Terrestrial Ecological Assessment

Wilmar Processing (Pty) Ltd Vegetable Oil Pipeline, Richards Bay Port, KwaZulu-Natal
(Savannah Ref No: SE2306)

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Even though every care is taken to ensure the accuracy of this report, ecological assessment studies are limited in scope, time and budget. Discussions 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.

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EXECUTIVE SUMMARY

Wilmar Processing (Pty) Ltd is proposing the development of a vegetable oil pipeline from Richards Bay port to Phase 1A of the Richards Bay Industrial Development Zone. Rautenbach Biodiversity Consulting was commissioned by Savannah Environmental (Pty) Ltd to conduct a flora, vegetation and fauna assessment as part of the environmental assessment and authorisation process.

Results from the desktop assessment determined that:

- The Richards Bay Game Reserve & IBA, and the Enseleni Game Reserve are located within 20 km of the proposed pipeline route;
- The pipeline route falls within the 'Critically Endangered' Kwambonambi Hygrophilous Grassland ecosystem, and the 'Vulnerable'Subtropical Freshwater Wetland vegetation type;
- The pipeline route will not bisect any NFEPA rivers or wetlands;
- The pipeline route falls partially within a municipal CBA: Irreplaceable area;
- The pipeline route will not bisect any local or regional important dispersal corridors.

Results from the field assessment showed that:

- All areas along the pipeline route was previously significantly transformed and fragmented by land clearance for industrial developments, with remnant natural vegetation degraded by alien & invasive plant species. Virtually none of the important floristic taxa, biogeoptraphically important or endemic taxa of the Subtropical Freshwater Wetland vegetation type or the Kwambonambi Hygrophilous Grassland ecosystem remained.

Vegetation and flora

- Based on floristic composition and vegetation structure, areas with remnant semi-natural vegetation were identified and classified into three discrete vegetation units and included the following: Secondary grassland in Phase 1A, *Osteospermum moniliferum* thicket on the corridor between Phase 1A and Richards Bay port, and a *Pinus elliottii* plantation within theTransnet port area, north of Railyard north;
- No Red Listed flora species were observed within any of the vegetation units;
- One tree species protected under the National Forest Act were identified in the *P. elliottii* vegetation community close to the pipeline corridor;
- Four provincial protected species were identified within the grassland and P. elliotti vegetation communities. Removal/destruction/translocation of these species will be subject to permit authorisation from eKZN Wildlife;
- None of the vegetation units provided suitable habitat for any other Red Listed flora species previously recorded within 20 km of the pipeline route. However, some provincial protected plants have a low probability of occurring within the *O. moniliferum* and *P. elliottii* vegetation communities. Removal of these species may require permit authorisation from eKZN Wildlife.

Fauna

- Observed fauna species consisted of widespread and abundant species with no risk of extinction. Potential occurrences included a few Red Listed and endemic species. It is highly unlikely that the proposed development will have negative impacts on any of the aquatic and migratory SCS bird species associated with the Richards Bay IBA since the site does not offer suitable habitat.

A key conclusion of the impact assessment was that all the impacts identified are amenable to mitigation. Should the proposed mitigation measures as proposed in this report be correctly implemented, it is unlikely that the proposed development will have an adverse impact on local fauna and flora populations and species of conservation significance potentially present.

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ACRONYMS AND ABBREVIATIONS

ADU	Animal Demography Unit
BGIS	Biodiversity GIS (SANBI)
BRAHMS	Botanical Research and Herbarium Management System
CBA	Critical Biodiversity Areas
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
EKZNW	Ezemvelo KZN Wildlife

ESA	Ecological support area
GIS	Geographic information system
GPS	Global positioning system
ha	hectares
IAPs	Alien and invasive plants
IBAs	Important Bird Areas
IDP	Integraded Development Plan
IDZ	Industrial Development Zone
IUCN	International Union for Conservation of Nature
km	kilometer
KZN	KwaZulu-Natal Province
KZNCMA	KwaZulu-Natal Nature Conservation Management Amendment Act (No. 5 of 1999)
KZNEBPA	KwaZulu-Natal Environmental, Biodiversity and Protected Areas Manageent Bill, 2014
LM	Local municipality
LUDS	Land Use Decision Support
mm	millimeters
NBA	National Biodiversity Assessment
NEMBA	National Environmental Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
QDGS	Quarter degree grid square
SABAP	South African Bird Atlas Project
SACAD	South Africa Conservation Areas Database
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database
SARCA	South African Reptile Conservation Assessment
SCS	Species of Conservation Significance

INVESTIGATOR DETAILS AND DECLARATION OF INDEPENDENCE

Document title	Wilmar Processing (Pty) Ltd Vegetable Oil Pipeline, Richards Bay Port, KwaZulu-Natal (Savannah Ref No: SE2306)
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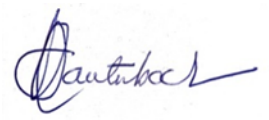
I, Anita Rautenbach (7103180154085) declare that I:

- Am committed to biodiversity conservation, but concomitantly recognise 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 a terrestrial ecological assessment for the Wilmar Processing (Pty) Ltd vegetable oil pipeline;
- 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 this 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;
- 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 recognise 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: 15 March 2019

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Wilmar Processing (Pty) Lt is proposing the development of a vegetable oil pipeline and associated corridor in the Richards Bay, KwaZulu-Natal Province. The pipeline will extend from Richards Bay port to Phase 1A of the Richards Bay Industrial development zone. It will consist of four pipelines to be stacked vertically in double rows, running side by side (depending on support and space restrictions) and will comprise of the following dimensions:

- Width: 216 mm;
- Total length: ~ 2.6 km.

A section of the pipeline in the port area will be above-ground, and will extend over the Transnet Railyard North area, where the pipeline will be supported by an overhead structural steel bridge of approximately 12 m high, and of approximately 5.5 m in height over the undeveloped area to the north of the Railyard North area. The corridor will have a general width of 50 m for the entire pipeline route.

The proposed development will also include the following infrastructure:

- Site offices and maintenance buildings, including workshop areas;
- Temporary laydown areas;
- Fencing and access roads; and;
- Security offices.

Rautenbach Biodiversity Consulting was appointed by Savannah Environmental (Pty) Ltd, to undertake a terrestrial ecological assessment to determine potential ecological sensitivities and impacts related to the proposed development. Primarily this report focused on the identification of ecological sensitive areas, and the reigning status of flora and fauna species currently occurring or likely to occur alongside the pipeline route and associated corridor (hereafter referred to as 'the site').

1.2 LOCATION

The pipeline route will extend from Richards Bay port, from berths 706 - 708 (GPS coordinates: Lat: -28.791008°; Long: 32.050981°), crossing Newark and Silver ocean roads, to Erf 17422 (GPS coordinates: Lat: -28.778641°; Long: 32.061965°) within Phase IA of the Richards Bay Industrial Development Zone (Figure 1). The site falls within uMhlathuze local municipality of the greater UThungulu district municipality, within the QDGS 2832CC.

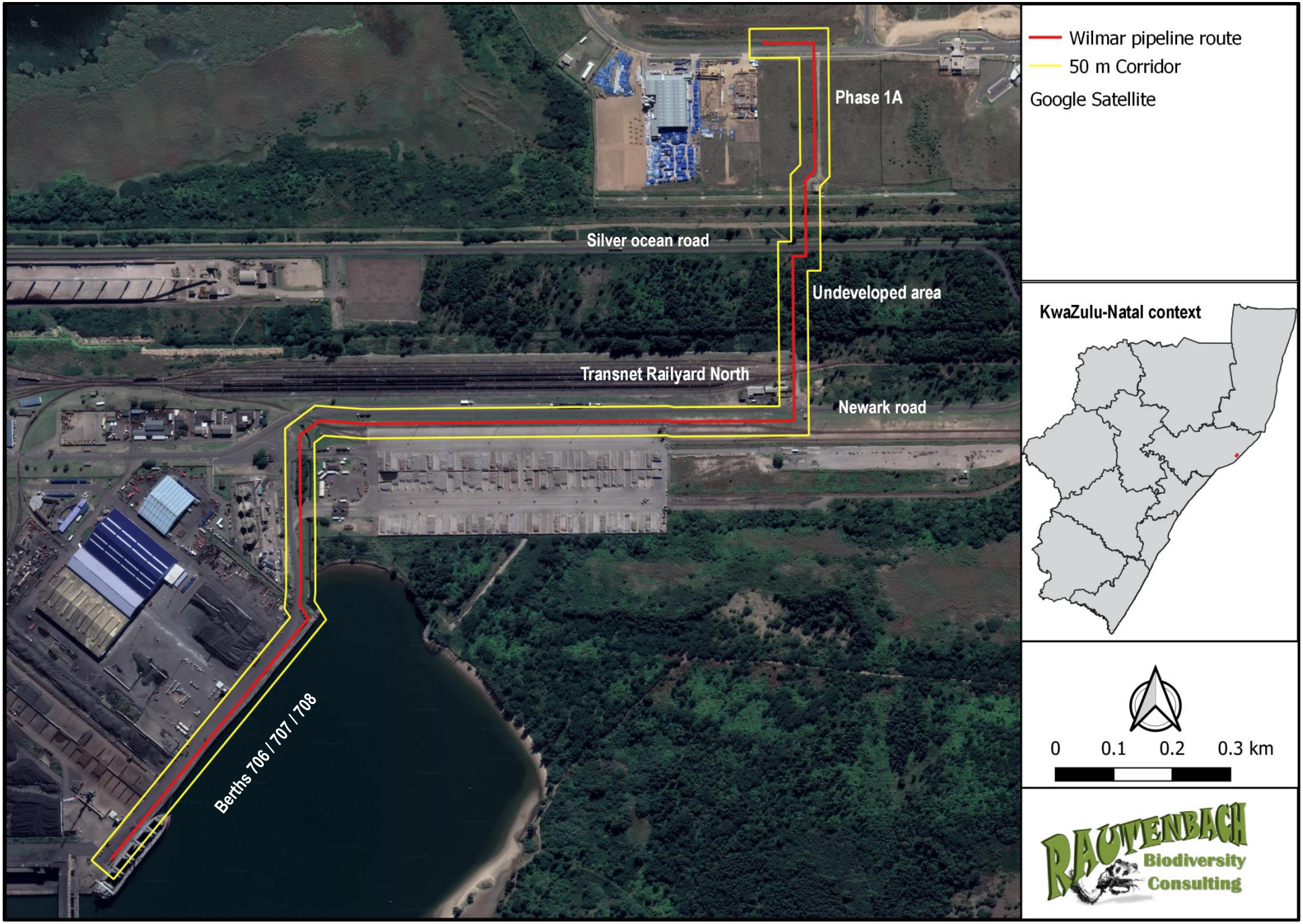


FIGURE 1: Locality of the proposed Wilmar oil pipeline route in Richards Bay.

The digital elevation profile from Google Earth Pro indicated low lying, relatively flat areas alongside the pipeline route, ranging in altitude from ~ 7 – 10 meters above sea level (Figure 2).

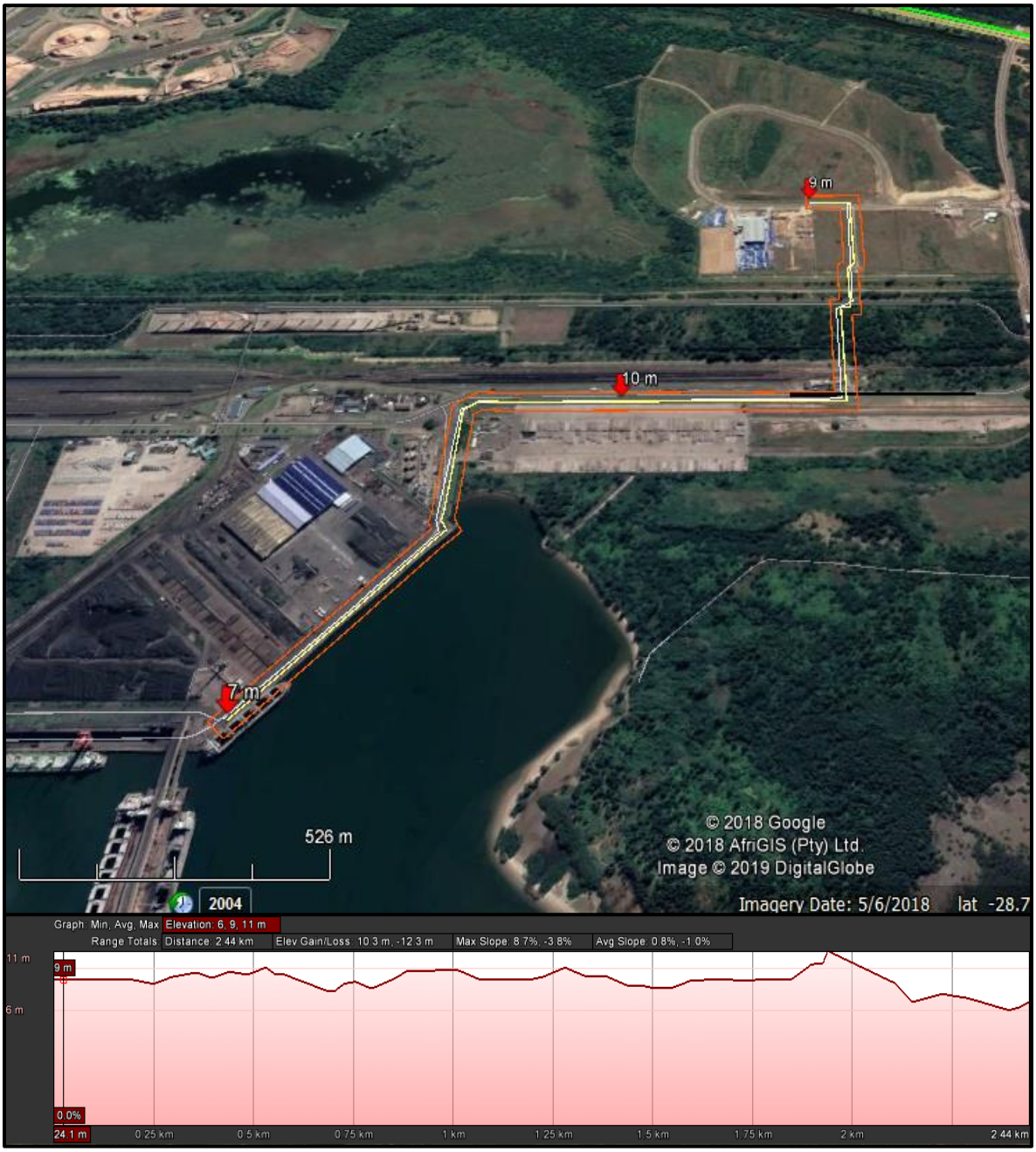


FIGURE 2: Digital elevation profile of the Wilmar oil pipeline route (adapted from Google Earth Pro).

1.3 PROJECT SCOPE AND OBJECTIVES

The purpose of this assessment was 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 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 significance;
- 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 adopted in assessing these impacts;
- To identify any environmental fatal flaws or red flag issues.

1.4 LEGISLATIVE FRAMEWORK

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.

TABLE 1: 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)
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	Mountain Catchment Areas Act (Act No. 63 of 1970)
	National Forest Act (Act No. 84 of 1998)
	National Water Act (Act No. 36 of 1998)
	National Environmental Management: Air Quality Act (Act No. 39 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)
	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 Systems Act (No 32 of 2000)

1.5 GUIDELINES

In addition to the legislation (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 (EKZNW 2014);
- KwaZulu-Natal Systematic Conservation Plan (EKZNW 2010);
- 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: 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).

2. APPROACH AND METHODOLOGY

2.1 DESKTOP REVIEW

The purpose of the desktop review was to gather contextual information on the area to be surveyed from existing spatial information, past surveys, literature and database searches. This information was used to provide background information for the field survey and subsequent reporting, and assisted in the identification of priority listed fauna, flora and vegetation occurring, or potentially occurring within the area.

Spatial information

The following GIS spatial information and data sources available from the SANBI BGIS website (www.sanbi.org) were consulted:

- **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 2010):**

- 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];
- Terrestrial Systematic Conservation Plan – EKZNW (2010) Minimum Selection Surface (MINSET). Unpublished GIS Coverage [tscp_minset_dist_2010_wll.zip].

- **uThungulu District Municipality: 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 data sets included the following spatial datalayers:

- **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.

Past surveys and reports

- Richards Bay Port Ecological Assessment: Cassuarina. Wetland Delineation Report. March 2016 (Project no 13642). Sivest;
- Richards Bay Port Ecological Assessment: Cassuarina. Fauna Assessment. March 2016 (Project no 13642). Sivest;
- Richards Bay Port Ecological Assessment: Railyard North. Wetland Delineation Report. March 2016 (Project no 13642). Sivest;
- Railyard North, Richards Bay Port Ecological, Richards Bay, KwaZulu-Natal. Vegetation Report. May 2016 (Project no 13642), Sivest;

- Wetland delineation and functionality assessment for the proposed central industrial area development, Richards Bay, Kwa-Zulu Natal. Exigent, 2017;
- Proposed edible oil pipeline for Wilmar SA (Pty) Ltd from berth 706 / 707 / 708 to RB IDZ Phase 1A (Version 7A of 16 August 2018), prepared by Royal HaskoningDHV;
- Baseline terrestrial ecological assessment Wilmar Processing (Pty) Ltd, Richards Bay, KwaZulu-Natal (Ref no: SE2287 of 16 November 2018).

Literature review

Flora and vegetation

- *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford, 2006; Mucina & Rutherford, 2018 vegetation delineation (for the delineation and description of regional vegetation types), EKZNW 2014 (for the delineation and description of provincial vegetation types);
- 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, 2018);
- *Trees of Southern Africa* (Coates-Palgrave, 2002);
- *Easy identification of South African Wetland Plants* (grasses, sedges, rushes, bulrushes, eriocaulons and yellow-eyed grasses (van Ginkel *et al*., 2011).
- *Guide to trees introduced into Southern Africa* (Glen *et al*., 2016);
- The extended occurrence of Maputaland Woodland Grassland further south in KwaZulu-Natal, South Africa. (Siebert *et al*., 2011).

Fauna

Fauna distribution data were obtained from various publications and field guides as a means to ascertain which species was historically recorded within the QDGS 2832CC.

- **Mammals**

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 and carnivores (i.e. elephants, rhino, wildebeests, buffalo, lions, spotted hyenas, sable antelope, roan antelope) have long since been extirpated by hunting, poaching, and urban and industrial developments, they can only be found in protected areas and was therefore not included in this assessment. In addition, all feral mammal species expected to occur on the site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these cannot be considered when estimating the site's conservation value.

- **Herpetofauna**

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.

TABLE 2: Literature sources consulted for fauna distributions.

MAMMALS	REPTILES & FROGS	AVIFAUNA
The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005)	A *Guide to the Reptiles of Southern Africa* (Alexander & Marais, 2007)	Important Bird and Biodiversity Areas of South Africa (Marnewick *et al*., 2015)
Bats of Southern and Central Africa (Monadjem *et al*., 2010)	*A Complete guide to the Snakes of Southern Africa* (Marais, 2004)	*The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland* (Taylor *et al*., 2015)
A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013)	*Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland* (Bates *et al*., 2014)	Roberts VII Multimedia Birds of Southern Africa
	A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009)	*Newman's Birds of Southern Africa* (Newman, 2010)
	Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Mintner *et al.*, 2004)	*Roberts Birds of Southern Africa* (Hockey *et al*., 2005)

Database searches

- **Flora distribution data**

BRAHMS (newposa.sanbi.org).

- **Mammal, reptile and frog distribution data**

- ADU's MammalMap (mammalmap.adu.org.za)
- The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za);
- FrogMAP (frogmap.adu.org.za);
- ReptileMAP (sarca.adu.org.za).

- **Bird distribution data**

Due to the inherent mobility of birds, it is important to consider avifauna not only on the site, but also the avifauna beyond the site. The broader areas included bird distribution data from the following pentads: 2840_3200; 2840_3205; 2845_3200 and 2845_3205. Bird distribution data were obtained from the First and Second Southern African Bird Atlas Projects (SABAP1 &SABAP2; http://sabap2.adu.org.za).

2.2 ASSESSMENT METHODOLOGY FOR SPECIES OF CONSERVATION SIGNIFICANCE

The presence of species of conservation significance (SCS) is a measure of habitat quality and an indicator when setting conservation priorities. The following categories were used to categorise SCS species:

- Threatened species;
- National protected species;
- Provincial protected species;
- Endemic/near-endemic species;
- Sensitive species.

2.2.1 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**).

EX - 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**.**
EW - Extinct in the wild	When it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
RE - 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.
CR PE - Critically endangered, possibly extinct	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.
CR - 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.
EN - 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.
VU - 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.
NT - 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)	When a species 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**	When a species 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.
LC - Least concern	When a species 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.
DDD - Data deficient (insufficient information)	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.
DDT - Data deficient)	When taxonomic problems hinder the distribution range and habitat from being well defined, so that an

taxonomically problematic)	assessment of risk of extinction is not possible.
NE - Not evaluated	When a species has not been evaluated against the criteria. Certain species do not qualify for national listing because they are naturalized 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.

2.2.2 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 on the NEMBA list are similar to those on 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:

CR - Critically endangered	Indigenous species facing an extremely high risk of extinction in the wild in the immediate future**.**
EN - Endangered	Indigenous species facing a high risk of extinction in the wild in the near future, although they are not a 'Critically Endangered' species.
VU - Vulnerable	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.
PROT - Protected	Indigenous species of high conservation value or national importance that require national protection.

For the flora assessment, the List of Protected tree species, Section 12 (1) (d) Schedule A (National Forest Act, No. 84 of 1998, Notice 536 of 2018 was included.

2.2.3 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 provincial scale.

2.2.4 Endemic/near-endemic species

Endemic and near-endemic species generally have restricted distributions and are generally highly adapted to their home range; consequently threats to endemics carry a higher risk of extinction than for widely distributed species.

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

2.2.5 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 fauna and flora does not threaten their

survival. Appendices I, II and III of the Convention are lists of species afforded different levels of protection from over-exploitation:

CITES categories:

Appendix I	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 authorized 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	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 authorized 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	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).

2.3 FIELDWORK

Field surveys were undertaken on 27 November 2018 and 11 March 2019 to gather information on significant flora, vegetation and fauna.

2.3.1 Flora & vegetation

A combination of traverses and opportunistic sampling techniques were used. Traverses were informal, unmarked routes along which data were collected. It is a useful method for gathering information for the general characterisation of flora and vegetation, and also for the collection of opportunistic and supplementary data.

2.3.2 Fauna

Fauna species were identified by visual sightings during traverses as well as indirect evidence from scats, tracks and runways. Periodic scanning for soaring birds and stops to listen for calls were incorporated during the traverses. Bird calls were recorded and compared with pre-recorded calls from Roberts VII Multimedia Birds of Southern Africa as an additional means of identification.

Possible retreats such as trees, under logs or stones were searched for the presence of reptile species. For frogs, suitable microhabitats such as pools, ponds, streams, marshlands, and open grassveld (du Preez & Carruthers, 2009) were searched. Attention was paid to features/habitats which may be of ornithological importance, e.g. grassland, trees.

An assessment of the status and condition of potential and available habitat for fauna species and possible dispersal connections were conducted. Specific attention was paid to the assessment of habitat availability for threatened fauna species.

2.4 LIKELY OCCURRENCE OF SPECIES OF CONSERVATION SIGNIFICANCE

This section involved collating current vegetation and habitat characteristics and literature relevant to SCS fauna and flora habitat suitability to draw up lists of SCS fauna and flora species likely to be present. Parameters used to assess probability of occurrence were evaluated according to the following:

PARAMETER	DESCRIPTION
Habitat requirements	Most SCS species have very specific habitat requirements; the presence of these habitats on the site was evaluated.
Habitat status	The ecological condition of available habitat on the site.
Habitat linkage	The connectivity of the site to surrounding habitats and the adequacy of these linkages.
Geographic distribution of species	i.e. Municipal, provincial, national.

The estimated likelihood of occurrence was then presented in the following categories:

CATEGORY	DESCRIPTION
High (71–100%)	Applicable to SCS species with a distributional range overlying the site as well as the presence of prime habitat. A further consideration included in this category was for a species to be common, abundant and widespread.
Medium (41-70%)	A species with its distributional range peripherally overlying the site, or required habitat on the 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%)	Applicable to species with its distributional range peripheral to the site, and habitat that was sub-optimal. These species are generally deemed to be rare.

2.5 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 in 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 was significantly disturbed. The main aspects of an ecosystem that was incorporated in the sensitivity analysis included 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 disturbance, and alterations to their specific habitats, of various magnitudes;
- An identification of the species or habitat features that were ‘key ecosystem providers’ and characterising their functional relationships (Kremen, 2005);
- A determination of the aspects of community structure that influenced function, especially aspects influencing stability or rapid decline of communities (Kremen, 2005);
- An assessment of key environmental factors that influenced the provision of services (Kremen, 2005);
- Gaining knowledge about the spatio-temporal scales over which these aspects operate (Kremen, 2005).

The sensitivity analysis was presented in the following categories:

CATEGORY	DESCRIPTION
High sensitivity	• Areas that were relatively undisturbed or pristine, and; • Either was very species-rich relative to immediate surroundings; • Or had a very unique and restricted indigenous species composition; • Or constitute specific habitats or a high niche diversity for SCS fauna and flora, and where the total extent of such habitats and associated SCS species 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 was of such nature that the habitat and its niche-diversity were the main reason for a higher species diversity and cannot be reconstructed or rehabilitated once physically altered in any way.
Medium - high sensitivity	• Areas where disturbances were 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 provided ecosystem services needed for the continued functioning of the ecosystem and the continued use thereof (e.g. grazing); • Although SCS 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 SCS or ecosystem functionality may be lost; • With a high species diversity and potentially higher number of SCS.
Medium - low sensitivity	• Areas where disturbances were 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 SCS 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; • With a high species diversity with few species of conservation significance; • 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; • Where the landscape can be rehabilitated to allow the re-establishment of most or all of the original species composition after physical alteration.
Low sensitivity	• 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; • SCS 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.

2.6 IMPACT ASSESSMENT

The ecological impact of issues identified was assessed in terms of the methodology outlined in Appendix 1.

2.7 ASSUMPTIONS AND LIMITATIONS

- This report deals exclusively with the biodiversity and ecosystems of the defined area;
- Only a rapid assessment of the fauna, flora and vegetation currently and potentially present was conducted. Whilst lists of fauna and flora species recorded during the site visits was included in this report, this was based on site observations made during two field visits, and therefore does not cover the seasonal variation in conditions potentially occuring on the 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 site. Due to time and budget constraints such long-term studies are unrealistic for this project and conclusions were 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. This invariably increases the probability of some species being overlooked;
- Many species, specifically those of conservation significance 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;
- This study excluded any assessment of invertebrates;
- At the time of this directive, information used to inform this assessment was limited to data and GIS coverage's available for the site on national, provincial, district and municipal scales;
- Threatened ecosystem delineation was based on one of the following national and regional spatial data layers: the South African vegetation map (Mucina & Rutherford, 2006), national forest types recognized by DAFF, priority areas identified on a provincial systematic biodiversity plan, high irreplaceablility forest patches or clusters systematically identified by DAFF, and does not take municipal scale conservation priority areas into consideration. Consequently demarcation of municipal scale conservation priority areas may not be equivalent/coincide with national and provincial scale conservation priority areas.

3. RESULTS – DESKTOP REVIEW

3.1 LAND USE AND EXISTING IMPACTS

Comparative Google Earth imagery indicated highly transformed areas alongside the pipeline route (red line)) and associated corridor (yellow line; Figure 3). Phase 1A was rezoned for light industrial development by the Department of Agricultural and Environmental Affairs (Ref no. EIA/2851), and historical google earth imagery clearly depicted the extent of vegetation clearance in preparation for future industrial developments. The Richards Bay port area was already significantly transformed by linear (i.e roads, railway lines) and port-related infrastructure.

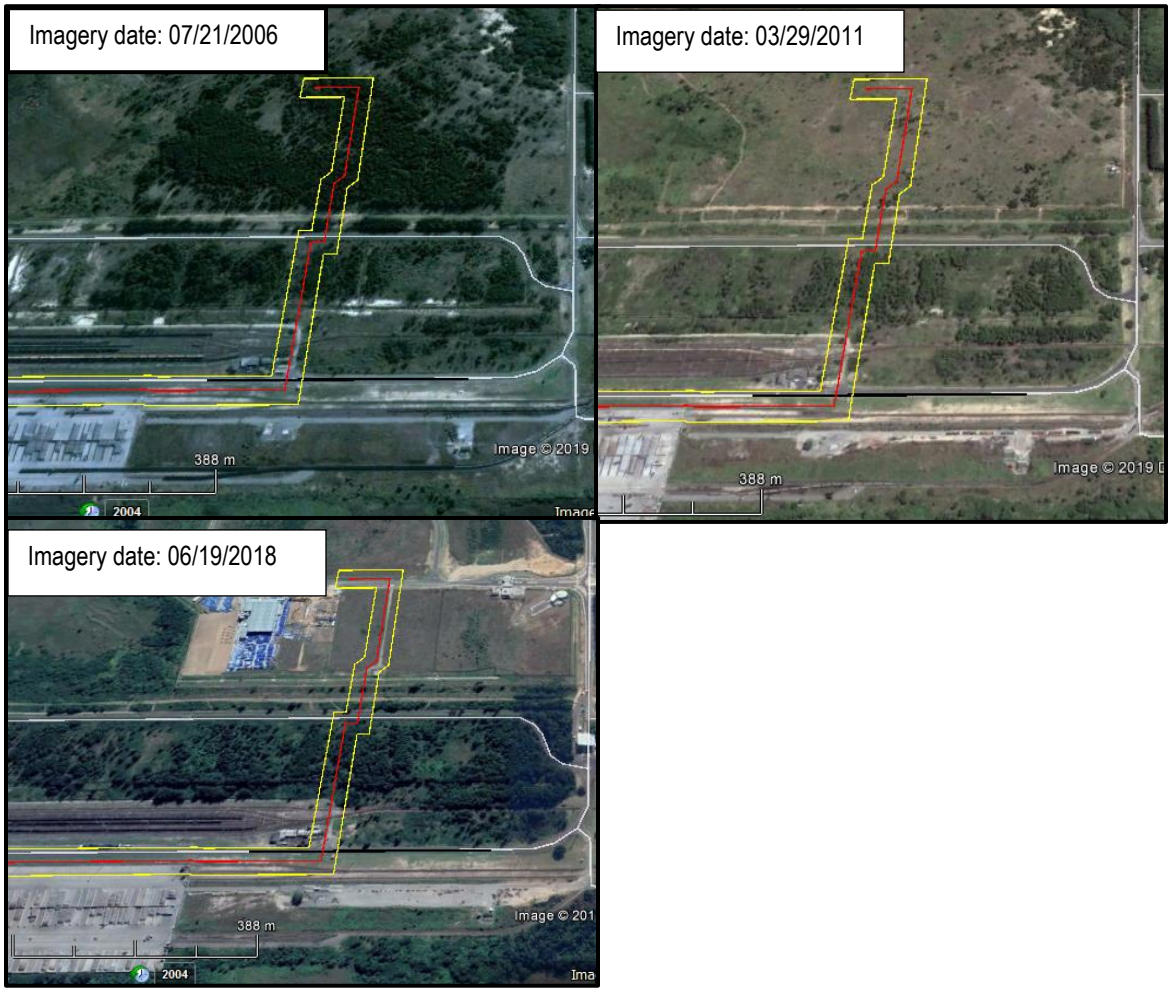


FIGURE 3: Comparative Google Earth imagery of land use and transformation on Phase 1A and Transnet Railyard north.

3.2 CONSERVATION CONTEXT

Areas of conservation importance are amongst the best areas for the conservation of wildlife and habitats. These areas are important core areas, stepping stones and corridors for wildlife in a fragmented landscape. The conservation importance of the site was assessed on national (NBA 2011), provincial (EKZNW 2010) district (EKZNW 2014) and municipal scales.

3.2.1 National level conservation priorities

3.2.1.1 Protected areas and other conservation areas

Protected areas included national parks, wildlife management areas, private nature reserves, IBA areas, national protected forest patches; NPAES focus areas and RAMSAR sites.

The following protected area falls within a 20 km radius of the site (Figure 4):

- Richards Bay Game Reserve IBA - ~ 3.8 km to the southwest

This IBA is an important site for several migratory and nomadic waterbirds. Threatened species such as Pink-backed Pelicans (*Pelecanus rufescens)*, Caspian Terns (*Sterna caspia),* Mangrove Kingfishers (*Halcyon senegaloides*), Great White Pelicans (*Pelecanus onocrotalus*), Greater Flamingo's (*Phoenicopterus roseus*) Little Terns (*Sterna albifrons*) and Whiskered Terns (*Chlidonias* hybrid) are known from this area.

3.2.1.2 National threatened ecosystems

The first list of national 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 were listed in one of four categories: Critically Endangered (CR), Endangered, (EN), Vulnerable (VU) or Protected (PROT).

Ecosystem delineation was based on the South African vegetation map (Mucina & Rutherford, 2006); National Forest Types (DWAF), priority areas identified in Provincial Systematic Biodiversity Plans, and high irreplaceability forest patches or clusters systematically identified by DWAF.

The entire site falls within the '**Critically Endangered**' Kwambonambi Hygrophilous Grassland ecosystem Threatened ecosystem code KZN 9; Figure 4). This 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.

It 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).

It is listed under Criterion F in the National List of Ecosystems which categorised it as a priority area 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.

No other area of national conservation importance falls within 20 km of the site.

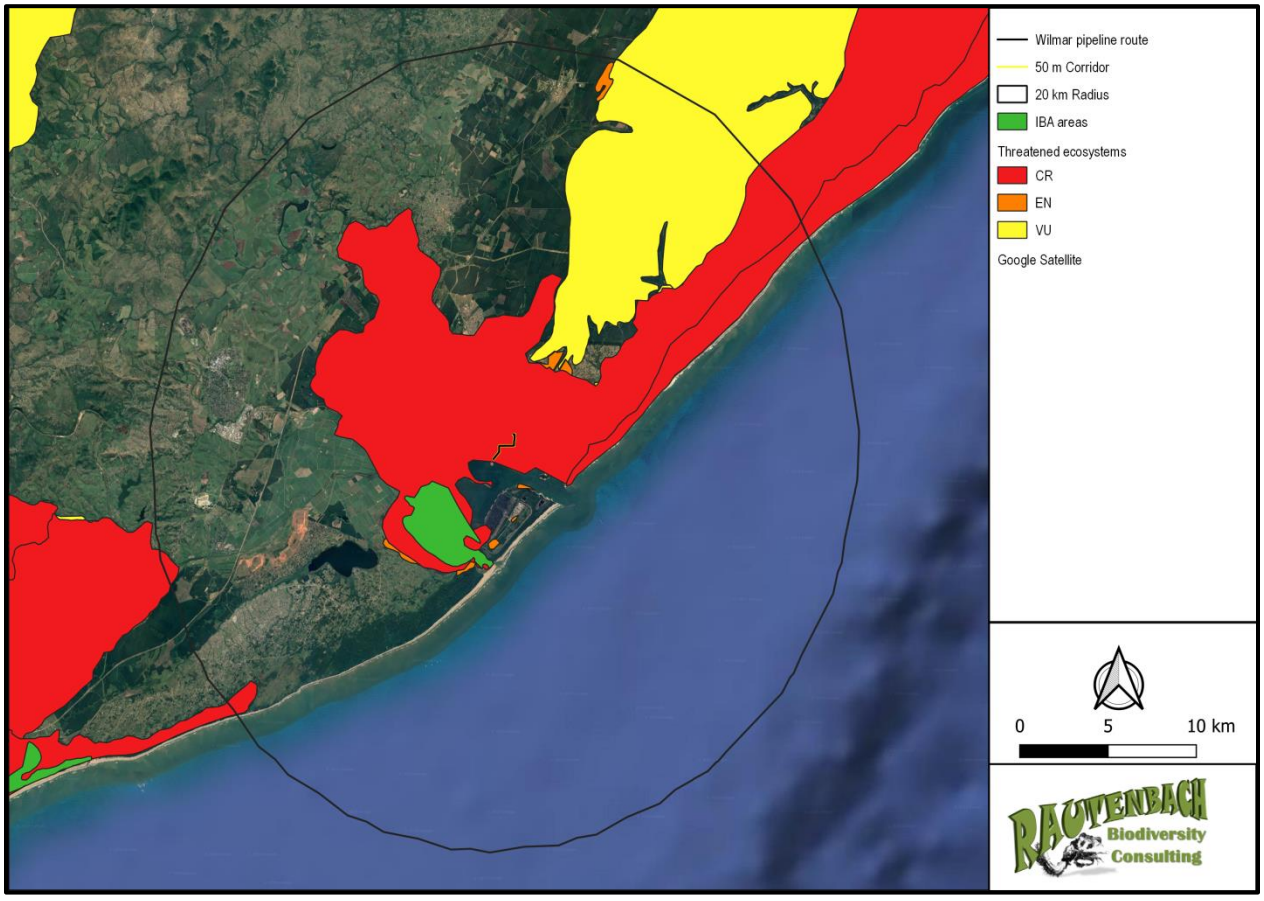


FIGURE 4: Areas of national conservation importance in relation to Wilmar pipeline.

3.2.1.3 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 developed 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 estuarine ecosystems of South Africa. It provided strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities were known as Freshwater Ecosystem Priority Areas, or 'FEPAs'.

Maps produced for South Africa's National Freshwater Ecosystem Priority Areas (NFEPA) project depicted areas that were prioritised for conserving freshwater ecosystems. The data presented below is a subset of the NFEPA project specific to the site. The pipeline route falls partially in and is close to extensive estuarine and unchanneled valley-bottom wetland systems. None of these wetlands were associated with threatened crane or frog species (Figure 5, Driver *et al*., 2011).

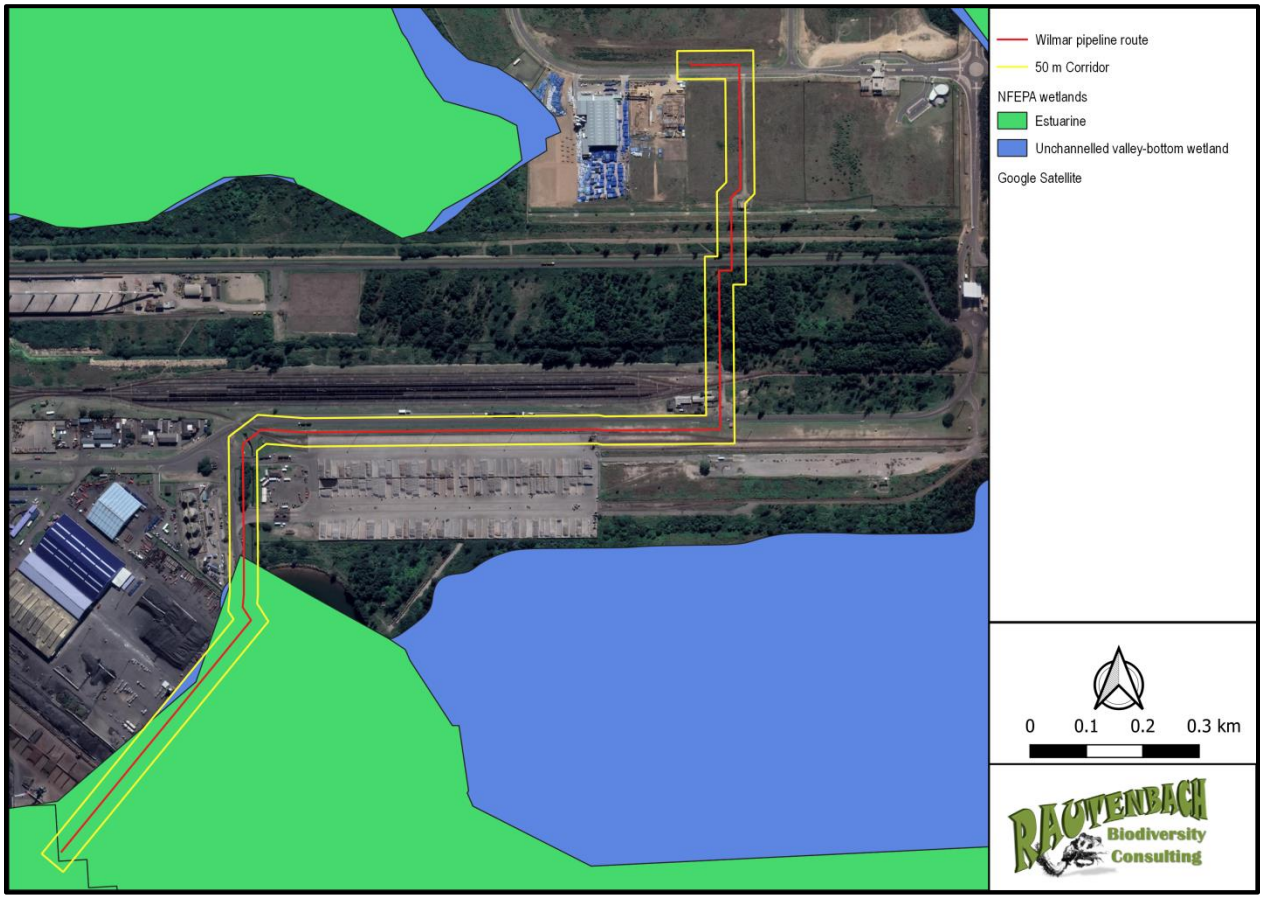


FIGURE 5: NFEPA wetlands in relation to Wilmar pipeline.

3.2.2 PROVINCIAL AND DISTRICT LEVEL CONSERVATION PRIORITIES

3.2.2.1 Provincial vegetation classification

The entire pipeline route falls within the Subtropcal Freshwater Wetlands vegetation type of the Azonal Wetland biome in KwaZulu-Natal (KZN veg type code – 76.1; SANBI veg type code AZf 6; Figure 6). Important vegetation characteristics associated with this vegetation type is described below:

- **AZf 6 Subtropical Freshwater Wetlands** (Mucina & Rutherford, 2006)

Historical distribution:
KwaZulu-Natal, Mpumalanga, Gauteng, North-West, Limpopo and Eastern Cape Provinces as well as in Swaziland: Wetlands embedded within the Albany Thicket Biome, the Coastal Belt from Transkei as far as Maputaland as well as those of Lowveld and the Central Bushveld regions. This vegetation type occurs at altitudes ranging from 0–1 400 m.

Vegetation & landscape features:
Flat topography supporting low beds dominated by reeds, sedges and rushes, and waterlogged meadows dominated by grasses. Found typically along edges of often seasonal pools in aeolian depressions as well as fringing alluvial backwater pans or artificial dams.

Geology, hydrology & soils:

Waterlogged, clayey soils of Champagne and Arcadia forms, containing certain levels of decaying organic matter, especially in very productive reed beds. These wetlands are underlain mostly by Cenozoic alluvium, less so by Karoo Supergroup volcanic rocks and sediments, as well as by the Cretaceous (and younger coastal) sediments of the Zululand and Maputaland Groups. Waterlogged habitats with water regularly forming columns of variable depth. The highest water levels are found in summer, during periods of maximum seasonal rainfall.

- **Important taxa:**

Marshes
Small trees: *Hyphaene coriacea*, *Phoenix reclinata*.

Graminoids and cyperoids: *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 arrhiza*, *Aponogeton desertorum, A. natalensis, A. rehmannii, Ceratophyllum muricatum*, *Marsilea macrocarpa*, *Najas marina* subsp. *delilei*, *N. pectinata*, *Nymphoides indica* subsp. *occidentalis*, *N. rautanenii*, *Ottelia exserta*, *Potamogeton crispus*, *P. pectinatus*, *P. schweinfurthii*, *Spirodela polyrhiza*, *S. punctata, 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 and cyperoids: *Cyperus fastigiatus*, *C. difformis*, *C. digitatus, C. latifolius*, *C. sexangularis*, *Fuirena ciliaris*.

- **Biogeographically Important Taxa** (all southernmost distribution limits)

Streambanks
Herbs: *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
Cyperoids: *Cyperus dives, C. procerus, C. prolifer.*

- **Endemic Taxa**

Marshes
Cyperoids: *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).

- **Conservation status**

Nationally listed as **'**Least Threatened' with a conservation target of 24%. Some 40–50% is statutorily conserved in the Greater St Lucia Wetland Park (including RAMSAR sites such as St Lucia System, Kosi Bay System and Lake Sibaya), Kruger National Park, Ndumo Game Reserve, and Tembe Elephant Park as well as in Nhlabane, Nylsvley (RAMSAR site), Mkombo, Sileza and Richards Bay Nature Reserves.

A further 10% enjoys protection in a number of private game farms and other reserves in the Limpopo, Mpumalanga and KwaZulu-Natal Provinces. So far only about 4% has been transformed (largely for cultivation), but the pressure of local grazing and urban sprawl will result in the demise of many subtropical freshwater habitats. Disturbance leads to invasion by alien plants such as *Lantana camara*, *Chromolaena discolor* and *Melia azedarach* (on the edges of wetlands) and aquatic weeds such as *Eichhornia crassipes*, *Pistia stratiotes* and *Salvinia molesta* (in water bodies; Mucina & Rutherford, 2006).

Provincially listed as '**Vulnerable**' (Figure 7; Scott-Shaw & Escott 2011; Jewitt, 2011).

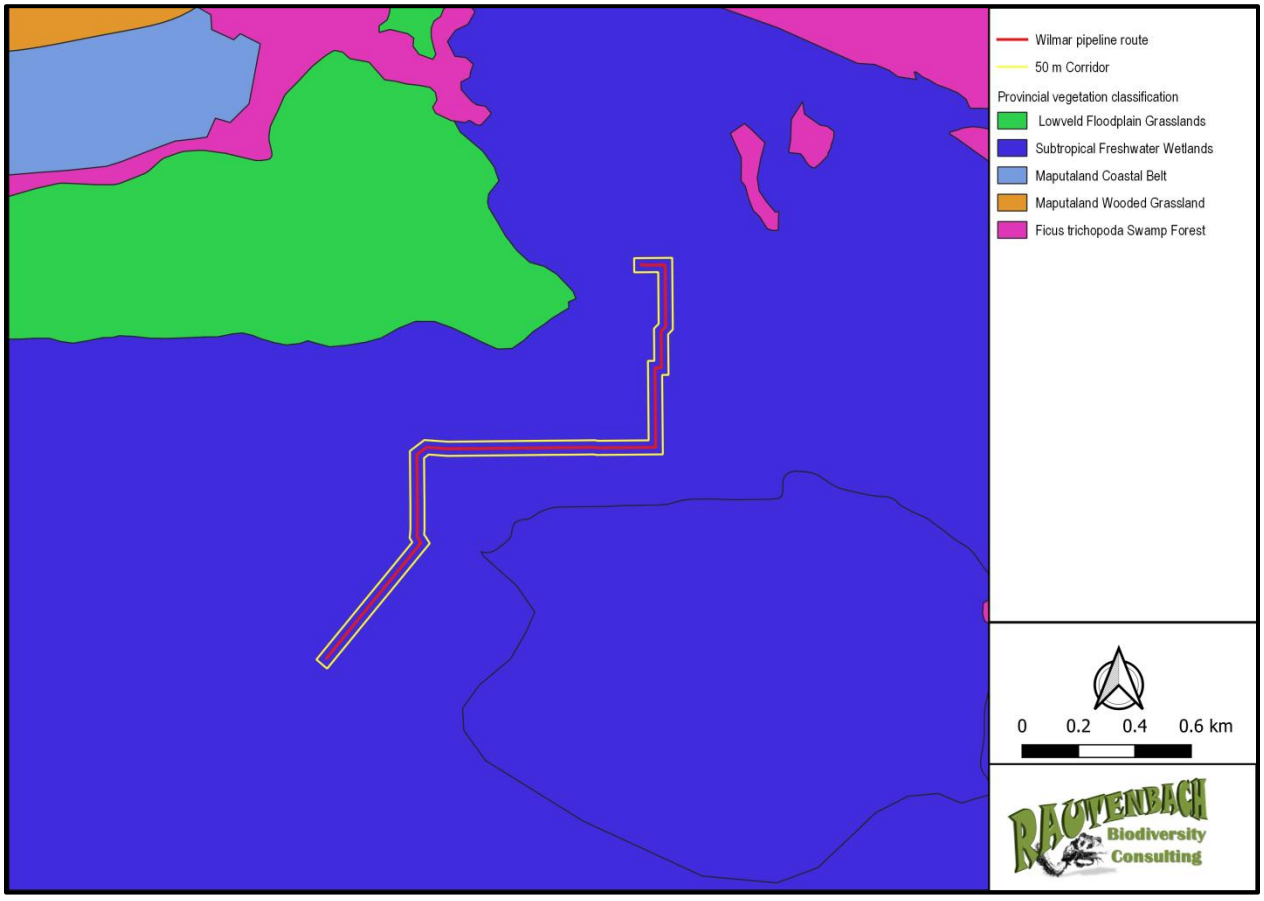


FIGURE 6: Historical coverage of Subtropical Freshwater wetlands alongside Wilmar pipeline.

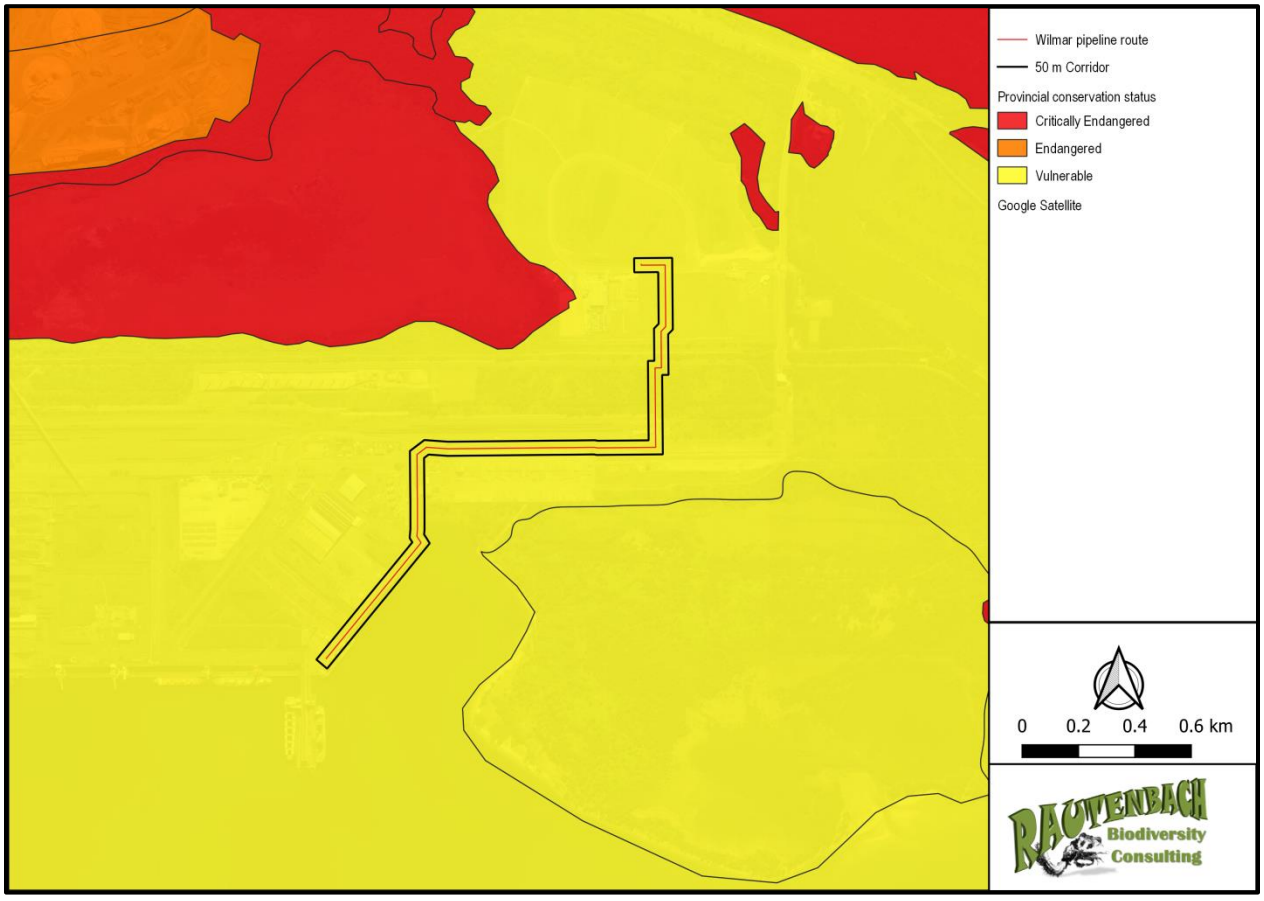


FIGURE 7: Provincial conservation status of vegetation types alongside Wilmar pipeline.

3.2.2.2 CBA and ESA areas

Terrestrial conservation priority areas highlighted for the province in the KwaZulu-Natal Systematic Conservation plan and uThungulu District are presented in Figures 8 and 9. The provincial scale KZN Systematic Conservation Plan (EKZNW 2010) and the district scale uThungulu Biodiversity Sector Plan (EKZNW 2014) identified and mapped critical biodiversity areas (CBA) and ecological support areas (ESA) within the province.

It is important to note that categorical classes of CBAs and ESAs are reflected differently in the EKZNW 2010 and EKZNW 2014 plans (Table 3). The EKZNW 2010 planning product highlighted the key priority areas for biodiversity conservation as reflected against a uniform biome i.e. the marine, estuarine, freshwater and terrestrial biomes, while the EKZNW 2014 was a higher order spatial planning tool which took into consideration locally identified CBA and ESA localities, and incorporated priorities identified on a national level.

TABLE 3: Summary of the CBA/ESA categories used in the KwaZulu-Natal Systematic Conservation Plan (EKZNW 2010) and the uThungulu Biodiversity Sector Plan (EKZNW 2014).

EKZNW 2010	
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.

100% transformed	No natural areas remaining.
EKZNW 2014	
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 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.

KZN Systematic Conservation Plan (EKZNW 2010)

The entire pipeline route falls within areas designated as 'Biodiversity areas' (Figure 8). These areas typically represented natural and/or near natural environmental areas considered to have some biodiversity value. For example, important biodiversity features potentially contained within these areas included subtropical alluvial vegetation and Maputaland coastal grassland, the rare butterfly species *Teriomima zuluana* and the grasshopper species, *Parepistaurus eburlineatus*.

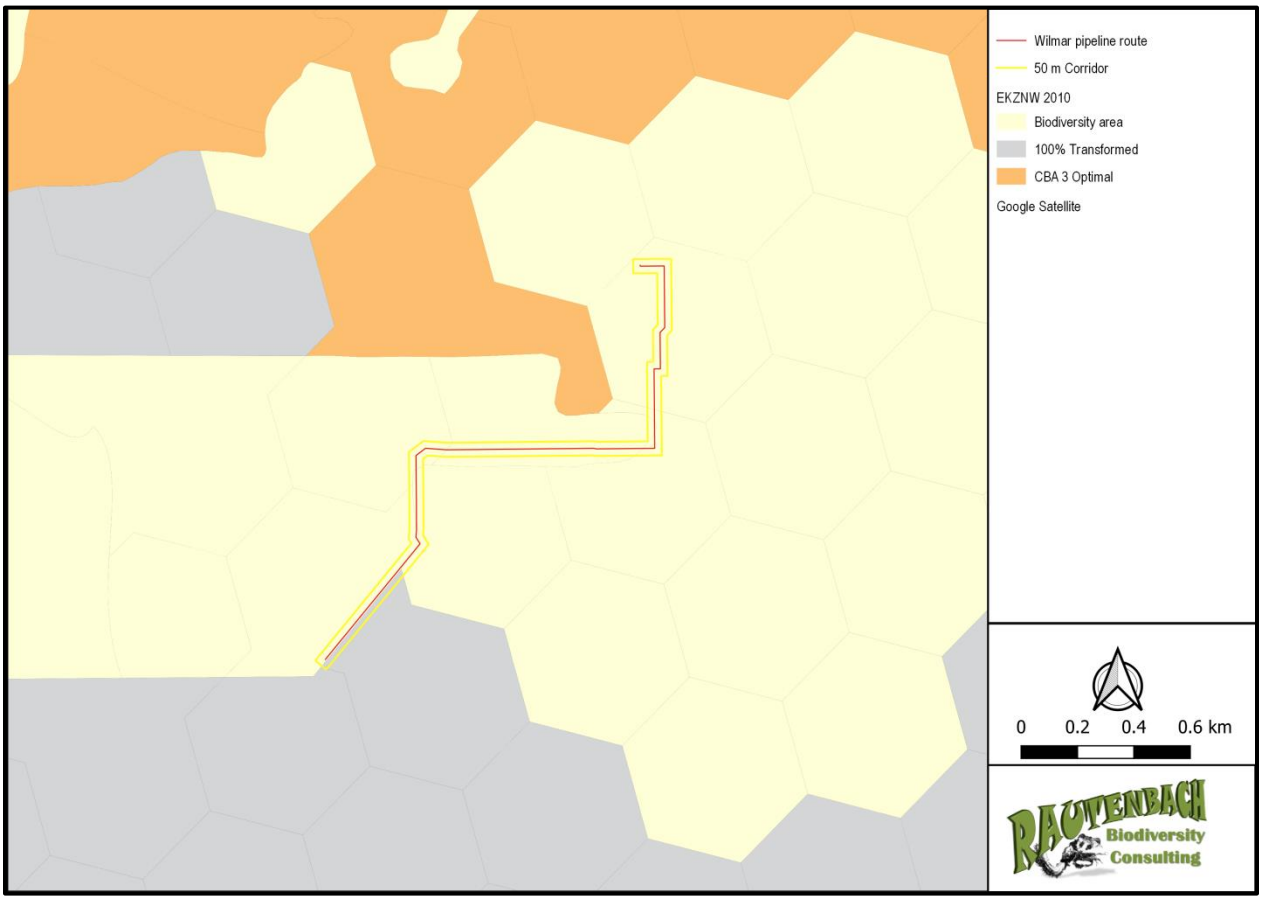


FIGURE 8: Provincial CBA areas in relation to Wilmar pipeline.

UThungulu Biodiversity Sector Plan (EKZNW 2014)

The pipeline route falls partially within, or borders on CBA: Irreplaceable areas (Figure 9). Industrial developments are generally not recommended within these areas (EKZNW 2014). No CBA: Optimal, or ESA areas are close to the pipeline route.

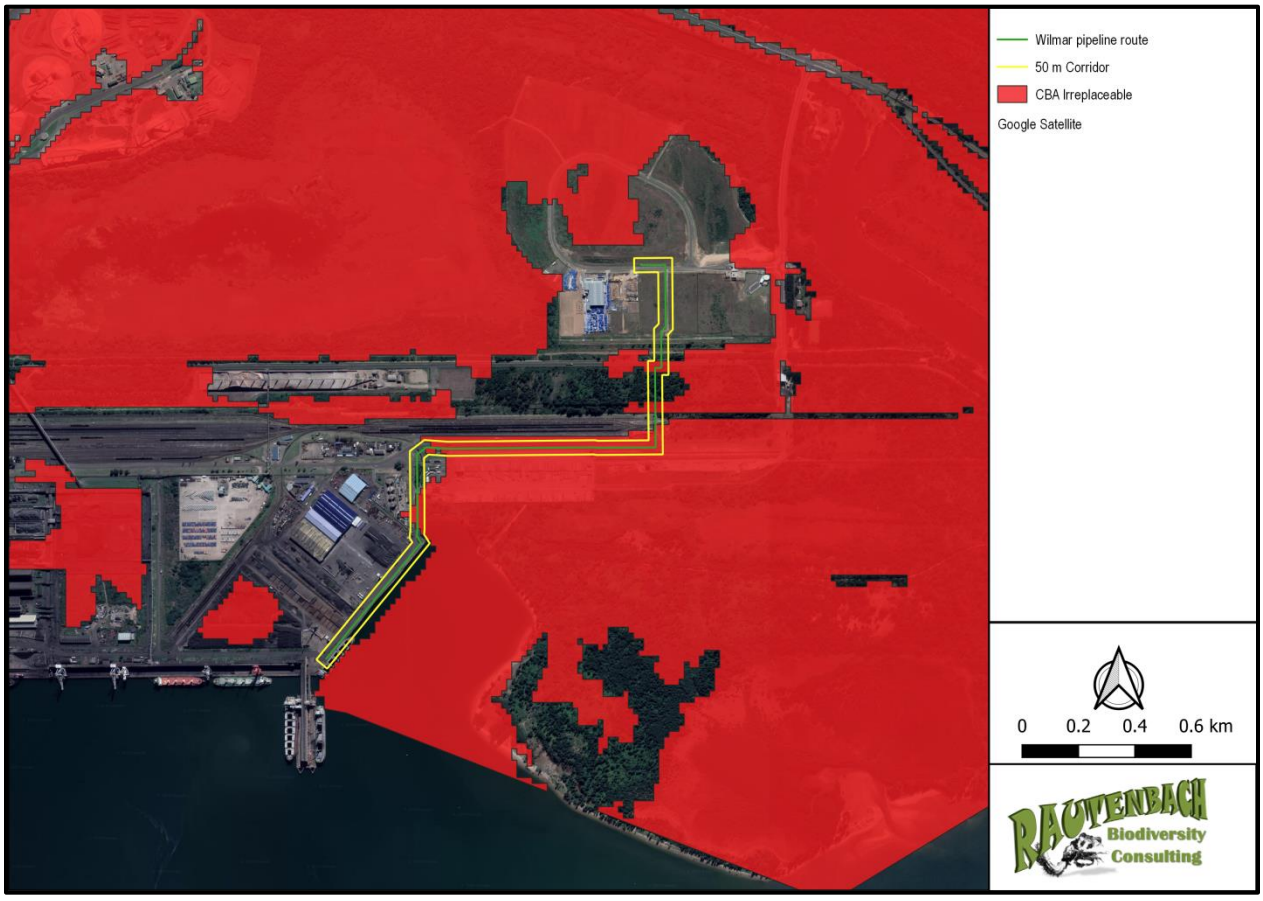


FIGURE 9: District CBA priority areas in relation to Wilmar pipeline.

3.2.2.3 Provincial protected areas and other conservation areas

The following provincial protected areas are located within 20 km of the site (Figure 10):

- Richards Bay Game Reserve - ~ 3.8 km to the southwest;
- Enseleni Nature Reserve - ~ 11.2 km to the northwest.

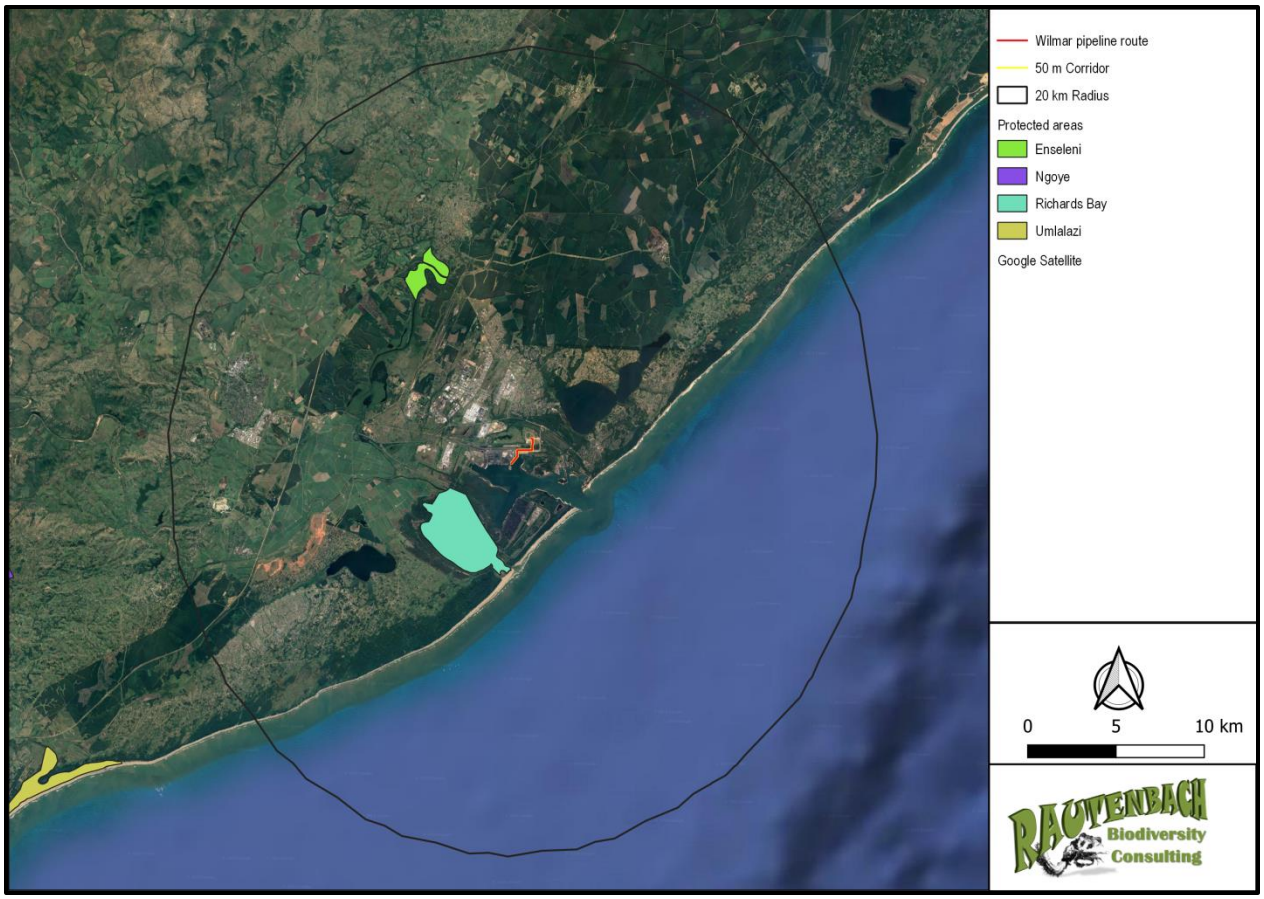


FIGURE 10: Provincial protected areas in relation to Wilmar pipeline.

3.2.2.4 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.

The Biodiversity Conservation Planning Division of eKZN Wildlife identified a series of altitudinal and biogeographic corridors in KZN to facilitate evolutionary, ecological and climate change processes and created a linked landscape for the conservation of species in a fragmented landscape (EKZNW 2010; EKZNW 2014). No local or regional important dispersal corridors were identified on or close to the pipeline route.

3.2.3 Municipal level conservation priorities

Following an extensive public participation process undertaken during 2013, the new "uMhlathuze Land Use Scheme" was adopted by the uMhlathuze Council. The new scheme 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 on 7 January 2014, and was reviewed in 2015. The effective date of the reviewed scheme was 25 June 2015.

This scheme identified zones required for the protection and conservation of environmentally important land and/or ecological features which are to be rehabilitated back to its original natural state. The pipeline foute falls in areas zoned for industrial and harbour developments (http://gis.umhlathuze.gov.za/flexviewers/lums/).

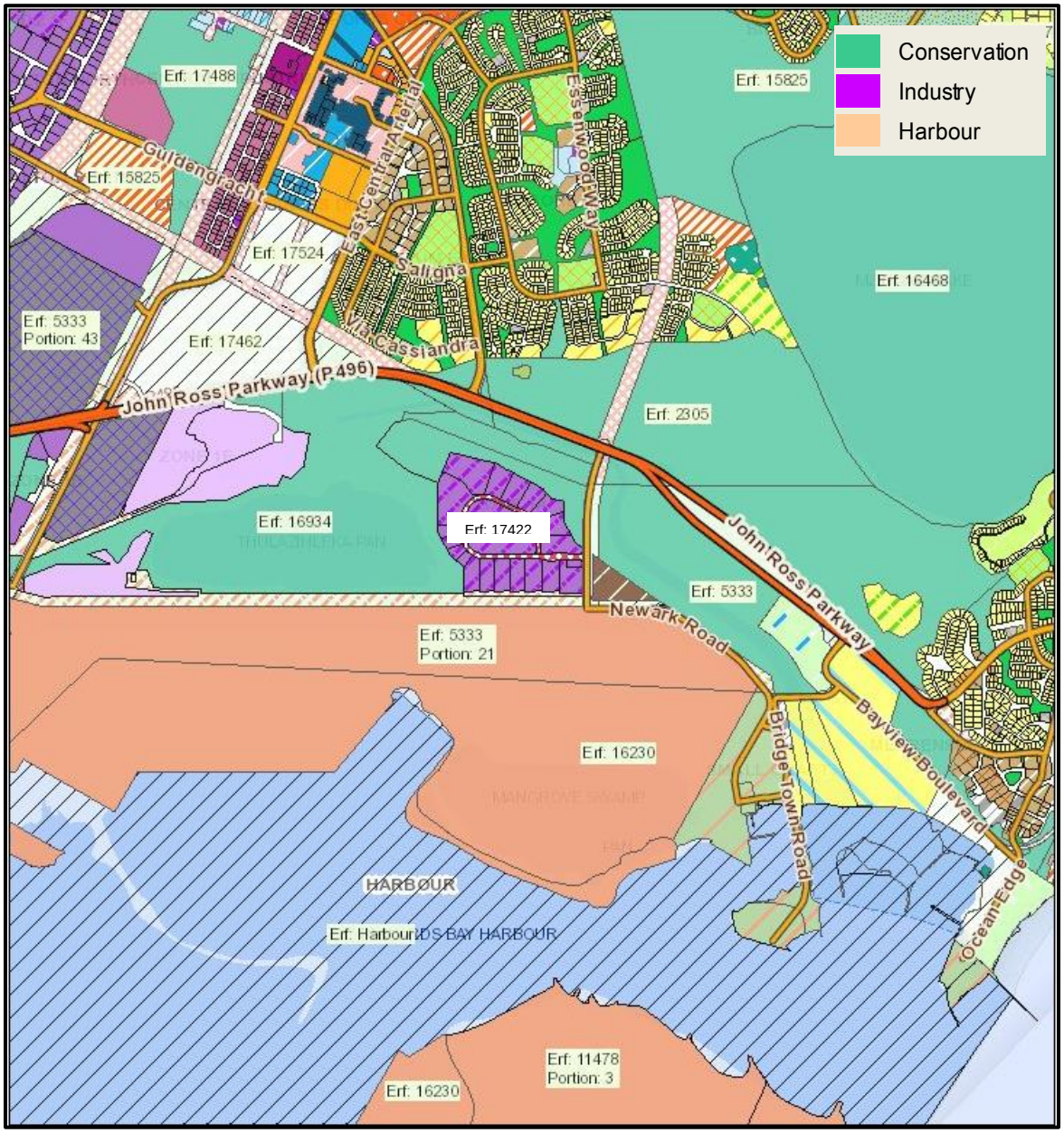
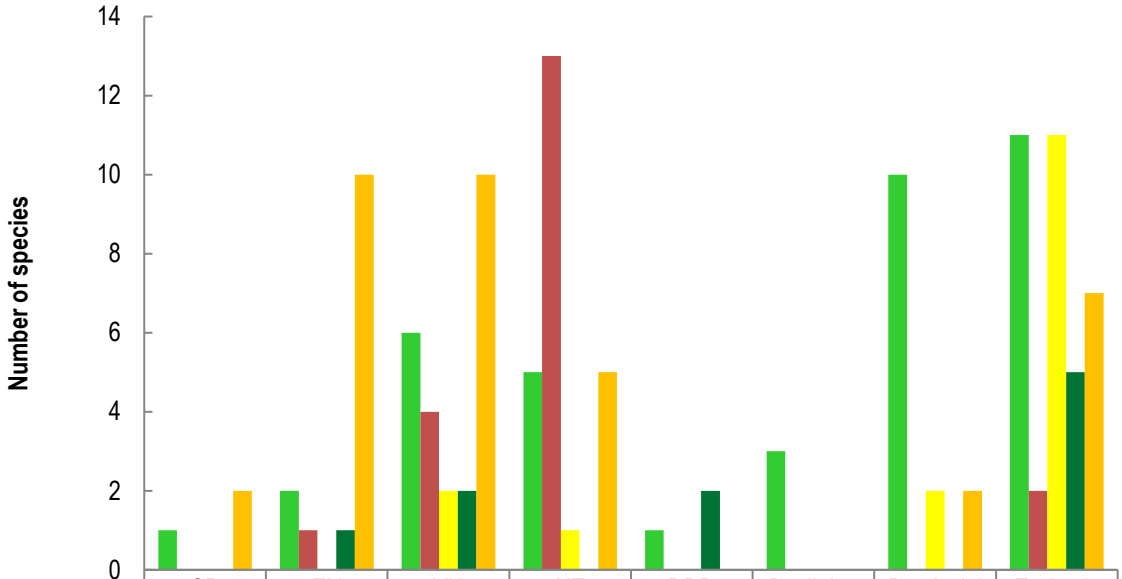


FIGURE 11: Simplified representation of land uze zoning on Erf 17422 (Phase 1A and the Transnet Port area (map adapted from http://gis.umhlathuze.gov.za/flexviewers/lums/).

3.2.4 Species of conservation significance

The database searches identified a significant number of SCS flora and fauna taxa that were previously recorded from within 20 km of the pipeline route (refer to Appendices 2 and 3 for complete lists and descriptions). This included 28 flora species, 18 mammal species, five reptile species, five frog species and 29 bird species, including several endemic/near-endemics (Figure 12).



	CR	EN	VU	NT	DDD	Declining	Provincial	Endemic
Flora	1	2	6	5	1	3	10	11
Mammals	0	1	4	13	0	0	0	2
Reptiles	0	0	2	1	0	0	2	11
Frogs	0	1	2	0	2	0	0	5
Birds	2	10	10	5	0	0	2	7

FIGURE 12: Summary of the number of SCS fauna and flora species previously recorded from the Richards Bay area.

4. RESULTS – FIELD ASSESSMENT

4.1 FLORA AND VEGETATION

4.1.1 Flora

Eighty seven species of vascular flora from 73 genera were identified alongside the pipeline route. The Families with the highest representation was from the ASTERACEAE and POACEAE (11 species each; Appendix 4). The number of flora species in each growth form identified is represented in Figure 13.

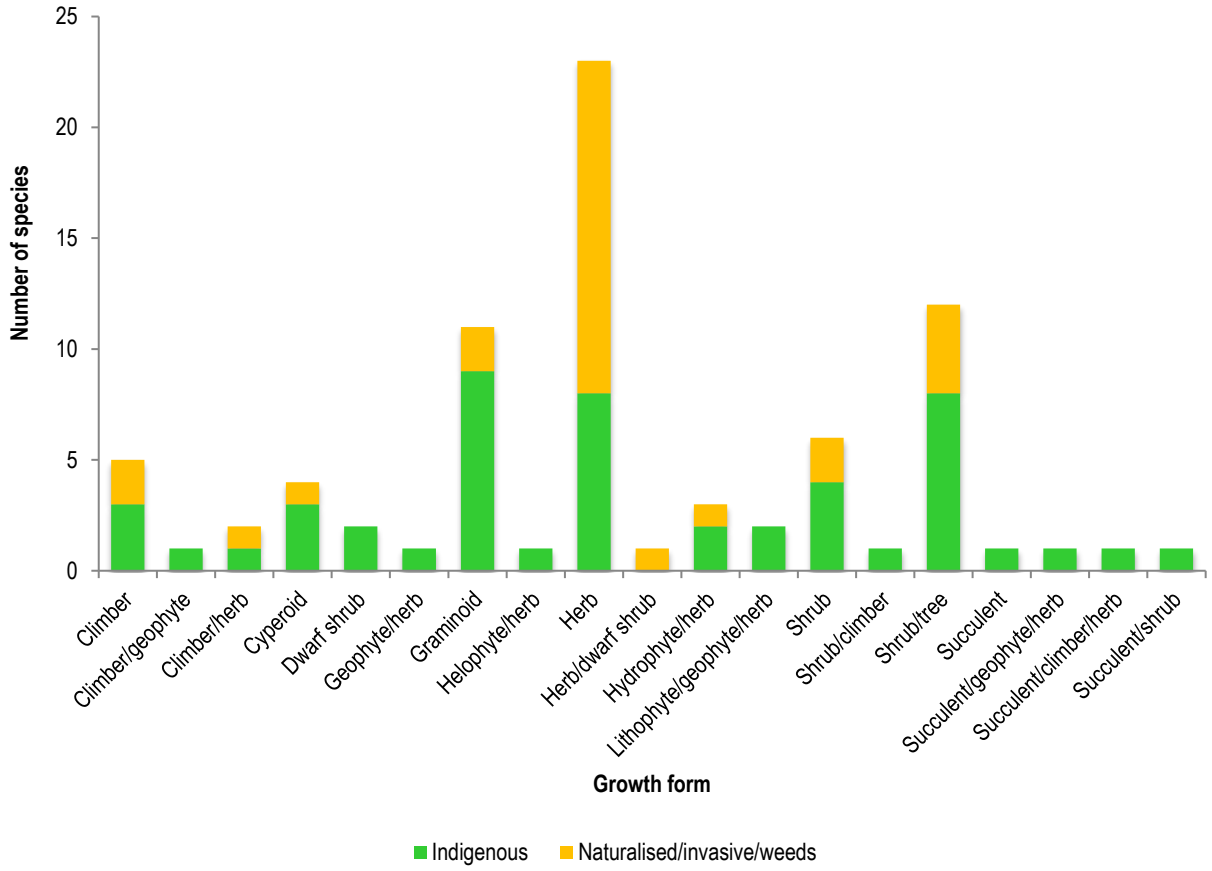


FIGURE 13: Number of flora species in each growth form identified alongside the pipeline route.

No Red Listed species were observed. Nonetheless one tree species, *Ficus trichopoda*, protected under the National Forest Act, and four provincial protected species were identified (Table 4; Figures 14 & 15). These species may not be removed or destroyed without permit authorisation from DAFF (*F. trichopoda*) and Ezemvelo KZN Wildlife.

TABLE 4: SCS flora species confirmed to be present alongside the pipeline route.

SCIENTIFIC NAME	VEGETATION COMMUNITY	GPS COORDINATES	
		Latitude	Longitude
Ficus trichopoda (single specimen)	*P. elliottii*	-28.78312°	32.06218°
Zantedescia aethiopica (single specimen)	*P. elliottii*	-28.78831°	32.06323°
Ekebergia capensis (single specimen)	*P. elliottii*	-28.78268°	32.06283°
Eulophia speciosa (2-3 specimens)	Grassland	-28.779975°	32.063108°
Strelitzia nicolai (clump of approximately 5 specimens)	*P. elliottii*	-28.78254°	32.06296°

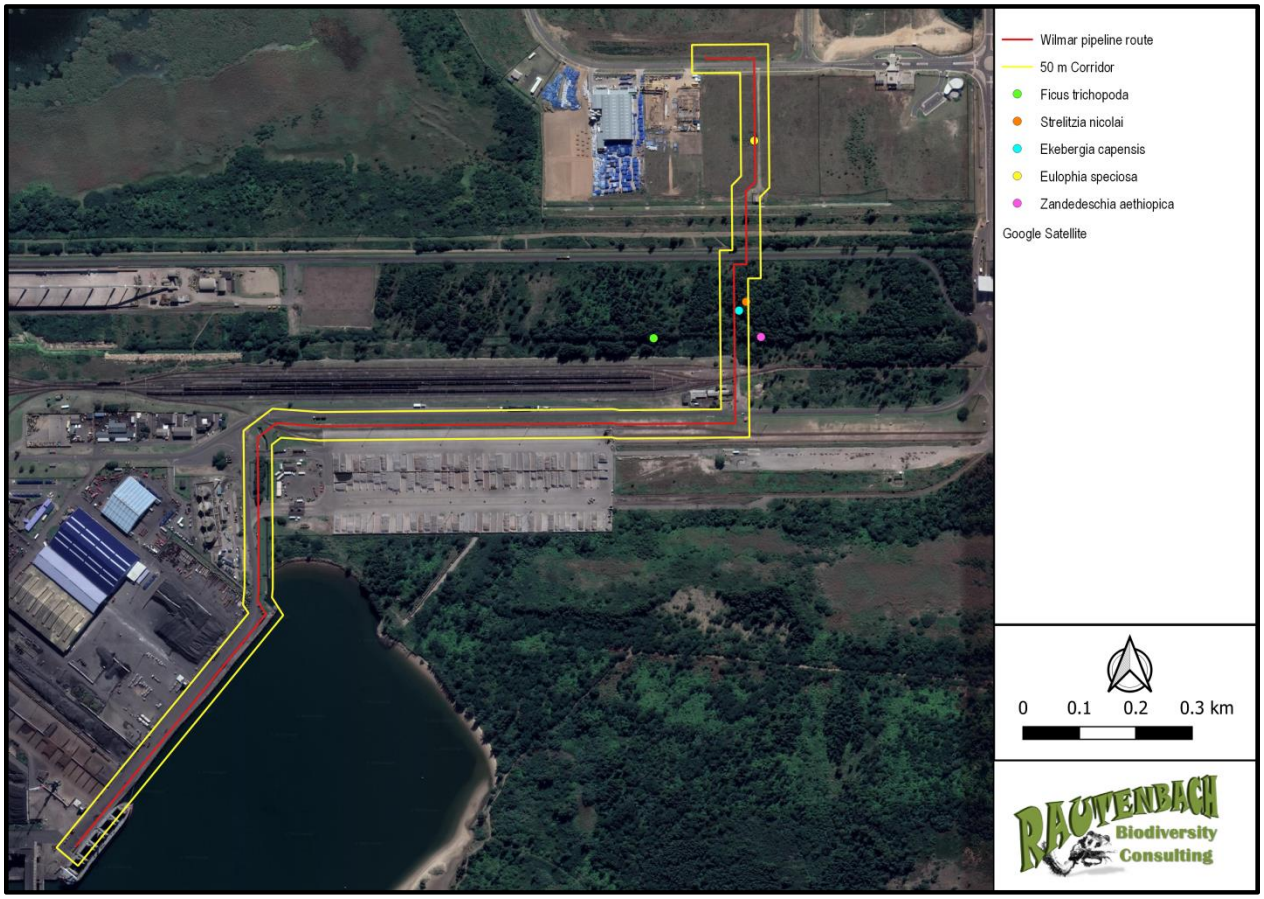


FIGURE 14: The location of SCS flora species in relation to the pipeline route.

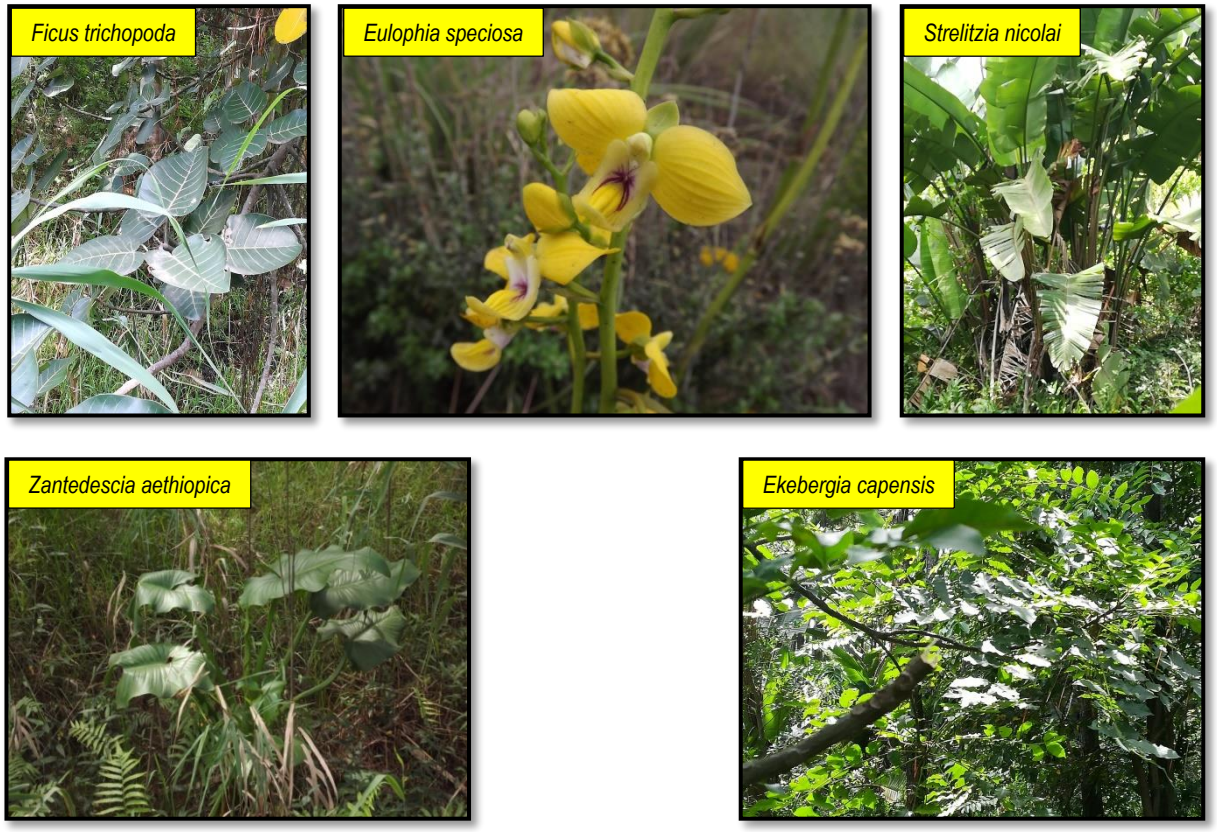


FIGURE 15: SCS flora species identified alongside the pipeline route.

The SA endemics, *Helichrysum asperum* var. *comosum* and *Wahlenbergia grandiflora*, were sparsely scattered throughout the matrix and did not form any viable populations.

4.1.2 Local vegetation communities

Most of the areas alongside the pipeline route in the port area were already 100% transformed with none of the important taxa, or biogeographically important and endemic taxa of the reference vegetation type as described by Mucina & Rutherford (2006) remaining, and therefore of no ecological significance. Consequently, the vegetation survey focused on areas where some natural vegetation remained.

Local variation in factors such as soil structure, soil depth, past land use and level of disturbance may result in many different vegetation communities embedded within the major vegetation types as described by Mucina & Rutherford (2006). Based on floristic composition and vegetation structure, areas alongside the pipeline route contained three discrete vegetation communities (Figure 18). Descriptions of each community are as follows:

Secondary grassland (area investigated - ~ 3.39 ha)

This entire vegetation community fell within Richards Bay IDZ Phase 1A. Growth form diversity was low and the area was dominated by common grass species such as *Melinis repens, Chloris gayana*, *Eragrostis curvula* and *Sporobolus pyramidalis*, resulting in thick and luxuriant basal cover. The tree layer was poorly defined; with only a few scattered trees such, i.e. *Vachellia karroo*, and the invasive *Casuarina equisetifolia* (Figure 16).

The general species assemblage was composed of widespread and abundant species with a low risk of extinction, naturalised weeds and invasive plants (Appendix 4).

FIGURE 16: Grassland vegetation on Phase 1A.

- ***Osteospermum moniliferum*** (area investigated ~ 0.39 ha)

A small vegetation community identified on the corridor between Phase 1A and Richards Bay port. Characteristic of this area was the impenetrable stands of *O. moniliferum* and *Searsia rehmanniana* thickets, with climbers such as *Rhoicissus digitata, Tacazzea apiculata* and *Secomone filiformis* well established. The tree layer was mostly composed of invasive species such as *Casuarina equisetifolia*, *Psydium guajava* and *Schinus terebinthifolius*, with a few scatted indigenous species such as *Brachylaena discolor* and *Searsia nebulosa* present.

The general species assemblage was composed of widespread and abundant species with a low risk of extinction, naturalised weeds and invasive plants (Appendix 4).

- ***Pinus elliottii* plantation** (area investigated ~ 2,70 ha)

This area was present within the Transnet port area, next to Railyard north, and planted with exotic *P. elliottii* trees. Indigenous trees/shrubs were limited and scattered throughout the matrix with species such as *Brachylaena discolour*, *Searsia nebulosa* and *Trema orientalis* dominant. The understory was dominated by invasive plants such as *Chromolaena odorata*, *Lantana camara* and *Psidium guajava*. The fern, *Microsorum scolopendria* dominated the forest floor and formed several large colonies. An unlined drainage line crossed the southern extent of this vegetation community (Figure 17).

The general of the species assemblage was composed of widespread and abundant species with a low risk of extinction, naturalised weeds and invasive plants.

FIGURE 17: Examples of vegetation inthe *Pinus Elliottii* plantation, and the unlined drainage line.

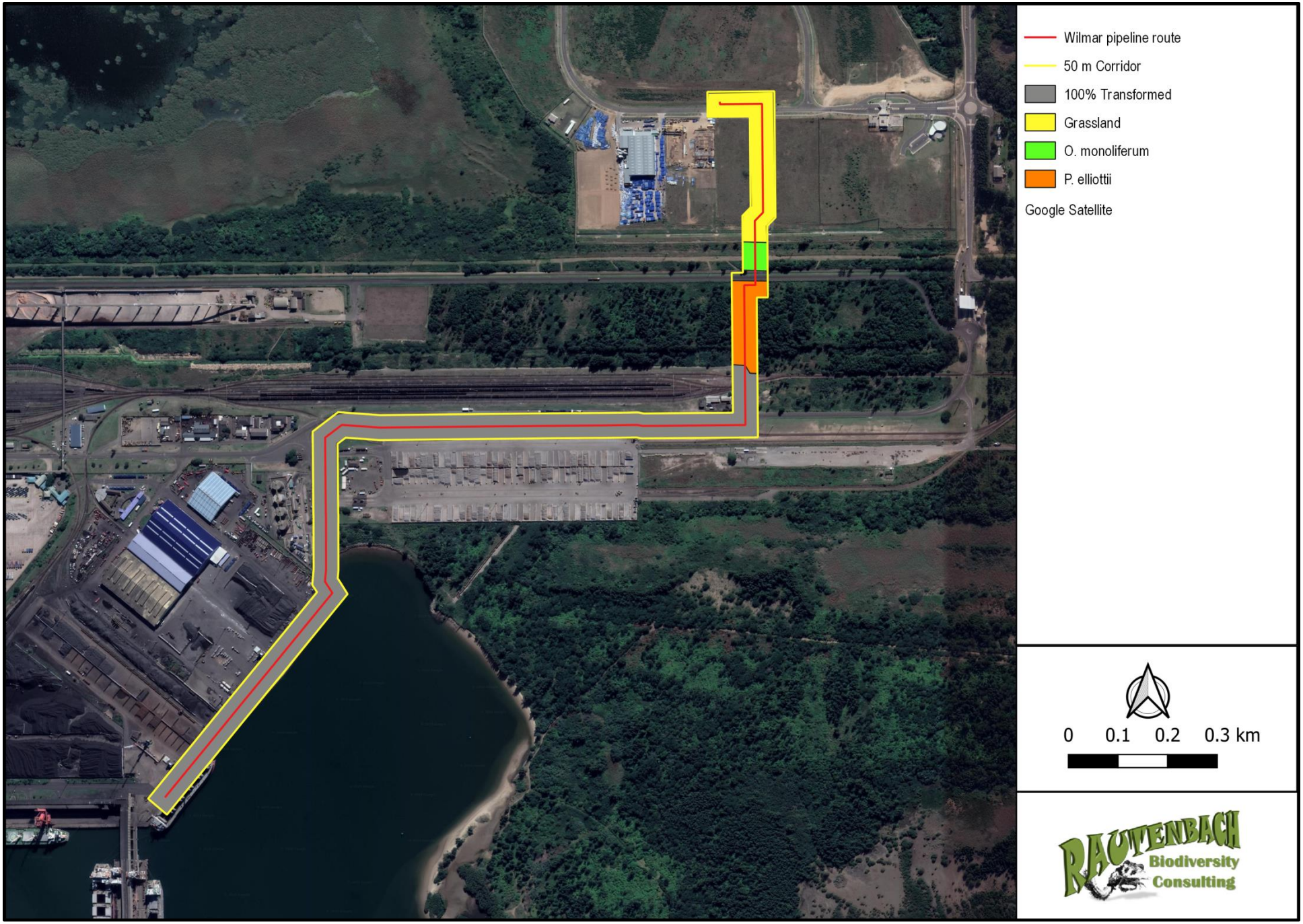


FIGURE 18: Local vegetation communities alongside the pipeline route.

4.1.3 Species of conservation significance

Seasonal constraints often result in a high probability of Red Listed flora species being overlooked during short surveys. The available habitat on the site was therefore compared to the habitat requirements of SCS flora species previously recorded from the QDGS 2832CC (Appendix 2).

None of the listed species were found on the site, and due to the transformed and degraded nature of the vegetation, it is unlikely for most of these species to be present.

Possible exceptions included the following:

- **SA Red List species**

Sisyranthus franksiae

The genus *Sisyranthus* is in need of revision. The type specimen of *S. franksiae* is from an unknown locality in KwaZulu-Natal. Recent collections from St Lucia and Richards Bay was identified as this species, but an expert on this group noted that these plants do not match the type exactly. They may be a separate subspecies, in which case *Sisyranthus franksiae* itself remains poorly known. It is thought to occur in wetlands, marshes or swamps. Since the site falls within the Subtropical Freshwater vegetation type, their presence can therefore not be entirely excluded.

Refer to Appendix 5 for development implications for areas where Red Listed species are present.

- **Provincial protected species**

Provincial protected species likely to be present and that was previously recorded from within 20 km of the site is listed in Table 5. Removal of these species may be subject to permit authorisation from eKZN Wildlife.

The rest of the SCS flora species listed in Appendix 2 is unlikely to be present since the area does not offer suitable habitat and/or is too transformed.

TABLE 5: List of flora species of conservation significance likely to be present.

TAXONOMIC INFORMATION		CONSERVATION STATUS					HABITAT & ECOLOGY			
FAMILY	**SCIENTIFIC NAME**	**SA RED LIST STATUS**	**NEMBA (2015)**	**PROVINCIAL**	**SA ENDEMISM**	**SA FOREST ACT**	**GROWTH FORM**	**HABITAT**	**PROBABILITY OF OCCURRENCE**	**VEGETATION UNIT**
AMARYLLIDACEAE	*Scadoxus multiflorus*	LC	-	PROT	-	-	Geophyte	Bushveld, grassland, coast. Flowering Oct-Dec.	Low	*P. elliottii*
APOCYNACEAE	*Sisyranthus franksiae*	DDD	-	Threatened	Endemic		Herb	Unknown, possibly wetlands, marshes or swamps.	Insiffucient information	
ASPARAGACEAE	*Asparagus falcatus* var. *ternifolius*	LC	-	PROT	-	-	Climber	On forest margins, in thickets. Flowering Sept-Dec.	Medium	*P. elliottii* & O. *moniliferum*
	Asparagus setaceus	LC	-	PROT	-	-	Shrub	Terrestrial, in thicket, S Cape – Trop Afr. Flowering Feb-May.	Medium	*P. elliottii* & O. *moniliferum*
HYACINTHACEAE	*Albuca virens* subsp. *arida*	LC	-	PROT	-	-	Geophyte	Terrestrial. Grassland; thicket in drier areas, S Afr – Trop Afr. Flowering spring/summer.	Low	*P. elliottii* & *O. moniliferum*
IRIDACEAE	*Crocosmia aurea*	LC	-	PROT	-	-	Geophyte	In forest, coast to 2000 m, in colonies. Flowering Jan-Apr.	Low	*P. elliottii* drainage line
ORCHIDACEAE	*Eulophia horsfallii*	LC	-	PROT	-	-	Succulent/ geophyte	Swampy soils in the shade of bushes and trees, along watercourses and in forests, 0-1000 m. Flowering Sept-Jul.	Low	*P. elliottii* drainage line

4.1.4 Alien and invasive plants

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 on ecosystems. 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 for up to 10 years.

IAPs are classified into four different categories and described below:

TABLE 6: IAP categories

IAP CATEGORY	DESCRIPTION

1a	• A person in control of a Category 1a listed invasive species must –
	  o comply with the provisions of Section 73(2) of the Act;
	  o immediately take steps to combat or eradicate listed invasive species in compliance with Sections 75(1), (2) and (3) of the Act; and
	  o 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.

1b	• 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.
2	• 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.

3	• 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.

Listed IAPs were observed in all vegetation units. Refer to Appendix 2 for a list of IAPs identified along the pipeline route and to Table 6 for development implications for areas where IAPs are present.

4.2 FAUNA

4.2.1 Fauna habitat assessment

Global fauna 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 occurrence of fauna species 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 site offers only two major fauna habitats, i.e. terrestrial and arboreal, and to a very limited extent, aquatic (Figure 19). Refer to Appendix 6 for a summary of the relative abundance of selected microhabitat characteristics within each vegetation community.

Secondary grassland vegetation community

Basal cover on Phase 1A was found to be thick and luxuriant which supplies both food and cover to a number of the smaller mammal species such as rodents and shrews. Indirect evidence from runways and scats confirmed the presence of small mammal populations. Consequently, it is likely for the smaller and more reticent and adaptable carnivore species such as mongooses and genets to be present. These species often manage to persist in degraded and disturbed environments as long as prey densities remain above nutritional requirements (Skinner & Chimimba 2005). No large trees or caves were present that could provide roosting opportunities for bats.

Reptile habitat was limited to leaf litter at the base of vegetation, grassy clumps and a manmade structure to the south, next to a canal. No rock outcrops or other rupiculous habitat were present. Frog habitats were limited to the grassland and a canal to the south, and may provide limited habitat to frog species such as toads and puddle frogs.

Bird microhabitat was limited and restricted to the grassland, and provided habitat to species such as pipits, larks, longclaws and cisticolas.

***O. moniliferum* vegetation community**

Basal cover on these areas varied from sparse to relatively abundant, providing sufficient cover to a few rodent and shrew species. The few trees are unlikely to provide habitat to any arboreal rodent species, however, the area may be occasionally utilised by Vervet monkeys and a few bat species. No caves were present that could provide roosting opportunities for cave-dwelling bats.

The *C. monilifera* thickets and trees provided habitat to a number of bird species such as drongos, doves and cuckoos, and a few reptile species such as skinks and agamas. No rock outcrops or other rupiculous habitat were present. No frogs are expected within this vegetation community.

***Pinus elliottii* vegetation community**

The vegetation of the *P. elliottii* was completely transformed, with mammal and herpetofauna habitat limited to a few fallen logs, decorticating bark, litter, grass and an unlined drainage line. Consequently fauna abundance and diversity were expected to be low. Litter and grassed areas may provide habitat to small mammals such as rodents but will probably only be restricted to generalist species such as the Natal multimammate mouse (*Mastomys natalensis*). No threatened shrew species are expected to be present since the area does not offer suitable habitat.

Little is known about how bats use exotic plantations and how it affects them in South Africa. Nontheless, the trees and decorticating bark may provide habitat to abundant bat species such as Little free-tailed bats (*Chaerephon pumilus*) and Egyptian free-tailed bats (*Tadarida aegyptiaca*).

Few reptile and frog species are expected to be present since these species have specialised habitat requirements and are in general sensitive to habitat modifications. Gutteral toads (*Amietophrynus gutteraliss*) and a few skink, gecko and threadsnake species might be found in this area.

The *P. elliottii* plantation may provide nesting and roosting opportunities to some forest adapted bird species. Birds of prey such as African Wood Owls, African Crowned Eagles, Forest Buzzards, Rufous-chested Sparrowhawks, Ovambo Sparrowhawks, Little Sparrowhawks, Black Sparrowhawks and African Goshawks have benefited from the forestry industry and have expanded their natural geographic ranges to previously treeless areas. Although no active or abandoned raptor nests were identified during the site visits, this should not be an indication of raptors being completely absent from this vegetation community.

Grassland in Phase 1A may provide habitat to a number of the smaller mammal species such as rodents and shrews, and to bird species such as cisticolas and widowbirds.

The canal may offer limited breeding opportunities to frog species such as grass frogs and puddle frogs.

Manmade structures may provide habitat to reptile species such as gecko's and skinks.

Trees in the *P. elliottii* vegetation unit may provide habitat to bird species such as cuckoos, mousebirds and doves.

The drainage line may offer limited habitat to frog species such as cacos.

O. monoliferum thickets may provide habitat to bird species such as white-eyes, mannikins and prinias.

FIGURE 19: Examples of fauna habitat alongside the pipeline route.

4.2.2 Observed fauna species

Species observed during the site visits included a range of locally common bird species, three provincial protected species and one near-endemic (Table 7). Provincial protected species may not be hunted, disturbed or destroyed. The near-endemic Cape white-eye is listed as of 'Least Concern', and although widespread and abundant, all endemics/near-endemics require some vigilance in order to ensure that population numbers stay stable.

Herpetofauna sightings were limited to that of a single Yellow-striped reed frog within the *P. elliottii* vegetation community. This species is common and abundant throughout its distribution range.

Indirect evidence from numerous runways within the grassland vegetation community indicated the presence of small mammals such as rodents and shrews. No other mammal species were observed. The fact that no mammals and virtually no herpetofauna were observed should not be interpreted as meaning that no mammal or herpetofauna species were present. Due to their secretive and reticent manner, many species are difficult to detect even when they are present.

TABLE 7: Fauna species observed alongside the pipeline route.

TAXONOMIC INFORMATION			CONSERVATION STATUS			HABITAT				
FAMILY	**SCIENTIFIC NAME**	**COMMON NAME**	**SA RED LIST**	**PROVINCIAL**	**ENDEMISM**	**GRASSLAND**	***O. MONOLIFERUM***	***P. ELLIOTTII***	**TRANSFORMED**	**OBSERVATION INDICATOR**
FROGS										
HYPEROLIIDAE	*Hyperolius semidiscus*	Yellow-striped reed frog	LC	-	-			x		Sighting
BIRDS										
ACCIPITRIDAE	*Milvus aegyptius*	Kite, Yellow-billed	LC	-	-	x	x	x	x	Fly over
ALAUDIDAE	*Mirafra africana*	Lark, Rufous-naped	LC	-	-	x				Sighting
ARDEIDAE	*Ardea cinerea*	Heron, Grey	LC	PROT	-				x	Sighting
CAPRIMULGIDAE	*Caprimulgus pectoralis*	Nightjar, Fiery-necked		-	-			x		Sighting
CHARADRIIDAE	*Vanellus armatus*	Lapwing, Blacksmith	LC	-	-	x				Sighting
CICONIIDAE	*Ciconia episcopus*	Stork, Woolly-necked	LC	PROT	-				x	Sighting
CISTICOLIDAE	*Camaroptera brachyura*	Camaroptera, Green-backed	LC	-	-		x	x		Call
	Cisticola juncidis	Cisticola, Zitting	LC	-	-	x				Sighting
	Cisticola natalensis	Cisticola, Croaking	LC	-	-	x				Sighting
	Prinia subflava	Prinia, Tawny-flanked	LC	-	-	x		x		Sighting
COLUMBIDAE	*Streptopelia capicola*	Dove, Cape Turtle	LC	-	-		x	x		Call
	Streptopelia senegalensis	Dove, Laughing	LC	-	-			x		Call
	Streptopelia semitorquata	Dove, Red-eyed red	LC	-	-	*x*				Sighting
COLIIDAE	*Colius striatus*	Mousebird, Speckled	LC	-	-		x			Sighting
CORVIDAE	*Corvus albus*	Crow, Pied	LC	-	-	x				Fly over
CUCULIDAE	*Chrysococcyx caprius*	Cuckoo, Diederick	LC	-	-	*x*		*x*		Call
ESTRILDIDAE	*Spermestes cucullatus*	Mannikin, Bronze	LC	-	-		x	x		Sighting
FRINGILIDAE	*Crithagra sulphuratus*	Canary, Brimstone	LC	PROT	-			x		Sighting
HIRUNDINIDAE	*Hirundo*	Swallow, Lesser striped	LC	-	-	x	x			Sighting

	abyssinica									
LANIIDAE	*Lanius collaris*	Fiscal, Common	LC	-	-	*x*				Sighting
LYBIIDAE	*Lybius torquatus*	Barbet, Black-collared	LC	-	-			x		Call
	Trachyphonus vaillantii	Barbet, Crested	LC	-	-		x			Sighting
MEROPIDAE	*Merops persicus*	Bee-eater, Blue-cheeked	LC	-	-		x			Sighting
MOTACILLIDAE	*Macronyx croceus*	Longclaw, Yellow-throated	LC	-	-	x				Sighting
	Anthus cinnamomeus	Pipit, African	LC	-	-	x				Sighting
	Motacilla aguimp	Wagtail, Pied	LC	-	-				x	Sighting
PASSERIDAE	*Passer domesticus*	Sparrow, House	LC	-	* I				x	Sighting
PLOCEIDAE	*Euplectes axillaris*	Widowbird, Fan-tailed	LC	-	-	x				Sighting
PYCNONOTIDAE	*Andropadus importunus*	Greenbul, Sombre	LC	-	-			x		Call
	Pycnonotus tricolor	Dark-capped bulbul	LC	-	-	*x*				Sighting
STURNIDAE	*Acridotheres tristis*	Myna, Common	LC	-	* I	x				Sighting
	Lamprotornis corruscus	Starling, Black-bellied	LC	-	-			x		Sighting
THRESKIORNITHIDAE	*Bostrychia hagedash*	Ibis, Hadeda	LC	-	-	x	x	x		Fly over
PANDIONIDAE	*Pandion haliaetus*	Osprey, Western	LC	PROT	-			x	x	Fly over
ZOSTEROPIDAE	*Zosterops virens*	White-eye, Cape	LC	-	Near-endemic		x	x		Sighting

I – Introduced

4.2.3 Species of conservation significance

No habitat existed for any of the threatened migratory and nomadic waterbirds known from the Richards Bay IBA. Nontheless, the *O. moniliferum* and *P. elliottii* vegetation units may provide habitat to some SCS fauna species and is listed in Table 8.

TABLE 8: Fauna species of conservation significance likely to be present.

TAXONOMIC INFORMATION			CONSERVATION STATUS							
FAMILY	**SCIENTIFIC NAME**	**COMMON NAME**	**SA RED LISTING**	**NEMBA 2015**	**PROVINCIAL**	**CITES LISTING**	**SA ENDEMISM**	**HABITAT AND ECOLOGY**	**PROBABILITY OF OCCURRENCE**	**VEGETATION COMMUNITY**
MAMMALS										
MUSTELIDAE	*Poecilogale albinucha*	African Striped Weasel	NT	-	PROT	-	No	Savannah and grassland habitats, although it probably has a wide habitat tolerance and has been recorded from lowland rainforest, semi-desert grassland, fynbos with dense grass and pine plantations.	Low	*O. moniliferum* /*P. elliottii*
REPTILES										
GERRHOSAURINAE	*Tetradactylus africanus*	Eastern long-tailed seps	LC	-	-	-	Endemic	Open and wooded grasslands, dry, sandy grasslands near the coast and on the edges of forests and plantations.	Low	*O. moniliferum* /*P. elliottii*
LAMPROPHIIDAE	*Lycodonomorphus inornatus*	Olive house snake	LC	-	-	-	Endemic to KZN	Inhabits grassland, savanna, fynbos and forest habitats. Shelters under rocks and soil and in or under rotting logs.	Low	*O. moniliferum* /*P. elliottii*
FROGS										
ARTHROLEPTIDAE	*Arthroleptis wahlbergi*	Bush squeaker	LC	-	-	-	Endemic to KZN	A forest species but it is also found in adjacent thickets and grassland where there is dense cover and accumulations of leaf litter. The frogs are common where they occur and are frequently resident in gardens and even in alien tree plantations.	Low	*P. elliottii; O. moniliferum*
HEMISOTIDAE	*Hemisus guttatus*	Spotted Shovel-nosed Frog	VU		PROT		Endemic	Along the coast, inhabits Coastal Bushveld/ Grassland, while in the interior it occurs in Northeastern Mountain Grassland and Natal Central Bushveld. It breeds on the edges of pans or swampy areas, and along rivers, especially where the gradient is slight and alluvial deposits are present.	Low	*P. elliottii* drainage line
BIRDS										

TAXONOMIC INFORMATION			CONSERVATION STATUS							
FAMILY	SCIENTIFIC NAME	COMMON NAME	SA RED LISTING	NEMBA 2015	PROVINCIAL	CITES LISTING	SA ENDEMISM	HABITAT AND ECOLOGY	PROBABILITY OF OCCURRENCE	VEGETATION COMMUNITY
ACCIPITRIDAE	*Circaetus fasciolatus*	Snake-eagle, Southern Banded	CR	-	PROT	II	No	Lowland evergreen forest, sand forest and plantation margins. Laying dates, Aug-Oct.	Low	*P. elliottii*
	Stephanoaetus coronatus	Eagle, African Crowned	VU	-	PROT	II	No	Favours tall closed canopy forest, also found in riparian forest, dense woodland and forested gorges in grassland. Inhabits gum and pine plantations. Laying dates, Aug-Oct.	Low	*P. elliottii*
MUSCICAPIDAE	*Cercotrichas signata*	Scrub-robin, Brown	LC	-	-	-	Near-endemic	From coastal dune to mistbelt forests.Laying dates, Oct-Jan.	Medium	*P. elliottii*
	Sigelus silens	Flycatcher, Fiscal	LC	-	-	-	Near-endemic	Open woodland, from moist to semi-arid regions. Frequent resident in gardens, especially in W Cape. Laying dates, mainly Oct-Dec.	High	*O. moniliferum /P. elliottii*

5. HABITAT SENSITIVITY ANALYSIS

The vegetation of the site was found to be significantly transformed by land clearance, land transformation, IAPs and weeds, with virtually none of the reference vegetation type remaining. The abiotic nature of landscape is currently of such a nature that it can not be rehabilitated easily.

Although a few SCS flora species were present, these species are not restricted to the habitat available alongside the pipeline route. Potential occurrences of SCS flora species such as those from the Families AMARYLLIDACEAE, HYACINTHACEAE, IRIDACEAE and ORCHIDACEAE can be relocated with ease. From a vegetation perspective, the entire site is therefore regarded as of low ecological sensitivity (Figure 20).

Impacts on SCS fauna species potentially present within the *O. moniliferum* and *P. elliottii* vegetation units can be adequately mitigated, consequently fauna habitats are regarded as of low sensitivity (Figure 20).

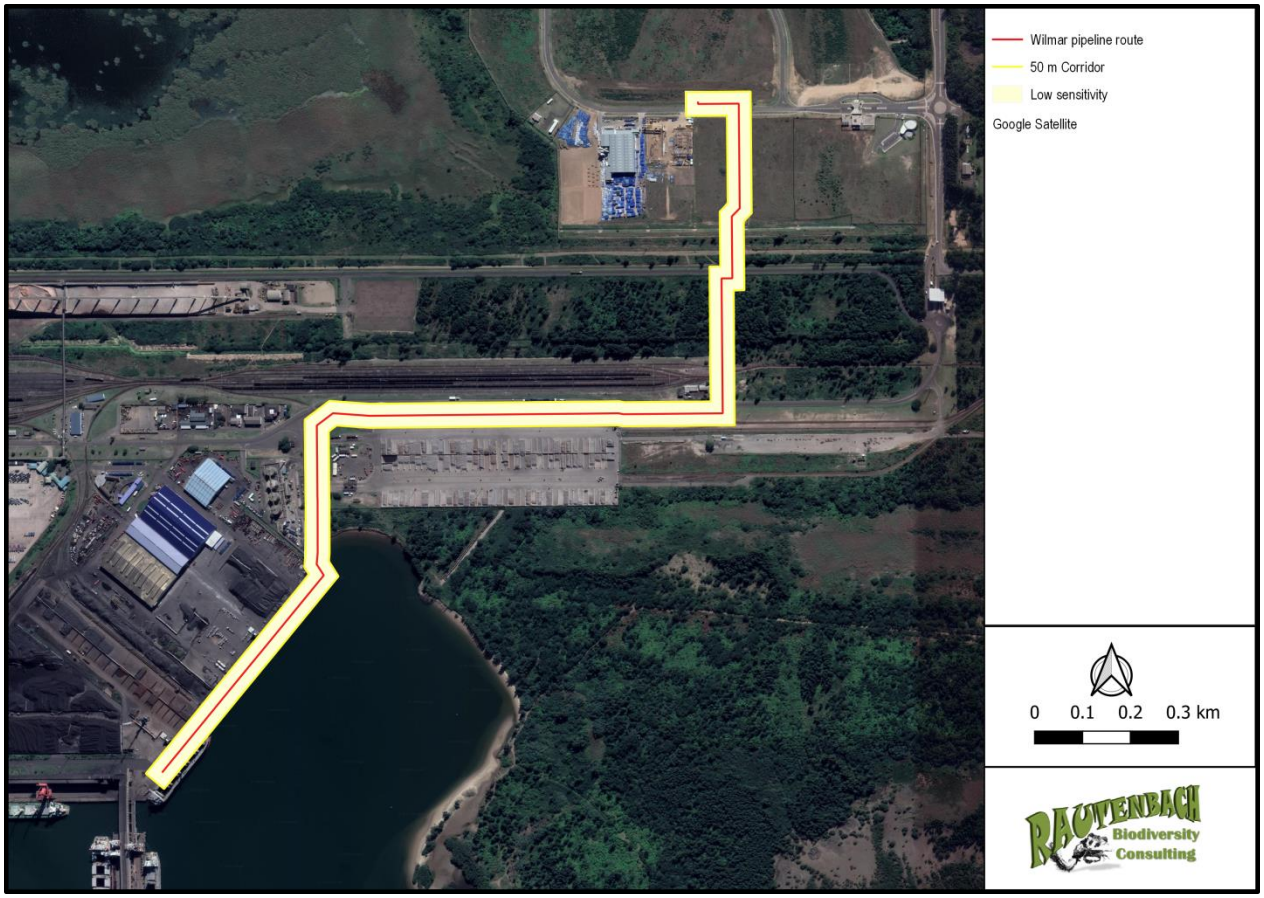


FIGURE 20: Overall habitat sensitivity analysis.

6. ECOLOGICAL IMPACT ASSESSMENT

This section identified and quantified the primary ecological impacts expected to result from construction and operation of the Wilmar pipeline.The maximum project impacts expected will be during the construction phase, with the operational phase expected to carry little concern with regards to generating impacts. Impacts likely to be associated with the proposed development were identified and are summarised below (Table 9):

TABLE 9: Summary of primary ecological impacts expected from the construction and operational phases of Wilmar pipeline.

ENVIRONMENTAL IMPACT	RECEIVING COMPONENT OF THE ENVIRONMENT
CONSTRUCTION PHASE	
Destruction and loss of flora and vegetation	Fauna & Flora
Potential loss of SCS species	Fauna & Flora
Potential injury and disturbance of local fauna populations	Fauna
Noise and artificial lighting	Fauna
Pollution of soils and habitat	Habitat
OPERATIONAL PHASE	
Colonisation by IAPs and weeds	Flora & Habitat

6.1 CONSTRUCTION PHASE IMPACTS

Construction phase activities may include but will not necessarily be limited to the following general activities:

- Site access (establishment of access roads);
- Vegetation clearance;
- Site establishment (i.e. offices, workshops, parking, ablution facilities, storage areas, laydown areas etc.);
- Civil works;
- Concrete works.

TABLE 10: Destruction and loss of flora and vegetation

This impact relates to the complete removal and/or partial destruction/disturbance of vegetation by machinery and workers, impacting directly on the ecological condition and available habitat. This impact is typically associated with activities within the construction zone but may extend beyond this footprint should construction activities not be carefully managed.

Although the site will be located within a 'Critically Endangered' ecosystem and 'Vulnerable'vegetation type, past anthropogenic disturbance have already significantly transformed and degraded the site. The general species assemblage was found to be composed of widespread and abundant flora species with a low risk of extinction, naturalised weeds and invasive plants. No sensitive habitats were present and the site was regarded as of low ecological sensitivity.

	Without mitigation	With mitigation
Extent	2	1
Duration	1	1
Magnitude	4	2
Probability	4	3
Significance	**28 (LOW)**	**12 (LOW)**
Status (positive or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

MITIGATION

- Clearing of vegetation in preparation for construction should be carried out in such a way that the area cleared is minimised to prevent soil erosion.
- Vegetation clearance must be restricted to the construction footprint.
- The timing between clearing of an area and subsequent development must be minimised.
- Where possible, cut natural vegetation to ground level rather than removing completely, leaving root systems intact to ensure rapid re-colonisation.
- As far as possible, indigenous plants/trees should be removed intact and relocated/used in rehabilitation. Smaller trees (3-4

m) can be easily removed intact and replanted in suitable areas outside of the construction zone.

- Collection of firewood must be prohibited.
- No open fires to be allowed on the construction site.
- Any post-development re-vegetation should use locally indigenous species.

CUMULATIVE IMPACTS
Surrounding areas was already significantly transformed and fragmented by anthropogenic disturbance, thus no significant cumulative impacts are expected.
RESIDUAL IMPACTS
None expected should mitigation measures be correctly implemented.

TABLE 11: Potential loss of SCS species

Activities involving the clearing of vegetation could result in the destruction or loss of SCS fauna and flora species. SCS flora species such as *Ficus trichopoda* and *Zantedescia aethiopica* falls outside of the development footprint and impacts on these species can be easily mitigated.

The 'Declining' and provincial protected flora species, *Eulophia speciosa* does not form a viable colony and can be relocated with ease. Other provincial protected species such as *Ekebergia capensis* and *Strelitzia nicolai* have a much wider distribution than that of the site. The rest of the SCS flora species potentially present can be relocated with ease. Should the proposed mitigation measures be correctly implemented, the impact on SCS flora species expected to be low.

The 'Critically Endangered' Southern Banded snake-eagle and the 'Vulnerable' African Crowned eagle may potentially be present in the *P. elliottii* vegetation unit and the plantations' edges. Both species are known to occur within the Richards Bay area (SABAP2), consequently their presence on the site cannot be entirely excluded. By correctly implementing the proposed mitigation measures provided below, potential adverse impacts on these species can be adequately mitigated.

Mobile fauna species such as African Striped weasels, Brown Scrub-robins and Fiscal flycatchers will simply move away following disturbance from construction activities. Less mobile species such as Spotted shovel-nosed frogs, Eastern Longtailed seps, Olive house snakes and Bush squeakers can be adequately protected should the proposed mitigation measures be correctly implemented.

	Without mitigation	**With mitigation**
Extent	5	2
Duration	5	1
Magnitude	6	4
Probability	2	2
Significance	**32 (MEDIUM)**	**14 (LOW)**
Status (positive or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

MITIGATION

Flora:

- Prior to vegetation clearance, the development footprint and 100 m of adjoining areas should be scanned for the presence of SCS flora species.
- Where removal of SCS species is required, the necessary permits must be obtained (eKZN Wildlife).
- Removed plants must either be housed in a temporary nursery or transplanted into suitable natural habitats near to where they were rescued; or kept for replanting in rehabilitation areas. If planted in suitable habitat, the position must be marked to aid in future monitoring of those plants.
- Relocation/rescue activities should be undertaken within the spring flowering period in order to avoid missing bulb species which will only appear during this time. Suggested plant relocation and monitoring protocols are presented in Appendix 7.
- 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.
- The collection and/or destruction of plants by unauthorised persons must be prevented and signs stating so must be placed

at the entrance of the main site camp and clearly communicated to all employees.

Fauna:

- No more than two weeks in advance of vegetation clearance that will commence during the breeding season of SCS bird species potentially occupying the area, a suitably qualified Zoologist must conduct a pre-construction survey of all potential SCS bird nesting habitat in the vicinity of the construction footprint. If this survey indicate that no nests or SCS birds are present or that nests are inactive or potential habitat is unuccopied, 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, relocation of birds, or seasonal avoidance (i.e. vegetation clearance and construction activities starting after the breeding season). If buffers are created, a no disturbance zone must be created around active nests during the breeding season by a suitably qualified Zoologist.
- During vegetation clearance, methods should be employed to minimise potention harm to fauna species. Clearing has to take place in a phased and slow manner, commencing from the interior of the site, progressing outwards towards the boundary to maximise potential for mobile species to move to adjacent areas.
- Fauna species such as frogs and reptiles that have not moved away should be carefullly and safely removed to a suitable location beyond the extent of the development footprint by a suitably qualified EO/ESO trained in the handling and relocation of animals.

CUMULATIVE IMPACTS
Surrounding areas was already significantly transformed and fragmented by anthropogenic disturbance, thus no significant cumulative impacts are expected.
RESIDUAL IMPACTS
Expected to be low if mitigation measures are correctly implemented.

TABLE 12: Potential disturbance and injury of local fauna populations

The construction phase of a project can be highly disturbing to birds breeding in the vicinity of the construction activities. Many birds, especially shy and/or ground nesting species such as pipits and larks, 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 fledglings. Such a sequence of events can have far reaching implications for species that only breed once a year or once every two years.

Slower moving species such as reptiles and frogs 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 killed out of fear and superstition. Mammal species such as rodents are tolerant to disturbance and would simply move away to more suitable habitats during the construction phase. Consequently the construction phase impacts on these species are expected to be low.

Adverse environmental impacts on fauna populations can however be minimised through a number of mitigation measures, including timing restrictions on clearing of vegetation.

	Without mitigation	**With mitigation**
Extent	2	1
Duration	4	1
Magnitude	4	2
Probability	4	3
Significance	**40 (MEDIUM)**	**12 (LOW)**
Status (positive or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
MITIGATION		

- Vegetation clearance should ideally start during the non-breeding season of fauna species (i.e winter).
- Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles time to weather the disturbance in an undisturbed zone close to their original territories.
- 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 site to maximise potential for mobile species to move to adjacent aeas.
- Slow moving species such as frogs and reptiles that have not moved away should be carefuly and safely removed by a suitably qualified ESO/EO trained in the handling and relocation of animals, to a location beyond the extent of the development footprint.
- Areas beyond the development footprint should be expressly off limits to construction personnel and construction machinery and this should be communicated to them.
- It is recommended that, while trenches are open, a 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.
- No animals must be intentionally killed or destroyed and poaching and hunting should not be permitted on the site and surrounding areas.

CUMULATIVE IMPACTS
None expected if mitigation measures are correctly implemented.
RESIDUAL IMPACTS
Expected to be low if mitigation measures are correctly implemented.

TABLE 13: Noise and artificial lighting

Fauna generally respond to disturbance caused by human activities according to the magnitude, timing and duration of the particular disturbance. Human activities can affect an animals'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 construction workers and activities can therefore affect wildlife utilising nearby habitats.Noise from human activities, in particular from construction sites, has a strong impact on the physiology and behavior of for example birds. This impact concerns the masking of signals used for communication, mating and hunting, resulting in a decrease in bird density. 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. It is however likely to be short-lived during the construction phase and will probably only affect local bird species that can easily migrate to other areas.

The ecological effects of artificial lighting have been well documented. Research on insects, birds, reptiles and other wildlife species showed that light pollution can alter behavior, foraging areas and breeding cycles, not only in urban centres, but also in rural areas.

	Without mitigation	**With mitigation**
Extent	2	1
Duration	1	1
Magnitude	4	4
Probability	3	3
Significance	**21 (LOW)**	**18 (LOW)**
Status (positive or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

MITIGATION

- Outside lighting at the construction camp should be designed to minimise impact on local fauna populations.
- All outside lighting should be directed into the construction camp as opposed to away from the camp.
- 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 manufacturers'specifications, and should be regularly serviced.

CUMULATIVE IMPACTS

None expected if mitigation measures are correctly implemented.

RESIDUAL IMPACTS

None expected if mitigation measures are correctly implemented.

TABLE 14: Pollution of soils and aquatic habitat

Waste products and polutants generated during the construction phase may include fuels and oils from construction vehicles, solid waste from building material and litter, and can enter surrounding areas directly through the disposal/mismanagement of waste products, or indirectly through surface water runoff during rainfall. However, with proper waste management procedures being followed such impacts could be controlled and/or minimised.

The potential impacts to surface water will largely be confined to the area within the harbor and north of the Railyard on the undeveloped area (unlined drainage channel). Potential impacts on the surface water could be in the form of increased pollution load by way of airborne particulates generated out of the construction/vehicle movement activities. Trenching activities may generate trench water, high suspended solids concentration due to turbidity.

	Without mitigation	With mitigation
Extent	3	1
Duration	5	1
Magnitude	8	0
Probability	3	2
Significance	**48 (MEDIUM)**	**4 (LOW)**
Status (positive or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

MITIGATION

- Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered waste disposal facilities.
- All builders' rubble and liquid waste must be disposed of as necessarry at a registered waste disposal facility. No refuse wastes must be burnt.
- Adequate provision such as chemical toilets must be made available for construction workers. These toilets must be emptied on a weekly basis. Should fuels and chemicals be stored on the construction site, install bunds around storage areas.
- Minimise the amount of fuel and chemicals stored on site.
- Implement a contingency plan to handle spills so that environmental damage is avoided.
- No refuelling, servicing of plant/equipment or chemical substances must be allowed outside of the designated chemical storage facility.
- Drip trays should be used during all fuel/chemical dispensing.
- Drip trays must be placed beneath stationary machinery/plant.
- In case of petrochemical spillages, the spill should be collected immediately and stored in a designated area until it can be safely disposed of at a registered hazardous chemical substance disposal facility as described in the Hazardous Chemical Substance Regulations, 1995 (Regulation 15).
- Measures must be taken to divert runoff from open water bodies and drainage lines.
- Where possible, leave a continuous buffer of vegetation around the site perimeter to intercept any sediment that might be transferred off site via surface water flow.
- Install silt fencing along open water and drainage lines as a sediment control method. Fences should be inspected weekly to

check to breaks in the system and for sediment accumulation. • No untreated construction site runoff may be discharged directly into any open surface water body or drainage channel.
CUMULATIVE IMPACTS
None expected should mitigation measures be correctly implemented.
RESIDUAL IMPACTS
Expected to be low of mitigation measures are correctly implemented.

6.2 OPERATIONAL PHASE IMPACTS

Environmental impacts associated with the operational phase of the proposed development were mainly associated with the colonisation of IAPs and weeds along the pipeline route.

TABLE 15: Colonisation by IAPs and weeds

The colonisation of areas by weeds and IAPs poses a risk to remaining indigenous flora species and would be facilitated by the disturbance of natural vegetation and surface soil layers during construction. IAPs and indigenous weeds have the ability to out-compete and replace indigenous flora, which will in turn impact on natural biodiversity. Clearing and disturbance is also likely to result in an increase in edge habitat immediately adjacent to disturbed areas. Edge habitat is characterized by a predominance of generalist and alien species that are usually highly competitive species which can invade areas of established vegetation. Although the impact is initiated during the construction phase, it is really an operational issue as recovery of vegetation is a long term process. Potential impacts of increased levels of IAPs on the composition and function of the remaining natural vegetation and flora would probably be quite localised and may extent over a long term since recovery of vegetation is generally a lenghty process.		
	Without mitigation	**With mitigation**
Extent	3	1
Duration	5	1
Magnitude	4	2
Probability	4	2
Significance	**48 (MEDIUM)**	**8 (LOW)**
Status (positive or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
MITIGATION		
Development and implementation of an IAP control and eradication program. Refer to Appendix 8 for guidelines.		
CUMULATIVE IMPACTS		
None expected if mitigation measures are correctly implemented.		
RESIDUAL IMPACTS		
None expected if mitigation measures are correctly implemented.		

6.3 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 operational 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 SCS flora		
PROJECT COMPONENT/S	Infrastructure	
POTENTIAL IMPACTS	• Loss of SCS flora species; • Pollution of soils and habitat; • Colonisation by IAPs and weeds.	
ACTIVITY/RISK SOURCE	• Vegetation clearance; • Refuelling of machinery; • Littering; • Spread of IAPs and weeds.	
MITIGATION: TARGET/OBJECTIVE	Protection of SCS flora species and habitat	
PERFORMANCE INDICATOR	No destruction of SCS flora species and habitat	
MONITORING	• ECO to ensure that the proposed mitigations measures are correctly implemented. • Monitoring of IAPs and weeds as per the Guidelines provided in Appendix 8.	
MITIGATION: ACTION/CONTROL	**RESPONSIBILITY**	**TIMEFRAME**
Protected plants such as *Ficus trichopoda* and *Zantedescia aethopica* located close to the site must be clearly marked and cordoned off with construction tape or similar barriers and marked as no-go areas.	EO/ESO, Contractor	Pre-construction
Search and rescue of SCS flora species (Table 4):		
The identification of SCS flora species on the site during a final walkthrough.	Ecological/Botanical Specialist consultant; EO/ESO	Pre-construction
The identification of SCS flora species and areas suitable for translocation.	Ecological/Botanical Specialist consultant; EO/ESO	Pre-construction
Acquisition of permits from eKZNw for the removal of protected flora species.	Wilmar oil, Contractor	Pre-construction
Acquisition of permits from eKZNw for the translocation of plants. Translocation and monitoring guidelines provided in Appendix 7.	EO/ESO, Contractor	Construction & operational phases
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	Construction phase
Implementation of an IAP & weed eradication/control and monitoring plan (Guidelines provided in Appendix 8).	Contractor, Environmental Manager, EO/ESO	Pre-construction, construction, operational phases

Monitoring of the implementation of the recommended mitigation measures as set out in the EIA report.	EO/ESO, Environmental Manager	Construction & operational phases

OBJECTIVE: Protection of SCS fauna and local fauna populations		
PROJECT COMPONENT/S	Infrastructure	
POTENTIAL IMPACTS	• Loss of SCS fauna species; • Local fauna mortalities; • Disturbance of local fauna populations.	
ACTIVITY/RISK SOURCE	• Vegetation clearance; • Moving vehicles, machinery; • Human disturbance caused by construction activities. • Poaching • Inadvertent killing of fauna species by moving machinery	
MITIGATION: TARGET/OBJECTIVE	Protection of SCS fauna species and local fauna populations	
PERFORMANCE INDICATOR	No loss/disturbance of SCS fauna species/local fauna populations	
MONITORING	ECO to ensure that the proposed mitigation measures as set out in this report is correctly implemented.	
MITIGATION: ACTION/CONTROL	**RESPONSIBILITY**	**TIMEFRAME**
Pre-construction survey for all SCS fauna (specifically for raptors potentially present within the *P. elliottii* vegetation community) species potentially present	Environmental Manager, EO/ESO , Ecologist	2 Weeks before the onset of the construction phase
Vegetation clearance to start in the dry season.	Contractor	Construction phase
The implementation of mitigation measures as set out in this report to reduce harm to local fauna populations.	Contractor, Environmental Manager, EO/ESO	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	Construction phase
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, EO/ESO	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, EO/ESO	Construction phase

7. SUMMARY AND CONCLUSION

The vegetation on the site was determined to be significantly degraded, transformed and fragmented by past anthropogenic disturbance, with no rehabilitation possible. The vegetation, in its present ecological state, can not be considered representative of intact Subtropical freshwater wetland vegetation, the Kwambonambi hygrophilous grassland ecosystem, or CBA: Irreplaceable areas, and highly unlikely to add to the conservation value of the area on national, provincial and district scales.

The general flora species assemblages across all vegetation communities were composed of widespread and abundant species with a low risk of extinction, naturalised weeds and invasive plants. Noteworthy exceptions

included *Ficus trichopoda*, protected under the National Forest Act, *E. speciosa*, listed as Declining on the SA Red list of Plants, and three provincial protected species, i.e. *Ekebergia capensis*, *Zantedescia aethopica* and *Strelitzia nicolai*.

Ficus trichopoda and *Zantedescia aethopica* falls outside of the development footprint and can be adequately protected by the implementation of the proposed mitigation measures as set out in this report. *E. speciosa* was present at extremely low abundance (approximately 2 -3 specimens) and did not form a viable colony. Translocation of this species is relatively easy. *Ekebergia capensis* (single specimen) and *Strelitzia nicolai* falls within the development footprint. Removal/destruction of these species will be subject to permit authorisation from eKZN Wildlife.

The two SA endemic, *Helichrysum asperum* var. *comosum* and *Wahlenbergia grandiflora* were present at low densities, with both species having a much wider distribution than that of the site. SCS flora species likely to be present mainly included provincially protected species that are not restricted to habitats available alongside the pipeline route and that can be relocated with ease.

Observed fauna species consisted of widespread and abundant species with no risk of extinction. Potential occurrences included a few Red Listed and endemic species. It is highly unlikely that the proposed development will have negative impacts on any of the aquatic and migratory SCS bird species associated with the Richards Bay IBA since the site does not offer suitable habitat.

A key conclusion of the impact assessment was that all the impacts identified are amenable to mitigation. Should the proposed mitigation measures as proposed in this report be correctly implemented, it is unlikely that the proposed development will have an adverse impact on local fauna and flora populations and species of conservation significance potentially present.

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APPENDIX 1: 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 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**

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.

APPENDIX 2: SCS flora species previously recorded from the QDGS 2832CC.

TAXONOMIC INFORMATION		CONSERVATION STATUS					HABITAT & ECOLOGY	
FAMILY	**SCIENTIFIC NAME**	**SA RED LIST STATUS**	**NEMBA (2015)**	**PROVINCIAL**	**SA ENDEMISM**	**SA FOREST ACT**	**GROWTH FORM**	**HABITAT**
ACANTHACEAE	*Avicennia marina*	LC	-	PROT	-	PROT	Tree	Intertidal zone mudflats and sandy shores, and estuaries and tidal river banks with brackish water. It is a common and often dominant constituent of mangrove swamps (usually the inland fringes of mangrove associations), and is also a pioneer of new mud banks.
APOCYNACEAE	*Asclepias gordon-grayae*	EN	-	Threatened	Endemic	-	Herb	Tall, unburnt coastal grassland, in black peat soils in marshy areas, 10-100 m. Flowering Sept-Apr.
	Raphionacme lucens	NT	-	PROT	-	-	Succulent/geophyte/herb	Coastal grasslands. Flowering Jul-Jan.
ASPHODELACEAE	*Aloe cooperi*	DECLINING	-	PROT	-	-	Succulent	Grows in grasslands in dry, rocky areas or wet, marshy habitats in altitude from sea level to 1 800 m. Flowering Sept-Mar.
	Aloe linearifolia	NT	-	PROT	Endemic	-	Succulent/herb	High rainfall mistbelt, Ngongoni and coastal grassland, occurs in short grasslands in hilly areas, often in rocky outcrops. Flowering Jan-Apr.
	Kniphofia leucocephala	CR	-	Threatened	Endemic	-	Herb	Known only from vleis or wetlands in low-lying coastal grassland in the Richards Bay area of KwaZulu-Natal. Flowering Feb-Mar.
	Kniphofia littoralis	NT	-	PROT	Endemic	-	Herb	Coastal grassland. Moist depressions, not usually in permanently waterlogged soils, 5-200m. Flowering Apr-Sept.
ASTERACEAE	*Cineraria atriplicifolia*	VU	-	Threatened	Endemic	-	Herb	Grassland, open dry thornveld, or sometimes at the edges of thicket or forest or below steep cliffs in river valleys, 30-800 m. Flowering Mar-Jun.
	Nidorella tongensis	EN	-	-	Endemic	-	Succulent/ herb	Damp places among dunes overlooking the sea.
CELASTRACEAE	*Elaeodendron croceum*	DECLINING	-	PROT	-	-	Tree	Margins of moist coastal, inland and montane forests. Flowering Oct-May.
CYPERACEAE	*Cyperus sensilis*	NT	-	PROT	Endemic	-	Heliophyte/ cyperoid	Coastal grasslands and dunes, associated with seasonal pans, forms a conspicuous zone around the water edge, 5-50 m.
FABACEAE	*Aspalathus gerrardii*	VU	-	Threatened	Endemic	-	Shrub	Coastal grasslands, forest margins, often in damp or marshy sites, on sandstones and Msikaba Formation Sandstone in the south, 0-500 m. Flowering throughout year.
IRIDACEAE	*Freesia laxa subsp. azurea*	VU	-	Threatened	-	-	Geophyte	Grassy dunes or light shade along margins of coastal forests. Flowering late winter to early spring.
LECYTHIDACEAE	*Barringtonia racemosa*	LC	-	PROT	-	PROT	Shrub/tree	Streamsides, freshwater swamps and less saline areas of coastal mangrove swamps.
MORACEAE	*Ficus trichopoda*	LC	-	PROT	-	PROT	Shrub/tree	Swamps and swamp forest.
ORCHIDACEAE	* *Bonatea lamprophylla*	VU	-	Threatened	-	-	Geophyte/herb	Deeply shaded areas in coastal dune forest. Flowering Sept-Oct.
	Disperis johnstonii	NT	-	PROT	-	-	Geophyte/herb	Brachystegia woodland, forest patches, usually in shelter of rocks, 1050-1350 m. Flowering Mar-Jun.
PASSIFLORACEAE	*Adenia gummifera* var. *gummifera*	DECLINING	-	PROT	-	-	Succulent/climber	Forested ravines, forest patches and forest margins, forest scrub, miombo woodland, savanna, dune forest, on stony slopes, termitaria and littoral bush, 0-1 800 m. Flowering Oct-Apr.
RHIZOPHORACEAE	*Bruguiera*	LC	-	PROT	-	PROT	Tree/shrub	Evergreen woodlands and thickets along the intertidal mud-flats of sheltered

TAXONOMIC INFORMATION		CONSERVATION STATUS					HABITAT & ECOLOGY	
FAMILY	SCIENTIFIC NAME	SA RED LIST STATUS	NEMBA (2015)	PROVINCIAL	SA ENDEMISM	SA FOREST ACT	GROWTH FORM	HABITAT
	gymnorrhiza							shores, estuaries and inlets, mainly towards the seaward side of mangrove formation.
	Rhizophora mucronata	LC	-	PROT	-	PROT	Tree/shrub	Evergreen woodlands and thickets along the intertidal mud-flats of sheltered shores, estuaries and inlets, mainly in the seaward side of the mangrove formation.
SANTALACEAE	*Thesium polygaloides*	VU	-	Threatened	Endemic	-	Parasite/herb	Swamps on coastal flats.
SAPOTACEAE	*Mimusops caffra*	LC	-	PROT	-	PROT	Shrub/tree	Dune forest.
	Sideroxylon inerme	LC	-	PROT	-	PROT	Shrub/tree	Dune forest, coastal woodland and littoral forest.

* CITES Appendix II

APPENDIX 3: SCS fauna species previously recorded from the QDGS 2832CC.

TAXONOMIC INFORMATION			CONSERVATION STATUS					HABITAT AND ECOLOGY
FAMILY	**SCIENTIFIC NAME**	**COMMON NAME**	**SA RED LISTING**	**NEMBA 2015**	**PROVINCIAL**	**CITES LISTING**	**SA ENDEMISM**	
MAMMALS								
BOVIDAE	*Cephalophus natalensis*	Natal Red Duiker	NT	-	PROT	-	No	Indigenous forests, dense thickets, including coastal, riverine, swamp and montane slope forests and forest clumps, as well as wooded ravines.
FELIDAE	*Leptailurus serval*	Serval	NT	PROT	PROT	II	No	In and around marshland, well-watered savannah and long-grass environments, and are particularly associated with reed-beds and other riparian vegetation types.
HIPPOSIDERIDAE	*Cloeotis percivali*	Short-eared Trident Bat	EN	-	PROT	-	No	Savannah and woodland areas with sufficient cover in the form of caves and mine tunnels for day roosting.
MINIOPTERIDAE	*Miniopterus inflatus*	Greater long-fingered bat	NT	-	PROT	-	No	Associated with moist savannah habitats, depending on the availability of roosting sites (primarily caves).
MURIDAE	*Dasymys incomtus*	African Marsh Rat	NT	-	PROT	-	No	Wide variety of habitats, including forest and savannah, swampland and grasslands, but they rely on intact wetlands in these areas.
	Otomys auratus	Vlei Rat (Grassland type)	NT	-	-	-	No	Mesic grasslands and wetlands within alpine, montane and sub-montane regions in dense vegetation in close proximity to water.
	Otomys laminatus	Laminate Vlei Rat	NT	-	PROT	-	Endemic	Mesic sub-montane grasslands along the Drakensberg foothills and has also been recorded from coastal forests as well as Restio-dominated coastal and mountain fynbos.
MUSTELIDAE	*Aonyx capensis*	Cape Clawless Otter	NT	-	PROT	II	No	Predominantly aquatic and seldom found far from permanent water. Fresh water is an essential habitat requirement.
	Hydrictis maculicollis	Spotted-necked Otter	VU	-	PROT	II	No	Freshwater habitats where water is not silt-laden, and is unpolluted, and rich in small fishes.
	Poecilogale albinucha	African Striped Weasel	NT	-	PROT	-	No	Savannah and grassland habitats, although it probably has a wide habitat tolerance and has been recorded from lowland rainforest, semi-desert grassland, fynbos with dense grass and pine plantations.
NYCTERIDAE	*Nycteris woodi*	Wood's Slit-faced Bat	NT	-	-	-	End of range	Semi-arid and moist woodland savannahs (including miombo and mopane woodlands) where suitable day-roosts such as hollow trees, caves, rock fissures, maine adits and buildings are available.
RHINOLOPHIDAE	*Rhinolophus blasii*	Peak-saddle Horseshoe Bat	NT	-	PROT	-	End of range	Savannah woodlands and are dependent on the availability of daylight roosting sites such as caves, mine adits or boulder piles.
SORICIDAE	*Crocidura maquassiensis*	Maquassie Musk Shrew	VU	-	PROT	-	No	It may tolerate a wide range of habitats, including urban and rural landscapes. Restricted to wetlands and waterlogged areas.
	Crocidura mariquensis	Swamp Musk Shrew	NT	-	-	-	No	Occuring only close to open water with intact riverine and semi-aquatic vegetation such as reedbeds, wetlands and the thick grass along river banks.
	Myosorex sclateri	Sclater's Forest Shrew	VU	-	PROT	-	Endemic	Near water in subtropical swamps and coastal forests. Present in grassland, wetland and reedbed habitats.
VESPERTILIONIDAE	*Kerivoula argentata*	Damara Woolly Bat	NT	-	PROT	-	End of range	Evergreen forests, riverine forests and both mesic and dry woodland savannahs (including bushveld and miombo), mostly occurring in riverine associations such as riparian corridors.
	Laephotis wintoni	De Winton's Long-eared Bat	VU	-	PROT	-	End of range	Appears to prefer highland, mountainous grassland regions and has also been recorded from mountainous areas within mosaics of evergreen bushland,

TAXONOMIC INFORMATION			CONSERVATION STATUS					HABITAT AND ECOLOGY
FAMILY	SCIENTIFIC NAME	COMMON NAME	SA RED LISTING	NEMBA 2015	PROVINCIAL	CITES LISTING	SA ENDEMISM	
								secondary wooded grasslands and farmlands, and forests.
	Scotoecus albofuscus	Thomas' House Bat	NT	-	PROT	-	End of range	Appears to be associated with low-lying, humid savannahs of the coastal plains of Mozambique and northern KwaZulu-Natal, especially where large rivers or wetlands occur.
REPTILES								
AGAMIDAE	*Agama aculeata distanti*	Distant's ground agama	LC	-	-	-	Endemic	Grassland and woodland habitat.
CORDYLIDAE	*Chamaesaura anguina anguina*	Cape grass lizard	LC	-	-	-	Endemic	On mountain slopes in fynbos and grassland, or wooded grassland, at altitudes from 0-1500 m.
	Chamaesaura macrolepis	Large-scaled grass lizard	NT	-	-	-	Near-endemic to KZN	Occurs in the Savanna, Indian Ocean Coastal Belt and Grassland biomes in grassland, especially rocky, grassy hillsides.
	Cordylus vittifer	Common girdled lizard	LC	-	-	-	Near-endemic	Rocky outcrops in grassland and savanna habitat.
CROCODYLIDAE	*Crocodylus niloticus*	Nile crocodile	VU	VU	PROT	II	No	Rivers
GEKKONIDAE	*Afroedura pondolia*	Pondo flat gecko	LC	-	-	-	Endemic	Rupiculous, occurring on rock outcrops and cliffs in a variety of wooded habitats.
	Pachydactylus maculatus	Spotted gecko	LC	-	-	-	Near-endemic	Found in a broad range of habitat types, chiefly in mesic areas where it uses rocks, old termitaria, logs or debris as refuge sites.
	Pachydactylus vansoni	Van Son's thick-toed gecko	LC	-	-	-	Near-endemic	On soil under rocks or dead aloes or rocky outcrops.
GERRHOSAURINAE	*Tetradactylus africanus*	Eastern long-tailed seps	LC	-	-	-	Endemic	Open and wooded grasslands, dry, sandy grasslands near the coast and on the edges of forests and plantations.
LACERTIDAE	*Nucras lalandii*	Delalande's sandveld lizard	LC	-	-	-	Endemic	Associated with montane and temperate grassland where it shelters in burrows in the ground or under rocks.
LAMPROPHIIDAE	*Lycodonomorphus inornatus*	Olive house snake	LC	-	-	-	Endemic to KZN	Inhabits grassland, savanna, fynbos and forest habitats. Shelters under rocks and soil and in or under rotting logs.
PELOMEDUSIDAE	*Pelusios rhodesianus*	Variable hinged terrapin	VU	-	-	-	No	Temporary pans and semi-permanent, well-vegetated water bodies in sady coastal regions.
SCINCIDAE	*Scelotes mossambicus*	Mozambique dwarf burrowing skink	LC	-	-	-	Near-endemic	Rocky grassland and alluvial sands from the coast to 1300 m.
VARANIDAE	*varanus albigularis albigularis*	Southern rock monitor	LC	-	PROT	-	No	Savannas and arid areas over a wide range of altitudes.
	Varanus niloticus	Water monitor	LC	-	PROT	II	No	Found close to, or in, water, but may be found some distance away when foraging. Occurs at altitudes ranging from sea level to 1700m.
FROGS								
ARTHROLEPTIDAE	*Arthroleptis wahlbergi*	Bush squeaker	LC	-	-	-	Endemic to KZN	A forest species but it is also found in adjacent thickets and grassland where there is dense cover and accumulations of leaf litter. The frogs are common

TAXONOMIC INFORMATION			CONSERVATION STATUS					HABITAT AND ECOLOGY
FAMILY	SCIENTIFIC NAME	COMMON NAME	SA RED LISTING	NEMBA 2015	PROVINCIAL	CITES LISTING	SA ENDEMISM	
								where they occur and are frequently resident in gardens and even in alien tree plantations.
BREVICIPTIDAE	*Breviceps sopranus*	Whistling rain frog	DD	-	-	-	No	This is a species of coastal and dune forest, and dry woodland savannah, which is not found in altered habitats. It presumably breeds by development occurring directly in subterranean nests.
HYPEROLIIDAE	*Afrixalus spinifrons*	Natal Leaf-folding Frog	VU	-	PROT	-	No	Wide variety of habitats in coastal bushveld grassland and moist upland grassland.
	Afrixalus aureus	Golden leaf-folding frog			Restricted to KZN			It is a species of the lowland coastal plain, inhabiting savannah, bush land and grassland. It lives in leaf axils during the dry season. It breeds in perennial and ephemeral standing pools and marshes, and in dense grass at the edges of shallow semi permanent pans.
	Hyperolius pickersgilli	Pickersgill's reed frog	EN	-	PROT	-	No	Coastal Bushveld-Grassland, where it breeds in marshy areas containing dense stands of Saw Grass Cyperus immensus. The water at breeding sites is stagnant and rarely exceeds 50 cm in depth.
	Hyperolius semidiscus	Yellowstriped reed frog	LC	-	-	-	Endemic	Inhabits a variety of vegetation types in the Savanna Biome, usually in low-lying areas, where breeds in moderately deep rivers, pans and dams that are surrounded by dense reed beds and other emergent vegetation.
PYXICEPHALIDAE	*Cacosternum striatum*	Stiped caco	DD	-	-	-	Endemic	Inhabits various vegetation types within the Grassland Biome in the summer-rainfall region. Breeding habitat appears to be in inundated wetlands, or adjacent to slow-flowing sidewaters of highland streams.
	Strongylopus grayii	Clicking stream frog	LC	-	-	-	Endemic	The species inhabits the entire Fynbos Biome as well as parts of the Succulent Karoo, Nama Karoo, Savanna, Grassland, Thicket and Forest biomes.
BIRDS								
ACCIPITRIDAE	*Aquila rapax*	Eagle, Tawny	EN	EN	PROT	II	No	Favours open savanna woodland. Able to colonize treeless areas where pylons can support nest structures.
	Buteo rufofuscus	Buzzard, Jackal	LC		PROT	II	Near-endemic	Hilly and mountainous regions from sea level to 3000 m.
	Circaetus fasciolatus	Snake-eagle, Southern Banded	CR	-	PROT	II	No	Lowland evergreen forest, sand forest and plantation margins; in se Zimbabwe in mixed miombo woodland and evergreen forest.
	Circus ranivorus	Marsh-harrier, African	EN	-	PROT	II	No	Inland and coastal wetlands and adjacent moist grassland.
	Gyps africanus	Vulture, White-backed	CR	EN	PROT	II	No	Savanna woodland and bushveld.
	Polemaetus bellicosus	Eagle, Martial	EN	EN	PROT	II	No	Mostly open savanna and woodland on plains, also semi-arid shrublands; rare in mountainous areas.
	Stephanoaetus coronatus	Eagle, African Crowned	VU	-	PROT	II	No	Favours tall closed canopy forest, also found in riparian forest, dense woodland and forested gorges in grassland. Inhabits gum and pine plantations.
ALCEDINIDAE	*Alcedo semitorquata*	Kingfisher, Half-collared	NT	-	PROT	-	No	Mostly along clear well vegetated fast flowing streams.
	Halcyon senegaloides	Kingfisher, Mangrove	EN	-	PROT	-	No	Occupies two different habitats. The non-br season (Mar-Sept) is spent in mangroves. During Oct-Mar, the KwaZulu-Natal population migrates to the Transkei estuarine forests, and the Mozambique birds move to adjacent lowland forest to breed

TAXONOMIC INFORMATION			CONSERVATION STATUS					HABITAT AND ECOLOGY
FAMILY	SCIENTIFIC NAME	COMMON NAME	SA RED LISTING	NEMBA 2015	PROVINCIAL	CITES LISTING	SA ENDEMISM	
ANATIDAE	*Nettapus auritus*	Pygmy-Goose, African	VU	-	PROT	-	No	Prefers permanent waters with water-lilies.
CICONIIDAE	*Ephippiorhynchus senegalensis*	Stork, Saddle-billed	EN	-	PROT	-	No	Along large river systems, lake margins and wetlands.
	Mycteria ibis	Stork, Yellow-billed	EN	-	PROT	-	No	Shoreline of most inland freshwater bodies, also occasionally in estuaries
CORACIIDAE	*Coracias garrulus*	Roller, European	NT	-	-	-	No	Open woodlands, perching on open dead branches, on telephone poles and power lines.
ESTRILDIDAE	*Coccopygia melanotis*	Waxbill, Swee	LC	-	PROT	-	Near-endemic	Edges of forest, plantations and gardens.
FALCONIDAE	*Falco biarmicus*	Falcon, Lanner	VU	-	PROT	II	No	Favours open grassland or woodland near cliff or electricity pylon br sites.
GRUIDAE	*Balearica regulorum*	Crane, Grey Crowned	EN	EN	PROT	II	No	Breeds in marshes, pans and dam margins with tall emergent vegetation. Feeds in adjacent short to medium height open grassland, wetlands and in agricultural lands (in flocks) in non-br season. Non-breeding birds roost communally in trees, structures and in shallow water at night. Breeding birds roost on the ground near the nest in wetlands.
HELIORNITHIDAE	*Podica senegalensis*	Finfoot, African	VU	-	PROT		No	Favours slow flowing streams with overhanging branches.
JACANIDAE	*Microparra capensis*	Jacana, Lesser	VU	-	PROT	-	No	Permanent and seasonal shallow freshwaters with floating vegetation, especially water lilies.
LARIDAE	*Sterna caspia*	Tern, Caspian	VU	-	PROT	-	No	Predominantly a marine or estuarine species; also occurs inland.
MUSCICAPIDAE	*Cercotrichas signata*	Scrub-robin, Brown	LC	-	-	-	Near-endemic	From coastal dune to mistbelt forests.
	Cossypha dichroa	Robin-chat, Chorister	LC	-	-	-	* SLS	Evergreen forests and adjacent well wooded gardens.
	Sigelus silens	Flycatcher, Fiscal	LC	-	-	-	Near-endemic	Open woodland, from moist to semi-arid regions. Frequent resident in gardens, especially in W Cape.
PELECANIDAE	*Pelecanus onocrotalus*	Pelican, Great White	VU	-	PROT	-	No	Shallow lakes, estuaries, large pans and dams. Food Mainly fish, also shrimps, and occasionally scavenges offal.
	Pelecanus rufescens	Pelican, Pink-backed	VU	-	PROT	-	No	Wetlands and estuaries.
PHALACROCORACIDAE	*Phalacrocorax capensis*	Cormorant, Cape	EN	-	-	-	No	Inshore marine habitats, also estuaries and lagoons.
PHOENICOPTERIDAE	*Phoenicopterus minor*	Flamingo, Lesser	NT	-	PROT	II	No	Primarily eutrophic shallow wetlands, especially saltpans.
	Phoenicopterus ruber	Flamingo, Greater	NT	-	PROT	II	No	Favours saline or brackish shallow water bodies such as saltpans, large dams and coastal mudflats.
PLOCEIDAE	*Ploceus capensis*	Weaver, Cape	LC	-	-	-	Near-endemic	Open grassland, lowland fynbos, coastal thickets and farmland.
SCOLOPACIDAE	*Numenius arquata*	Curlew, Eurasian	NT	-	-	-	No	Primarily sandy coastal wetlands but with more frequent inland records than Whimbrel.
STERCORARIIDAE	*Catharacta*	Skua, Subantarctic	EN	-	-	-	No	Mainly over the continental shelf; scarce in oceanic waters. May be seen from

TAXONOMIC INFORMATION			CONSERVATION STATUS					HABITAT AND ECOLOGY
FAMILY	SCIENTIFIC NAME	COMMON NAME	SA RED LISTING	NEMBA 2015	PROVINCIAL	CITES LISTING	SA ENDEMISM	
	antarctica							the coastline.
SULIDAE	*Morus capensis*	Gannet, Cape	VU	-	-	-	No	Mainly coastal (to continental shelf).
TURDIDAE	*Zoothera guttata*	Ground-thrush, Spotted	EN	-	PROT	-	No	Coastal and coastal-scarp forests.
TURNICIDAE	*Turnix sylvaticus*	Buttonquail, Kurrichane	VU	-	PROT		No	Open savanna woodland, also cultivated and fallow lands.
ZOSTEROPIDAE	*Zosterops virens*	White-eye, Cape	LC	-	-	-	Near-endemic	All wooded habitats, from sea level to about 2770 m.

SLS – Endemic to South Africa, Lesotho & Swaziland

APPENDIX 4: List of plant species identified along the pipeline route. SCS species are highlighted in red.

TAXONOMIC INFORMATION				CONSERVATION STATUS			VEGETATION UNIT		
FAMILY	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	SA RED LISTING	PROVINCIAL	ECOLOGICAL STATUS	GRASSLAND	P. ELLIOTTII	O. MONILIFERUM
ACANTHACEAE	*Asystasia gangetica*		Herb	LC	-	Indigenous	x	x	x
AIZOACEAE	*Carpobrotus dimidiatus*	Natal dune vygie	Succulent	LC	-	Indigenous		x	
ANACARDIACEAE	*Schinus terebinthifolius*	Brazilian pepper tree	Shrub/tree	NE	-	Cat 1b invader			x
	Searsia nebulosa	Coastal current	Shrub/tree	LC	-	Indigenous		x	x
	Searsia pyroides	Firethorn crowberry	Shrub/tree	LC	-	Indigenous		x	
	Searsia rehmanniana	Blunt-leaved currant rhus	Shrub/tree	LC	-	Indigenous		x	x
APIACEAE	*Centella asiatica*		Climber/herb	LC	-	Indigenous/weed		x	
APOCYNACEAE	*Carissa macrocarpa*	Amatigulu num-num	Shrub	LC	-	Indigenous		x	
	Gomphocarpus physocarpus	Milkweed	Herb	LC	-	Indigenous	x	x	
	Secamone filiformis	Narrow-leaved secamone	Climber	LC	-	Indigenous			x
	Tacazzea apiculata	Crawcraw vine	Climber	LC	-	Indigenous		x	x
ARACEAE	*Zantedeschia aethiopica*	Arum lily	Geophyte/herb	LC	PROT	Indigenous		x	
ARALIACEAE	*Hydrocotyle bonariensis*		Hydrophyte/herb	LC	-	Indigenous/weed		x	
ARECACEAE	*Phoenix reclinata*	Wild datepalm	Shrub/tree	LC	-	Indigenous		x	
ASTERACEAE	*Bidens bipinnata*		Herb	NE	-	Weed/naturalised	x	x	x
	Bidens pilosa	Spanish blackjack	Herb	NE	-	Weed/naturalised	x	x	x
	Brachylaena discolor	Coastal silver oak	Shrub/tree	LC	-	Indigenous		x	x
	Chromolaena odorata	Paraffin weed	Shrub	NE	-	Cat 1b invader		x	x
	Conyza bonariensis	Hairy fleabane	Herb	NE	-	Weed/naturalised	x	x	x
	Helichrysum asperum var. *comosum*		Dwarf shrub	LC	-	SA endemic	x	x	
	Helichrysum decorum		Herb	LC	-	Indigenous	x		x
	Helichrysum kraussii		Shrub	LC	-	Indigenous	x		x
	Nidorella auriculata		Herb	LC	-	Indigenous	x		
	Osteospermum moniliferum moniliferum	Bushtick berry	Succulent/shrub	LC	-	Indigenous	x	x	x
	Tagetes minuta	Tall khaki weed	Herb	NE	-	Weed/naturalised/invasive	x	x	x
BLECHNACEAE	*Stenochlaena tenuifolia*	Bracken	Climber/herb	LC	-	Indigenous		x	
BRASSICACEAE	*Capsella bursa-pastoris*	Sheperd's purse	Herb	NE	-	Weed/naturalised	x	x	x
	Lepidium africanum	Pepper weed	Herb	LC	-	Indigenous/weed	x	x	x

TAXONOMIC INFORMATION				CONSERVATION STATUS			VEGETATION UNIT		
FAMILY	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	SA RED LISTING	PROVINCIAL	ECOLOGICAL STATUS	GRASSLAND	P. ELLIOTTII	O. MONILIFERUM
CAMPANULACEAE	*Wahlenbergia grandiflora*		Herb	LC	-	SA endemic	x		
CANNABACEAE	*Trema orientalis*	Pigeonwood	Shrub/tree	LC	-	Indigenous		x	x
CASUARINACEAE	*Casuarine equisetifolia*		Tree	NE	-	Cat 2 invader	x	x	x
COLCHICACEAE	*Gloriosa superba*	Flame lily	Climber/geophyte	LC	-	Indigenous		x	
COMMELINACEAE	*Commelina diffusa*		Helophyte/herb	LC	-	Indigenous	x		
	Commelina erecta	Dayflower	Herb	LC	-	Indigenous		x	x
CONVOLVULACEAE	*Ipomoeia ficifolia*		Succulent/climber/herb	LC	-	Indigenous	x		
CYPERACEAE	*Cyperus prolifer*		Cyperoid	LC		Indigenous		x	x
	Cyperus rotundus		Cyperoid	LC	-	Indigenous/weed	x	x	x
	Kyllinga alba	White button sedge	Cyperoid	LC	-	Indigenous	x	x	x
	Pycreus polystachyos var. *polystachyos*	Cyperoid	LC	-		Indigenous		x	x
EUPHORBIACEAE	*Ricinus communis*	Castor oil plant	Shrub/tree	NE	-	Cat 2 invader		x	x
FABACEAE	*Desmodium incanum*	Sweethearts	Herb/dwarf shrub	NE	-	Naturalised	x	x	x
	Eriosema psoraleoides	Canary pea	Dwarf shrub	LC	-	Indigenous	x		
	Erythrina lysistemon	Common coral tree	Tree	LC	-	Indigenous		x	
	Melilotus indica	Yellow sweet clover	Herb	NE	-	Weed/naturalised/invasive	x	x	x
	Vachellia karroo		Tree	LC	-	Indigenous/Bush enchroacher	x	x	
	Zornia capensis	Catterpillar bean	Herb	LC	-	Indigenous	x		x
LAMIACEAE	*Volkameria grabra*	Smooth tinderwood	Shrub/tree	LC	-	Indigenous		x	
MALVACEAE	*Abutilon grantii*		Shrub	LC	-	Indigenous		x	
MELIACEAE	*Ekebergia capensis*	Cape-ash	Tree	LC	PROT	Indigenous		x	
MORACEAE	*Ficus sur*	Broom cluster fig	Tree	LC	-	Indigenous		x	
	* *Ficus trichopoda*	Swamp fig	Tree	LC	PROT	Indigenous		x	
MYRICACEAE	*Morella serrata*	Lance-leaved wax berry	Shrub/tree	LC	-	Indigenous		x	
MYRTACEAE	*Psidium guajava*	Guava	Shrub/tree	NE	-	Cat 3 invasive		x	x
ONAGRACEAE	*Ludwigia octovalvis*	Shrubby ludwigia	Hydrophyte/herb	LC	-	Indigenous			x
	Oenothera indecora	Evening primrose	Herb	NE	-	Weed/naturalised/invasive	x		
ORCHIDACEAE	*Eulophia speciosa*	Large yellow eulophia	Succulent/ geophyte/herb	DECLINING	PROT	Indigenous	x		

TAXONOMIC INFORMATION				CONSERVATION STATUS			VEGETATION UNIT		
FAMILY	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	SA RED LISTING	PROVINCIAL	ECOLOGICAL STATUS	GRASSLAND	P. ELLIOTTII	O. MONILIFERUM
PASSIFLORACEAE	*Passiflora edulis*	Grenadella	Climber	NE	-	Invasive		x	x
	Passiflora subpeltata	Wild grenadilla	Climber	NE	-	Invasive		x	
PHYLLANTHACEAE	*Bridelia micrantha*	Mitzeerie	Shrub/tree	LC	-	Indigenous		x	
PHYTOLACCACEAE	*Rivina humilis*	Bloodberry	Herb	NE	-	Cat 1b invasive	x	x	x
PINACEAE	*Pinus elliottii*	Slash pine	Tree	NE	-	Cat 2 invasive(sterile specimens), Cat 1b (non-sterile specimens)		x	
PLANTAGINACEAE	*Plantago major*	Broadleaf ribwort	Herb	NE	-	Naturalised/weed	x	x	x
POACEAE	*Chloris gayana*	Rhodes grass	Graminoid	LC	-	Indigenous	x	x	x
	Dactyloctenium aegyptium	Coast buttongrass	Graminoid	LC	-	Indigenous	x	x	x
	Eragrostis curvula	African love grass	Graminoid	LC	-	Indigenous	x		x
	Imperata cylindrica	Beady grass	Graminoid	LC	-	Indigenous	x	x	x
	Melinis repens	Natal red top	Graminoid	LC	-	Indigenous	x		x
	Paspalum notatum		Graminoid	NE	-	Weed/naturalised	x	x	x
	Paspalum urvillei	Tall paspalum	Graminoid	NE	-	Weed/naturalised	x	x	
	Phragmites australis	Common reed	Graminoid	LC	-	Indigenous		x	
	Sporobolus africanus	Ratstail dropseed	Graminoid	LC	-	Indigenous	x	x	x
	Sporobolus pyramidalis	Cat's tail dropseed	Graminoid	LC	-	Indigenous	x	x	x
	Tristachya leucothrix	Hairy trident grass	Graminoid	LC	-	Indigenous		x	
POLYPODIACEAE	*Microsorum scolopendria*	Wart fern	Lithophyte/geophyte/herb	LC	-	Indigenous		x	
PTERIDACEAE	*Cheilanthes viridis var. viridis*	Common lip fern	Lithophyte/geophyte/herb	LC	-	Indigenous		x	x
RUBIACEAE	*Richardia brasiliensis*	Mexican clover	Herb	NE	-	Weed/naturalised	x	x	x
SMILACACEAE	*Smilax anceps*	Leg-ripper	Shrub/climber	LC	-	Indigenous		x	
SOLANACEAE	*Physalis viscosa*	Gooseberry	Herb	NE	-	Weed/naturalised/invasive	x	x	x
	Solanum mauritianum	Bugweed	Shrub/tree	NE	-	Cat 1b invader	x		
	Solanum retroflexum	Sobosobo berry	Herb	LC	-	Indigenous	x	x	x
STRELITZIACEAE	*Strelitzia nicolai*	Natal wild banana	Shrub	LC	PROT	Indigenous		x	
THELYPTERIDACEAE	*Cyclosorus interruptus*		Hydrophyte/herb	LC	-	Indigenous		x	x
VERBENACEAE	*Lantana camara*	Common lantana	Shrub	NE	-	Cat 1b invader	x	x	x

TAXONOMIC INFORMATION				CONSERVATION STATUS			VEGETATION UNIT		
FAMILY	SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	SA RED LISTING	PROVINCIAL	ECOLOGICAL STATUS	GRASSLAND	P. ELLIOTTII	O. MONILIFERUM
	Verbena aristigera	Wild verbena	Herb	NE	-	Weed/naturalised	x	x	x
	Verbena bonariensis	Purple top	Herb	NE	-	Naturalised/invasive	x	x	
	Verbena officinalis	Common verbain	Herb	NE	-	Weed/indigenous	x		x
VITACEAE	*Rhoicissus digitata*	Baboon grape	Climber	LC	-	Indigenous		x	x

*** Protected under the National Forest Act**

APPENDIX 5: 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 6: Summary of the relative abundance of microhabitat characteristics within each vegetation community.

HABITAT CHARACTERISTIC	VEGETATION UNIT		
	GRASSLAND	*O. MONILIFERUM*	*P. ELLIOTTII*
Trees	1	4	7
Shrubs	2	6	4
Hollows in trees	0	0	2
Fallen logs (>10 cm diam)	0	0	3
Decorticating bark	0	0	3
Course litter (>2 cm diam)	6	4	4
Fine litter (<2cm diam)	2	4	4
Bare ground	3	3	3
Grass	6	4	3
Soil cracks	0	2	2
Stones (20-60cm)	0	0	0
Boulders (61-2m)	0	0	0
Large boulders (>2m)	0	0	0
Rock crevices	0	0	0
Exfoliating rocks	0	0	0
Culverts	0	0	0
Caves	0	0	0
Ponds	0	0	0
Dams	0	0	0
Wetlands	0	0	0
Rivers/streams	0	0	0
Drainage lines/canals	1	0	1
Termitaria	0	0	0
Manmade structures	1	0	0

Abundance of characteristic (0-7), where 0 = nil; 1 = rare; 2 = rare to occasional; 3 = occasional; 4 = occasional to common; 5 = common; 6 = common to abundant; 7 = abundant.

APPENDIX 7: Plant translocation and monitoring protocol

This section provides some basic principles for the removal and translocation of SCS flora that may potentially be affected:

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 Listed 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 Listed species has a high probability of being colonised.

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 from.
- 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 the steps required to house them temporarily before translocation into suitable habitats.

ACTION	RESPONSIBLE PERSON
Initial identification of all listed species that may occur on the site. This is largely covered in this report, but can be supplemented by observations on site by the ECO prior to construction.	EO/ESO
The footprint of proposed development must be marked out prior to breaking ground.	Contractor / Engineer / Client
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.	EO/ESO
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.	EO/ESO / 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.	EO/ESO
EO/ESO / Qualified Botanist to give permission to clear vegetation only once all search and rescue operations have been completed.	EO/ESO / Qualified Botanist
The ECO should monitor construction activities in sensitive habitats to ensure that impacts	ECO

within these areas are kept to a minimum.	
The collecting of plants by unauthorized persons should be prevented and signs stating so should be placed at the entrance to the site.	Client

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 on the site in order to minimize the probability of invasive alien plants becoming established and ensuring that any outbreaks are managed quickly so that they do not become a long-term problem. The establishment of any dense infestations will be expensive to eradicate and will require more complex control measures than would be unnecessary 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 IAPs shortly after they arrive on the site. 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 IAPs are spotted an immediate response of locating the area 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 IAPs 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 minimum energy and resources are required to maintain this status over the long-term. This will also ensure that natural systems are impacted on to the smallest degree possible.

Construction phase activities required

The following management actions are required to minimise soil, vegetation disturbance and the establishment of IAPs on site during the construction phase:

ACTION	FREQUENCY
The Environmental Officer (EO/ESO) 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.	Weekly

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.	
EO/ESO 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 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.

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).
- All areas of exposed soil should immediately be protected by creating erosion control barriers.
- 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 IAPs and protecting the area from other forms of disturbance (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 an 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, it leads to immediate action.

Construction phase monitoring

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

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

APPENDIX 9: Glossary

Aeolian	Relating to or arising from the action of the wind.
Alluvial	Clay, silt, sand, gravel or similar detrital material deposited by running water.
Carnivore	An animal or plant that requires a staple diet consisting mainly or exclusively of animal tissue through predation or scavenging.
Critical Biodiversity Areas	Crucial for supporting biodiversity features and ecosystem functioning and are required to meet conservation targets.
Cyperoid	Resembling, allied to, or belonging to the plant-genus *Cyperus* or the Family CYPERACEAE.
Decorticating bark	Strips of loose bark on some tree species.
Ecological Support Areas	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.
Endemic	Having a natural distribution confined to a particular geographical region.
Geophyte	A perennial plant with an underground food storage organ such as a bulb, tuber, corm or rhizome.
Graminoid	A term used for members of the grass Family, POACEAE.
Heliophyte	A plant that is characteristic of, and showing adaptation to bright, sunlit habitats, as opposed to shade-tolerant or shade-preferring species.
Helophyte	Plants growing in marshes.
Herpetofauna	Reptiles and frogs.
Hydrophyte	A plant living in water or in a very moist habitat; an aquatic plant.
Littoral bush	Relating to or situated on the shore of the sea or a lake.
Near-endemic	~70% or more of population in South Africa.
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.
Ornithological	The branch of Zoology that deals with birds.
Parasite	An organism living on or in a different live organism and deriving nourishment from it.
Pentad	Five minutes of latitude by five minutes of longitude. One QDS comprises of nine pentads.
Poikilothermic	An organism (such as a frog) with a variable body temperature that tends to fluctuate with and is similar to or slightly higher than the temperature of its environment : a cold-blooded organism.
Quarter Degree Grid Square	The division of longitude and latitude degree square cells into smaller units.
Restioid	A term used for members of the RESTIONACEAE Family.
Riparian	Plant communities characterized by hydrophilic plants located along watercourses/wetlands.
Succulent	A plant which accumulates water in fleshy, water-storing stems, leaves or roots; juicy, fleshy in reference to texture or appearance.