the footprint activities inside Eskom's boundary fence on site 1D of the Richards Bay Industrial Development Zone (IDZ).

The main infrastructure associated with the facility includes the following:

- Gas turbines for the generation of electricity through the use of natural gas or diesel (back-up resource).
- Heat recovery steam generators (HRSG) to capture heat from high temperature exhaust gases to produce high temperature and high-pressure dry steam to be utilised in the steam turbines.
- Steam turbines for the generation of additional electricity through the use of dry steam generated by the HRSG.
- Bypass stacks associated with each gas turbine.
- Dirty Water Retention Dams.
- Exhaust stacks for the discharge of combustion gases into the atmosphere.
- A water treatment plant for the treatment of potable water and the production of demineralised water (for steam generation).
- Water pipelines and water tanks to transport and store water of both industrial quality and potable quality (to be supplied by the Local Municipality).
- Dry-cooled system consisting of air-cooled condenser fans situated in fan banks.
- Closed Fin-fan coolers to cool lubrication oil for the gas and steam turbines.

[2] Mid-merit electricity generation capacity refers to the generation of electricity which is adjusted according to the fluctuations in demand in the national grid.

» A gas pipeline and a gas pipeline supply conditioning process facility for the conditioning and measuring of the natural gas prior to being supplied to the gas turbines. It must be noted however that the environmental permitting processes for the gas pipeline construction and operation will be undertaken under a separate EIA process.
» Diesel off-loading facility and storage tanks.
» Ancillary infrastructure including access roads, warehousing, buildings, access control facilities and workshop area, storage facilities, emergency back-up generators, firefighting systems, laydown areas and 132kV and 400kV switchyards.
» A power line to connect the Richards Bay CCPP to the national grid for the evacuation of the generated electricity. It must be noted however that the due environmental permitting processes for the development of the power line component are being undertaken under a separate EIA Process.

3. SCOPE AND OBJECTIVES OF THE STUDY

Scope:

The purpose of the EIA assessment is to determine the main issues and potential impacts that the proposed development may have on the environment through the use of existing data and field investigations.

Objectives:

- To qualitatively and quantitatively assess the significance of the fauna and flora habitat components and the current general conservation status of the project site;
- To identify and comment on ecological sensitive areas and ecological service(s);
- Comment on the connectivity of natural vegetation and habitats along a 500 meter zone on adjacent terrain;
- To provide a list of fauna and flora species that occur or might occur, and to identify species of conservation concern;
- To determine the nature and extent of potential impacts during the construction and operation phases;
- The identification of no-go areas, where applicable;
- To describe and assess the potential impacts that the proposed development may have on the receiving environment and provide details of the methodology that should be adopted in assessing these impacts;
- To identify any environmental fatal flaws or red flag issues;
- To propose feasible recommendations to manage impacts.

4. ASSUMPTIONS AND LIMITATIONS

- This report deals exclusively with the defined area and the impacts associated with the proposed development on the biodiversity and ecosystems of the area;
- Only a rapid assessment of the available fauna and flora that may be potentially impacted by the proposed development was conducted. Whilst fauna and flora species recorded during the site visit (January 2018) have been included in this report, this was based on site observations made during one field visit, and therefore does not cover the seasonal variation in conditions that may occur at the project site;
- Ecological studies usually extend over a number of seasons or years in order to obtain long-term and significant ecological data that takes into account the impacts of unusual/abnormal conditions prevailing on a project site. Due to time constraints such long-term studies are unrealistic for this project and conclusions are therefore drawn from data collected over a much shorter time period;

- Consequently, due to the dynamic nature of ecosystems, there is the likelihood that some aspects (of which some may be important) may have been overlooked.
- Sampling, by nature, means that not all aspects of ecosystems can be assessed and identified, especially on larger areas such as the project site. This invariably increases the probability of some species being overlooked.
- Some species, specifically those of conservation concern, are extremely secretive and difficult to observe, even during intensive field surveys conducted over several years/seasons. Consequently, the species described in this report may not comprise an exhaustive list.
- The fact that only one reptile species has been observed on the project site cannot support the assumption that reptiles do not occur on the project site. It can only indicate a decreased probability of reptiles being present. Reptiles are highly mobile and secretive in nature, and have the ability to avoid detection and capture.
- The assessment of impacts and recommendation of mitigation measures was informed by site-specific environmental conditions and ecological concerns arising from the fauna and flora surveys and based on the investigator's working knowledge and experience with similar development projects
- Information used to inform the assessment was limited to data and GIS coverage's available for the project site on National and Provincial, District and Municipal scales.

5. KEY LEGISLATIVE REQUIREMENTS

In South Africa, there are dedicated legal, policy and planning tools for biodiversity management and conservation, linked to broader environmental management on International, National and Provincial levels. Table 1 lists key legislation relevant to biodiversity conservation and management in KwaZulu-Natal that were taken into consideration during the assessment.

TABLE 1: The key legislation relevant to biodiversity and conservation in KwaZulu-Natal.

INTERNATIONAL	Convention on Biological Diversity (CBD, 1993)
	The Convention on Wetlands (RAMSAR Convention, 1971)
	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)
	National Environmental Management Act (Act No 107 of 1998)
	Environmental Impact Assessment Regulations Listing Notices 1-3 of 2014, as amended
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	National Environmental Management Biodiversity Act (No. 10 of 2004) Alien and Invasive Species Regulations, 2014
	National Protected Areas Expansion Strategy (NPAES)
	Environmental Conservation Act (Act No. 73 of 1983)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Environmental Management: Waste Amendment Act (Act No. 26 of 2014)
	National Environmental Management: Waste Act (No. 59 of 2008)
	National Environmental Management: Waste Act (Act No. 59 of 2008) Waste Classification and Management Regulations;

	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations (Act No 10. of 2004) Alien and Invasive Species Lists, 2016
PROVINCIAL	KwaZulu-Natal Environmental, Biodiversity and Protected Areas Management Bill, 2014
	KwaZulu-Natal Nature Conservation Management Act (No. 9 of 1997)
	KwaZulu-Natal Nature Conservation Management Amendment Act (No. 5 of 1999)
	KwaZulu-Natal Planning and Development Act (No. 6 of 2008)
	Local Government Municipal System's Act (No 32 of 2000)

In addition to the legal requirements (Table 1), the following National and Regional guidelines were taken into consideration:

- Guidelines for Biodiversity Impact Assessments in KZN (2013)
- UThungulu District Municipality: Biodiversity Sector Plan (2014)
- King Cetshwayo District Municipality: Integrated Development Plan 2017/18
- KwaZulu-Natal Systematic Conservation Plan (KZNSCP, 2012)
- KZN Biodiversity Spatial Planning Terms and Processes Version 3.3 (Ezemvelo KZN Wildlife, 2016)
- Ezemvelo KZN Wildlife Strategy (2009 – 2014)
- Technical Report for the National Freshwater Ecosystem Priority Areas (Nel *et al.*, 2011)
- uMhlathuze Local Municipality: Final IDP Review 2015/2016
- uMhlathuze Local Municipality: IDP 2017/2018
- uMhlathuze Municipality Spatial Development Framework 2017/2018-2021/2022
- uMhlathuze Local Municipality Land Use Scheme Regulations (2014)
- Lexicon of Biodiversity Planning in South Africa (2016)

6. GENERAL OVERVIEW OF THE PROJECT SITE

6.1 LOCATION

The project site (Erf 2/11376 and Erf 4/11376) is located in Richards Bay on the north coast of KwaZulu-Natal, approximately 170 km north of Durban, in the uMhlathuze Local Municipality of the greater King Cetshwayo (previously UThungulu) District Municipality.

It lies approximately 5 km west of Richards Bay along the Western Arterial highway in the Industrial Development Zone (IDZ) of Richards Bay, with Mondi Richards Bay bordering the project site on the east. Areas to the north and south are bordered by a railway line and associated service road. Erf 4/11376: GPS coordinates: Lat – 28.767751; Long 31.988576; Erf 2/11376: GPS coordinates: Lat -28.769893; Long 31.985309 (Figure 1). The area falls within the QDGS 2831DD and is approximately 71 ha in extent.

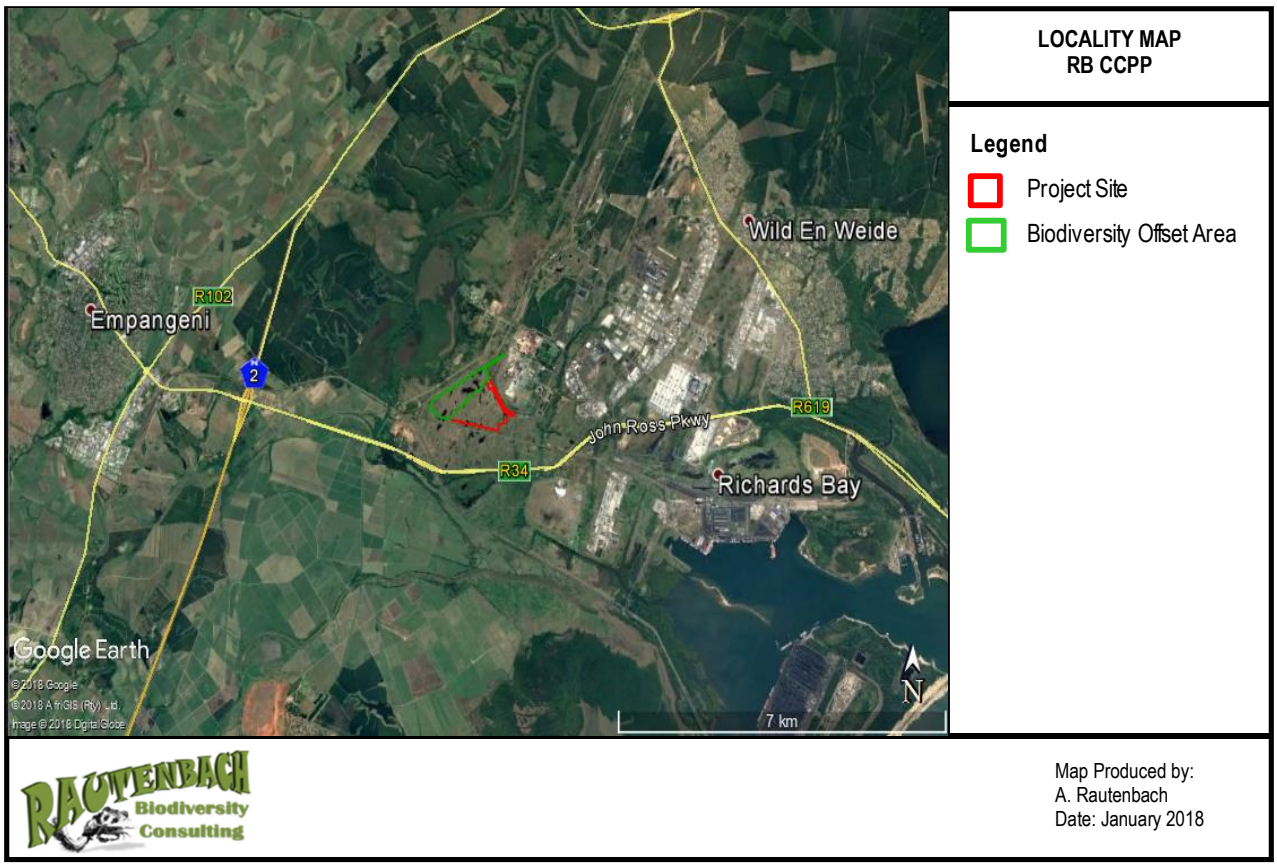

FIGURE 1: The location of the project site and Biodiversity Offset area to the west of Richards Bay.

6.2 CLIMATE AND RAINFALL

The area is characterised by a warm to hot and humid subtropical climate, with warm moist winters. Average daily maximum temperatures range from 29º C in January to 23º C in July, and extremes can reach more than 40º C in summer. The average annual rainfall is 1 228 mm with most (~80 %) of the rainfall in summer (October to March).

Extreme rainfall and thundershowers have occurred on several occasions in the Zululand Region, resulting in extensive flooding with loss of life, property and infrastructure. An increasing trend in the frequency of cyclonic activity has been observed, which needs to be considered in future planning of the region. Annual climatic data has been summarised in the graph presented in Figure 2.

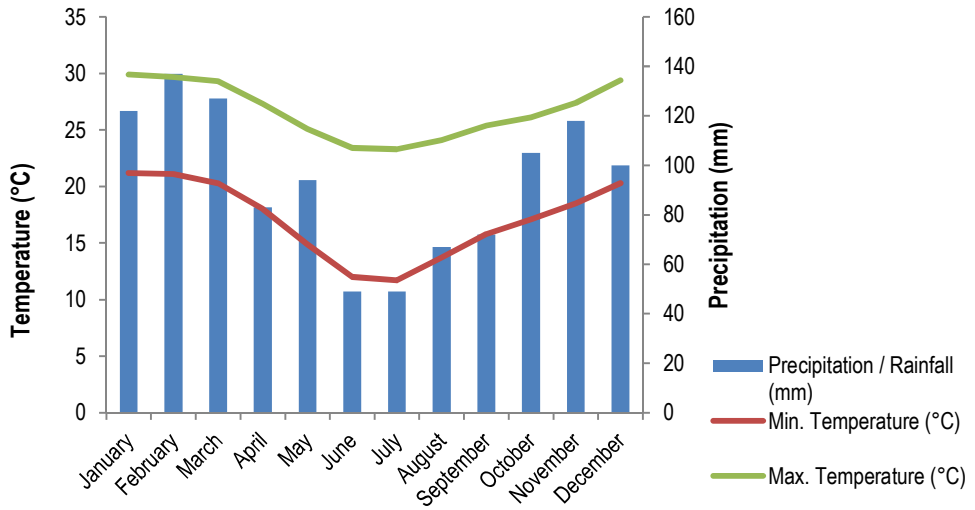

FIGURE 2: Average minimum and maximum temperatures and monthly rainfall for Richards Bay (adapted from http://en/climate-data.org).

6.3 GENERAL TOPOGRAPHY

The project site is located on the flat coastal plains of the Natal Coastal Belt and the terrain is slightly undulating, with elevation ranging from approximately 23 – 31 masl.

6.4 REGIONAL BIODIVERSITY

The uMhlathuze Municipal Area falls within the Maputaland-Pondoland-Albany Biodiversity hotspot which is recognised as the second richest floristic region in Africa. It contains approximately 80 % of South Africa's remaining forests, rich birdlife and many other significant flora and fauna species.

The area supports a total of 174 Red Data species, which has been reported as amongst the highest in the country for an area of its size. This remarkable concentration of Red Data Species is one of the main reasons that the remaining percentage of its surface area under indigenous cover is considered largely irreplaceable by KZN Wildlife for meeting its conservation objectives in the province. Nonetheless, large proportions of this Biodiversity Hotspot are being transformed and degraded by human activities, resulting in many vegetation types being vulnerable to further disturbances. These disturbances threaten species complexity and lead to imbalances within ecosystems.

6.5 CURRENT LAND USE AND INFRASTRUCTURE

Land use of the project site is mainly grazing by cattle, with cattle boma's and occupied informal dwellings present on the northern section of the site (Figure 3). Other activities include hunting with dogs and quad biking (personal observation). The area is bisected by a gravel road crossing a wetland.

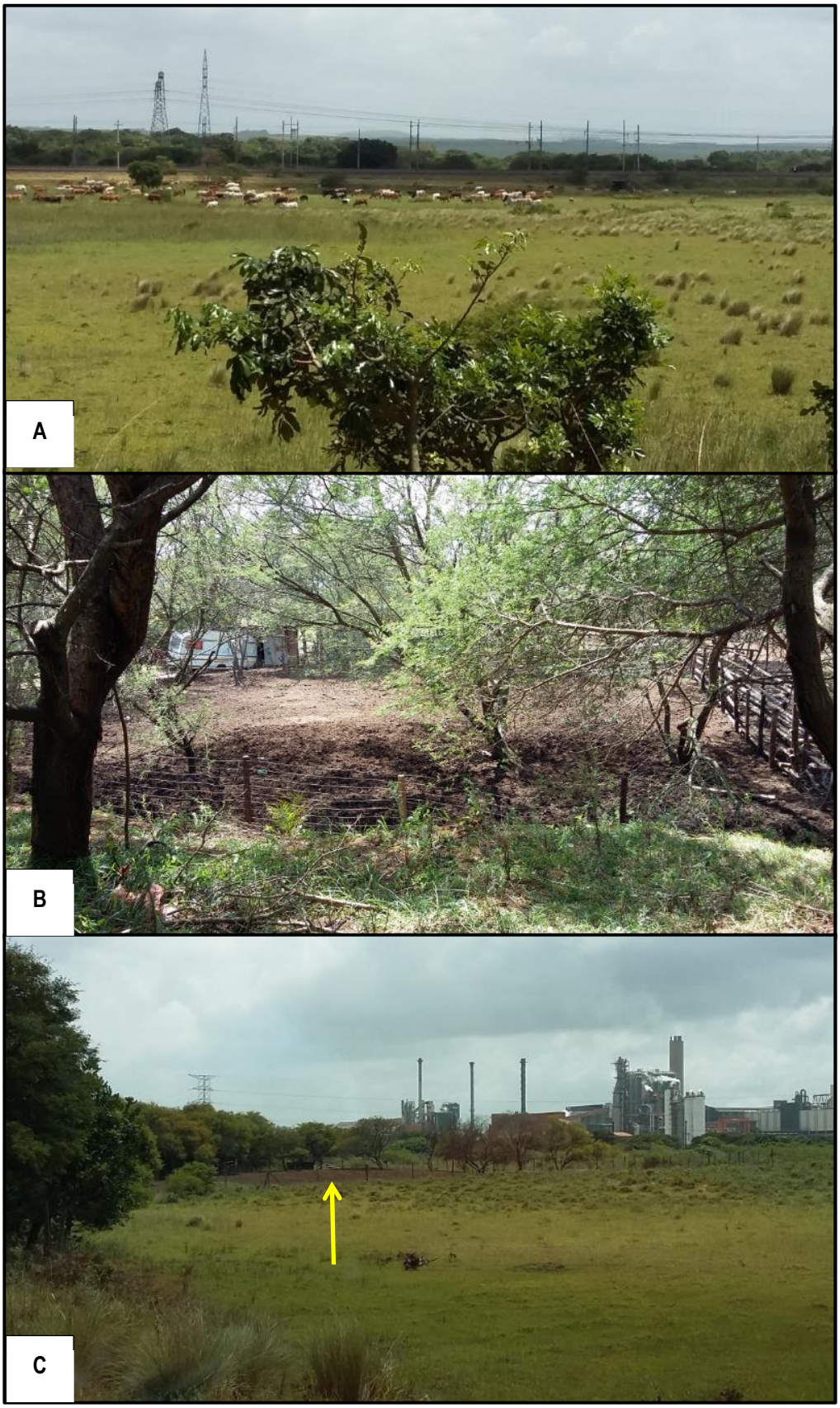

FIGURE 3: A - Cattle in the biodiversity offset area before being moved to the project site. **B** - Informal dwellings and cattle bomas on the western border of the site. **C** –Cattle bomas (indicated with arrow), with Mondi Richards Bay in the background.

7. ASSESSMENT METHODOLOGY

7.1 COLLECTION AND REVIEW OF EXISTING ENVIRONMENTAL DATA

A comprehensive desktop study was carried out to document all baseline ecological information for the project site and mapped at a desktop level. Mapping was informed by available digital imagery and other supporting datasets.

The following spatial data sets were included and are available from the SANBI BGIS website (www.sanbi.org):

- **National Biodiversity Assessment (NBA 2011):**
  - NBA 2011 Terrestrial Formal Protected Areas – SANBI BGIS [vector geospatial dataset];
  - National List of Threatened Ecosystems 2011 – SANBI [vector geospatial dataset];
  - NBA 2011 Terrestrial Ecosystem Protection Level – SANBI BGIS Terrestrial Ecosystem Protection Level [vector geospatial dataset].

- **2011 National Freshwater Ecosystem Priority Areas (NFEPA):**
  - NFEPA fish sanctuaries 2011 – CSIR – NFEPA fish sanctuaries [vector geospatial dataset];
  - NFEPA river FEPAs 2011 – CSIR. [vector geospatial dataset];
  - NFEPA wetland clusters 2011 – CSIR [vector geospatial dataset];
  - NFEPA wetlands 2011 – CSIR [vector geospatial dataset];
  - NFEPA wetlands vegetation 2011 – CSIR [vector geospatial dataset];
  - NFEPA rivers 2011 [vector geospatial dataset].

- **2010 National Protected Areas Expansion Strategy (NPAES):**
  - NPAES Focus areas 2010 – North West Province of Rural, Environment and Agriculture Department [vector geospatial dataset];
  - NPAES Protected Areas – Formal land-based 2010 – SANParks/SANBI [vector geospatial dataset];
  - NPAES Protected Areas – Informal 2010 – SANParks/SANBI [vector geospatial dataset].

- **KwaZulu-Natal Systematic Conservation Plan (EKZNW 2012):**
  - KZN Landscape Ecological Corridors 2010 – Ezemvelo KZN Wildlife (2010) Version 3.1. Unpublished GIS Coverage [kzncor05v3_1_10_wll.zip];
  - KwaZulu-Natal Freshwater Systematic Conservation Plan (KZNSCP); Best Selected Surface (Marxan). Unpublished GIS Coverage [Freshwater_cons_plan_2007];
  - KZNSCP: Terrestrial Systematic Conservation Plan – EKZNW (2010) Minimum Selection Surface (MINSET). Unpublished GIS Coverage [tscp_minset_dist_2010_wll.zip].

- **UThungulu Biodiversity Sector Plan, V1.0 (EKZNW 2014):**
  - Ezemvelo KZN Wildlife. KZN Biodiversity Sector Plans Local Corridors 2014 [Vector] 2014;
  - KZN CBA Irreplaceable version 26012016 (2016). GIS Coverage [KZN_CBA_Irreplaceable_wll_26012016];
  - KZN CBA Optimal version 03032016 (2016). GIS Coverage [KZN_CBA_Optimal_wll_03032016.zip];
  - KZN ESA version 01022016 (2016). GIS Coverage [KZN_ESA_wll_01022016.zip];
  - KZN ESA Species Specific version 01022016 (2016). GIS Coverage [KZN_ESA_Species_wll_01022016_01022016.zip];
  - Ezemvelo Managed Protected Area Boundary – Areas recently acquired but not currently proclaimed (2016). Unpublished GIS Coverage [ekznw_pabnd_owned_not_yet_proclaimed_ 2016_wll.zip];

- DAFF Managed Forest Wilderness Area Boundary – DEA Protected Area Database Extract (2016). Published GIS Coverage [DAFF_forest_wilderness_area_wll_2016.zip];
- Ezemvelo KZN Wildlife. KZN Landscape Corridors 2016 [Vector] 2016;
- Ezemvelo KZN Wildlife (2016). KZN Private Nature Reserves (2016). Unpublished GIS Coverage [KZN_Private_NR_wll_2016.zip];
- Ezemvelo KZN Wildlife Proclaimed Protected Area boundary (2015). Unpublished GIS Coverage [ekznw_pabnd_2015_wdd.zip];
- Ezemvelo KZN Wildlife (2016) KZN Proclaimed Stewardship Sites (January 2016). Unpublished GIS Coverage [stewardship_wll_jan2016_draft.zip];
- KZN Vegetation Types Provincial Conservation Status [kznveg05v2_0_11_public_oct2011_constats_wll.zip].

Supplementary datasets included the following spatial data layers:

- **Department of Environmental Affairs (2017):**
  - SAPAD – South Africa Protected Areas Database (SAPAD_OR_2017_Q2; http://egis.environment.gov.za);
  - SACAD – South Africa Conservation Areas Database (SACAD_OR_2017_Q2; http://egis.environment.gov.za).

- **Birdlife South Africa:**
  - Important Bird Areas 2015 – http://www.birdlife.org.za/conservation/important-bird-areas/documents-and-downloads.

7.2 VEGETATION ASSESSMENT

Literature review

Flora distribution data were obtained from various publications and field guides as a means to ascertain which species have historically been recorded within the QDGS 2831DD. The primary sources of flora distribution data were obtained from the following information sources:

- *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford, 2006)
- National Red List of Threatened Plants of South Africa (Driver *et al*., 2009)
- *Medicinal Plants traded on South Africa's Eastern Seaboard* (von Ahleveldt *et al*., 2003)
- *A Field Guide to Wild Flowers of KwaZulu-Natal and the Eastern Region* (Pooley, 2005)
- *Guide to Grasses of Southern Africa* (van Oudtshoorn, 2014)
- *Identification guide to southern African grasses* (Fish *et al*., 2015)
- *Problem Plants and Alien Weeds of South Africa* (Bromilow, 2010)
- Plants of southern Africa: an online checklist (posa.sanbi.org)
- BRAHMS (Botanical Research and Herbarium Management System (newposa.sanbi.org)
- *Trees of Southern Africa* (Coates-Palgrave, 2002)
- *Easy identification of South African Wetland Plants* (grasses, sedges, rushes, bulrushes, eriocaulons and yellow-eyed grasses (2011)

Field Survey

Site visits were undertaken from 3-6 January 2018 to gather information on significant flora and vegetation and to determine the likely impacts that the proposed development may have on the vegetation of the project site. A combination of traverses and opportunistic sampling techniques were used for this survey.

A traverse is an informal, unmarked route along which data is collected. Traverses are a useful method of gathering information for general characterisation of flora and vegetation and also aid in identifying the boundaries of vegetation

units. Traverses can be used for targeted searches for significant flora or vegetation and can also be used to collect opportunistic or supplementary data.

7.3 FAUNA ASSESSMENTS

Fauna distribution data were obtained from various publications and field guides as a means to ascertain which species have historically been recorded within the QDGS 2831DD. During the fieldwork phase of the project, these derived lists of occurrences were audited. Fieldwork was undertaken from 3-6 January 2018.

7.3.1 Mammal Assessment

Literature Review

As the majority of mammals are either secretive, nocturnal, hibernators and/or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species. This can be done with a high level of confidence, irrespective of season.

Since all mega-mammals and many of the large and medium sized ungulates (i.e. Elephants, Rhino, Wildebeests, Buffalo, Lions, Spotted Hyenas, Sable Antelope, Roan Antelope) have long since been extirpated by hunting, poaching, and to urban and industrial developments, they can only be found in protected areas and have therefore not been included in the assessment. In addition, all feral mammal species expected to occur within the project siteproject site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these cannot be considered when estimating the conservation value of the project site.

The primary sources of mammalian distribution data were obtained from the following 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);
- ADU's MammalMap (mammalmap.adu.org.za);
- *A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife* (Stuart & Stuart, 2013).

Field Survey

During the site visit, mammals were identified by visual sightings through random transect walks, trapping as well as indirect evidence from tracks, scats and runways. An assessment of the status and condition of potential and available habitat for mammalian species were conducted.

- **Small Mammal Trapping**

The term small mammal generally refers to any small mammal weighing less than 1 kg when adult. For the purpose of this assessment, the term small mammal will be applicable to rodents and shrews. Though there are many ways of studying small mammals, trapping is the basic and most widespread technique and is often used in field surveys as a means to ascertain small mammal species composition.

Small mammals were trapped with a combination of pitfall and catch-alive rodent traps from 3 – 6 January 2018 at six sample sites (Figure 4). Site selection was based on overall small mammal habitat diversity and included woodland, grassland and aquatic edges. An additional consideration was the presence of sufficient vegetation cover. Dense basal cover such as thick grass clumps is an essential habitat requirement for many small mammal species; therefore, sample sites were limited to those areas. GPS coordinates for the trap sites are provided for in Table 2.

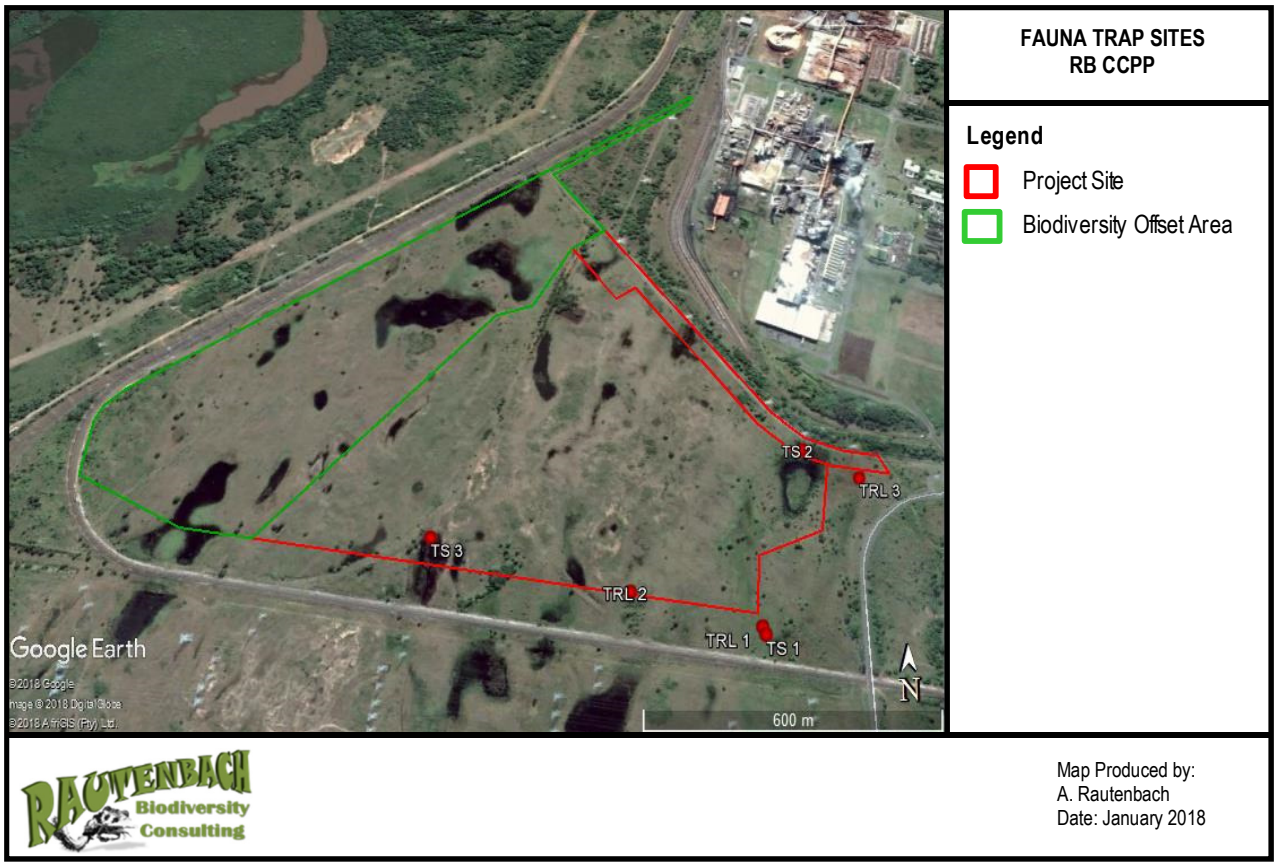

FIGURE 4: Location of the fauna trap sites on the project site.

TABLE 2: GPS coordinates for fauna trap sites.

TRAP SITE NAME	GPS COORDINATES
TS 1 (Trap station – pitfall traps)	Latitude: -28.773840°; Longitude: 31.988450°
TS 2	Latitude: -28.770141°; Longitude: 31.990229°
TS 3	Latitude: -28.771725°; Longitude: 31.981310°
TRL 1 (Trap line – catch-alive rodent traps)	Latitude: -28.773696°; Longitude: 31.988413°
TRL 2	Latitude: -28.772948°; Longitude: 31.985668°
TRL 3	Latitude: -28.770816°; Longitude: 31.991396°

Pitfall trap sites consisted of four 20 L buckets that were buried in the ground with the rim of the bucket at ground level. The buckets were placed 4 m apart from rim to rim in a Y-shaped design. A 40 cm high drift fence made from plastic sheeting/shadecloth, anchored with metal poles placed at 1 m intervals connected the pitfall traps (Figure 5A).

Ten catch-alive rodent traps (*viz*. Sherman & PVC Live traps) were set in a line transect with traps spaced approximately 10 m apart, close to the pitfall arrays (Figure 5B). Catch-alive rodent traps were baited daily with a mixture of peanut butter and oats. Traps were left open for 3 consecutive nights.

The following external measurements were taken from captured animals: head-body length (HB), tail length (T); hind-foot length (Hf), and weight (g). Animals were identified and subsequently released at the site of the capture.

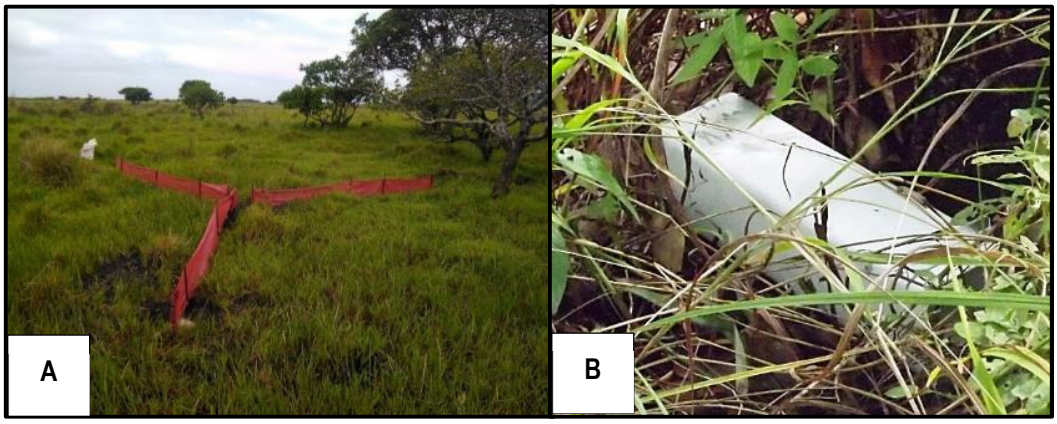

FIGURE 5: A - Pitfall trap array **B** - PVC catch-alive rodent trap.

7.3.2 Herpetofauna Assessment

Literature Review

As the majority of reptiles and amphibians are secretive, poikilothermic and/or nocturnal or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season. Herpetofauna distribution data and species specific information was obtained from the following information sources:

- SARCA (sarca.adu.org);
- A *Guide to the Reptiles of Southern Africa* (Alexander & Marais, 2007);
- *A Complete guide to the Snakes of Southern Africa* (Marais, 2004);
- *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);
- FrogMAP (frogmap.adu.org.za);
- *Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland* (Mintner *et al*., 2004).

Field Survey

During random transect walks, possible reptile retreats such as rocky outcrops, trees, under logs or stones were searched for the presence of reptile species. Potential dispersal connections between habitats were investigated.

For frogs, suitable environmental conditions, especially breeding sites, are critically important and most species tend to be located in very specific microhabitats such as pools, ponds, streams, marshlands, rocky outcrops and open grassveld (du Preez & Carruthers, 2009). The evaluation of qualitative and quantitative habitats for frog species on the project site was also investigated.

Nocturnal surveys for frogs were conducted on two nights and included active searches and call recordings. Focal habitats such as ponds, pools, dams, wetlands and streams/drainage lines were searched systematically for approximately 3 hours per survey effort. Searches were conducted by slowly wading or walking on adjacent riparian banks while visually searching for adult frogs by using a bright light to look for eye shine. Frog calls were recorded and compared with pre-recorded calls from du Preez & Carruthers (2009) as an additional means to identify frog species.

The pitfall traps with associated drift fences erected for small mammal sampling were also used to sample small, terrestrial herpetofauna and frog species (Figure 5A). Pitfall trapping is useful for documenting small, rare, often fossorial species that are difficult to detect using other techniques.

7.3.3 Avifauna Assessment

Literature Review

Due to the inherent mobility of birds, it is important to consider avifauna not only on the project site, but also the avifauna beyond the project site. The broader areas include bird distribution data from the following pentads: 2845_3155; 2845_3200; 2840_3155 and 2840_3200. The primary sources of avifaunal distribution data were obtained from the following sources:

- The First and Second Southern African Bird Atlas Projects (SABAP1 and SABAP2; Harrison *et al*., 1997, http://sabap2.adu.org.za);
- BirdLife South Africa Area (IBA) Directory (Barnes 1998);
- *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland* (Taylor *et al*., 2015);
- Roberts VII Multimedia Birds of Southern Africa;
- *Newman's Birds of Southern Africa* (Newman, 2010);
- *Roberts Birds of Southern Africa* (Hockey *et al*., 2005).

Field Survey

Birds were identified by means of direct observation by using a 'Walkover' method of all the key habitats identified on the project site. Specific attention was paid to features/habitats which may be of potential ornithological importance, e.g. water bodies, grassland, trees. Periodic scanning for soaring birds and stops to listen for calls were incorporated during the walkover. Bird calls were recorded and compared with pre-recorded calls from *Roberts VII Multimedia Birds of Southern Africa*, as an additional means to identify bird species. Specific attention was paid to the assessment of habitat availability for threatened crane species.

Daily walkover surveys were conducted from 07H00 - 11H00 am and again from 17H00 – 19H30 pm when birds are likely to be most active. Nocturnal birds were surveyed by listening for calling birds from around dusk to approximately 21H00 pm.

7.4 ASSESSMENT METHODOLOGY FOR SPECIES OF CONSERVATION CONCERN

The following categories were used to categorise Species of Conservation Concern (SCC):

- Threatened species;
- Sensitive species;
- Nationally protected species;
- Provincially protected species;
- Endemic/near-endemic species.

7.4.1 Threatened Species

South Africa uses the internationally endorsed IUCN Red List categories and criteria to measure a species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. Any species classified in the IUCN categories as Critically Endangered, Endangered or Vulnerable is a threatened species. Threatened species are species that are facing a high risk of extinction.

Species classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically/Extremely Rare, Rare, Declining and Data Deficient – Insufficient Information (DDD) have a high conservation importance in terms of preserving South Africa's high biodiversity. A brief summary of National Red List categories are provided below:

National Red List category definitions (SANBI, 2015)

Categories marked with [N] are non-IUCN, National Red List categories for species not in danger of extinction, but considered to be of national conservation concern. The IUCN equivalent of these categories is of Least Concern (**LC**).

Extinct (**EX**) A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.

Extinct in the Wild (**EW**) A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalised population (or populations) well outside the past range.

Regionally Extinct (**RE**) A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.

Critically Endangered, Possibly Extinct (**CR PE**) Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.

Critically Endangered (**CR**) A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

Endangered (**EN**) A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.

Vulnerable (**VU**) A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

Near Threatened (**NT**) A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.

[N]Critically Rare (plants) – Extremely Rare (butterflies) A species is Critically / Extremely Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.

[N]Rare A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:

- Restricted range: Extent of Occurrence (EOO) <500 km^2, OR
- Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km^2, OR
- Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
- Small global population: Less than 10 000 mature individuals.

Least Concern A species is of Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as of Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

Data Deficient – Insufficient Information (DDD) A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.

Data Deficient – Taxonomically Problematic (DDT) A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

Not Evaluated (NE) A species is Not Evaluated when it has not been evaluated against the criteria. Certain species do not qualify for national listing because they are naturalised exotics, hybrids (natural or cultivated), or synonyms. In certain cases species have not been assessed nationally as taxon specialists prefer to use only the Global Red List status.

7.4.2 National Protected Species

The lists of threatened and protected species in terms of Chapter 4 of the National Environmental: Biodiversity Act, 2004 (Threatened and Protected Species Regulations of 2015) lists various species that are threatened or otherwise in need of protection. It is important to note that although the category names in the NEMBA list are similar to those in the IUCN Red List, and NEMBA category definitions are broadly similar to those of the IUCN categories, they are not equivalent since different classification systems were used. Therefore, a species classification in NEMBA may differ from its Red List category.

NEMBA Categories:
Critically endangered (CR) – Indigenous species facing an extremely high risk of extinction in the wild in the immediate future.

Endangered species (EN) – Indigenous species facing a high risk of extinction in the wild in the near future, although they are not a Critically Endangered species.

Vulnerable Species (VU) – Indigenous species facing a high risk of extinction in the wild in the medium-term future, although they are not a Critically Endangered species or an Endangered species.

Protected Species (PROT) – Indigenous species of high conservation value or national importance that require national protection.

For the vegetation assessment, the List of Protected tree species, Section 12 (1) (d) Schedule A (National Forest Act, No. 84 of 1998, Notice 1602 of December 2016) was included.

7.4.3 Provincial Protected Species

The KwaZulu-Natal Environmental, Biodiversity and Protected Areas Management Bill, 2014 (hereafter referred to as KZNEBPA 2014), and the KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (Act No. 5 of 1999, hereafter referred to as the KZNCMA 1999) was used to evaluate the conservation status of fauna and flora species on a Provincial scale.

7.4.4 Endemic/Near-Endemic Species

Endemic and near-endemic species generally have restricted distribution and are generally highly adapted to their home range; therefore threats to endemics carry more risk of extinction than for broadly distributed species.

Although many of these species have wide distributional ranges within the region and have a conservation ranking of Least Concern, and some rank among our most widespread and abundant, all endemic species require some vigilance to ensure that population numbers stay stable.

Endemic species – A species in which the entire global range is restricted to a specific area (e.g. South Africa; KwaZulu-Natal).

Near-endemic species – A species that occurs only marginally outside a specific area (e.g. South Africa; KwaZulu-Natal Province).

7.4.5 Sensitive Species

Species were also evaluated in terms of CITES agreements. CITES is an international agreement between governments that aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Appendices I, II and III of the Convention are lists of species afforded different levels or types of protection from over-exploitation.

CITES categories:

Appendix I – A list of species threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial (see Article III of the Convention), for instance for scientific research. In these exceptional cases, trade may take place provided it is authorised by the granting of both an import permit and an export permit (or re-export certificate). Article VII of the Convention provides for a number of exemptions to this general prohibition.

Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e. species whose specimens in trade look like those of species listed for conservation reasons (see Article II, paragraph 2 of the Convention). International trade in specimens of Appendix II species may be authorised by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires). Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild (See Article IV of the Convention).

Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation (see Article II, paragraph 3, of the Convention). International trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates (See Article V of the Convention).

7.5 THE PROBABILITY OF OCCURRENCE OF SPECIES OF CONSERVATION CONCERN

The desktop component of this report involved collating vegetation characteristics and literature relevant to the fauna and flora of the Province, to draw up lists of SCC fauna and flora species that may be present on the project site.

Four parameters were used to assess the probability of occurrence of SCC fauna and flora species:

- Habitat requirements – Most SCC species, have very specific habitat requirements; the presence of these habitats on the project site was evaluated;
- Habitat status – The ecological condition of available habitat in the project site;
- Habitat linkage – The connectivity of the project site to surrounding habitats and adequacy of these linkages;
- Geographic distribution of species.

The estimated probability of occurrence is presented in three categories:

- High (71–100%) would be applicable to species with a distributional range overlying the project site as well as the presence of prime habitat. A further consideration included in this category is for a species to be common, abundant and widespread;
- Medium (41-70%) pertains to a species with its distributional range peripherally overlying the project site, or required habitat on the project site being sub-optimal; the size of the area as it relates to its likelihood to sustain a viable breeding population, as well as its geographical location. These species normally do not occur at high population numbers, but cannot be deemed as rare;
- Low (0–40%) are applicable to species with its distributional range peripheral to the project site, and habitat that is sub-optimal. These species are generally deemed to be rare.

7.6 HABITAT SENSITIVITY ANALYSIS

The determination of specific ecosystem services and the sensitivity of ecosystem components, both biotic and abiotic, is rather complex and no single overarching criterion will apply to all habitats studied. Sensitivity analyses do not only consider aspects that currently prevail on the area, but also take into account the possibility of full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed.

The main aspects of an ecosystem that need to be incorporated in a sensitivity analysis, however, include the following:

- A description of the nature and number of species present, taking into consideration their conservation value as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats, of various magnitudes;
- An identification of the species or habitat features that are 'key ecosystem providers' and characterising their functional relationships (Kremen, 2005);
- A determination of the aspects of community structure that influence function, especially aspects influencing stability or rapid decline of communities (Kremen, 2005);
- An assessment of key environmental factors that influence the provision of services (Kremen, 2005);
- Gaining knowledge about the spatio-temporal scales over which these aspects operate (Kremen, 2005).

The sensitivity analyses are presented in the following categories:
High Sensitivity: Areas that are relatively undisturbed or pristine, and

- Either is very species-rich relative to immediate surroundings;
- Or have a very unique and restricted indigenous species composition;
- Or constitute specific habitats or a high niche diversity for fauna and/or flora species of conservation concern, and where the total extent of such habitats and associated species of conservation concern remaining in Southern Africa is limited;
- Where excessive disturbance of such habitats may lead to ecosystem destabilisation and/or species loss;

- This would also include areas where the abiotic environment is of such nature that the habitat and its niche-diversity are the main reason for a higher species diversity and cannot be reconstructed or rehabilitated once physically altered in any way.

Medium Sensitivity: Areas where disturbances are at most limited and

- Areas with a species diversity representative of its natural state, but not exceptionally high or unique compared to its surroundings;
- Areas of which the biotic configuration does not constitute a very specific or restricted habitat or very high niche diversity;
- Areas that provide ecosystem services needed for the continued functioning of the ecosystem and the continued use thereof (e.g. grazing);
- Although species of conservation concern may occur on the area, these are not restricted to these habitats only;
- Areas that need to remain intact to ensure the functioning of adjacent ecosystems, or wildlife corridors or portions of land that prevent the excessive fragmentation of natural fauna and flora populations, or areas that will be difficult or impossible to rehabilitate to a functional state after physical alteration.
- Where the landscape can be rehabilitated to allow the re-establishment of some of the original species composition after physical alteration, but some of the species of conservation concern or ecosystem functionality may be lost; where the landscape can be rehabilitated to allow the re-establishment of most or all of the original species composition after physical alteration.
- This could also include areas with previous disturbance or transformation, where the impact of the development will lead to irreversible, unjustified degradation of the landscapes that will be difficult to prevent and mitigate;

Low Sensitivity: Areas that have been previously transformed or disturbed or

- Areas that provide limited ecosystem services, or have a low ecological value;
- Species diversity may be low or all species present have a much wider distribution beyond this habitat or locality;
- Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease;
- Further arguments may include landscapes where the abiotic nature is such that it can be rehabilitated relatively easy to allow the re-establishment of the original species composition, and where the development will not lead to any unjustified degradation of landscapes or ecosystem services if adequately mitigated.

8. RESULTS – DESKTOP ASSESSMENT

The conservation importance of the project site was assessed on National (NBA 2011), Provincial (KZNSCP 2012) and District (UThungulu District Municipality: BSP 2014) scales.

8.1. NATIONAL LEVEL CONSERVATION PRIORITIES

8.1.1 Protected Areas and Other Conservation Areas

Protected areas include National Parks, Provincial Nature Reserves, Local Authority Nature reserves, Wildlife Management Areas, Private Nature Reserves, IBA Areas, Game Farms, Game Reserves, Nationally Protected Forest Patches and NPAES focus areas.

The following protected areas are located within a 30 km radius of the project site (Figure 6):

- Richards Bay Game Reserve and IBA ~ 4.5 km to the southeast
- Enseleni Nature Reserve ~ 7.8 km to the north
- Ngoya Forest Reserve and IBA ~ 23.3 km to the southwest
- Thukela NPAES focus area ~ 22.9 km to the west

The proposed development is not expected to have an impact on existing protected areas within the region.

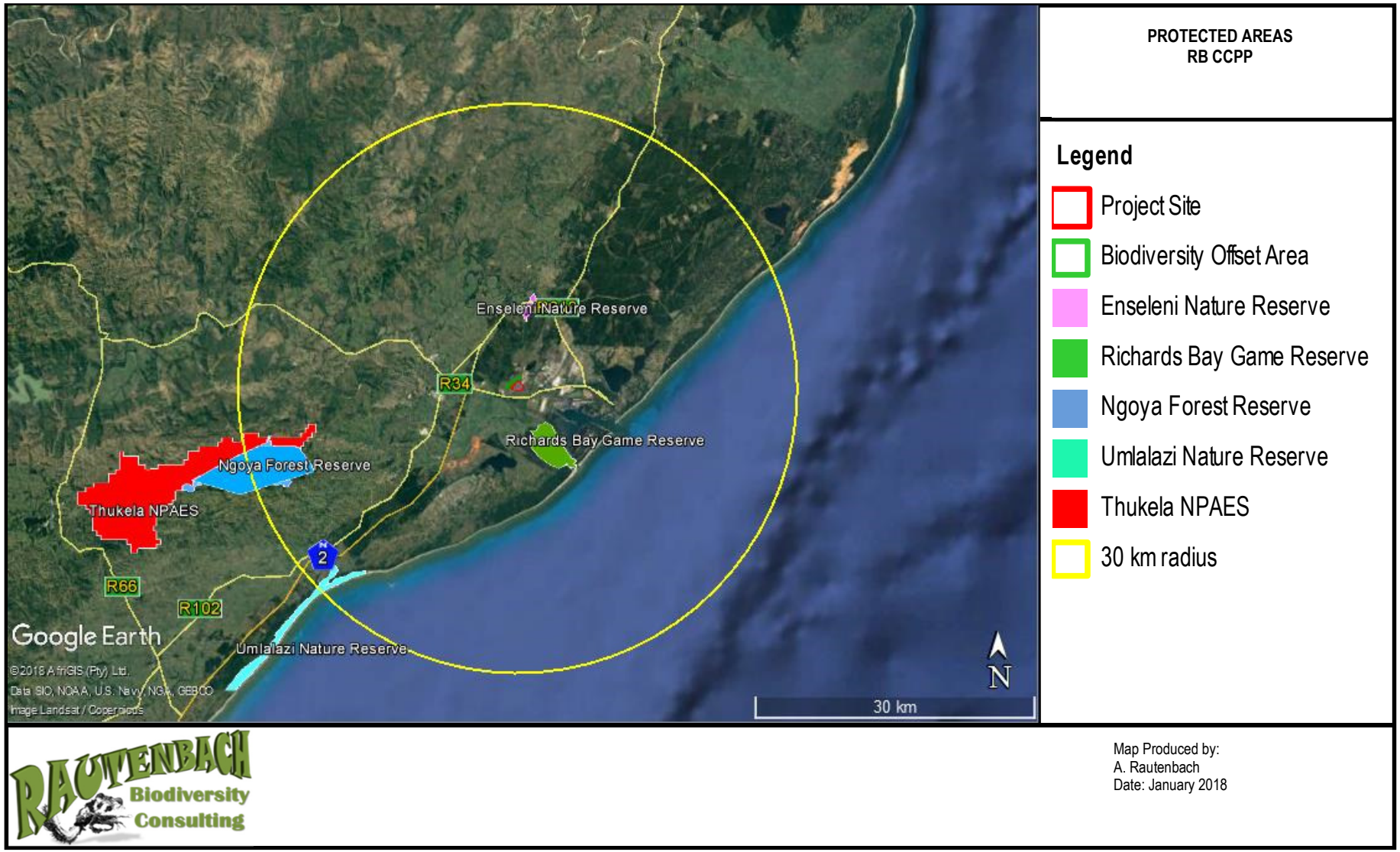

FIGURE 6: The location of protected areas in relation to the project site.

8.1.2 National Threatened Ecosystems

The first list of nationally threatened terrestrial ecosystems in South Africa was gazetted in December 2011 (NEMBA: National List of ecosystems that are threatened and in need of protection, G34809, GoN 1002), with the aim of reducing the rate of ecosystem and species extinction, by preventing further degradation and loss of structure, function and composition. This list also includes ecosystems outside of protected areas. Ecosystems are listed in one of four categories: critically endangered (CR), endangered, (EN), vulnerable (VU) or protected.

Ecosystem delineation was based on the South African Vegetation Map (Mucina & Rutherford, 2012 delineation); National Forest Types (DWAF), priority areas identified in Provincial Systematic Biodiversity Plans, and high irreplaceability forest patches or clusters systematically identified by DWAF. The project site is located in the '**Critically Endangered**' Kwambonambi Hygrophilous Grassland ecosystem (Threatened ecosystem code KZN 9; Figure 7).

The **Kwambonambi Hygrophilous Grasslands** ecosystem lies inland, but adjacent to the Kwambonambi Dune Forest ecosystem. It incorporates the hygrophilous grasslands behind the primary dune system as well as swamp forests, including the Richards Bay surrounds up to the lower Umfolozi Flats.

This ecosystem contains six threatened or endemic plant and animal species, including one amphibian species, *Hyperolius pickersgilli*, four millipede species, *Centrobolus fulgidus*, *Centrobolus richardi, Centrobolus rugulosus* and *Doratogonus zuluensis*; one plant species, *Kniphofia leucocephala*; and six vegetation types *viz.* KwaZulu-Natal Coastal Forest, KwaZulu-Natal Dune Forest, Mangrove Forest, Maputaland Wooded Grassland, Maputaland Coastal Belt and Swamp Forest.

More or less 8% of the original area of this ecosystem is protected in the Enseleni Nature Reserve, Richards Bay Game Reserve, Nhlabane Nature Reserve and isiMangaliso Wetland Park (Goodman, 2007).

This ecosystem is listed under Criterion F in the National List of Ecosystems which categorises it as priority areas for meeting explicit biodiversity targets as defined by a systematic biodiversity plan, including DAFFs systematic biodiversity plans for the Forest biome. Typically, development in 'Critically Endangered' ecosystems, especially those with large footprints, should avoid conflict with or negative impacts on threatened ecosystems.

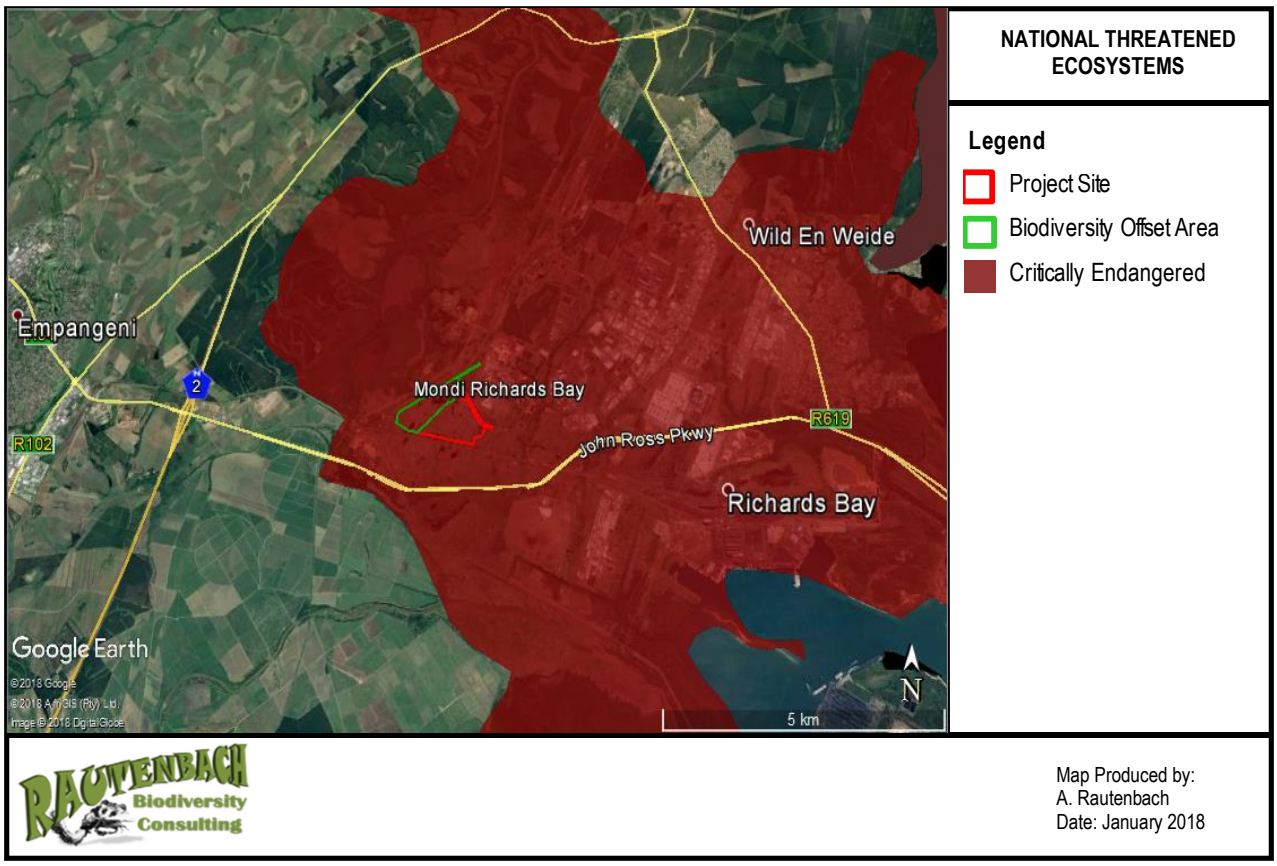

FIGURE 7: The project site falls within the Critically Endangered Kwambonambi Hygrophilous Grasslands ecosystem.

8.1.3 Sensitive Aquatic Ecosystems

The National Freshwater Ecosystem Priority Areas (NFEPA) project was a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute for Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks).

The NFEPA project aimed to identify Freshwater Ecosystem Priority Areas (FEPAs) to meet national biodiversity goals for freshwater ecosystems; and develop a basis for enabling effective implementation of measures to protect FEPAs, including free flowing rivers. The NFEPA study responded to the high levels of threat prevalent in river, wetland and estuary ecosystems of South Africa. It provides strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or 'FEPAs'.

Maps produced for South Africa's National Freshwater Ecosystem Priority Areas (NFEPA) project depict areas that have been prioritised for conserving freshwater ecosystems and supporting sustainable use of water resources. The data presented below is a subset of the NFEPA project specific to the project site.

The NFEPA project highlights four natural, Indian Ocean Coastal Belt wetlands with wetland conditions of AB (i.e. percentage natural cover $\geq$ 75 %, therefore in natural or good condition), and NFEPA rankings of 2 (wetlands with the majority of its area within a sub-quaternary catchment that has sightings or breeding areas for threatened wattled cranes, grey crowned cranes and blue cranes) to be on the project site (Figure 8; Nel *et al.*, 2011).

However, Google Imagery clearly indicates these wetlands were fragmented long ago with the construction of a railway line and its associated service road.

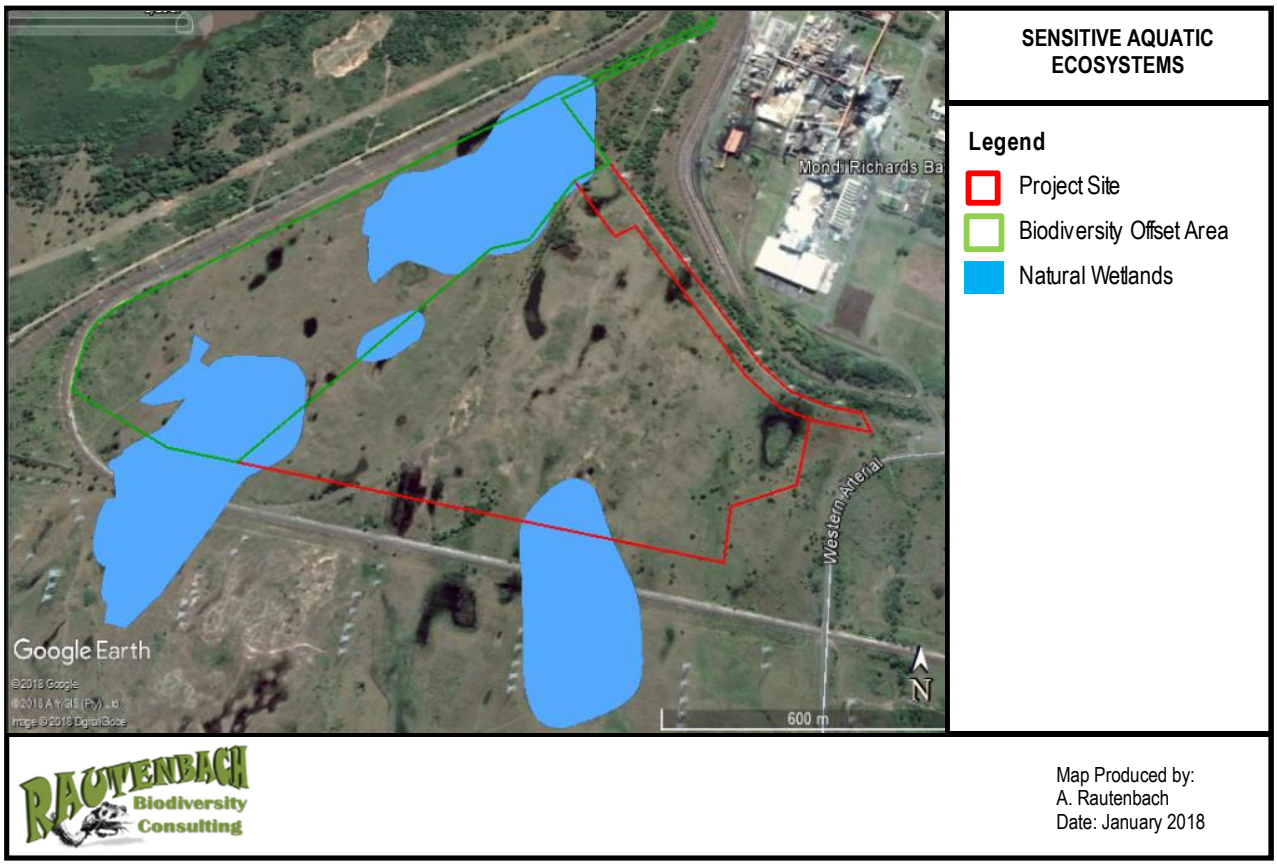

FIGURE 8: The location of the NFEPA wetlands on the project site.

8.2 PROVINCIAL AND DISTRICT LEVEL CONSERVATION PRIORITIES (KZNSCP 2012 & KZNBSP 2014)

The provincial scale KZN Systematic Conservation Plan (KZNSCP 2012) and the district scale UThungulu Biodiversity Sector Plan (KZNBSP 2014) identifies and map critical biodiversity areas and ecological support areas within the Province. Biodiversity mapping covers terrestrial, aquatic and marine environs at Provincial and District scales.

It is important to note that categorical classes of CBAs and ESAs are reflected differently in the KZNSCP 2012 (Table 3) and KZNBSP 2014 plans (Table 4). The KZNSCP 2012 planning product highlights the key priority areas for biodiversity conservation as reflected against a uniform biome i.e. the marine, estuarine, freshwater and terrestrial biomes, while the KZNBSP 2014 is a higher order spatial planning tool which takes into consideration locally identified CBA and ESA localities, as well as incorporates priorities identified at a national level.

TABLE 3: Summary of the CBA categories used in the KwaZulu-Natal Systematic Conservation Plan (KZNSCP 2012).

CBA 1 (Mandatory)	Areas representing the only localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved i.e. there are no alternative sites available.
CBA 2 (Mandatory)	Areas of significantly high biodiversity value. There are alternate sites within which the conservation targets can be met for the biodiversity features contained within, but not many.
CBA 3 (Optimal)	These areas are not necessarily of lower biodiversity value, but only indicate that there are more alternate options available within which the features located within can be met.

Biodiversity Areas/Other Natural Areas	Areas representing the natural and/or near natural environmental areas which still have biodiversity value, but it is preferred that development be focused within these areas.

The KZNBSP 2014 is reflected as biodiversity sector maps consisting of two main layers, namely Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

TABLE 4: Summary of the CBA and ESA categories used in the UThungulu District Municipality: Biodiversity Sector Plan (KZNBSP 2014).

Critical Biodiversity Areas (CBAs) – Crucial for supporting biodiversity features and ecosystem functioning and are required to meet conservation targets.	
Critical Biodiversity Areas: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of the ecosystems.
Critical Biodiversity Areas: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding areas where the risk of biodiversity loss is high. Category driven primarily by process but is also informed by expert input.
Ecological Support Areas (ESAs) – Functional but not necessarily entirely natural areas that are required to ensure persistence and maintenance of biodiversity patterns and ecological processes within the CBA areas.	
Ecological Support Areas (ESAs)	Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs. These areas also contribute significantly to the maintenance of ecological infrastructure.
Ecological Support Areas: Species Specific	Terrestrial modified areas that provide a support function to a threatened or protected species.

The proposed development footprint includes areas to the southwest of the project site designated as a 'Critical Biodiversity Area' (CBA type 3; KZNSCP 2012; Figure 9A). This rating is due to the potential presence of a number of threatened invertebrates such as molluscs, millipedes and orthopterans and threatened vegetation types, i.e. Maputaland Coastal Grassland and *Ficus trichopoda* Swamp Forest.

Most of the proposed development footprint on the project site falls into an area classified as 'Biodiversity areas'. These areas represent the natural and/or near natural environmental areas not identified as CBA areas, but still considered to be of biodiversity value.

On a district scale, almost the entire project site falls within a CBA: Irreplaceable area (Figure 9B). Land-use management objectives for these areas include limited to no biodiversity loss in order to maintain these areas in a natural state, thus the proposed land-use activities are not compatible with the aims of the land-use objectives of CBA: Irreplaceable areas (KZNBSP 2014; Nel *et al*., 2011).

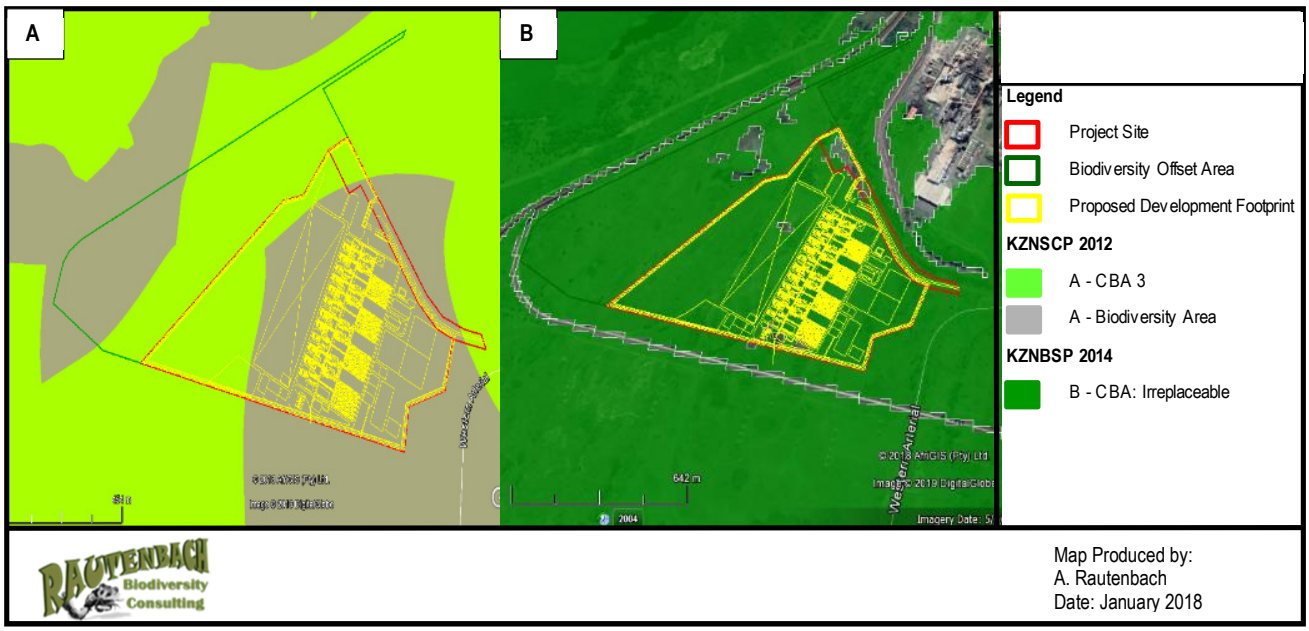

FIGURE 9: CBA areas on the project site in relation to the proposed development footprint according to the **A** – KZN Systematic Conservation Plan (2012) and; **B** – UThungulu Biodiversity Sector Plan (2014).

8.2.1 Regional Connectivity

Maintaining connectivity between natural areas is considered critical for the long term persistence of both ecosystems and species. Natural ecological corridors/linkages are considered crucial for allowing species to migrate naturally and to accommodate shifts in species ranges in response to climate change.

Areas surrounding the project site is characterised by high levels of infrastructural developments such as roads and railway lines, industrial and agricultural developments, alien and invasive weed infestations, particularly along linear developments, resulting in only small fragmented pockets of natural and/or semi-natural habitat remaining in most instances. Therefore, on a local scale, connectivity between natural habitats and ecosystems has already been severely compromised. Thus, from a biodiversity perspective, connectivity with other natural habitat adjacent to the project site is poor and the site is essentially isolated (Figure 10).

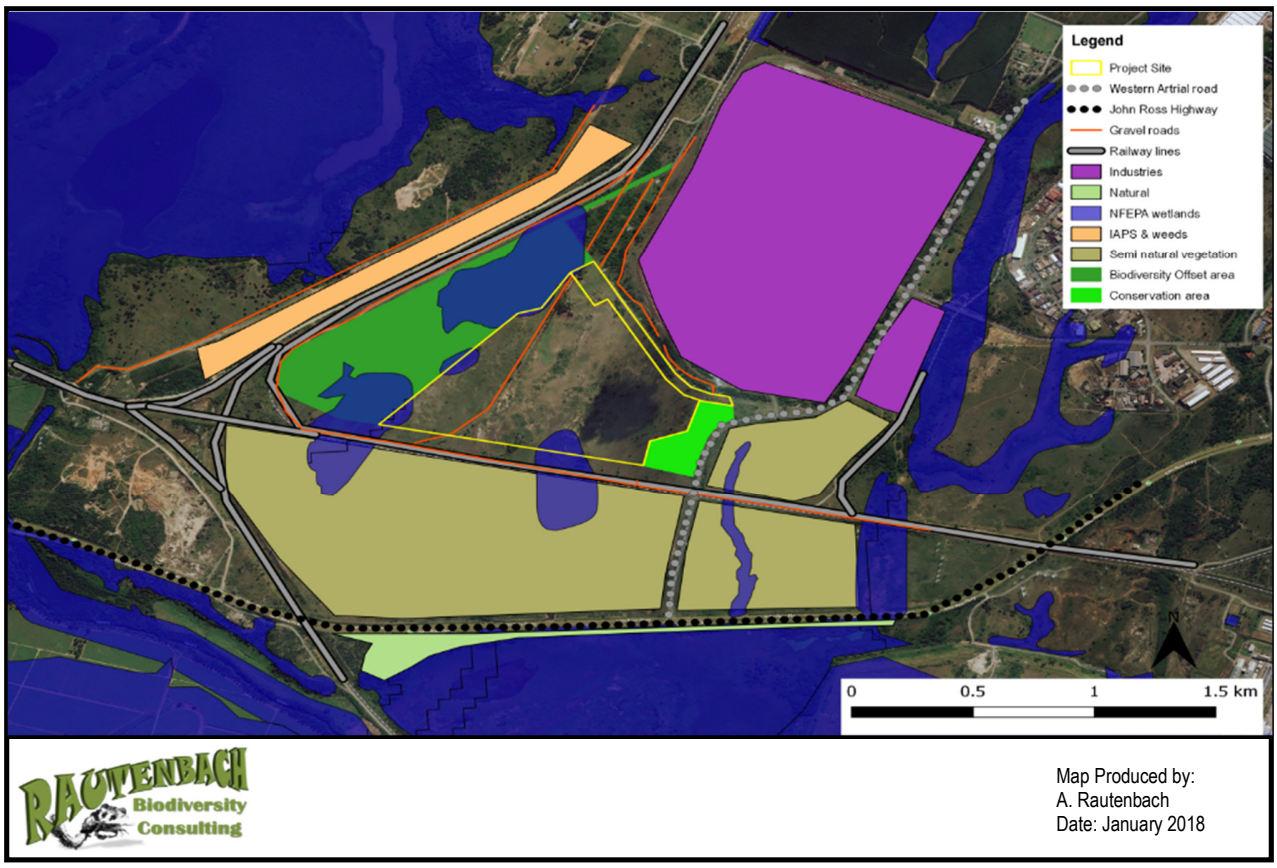

FIGURE 10: Exensive linear developments had essentialy isolated vegetation communities on the project site with adjacent semi-natural vegetation.

8.2.2 Regional Vegetation Classification

The project site falls within the following KZN vegetation biomes and vegetation types (Table 5; Figure 11).

TABLE 5: Summary of the vegetation types bisecting the project site.

KZN VEGETATION BIOME	KZN VEGETATION TYPE	CONSERVATION STATUS
Wetlands	Freshwater Wetlands: Subtropical Freshwater Wetlands	**VU**
Indian Ocean Coastal Belt	Maputaland Wooded Grassland	**EN**

Vegetation types that historically covered the project site include **Subtropical Freshwater Wetlands** and **Maputaland Wooded Grassland**.

Subtropical Freshwater Wetlands ordinarily occurred in low lying areas and were dominated by reeds, sedges, rushes and water-logged meadows dominated by grasses.

Important taxa of Subtropical Freshwater Wetlands include the following species (Mucina & Rutherford, 2006):

Marshes

- Small Trees: *Hyphaene coriacea*, *Phoenix reclinata*
- Graminoids: *Chloris virgata* , *Cynodon dactylon* , *Cyperus articulatus* , *Dactyloctenium aegyptium*, *Diplachne fusca, Echinochloa pyramidalis*, *Fimbristylis obtusifolia*, *Hemarthria altissima* , *Imperata cylindrica*, *Ischaemum arcuatum*,

Leersia hexandra , *Pycreus mundii* , *Sporobolus nitens* , *S. smutsii* , *Urochloa stolonifera* , *Bolboschoenus glaucus, Courtoisia cyperoides*, *Cyperus alopecuroides*, *C. pectinatus*, *Digitaria natalensis*, *Echinochloa stagnina*, *Eragrostis chapelieri, E. lappula, Eriochloa meyeriana*, *Fimbristylis bisumbellata*, *Fuirena ecklonii*, *Oxycaryum cubense*, *Paspalidium obtusifolium*, *Paspalum commersonii*, *Pycreus pelophilus*, *P. polystachyos*, *Scleria poiformis*, *Sporobolus consimilis*.

- Herbs: *Pentodon pentandrus* , *Persicaria senegalensis* , *Burmannia madagascariensis, Centella coriacea*, *Commelina diffusa, Convolvulus mauritanicus*, *Desmodium dregeanum*, *Eclipta prostrata, Epaltes gariepina*, *Eriocaulon abyssinicum*, *Ethulia conyzoides*, *Glinus lotoides*, *Hydrocotyle ranunculoides, Ludwigia adscendens* subsp. *diffusa*, *L. leptocarpa*, *L. octovalvis*, *L. palustris*, *Neptunia oleracea*, *Persicaria attenuata* subsp. *africana, P. hystricula*, *Rorippa madagascariensis*, *Sium repandum*, *Vahlia capensis*.
- Geophytic Herbs: *Eulophia angolensis*, *Zeuxine africana*.
- Succulent Herb: *Salicornia pachystachya*.
- Semiparasitic Herb: *Buchnera longespicata*.
- Aquatic Herbs: *Bergia salaria*, *Lagarosiphon crispus*

Lakes & ponds

- Graminoid: *Eleocharis dulcis* (forming rafts).
- Aquatic Herbs: *Azolla pinnata* var. *africana*, *Ceratophyllum demersum*, *Lemna minor*, *Nymphaea nouchali* var. *caerulea*, *Pistia stratiotes*, *Wolffia africana*, *Aponogeton desertorum, A. natalensis, A. rehmannii, Ceratophyllum muricatum*, *Marsilea macrocarpa*, *Najas marina* subsp. *delilei*, *N. africana Nymphoides indica* subsp. *occidentalis*, *N. rautanenii*, *Ottelia exserta*, *Potamogeton crispus*, *P. pectinatus*, *P. schweinfurthii*, *Spirodela polyrhiza*, *S. africana, Trapa natans* var. *bispinosa*.
- Carnivorous Herbs: *Utricularia gibba* subsp. *exoleta*, *U. inflexa*, *U. subulata.*
- Geophytic Herb: *Crinum paludosum.*

Reed & sedge beds

- Megagraminoids: *Cladium mariscus* subsp. *jamaicense*, *Cyperus papyrus*, *Phragmites australis*, *P. mauritianus*, *Schoenoplectus corymbosus*, *S. scirpoideus*, *Typha capensis*.
- Graminoids: *Cyperus fastigiatus*, *C. difformis*, *C. digitatus, C. latifolius*, *C. sexangularis*, *Fuirena ciliaris*.

Biogeographically Important Taxa (all southernmost distribution limits)

Streambanks

- Herb: *Floscopa glomerata, Ipomoea aquatica*
- Geophytic Herb: *Bolbitis heudelotii*.

Lakes & ponds

- Aquatic Herbs: *Brasenia schreberi*, *Ceratopteris cornuta, Wolffia globosa, Wolffiella welwitschii.*
- Herbs: *Hygrophila schulli, Limnophyton obtusifolius, Marsilea apposita, M. coromandelina, M. minuta*, *M. villifolia.*

Reed & sedge beds

- Graminoids: *Cyperus dives, C. procerus, C. prolifer.*

Endemic Taxa

Marshes

- Graminoid: *Cyperus sensilis* (embedded within Indian Ocean Coastal Belt of KwaZulu-Natal).

Lakes & ponds

- Geophytic Herbs: *Crinum campanulatum* (Albany region).

- Aquatic Herbs: *Isoetes wormaldii* (Albany region), *Wolffiella denticulata* (Maputaland).

The dominant vegetation type in the project site is the **Maputaland Wooded Grassland**. This vegetation type typically supported coastal sandy grasslands rich in geoxylic suffritices, dwarf shrubs, small trees and very rich herbaceous flora.

Important taxa of Maputaland Wooded Grasslands include the following species (Mucina & Rutherford, 2006):

- Geoxylic suffritices: *Parinari curatellifolia, Salacia kraussii, Ancylobotrys petersiana, Diospyros galpinii, Eugenia capensis, Syzygium cordatum.*
- Gramminoids: *Diheteropogon amplectens, Themeda triandra, Aristida stipitata* subsp. *gracilifllora, Bewsia biflora, Cyperus obtusiflorus, C. tenax, Digitaria natalensis, Eustachya paspaloides, Setaria sphacelata, Sporobolus fimbriatus, S. subulatus, Urelytrum agropyroides.*
- Herbs: *Chamaecrista plumose.*
- Geophytic herb: *Cyrtanthus galpinii.*
- Low shrubs: *Helichrysum krausii, Agathisanthemum bojeri, Crotalaria monteiroi* var. *monteiroi*
- Small trees and tall shrubs: *Acridocarpus natalitius* var. *linearifolius, Dichrostachys cinerea* subsp. *nyassana, Diospyros lycioides* subsp. *sericea, Hyphaene coriacea, Terminalia sericea.*

Biogeographically important taxa:

- Geoxylic suffritices: *Eugenia albanensis, Gymnosporia markwardii.*
- Graminoids: *Abildgaardia hygrophila, Cyperus natalensis.*
- Herbs: *Helichrysopsis septentrionale, Oxygonum robustum, Tricliceras mossambicense.*
- Tall shrubs: *Grewia microthyrsa.*
- Woody climers: *Albertisia delagoensis, Cissampelos hirta.*

Endemic taxa:

- Geoxylic suffritices: *Ochna* sp. nov., *Syzygium cordatum*
- Succulent herb: *Aloe* sp. nov. (Strey 5100 PRE)
- Geophytic herb: *Brachystelma vahrmeijeri*

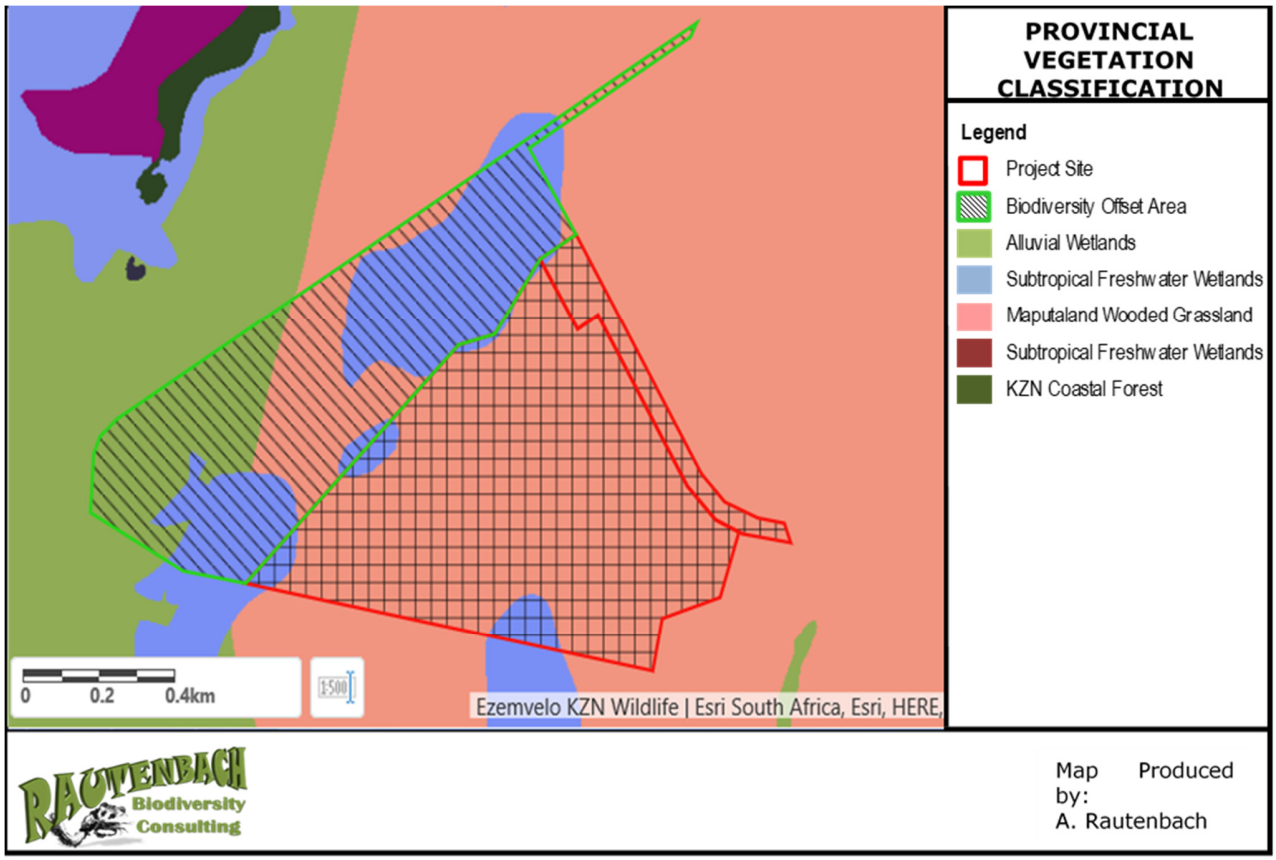

FIGURE 1: Vegetation types on the project site. Most of the project site falls within the Maputaland Wooded Grassland vegetation type.

8.3 MUNICIPAL LEVEL CONSERVATION PRIORITIES

Following an extensive public participation process undertaken during 2013, the new "uMhlathuze Land Use Scheme" was adopted by the uMhlatuze Council, which replaced the old Richards Bay and Empangeni Town Planning Schemes and also extended the scheme area to include land owned by the Ingonyama Trust Board.

The new Scheme became effective from 7 January 2014. During 2015, the scheme was reviewed. The effective date of the reviewed scheme is 25 June 2015. With this scheme, the project site falls in the High Impact Industry zone (Figure 12), an area earmarked for the development of large industries. This zone permits manufacturing uses which may not be compatible with other manufacturing uses and which would have major externalities on adjacent sensitive land uses. This zone would permit manufacturing activities that may produce significant air pollution, vibration, noise, odour, or high-volume automobile and truck traffic. Warehousing of materials that may be considered noxious or hazardous may be permitted in buildings in this zone, with possible conditions and/or exceptions. Outdoor storage, as either a principal use or an ancillary use, could also be permitted in the zone, with some possible conditions or restrictions.

Conservation areas, identified as environmentally important to protect and conserve important land and/or water bodies, and which are to be rehabilitated back to its original natural state has been identified to the north and south of the project site. These areas normally form part of the sustainable open space system, which includes independent or linked open space areas and permits only limited and specific developments.

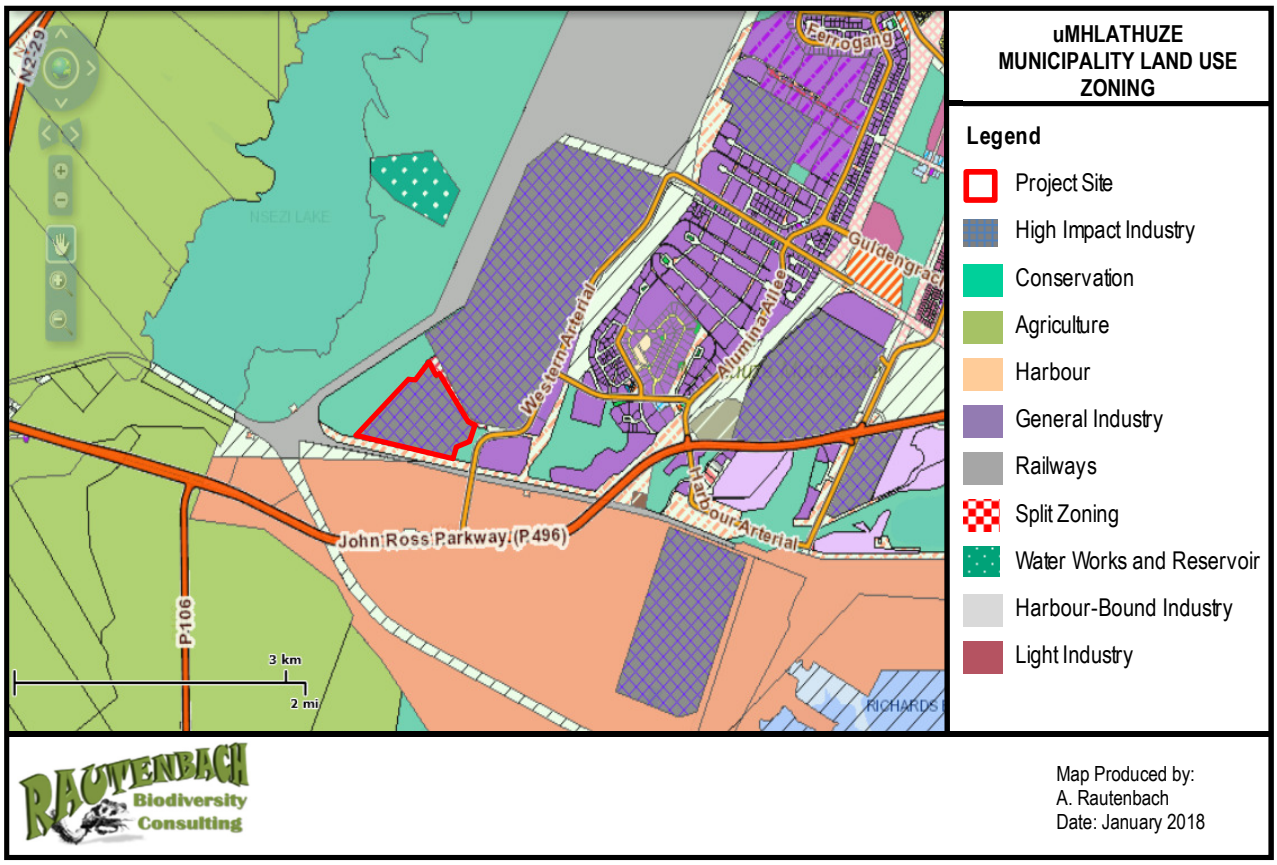

FIGURE 11: The location of the conservation areas in relation to the project site (map adapted from GIS.UMHLATHUZE.GOV.ZA).

9. RESULTS – FIELD ASSESSMENTS

9.1 GENERAL OVERVIEW OF ENVIRONMENTAL CONDITIONS

During the brief site visit conducted in February 2017, the project site was found to be quite dry. With the exception of a small wetland on the southern site boundary, which was severely trampled by watering cattle and covered with duckweed, no obvious surface water was evident. Nonetheless, some hygrophilous plant species were noted in several depressions, thereby suggesting plant communities with a preference for higher water tables. Basal cover was found to be low, and in some cases very sparse.

However, during recent investigations the general area was found to be fairly marshy with several shallow surface water bodies present (Figure 13) which appeared in good ecological condition (Figure 14). Basal cover similarly improved, with few bare patches evident.

Areas with surface water were carefully delineated and are presented in Figure 13. It should be emphasised that these delineations cannot be regarded as wetland delineations, but merely an indication of how surface water was distributed across the project site at the time of the assessment. Wetland delineations will be dealt with in a separate wetland and aquatic study.

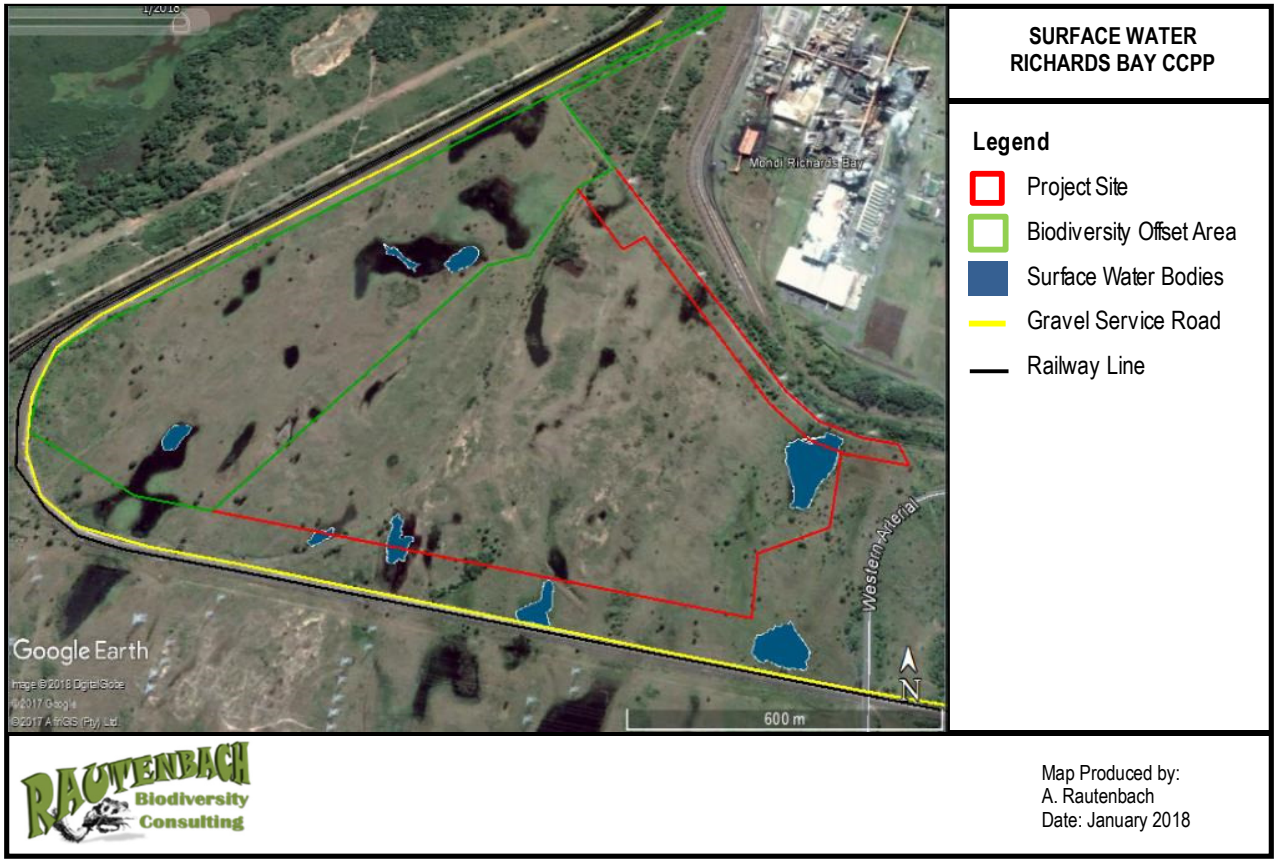

FIGURE 12: The distribution of surface water on the project site.

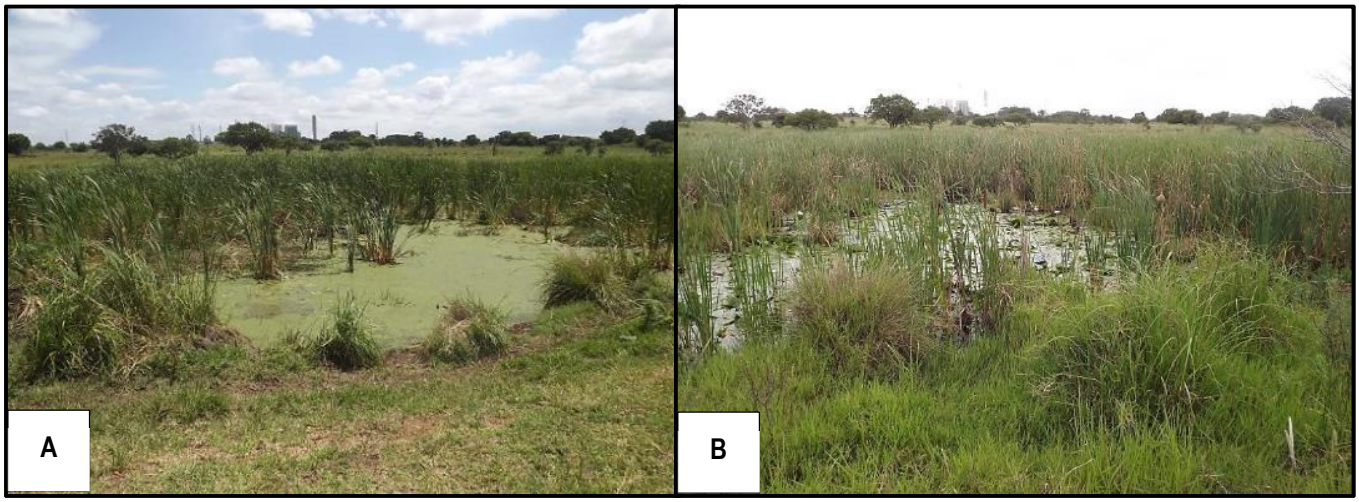

FIGURE 13: Comparison of past and current wetland conditions. **A** – Wetland on the southern site boundary in February 2017. **B** - The same wetland in January 2018.

9.2 VEGETATION ASSESSMENT

9.2.1 Local Vegetation Communities

The vegetation of the project site is characterised by plant communities representing two major vegetation types, i.e. Maputaland Wooded Grassland and Subtropical Freshwater Wetlands (Figure 11). At local scales, such as the project

site, variations in environmental factors i.e. soil structure, soil depth and past land use, may result in many different vegetation communities embedded within these major vegetation units.

Four local vegetation communities were identified, described and mapped on the project site and are discussed below:

- *Imperata cylindrica – Syzygium cordatum* wooded grassland (~26,03 ha – includes biodiversity offset area and areas surrounding the site; ~19.13 ha site only);
- *Helichrysum kraussii – Parinari capensis* shrubland (~67.4 ha – includes biodiversity offset area and areas surrounding the site; ~25.09 ha site only);
- Wetlands and wetland ecotones (~3.25 ha includes biodiversity offset area and areas surrounding the site; ~1.85 ha site only);
- Low-lying hygrophilous grassland (~42.6 ha includes biodiversity offset area and areas surrounding the site; ~24.96 ha site only).

The *Imperata cylindrica – Syzygium cordatum* wooded grassland, *Helichrysum kraussii – Parinari capensis* shrubland and Low-lying hygrophilous grassland vegetation communities are embedded within the Maputaland Wooded Grassland major vegetation type while the Wetlands with associated ecotone vegetation are embedded within the Subtropical Freshwater Wetlands major vegetation type. **Due to the mosaic nature of the vegetation, delineation of the boundaries of local plant communities is not precise, but follows broad patterns.**

Land use on all areas is mainly grazing by livestock, with human activities including hunting with dogs and quad biking. Evidence of deforestation of large woodland trees, particularly in the *Helichrysum kraussii – Parinari capensis* shrubland was evident.

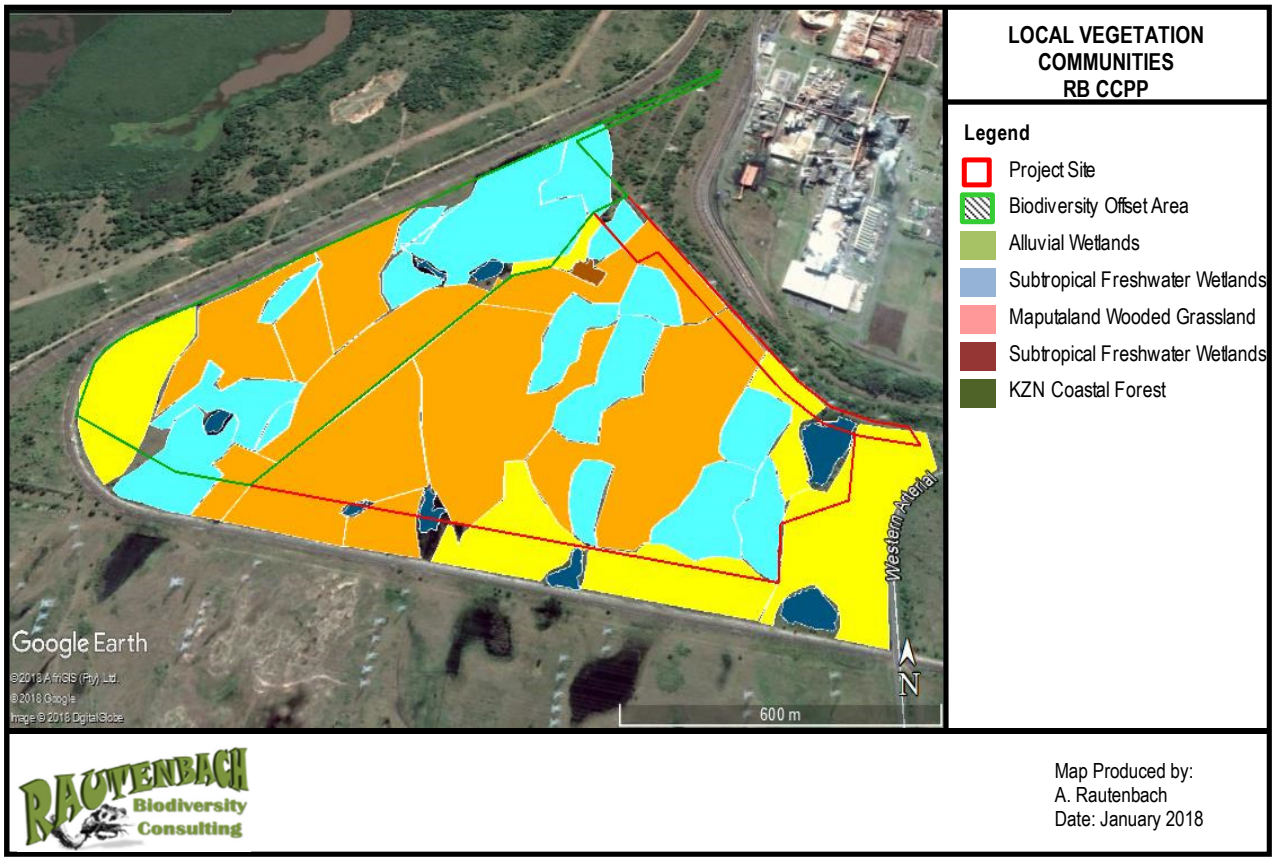

FIGURE 14: Local vegetation communities.

A total of 101 flora species, from 40 Families were identified on the project site. The number of species in each growth form identified within the vegetation communities is presented in Table 6. A complete list of plant species is presented in Table 7.

TABLE 6: The number of plant species in each growth form recorded in the vegetation communities.

	NR OF SPECIES			
GROWTH FORM	***IMPERATA CYLINDRICA – SYZYGIUM CORDATUM* OPEN WOODLAND**	***HELICHRYSUM KRAUSSII – PARINARI CAPENSIS* SHRUBLAND**	**WETLANDS AND WETLAND ECOTONES**	**LOW-LYING HYGROPHILOUS GRASSLAND**
Climber	1	1	1	-
Climber/Geophyte	1	-	-	-
Cyperoid	6	5	19	11
Dwarf Shrub	-	1	-	-
Dwarf Shrub/Herb	3	3	-	1
Epihydate/Herb/Hydrophyte	-	-	1	-
Geophyte	1	1	-	-
Geophyte/Herb	1	1	1	-
Geophyte/Succulent	1	0	-	-
Graminoid	14	14	6	8
Herb	22	21	4	9
Herb/Hydrophyte/hyperhydate	-	-	1	-
Herb/hydrophyte	2	1	3	2
Herb/Parasite	-	-	1	-
Hydrophyte	-	-	1	-
Shrub	3	2	1	1
Shrub/Herb	-	-	2	1
Shrub/Succulent	1	-	-	-
Shrub/Tree	9	7	2	2
Tree	6	8	2	0
Total number of species	**71**	**65**	**45**	**35**

VEGETATION COMMUNITY DESCRIPTIONS:

1. *Imperata cylindrica – Syzygium cordatum* wooded grassland (Figure 16)

This community is prominent on the southeastern and southern side of the project site and in areas within close proximity to areas where water accumulates. The area is characterised by grasslands dominated by the graminoids *Imperata cylindrica* and *Dactyloctenium aegyptium*, with cyperoids such as *C. esculentes* and *C. rotandus* well represented. Several *S. cordatum* and *H. coriacea* trees are interspersed in the grassland. Two small clumps of trees are present on the eastern border, with trees such as *T. emetica* and *B. micrantha* dominant. A few *Dichrostachys cinerea* thickets are also present on the eastern boundary of this community. Basal cover is high and luxuriant.

Invasive alien species that occur in this vegetation community is *Psidium guajava*, *Schinus terebinthifolius, Catharanthus roseus, Solanum mauritianum, Lantana camara* and *Verbena bonariensis.*

No threatened medicinal plant species were observed.

Dominant species:

Trees: *Syzygium cordatum, Bridelia micrantha, Dichrostachys cinerea, Trichilia emetica*, *Hyphaene coriacea*

Herbs: *Asystasia gangetica, Helichrysum auriceps, Helichrysum nudifolium*
Graminoids: *Imperata cylindrica; Digitaria natalensis; Sporobolus africanus, Sporobolus pyramidalis; Dactyloctenium aegyptium*
Cyperoids: *Cyperus esculentes, Cyperus rotandus*
Climbers: *Smilax anceps*

Of the 71 species recorded within this vegetation community, five species, or 7% are regarded as important floristic elements of the Maputaland Wooded Grassland by Mucina & Rutherford (2006). This includes the trees *Hyphaene coriacea, Dichrostachys cinerea* and *Syzygium cordatum* (endemic), the shrub, *Helichrysum kraussii*; and the graminoid *Digitaria natalensis.*

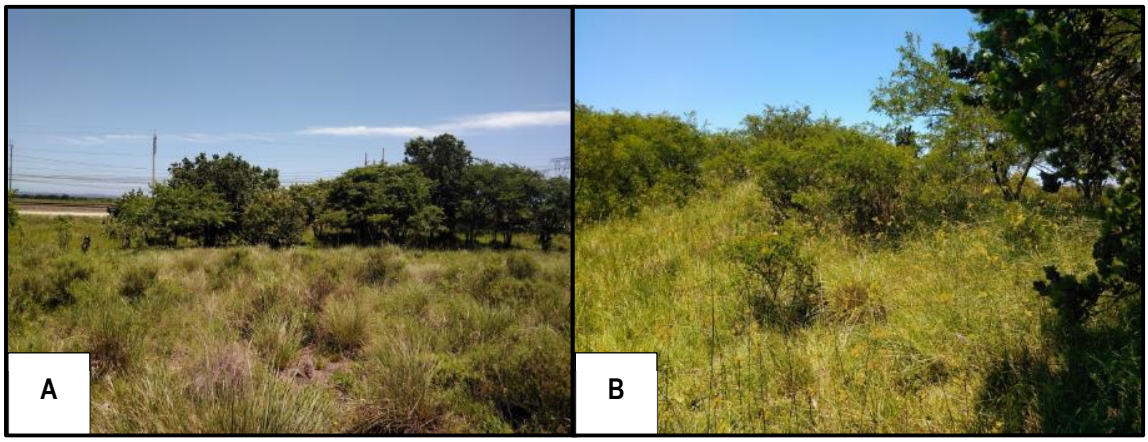

FIGURE 15: *Imperata cylindrica – Syzygium cordatum* wooded grassland. **A** – Tree stand dominated by *Trichilia emetica* and *Bridelia micrantha* **B** – *Dichrostacys cinerea* thicket.

2. *Helichrysum kraussii – Parinari capensis* shrubland (Figure 17)
This vegetation community is prominent central and north of the project site. Evidence of extensive tree harvesting is present. This area is completely dominated by the shrub species *Helichrysum kraussii*, with several *Parinari capensis* shrubs interspersed with *H. kraussii*, specifically on the western site boundary (Figure 16). With the exception of several *D. cinerea* thickets, few trees are present. Although both *H. kraussii* and *D. cinerea* naturally occur within the Maputaland Wooded Grassland vegetation type, their abundance on the project site is an indication of past disturbance. As a result, basal cover varied from relatively low to intermediate.

Invasive alien species that occur in this vegetation community is *Psidium guajava, Schinus terebinthifolius, Catharanthus roseus, Solanum mauritianum, Lantana camara* and *Verbena bonariensis*.

Dominant species:
Trees: *Dichrostachys cinerea; Hyphaene coriacea*
Shrubs: *Helichrysum kraussii*; *Parinari capensis*
Herbs: *Senecio pterophorus; Lobelia coronopifolia*
Geophytes: *Hypoxis hemerocallidae*
Graminoids: *Digitaria natalensis; Sporobolus africanus, Sporobolus pyramidalis*
Cyperoids: *Cyperus esculentes, Cyperus rotandus*
Climbers: *Smilax anceps*

Of the 65 species recorded within this community, seven species, or ~10 % are regarded as important floristic elements of the Maputaland Wooded Grassland by Mucina & Rutherford (2006). This includes the trees *H. coriacea, D. cinerea,*

S. cordatum, the geoxylic suffritex *Parinari capensis*, the shrub *H. kraussii,* the graminoid *D. natalensis*, and the cyperoid *Cyperus obtusifolius*.

No threatened medicinal plant species were observed.

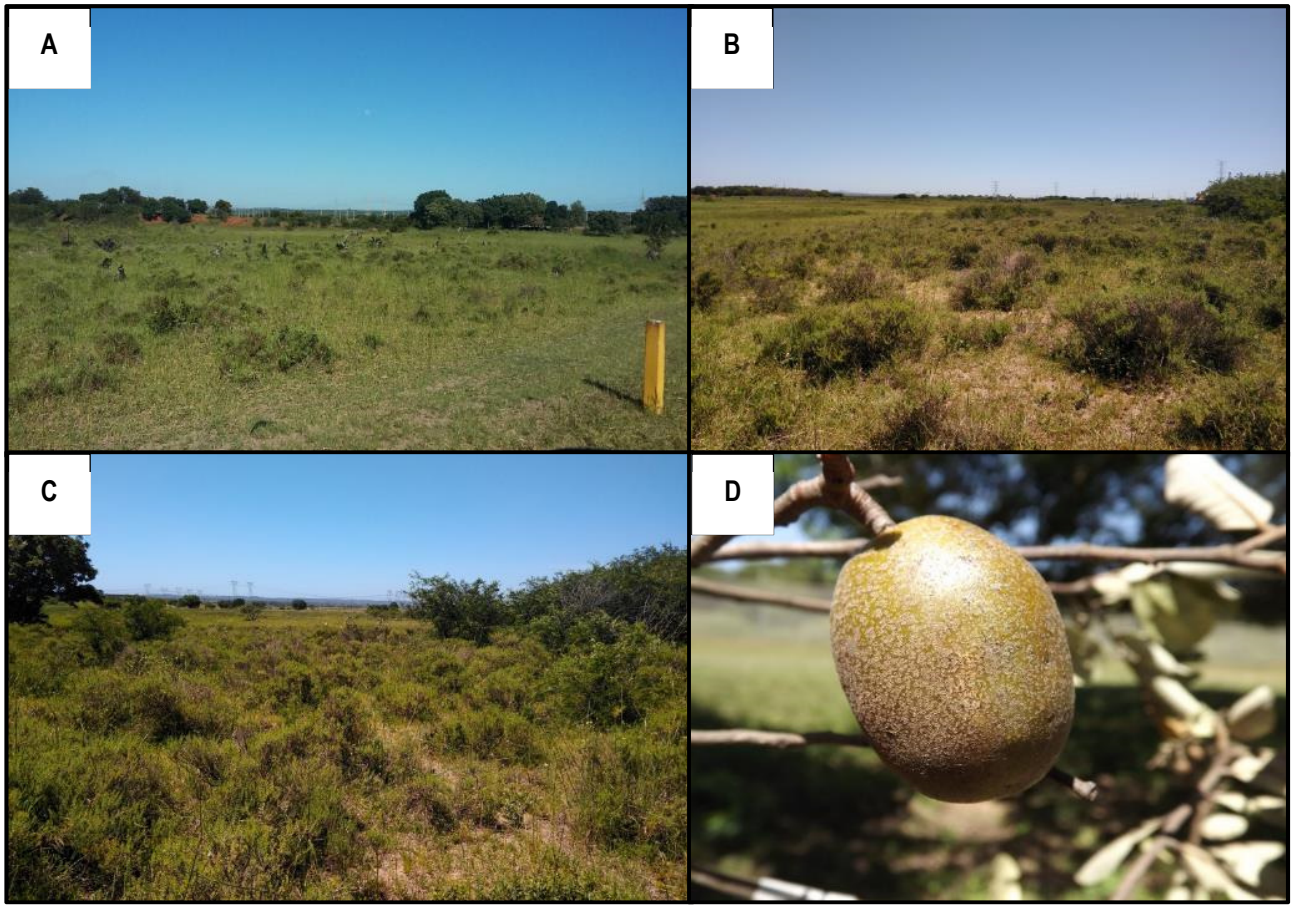

FIGURE 16: A - **C** Large areas on the project site is covered with the shrub *Helichrysum kraussii*. **D** - *Parinari capensis*.

3. Wetlands and wetland ecotones (Figure 18)
Vegetation communities on these areas were dominated by several cyperoid species and the swamp-fern *Cyclosorus interruptus. Typha capensis* (bulrushes) were only present at one wetland, outside of the project site. Alien and invasive species present in this community includes *Lantana camara, Psidium guajava* and *Schinus terebinthifolius.*

Dominant species:
Herbs/hydrophytes: *Cyclosorus interruptus*
Graminoids: *Chloris gayana, Dactyloctenium aegyptium*
Cyperoids: *Cyperus congestus, C. marginatus, C. dives, C. esculentus, C. natalensis, Pycreus polystachyos*

Of the 45 species recorded within this community, 13 species, or ~28 % are regarded as important floristic elements of the Subtropical Freshwater Wetlands by Mucina & Rutherford (2006). This includes the cyperoids, *Cyperus articulates, C. dives, C. papyrus, C. prolifer, Fuirena ciliaris, Pycreus polystachyos*; the hydrophytes *Nymphaea nouchali*, *Azolla pinnata* subsp. *africana* and *Typha capensis;* the herb/hydrophyte *Ludwigia octovalvis,* the geophyte *Eulophia angolensis*, and the graminoids *Imperata cylindrica* and *Phragmites mauritianus. C. dives* and *C. prolifer* is also regarded as biogeographically important species (Mucina & Rutherford, 2006).

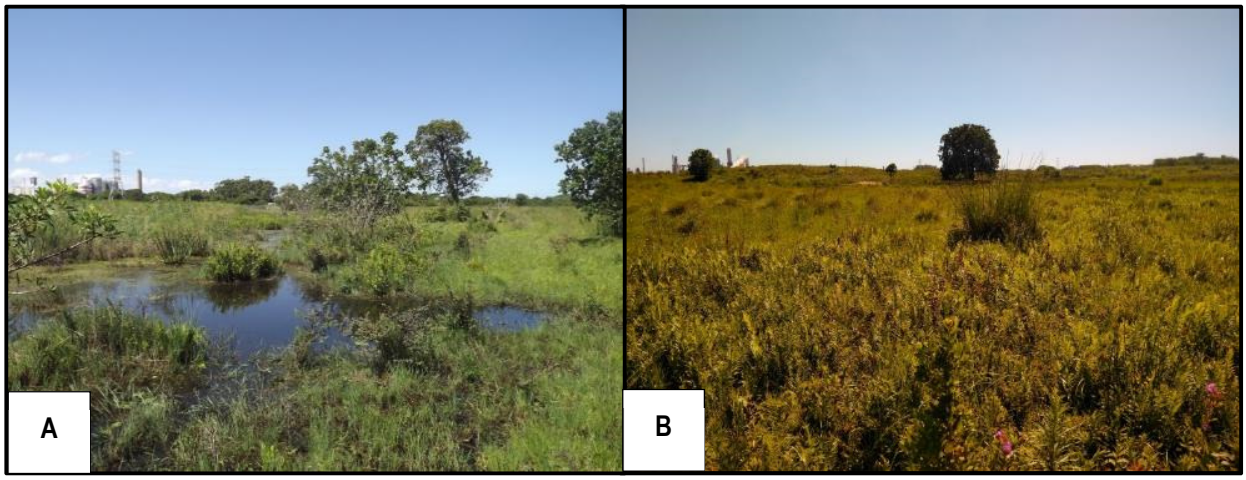

FIGURE 17: A – An example of a typical wetland found on the project site **B** - Wetland ecotone dominated by the fern *Cyclosorus interruptus*.

4. Low-lying hygrophilous grassland (Figure 19)
These low-lying areas are almost completely devoid of trees, covered with a tight, low sward with no structural diversity. These vegetation communities were dominated by several cyperoids and hygrophilous graminoids such as *Chloris gayana*, and *C. virgate* (Figure 19).

Of the 35 species recorded within this community, two, or ~ 5 % are regarded as important floristic elements of Maputaland Wooded Grassland by Mucina & Rutherford (2006). These include the tree *Hyphaene coriacea*, and the graminoid *Digitaria natalensis*.

Invasive alien species that occur in this vegetation community is *Catharanthus roseus* and *Lantana camara*. No medicinal plant species was observed.

Dominant species:
Graminoids: *Chloris gayana, C. virgate*
Cyperoids: *Cyperus esculentes*

FIGURE 18: Example of a Low-lying hygrophilous grassland vegetation community on the project site.

TABLE 7: List of plant species identified within each vegetation community on the project site.

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	IMPERATA CYLINDRICA – SYZYGIUM CORDATUM WOODED GRASSLAND	HELICHRYSUM KRAUSSII – PARINARI CAPENSIS SHRUBLAND	WETLANDS AND WETLAND ECOTONES	HYGROPHILOUS GRASSLAND	MWG ELEMENTS	SFW ELEMENTS
ACANTHACEAE	*Asystasia gangetica*	Asystasia	Herb	+	+	-	-		
ANACARDIACEAE	* *Schinus terebinthifolius*	Brazilian Pepper Tree	Tree	+	+	+	-		
	Sclerocarya birrea	Marula	Tree	-	Rare	-	-		
ANNONACEAE	*Annona senegalensis*	Custard Apple	Shrub/tree	-	+	-	-		
	* *Catharanthus roseus*	Periwinkle	Herb	+	+	-	+		
	Gomphocarpus physocarpus	Milkweed	Herb	+	-	-	-		
ARECACEAE	*Hyphaene coriacea*	Southern Lala Palm	Tree	+	+	-	-	x	x
	Phoenix reclinata	Wild Date Palm	Shrub/tree	+	+	-	+		x
ASPARAGACEAE	*Asparagus laricinus*	Cluster-leaved Asparagus	Shrub	Rare	-	-	-		
ASPHODELACEAE	*Trachyandra asperata*	Wilde Knoflok	Herb	+	+	-	-		
	Trachyandra saltii		Herb	+	+	-	+		
ASTERACEAE	*Brachylaena discolor*	Coastal Silver Oak	Shrub/tree	+	+	-	-		
	Chrysanthemoides monilifera	Eastern Coastal Bush-tick Berry	Shrub/succulent	+	-	-	-		
	Helichrysum auriceps		Herb	+	+	-	-		
	Helichrysum kraussii	Straw Everlasting	Shrub	+	+	-	-	x	
	Helichrysum nudifolium	Hottentot's Tea	Herb	+	+	-	+		
	Senecio pterophorus		Herb	+	+	-	+		
CAMPANULACEAE	*Wahlenbergia krebsii*	Fairy-Bell Flower	Herb	+	+	-	+		
CHRYSOBALANACEAE	*Parinari capensis*	Mobola Plum	Dwarf shrub	-	+	-	-	x	
CLUSIACEAE	*Garcinia livingstonei*	African Mangosteen	Tree	Rare	Rare	-	-		

COLCHICACEAE	*Gloriosa superba*	Flame Lily	Climber/geophyte	Rare	-	-	-		
COMMELINACEAE	*Commelina erecta*	Blue Commelina	Herb	+	+	+	+		
CYPERACEAE	*Bulbostylis hispidula* subsp. *pyriformis*	Slender Sedge	Cyperoid	-	-	+	+		
	Cyperus articulatus	Jointed Flatsedge	Cyperoid	-	-	+	-		x
	Cyperus congestus	Hedgehog Sedge	Cyperoid	+	-	+	+		
	Cyperus dives	Ikhwane	Cyperoid	-	-	+	-		x
	Cyperus esculentus	Yellow Nut Grass	Cyperoid	+	+	+	+		
	Cyperus marginatus	Matjiesgoed	Cyperoid	-	-	+	-		
	Cyperus natalensis		Cyperoid	-	-	+	+	x	
	Cyperus papyrus	Papyrus	Cyperoid	-	-	+	-		x
	Cyperus prolifer	Dwarf Papyrus	Cyperoid	-	-	+	-		x
	Cyperus rotundus	Purple Nut Sedge	Cyperoid	+	+	+	+		
	Cyperus sphaerospermus		Cyperoid	+	+	+	+		
	Cyperus obtusitolius		Cyperoid	-	+	+	+	x	
	Eleocharis acutangula		Cyperoid	-	-	+	-		
	Eleocharis limosa		Cyperoid	+	-	+	-		
	Fuirena ciliaris		Cyperoid	-	-	+	+		x
	Kyllinga alba	White Button Sedge	Cyperoid	-	-	-	+		
	Pycreus polystachyos	Sedge	Cyperoid	-	+	+	+		x
	Rhynchospora corymbosa	Saw Grass	Cyperoid	+	-	+	-		
	Schoenoplectus brachyceras		Cyperoid	-	-	+	-		
FABACEAE	*Argyrolobium harveyanum*		Dwarf shrub/herb	+	+	-	-		
	Crotalaria lanceolata	Thin-leaved Rattle Bush	Herb	+	+	-	-		
	Desmodium dregeanum	Marsh Desmodium	Herb	+	+	-	-		x
	Desmodium incanum	Sweethearts	Herb	+	+	-	-		
	Dichrostachys cinerea	Sickle Bush	Shrub/tree	+	+	-	-	x	

	Eriosema salignum	Narrow Leaved Eriosema	Herb	+	+	-	-		
	Erythrina lysistemon	Coral Tree	Tree	Rare	-	-	-		
	Indigofera hilaris	Red Indigo Bush	Herb	+	+	-	-		
	Stylosanthes fruticosa	Wild Lucern	Dwarf shrub/herb	+	+	-	-		
	Vachellia karroo	Sweet Thorn	Tree	-	+	-	-		
	Vigna unguiculata	Wild Cow Pea	Herb	+	+	+	-		
HYPOXIDACEAE	*Hypoxis iridifolia*	Star-Flower	Geophyte	+	+	-	-		
JUNCACEAE	*Juncus lomatophyllus*		Cyperoid	-	-	+	+		
LOBELIACEAE	*Lobelia coronopifolia*	Wild Lobelia	Dwarf shrub/herb	+	+	-	+		
	Monopsis sp.		Herb	+	+	-	+		
LOGANIACEAE	*Strychnos madagascariensis*	Black Monkey Orange	Shrub/tree	+	+	-	-		
MALVACEAE	*Hibiscus aethiopicus*	Common Dwarf Wild Hibiscus	Herb	+	+	-	+		
MELASTOMATACEAE	*Dissotis canescens*	Pink Marsh Dissotis	Shrub/herb	-	-	+	-		
	Dissotis princeps	Purple Wild Tibouchina	Shrub/herb	-	-	+	+		
MELIACEAE	*Trichilia emetica*	Natal Mahogony	Tree	+	+	-	-		
MENYANTHACEAE	*Nymphoides thunbergiana*	Small Yellow Waterlily	Hydrophyte	-	-	Rare	-		
MORACEAE	*Ficus trichopoda*	Swamp Fig	Shrub/tree	+	-	+	+		
MYRTACEAE	* *Psidium guajava*	Guava	Tree	+	+	+	-		
	Syzygium cordatum	Umdoni Waterberry	Shrub/tree	+	+	+	+	x	
NYMPHAEACEAE	*Nymphaea nouchali*	Blue Waterlily	Epihydate/herb /hydrophyte	-	-	+	-		x
ONAGRACEAE	*Ludwigia octovalvis*	Shrubby Ludwigia	Herb/hydrophyte	+	+	+	+		x
ORCHIDACEAE	*Eulophia angolensis*	Vlei Orchid	Geophyte/herb	-	-	Rare	-		x
OROBANCHACEAE	*Alectra sessiliflora*	Verfblommetjie	Herb/parasite	-	-	+	-		
PHYLLANTHACEAE	*Bridelia micrantha*	Mitzeeri	Shrub/tree	+	-	-	-		

POACEAE	*Chloris gayana*	Rhodes Grass	Graminoid	+	+	+	+		
	Chloris virgata	Feather-top Chloris	Graminoid	+	+	-	+		x
	Dactyloctenium aegyptium	Common Crowfoot	Graminoid	+	+	-	+		x
	Dactyloctenium australe	LM Grass	Graminoid	+	+	+	+		
	Digitaria natalensis	Coast Finger Grass	Graminoid	+	+	-	+	x	x
	Eragrostis capensis	Heart-Seed Love Grass	Graminoid	+	+	-	-		
	Eustachys paspaloides	Red Rhodes Grass	Graminoid	+	+	-	-		
	Imperata cylindrica	Cotton-Wool Grass	Graminoid	+	+	+	+		x
	Melinis repens	Natal Red Top	Graminoid	+	+	-	-		
	Paspalum distichum	Couch Paspalum	Graminoid	-	-	+	+		
	Paspalum dilatatum	Dallis Grass	Graminoid	+	+	+	+		
	Perotis patens	Purple Spike Grass	Graminoid	+	+	-	-		
	Phragmites mauritianus	Lowveld Reed	Graminoid	-	-	+	-		x
	Pogonarthria squarrosa	Herringbone Grass	Graminoid	+	+	-	-		
	Sporobolus africanus	Ratstail Dropseed	Graminoid	+	+	-	-		
	Sporobolus pyramidalis	Cat's Tail Dropseed	Graminoid	+	+	-	-		
POLYGONACEAE	*Oxygonum dregeanum*	Starstalk	Herb	+	+	-	-		
	Persicaria laphatifolia	Pale Persicaria	Herb	-	-	+	-		
PTERIDACEAE	*Cheilanthes viridis*		Geophyte/herb	+	+	-	-		
	Psychotria capensis	Bird-Berry	Shrub/tree	Rare	-	-	-		
	Vangueria infausta	Velvet Wild Medlar	Tree	-	+	-	-		
RUBIACEAE	*Richardia brasiliensis*	Mexican richardia	Herb	+	+	+	+		
RUSCACEAE	*Sansevieria hyacinthoides*	Mother-in-law's-Tongue	Geophyte/succulent	Rare	-	-	-		
SALVINIACEAE	*Azolla pinnata* subsp. *africana*	Mosquito Fern	Herb/hydrophyte	-	-	+	-		x

SMILACACEAE	*Smilax anceps*	Leg-ripper	Climber	+	+	+	-	
SOLANACEAE	* *Solanum mauritianum*	Bugweed	Shrub/tree	+	+	-	-	
THELYPTERIDACEAE	*Cyclosorus interruptus*		Herb/hydrophyte	+	-	+	+	
TYPHACEAE	*Typha capensis*	Common Bulrush	Herb,hydrophyte, hyperhydate	-	-	Rare	-	x
VERBENACEAE	* *Lantana camara*	Lantana	Shrub	+	+	+	+	
	Verbena aristigera	Fine-leaved Verbena	Herb	+	+	-	-	
	* *Verbena bonariensis*	Tall Verbena	Herb	+	+	-	-	

* Alien & Invasive species
Rare = Recorded only once
** MWG Elements = Important species of the Maputaland Wooded Grassland vegetation type
*** SFW Elements = Important species of the Subtropical Freshwater Wetlands vegetation type

9.2.2 Flora Species of Conservation Concern

Several SCC plant species are present within all vegetation communities (Tables 7& 8). The distribution of SCC tree species confirmed to be present on the project site is represented in Figure 20. Georeferenced localities are provided in Appendix 6.

TABLE 8: List of SCC plant species identified on the project site.

					CONSERVATION STATUS			
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**	**GROWTH FORM**	**ECOLOGICAL STATUS**	**SA RED LIST CATEGORY (2009)**	**NEMBA (2015)**	**KZNEBPA (2014)**	**KZNCMA (1999)**
ANACARDIACEAE	** Sclerocarya birrea*	Marula	Tree		LC		PROTECTED	
ARECACEAE	*Hyphaene coriacea*	Southern Lala Palm	Tree	SA endemic			PROTECTED	
ASPARAGACEAE	*Asparagus laricinus*		Shrub/tree		LC		PROTECTED – All ASPARAGACEAE	
ASPHODELACEAE	*Trachyandra asperata*		Geophyte/ succulent		LC		PROTECTED – All ASPHODELACEAE	
	Trachyandra saltii		Geophyte/ succulent		LC			
ASTERACEAE	*Helichrysum auriceps*		Herb	SA endemic	LC			
LOBELIACEAE	*Lobelia coronopifolia*	Wild Lobelia	Dwarf shrub/herb	SA endemic	LC			
MELIACEAE	*Trichilia emetica*	Natal Mahogony	Tree		LC		PROTECTED	
MORACEAE	** Ficus trichopoda*	Swamp Fig	Shrub/tree		LC		PROTECTED	PROTECTED
NYMPHAEACEAE	*Nymphaea nouchali*	Blue Waterlily	Epihydate/ herb/hydrophyte		LC		PROTECTED	
ORCHIDACEAE	*Eulophia angolensis*		Herb	SA endemic	LC		All ORCHIDACEAE	

* Protected under The National Forest Act (No. 84 of 1998)

- **Provincially Protected Species**

KZNEBPA (2014)

- *Sclerocarya birrea*
- *Hyphaene coriacea*
- *Trichilia emetica*
- *Ficus trichopoda*
- All species from the Family ASPARAGACEAE
- All species from the Family ASPHODELACEAE
- All species from the Family ORCHIDACEAE

Permit authorisation will be required from eKZNw to remove or re-locate these species.

KZNCMA (1999)

- *Ficus trichopoda*

Permit authorisation will be required from eKZNw to remove/destroy or re-locate this species.

Species Protected by the National Forest Act (No. 84 of 1998)

- *Sclerocarya birrea*
- *Ficus trichopoda*

Permit authorisation from DAFF will be required to damage or destroy these species.

Endemic Species:

Endemic plant species are regarded as important focal taxa to establish critical habitat for conservation priority. Four species endemic to South Africa were recorded on the project site and is listed below:

- *Hyphaene coriacea*
- *Helichrysum auriceps*
- *Lobelia coronopifolia*
- *Eulophia angolensis*

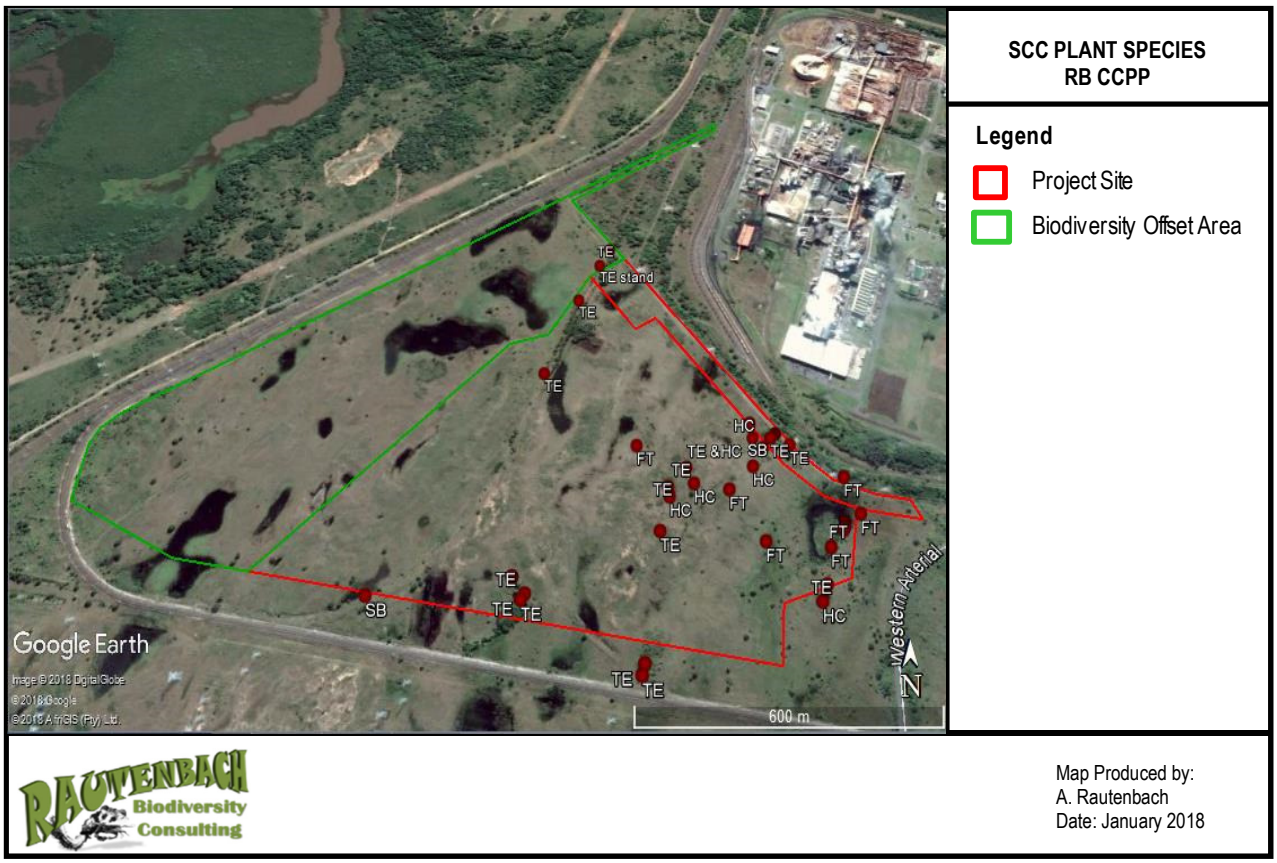

FIGURE 19: The distribution of SCC plant species on the project site.

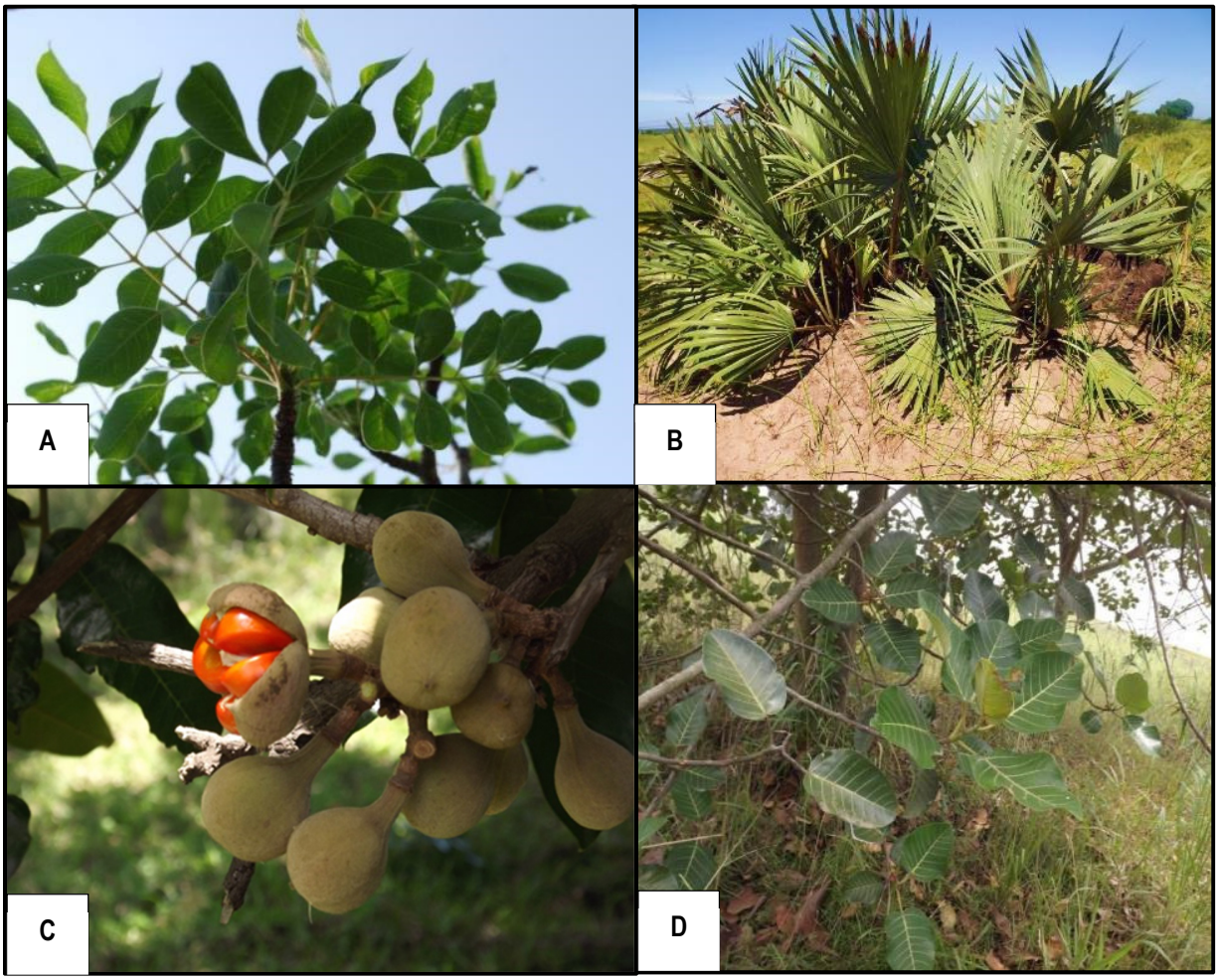

FIGURE 20: Images of some of the SCC plants on the project site. **A** – *Sclerocarya birrea* **B** – *Hyphaene coriacea* **C** – *Trichilia emetica* seeds **D** – *Ficus trichopoda* leaves.

Potential occurrences include the following SCC species (Medium – High probability of occurrence). Species specific information is provided in Table 9.

- *Crinum macowanii* Baker
- *Crinum moorei* Hook.f.
- *Crinum stuhlmannii* Baker (Synonym - *C. delagoense*)
- *Cyrtanthus contractus* N.E.Br.
- *Boophone disticha*
- *Scadoxus membranaceus* (Baker) Friis & Nordal
- *Brachystelma sandersonii* (Oliv.) N.E.Br.
- *Asparagus falcatus* L.
- *Asparagus densiflorus* (Kunth) Jessop
- *Aloe ecklonis* Salm-Dyck
- *Kniphofia laxiflora* Kunth
- *Kniphofia leucocephala* Baijnath
- *Kniphofia littoralis* Codd
- *Trachyandra asperata* Kunth var. *asperata*

- *Trachyandra saltii* (Baker) Oberm. var. *saltii*
- *Senecio ngoyanus* Hilliard
- *Senecio erubescens* Aiton var. *erubescens*
- *Monsonia praemorsa* E.Mey. ex R.Knuth
- *Ledebouria ovatifolia*
- *Hypoxis hemerocallidae*
- *Ekebergia capensis* Sparrm.
- *Eulophia speciosa* (R.Br. ex Lindl.) Bolus

For development implications with regards to areas where Red Listed flora species is present refer to Appendix 1.

TABLE 9: A list of SCC plant species known to occur within the QDGS 2831DD.

FAMILY NAME	SCIENTIFIC NAME	GROWTH FORM	PREFERRED HABITAT	CONSERVATION STATUS				
				SA RED LIST CATEGORY (2009)	NEMBA (2015)	KZNEBPA (2014)	KZNCMA (1999)	PROBABILITY OF OCCURRENCE
AMARANTHACEAE	*Crinum macowanii* Baker	Geophyte	Terrestrial. Albany thicket, Grassland, Indian Ocean Coastal Belt in grassland, rocky areas, near rivers. Flowering time Oct – Feb.	Declining		Sched 8	PROT	MEDIUM
	* *Crinum moorei* Hook.f.	Geophyte	Coastal and riverine forest, scarp forest, in damp or marshy places along watercourses, never in grassland in Scarp Forest, Southern Mistbelt Forest, Eastern Valley Bushveld. Flowering time Sept – Jan.	VU	VU	Sched 7	PROT	MEDIUM
	Crinum stuhlmannii Baker (Synonym - *C. delagoense*)	Geophyte	Scattered in grassland, bushveld and on sandy soils at low altitudes; in deep sand in African bushveld.	Declining		Sched 8	PROT	HIGH
AMARYLLIDACEAE	*Cyrtanthus contractus* N.E.Br.	Geophyte	In grasslands from E Cape to N Province. Flowering time Aug – Oct.	LC		Sched 8		HIGH
	Boophone disticha	Geophyte	Dry grassland/rocky areas. Flowering Jul-Oct.	Declining		Sched 8	PROT	MEDIUM
	* *Scadoxus membranaceus* (Baker) Friis & Nordal	Geophyte	In shade of low-lying coastal forest. Flowering time Dec – Apr.	LC			PROT	HIGH
	*Scadoxus multiflorus (*Martyn) Raf. Subsp. *katharinae* (Baker) Friis & Nordal	Geophyte	Coastal and swamp forest. Flowering time Jan – Mar.	LC			PROT	LOW
ANACARDIACEAE	*Protorhus longifolia* (Bernh.) Engl.	Tree	In coastal and montane forest, on rocky outcrops and in riverine vegetation, from Limpopo Province to the Eastern Cape.	LC		Sched 8		LOW
APIACEAE	* *Alepidea peduncularis* A.Rich.	Herb	Terrestrial. Montane, often burnt grassland and montane forests, *Brachystegia* woodland and on rocky hills, at altitudes from 1 000 – 3 800 m. Flowering from Nov – unknown.	DDT				LOW
APOCYNACEAE	* *Brachystelma sandersonii* (Oliv.) N.E.Br.	Herb, succulent	Pondoland-Ugu Sandstone Coastal Sourveld, KwaZulu-Natal Coastal Belt Grassland, KwaZulu-Natal Sandstone Sourveld, Zululand Lowveld, Coastal grassland, 10-200 m. Flowering from Nov – unknown.	VU		Sched 7	PROT	MEDIUM
AQUIFOLIACEAE	*Ilex mitis* (L.) Radlk. Var. *mitis*	Shrub, tree	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to	Declining		Sched 8		LOW

FAMILY NAME	SCIENTIFIC NAME	GROWTH FORM	PREFERRED HABITAT	CONSERVATION STATUS				PROBABILITY OF OCCURRENCE
				SA RED LIST CATEGORY (2009)	NEMBA (2015)	KZNEBPA (2014)	KZNCMA (1999)	
			inland mountain slopes, in Forest, Fynbos, Grassland, Indian Ocean Coastal Belt, Savanna.					
ASPARAGACEAE	*Asparagus falcatus* L.	Climber	Terrestrial	LC		Sched 8		HIGH
	Asparagus densiflorus (Kunth) Jessop	Dwarf shrub	Terrestrial	LC		Sched 8		MEDIUM
ASPHODELACEAE	*Aloe ecklonis* Salm-Dyck	Herb, succulent	Generally in heavy clay soils in grassland. Occurs in moist as well as well-drained sites, and from near sea level to very high altitudes. Often found in severely degraded and disturbed species-poor grasslands as well as in areas under heavy alien infestation. Flowering time Nov – Jan.	LC			PROT	HIGH
	Aloe marlothii A.Berger subsp. *orientalis* Glen & D.S.Hardy	Shrub, succulent	Low altitudes, including dunes near the coast, and also prefer sandy rather than rocky soils.	LC			PROT	LOW
	* *Kniphofia laxiflora* Kunth	Herb	In moist grassland, coast to mountains, up to 2 450 m. Flowering time Nov – May.	LC			PROT	HIGH
	* *Kniphofia leucocephala* Baijnath	Herb	Wetlands in low lying coastal grassland in moist, black, sandy clay soil. Flowering time Sept – Dec.	CR		Sched 8		MEDIUM
	* *Kniphofia littoralis* Codd	Herb	Coastal grassland. Moist depressions, not usually in permanently waterlogged soils, 5-200 m in the Indian Ocean Coastal Belt. Flowering time Aug – Oct.	NT		Sched 8	PROT	MEDIUM
	Trachyandra asperata Kunth var. *asperata*	Geophyte, succulent	Terrestrial. In grassland. Flowering time Sept – Mar.	LC		Sched 8		MEDIUM
	Trachyandra saltii (Baker) Oberm. var. *saltii*	Geophyte, succulent	Terrestrial. Widespread in grasslands. Flowering time Aug – Mar.	LC		Sched 8		MEDIUM
ASTERACEAE	* *Nidorella tongensis* Hilliard	Herb, succulent	Damp places among dunes overlooking the sea in Subtropical Dune Thicket, Maputaland Coastal Belt.	EN				LOW
	Senecio ngoyanus Hilliard	Herb	Coastal grassland, marshy depressions, sometimes on granite domes in Maputaland Coastal Belt, KwaZulu-Natal Coastal Belt Grassland, Maputaland Wooded Grassland.	VU		Sched 7		HIGH

FAMILY NAME	SCIENTIFIC NAME	GROWTH FORM	PREFERRED HABITAT	CONSERVATION STATUS				PROBABILITY OF OCCURRENCE
				SA RED LIST CATEGORY (2009)	NEMBA (2015)	KZNEBPA (2014)	KZNCMA (1999)	
	Senecio erubescens Aiton var. *erubescens*	Herb	Seasonally wet grassland and marshes. Flowering Sept – Jan.			Sched 8		HIGH
BURSERACEAE	*Commiphora woodii* Engl.	Tree	Coastal and mistbelt forest, often in rocky places.	LC		Sched 8		LOW
CELASTRACEAE	*Elaeodendron croceum* (Thunb.) DC.	Tree	Margins of coastal and montane forests.	LC		Sched 8		LOW
GERANIACEAE	* *Monsonia praemorsa* E.Mey. ex R.Knuth	Herb	In coastal grassland up to 300 m. Flowering Jul – Nov.	LC		Sched 8		HIGH
HYACINTHACEAE	* *Ledebouria ovatifolia*	Geophyte	Widespread in grassland/woodland. Flowering Aug-Nov.				PROT	HIGH
HYPOXIDACEAE	*Hypoxis hemerocallidae*	Geophyte	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Flowering Aug-Apr.	Declining		Sched 8		HIGH
LECYTHIDACEAE	***Barringtonia racemosa* (L.) Roxb.	Tree	Streamsides, freshwater swamps and less saline areas of coastal mangrove swamps.	LC		Sched 8	PROT	LOW
MELIACEAE	*Ekebergia capensis* Sparrm.	Tree	Terrestrial	LC		Sched 8		HIGH
ORCHIDACEAE	*Eulophia speciosa* (R.Br. ex Lindl.) Bolus	Geophyte	Grasslands, coastal bush, woodland. Flowering Aug-Jan.	Declining		Sched 8	PROT	HIGH

* SA Endemic
** Protected under the National Forest Act

9.2.3 Alien and Invasive Plant Species

Invasive alien plants (IAPs) are widely considered as a major threat to biodiversity, human livelihoods and economic development. On 1 August 2014, the Minister of Environmental Affairs published the Alien and Invasive Species Regulations which came into effect on the 1st of October 2014 in a bid to curb the negative effects of IAPs and other alien invasive species. An updated set of Invasive Species Lists (as per the NEMBA Regulations) was published on 29 July 2016.

The Regulations call on land owners and sellers of land alike to assist the Department of Environmental Affairs to conserve our indigenous fauna and flora and to foster sustainable use of our land. Non-adherence to the Regulations by a land owner or seller of land can result in a criminal offence punishable by a fine of up to R5 million (R10 million in the case of a second offence) and/or a period of imprisonment of up to 10 years.

IAPs are classified into four different categories and are described below:

1. Category 1a Listed Invasive Species

- Category 1a Listed Invasive Species are those species listed as such by notice in terms of Section 70(1) (a) of the Act as species which must be combatted or eradicated.
- A person in control of a Category 1a Listed Invasive Species must –
    - comply with the provisions of Section 73(2) of the Act;
    - immediately take steps to combat or eradicate listed invasive species in compliance with Sections 75(1), (2) and (3) of the Act; and
    - allow an authorised official from the Department to enter onto land to monitor, assist with or implement the combatting or eradication of the listed invasive species.
- If an Invasive Species Management Programme has been developed in terms of Section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

2. Category 1b Listed Invasive Species

- Category 1b Listed Invasive Species are those species listed as such by notice in terms of Section 70(1)(a) of the Act as species which must be controlled.
- A person in control of a Category 1b Listed Invasive Species must control the listed invasive species in compliance with Sections 75(1), (2) and (3) of the Act.
- If an Invasive Species Management Programme has been developed in terms of Section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.
- A person contemplated in sub-regulation (2) must allow an authorised official from the Department to enter onto the land to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in Section 75(4) of the Act.

3. Category 2 Listed Invasive Species

- Category 2 Listed Invasive Species are those species listed by notice in terms of Section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be.
- Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 listed Invasive Species without a permit.
- A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.

- If an Invasive Species Management Programme has been developed in terms of Section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.
- Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3.
- Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.

4. Category 3 Listed Invasive Species

- Category 3 Listed Invasive Species are species that are listed by notice in terms of Section70(1)(a) of the Act, as species which are subject to exemptions in terms of Section 71(3) and prohibitions in terms of Section 71A of Act, as specified in the Notice.
- Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3.
- If an Invasive Species Management Programme has been developed in terms of Section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

The *Imperata-cylyndrica-Syzygium cordatum* wooded grassland vegetation community located on the western portion of the biodiversity offset area is heavily infested by *Lantana camara* and *Psidium guajava* (Figure 22).

IAPs are also present in all the vegetation communities on the project site, albeit at low densities. IAPs identified on the project site and biodiversity offset area is listed in Table 10.

TABLE 10: IAPS identified on the project site and biodiversity offset area.

FAMILY	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	IAP CATEGORY
ANACARDIACEAE	*Schinus terebinthifolius*	Brazilian Pepper Tree	Tree	1b
	Catharanthus roseus	Periwinkle	Herb	1b
MYRTACEAE	*Psidium guajava*	Guava	Tree	1b
SOLANACEAE	*Solanum mauritianum*	Bugweed	Shrub/tree	1b
VERBENACEAE	*Lantana camara*	Lantana	Shrub	1b
	Verbena bonariensis	Tall Verbena	Herb	1b

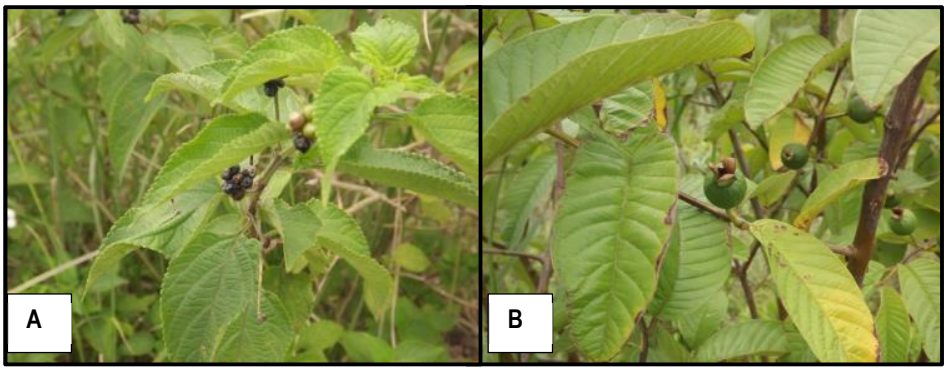

FIGURE 21: Examples of IAPs on the project site. **A** - *Lantana camara* **B** - *Psidium guajava*.

9.3 MAMMAL ASSESSMENT

9.3.1 Mammal Habitat Assessment

Global mammal distributions correlate well with biomes as defined by Acocks (1953), Low & Rebelo (1998), Knobel & Bredenkamp (2005) as well as Mucina & Rutherford (2006). However, the local occurrences of mammals are more closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland/aquatic-associated vegetation cover rather than fine-scale vegetation mapping.

The project site offers three major mammal habitats, i.e. terrestrial, arboreal and wetland/aquatic. These areas may offer refuge to a number of the smaller and more reticent mammal species.

Terrestrial habitat is by far the biggest and may provide habitat to a number of species such as rodents, shrews and mongooses. Arboreal habitat is represented by a few scattered trees and tree copses. Species such as bats may utilise these habitats.

Wetland/aquatic habitat is presented by a few scattered surface water bodies (Figure 13). Although these areas are entirely isolated, which has zoogeographical repercussions; it may still provide habitat and refuge to some of the small mammal species such as shrews. No rupiculous habitat and no caves are present on, or in the vicinity of the project site.

Connectivity with adjacent habitats is severely impaired by industrial developments, the Western Arterial highway on the east, and a railway line with associated service road to the north, south and west of the project site. As a result of urban sprawl, hunting and poaching pressure, none of the larger mammal species are expected to be present on the project site, or in the proximity of the project site.

9.3.2 Expected and Observed Mammal Species Richness

A total of 48 mammal species potentially occur within the area (Appendix 2). It should be noted that potential occurrence is interpreted as to be possible over a period of time as a result of environmentally induced expansion and contractions of population densities and ranges which simulates migration.

Of the 48 mammal species that could potentially occur in the area, the presence of six species was confirmed (Table 11; Figure 23). With the exception of *Crocidura mariquensis*, all the species listed in Table 11 are common and widespread, all with wide habitat tolerances. Reasons for their survival success lie predominantly in their remarkable reproductive success and wide habitat tolerance (viz. *Mastomys natalensis, Mus minutoides*). The mongooses are reticent in habit and manage to persist as long as prey densities remain above nutritional requirements.

- **Threatened Species**

Crocidura mariquensis (Swamp Musk Shrew) **NT**
A single specimen has been collected from Trap line 3 (TR L3; Table 11). *C. mariquensis* is listed as 'NT 'on the most recent Red List of Mammal Species (2016), and is protected within KwaZulu-Natal Province (KZNEBPA 2014, Schedule 3). This species is widely distributed in South Africa and occurs in many protected areas. However, they are restricted to wetlands and waterlogged areas and therefore have a patchy area of occupancy. As a result of urban and rural expansions, overgrazing and water abstractions, these areas have been severely reduced and fragmented; leading to continuous population declines (Taylor *et al*., 2016).

The rest of the species of the expected resident diversity (Appendix 2) are common and widespread, all with wide habitat tolerances.

Several of the bat species listed, for example the Little free-tailed bat, Angola free-tailed bat, Egyptian free-tailed bat, Egyptian slit-faced bat, Cape serotine, Banana bat and Dusky pipistrelle, shows remarkable adaptivity by expanding their distribution ranges and population numbers significantly by capitalising on the roosting and feeding opportunities offered by manmade structures (Schoeman & Waddington, 2011; Schoeman, 2016).

Mongooses and genets are reticent in habits and manage to persist as long as prey densities remain above the nutritional requirements (Skinner & Chimimba, 2005).

TABLE 11: A list of mammal species observed during the field survey.

COMMON NAME	SCIENTIFIC NAME	OBSERVATION INDICATOR	HABITAT
Marsh Mongoose	*Atelerix paludinosus*	Tracks	Wetlands/Biodiversity Offset Area
Slender Mongoose	*Galerella sanguinea*	Sighting	Grassveld/road
Shrub Hare	*Lepus saxatillis*	Sighting/Nocturnal survey	Shrub
Pygmy Mouse	*Mus minutoides*	TS 2	Wetlland
Natal Multimammate Mouse	*Mastomys natalensis*	TR L 2	Grassland
Swamp Musk Shrew	*Crocidura mariquensis*	TR L 3	Grassland close to wetland

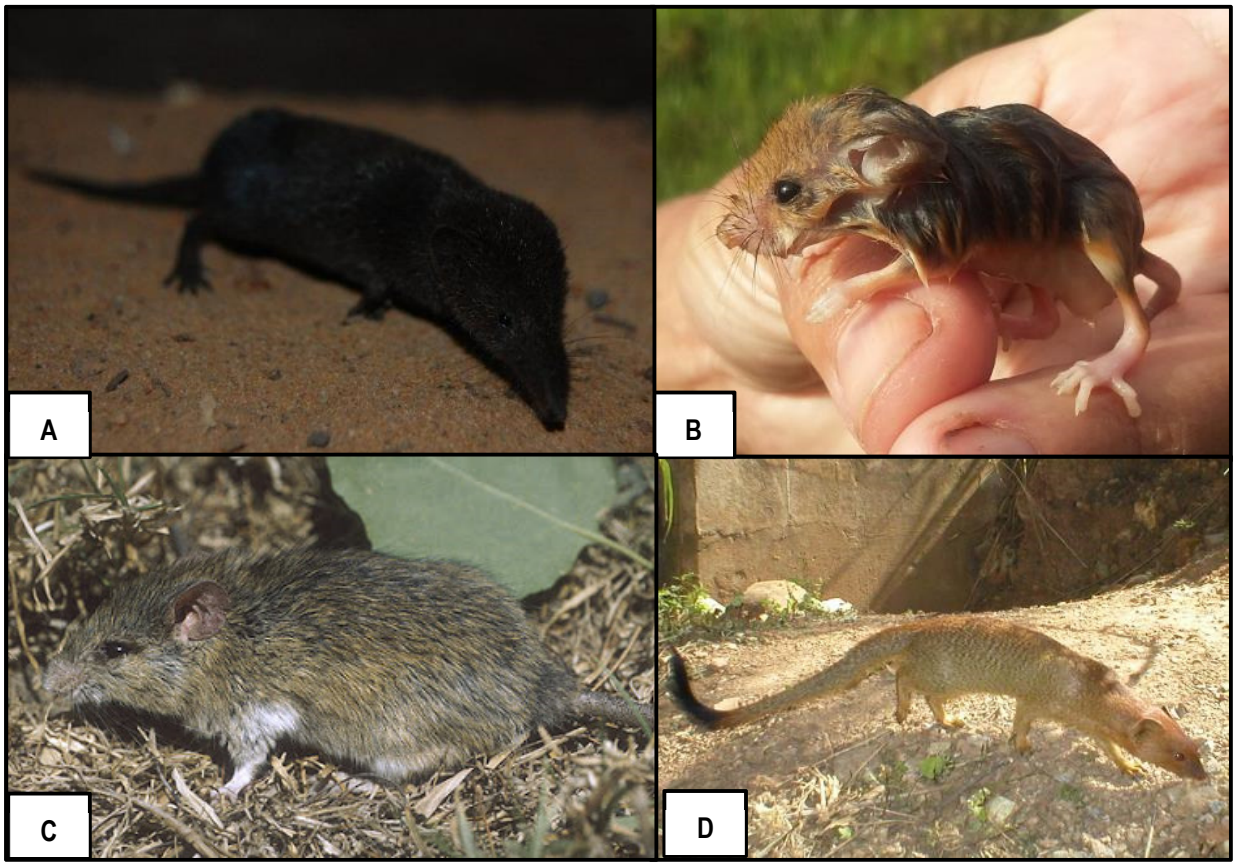

FIGURE 22: Some of the mammal species observed on the project site. **A** - *Crocidura mariquensis* **B** - *Mus minutoides* **C** - *Mastomys natalensis* **D** – *Galerella sanguinea.*

9.3.3 Mammal Species of Conservation Concern

SCC mammal species that may potentially be present on the project site is listed in Table 12.

- **Threatened species**

Scotoecus albofuscus has been sparsely recorded from the eastern parts of the region and is known from only a few scattered localities in South Africa. It appears to be associated with low-lying, humid savannas of the coastal plains of Mozambique and KwaZulu-Natal, especially where rivers and wetlands occur (Monadjem *et al.*, 2010).

The project site offers roosting opportunities such as hollow trees and dense foliage, for example *Hyphaene coriacea.* Therefore, its presence on the project site should be considered.

- **Provincially Protected Species**

Although ***Nycteris hispida*** does not appear on the most recent National Red list (2016), they are protected under Schedule 3 of the KZN-EPBA (2014). Prohibited activities include hunting and killing by fumigation; with restricted activities including the damage of communal or colonial breeding or roosting sites; possession, breeding, selling, making available for sale or otherwise trade in, buying, receiving, giving, donating or accepting as a gift, or in any way acquire or dispose of, capture, collect, immobilise, kill, translocate, release, display, export, import or keeping in captivity.

- **Sensitive Species**

Chlorocebus pygerythrus are listed as of 'Least Concern', but they appear under Appendix II of CITES and are protected within KwaZulu-Natal Province (KZNEBPA 2014, Schedule 3). Appendix II lists species that are not necessarily now threatened with extinction but may become so unless trade is closely controlled.

Although the project site does not have ideal habitat conditions for Vervet monkeys (i.e. sufficient tree cover), a small, and well vegetated area within the Mondi Richards Bay premises, bordering the project site to the east, offers ideal habitat, although the area is quite small. Adaptive traits such as behavioural plasticity enable vervet monkeys to persist in apparently unsuitable environments, even at small spatial scales (Healy & Nijman, 2014). Thus, the presence of Vervet monkeys, at least as occasional visitors should be considered.

No other SCC mammal species listed in Appendix 2 are expected to be present since the site is too isolated, or does not offer suitable habitat.

TABLE 12: SCC mammal species deduced to occupy the project site, or expected to be occasional visitors.

COMMON NAME	SCIENTIFIC NAME	PREFERRED HABITAT	NATIONAL RED LIST CATEGORY (2016)	CONSERVATION STATUS NEMBA (2015)	CONSERVATION STATUS KZNEBPA (2014)	CONSERVATION STATUS KZNCMA (1999)	PROBABILITY OF OCCURRENCE
Hairy Slit-Faced Bat	*Nycteris hispida*	Savanna, woodland, forest.	LC		Sched 3		MEDIUM
Thomas's House Bat	*Scotoecus albofuscus*	Low lying humid Savanna with large rivers/wetlands.	NT		Sched 3	PROT	MEDIUM
*** Vervet Monkey**	*Chlorocebus pygerythrus*	Coastal forest, suburban areas.	LC		Sched 3		HIGH

***** Listed on Appendix II of CITES

9.4 HERPETOFAUNA ASSESSMENT

9.4.1 Herpetofauna Habitat Assessment

The local occurrence of reptiles is closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and fossorial (underground), rather than fine scale vegetation types. It is

therefore possible to deduce the presence or absence of herpetofauna species by evaluating the habitat types within the context of global distribution ranges.

Suitable reptile microhabitats on the project site include scrub, rotting logs, leaf litter at the base of trees/vegetation, grassy clumps and trees. No rocky outcrops are present on the project site.

For frogs, suitable environmental conditions, especially breeding sites, are critically important and most species tend to be located in very specific microhabitats such as pools, ponds, streams, marshlands, rocky outcrops and open grassveld (du Preez & Carruthers, 2009). Frog habitats on the project site include grassveld, trees and wetlands/marshlands.

9.4.2 Expected and Observed Herpetofauna Species Richness

A total of 48 reptile and 38 frog species potentially occur within the area (Appendix 3). It should be noted that potential occurrence is interpreted as to be possible over a period of time as a result of environmentally induced expansion and contractions of population densities and ranges which simulates migration.

During the field survey, only one reptile species, *Hemidactylus mabouia* (Tropical House Gecko) was observed. This species is widespread and common.

Frogs were abundant on the project site and the sound of frogs calling from the wetlands reached deafening levels. Eleven frog species were identified (Table 13; Figure 24). With the exception of *Hyperolius microps* (Sharp-nosed reed frog) and *Hemisus guttatus* (Spotted shovel-nosed frog), all species listed in Table 13 are widespread and abundant, with stable population numbers and occurring in several protected areas. Pickersgill Reed Frog was not observed on the project site, or on any area within the proximity of the project site.

- **Threatened Species**

Hemisus guttatus (Spotted shovel-nosed frog) **VU**
This species has a national and provincial conservation status of '**Vulnerable**'. *H. guttatus* is endemic to the atlas region, occurring in southern Mpumalanga and central and eastern KwaZulu-Natal. Along the coast it has been recorded from Hluhluwe (2832BA) in the north, to Durban (2930DD, 2931CC) in the south. It also occurs as far inland as Dundee (2830AA, AB), Newcastle (2729DB) and Piet Retief (2630DD).

Although *H. guttatus* may be locally abundant, its fossorial habitat ensures that it is rarely observed and few locality records exist. Calling males are notoriously difficult to find since calling may initially take place underground, with males emerging onto the surface only when the chorus intensity increases.

The long-term survival of *H. guttatus* is threatened by rapid and extensive urban development, forestry and other agricultural practices, particularly along the KwaZulu-Natal north coast (FrogMAP, 2018).

Locality: Latitude: -28.771692° Longitude: 31.979631°

- **Range Restricted Species**

Hyperolius microps (Sharp-nosed reed frog)
Although listed as of 'Least Concern' and not afforded provincial protection, this species' range has been considerably diminished during the past c. 15 years as a result of drainage of wetlands for agricultural and urban development in several areas in KwaZulu-Natal, and is now only encountered rarely outside of protected areas.

Locality: Latitude: -28.773971° Longitude: 31.988327°; Latitude: -28.770069° Longitude: 31.990108

TABLE 13: Frog species identified on the project site.

COMMON NAME	SCIENTIFIC NAME	OBSERVATION INDICATOR	HABITAT
Broad Banded Grass Frog	*Ptychadena mossambica*	Sighting	Wetland
Brown-Backed Tree Frog	*Leptopelis mossambicus*	Sighting	Tree
Clicking Stream Frog	*Strongylopus grayii*	Vocalization	Wetland
Common Platanna	*Xenopus laevis*	Sighting	Wetland
Gutteral Toad	*Sclerophrys gutteralis*	Sighting	On service road
Marbled Reed Frog	*Hyperolius marmoratus*	Sighting	Wetland
Red Legged Cassina	*Kassina maculata*	Sighting	Wetland
Sharp-Nosed Reed Frog	*Hyperolius microps*	Sighting	Wetland
Snoring Puddle Frog	*Phrynobatrachus natalensis*	Sighting	Wetland
Spotted Shovel-Nosed Frog	*Hemisus guttatus*	Vocalization	Close to wetland
Tinker Reed Frog	*Hyperolius tuberlinguis*	Sighting	Wetland

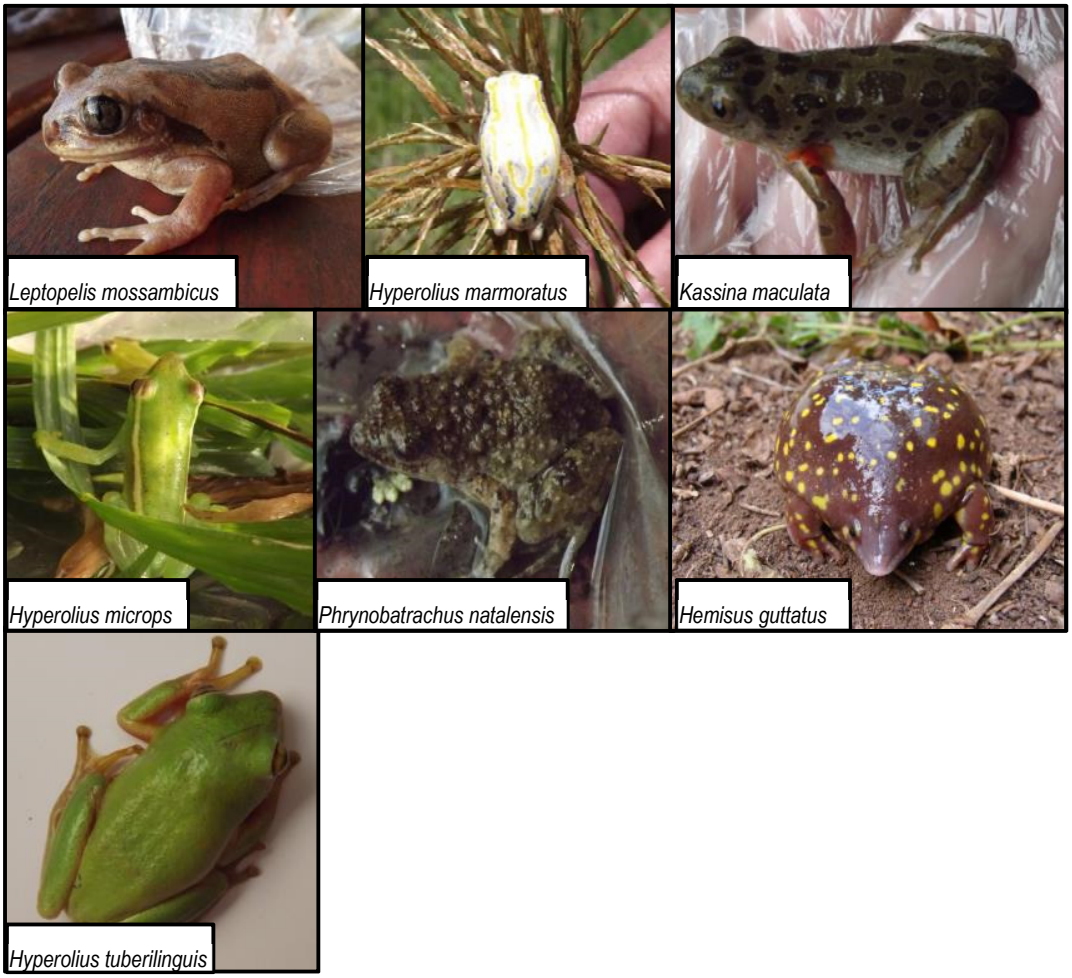

FIGURE 23: Some of the frog species confirmed to be present on the project site. With the exception of *Hemisus guttatus*, all photographs are from actual specimens encountered on the project site.

9.4.3 Herpetofauna Species of Conservation Concern

No SCC reptile species are expected to be present on the project site. Nonetheless, the project site offers suitable habitat to two SCC frog species that may potentially be present and are discussed below (Table 14):

Cacosternum striatum and *Breviceps sopranus* are listed as '**Data Deficient'**. Data Deficient species are those species where insufficient information on their abundance and distribution exist for a proper assessment of their conservation status to be made. A precautionary approach to listing would therefore be to use the IUCN classification of "Data Deficient" as a category.

No other SCC reptile or frog species (Appendix 3) are considered to be present in the project site since the site does not offer suitable habitat.

TABLE 14: SCC frog species deduced to occupy the project site, or to be occasional visitors.

COMMON NAME	SCIENTIFIC NAME	PREFERRED HABITAT	CONSERVATION STATUS			PROBABILITY OF OCCURRENCE
			RED LIST CATEGORY	NEMBA (2015)	KZNEPBA (2014)	
Striped Caco	*Cacosternum striatum*	Variety of grassland areas.	DDD			HIGH
Whistling Rain frog	*Breviceps sopranus*	Variety of vegetation types in forest and savanna biomes including coastal forest and thornveld, riparian forest. Preferred soil types vary from sandy to clay loam.	DDD			HIGH

9.5 AVIFAUNA ASSESSMENT

9.5.1 Avifauna Habitat Assessment

It is widely accepted that vegetation structure, rather than plant species richness influence bird species richness and abundance (Corcuera & Alejandro, 2006; Mohd-Azlan *et al*., 2015; Casas *et al*., 2016). Therefore, the avian habitat assessment focuses on factors which are relevant to bird distribution.

Bird microhabitats on the project area include grassland, wooded areas and inland water. It must be emphasised that birds, by virtue of their mobility, will utilise almost any area in a landscape from time to time.

GRASSLAND/SHRUBLAND

The majority of the project site falls within this bird microhabitat. This area may provide habitat to a number of bird species such as pipits, larks, longclaws and cisticolas.

WOODED AREAS

A few small wooded areas (tree copses) may provide habitat to bulbuls, doves and mousebirds.

INLAND WATER

These areas are represented by the several wetlands (Figure 13). Wetlands are fringed by *Phragmites mauritianus*, *Papyrus* sp. and several cyperoid species, offering suitable habitat to a number of bird species such as warblers, weavers and geese.

9.5.2 Expected and Observed Avifauna Species Richness

The project site falls within the distributional range of 341 bird species (Appendix 4). Of these, the presence of 67 species was confirmed (Table 15). Large congregations of Spurwinged Geese and Woolly Necked Storks were frequently observed on the Biodiversity Offset area. Woodland bird species was contrary to expectation quite frequently encountered; however, this may be attributed to the small, but well wooded area on the site's eastern boundary, on the premises of Mondi Richards Bay. Woodland species were frequently observed flying from this area, to the small wooded areas on the project site.

No threatened bird species were observed. However, five provincially protected species were present and include the following:

- *Egretta alba* (Great Egret)
- *Ardea melanocephala* (Black Headed Heron)
- *Actophilornis africanus* (African Jacana)
- *Ciconia episcopus* (Woolly-necked Stork)
- *Glareola pratincola* (Collared Pratincole)

These species are protected under Schedule 3 of the KZNEBPA 2014.

Other SCC species observed include the near-endemic *Zosterops virens* (Cape White-eye). Near-endemics are those species with at least 70 % of their population present in South Africa.

The rest of the species listed in Table 15 are widespread and abundant throughout their distributional range.

TABLE 15: A list of bird species observed on the project site.

COMMON NAME	SCIENTIFIC NAME	HABITAT GRASSLAND	HABITAT INLAND WATER	HABITAT WOODED AREAS
Apalis Bar-throated	*Apalis thoracica*	+		
Barbet Black-collared	*Lybius torquatus*			+
Barbet Crested	*Trachyphonus vaillantii*			+
Bee-eater White-fronted	*Merops bullockoides*	+		
Bee-eater European	*Merops apiaster*	+		
Bishop Southern Red	*Euplectes orix*		+	
Bulbul Dark-capped	*Pycnonotus tricolor*			+
Camaroptera Green-backed	*Camaroptera brachyura*			+
Canary Yellow-fronted	*Crithagra mozambicus*	+		
Cisticola Zitting	*Cisticola juncidis*	+		
Cisticola Croaking	*Cisticola natalensis*	+		
Crake Black	*Amaurornis flavirostra*		+	
Cisticola Lazy	*Cisticola aberrans*	+		
Coucal Burchell's	*Centropus burchellii*			+
Cuckoo Diderick	*Chrysococcyx caprius*			+
Dove Red-eyed	*Streptopelia semitorquata*			+
Drongo Fork-tailed	*Dicrurus adsimilis*			+
Duck Yellow-billed	*Anas undulata*		+	
Duck White-faced	*Dendrocygna viduata*		+	
Egret Great	*Egretta alba*		+	
Fiscal Common (Southern)	*Lanius collaris*	+		+
Flycatcher Southern Black	*Melaenornis pammelaina*	+		+
Goose Spur-winged	*Plectropterus gambensis*		+	
Goose Egyptian	*Alopochen aegyptiacus*		+	
Heron Black-headed	*Ardea melanocephala*		+	
Hoopoe African	*Upupa Africana*			+
House-martin Common	*Delichon urbicum*	+	+	+
Ibis African Sacred	*Threskiornis aethiopicus*		+	
Jacana African	*Actophilornis africanus*		+	
Kingfisher Brown-hooded	*Halcyon albiventris*	+		+
Kite Yellow-billed	*Milvus aegyptius*	+	+	+
Lapwing Crowned	*Vanellus coronatus*	+	+	
Lapwing Blacksmith	*Vanellus armatus*		+	
Lark Rufous-naped	*Mirafra Africana*	+		
Longclaw Yellow-throated	*Macronyx croceus*	+		
Masked-weaver Southern	*Ploceus velatus*		+	
Moorhen Common	*Gallinula chloropus*		+	
Mousebird Speckled	*Colius striatus*	+		+

COMMON NAME	SCIENTIFIC NAME	GRASSLAND	HABITAT INLAND WATER	WOODED AREAS
Pipit African	*Anthus cinnamomeus*	+		
Plover Kittlitz's	*Charadrius pecuarius*		+	
Plover Three-banded	*Charadrius tricollaris*		+	
Pratincole Collared	*Glareola pratincola*		+	
Prinia Tawny-flanked	*Prinia subflava*	+		
Ruff Ruff	*Philomachus pugnax*		+	
Sandpiper Common	*Actitis hypoleucos*		+	
Snake-eagle Black-chested	*Circaetus pectoralis*	+	+	+
Spoonbill African	*Platalea alba*		+	
Starling Violet-backed	*Cinnyricinclus leucogaster*	+		+
Starling Cape Glossy	*Lamprotornis nitens*	+		+
Stilt Black-winged	*Himantopus himantopus*		+	
Stork Woolly-necked	*Ciconia episcopus*		+	
Swallow Barn	*Hirundo rustica*	+	+	+
Swallow White-throated	*Hirundo albigularis*	+	+	+
Swallow Red-breasted	*Hirundo semirufa*	+		
Swallow Lesser Striped	*Hirundo abyssinica*	+		
Swamp-warbler Lesser	*Acrocephalus gracilirostris*		+	
Teal Red-billed	*Anas erythrorhyncha*		+	
Teal Hottentot	*Anas hottentota*		+	
Tinkerbird Yellow-rumped	*Pogoniulus bilineatus*			+
Wagtail African Pied	*Motacilla aguimp*		+	+
Wagtail Cape	*Motacilla capensis*		+	+
Weaver Spectacled	*Ploceus ocularis*			+
Weaver Village	*Ploceus cucullatus*			+
Weaver Yellow	*Ploceus subaureus*			+
Weaver Thick-billed	*Amblyospiza albifrons*		+	
(*) White-eye Cape	*Zosterops virens*			+
Widowbird Fan-tailed	*Euplectes axillaris*	+		

(*) Near-endemic

9.5.3 Avifauna Species of Conservation Concern

Several SCC species have a **Medium – High probability** of occurring in the project site, or expected to be occasional visitors and are discussed below (Table 16).

- **Threatened species**

Balearica regulorum (Grey Crowned Cranes) **EN**
This species has a global, national (NEMBA 2015) and provincial (KZNEBPA 2014) listing of Endangered.

Typical habitat requirements include mixed wetland-grassland habitats, where they nest within or on the edges of wetlands, while foraging in wetlands and nearby grasslands. Foraging takes place in short to medium height open grassland, lightly wooded savannah and agricultural fields.

Since the wetlands and grasslands on the project site has been identified as a possible breeding site for *B. regulorum* (Nel *et al*., 2011) and suitable habitat do exist at some of the wetlands, including on the Biodiversity Offset area, their presence should be considered.

- **Provincially Protected Species**

With the exception of *Balearica regulorum* and *Sigelus silens*, all the species listed in Table 16 are protected under

Schedule 3 of the KZNEBPA 2014. Schedule 3 lists protected species and provides for certain prohibited and restricted activities applicable to listed species.

Prohibited activities include hunting, and restricted activities including the disturbance, destruction, damage or removal of nests, the possession, breeding, selling, making available for sale or otherwise trade in, buying, receiving, giving, donating or accepting as a gift, or in any way acquiring or disposal of, capturing, collection, immobilisation, killing, translocation, release, display, export, import or keeping and captivity of any species listed under Schedule 3.

- **Endemic/Near-endemic Species**

Species that may potentially be present include the near-endemic ***Sigelus silens*** (Fiscal Flycatcher). Near-endemic species are those with their distributional range at least 70 % restricted to South Africa, Lesotho and Swaziland. It poses a special conservation responsibility to the region's conservation authorities, government, landowners and citizens. Even though these species have wide distributional ranges within the region and have a conservation ranking of 'Least Concern', and some rank among our most widespread and abundant birds (i.e. Cape White Eye, Fiscal Flycatcher), all endemic species require some vigilance (Taylor *et al*., 2015) to ensure that population numbers stay stable.

The rest of the SCC species listed in Appendix 4 have a low probability of occurrence since the project site does not offer suitable habitat.

TABLE 16: A list of SCC bird species deduced to occupy the project site, or expected to be occasional visitors.

COMMON NAME	SCIENTIFIC NAME	PREFERRED HABITAT	CONSERVATION STATUS				PROBABILITY OF OCCURRENCE
			RED LIST CATEGORY (REGIONAL/ GLOBAL)	NEMBA (2015)	KZN-EBPA (2014)	KZNCMA (1999)	
Bishop Yellow-crowned	*Euplectes afer*	Marshes and wetlands.			Sched 3		HIGH
Bittern Little	*Ixobrychus minutus*	Bulrushes and reedbeds.			Sched 3		MEDIUM
Buttonquail Kurrichane	*Turnix sylvaticus*	Open savanna woodland, cultivated and fallow fields.			Sched 3		MEDIUM
Buzzard Steppe	*Buteo vulpinus*	Open woodland, grassland and agricultural areas.			Sched 3		MEDIUM
Canary Brimstone	*Crithagra sulphuratus*	Montane shrublands to coastal forest margins.			Sched 3		HIGH
Crane Grey Crowned	*Balearica regulorum*	Marshes, pans, dam margins with tall emergent vegetation.	EN/EN	EN	Shed 3	PROT	MEDIUM
Eagle Long-crested	*Lophaetus occipitalis*	Moist woodland adjacent grassland, marshes, drainage lines.			Sched 3		MEDIUM
Eagle-owl Spotted	*Bubo africanus*	Tolerant to a wide variety of habitats and has adapted to suburban areas.			Sched 3		MEDIUM
Egret Cattle	*Bubulcus ibis*	Open grassland and agricultural lands.			Sched 3		HIGH
Egret Little	*Egretta garzetta*	Most shallow water bodies.			Sched 3		MEDIUM
Egret Yellow-billed	*Egretta intermedia*	Shallow water margins and flooded wetlands.			Sched 3		MEDIUM
Falcon Amur	*Falco amurensis*	Grassland, lightly wooded grassland and cropland margins.			Sched 3		MEDIUM
(*) Flycatcher Fiscal	*Sigelus silens*	Open woodland, from moist to semi-arid regions.					HIGH
Lapwing Black-winged	*Vanellus melanopterus*	Short grassland, from the highlands to coastal flats.			Sched 3		HIGH
Owl Barn	*Tyto alba*	Open habitat (Not forest).			Sched 3		HIGH
Quailfinch African	*Ortygospiza atricollis*	Short open grassland near water.			Sched 3		HIGH
Waxbill Orange-breasted	*Amandava subflava*	Moist grasslands and wetland margins.			Sched 3		MEDIUM

(*) Near-endemic species

10. KEY FINDINGS OF THE ECOLOGICAL ASSESSMENT

A summary of the findings of the ecological assessment is presented in Table 17.

TABLE 17: Summary of the desktop and field assessments.

ECOLOGICAL VALUE	APPLICABILITY TO PROJECT SITE
Species Aspect Of Biodiversity	
Protected species of fauna/flora	**Flora (**Observed**)**: • Provincially protected species (Table 8): *Sclerocarya birrea; Hyphaene coriaceae; Trichilia emetica, Ficus trichopoda*; All species from the following Families – ASPARAGACEAE; ASPHODELACEAE; ORCHIDACEAE. • Species protected under the National Forest Act (Table 8): *Sclerocarya birrea; Ficus trichopoda.* **Fauna:** Mammals**:** Observed: None observed. Potential occurrences – *Nycteris hispida*, *Chlorocebus pygerythrus (*CITES listed; Table 12). Reptiles: None observed or expected. Frogs: Observed: *Hemisus guttatus* listed as 'Vulnerable' confirmed to be present (Table 13). Potential occurrences: None Birds: Provincially protected species: Observed: *Egretta alba; Ardea melanocephala; Actophilornis africana; Glareola praticola, Ciconia episcopus* (Table 15). Potential occurrences: 15 species expected (Table 16).
Threatened species	**Flora:** Observed: None Potential occurrences (Table 9): One species listed as 'Critically Endangered'; one species listed as 'Endangered'; three species listed as 'Vulnerable'; one species listed as 'Near Threatened'; three species listed as Declining; one species listed as 'Data Deficient'. **Fauna**: Mammals: Observed: *Crocidura mariquensis* listed as 'Near Threatened' confirmed to be present. Potential occurrences: *Scotoecus albofuscus* Reptiles: None observed or expected. Frogs: Observed: None Potential occurrences: *Cacosternum striatum, Breviceps sopranus* listed as 'Data Deficient' (Table 14). Birds: Observed: None Potential occurrences: *Balearica regulorum* listed as 'Endangered'.
Keystone species performing a key ecological role (e.g. key predator, primary producer)	None observed or expected.
Endemic species or species with restricted ranges	**Flora:** Observed*:* Endemic species confirmed to be present (Table 8): *Hyphaene coriaceae; Helichrysum auriceps, Lobelia coronopifolia, Eulophia angolensis*. **Fauna:**

	Mammals – None observed or expected. Reptiles – None observed or expected. Frogs: Observed: Range restricted species: *Hyperolius microps* confirmed to be present. Birds: Observed: *Zosterops virens* (near-endemic; Table 15) Potential occurrences: *Sigelus silens* (near-endemic; Table 16).
Previously unknown species	None observed or expected.
Community and Ecosystem Aspects of Biodiversity	
Distinct or diverse communities or ecosystems.	The project site falls within the Maputaland-Pondoland-Albany Biodiversity Hotspot.
Unique ecosystems	The project site falls within the Maputaland-Pondoland-Albany Biodiversity Hotspot.
Locally adapted communities or assemblages	*Hemisus guttatus; Hyperolius microps*
Communities with a high proportion of endemic species or species with restricted ranges	Few present/expected to be present.
Communities with a high proportion of threatened and/or declining species.	Few present/expected to be present.
The main uses and users of the area and its ecosystem goods and services: important ecosystem services (e.g. important water area, buffer zone), valued ecosystem goods (e.g. harvestable goods important for lives and/or livelihoods), valued cultural areas.	The area is currently being used for communal cattle grazing. An informal dwelling and cattle boma is present on the project site.
Landscape Level Aspects of Biodiversity	
Key ecological processes (e.g. seed dispersal, pollination, primary production, carbon sequestration).	Wetlands: Hydraulic flux and storage, ground water recharge, climate control, oxidation-reduction, Hydraulic flux and life support, biogeochemical cycling and storage, biological productivity, community structure and wildlife support.
Areas with large congregations of species and/or breeding grounds.	Large congregations of Spurwinged Geese and Woolly-necked Storks were frequently observed on the Biodiversity Offset Area.
Importance as a link or corridor to other fragments of the same habitat, to protected or threatened or valued biodiversity areas.	Connectivity to similar habitats is severely impaired by anthropogenic disturbance. Nonetheless, due to the highly mobile nature of bird species, wetland areas might provide possible breeding grounds/resting/foraging areas for the Grey Crowned Crane.
Importance and role in the landscape with regards to a range of spatial components or ecological processes; comprising processes tied to fixed physical features (e.g. soil or vegetation interfaces, river or sand movement corridors, upland-lowland interfaces) and flexible processes (e.g. upland-lowland gradients and macro-climatic gradients) as well as important movement or migration corridors for species.	Wetlands: Hydraulic flux and storage, ground water recharge, climate control, oxidation-reduction, Hydraulic flux and life support, biogeochemical cycling and storage, biological productivity, community structure and wildlife support.

11. HABITAT SENSITIVITY ANALYSIS

The wetland areas provide habitat to threatened fauna species and should be regarded as of **High Sensitivity**. The proposed biodiversity offset area located to the north of the project site does not offer suitable habitat to these wetland dependent fauna species, thus the availability of candidate offset sites with similar habitat structure and ecological functioning catering explicitly for the habitat needs of the affected fauna species are currently being investigated to fully compensate for the loss of wetland areas on the project site.

Nontheless, the biodiversity offset area and conservation area located to the north and south, as well as CBA: irreplaceable areas surrounding the project site should be regarded as no-go areas (Figure 25).

From a vegetation perspective, the project site is not regarded as being particularly sensitive. Reasons for this include the following:

- Extensive developments on surrounding areas have effectively isolated this site from similar plant communities. As a result, plant populations were also subdivided and reduced, thereby increasing their probability of extinction (Collinge *et al*., 1996);
- Large areas on the project site showed population increases in *Helichrysum kraussii* and *Dichrostachys cinerea* plants, an indication of past disturbance;
- Deforestation of large woodland tree species particularly within the *Helichrysum kraussii – Parinari capensis*, and to a lesser extent in the *Imperata cylindrica – Syzygium cordatum* vegetation communities (Figure 26);
- The project site falls within a zone intended for the development of High Impact Industry and is not recognised as an area earmarked for conservation (Figure 8);
- The project site falls within the Industrial Development Zone of Richards Bay where future developments are planned, full restoration of the original environment and biota will thus not be feasible in the long run;
- A number of provincially protected and flora endemic species are present on the project site. However, these species are not restricted to the project site. Threatened plant species that could potentially be present include species such as geophytes and herbs that can be easily translocated (Table 9).

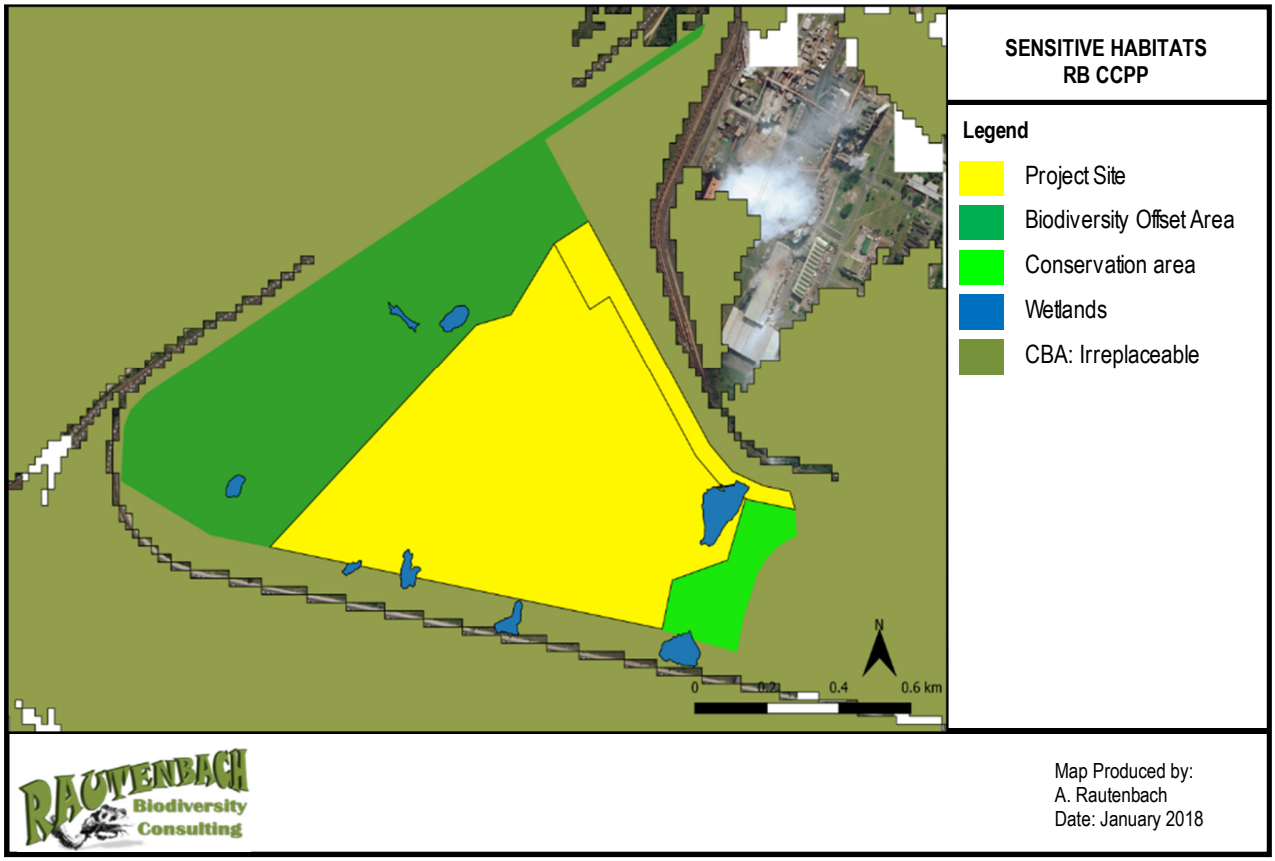

FIGURE 24: Habitat sensitivity map of the project site and surroundings.

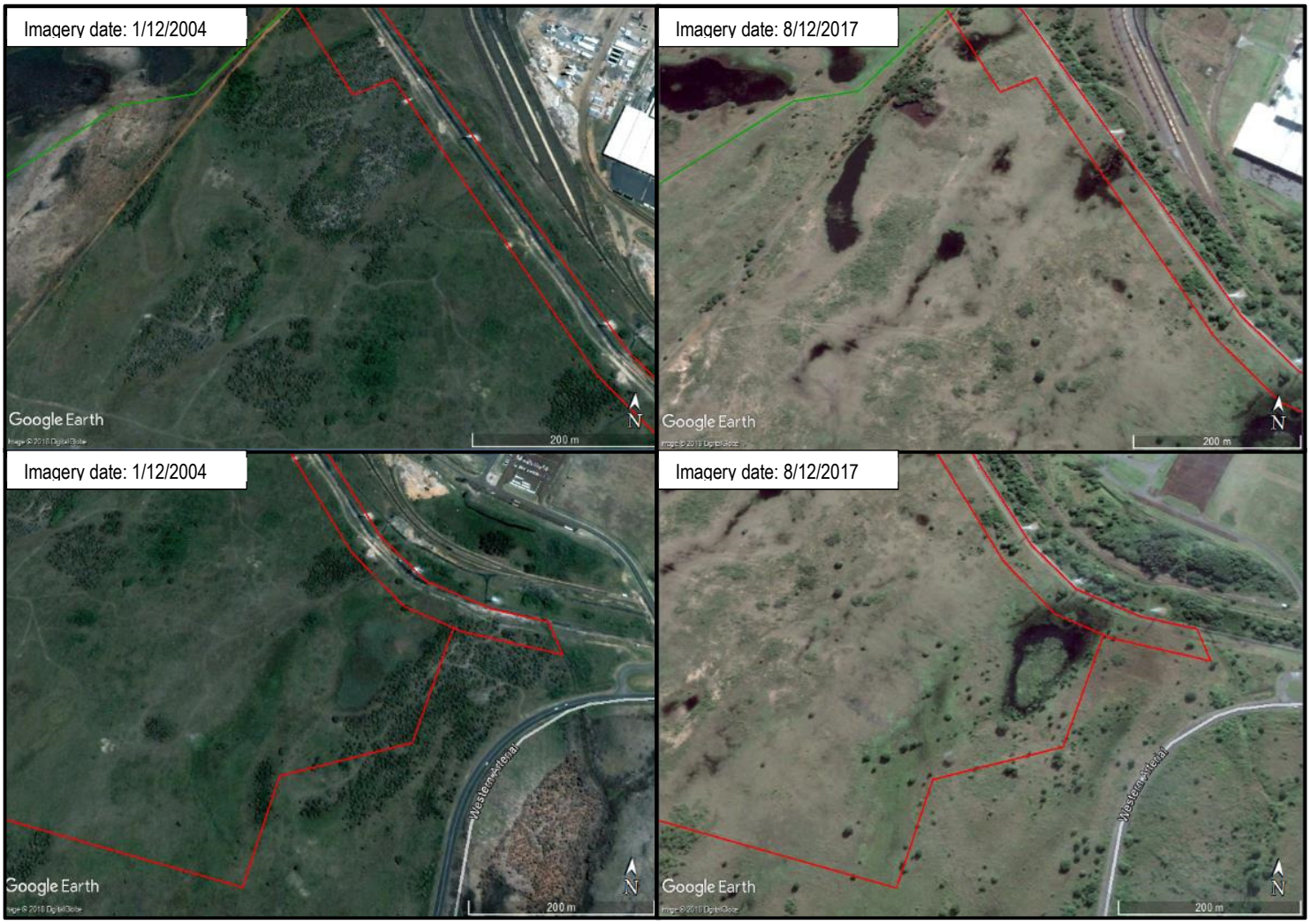

FIGURE 25: Comparison of historical Google Earth images from the project site with the most recent images available. The extent of deforestation on the selected areas is clearly visible.

12. ECOLOGICAL IMPACT ASSESSMENT

This section provides an overview of the potential ecological impacts that the development of the Richards Bay CCPP project may have on the biodiversity of the area. It includes an assessment of the nature and extent of impacts on the receiving environment during the construction and operation phases of the project. Furthermore, the potential for mitigation of negative impacts and enhancement of positive impacts are described.

Impacts have been assessed based on the methodology provided for in Appendix 5.

12.1 CONSTRUCTION PHASE IMPACTS

The expected duration of the construction phase is approximately 36 to 48 months. The construction activities will involve the following:

- Establishment of access roads;
- Vegetation clearance and stripping of topsoil;
- Excavations for foundations;

» Concrete works;
» Mechanical and electrical works

Ecological impacts likely to be associated with the construction phase have been described and assessed below:

Impact 1: Loss of sensitive terrestrial ecosystems

Nature:
The project site falls within the 'Critically Endangered' Kwambonambi Hygrophilous Grassland ecosystem. Of particular concern for biodiversity conservation in this region has been the ongoing attrition of this ecosystem to the extent that conservation targets can no longer be met. Consequently, all remaining grassland within this ecosystem is ideally required for conservation but a number of these areas are in high demand for development. In an effort to resolve this conflict, a memorandum of understanding was reached between eKZNw and the uMhlathuze Municipality for the conservation of remaining areas, and the new 'uMhlathuze Land Use Scheme' was adopted by the uMhlathuze Council.

With this scheme, the project site falls in the High Impact Industry zone (Figure 12), an area earmarked for the development of large industries. However, areas important for conservation as identified by the 'uMhlathuze Land Use Scheme'are present to the north and south of the project site and should be regarded as no-go areas.

	Without mitigation	With mitigation
Extent	2	1
Duration	5	2
Magnitude	6	4
Probability	4	3
Significance	**(Medium) 52**	**(Low) 21**
Status (positive or negative)	Negative	Negative
Reversibility	No	Reversible
Irreplaceable loss of resources?	Probably	Probably
Can impacts be mitigated?	Should the proposed mitigation measures be correctly implemented, the impacts on conservation areas can be reduced.	

Proposed mitigation measures:

- The biodiversity offset area, conservation area and CBA: Irreplaceable areas surrounding the project site (Figure 25) must be considered as no-go areas.
- The presence and location of all no-go areas must be clearly communicated to all employees and visitors to the project site.
- No vegetation clearance, construction camps, access roads, firewood collecting, hunting, disturbance of fauna must be allowed in the no-go areas.
- No stockpiling of topsoil on the no-go areas to be allowed.
- No open fires to be allowed on the construction site, or any of the no-go areas.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 2: Loss of CBAs

Nature:
Provincial level conservation assessments (KZNEBPA 2012) identifies the project site as falling mostly within an area classified as 'Biodiversity areas' with areas to the southwest designated as CBA 3 areas. District level conservation assessments (KZNBSP 2014) identify the project site as falling within a CBA: Irreplaceable area, where limited or no loss of biodiversity is advocated.

However, extensive developments on areas surrounding the project site have effectively isolated this site from similar plant communities, and the vegetation on site was found to be significantly transformed by past disturbance. Although remnants of the original vegetation still remain, large areas on the project site are dominated by the woody dwarf shrub *Helichrysum kraussii*, interspersed with several *Dichrostachys cinerea* thickets. Therefore, the area is not considered to be particularly sensitive.

The surrounding CBA: Irreplaceable areas should however be regarded as Highly Sensitive and should be considered no-go areas (Figure 25).

	Without mitigation	With mitigation
Extent	2	1
Duration	2	2
Magnitude	6	4
Probability	3	3
Significance	**(Medium) 30**	**(Low) 21**
Status (positive or negative)	Negative	Negative
Reversibility	No	Reversible
Irreplaceable loss of resources?	Probably	Probably
Can impacts be mitigated?	Should the proposed mitigation measures be correctly implemented, the impacts can be reduced.	

Proposed mitigation measures:

- CBA areas outside of the development footprint must be clearly demarcated and considered as no-go areas.
- The presence and location of no-go areas must be clearly communicated to all employees and visitors to the project site.
- No vegetation clearance, construction camps, access roads, firewood collecting, hunting, disturbance of fauna must be allowed in the no-go areas.
- No stockpiling of topsoil on the no-go areas to be allowed.
- No open fires to be allowed on the construction site, or any of the no-go areas.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 3: Loss of sensitive aquatic ecosystems

Nature:
Wet areas on the project site are regarded as Highly Sensitive (Figure 25). The biodiversity offset area located to the north of the project site does not offer suitable habitat to wetland dependent fauna species and are therefore regarded as unsuitable. Candidate biodiversity offset sites with similar habitat structure and ecological functioning are currently being investigated to fully compensate for the loss of wetland habitat on the project site.

Wet area are present on the Biodiversity offset area and the conservation area. Construction activities will result in the disturbance of the existing soils, potentially causing soil erosion and sedimentation of these wetlands. Soil erosion and sediment control measures should therefore be implemented to prevent sediment from being washed from excavated areas.

	Without mitigation	With mitigation
Extent	3	1
Duration	5	5
Magnitude	10	6
Probability	5	4
Significance	**(High) 90**	**(Medium) 48**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	To a degree
Irreplaceable loss of resources?	Highly likely	Likely
Can impacts be mitigated?	Yes	

Proposed mitigation measures:

- Finalisation of candidate biodiversity offset sites prior to vegetation clearance and construction.
- The biodiversity offset area to the north and conservation area to the south of the project site should be regarded as no-go areas.
- No vehicles must be allowed in the no-go areas.
- No equipment or vehicles may be washed on or close to the no-go areas.
- No dumping of waste may be allowed within the no-go areas.

- Refueling of vehicles and machinery to take place in demarcated areas outside of the no-go areas.
- The construction of access roads must be limited, and be located away from no-go areas where possible.
- The presence and location of these areas, as well as their importance must be clearly communicated to all employees and visitors to the project site during inductions.
- Construction activities should take place during the dry season to reduce erosion of exposed surfaces and sedimentation of adjacent wetland areas, if possible.
- Vegetation should be cleared in a slow and phased manner to minimise exposed soil surfaces.
- Soil erosion and sedimentation control measures (i.e. silt fences, hay bales) should be implemented and maintained in good condition and left in place for the duration of the construction phase.
- Development of a stormwater management plan for the project site is required. This plan must include clear methods for separating dirty and clean water. Only clean water may be diverted back to wetland systems, provided that it flows across a vegetated strip or other means designed for the reduction of sediments and decreased velocity of water entering the system.

Residual impacts:
Expected to be moderate if mitigation measures are properly implemented.

Impact 4: Loss of natural vegetation

Nature:
Most of the project site falls within the 'Endangered' Maputaland Wooded Grassland regional vegetation type, with a few small areas falling within the 'Vulnerable' Subtropical Freshwater vegetation type (Figure 11).

Areas within the Maputaland Wooded Grassland main vegetation type are regarded as being of a low sensitivity. Reasons for this rating include the following:

- Extensive developments on surrounding areas have effectively isolated this site from similar plant communities. As a result, plant populations were also subdivided and reduced, thereby increasing their probability of extinction (Collinge *et al.*, 1996);
- Large areas on the project site showed population increases in *Helichrysum kraussii* and *Dichrostachys cinerea* plants, an indication of past disturbance;
- Deforestation of large woodland tree species particularly within the *Helichrysum kraussii – Parinari capensis*, and to a lesser extent in the *Imperata cylindrica – Syzygium cordatum* vegetation communities;
- The project site falls within the Industrial Development Zone of Richards Bay where future developments are planned, full restoration of the original environment and biota will thus not be feasible;
- The project site falls within a zone intended for the development of High Impact Industry and not recognised as an area earmarked for conservation;
- A number of provincially protected and endemic species are present on the project site. However, these species are not restricted to the project site. Threatened plant species that could potentially be present, include species that can be easily translocated.

During the construction phase of the project, large areas will be cleared from all vegetation to accommodate infrastructure. The loss of natural vegetation is irreversible and permanent. However, most of the area falls within an area regarded as of low sensitivity and the impact is not expected to be highly significant. Although several protected plant species are present, these species are not restricted to the project site. It should be noted that a few threatened plant species could potentially be present that may have been overlooked during the field survey. Nontheless, threatened plant species that could potentially be present include species such as geophytes and herbs that can be easily translocated.

Where protected/threatened plant species fall within the development footprint and avoidance is not posssible, then it may be possible to translocate the affected individual plant specimen outside of the development footprint. Not all species are suitable for translocation as only some species are able to survive this disturbance. Suitable candidates for translocation include most geophytes and succulents. It should be noted that the majority of woody species do not survive translocations well, therefore the translocation of tree species is not advised. However, permits from eKZNw and DAFF will be required before the destruction/removal/translocation of SCC species. A list of georeferenced localities of protected tree species on the project site is provided in Appendix 6.

Relative intact examples of the Subtropical Freshwater Wetland vegetation type are present within the wetland areas. Approximately 28% of plant species identified within this vegetation community is regarded as important floristic elements of the Subtropical Freshwater Wetlands by Mucina & Rutherford (2006). Futhermore, these areas also provide habitat to wetland dependant SCC fauna species. Destruction of their habitat will ultimately result in further population declines. Candidate biodiversity offset areas with similar habitat structure and ecological functioning are currently being investigated to fully compensate for the loss of wetland habitat on the project site.

	Without mitigation	**With mitigation**
Extent	3	2
Duration	5	5
Magnitude	8	4
Probability	4	3
Significance	**(High) 64**	**(Medium) 33**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	To a degree
Irreplaceable loss of resources?	Highly likely	Likely
Can impacts be mitigated?	Should the proposed mitigation measures be implemented the impacts can be significantly reduced.	

Proposed mitigation measures:

- Finalisation of candidate biodiversity offset areas prior to vegetation clearance and construction.
- Prior to vegetation clearance, the development footprint and the 200 m of adjoining areas must be scanned for the presence of protected and threatened flora species, by a suitably qualified Botanist/Ecologist.
- This scan should be conducted at a favourable time of the year when the probability of recognising SCC flora species is high.
- A search and rescue operation must be undertaken to translocate protected species within the development footprint. Affected plant specimens should be translocated to a similar habitat outside of the development footprint and marked for monitoring purposes. All plants requiring translocations must be translocated by following the plant rescue and translocation guidelines outlined in Appendix 7.
- Where translocations are not possible, the necessary permits for the removal or destruction of protected species must be obtained from eKZNw or DAFF, before vegetation clearance starts.
- Any protected plants close to the site that will remain in place must be clearly marked and may not be defaced, disturbed, destroyed or removed. They must be cordoned off with construction tape or similar barriers and marked as no-go areas;
- During construction, the ECO must monitor vegetation clearing at the site. Any deviations from the approved plans which will result in the removal of vegetation from additional areas should first be checked for protected species by the ECO. Any protected species present which are able to survive translocation should be translocated to a safe site.
- The ECO must translocate any listed species observed within the development footprint that were missed during the pre-construction vegetation walk-through.
- No plant species are permitted to be collected or removed by the contractor without prior approval from the ECO. The ECO should carefully monitor construction activities in sensitive habitats such as near wetlands to ensure that impacts to these areas are minimised.
- The timing between clearing of an area and subsequent development is to be minimised.
- No harvesting of plants for firewood, medicinal or any other purposes are to be permitted.

  The removal of vegetation will result in the disturbance of soil surfaces. The exposed soil surfaces will potentially be open to invasion by alien plant species. A detailed alien invasive species management plan will have to be implemented and maintained during the construction and operational phases. Guidelines are provided in Appendix 8.

Residual impacts:
Expected to be moderate if mitigation measures are properly implemented.

Impact 5: Loss/disturbance of local fauna populations

Nature:

Based on the results of the field survey it is evident that the project site provides habitat to a number of fauna species. Although it is assumed that the majority of fauna species will move to different areas as a result of disturbance, many SCC fauna species have very specific habitat requirements (i.e. frogs), and the complete destruction of their habitats will result in displacement to less optimal habitats, or ultimately may result in their complete demise. Of concern is the presence of wetland dependent SCC species such as the frog species *Hemisus guttatus, Hyperolius microps* and the shrew species *Crocidura mariquensis*.

For frogs, wetlands serve as breeding sites, as a habitat for larval development and as a primary food source for adults. Due to their amphibious lifestyles, frogs are very sensitive to changes in the water and surrounding land. Frogs are particularly sensitive to chemical contaminants owing to their permeable skin and eggs. Thus, wetland destruction or disturbance will have significant negative effects on these sensitive species. Similarly, *C. mariquensis* is a wetland specialist, occurring only in moist, swampy habitats (Skinner & Chimimba, 2005). This species is dependent on the medium to tall grass cover surrounding wetland ecosystems. The complete destruction of wetlands will have a devastating effect on these habitat specialists and the impact is therefore considered very high. This will also include the demise of the abundant local frog population currently present on the project site. Candidate biodiversity offset sites with similar habitat structure and ecological functioning are currently being investigated to fully compensate for the loss of wetland habitat on the project site.

The smaller non-volant mammal species such as rodents and mongooses are tolerant to disturbance and would simply move away to more suitable habitats during the construction phase, if provided the opportunity. Consequently, the construction phase impacts on these species are expected to be low. Volant mammal species such as *Scotoecus albofuscus* and *Nycteris hispida* may be affected by the loss of roosting and foraging areas.

However, slower moving species such as reptiles and the more terrestrial frog species would either seek shelter or not be able to move away from construction machinery and would be killed by vehicles and earth-moving machinery. These slower moving species would also be vulnerable to poaching for food, trade or fatality.

Construction phase activities are likely to cause disturbance and displacement of local bird populations, especially shy and/or ground nesting species such as pipits, larks and waterfowl. These activities have an impact on breeding, foraging and roosting activities, on or in close proximity to the project site. The construction phase of a project can be highly disturbing to birds breeding in the vicinity of the construction activities. Many birds are highly susceptible to disturbance and should this disturbance take place during a critical time in the breeding cycle, for example, when the eggs have not hatched or just prior to the chick fledging, it could lead to temporary or permanent abandonment of the nest or premature fledging. In both instances, the consequences are almost invariably fatal for the eggs or the fledgling. Such a sequence of events can have far reaching implications for certain large, rare species that only breed once a year or once every two years.

Although no Threatened bird species have been observed on the project site, *Balearica regulorum* (EN) are known to be present within the Richards Bay area, thus their potential occurrence should be considered.

Adverse environmental impacts of the project on fauna populations can however be minimised through a number of mitigation measures.

	Without mitigation	**With mitigation**
Extent	4	2
Duration	5	5
Magnitude	10	6
Probability	5	3
Significance	**(High) 95**	**(Medium) 39**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible to a degree
Irreplaceable loss of resources?	Likely	Unlikely
Can impacts be mitigated?	Although this impact can be mitigated to a degree, all developments have a negative impact on biodiversity. However, with appropriate mitigation measures these impacts can be reduced.	

Proposed mitigation measures:

- Finalisation of candidate biodiversity offset areas prior to vegetation clearance and construction.

General mitigation measures

- Vegetation clearance should, ideally, start during the non-breeding season of fauna populations (i.e. winter).
- Where possible work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- During vegetation clearance, methods should be employed to minimise potential harm to fauna species. Clearing has to take place in a phased and slow manner, commencing from the interior of the project area progressing outwards towards the boundary to maximise potential for mobile species to move to adjacent areas.
- Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery.
- Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint by an Ecologist/Zoologist or a suitably qualified ECO trained in the handling and relocation of animals.
- Areas beyond the development footprint should be expressly off limits to construction personnel and construction vehicles and this should be communicated to them.
- It is recommended that, while trenches are open during the construction phase, an appropriately sloping section of the side-wall is made available for the escape of any trapped animals.
- All stormwater structures should be designed so as to block amphibian and reptile access to the road surface.
- All contractors and subcontractor personnel working on the project must participate in an environmental awareness program. The program must include appropriate wildlife avoidance methodologies, such as impact minimisation procedures and methods for protecting nesting birds. Information about the importance and purpose of protecting wildlife must be described in the program.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted in the project site or surrounding areas.

Mitigation measures for mammals and herpetofauna

- Prior to construction and vegetation clearance a suitably qualified Zoologist should closely examine the project site for the presence of any animal burrows, rock crevices, under logs/stumps and in trees, and relocate any affected non-Red Listed/Protected animals to appropriate habitat away from the project site.

Mitigation measures for birds

- No more than two weeks in advance of vegetation clearance that will commence during the breeding season (1 September – 1 March) a qualified Zoologist must conduct a pre-construction survey of all potential special-status bird nesting habitat in the vicinity of the project site, and on the project site. If pre-construction surveys indicate that no nests of special-status birds are present or that nests are inactive or potential habitat is unoccupied, no further mitigation is required.
- If active nests are found, avoidance procedures must be implemented on a case-by-case basis. Avoidance procedures may include the implementation of buffer zones and relocation of birds or seasonal avoidance. If buffers are created, a no disturbance zone must be created around active nests during the breeding season by a suitably qualified Zoologist.

Mitigation measures for bats

- Mitigation measures to offset the loss of roosts are detailed below:

  Trees:
  - Prior to vegetation clearance and construction, all trees will be subject to assessment by means of walk-through surveys for the location of potential bat roosts. This must be done by a bat specialist and/or the Bat Interest Group of KwaZulu-Natal (hereafter referred to as BIG).
  - Immediately prior to felling, trees should be examined for the presence of bats or bat activity. This survey could be carried out by a suitable bat specialist or member/s of the BIG. Where bats are still present within an identified roost, it will be necessary to undertake exclusion procedures. The bat specialist/BIG member will advise on the steps necessary for exclusion and the likely time period. If a tree containing a confirmed bat roost must be felled outside the optimum time period, a bat specialist must remove any bats to safety.

  Tree felling procedures
  - In order to ensure the optimum warning for bats in any unconfirmed bat roosts that may be present, the trees should be pushed lightly two or three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly and should be left intact on the ground for at least 24 hours to allow any bats within the tree to escape

Residual impacts:
Expected to be moderate if mitigation measures are properly implemented.

Impact 6: Noise and artificial light disturbance

Nature:
Fauna generally respond to disturbances caused by human activities according to the magnitude, timing, and duration of the particular disturbance. Human activities can affect an animal's ability to feed, rest, and breed if it is unable to habituate to the disturbance caused. Disturbance created by general visual and noise pollution associated with workers and construction activities can therefore affect wildlife utilising nearby habitats.

Noise from human activities (in particular from infrastructure and construction sites) has a strong impact on the physiology and behavior of birds. This impact concerns the masking of signals used (1) for communication and mating and (2) for hunting. As a result of this masking, there is a decrease in bird density with an increase in noise level. Furthermore, if alternative silent habitats do not exist, the noise impact could negatively affect wild bird conservation (Bottalico *et al.,* 2015).

Unfortunately it is very difficult to mitigate this impact. This impact is, however, likely to be short-lived during the construction phase and will probably mainly affect local bird species that can easily migrate to other areas.

The ecologic effects of artificial light have been well documented. Light pollution has been shown to affect both flora and fauna. For instance, prolonged exposure to artificial light prevents many trees from adjusting to seasonal variations. This, in turn, has implications for the wildlife that depend on trees for their natural habitat. Research on insects, turtles, birds, fish, reptiles, and other wildlife species shows that light pollution can alter behaviors, foraging areas, and breeding cycles, and not just in urban centers but in rural areas as well.

For example, bright electric lights can disrupt the behavior of birds especially during inclement weather with low cloud cover, they routinely are confused during passage by brightly lit buildings, communication towers, and other structures, increasing the risk of collision with these man-made structures. Frogs have been found to inhibit their mating calls when they are exposed to excessive light at night, reducing their reproductive capacity. The feeding behavior of bats also is altered by artificial light (Chepesiuk, 2009).

	Without mitigation	With mitigation
Extent	2	1
Duration	2	2
Magnitude	6	4
Probability	4	3
Significance	**(Medium) 40**	**(Low) 21**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	To a degree but very difficult to mitigate.	

Proposed mitigation measures:

- Outside lighting should be designed to minimise impacts on fauna.
- All outside lighting should be directed into the proposed development as opposed to away from the development, and also not in the direction of sensitive areas, including sensitive areas on neighboring properties.
- Fluorescent and mercury vapor lighting should be avoided and sodium vapor (yellow) lights should be used wherever possible.
- In order to reduce low intensity noise levels, work areas need to be effectively screened to reduce or deflect noise. Engineering controls such as modifications to equipment or work areas to make it quieter, the acquisition of equipment designed to emit low noise and vibration, creation of noise barriers, proper maintenance of tools and equipment must be considered.

- Noise from vehicles and powered machinery and equipment on-site should not exceed the manufacturer's specifications, based on the installation of a silencer. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipment.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 7: Soil erosion and sedimentation

Nature:
Construction activities will temporarily denude the vegetation on the site and expose the soils to the erosive elements. This could be exacerbated by water flowing down trenches and access roads, as well as from trench de-watering activities. Soil erosion can result in the loss of valuable topsoil and formation of erosion gullies. This can cause localised habitat loss / alteration due to increased sediment deposition or erosion of areas. Rapid and effective rehabilitation of these areas will be important in reducing erosion risk.

Although impacts would be localised, erosion is likely to persist or worsen over time if not addressed. If managed properly, the probability and extent of this impact can be reduced quite significantly.

	Without Mitigation	With Mitigation
Extent	2	1
Duration	2	2
Magnitude	6	4
Probability	4	2
Significance	**(Medium) 40**	**(Low) 14**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Can be effectively mitigated and managed onsite through the appropriate control measures.	

Proposed mitigation measures:

- Adequate characterisation of the natural soil catena through detailed mapping, soil classification and profile descriptions are necessary to provide background data required for restoration of ecological gradients and surface drainage characteristics.
- Program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example during summer when intense rainstorms are common.
- Site-specific plans for site erosion and sediment control should be developed and implemented. This should include a determination of site erosion potential and the identification of water bodies at risk.
- Site drainage such as those generated by the dewatering of excavated trenches must be diverted away from cleared, graded or excavated areas.
- Sediment barriers or sediment traps such as silt fences, sandbags, and hay bales for example must be established to curb erosion and sedimentation where necessary.
- Sediment barriers should be regularly maintained and cleaned to ensure effective drainage.
- These temporary barriers may only be removed once construction has been completed and there is no further risk of sedimentation.
- Topsoil, leaf and plant litter as well as subsoil removed during the construction of roads and building platforms must be stockpiled separately in low heaps, less than 1.5 m high not exceeding 2 m in height. Microbial activity, seed viability and soil fertility are adversely affected by long periods of stockpiling when high temperatures can be generated in thick deposits, therefore the topsoil should be restored as soon as possible. An alternative is to aerate the stockpiled topsoil regularly (as a minimum every six months). Vegetate with a grass mix natural to the area to control erosion if soil stockpiles will be kept for more than three months.
- Stockpiles are not to be used as stormwater control features.
- Erosion, sediment control measures such as silt fences, concrete blocks and/or sandbags must be placed around stockpiles (i.e. soil and materials) to limit runoff.

- Stockpiling of any materials on slopes is to be avoided, unless appropriate erosion control and management measures are implemented.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 8: Pollution of soils and habitat

Nature:
Waste products and pollutants, generated during the construction phase may include fuels and oils from construction vehicles as well as solid waste in the form of building material and litter from labourers. These can potentially enter the surrounding sensitive areas either directly through disposal/mismanagement of waste products, or indirectly through surface water runoff during periods of rainfall.

Chemicals can enter the air, water, and soil when they are produced, used or disposed. Their impact on the environment is determined by the amount of the chemical that is released, the type and concentration of the chemical, and where it is found. Some chemicals can be harmful if released to the environment even when there is not an immediate, visible impact. Some chemicals are of concern as they can work their way into the food chain and accumulate and/or persist in the environment for many years. Harmful effects of such chemical and biological agents as toxicants from pollutants, insecticides, pesticides, and fertilizers can affect an organism and its community by reducing its species diversity and abundance. Such changes in population dynamics affect the ecosystem by reducing its productivity and stability.

	Without Mitigation	With Mitigation
Extent	3	1
Duration	2	2
Magnitude	8	2
Probability	4	3
Significance	**(Medium) 52**	**(Low) 15**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Reversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Can be effectively mitigated and managed onsite through the appropriate control measures.	

Proposed mitigation measures:

- Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly, or at an appropriate frequency, at registered waste disposal sites.
- All building rubble, solid and liquid waste etc. must be disposed of as necessary at an appropriately licensed refuse facility.
- Ensure that no refuse wastes are burnt on the premises or on surrounding premises. No fires will be allowed on site, unless in designated areas approved by the ECO.
- Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period of the project and that the waste is disposed of at dumping site as approved by the Council.
- Adequate provision must be made for sanitation for the construction workers. Chemical toilets on site are to be emptied weekly or as required to avoid spillages.
- Minimise fuels and chemicals stored on site.
- Install bunds on storage areas and take other precautions to reduce the risk of spills.
- Implement a contingency plan to handle spills, so that environmental damage is avoided.
- No refueling, servicing of plant/equipment or chemical substance storage allowed outside of designated areas.
- Drip trays should be used during al fuel/chemical dispensing.
- Drip trays to be placed beneath standing machinery/plant.

• In the case of petrochemical spillages, the spill should be collected immediately and stored in a designated area until it can be disposed of in accordance with the Hazardous Chemical Substances Regulations, 1995 (Regulation 15).
Residual impacts: Expected to be low if mitigation measures are properly implemented.

12.2 OPERATION PHASE IMPACTS

Ecological impacts associated with the operation phase of the proposed development are likely to be associated mainly with the operations of the power plant and associated infrastrucure (i.e. personnel and vehicle site access, handling of hazardous chemical substances, operations and maintenance of the facility and waste generation).

Impacts likely to be associated with the operational phase are assessed below:

Impact 1: Introduction and spread of Alien & Invasive plant species and weeds

Nature:
This impact is generally initiated during the construction phase, when large areas of vegetation are cleared to accommodate infrastructure. This creates ideal opportunities and optimal conditions for weeds and alien & invasive plant species to invade disturbed areas. IAPs and indigenous weeds have the ability to out-compete and replace indigenous flora, which will in turn impact on natural biodiversity.

Clearance and disturbance can also result in an increase in 'edge habitat' immediately adjacent to disturbed areas. These areas are particularly prone to alien & invasive species invasions and can invade areas of established vegetation. This is particularly concerning since conservation areas are bordering on the proposed development footprint. The spread of IAPs and weeds to adjacent sensitive areas can be exacerbated if not properly managed and may even introduce new alien species to sensitive areas as a result of disturbance.

However, the alien invasive plant issue is one that can be successfully mitigated, by means of ongoing alien invasive plant management around the proposed development.

	Without mitigation	With mitigation
Extent	3	1
Duration	4	4
Magnitude	8	2
Probability	4	2
Significance	**(High) 60**	**(Low) 14**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Reversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	The impacts can be effectively managed through the implementation of an appropriate alien plant management programme which includes follow-up treatment/control procedures.	
Proposed mitigation measures: Development and implementation of an IAP Control and Eradication Programme. Guidelines are provided in Appendix 8.		
Residual impacts: Expected to be Low if mitigation measures are properly implemented.		

Impact 2: Disturbance of local fauna communities

Nature:
Local fauna populations, with the exception of vermin and a few generalist bird species such as House Sparrows, Indian mynahs and Crows are unlikely to utilise the project site during the operation phase.

However, conservation and sensitive areas (i.e. wetlands) are present close to and within the project site. The presence of humans close to these areas can lead to increased pressure on the natural resources through illegal hunting/poaching/trapping of fauna and flora species collected for medicinal purposes as well as littering. This is likely to be an ongoing threat during the entire operation phase of the project.

	Without Mitigation	With Mitigation
Extent	2	1
Duration	4	4
Magnitude	6	2
Probability	4	2
Significance	**(Medium) 48**	**(Low) 14**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Reversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Yes, this impact can be effectively mitigated on the site with proper management.	

Proposed mitigation measures:

- A suitable perimeter fence should be constructed around the facility to restrict access of fauna to the site and to restrict/control access of staff to adjacent natural areas.
- Education of employees on the conservation importance of natural areas and fauna must be provided.
- Access to no-go areas (Figure 25) to be restricted and controlled. This should be clearly communicated to all employees.
- No hunting, snaring, killing or disturbing any fauna species to be allowed on the site or in any of the no-go areas.
- No collecting of flora species to be permitted in the no-go areas.
- No open fires to be allowed on the site or the surrounding areas.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 3: Noise and artificial light disturbance

Nature:
Potential negative ecological consequences of noise and artificial light disturbance have been discussed under the Construction phase impacts. Since those impacts are also applicable during the Operation phase, it will not be discussed further.

	Without mitigation	With mitigation
Extent	2	1
Duration	4	4
Magnitude	6	4
Probability	4	3
Significance	**(Medium) 48**	**(Low) 27**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	To a degree but very difficult to mitigate.	

Proposed mitigation measures:

- Outside lighting should be designed to minimise impacts on fauna.
- All outside lighting should be directed into the proposed development as opposed to away from the development, and also not in the direction of sensitive areas, including sensitive areas on neighboring properties.
- Fluorescent and mercury vapor lighting should be avoided and sodium vapor (yellow) lights should be used wherever possible.

- In order to reduce low intensity noise levels, work areas need to be effectively screened to reduce or deflect noise. Engineering controls such as modifications to equipment or work areas to make it quieter, the acquisition of equipment designed to emit low noise and vibration, creation of noise barriers, proper maintenance of tools and equipment must be considered.
- Noise from vehicles and powered machinery and equipment used during operations should not exceed the manufacturer's specifications, based on the installation of a silencer. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipment.

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

Impact 4: Pollution of soils and habitat

Nature:
Hazardous chemical substances stored and handled at the proposed development used during operations and maintenance could enter the adjacent sensitive ecosystems if not managed properly and lead to pollution of the affected environment. Potential negative ecological consequences of hazardous substances on ecosystems have already been discussed under the construction phase impacts.

	Without Mitigation	With Mitigation
Extent	2	1
Duration	4	4
Magnitude	6	2
Probability	4	2
Significance	**(Medium) 48**	**(Low) 14**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Reversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Yes, this impact can be effectively mitigated on the site with proper management.	

Proposed mitigation measures:
In order to reduce the impact on human health and the environment, the minimum requirements and licensing for activities involving the storage, transportation, re-use, recycling, treatment and disposal of waste as set out by the following legislation (http://sawic.environment.gov.za) must be adhere to:
National Environmental Management Waste Act (Act No. 59 of 2008);
National Environmental Management Water Amendment Act (Act No. 26 of 2014).

Residual impacts:
Expected to be low if mitigation measures are properly implemented.

12.3 CUMULATIVE IMPACTS

The combined, incremental effects of human activity, referred to as cumulative impacts, pose a serious threat to the environment. While they may be insignificant in itself, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources.

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of the cumulative impact analysis. While impacts can be differentiated by direct, indirect, and cumulative aspects, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time.

Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity is taking the actions. The assessment of cumulative impacts is not substantially different from the assessment of direct or indirect impacts. The same type of considerations is made to determine the environmental consequences of the alternatives for direct, indirect, or cumulative impacts. One possible difference is that a cumulative impact assessment entails a more extensive and broader review of possible effects.

The main principles for describing and assessing cumulative impacts are listed below (after DEAT, 2004):

- Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.
- Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who has taken the action.
- It is not practical to analyse the cumulative effects of an action on every environmental receptor, the list of environmental effects must focus on those that are truly meaningful.
- Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
- Cumulative effects analysis on natural systems must use natural ecological boundaries.
- Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
- Cumulative effects may last for years beyond the life of the action that caused the effects.
- Each affected resource, ecosystem, and human community must be analysed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

The approach to assessing cumulative impacts is to screen potential interactions with other projects on the basis of:

- Past ecological impacts;
- Present ecological impacts;
- Future ecological impacts/development pressure.

Past ecological impacts

The project site has experienced past environmental impacts that are judged to have had a negative influence on its biodiversity and ecology:

- The first impact is associated with the development of the Richards Bay Coal Railway line which borders the Biodiversity Offset area to the north, and the project site to the south. This railway line crosses three NFEPA wetlands, causing extensive fragmentation of these sensitive aquatic ecosystems. In addition to the fragmentation, land clearance to accommodate infrastructure resulted in the direct loss of indigenous vegetation and an increase in IAPs and weeds along the edges of this linear development, resulting in IAP and weed invasions on the adjacent properties.
- The second impact is related to the deforestation of large woodland trees on the project site. This, together with the current grazing pressure probably contributed to the proliferation of the woody scrubs *Helichrysum kraussii* and *Dichrostachys cinerea*.
- A wetland on the project site has been fragmented by an informal gravel road.

Present ecological impacts

The proposed development area is located within the Richard's Bay Industrial Development Zone. This area is bordered by a mixed-use of industrial developments as well as open areas. The John Ross Highway lies approximately 1 km to the south of the project site, with the Western Arterial Highway running along the eastern boundary. Agricultural activities, mainly relating to plantations and sugarcane are located within 2 km southwest of the project site.

These intense past land-use modifications resulted in severe fragmentation of a once-continuous vegetation type. Characteristic of several of these fragmented areas are the high levels of IAPs and weed infestations, particularly along linear developments.

Currently the project site is being used for cattle grazing, with cattle bomas and informal occupied dwellings present on the northern boundary. Other human uses include hunting with dogs and quad biking (personal observation). A gravel road bisects the project site to the north, traversing a wetland.

Impacts associated with current land use activities on the project site and surroundings include:

- Fragmentation of sensitive vegetation types and ecosystems as a result of industrial developments and infrastructure;
- Grassland/wetland habitat degradation through grazing by livestock;
- Fragmentation of sensitive aquatic ecosystems;
- Loss of threatened fauna species;
- Loss of protected fauna species;
- Loss of protected flora species;
- Hunting of wildlife on the project site; and
- IAP and weed proliferation and an increased source of regenerative/seed material.

Future development pressure

The project site is located within the Richards Bay Industrial Development Zone, an area earmarked for the future development of various industries. Impacts associated with these developments will probably be similar to impacts expected from the currently proposed project which include:

- The destruction of natural vegetation;
- The destruction of sensitive aquatic ecosystems;
- Habitat fragmentation;
- Post-disturbance proliferation of IAPs and weeds;
- Increase in noise and light pollution
- Soil pollution and sedimentation
- Soil erosion

The cumulative impacts identified for the currently proposed development have been described and assessed in terms of cumulative impact significance:

Cumulative impact 1: Cumulative impacts on regional and municipal conservation targets

Nature:

Most of the project site is located within the 'Endangered' Maputaland Wooded Grassland (Veg code CB 2) vegetation type, with small areas extending into the 'Vulnerable' Subtropical Freshwater wetland ecosystems (Veg code 76.1).

Provincial conservation targets for the Maputaland Woodland Grassland vegetation type has been set at 25%, however, only 17% is protected within the province, with an estimated 37 % of the original extent of this vegetation type remaining (eKZNw: KZN Targets, statistics and conservation status October 2011). Thus, further loss of this vegetation type could potentially affect the ability to meet provincial conservation targets.

Although vegetation on the project site within the Maputaland Wooded Grassland vegetation type is quite large (~ 65 ha), the area has been severely impacted on by past anthropogenic disturbance (Figure 27). The project site is effectively isolated from adjacent semi-natural patches by infrastructural developments such as roads and railway lines, and is therefore unlikely to contribute significantly to provincial conservation targets.

The 'Vulnerable' wetland ecosystems on the project site are approximately 3, 6 ha in extent. Similar to the Maputaland Wooded Grassland vegetation type, provincial conservation targets (24 %) for this vegetation type is not being met (areas currently protected = 15.3 %). Similar to the Maputaland Wooded Grassland vegetation type, further loss of this vegetation type could potentially affect the ability to meet provincial conservation targets.

Future developments within the Richards Bay Industrial Development Zone will further isolate the few natural/semi-natural areas still present. Although the Umhlathuze Land Use scheme has set aside several areas for conservation, these areas are relatively small in relation to current and anticipated developments, scattered across the landscape (such as those within the vicinity of the project site), with no corridors connecting several of the smaller conservation areas, thereby creating greater obstacles to migration and dispersal, and an increase in 'edge' effects. In urban areas, the main problems associated with an increase in edge effects includes the proliferation of IAPs and weeds, the presence of cats and dogs which may kill native birds, human damage such as litter, trampling or vandalism, and the diversion of rainwater. Consequently, these impacts may render the objective of conservation areas moot.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	2	3
Duration	5	5
Magnitude	4	8
Probability	4	4
Significance	**Medium (44)**	**High (64)**
Status (Positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Given the extent of current habitat transformation within these vegetation types, mitigation would be extremely difficult.	

Proposed mitigation measures:

Given that very large areas have already been transformed within this vegetation type, mitigation would be difficult. The extent of transformed areas within the Maputaland Vegetation type can be clearly seen in Google Earth (Figure 27).

It is strongly recommended that the appropriate regional and local authorities undertake a more strategic assessment to understand the cumulative impact of future industrial and other development on the sensitive biodiversity of the Maputaland Wooded Grassland and Subtropical Freshwater vegetation types. In this way the potential cumulative impacts can be identified and proactively managed at the appropriate planning level.

Mitigation measures such as the implementation of corridors that connect conservation areas might be considered. Strategically, the Richards Bay authorities should maintain corridors of remnant natural vegetation in the landscape which new developments must avoid and which would provide for increased ecosystem resilience.

Confidence in findings:
Moderate

FIGURE 26: Google Earth view of the historical extent of the Maputaland Wooded Grassland where the scale of habitat transformation is clearly visible.

Cumulative impact 2: Loss of SCC fauna and flora species

Nature:
The clearance of natural vegetation to accommodate infrastructure could lead to the destruction of SCC fauna and flora species. Not only are several SCC fauna and flora species confirmed to be present on the project site, similar studies within the Richards Bay Industrial Development Zone have confirmed the presence of several SCC flora species. Flora species such as *Crinum delagoense* (Declining), *Ledebouria ovatifolia* (SA endemic), *Boophane disticha*, *Hypoxis hemerocallidae*, *Eulophia speciosa* (all listed as Declining) and *Barringtonia racemose* (protected under the National Forest Act; Eco-Pulse, 2016, Exigent, 2017) could be affected. Within the broader RBIDZ, these and potentially other SCC fauna and flora species could be lost to future developments.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	4	4
Duration	5	5
Magnitude	6	8
Probability	2	3
Significance	**Medium (30)**	**Medium (51)**
Status (Positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Loss of resources?	Likely	Likely
Can impacts be mitigated?	The loss of Threatened fauna species is irreversible, but can be mitigated depending on specific circumstances. Loss of certain SCC flora species can be mitigated to an extent, depending on the life form of the plant.	

Proposed mitigation measures:

- Candidate biodiversity offset sites with similar habitat structure and ecological functioning are currently being investigated to fully compensate for the loss of wetland habitat on the project site. Finalisation of candidate biodiversity offset areas prior to vegetation clearance and construction are required.
- Mitigation measures such as ongoing education of employees on the value of biodiversity conservation.
- All new developments should be subjected to a rigorous environmental impact assessment, where applicable.

Confidence in findings:
Moderate

12.4 ENVIRONMENTAL MANAGEMENT PROGRAM (EMPr)

An Environmental Management Program (EMPr) for the proposed development is required in terms of Section 2 and Section 28 of the National Environmental Management Act (1998). The EMPr tends to become a legally binding document on the applicant as a condition of approval of the Project by the Department of Environment Affairs, in addition to other conditions that may be stipulated in the Environmental Authorisation.

The aim of an EMPr is to facilitate appropriate environmental controls during all phases of the project to minimise environmental damage arising from implementation of the project during the construction and operation phases. To achieve this, the EMPr must make recommendations for the planning and design (pre-construction/design phase), specify the limitations the contractor must abide by during construction, detail the issues that should be taken cognisance of and indicate specific actions that must be undertaken so as to ensure that the environment is not unnecessarily damaged. The EMPr therefore specifies the framework within which the contractor must carry out operations. Management and monitoring measures for the operation phase are also included to provide environmental guidance for the lifetime of the Development.

In addition, the EMPr provides a clear indication of the responsibilities for environmental management requirements by each of the role players involved in the construction and operation phases of the Development. Guidance for the implementation of the EMPr is provided, including the compilation of method statements which are required to be

implemented to achieve compliance with the Environmental Specifications. Corrective actions in the event of non-compliance with the EMPr are also defined.

Specialist ecological impact mitigation measures for inclusion in the EMPr are outlined below:

OBJECTIVE: Protection of sensitive ecosystems

PROJECT COMPONENT/S	Infrastructure
POTENTIAL IMPACTS	• Loss of sensitive aquatic ecosystems • Loss of SCC fauna species
ACTIVITY/RISK SOURCE	• Vegetation clearance • Site access: moving vehicles; machinery • Use and storage of plant machinery
MITIGATION: TARGET/OBJECTIVE	To ensure that the final project design responds to the identified environmental sensitivities; protection of environmentally sensitive areas.Finalisation of candidate biodiversity offset areas for the protection of wetland dependent fauna species and ecosystems.

MITIGATION: ACTION/CONTROL	RESPONSIBILITY	TIMEFRAME
Finalisation of candidate biodiversity offset areas.	Eskom	Planning & Design phase
Search and rescue of SCC flora species:		Pre-construction phase
The identification of SCC flora species on the site during a final walkthrough.	Ecological/Botanical Specialist consultant; ECO	Pre-construction
The identification of SCC flora species and areas suitable for translocation.	Ecological/Botanical Specialist consultant; ECO	Pre-construction
Acquire permit authorsation from eKZNw and DAFF for the removal of protected tree species.	Eskom, Contractor	Pre-construction
Acquire permit authorisation from eKZNw for the translocation of plants. Monitoring of translocated plants as set out in Appendix 7.	ECO, Contractor	Construction & operation phases
Laydown and storage areas to be located away from no-go areas as far as possible.	Contractor	Pre-construction & Construction phase
Development of a stormwater management plan for the site.	Contractor	Pre-construction phase
The provision of adequate sanitation and ablution facilities for all employees.	Contractor	Pre- construction & construction phases
Implementation of an IAPs and weeds eradication/control plan (Guidelines provided in Appendix 8).	Contractor, Environmental Manager, ECO	Pre-construction, construction, operational phases
Monitoring of the implementation of the recommended mitigation measures as set out in the EIA report.	ECO, Environmental Manager	Pre-construction & construction phases

PERFORMANCE INDICATOR	New proposed layout does not destroy/degrade no-go areas. No disturbance of no-go areas
MONITORING	ECO to ensure that the facility layout meets the objectives and implements the proposed mitigation measures as set out in the EIA report.

OBJECTIVE: Loss/disturbance of local fauna populations

PROJECT COMPONENT/S	Infrastructure Development
POTENTIAL IMPACTS	• Fauna mortalities • Disturbance of the local fauna populations • Loss of SCC fauna species
ACTIVITY/RISK SOURCE	• Vegetation clearance • Site access: Moving vehicles, machinery. • Human disturbance caused by construction activities • Poaching • Inadvertent killing of fauna species by moving machinery
MITIGATION: TARGET/OBJECTIVE	Protection of SCC and local fauna species

MITIGATION: ACTION/CONTROL	RESPONSIBILITY	TIMEFRAME
Vegetation clearance to start in the dry season, if possible.	Contractor	Pre-construction
Prior to land clearance, the area should be investigated again for the presence of fauna species and relocated in the appropriate habitat away from the site.	Ecologist, ECO	Pre-construction
The implementation of mitigation measures as set out in the EIA report to reduce harm to local fauna populations, specifically those as set out in the Construction Phase impact assessment (Section 12.1 of this report).	Contractor, Environmental Manager, ECO	Duration of the contract
Access to adjacent conservation areas to be strictly controlled.	Contractor	Pre-construction
No dumping of any cleared vegetation, topsoil, rubble, and general waste in conservation areas.	Contractor	Duration of the contract
Adequate waste containers to be placed in a designated area. These containers need to be covered to prevent the pollution of adjacent areas by windblown rubbish. Waste to be removed at regular intervals. Frequency will depend on the amount of waste generated.	Contractor	Duration of the contract
Open excavations to be inspected for the presence of fauna species. Should any be present, it must be relocated away from the site to a suitable location.	Contractor, Environmental Manager, ECO	Daily for the duration of the construction phase.
No killing and poaching of any wild animal to be allowed. This should be clearly communicated to all employees, including subcontractors.	Contractor, Environmental Manager, ECO	Duration of the contract

PERFORMANCE INDICATOR	No loss of SCC fauna species. No disturbance of local fauna populations.
MONITORING	ECO to ensure that the proposed mitigation measures as set out in the EIA report is implemented.

13. DISCUSSION

A terrestrial ecological survey was undertaken to inform the Environmental Impact Assessment being conducted for the proposed development of a 3000 MW Combined Cycle Power Plant (CCPP) on Erven 4/11376 and 2/11376 in Richards Bay, KwaZulu-Natal (KZN) Province.

The proposed development is to be located within fragmented and previously transformed Maputaland Wooded Grassland (EN) and Subtropical Freshwater Wetlands (VU) major vegetation types. The project site was found to be dominated by four local vegetation communities, i.e. *Imperata cylindrica – Syzygium cordatum* wooded grassland, *Helichrysum kraussii – Parinari capensis shrubland*, Wetlands and wetland ecotones and Low-lying hygrophilous grassland. Most of the plant species identified within these vegetation communities are locally common species of Least Concern.

The vegetation of *the Imperata cylindrica – Syzygium cordatum* wooded grassland, *Helichrysum kraussii – Parinari capensis* scrubland and Low-lying hygrophilous grassland local vegetation communities was determined to be degraded, with ~ 8 % of species sampled regarded as important floristic elements of Maputaland Wooded Grassland by Mucina & Rutherford (2006). Composition of the reference vegetation type has been modified by deforestation of woodland tree species, grazing and an increase in the pioneer species *Helichrysum kraussii* and *Dichrostachys cinerea.*

Based on the habitat sensitivity assessment methodology, these areas are considered to be of low ecological significance since the distribution of these species are not limited to the project site, the project site has been isolated by past anthropogenic disturbance, has not locally been recognised as an area of conservation importance and future industrial developments are earmarked on surrounding areas.

Nonetheless, small areas within these vegetation communities harbour provincially and nationally protected flora species. Removal/destruction/translocation of these species will be subject to permit authorisation from eKZNw and DAFF.

The highly transformed nature of these habitats resulting from historical and current disturbances, coupled to its isolated nature with regards to adjacent vegetation communities means that there should be no objections to this proposed development on areas historically covered by the Maputaland Wooded Grassland major vegetation type. What natural vegetation remains is highly disturbed by past impacts relating to the construction of linear infrastructure on surrounding areas, deforestation of wooded areas and grazing pressure which is contributing to the invasion of *Helichrysum krausii* and *Dichrostachys cinerea* on large portions of the project site.

The Wetlands and wetland ecotone community are regarded as of high ecological value, with ~ 25 % of flora species sampled regarded as important floristic elements of the Subtropical Freshwater Wetlands vegetation type (Mucina & Rutherford, 2006). In addition, the presence of three wetland dependent SCC fauna species were confirmed i.e. *Crocidura mariquensis* (NT), *Hemisus guttatus* (VU) and *Hyperolius microps* (range restricted). Currently there are no specific conservation measures in place for the 'Near Threatened' shrew species *Crocidura mariquensis*. The main intervention for this species is thus the protection of rank vegetation around wetlands and surrounding areas by retaining and maintaining buffer strips of natural vegetation.

The current biodiversity offset area located to the north of the project site does not offer suitable habitat to wetland dependent fauna species present on the project site. Consequently, candidate offset sites, with similar habitat structure and ecological functioning are currently being investigated as a means to fully compensate for the loss of habitat of wetland dependent SCC fauna species.

The significance of the potential construction related impacts before mitigation range from High – Medium, with the loss/displacement of local fauna populations and sensitive aquatic ecosystems being the most significant. However, with the implementation of the proposed mitigation measures and adequate impact management many of the impacts can be reduced to acceptable levels.

Cumulative impacts on regional and municipal conservation targets and loss of SCC fauna and flora species and range from Medium to Highly significant based on the threat status and irreplaceability of the Maputaland Wooded Grassland and Subtropical Freshwater wetland vegetation types, the presence of SCC fauna and flora species.

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APPENDIX 1: Development implications for areas with Red Listed plant species (after Raimondo *et al.*, 2009).

Critically Endangered (CR):

Implications for development: RED LIST SPECIES: No further loss of natural habitat should be permitted as the species is on the verge of extinction. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Endangered (EN):

Implications for development: RED LIST SPECIES:

Case A: If the species has a restricted range (EOO < 2 000 km^2), recommend no further loss of habitat. If range size is larger, the species is possibly long- lived but widespread, and limited habitat loss may be considered under certain circumstances, such as the implementation of an offset whereby another viable, known subpopulation is formally conserved in terms of the National Environmental Management: Protected Areas Act (Act 57 of 2003), and provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.

Case B, C, D: No further loss of habitat should be permitted as the species is likely to go extinct in the near future if current pressures continue. All remaining subpopulations have to be conserved if this species is to survive in the long term.

Vulnerable (VU):

Implications for development: RED LIST SPECIES:

Case D: This species either constitutes less than 1 000 individuals or is known from a very restricted range. No further loss of habitat should be permitted as the species' status will immediately become either Critically Endangered or Endangered, should habitat be lost. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Case B, C: The species is approaching extinction but there are still a number of subpopulations in existence. Recommend no further loss of habitat as this will increase the extinction risk of the species.

Case A: If the species has a restricted range, EOO < 2 000 km^2, recommend no further loss of habitat. If range size is larger, the species is possibly long-lived but widespread, and limited habitat loss may be considered under certain circumstances, such as the implementation of an offset whereby another viable, known subpopulation is formally conserved in terms of the Protected Areas Act, and provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.

Near Threatened (NT):

Implications for development: ORANGE LIST SPECIES:

Case D: Currently known from fewer than 10 locations, therefore preferably recommend no loss of habitat. Should loss of this species' habitat be considered, then an offset that includes conserving another viable subpopulation (in terms of the Protected Areas Act) should be implemented, provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Case B, C: The species is approaching thresholds for listing as threatened but there are still a number of subpopulations in existence and therefore there is need to minimise loss of habitat. Conservation of subpopulations is essential if they occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.

Case A: If the species has a restricted range, EOO < 2 000 km^2, then recommend no further loss of habitat. If range size is larger, the species is possibly long-lived but widespread, and limited habitat loss may be considered. Conservation of subpopulations is essential if they occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant biodiversity conservation plan or (iii) on a site associated with additional ecological sensitivities.

Critically Rare:

Implications for development: ORANGE LIST SPECIES: This is a highly range-restricted species, known from single or isolated sites, and therefore no loss of habitat should be permitted as it may lead to extinction of the species. The Threatened Species Programme is not aware of any current threats to this species and should be notified without delay. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Rare:

Implications for development: ORANGE LIST SPECIES: The species is likely to have a restricted range, or be highly habitat specific, or have small numbers of individuals, all of which makes it vulnerable to extinction should it lose habitat. Recommend no loss of habitat. The Threatened Species Programme is not aware of any current threats to this species and should be notified without delay. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Declining:

Implications for development: ORANGE LIST SPECIES: The species is declining but the population has not yet reached a threshold of concern; limited loss of habitat may be permitted. Should the species be known to be used for traditional medicine and if individuals will not be conserved in situ, plants should be rescued and used as mother stock for medicinal plant cultivation programmes.

Data Deficient - Insufficient Information (DDD)

Implications for development: ORANGE LIST SPECIES:

Case D: This species is very poorly known, with insufficient information on its habitat, population status or distribution to assess it. However, it is highly likely to be threatened. If a Data Deficient species will be affected by a proposed activity, the subpopulation should be well surveyed and the data sent to the Threatened Species Programme. The species will be reassessed and the new status of the species, with a recommendation, will be provided within a short timeframe. The Threatened Species Programme must be informed immediately, providing details of the location, size and threats to the subpopulation.

Case T: There is uncertainty regarding the taxonomic status of this species, but it is likely to be threatened. Contact the taxonomist working on this group to resolve its taxonomic status; the species will then be reassessed by the Threatened Species Programme.

Data Deficient - Taxonomically Problematic (DDT):

Implications for development: GREEN LIST SPECIES: Implications for development: GREEN LIST SPECIES: Development is not expected to affect the conservation status of this species. Species removal may still be subject to provincial or national legislation.

APPENDIX 2: A checklist of mammal species for the QDGS 2831DD.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS			
		NATIONAL RED LIST CATEGORY (2016)	NEMBA (2015)	KZN-EBPA (2014)	CITES LISTING
African mole-rat	*Cryptomys hottentotus*	LC			
African striped weasel	*Poecilogale albinucha*	NT		Sched 3	
Angolan free-tailed bat	*Mops condylurus*	LC			
Banana bat	*Neoromicia nana*	LC			
Banded mongoose	*Mungos mungo*	LC		Sched 3	
Botswana long-eared bat	*Laephotis botswanae*	LC		Sched 3	
Brants'climbing mouse	*Dendromus mesomelas*	LC			
Cape serotine	*Neoromicia capensis*	LC			
Chestnut climbing mouse	*Dendromus mystacalis*	LC			
Dusky pipistrelle	*Pipistrellus hesperidus*	LC			
Egyptian free-tailed bat	*Tadarida aegyptiaca*	LC			
Egyptian slit-faced bat	*Nycteris thebaica*	LC			
Greater dwarf shrew	*Suncus lixus*	LC			
Greater red musk shrew	*Crocidura flavescens*	LC			
Green house bat	*Scotophilus viridis*	LC			
Grey climbing mouse	*Dendromus melanotis*	LC			
Hairy slit-faced bat	*Nycteris hispida*	LC		Sched 3	
Highveld gerbil	*Gerbilliscus brantsii*	LC			
Hottentot golden mole	*Amblysomus hottentotus*	LC			
Krebs's fat mouse	*Steatomys krebsii*	LC			
Laminate vlei rat	*Otomys laminatus*	NT			
Large-eared slit-faced bat	*Nycteris macrotis*	LC			
Large-spotted genet	*Genetta tigrina*	LC			
Least dwarf shrew	*Suncus infinitesimus*	LC			
Lesser dwarf shrew	*Suncus varilla*	LC			
Lesser grey-brown musk shrew	*Crocidura silacea*	LC			
Lesser red musk shrew	*Crocidura hirta*	LC			
Little free-tailed bat	*Chaerephon pumilus*	LC			
Marsh mongoose	*Atilax paludinosus*	LC			
Mauritian tomb bat	*Taphozous mauritianus*	LC			
Natal multimammate mouse	*Mastomys natalensis*	LC			
Percival's short-eared trident bat	*Cloeotis percivali*	EN		Sched 3	
Peters's epauletted fruit bat	*Epomophorus crypturus*	LC			
Pygmy mouse	*Mus minutoides*	LC			
Reddish-grey musk shrew	*Crocidura cyanea*	LC			
Sclater's forest shrew	*Myosorex sclateri*	VU		Sched 3	
Scrub hare	*Lepus saxatillis*	LC			
Slender mongoose	*Herpestes sanguineus*	LC			
Swamp musk shrew	*Crocidura mariquensis*	NT			
Tete veld rat	*Aethomys ineptus*	LC			
Thomas's house bat	*Scotoecus albofuscus*	NT		Sched 3	
Variegated butterfly bat	*Glauconycteris variegata*	LC		Sched 3	
Vervet monkey	*Chlorocebus pygerythrus*	LC		Sched 3	II
Vlei rat	*Otomys irroratus*	LC			
Wahlberg's epauletted fruit bat	*Epomophorus wahlbergi*	LC		Sched 3	
White-tailed mouse	*Mystromys albicaudatus*	VU		Sched 3	
Woodland dormouse	*Graphiurus murinus*	LC			
Yellow-bellied house bat	*Scotophilus dinganii*	LC		Sched 3	

APPENDIX 3: A checklist of herpetofauna species for the QDGS 2831DD.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
		RED LIST CATEGORY (SARCA 2014)	NEMBA (2015)	KZN-EBPA (2014)
Reptiles				
Black file snake	*Gonionotophis nyassae*	LC		
Black-headed Centipede-eater	*Aparallactus capensis*	LC		
Boomslang	*Dispholidus typus typus*	LC		
Brown house snake	*Boaedon capensis*	LC		
Brown water snake	*Lycodonomorphus rufulus*	LC		
Cape wolf snake	*Lycophidion capense capense*	LC		
Common dwarf gecko	*Lygodactylus capensis capensis*	LC		
Common file snake	*Gonionotophis capensis capensis*	LC		
Common Flap-neck Chameleon	*Chamaeleo dilepis dilepis*	LC		
Common Purple-glossed Snake	*Amblyodipsas polylepis polylepis*	LC		
Common tropical house gecko	*Hemidactylus mabouia*	LC		
Eastern coastal skink	*Trachylepis depressa*	LC		
Eastern natal green snake	*Philothamnus natalensis natalensis*	LC		
Giant legless skink	*Acontias plumbeus*	LC		
Mozambique spitting cobra	*Naja mossambica*	LC		
Nile crocodile	*Crocodylus niloticus*	VU	VU	Sched 3
Olive grass snake	*Psammophis mossambicus*	LC		
Olive house snake	*Lycodonomorphus inornatus*	LC		
Red-lipped Snake	*Crotaphopeltis hotamboeia*	LC		
Rhombic Egg-eater	*Dasypeltis scabra*	LC		
Rhombic night adder	*Causus rhombeatus*	LC		
Snouted cobra	*Naja annulifera*	LC		
South eastern green snake	*Philothamnus hoplogaster*	LC		
Southern tree agama	*Acanthocercus atricollis atricollis*	LC		
Southern twig snake	*Thelotornis capensis capensis*	LC		
Spotted bush snake	*Philothamnus semivariegatus*	LC		
Striped skink	*Trachylepis striata*	LC		
Variable hinged terrapin	*Pelusios rhodesianus*	LC		
Variable skink	*Trachylepis varia*	LC		
Variegated Slug-eater	*Duberria variegata*	LC		
Wahlberg's Snake-eyed Skink	*Panaspis wahlbergii*	LC		
Water monitor	*Varanus niloticus*	LC		Sched 3
Pondo flat gecko	*Afroedura pondolia*	LC		
Wahberg's velvet gecko	*Homopholis wahlbergii*	LC		
Spotted gecko	*Pachydactylus maculatus*	LC		
Van Son's thick-toed gecko	*Pachydactylus vansoni*	LC		
Delalande's sandveld lizard	*Nucras lalandii*	LC		
Cape grass lizard	*Chamaesaura anguina anguina*	LC		
Large-scaled grass lizard	*Chamaesaura macrolepis*	NT		
Common girdled lizard	*Cordylus vittifer*	LC		
Yellow-throated plated lizard	*Gerrhosaurus flavigularis*	LC		
Eastern long-tailed seps	*Tetradactylus africanus*	LC		
Cape skink	*Trachylepis capensis*	LC		
Rainbow skink	*Trachylepis margaritifer*	LC		
Mozambique dwarf burrowing skink	*Scelotes mossambicus*	LC		
Southern rock monitor	*Varanus albigularis albigularis*	LC		Sched 3
Umlalazi dwarf chameleon	*Bradypodion caeruleogula*	EN		
Distant's ground agama	*Agama aculeata distanti*	LC		
COMMON NAME	**SCIENTIFIC NAME**	**RED LIST CATEGORY (SAFAP 2004)**	**NEMBA (2015)**	**KZN-EBPA (2014)**
Frogs				
African bull frog	*Pyxicephalus edulis*	LC		
Argus reed frog	*Hyperolius argus*	LC		
Banded rubber frog	*Phrynomantis bifasciatus*	LC		

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
		RED LIST CATEGORY (SARCA 2014)	NEMBA (2015)	KZN-EBPA (2014)
Broadbanded grass frog	*Ptychadena mossambica*	LC		
Brownbacked tree frog	*Leptopelis mossambicus*	LC		
Bubbling kassina	*Kassina senegalensis*	LC		
Bush squeaker	*Arthroleptis wahlbergi*	LC		
Bushveld rain frog	*Breviceps adspersus*	LC		
Clicking stream frog	*Strongylopus grayii*	LC		
Common platanna	*Xenopus laevis*	LC		
Delalande's river frog	*Amietia delalandii*	LC		
Delicate Leaf-folding Frog	*Afrixalus delicates*	LC		
Dwarf puddle frog	*Phrynobatrachus mababiensis*	LC		
Greater Leaf-folding Frog	*Afrixalus fornasinii*	LC		
Guttural toad	*Sclerophrys gutturalis*	LC		
Mozambique rain frog	*Breviceps mossambicus*	LC		
Natal Leaf-folding Frog	*Afrixalus spinifrons*	VU		Sched 3
Natal sand frog	*Tomopterna natalensis*	LC		
Olive toad	*Sclerophrys garmani*	LC		
Painted reed frog	*Hyperolius marmoratus*	LC		
Pickersgill's reed frog	*Hyperolius pickersgilli*	EN		Sched 3
Plain grass frog	*Ptychadena anchietae*	LC		
Red toad	*Schismaderma carens*	LC		
Redlegged kassina	*Kassina maculate*	LC		
Sharp-headed Long Reed Frog	*Hyperolius microps*	LC		
Sharpnosed grass frog	*Ptychadena oxyrhynchus*	LC		
Shovel-footed Squeaker	*Arthroleptis stenodactylus*	LC		
Snoring puddle frog	*Phrynobatrachus natalensis*	LC		
Southern foam nest frog	*Chiromantis xerampelina*	LC		
Spotted Shovel-nosed Frog	*Hemisus guttatus*	VU		Sched 3
Stiped caco	*Cacosternum striatum*	DD		
Striped grass frog	*Ptychadena porosissima*	LC		
Striped stream frog	*Strongylopus fasciatus*	LC		
Tinker reed frog	*Hyperolius tuberilinguis*	LC		
Tremelo sand frog	*Tomopterna cryptotis*	LC		
Water lily frog	*Hyperolius pusillus*	LC		
Whistling rain frog	*Breviceps sopranus*	DD		
Yellowstriped reed frog	*Hyperolius semidiscus*	LC		

APPENDIX 4: A checklist of bird species for the pentads 2845_3155; 2850_3155; 2850_3200.

	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
			IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
	Apalis Rudd's	*Apalis ruddi*			Sched 3
	Apalis Yellow-breasted	*Apalis flavida*			
	Apalis Bar-throated	*Apalis thoracica*			
	Avocet Pied	*Recurvirostra avosetta*			
	Barbet Black-collared	*Lybius torquatus*			
	Barbet White-eared	*Stactolaema leucotis*			
	Barbet Crested	*Trachyphonus vaillantii*			
	Batis Cape	*Batis capensis*			
	Batis Chinspot	*Batis molitor*			
	Bee-eater Blue-cheeked	*Merops persicus*			
	Bee-eater White-fronted	*Merops bullockoides*			
	Bee-eater Little	*Merops pusillus*			
	Bee-eater European	*Merops apiaster*			
	Bishop Southern Red	*Euplectes orix*			
	Bishop Yellow-crowned	*Euplectes afer*			Sched 3
	Bittern Little	*Ixobrychus minutus*			Sched 3
	Boubou Southern	*Laniarius ferrugineus*			
	Brownbul Terrestrial	*Phyllastrephus terrestris*			
	Brubru	*Nilaus afer*			
	Bulbul Dark-capped	*Pycnonotus tricolor*			
	Bunting Cinnamon-breasted	*Emberiza tahapisi*			Sched 3
	Bunting Golden-breasted	*Emberiza flaviventris*			Sched 3
	Bush-shrike Orange-breasted	*Telophorus sulfureopectus*			
	Bush-shrike Olive	*Telophorus olivaceus*			
	Bush-shrike Gorgeous	*Telophorus quadricolor*			
	Bush-shrike Grey-headed	*Malaconotus blanchoti*			
	Bustard Black-bellied	*Lissotis melanogaster*			Sched 3
	Bustard Denham's	*Neotis denhami*		VU	Sched 3/ Protected
	Buttonquail Kurrichane	*Turnix sylvaticus*			Sched 3
*	**Buzzard Jackal**	*Buteo rufofuscus*			Sched 3
	Buzzard Steppe	*Buteo vulpinus*			Sched 3
	Buzzard Lizard	*Kaupifalco monogrammicus*			Sched 3
	Camaroptera Green-backed	*Camaroptera brachyura*			
	Canary Cape	*Serinus canicollis*			Sched 3
	Canary Yellow-fronted	*Crithagra mozambicus*			
	Canary Brimstone	*Crithagra sulphuratus*			Sched 3
	Chat Familiar	*Cercomela familiaris*			
	Cisticola Zitting	*Cisticola juncidis*			
	Cisticola Rattling	*Cisticola chiniana*			
	Cisticola Red-faced	*Cisticola erythrops*			
	Cisticola Croaking	*Cisticola natalensis*			
	Cisticola Lazy	*Cisticola aberrans*			
	Cisticola Rufous-winged	*Cisticola galactotes*			
	Coot Red-knobbed	*Fulica cristata*			
	Cormorant White-breasted	*Phalacrocorax carbo*			
	Cormorant Reed	*Phalacrocorax africanus*			
	Cormorant Cape	*Phalacrocorax capensis*	EN/EN		
	Coucal Burchell's	*Centropus burchellii*			
	Coucal White-browed	*Centropus superciliosus*			
	Courser Bronze-winged	*Rhinoptilus chalcopterus*			
	Crake Baillon's	*Porzana pusilla*			
	Crake Black	*Amaurornis flavirostris*			
	Crane Grey Crowned	*Balearica regulorum*	EN/EN	EN	EN/ Sched 3

	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
			IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
	Crested-flycatcher Blue-mantled	*Trochocercus cyanomelas*			
	Crombec Long-billed	*Sylvietta rufescens*			
	Crow Pied	*Corvus albus*			
	Crow Cape	*Corvus capensis*			
	Crow House	*Corvus splendens*			
	Cuckoo Red-chested	*Cuculus solitarius*			
	Cuckoo Klaas's	*Chrysococcyx klaas*			
	Cuckoo Diderick	*Chrysococcyx caprius*			
	Cuckoo Black	*Cuculus clamosus*			
	Cuckoo Jacobin	*Clamator jacobinus*			
	Cuckoo African Emerald	*Chrysococcyx cupreus*			
	Cuckoo-shrike Black	*Campephaga flava*			
	Curlew Eurasian	*Numenius arquata*	NT/NT		
	Darter African	*Anhinga rufa*			
	Dove Red-eyed	*Streptopelia semitorquata*			
	Dove Laughing	*Streptopelia senegalensis*			
	Dove Namaqua	*Oena capensis*			Sched 3
	Dove Tambourine	*Turtur tympanistria*			Sched 3
	Dove Lemon	*Aplopelia larvata*			Sched 3
	Dove Rock	*Columba livia*			
	Drongo Fork-tailed	*Dicrurus adsimilis*			
	Drongo Square-tailed	*Dicrurus ludwigii*			
	Duck Yellow-billed	*Anas undulata*			
	Duck White-faced	*Dendrocygna viduata*			
	Duck White-backed	*Thalassornis leuconotus*			Sched 3
	Duck African Black	*Anas sparsa*			Sched 3
	Duck Fulvous	*Dendrocygna bicolor*			
	Eagle Long-crested	*Lophaetus occipitalis*			Sched 3
	Eagle African Crowned	*Stephanoaetus coronatus*	VU/NT		Sched 3
	Eagle-owl Spotted	*Bubo africanus*			Sched 3
	Egret Great	*Egretta alba*			Sched 3
	Egret Little	*Egretta garzetta*			Sched 3
	Egret Yellow-billed	*Egretta intermedia*			Sched 3
	Egret Cattle	*Bubulcus ibis*			Sched 3
	Falcon Lanner	*Falco biarmicus*	VU/LC		Sched 3
	Falcon Peregrine	*Falco peregrinus*			Sched 3
	Falcon Amur	*Falco amurensis*			Sched 3
	Finfoot African	*Podica senegalensis*	VU/LC		VU/ Sched 3
	Firefinch African	*Lagonosticta rubricata*			Sched 3
	Firefinch Red-billed	*Lagonosticta senegala*			Sched 3
	Fiscal Common (Southern)	*Lanius collaris*			
	Fish-eagle African	*Haliaeetus vocifer*			
	Flamingo Greater	*Phoenicopterus ruber*	NT/LC		Sched 3
	Flamingo Lesser	*Phoenicopterus minor*	NT/NT		Sched 3
	Flufftail Buff-spotted	*Sarothrura elegans*			Sched 3
	Flycatcher Spotted	*Muscicapa striata*			
	Flycatcher African Dusky	*Muscicapa adusta*			
	Flycatcher Ashy	*Muscicapa caerulescens*			
	Flycatcher Southern Black	*Melaenornis pammelaina*			
(*)	**Flycatcher Fiscal**	*Sigelus silens*			
	Flycatcher Pale	*Bradornis pallidus*			
	Gannet Cape	*Morus capensis*			
	Godwit Bar-tailed	*Limosa lapponica*			
	Goose Spur-winged	*Plectropterus gambensis*			
	Goose Egyptian	*Alopochen aegyptiacus*			
	Goshawk African	*Accipiter tachiro*			Sched 3

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
		IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
Grebe Little	*Tachybaptus ruficollis*			
Greenbul Yellow-bellied	*Chlorocichla flaviventris*			
Greenbul Sombre	*Andropadus importunus*			
Green-pigeon African	*Treron calvus*			
Greenshank Common	*Tringa nebularia*			
Ground-thrush Spotted	*Zoothera guttata*			
Guineafowl Helmeted	*Numida meleagris*			
Guineafowl Crested	*Guttera edouardi*			Sched 3
Gull Kelp	*Larus dominicanus*			
Gull Grey-headed	*Larus cirrocephalus*			
Gull Hartlaub's	*Larus hartlaubii*			
Hamerkop Hamerkop	*Scopus umbretta*			Sched 3
Harrier-Hawk African	*Polyboroides typus*			Sched 3
Hawk African Cuckoo	*Aviceda cuculoides*			Sched 3
Heron Grey	*Ardea cinerea*			Sched 3
Heron Black-headed	*Ardea melanocephala*			Sched 3
Heron Goliath	*Ardea goliath*			Sched 3
Heron Purple	*Ardea purpurea*			Sched 3
Heron Squacco	*Ardeola ralloides*			Sched 3
Heron Green-backed	*Butorides striata*			Sched 3
Heron Black	*Egretta ardesiaca*			Sched 3
Hobby Eurasian	*Falco subbuteo*			
Honeybird Brown-backed	*Prodotiscus regulus*			
Honey-buzzard European	*Pernis apivorus*			
Honeyguide Greater	*Indicator indicator*			
Honeyguide Scaly-throated	*Indicator variegatus*			
Honeyguide Lesser	*Indicator minor*			
Hoopoe African	*Upupa africana*			
Hornbill Trumpeter	*Bycanistes bucinator*			
House-martin Common	*Delichon urbicum*			
Ibis African Sacred	*Threskiornis aethiopicus*			
Ibis Hadeda	*Bostrychia hagedash*			
Ibis Glossy	*Plegadis falcinellus*			
Indigobird Dusky	*Vidua funerea*			
Indigobird Village	*Vidua chalybeata*			
Jacana African	*Actophilornis africanus*			Sched 3
Jacana Lesser	*Microparra capensis*	VU/LC		Sched 3
Kingfisher Pied	*Ceryle rudis*			
Kingfisher Giant	*Megaceryle maximus*			
Kingfisher Malachite	*Alcedo cristata*			
Kingfisher Mangrove	*Halcyon senegaloides*	EN/LC		VU/ Sched 3
Kingfisher Brown-hooded	*Halcyon albiventris*			
Kingfisher Striped	*Halcyon chelicuti*			
Kingfisher Half-collared	*Alcedo semitorquata*	NT/LC		Sched 3
Kite Yellow-billed	*Milvus aegyptius*			
Kite Black-shouldered	*Elanus caeruleus*			Sched 3
Kite Black	*Milvus migrans*			Sched 3
Knot Red	*Calidris canutus*	LC/NT		
Lapwing Crowned	*Vanellus coronatus*			
Lapwing Blacksmith	*Vanellus armatus*			
Lapwing African Wattled	*Vanellus senegallus*			
Lapwing Black-winged	*Vanellus melanopterus*			Sched 3
Lark Rufous-naped	*Mirafra africana*			
Lark Sabota	*Calendulauda sabota*			
Longclaw Cape	*Macronyx capensis*			
Longclaw Yellow-throated	*Macronyx croceus*			

	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
			IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
	Malkoha Green	*Ceuthmochares australis*			
	Mannikin Bronze	*Spermestes cucullatus*			
	Mannikin Red-backed	*Spermestes bicolor*			Sched 3
	Marsh-harrier African	*Circus ranivorus*			
	Martin Rock	*Hirundo fuligula*			
	Martin Sand	*Riparia riparia*			
	Martin Brown-throated	*Riparia paludicola*			
	Martin Banded	*Riparia cincta*			
	Masked-weaver Lesser	*Ploceus intermedius*			
	Masked-weaver Southern	*Ploceus velatus*			
	Moorhen Common	*Gallinula chloropus*			
	Mousebird Speckled	*Colius striatus*			
	Mousebird Red-faced	*Urocolius indicus*			
	Myna Common	*Acridotheres tristis*			
	Neddicky Neddicky	*Cisticola fulvicapilla*			
	Nicator Eastern	*Nicator gularis*			
	Night-Heron Black-crowned	*Nycticorax nycticorax*			
	Nightjar European	*Caprimulgus europaeus*			
	Nightjar Fiery-necked	*Caprimulgus pectoralis*			
	Nightjar Square-tailed	*Caprimulgus fossii*			
	Olive-pigeon African	*Columba arquatrix*			
	Openbill African	*Anastomus lamelligerus*			Sched 3
	Oriole Eurasian Golden	*Oriolus oriolus*			
	Oriole Black-headed	*Oriolus larvatus*			
	Osprey Osprey	*Pandion haliaetus*			Sched 3
	Owl Barn	*Tyto alba*			Sched 3
	Owl Marsh	*Asio capensis*			Sched 3
	Painted-snipe Greater	*Rostratula benghalensis*	NA/NT		Sched 3
	Palm-swift African	*Cypsiurus parvus*			
	Paradise-flycatcher African	*Terpsiphone viridis*			
	Pelican Great White	*Pelecanus onocrotalus*	VU/LC		
	Pelican Pink-backed	*Pelecanus rufescens*	VU/LC		
	Petronia Yellow-throated	*Petronia superciliaris*			
	Pigeon Speckled	*Columba guinea*			
	Pipit African	*Anthus cinnamomeus*			
	Plover Common Ringed	*Charadrius hiaticula*			
	Plover White-fronted	*Charadrius marginatus*			
	Plover Kittlitz's	*Charadrius pecuarius*			
	Plover Three-banded	*Charadrius tricollaris*			
	Plover Grey	*Pluvialis squatarola*			
	Plover Lesser Sand	*Charadrius mongolus*			
	Plover Greater Sand	*Charadrius leschenaultii*			
	Pochard Southern	*Netta erythrophthalma*			
	Pratincole Collared	*Glareola pratincola*			Sched 3
	Prinia Tawny-flanked	*Prinia subflava*			
	Puffback Black-backed	*Dryoscopus cubla*			
	Pygmy-Goose African	*Nettapus auritus*	VU/LC		
	Pygmy-Kingfisher African	*Ispidina picta*			
	Quail Common	*Coturnix coturnix*			
	Quailfinch African	*Ortygospiza atricollis*			Sched 3
	Quelea Red-billed	*Quelea quelea*			
	Quelea Red-headed	*Quelea erythrops*			
	Rail African	*Rallus caerulescens*			
	Reed-warbler Great	*Acrocephalus arundinaceus*			
	Reed-warbler African	*Acrocephalus baeticatus*			
SLS	**Robin-chat Chorister**	*Cossypha dichroa*			
	Robin-chat Red-capped	*Cossypha natalensis*			

	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
			IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
	Robin-chat Cape	*Cossypha caffra*			
	Roller European	*Coracias garrulus*	NT/LC		
	Roller Broad-billed	*Eurystomus glaucurus*			
	Ruff Ruff	*Philomachus pugnax*			
	Rush-warbler Little	*Bradypterus baboecala*			
	Sanderling Sanderling	*Calidris alba*			
	Sandpiper Curlew	*Calidris ferruginea*	LC/NT		
	Sandpiper Common	*Actitis hypoleucos*			
	Sandpiper Marsh	*Tringa stagnatilis*			
	Sandpiper Wood	*Tringa glareola*			
	Sandpiper Terek	*Xenus cinereus*			
	Saw-wing Black (Southern race)	*Psalidoprocne holomelaena*			
	Scrub-robin White-browed	*Cercotrichas leucophrys*			
(*)	**Scrub-robin Brown**	*Cercotrichas signata*			
	Shoveler Cape	*Anas smithii*			
	Shrike Red-backed	*Lanius collurio*			
	Snake-eagle Brown	*Circaetus cinereus*			
	Snake-eagle Black-chested	*Circaetus pectoralis*			
	Snake-eagle Southern Banded	*Circaetus fasciolatus*	CR/NT		
	Snipe African	*Gallinago nigripennis*			Sched 3
	Sparrow House	*Passer domesticus*			
	Sparrow Southern Grey-headed	*Passer diffusus*			
	Sparrowhawk Black	*Accipiter melanoleucus*			Sched 3
	Sparrowhawk Little	*Accipiter minullus*			Sched 3
	Spoonbill African	*Platalea alba*			
	Spurfowl Swainson's	*Pternistis swainsonii*			
	Spurfowl Natal	*Pternistis natalensis*			
	Starling Wattled	*Creatophora cinerea*			
	Starling Violet-backed	*Cinnyricinclus leucogaster*			
	Starling Cape Glossy	*Lamprotornis nitens*			
	Starling Black-bellied	*Lamprotornis corruscus*			
	Starling Red-winged	*Onychognathus morio*			
	Starling Common	*Sturnus vulgaris*			
	Stilt Black-winged	*Himantopus himantopus*			
	Stint Little	*Calidris minuta*			
	Stonechat African	*Saxicola torquatus*			
	Stork Yellow-billed	*Mycteria ibis*	EN/LC		Sched 3
	Stork Woolly-necked	*Ciconia episcopus*			Sched 3
	Stork White	*Ciconia ciconia*			Sched 3
	Stork Saddle-billed	*Ephippiorhynchus senegalensis*	EN/LC		Sched 3
	Sunbird Purple-banded	*Cinnyris bifasciatus*			
	Sunbird White-bellied	*Cinnyris talatala*			
	Sunbird Grey	*Cyanomitra veroxii*			
	Sunbird Olive	*Cyanomitra olivacea*			
	Sunbird Collared	*Hedydipna collaris*			
	Sunbird Amethyst	*Chalcomitra amethystina*			
	Sunbird Scarlet-chested	*Chalcomitra senegalensis*			
	Swallow Barn	*Hirundo rustica*			
	Swallow White-throated	*Hirundo albigularis*			
	Swallow Wire-tailed	*Hirundo smithii*			
	Swallow Red-breasted	*Hirundo semirufa*			
	Swallow Lesser Striped	*Hirundo abyssinica*			
	Swallow Grey-rumped	*Pseudhirundo griseopyga*			
	Swallow Greater Striped	*Hirundo cucullata*			
	Swamphen African Purple	*Porphyrio madagascariensis*			
	Swamp-warbler Lesser	*Acrocephalus gracilirostris*			
	Swift African Black	*Apus barbatus*			

	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
			IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
	Swift White-rumped	*Apus caffer*			
	Swift Little	*Apus affinis*			
	Tchagra Black-crowned	*Tchagra senegalus*			
	Teal Red-billed	*Anas erythrorhyncha*			
	Teal Cape	*Anas capensis*			Sched 3
	Teal Hottentot	*Anas hottentota*			
	Tern Caspian	*Sterna caspia*	VU/LC		Sched 3
	Tern Common	*Sterna hirundo*			
	Tern Sandwich	*Sterna sandvicensis*			
	Tern Lesser Crested	*Sterna bengalensis*			
	Tern Swift	*Sterna bergii*			
	Tern Little	*Sterna albifrons*			
	Tern White-winged	*Chlidonias leucopterus*			
	Tern Whiskered	*Chlidonias hybrida*			
	Tern Black	*Chlidonias niger*			
	Thick-knee Water	*Burhinus vermiculatus*			
	Thick-knee Spotted	*Burhinus capensis*			
	Thrush Kurrichane	*Turdus libonyanus*			
	Thrush Groundscraper	*Psophocichla litsipsirupa*			
	Tinkerbird Red-fronted	*Pogoniulus pusillus*			
	Tinkerbird Yellow-rumped	*Pogoniulus bilineatus*			
	Tit Southern Black	*Parus niger*			
	Tit-flycatcher Grey	*Myioparus plumbeus*			
	Trogon Narina	*Apaloderma narina*			
	Turaco Purple-crested	*Gallirex porphyreolophus*			Sched 3
	Turaco Livingstone's	*Tauraco livingstonii*			Sched 3
	Turnstone Ruddy	*Arenaria interpres*			
	Turtle-dove Cape	*Streptopelia capicola*			
	Twinspot Green	*Mandingoa nitidula*			Sched 3
	Vulture Palm-nut	*Gypohierax angolensis*			Sched 3
	Wagtail African Pied	*Motacilla aguimp*			
	Wagtail Cape	*Motacilla capensis*			
	Wagtail Yellow	*Motacilla flava*			
	Wagtail Mountain	*Motacilla clara*			
	Warbler Garden	*Sylvia borin*			
	Warbler Willow	*Phylloscopus trochilus*			
	Warbler Marsh	*Acrocephalus palustris*			
	Warbler Sedge	*Acrocephalus schoenobaenus*			
(*)	**Warbler Barratt's**	*Bradypterus barratti*			
	Warbler Dark-capped Yellow	*Chloropeta natalensis*			
	Wattle-eye Black-throated	*Platysteira peltata*			
	Waxbill Orange-breasted	*Amandava subflava*			Sched 3
	Waxbill Common	*Estrilda astrild*			
	Waxbill Blue	*Uraeginthus angolensis*			
	Waxbill Grey	*Estrilda perreini*			
	Weaver Spectacled	*Ploceus ocularis*			
	Weaver Village	*Ploceus cucullatus*			
	Weaver Yellow	*Ploceus subaureus*			
	Weaver Southern Brown-throated	*Ploceus xanthopterus*			
	Weaver Thick-billed	*Amblyospiza albifrons*			
	Weaver Dark-backed	*Ploceus bicolor*			
	Weaver Cape	*Ploceus capensis*			
	Whimbrel Common	*Numenius phaeopus*			
(*)	**White-eye Cape**	*Zosterops virens*			
	Whydah Pin-tailed	*Vidua macroura*			
	Widowbird Red-collared	*Euplectes ardens*			

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS		
		IUCN RED LIST REGIONAL/GLOBAL	NEMBA (2015)	KZNEPBA (2014)
Widowbird White-winged	*Euplectes albonotatus*			
Widowbird Fan-tailed	*Euplectes axillaris*			
Wood-dove Emerald-spotted	*Turtur chalcospilos*			
Woodpecker Golden-tailed	*Campethera abingoni*			
Woodpecker Cardinal	*Dendropicos fuscescens*			
Woodpecker Olive	*Dendropicos griseocephalus*			

(*) Near endemic

SLS Endemic to South Africa, Lesotho and Swaziland

APPENDIX 5: Impact assessment methodology

The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase of the proposed projects. This is achieved by site visits and research in the site-specific project site as well as a comprehensive assessment of the impacts identified during the scoping phase.

Assessment of Impacts

Direct, indirect and cumulative impacts of the issues will be assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

» The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

The **duration**, wherein it will be indicated whether:

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

The **consequences (magnitude)**, quantified on a scale from 0-10, where:

- 0 is small and will have no effect on the environment;
- 2 is minor and will not result in an impact on processes;
- 4 is low and will cause a slight impact on processes;
- 6 is moderate and will result in processes continuing but in a modified way;
- 8 is high (processes are altered to the extent that they temporarily cease), and;
- 10 are very high and results in complete destruction of patterns and permanent cessation of processes.

The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where;

- 1 is very improbable (probably will not happen);
- 2 are improbable (some possibility, but low likelihood);
- 3 are probable (distinct possibility);
- 4 is highly probable (most likely) and;
- 5 is definite (impact will occur regardless of any prevention measures).

Significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high, and

- The **status**, which will be described as positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E + D + M) P$$

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: **LOW** (i.e. where this impact would not have a direct influence on the decision to develop in the area);
- 30-60 points: **MEDIUM** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated);
- 60 points: **HIGH** (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of cumulative impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, which in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section will address whether the construction of the proposed development will result in:

- Unacceptable risk;
- Unacceptable loss;
- Complete or whole-scale changes to the environment or sense of place;
- Unacceptable increase in impact.

APPENDIX 6: Georeferenced localities of protected tree species on the project site.

NAME	LATITUDE	LONGITUDE	ALTITUDE (m)

FT	-28.770622	31.990784	25.8
FT	-28.76908129	31.98597324	32.0
FT	-28.770774	31.99039	26.2
FT	-28.770876	31.990356	27.2
FT	-28.770938	31.990318	26.7
FT	-28.771286	31.989938	27.6
TE	-28.772011	31.989659	22.6
HC	-28.772319	31.98948	25.2
FT	-28.7702314	31.98787781	24.1
FT	-28.769838	31.990624	23.3
TE	-28.769109	31.989559	28.6
HC	-28.768852	31.989277	30.2
TE	-28.768949	31.989135	27.1
TE	-28.763916	31.985928	30.6
TE stand	-28.764398	31.985599	28.7
TE	-28.765395	31.984949	31.9
TE	-28.76733	31.983925	31.3
HC	-28.7686	31.988727	28.7
TE &HC	-28.768946	31.988721	30.5
SB	-28.769165	31.988913	27.2
HC	-28.76958	31.988594	26.5
HC	-28.769934	31.987169	25
TE	-28.769586	31.987057	31.1
TE	-28.770002	31.986568	28
HC	-28.770209	31.986573	27.8
TE	-28.770917	31.98625	28.6
FT	-28.771154	31.988543	21.9
SB	-28.772091	31.979819	28.7
TE	-28.772209	31.983105	26.9
TE	-28.772099	31.983196	24.5
TE	-28.771779	31.982938	28.7
TE	-28.771777	31.982943	29.2
TE	-28.773573	31.985494	24.3
TE	-28.773374	31.985577	26

HC = *Hyphaene coriacea*
FT = *Ficus trichopoda*
TE = *Trichilia emetica*
SB = *Sclerocarya birrea*

APPENDIX 7: Plant rescue, translocation and monitoring protocol

This section provides some basic principles of conservation of species of conservation concern that may affect the removal of plants from the wild and the translocation of these plants into new suitable habitats.

Principles of Plant Translocations

- *In situ* conservation is preferable to *ex situ* conservation. Removing a population from its natural habitat and placing it under artificial conditions results in the erosion of the inherent genetic diversity and characteristics of that species.
- In order to ensure the persistence of a population, it is imperative that the ecological processes maintaining that population persist.
- Translocation of Red Data species is an unacceptable conservation measure since the translocated species may have undesirable ecological effects. For example, alterations to habitat by translocated species may be harmful to other species and translocations may lead to transmission of pathogens or parasites (Hodder & Bullock, 1997). Translocation may result in rapid changes in the species itself (Conant, 1988). Translocations are expensive and rarely successful (Griffith *et al*., 1989). Success entails not only survival of the translocated individuals but also establishment of a self-sustaining, viable population able to reproduce and adapt to changing environmental conditions (Milton *et al.*, 1999).
- Suitable habitat adjacent to known populations of Red List plant species has a high probability of being colonized.

The implications of these principles are as follows:

- Rescued plants, if re-planted back in the wild, should be placed as close as possible to where they were originally removed.
- Re-planting into the wild must cause as little disturbance as possible to existing natural ecosystems.

Plant Rescue Plan

This section provides details on the actions that are required to rescue any listed plant species from the path of development and what steps are to be taken to house them temporarily and then to place them back into suitable habitats.

ACTION	RESPONSIBLE PERSON
Initial identification of all listed species that may occur within the project area. This is largely covered in this report, but can be supplemented by observations on site by the ECO prior to construction.	Botanist / ECO
The footprint of proposed development must be marked out prior to breaking ground.	Contractor / Engineer / Eskom
Identification of all listed species present within marked out areas (within the footprint of proposed infrastructure). The pegged out area must be walked and any listed species recorded.	ECO / qualified Botanist
Search and rescue operation of all listed species within the development footprint. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device. The plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant.	Qualified Botanist / horticulturalist
Rescued plants housed in temporary nursery may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.	ECO / qualified Botanist
Any listed plants close to the development servitude that will remain in place must be marked clearly and may not be defaced, disturbed, destroyed or removed. They should be cordoned off with construction tape or similar barrier and marked as no-go areas.	ECO / qualified Botanist
ECO to give permission to clear vegetation only once all search and rescue operations have been completed.	ECO

The ECO should monitor construction activities in sensitive habitats to ensure that impacts within these areas are kept to a minimum.	ECO
The collecting of plants by unauthorized persons should be prevented and signs stating so should be placed at the entrance to the site.	Eskom

Monitoring requirements

The following monitoring activities are recommended as part of the plant rescue plan:

Pre-construction walk-through survey to list the identity and location of all SCC species. The submission of a report that provides an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. Subsequent changes to infrastructure positions may result in areas that have not been properly searched and it is unknown whether these areas will impact upon listed species or not.

Construction phase monitoring by the ECO to determine whether any listed species will be affected and provide a full account of the number of individuals of each species that are affected.

Post-construction monitoring of plants relocated during search and rescue to evaluate whether the intervention was successful or not. This should be undertaken on a three-monthly basis for two years after transplanting in order to evaluate the success thereof.

APPENDIX 8: Control and monitoring guidelines for IAPs and weeds

CONTROL GUIDELINES

This section provides an outline of the overall approach that should be adopted at the site in order to minimize the probability of invasive alien plants becoming established and ensuring that any outbreaks are managed quickly to ensure that they do not become a long-term problem on site. The establishment of any dense infestations will be expensive to eradicate and will require more complex control measures than would be necessary for low density invasions.

Prevention

A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas. Prevention could also include measures such as washing the working parts and wheels of earth-moving equipment prior to it being brought onto site, visual walk-through surveys every three months and other measures, as listed in the section below ("Habitat management").

Early Identification and Eradication

Monitoring plans should be developed which are designed to catch Invasive Alien Plant Species shortly after they arrive on the project area. Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When new Invasive Alien Plant Species are spotted an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

Containment and Control

If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Separate plans of control actions should be developed for each location and/or each species. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The key is to ensure that no invasions get out of control. Effective containment and control will ensure that the least energy and resources are required to maintain this status over the long-term. This will also ensure that natural systems are impacted to the smallest degree possible.

Construction Phase Activities Required

The following management actions are required to minimize soils and vegetation disturbance during the construction phase, as well as reducing the probability that invasive alien plants will become established on site:

ACTION	FREQUENCY
The Environmental Control Officer (ECO) is to provide permission before any natural vegetation is to be cleared for development.	Daily/when required
Clearing of vegetation must be undertaken as the work front progresses. Mass clearing is not to be permitted unless the entire cleared area is to be rehabilitated immediately thereafter.	Weekly/when required
Should revegetation not be possible immediately, the cleared areas must be protected with packed brush or appropriately battered with fascine work (fixing horizontal branches along the ground using vertical pegs to create resistance to down-slope flow of water/materials). Alternatively, jute (Soil Saver) may be pegged over the soil to stabilize it.	Weekly
Organic matter used to encourage regrowth of vegetation on cleared areas should not be brought onto site from foreign areas. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments should not be used as this would encourage invasion.	Weekly

Care must be taken to avoid the introduction of alien invasive plant species to the site. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
ECO to survey site once a month to detect aliens and have them removed.	Monthly
Alien vegetation regrowth must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best practice for the species concerned. Such information can be obtained from the Working for Water website as well as herbicide guidelines.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into adjacent no-go areas. No-go areas should be clearly demarcated prior to construction.	Daily

Operational Phase Activities Required

The following management actions are aimed at maintaining non-invaded areas clear of invasive alien species as well as reducing the abundance of any aliens on site:

ACTION	FREQUENCY
Surveys for alien species should be conducted regularly. All aliens identified should be cleared.	Every 3 months for 2 years and biannually thereafter.
Re-vegetation with indigenous, locally occurring species should take place in areas where natural vegetation is slow to recover or where repeated invasion has taken place.	Biannually, but re-vegetation should take place at the beginning of the rainy season.
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected.	When necessary
No alien species should be cultivated on site. If vegetation is required for aesthetic or other purposes, then non-invasive locally occurring species should be used.	When necessary

CONTROL METHODS

This section is a summary of existing control measures that have been published for various alien plant species. There are various means of managing invasive alien plants:

Mechanical Control

This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ring-barking or bark stripping. This control option is only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive, and could cause severe soil disturbance and erosion.

For the current project, hand-pulling or manual removal using hand tools (in this case cutstumping) will be the most appropriate methods since there are no existing dense stands of invasive alien plants.

Chemical Control

Chemical control should only be used as a last resort, since it is hazardous for natural vegetation. It should not be necessary if regular monitoring is undertaken.

Chemical control involves the use of registered herbicides to kill the target weed. Managers and herbicide operators must have a basic understanding of how herbicides function. The use of inappropriate herbicides and the incorrect use of the appropriate herbicides are wasteful, expensive practices and often do more harm than good, especially when

working close to watercourses. Some herbicides can quickly contaminate fresh water and/or be transported downstream where they may remain active in the ecosystem.
Contractors using herbicides are required to have a permit according to Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). Herbicides are either classified as selective or non-selective. Selective herbicides are usually specific to a particular group of plants, e.g. those specified for use on broad leaf plants, but should not kill narrow-leaf plants such as grasses. Non-selective herbicides can kill any plant that they come into contact with and are therefore not suitable for use in areas where indigenous vegetation is present.

Chemical application techniques include foliar (leaf) application, stem applications (basal stem, total frill, stem injections) and stump applications (cut stump, total stump, scrape and paint).

Biological Control
Biological weed control consists of the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plants reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilized. All of these outcomes will help to reduce the spread of the species.

To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF) can be contacted.

Habitat Management
The best way to prevent invasion by alien invasive plant species is to manage the natural vegetation in such a way so as to reduce the opportunity for these plants becoming established. The general principle is to not disturb any areas beyond the footprint of the proposed infrastructure and to also ensure that the natural processes that maintain vegetation patterns are not disrupted.

Post-Removal Follow-Up and Rehabilitation
Re-establishment of indigenous vegetation needs to be undertaken to reduce the probability of re-emergence of invasive alien plants and to reduce the risk of soil erosion where the soil surface is poorly vegetated. In most soils, the seeds and other propagules of the plants of the former natural habitat still survive. Thus natural regeneration without the need for planting may be possible in many cases. However, if natural regeneration is not likely due to the length of time since disturbance or if the soil has been disturbed to such a degree that seeds and propagules no longer survive then planting or seeding may be required. Rehabilitation should follow these steps:

- Monitor cleared areas on a regular basis (monthly during construction and three-monthly during operation) for emergent seedlings of invasive alien species and remove these (hand pulling or chemical control).
- All areas of exposed soil should immediately be protected by placing packed brush on the slope, or creating erosion control barriers using branches, sticks or logs placed horizontally across the slope at 1 m intervals (the steeper the slope the closer the barriers should be placed to one another). If topsoil has been lost, rehabilitation of indigenous vegetation will be a difficult and expensive process.
- If the soil remains relatively undisturbed and the area has some indigenous vegetation left intact, the natural regeneration process of the indigenous vegetation on the site should be managed. This involves regular follow-up to remove emerging invasive alien plants and protecting the area from other forms of disturbance (heavy grazing, trampling, disturbance by vehicles, etc.) while the vegetation re-established naturally.
- If required, indigenous vegetation can be planted on the cleared areas. This can be in the form of a seed mix or plants rescued from previous clearing.

Monitoring Programme

In order to monitor the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide and assessment of the magnitude of alien invasion on site as well as an assessment of the success of the management programme.

In general, the following principles apply to monitoring:

- Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.
- Simple records must be kept of daily operations, e.g. area/location cleared, labour units and, if ever used, the amount of herbicide used.
- It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

Construction Phase Monitoring

The following monitoring is required during the construction phase of the project:

MONITORING ACTION	INDICATOR	TIMEFRAME
Document alien species present on site	Alien species list	Pre-construction and monthly thereafter
Alien plant distribution	Distribution maps, GPS coordinates	Monthly
Document and record alien control measures implemented	Record of clearing activities	6-monthly
Review alien control success rate	Decline in abundance of alien plant species over time	Annually

Operational Phase Monitoring

The following monitoring is required during the construction phase of the project:

MONITORING ACTION	INDICATOR	TIMEFRAME
Document alien species distribution and abundance on site	Alien species distribution maps	Annually
Document alien plant control measures implemented and success rate achieved	Records of control measures and their success rate	Annually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Annually