PROPOSED PORT DURNFORD MINE
TERRESTRIAL BIODIVERSITY, PLANT AND MAMMAL SPECIES SPECIALIST ASSESSMENT

WSP Africa Pty (Ltd)

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Submitted to:
WSP Africa Pty (Ltd)
Building 1, Maxwell Office Park
Waterfall City, Midrand
Gauteng
South Africa

Report Compiled By:
Andrew Zinn (*Pr.Sci.Nat.*)
Hawkhead Consulting

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Introduction

Hawkhead Consulting was appointed by WSP Africa Pty (Ltd) to conduct a Terrestrial Biodiversity, Plant Species (i.e., flora) and Mammal Species Specialist Assessment for the proposed Port Durnford Mine, near Mtunzini in KwaZulu-Natal, South Africa. WSP is the appointed by Tronox KZN Sands (Pty) Ltd (Tronox) to undertake the environmental impact assessment (EIA) for the proposed Port Durnford mineral sands mine.

Tronox holds several Prospecting Rights under the Department of Mineral Resources and Energy for ilmenite, rutile, zircon and heavy metals over several farm and farm portions that constitute the Port Durnford site. Tronox is now applying to convert these Prospecting Rights into a consolidated Mining Rights and seeks environmental authorisation to support this process. The proposed mining operation (hereafter termed the proposed Project) will be undertaken in two phases: Phase 1, between 2025 and 2036 which will entail the mining of 70 400 tpa and Phase 2, which will operate between 2036/2037 at 3000 tph (26 280 000 tpa) and continue until mine closure in 2069.

The purpose of this specialist report is to:

- Present a baseline description of terrestrial biodiversity (incl. flora and mammal species) occurring on-site, highlighting important and sensitive features and the presence/potential presence of Species of Conservation Concern (SCC);
- Present the findings of an impact assessment for the proposed Project;
- Recommend applicable mitigation and management measures; and
- Provide an impact statement on the appropriateness of the proposed Project with respects to terrestrial biodiversity, flora species and mammal species.

Study Methodology

The methodology followed during the specialist assessment included a desktop literature review component and a field programme. The desktop literature review aimed to establish the baseline ecological characteristics of the study area in relation to regional ecosystem attributes, conservation sensitivities, and flora and mammal communities. This study also built upon an earlier biodiversity assessment conducted of the study area by Coastal & Environmental Services in 2009. Several other literature and data sources were also consulted during the literature review component.

The field programme comprised one wet-season field survey that was conducted from 14th to 18th November 2022. Vegetation was sampled at 29 sites in the study area, while general habitat notes and representative photographs were collected at 26 reference points. Collected data included vegetation composition and structure, general condition, and presence of alien invasive species and flora species of conservation concern. Mammal sampling included both active and passive sampling. Active sampling included the use of baited motion-triggered camera traps (large- and medium-sized mammals) and Sherman traps (small mammals) placed at six sampling sites in the study area. Passive sampling aimed to record mammals of all sizes and included direct observations (sightings) and indirect observations (identification of tracks, scats, etc.) made while traversing through the study area.

Terrestrial Biodiversity, Flora and Mammal Baseline Description

The study area is located in the Indian Ocean Coastal Belt Biome, with embedded elements of the Forest Biome. The broader coastal region is termed the Maputaland-Pondoland-Albany Hotspot on account its rich biodiversity attributes. According to the 2018 SANBI mapping of South Africa's regional vegetation types, the study area consists of five primary regional vegetation types, namely Northern Coastal Forest (Foz7), Swamp Forest (Foa2), Maputaland Coastal Belt (CB1), KwaZulu-Natal Coastal Belt (CB3) and Subtropical Alluvial Vegetation (Aza7). These vegetation types have been parsed into several 'subtypes' at a provincial level, all of which are considered threatened with conservation statuses that range from Vulnerable to Critically Endangered. The provincial vegetation naming and numbering convention will be followed in this report.

This is reflected in the delineation of the KwaZulu-Natal Biodiversity Sector Plan, which recognises several patches of natural habitat in the study area as Critical Biodiversity Area (CBA) Irreplaceable and smaller patches as CBA Optimal. Portions of the study area have also been identified as Priority Focus Areas for protected area expansion, as per the National Protected Areas Expansion Strategy (2018).

The study area is located within a highly modified and fragmented landscape matrix. Large areas are characterised by rural residential areas, sugarcane farms and forestry plantations. The landscape is also fragmented by various linear developments including the national freeway, arterial- and informal roads, railway lines and powerline servitudes.

The study area comprises two main modified habitat units (Timber Plantations and Sugarcane Fields) and four natural habitat units, namely Coastal Lowland Forest, Swamp Forest, Riparian Woodland, and Grassland with Trees and Bush-clumps. Despite localised incidences of historic and current disturbances, the forest habitat units were rated as having a Very High or High ecological importance, while the Riparian Woodland has a High ecological importance. The Grassland with Trees and Bush-clumps is characterised mostly be regenerating vegetation, although small patches of undisturbed vegetation were also noted. The ecological importance of this habitat unit ranged from low to high.

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Timber Plantations	VERY LOW	VERY LOW	VERY LOW	VERY HIGH	VERY LOW
Sugarcane Fields	VERY LOW	VERY LOW	VERY LOW	VERY HIGH	VERY LOW
Swamp Forest	VERY HIGH	VERY HIGH	VERY HIGH	VERY LOW	VERY HIGH
Swamp Forest (regenerating)	VERY HIGH	MEDIUM	HIGH	MEDIUM	HIGH
Coastal Lowland Forest	VERY HIGH	VERY HIGH	VERY HIGH	VERY LOW	VERY HIGH
Coastal Lowland Forest (small / regenerating)	VERY HIGH	MEDIUM	HIGH	MEDIUM	HIGH
Grassland with Trees and Bush-clumps (disturbed/regenerating)	LOW	LOW	LOW	MEDIUM	LOW

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Grassland with Trees and Bush-clumps	HIGH	MEDIUM	MEDIUM	LOW	HIGH

Areas of natural habitat in the study area significantly increase landscape-scale habitat heterogeneity, provide important resource and refuge habitat for biodiversity, and form a network of dispersal and movement corridors or stepping-stone habitats that enhance broader-scale habitat connectivity. These attributes are likely to contribute to ecosystem processes and functioning across the landscape, which is likely to be particularly important and beneficial in maintaining the biodiversity of adjacent natural areas and formal protected areas.

Flora species of conservation concern were recorded in the study area, including *inter alia*; *Cassipourea gummiflua var. verticillata* (Vulnerable), which is listed in the National Web Based Screening Tool report for the study area, and the nationally protected trees *Ficus trichopoda* and *Barringtonia racemosa,* which are particularly abundant. Based on habitat suitability assessments it is also likely that several other flora species of conservation concern are likely to be present. Several flora species of conservation concern are thus likely to be impacted by the proposed Project.

In terms of mammals, Coastal & Environmental Services (2009) previously recorded 11 species in the study area, including five species of conservation concern, *viz.* Natal Red Duiker (*Cephalophus natalensis*), Sensitive Species 8, Cape Clawless Otter (*Aonyx capensis*), Samango Monkey (*Cercopithecus albogularis labiatus*) and Sclater's Forest Shrew (*Mysorex sclateri*). Of these, Sensitive Species 8 and Samango Monkey are listed as sensitive species for the study area in the National Web Based Screening Tool report. Only three common and widespread mammal species were recorded in the study area during the 2022 field survey; *viz.*, Vervet Monkey (*Chlorocebus pygerythrus*), Rusty-spotted Genet (*Genetta maculata*) and Slender Mongoose (*Herpestes sanguineus*). It is contended that the low mammal species count is probably attributable, at least in part, to high-levels of subsistence hunting in the study area. Notwithstanding the low 2022 mammal count, in line with the precautionary principle, it is likely that the aforementioned species of conservation concern, amongst others, are still present in the study area and would be impacted by the proposed Project.

Pursuant to these factors, the findings of this specialist study indicate that the environmental screening tool report's ratings of 'Very High' sensitivity for the Terrestrial Biodiversity theme and 'High' sensitivity for the Animal Species theme are supported/confirmed for undisturbed natural habitats, which comprise about 12% of the study area. The findings of this study also indicate that the Plant Species sensitivity rating for patches of undisturbed natural habitat is 'High', rather than the 'Medium' indicated by the environmental screening tool.

Impact Assessment and Mitigation Measures

In line with the mitigation hierarchy, since 2022 the proposed Project mining plan has undergone a series of amendments based on recommendations from the various ecologists and biodiversity specialists, in order to avoid and minimise negative impacts of sensitive biodiversity features.

The current proposed mine plan was assessed for its impacts of terrestrial vegetation, flora and mammals, and will have several negative impacts on terrestrial vegetation, flora and mammals were identified. These were assessed for significance for the various proposed Project phases, with a summary of the anticipated pre- and post- mitigation scenarios presented in the table below.

Impact	**Impact Significance**	
	Before Mitigation	**After Mitigation**
Site Establishment / Construction Phase		
Phase 1		
Direct loss and disturbance of natural habitat (no buffer)	Medium	Low
Direct loss and disturbance of natural habitat (buffer)	Medium	Low
Fragmentation of natural habitat	Low	Low
Establishment and spread of alien invasive species	Medium	Low
Sedimentation of drainage features	Low	Low
Loss of mammal species of conservation concern	Medium	Low
Phase 2: Primary Wet Plant		
Fragmentation of natural habitat	Low	Low
Establishment and spread of alien invasive species	Low	Low
Sedimentation of drainage features	Low	Low
Loss of mammal species of conservation concern	Medium	Low
Phase 1 Operations		
Establishment and spread of alien invasive species	Medium	Low
Sedimentation of drainage features	Low	Low
Loss of mammal species of conservation concern	Medium	Low
Phase 2 Operations		
Direct loss and disturbance of natural habitat: Forest habitats within mining/infrastructure footprints: Portions: 3, 7, 8, 9, 10, 11, 12, 14, 15	High	High
Direct loss and disturbance of natural habitat: Forest habitats within mining/infrastructure footprints: Portions 1, 2, 4, 5, 6, 13, 16, 17, 18, 23, 24	High	Medium
Direct loss and disturbance of natural habitat: Forest habitats adjacent to mining/infrastructure footprints: With Buffer	Medium	Low
Direct loss and disturbance of natural habitat: Forest habitats adjacent to mining/infrastructure footprints: Without Buffer	Medium	Medium
Direct loss and disturbance of natural habitat: Grassland with Tree and Bushclumps	Medium	Low
Fragmentation of natural habitat	High	Medium
Establishment and spread of alien invasive species	Medium	Low
Sedimentation of drainage features	Medium	Low
Loss of flora species of conservation concern	High	Low
Loss of mammal species of conservation concern (Natal Red Duiker, Sensitive species 8 & Samango Monkey)	High	Medium
Loss of mammal species of conservation concern (Scalter's Forest Shrew & Cape Clawless Otter)	Medium	Low
Loss of ecosystem services	Medium	Low
Decommissioning and Closure Phase		
Establishment and spread of alien invasive species	Medium	Low
Sedimentation of drainage features	Medium	Low

Impact	Impact Significance	
	Before Mitigation	After Mitigation
Cumulative Impacts		
Cumulative loss, disturbance and fragmentation of natural habitat	High	Medium
Cumulative loss of flora species of conservation concern	High	Low
Cumulative loss of mammal species of conservation concern	High	Medium

Several mitigation and management measures have been recommended in this report to further avoid, minimise and rehabilitate the identified and assessed impacts. Residual impacts associated with habitat loss nonetheless remain, and these will need to be addressed through additional conservation actions, including, but not limited to, biodiversity offsetting. Additional conservation actions should be developed in collaboration with conservation planners at Ezemvelo KZN Wildlife.

Acronyms and Abbreviations

Abbreviation	Explanation
AIS	Alien Invasive Species
AOO	Area of Occupancy
BI	Biodiversity Importance
BMP	Biodiversity Management Plan
CA	Conservation Areas
CBA	Critical Biodiversity Areas
CI	Conservation Importance
DMRE	Department of Mineral Resources and Energy
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EOO	Extent of Occurrence
EKZNW	Ezemvelo KZN Wildlife
FEPA	Freshwater Ecosystem Priority Areas
FI	Functional Integrity
Ha	Hectare
IBA	Important Bird Areas
KZN	KwaZulu-Natal
KZN BSP	KwaZulu-Natal Biodiversity Sector Plan
MRA	Mining Rights Area
MPRDA	Mineral and Petroleum Resources Development Act
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PA	Protected Areas
PR	Prospecting Right
QDS	Quarter Degree Square
RR	Receptor Resilience
SANBI	South African National Biodiversity Institute

Abbreviation	Explanation
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
SEI	Site Ecological Importance
SWSA	Strategic Water Source Areas
ToPS	Threatened or Protected Species
tpa	Tonnes per annum

Details of the Expertise of the Specialist

Specialist Information	
Name	Andrew D. Zinn Pr.Sci.Nat. - Ecological Science (400687/15)
Designation	Report Author – Terrestrial Ecologist
Cell Phone Number	+27 83 361 0373
Email Address	andrew@hawkhead.co.za
Qualifications	M.Sc. Resource Conservation Biology B.Sc. Hons. Ecology and Conservation Biology B.Sc. Zoology and Grassland Science
Affiliations	Member of the South African Council of Natural Scientific Professions Member of the South African Wildlife Management Association Member of the South African Association of Botanist
Summary of Past Experience	Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research, and is registered as a Professional Natural Scientist (*Pr.Sci.Nat.*) – Ecological Science, with the South African Council of Natural Scientific Professions (SACNASP). Andrew has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia.
Refer to Appendix A for a full Curriculum Vitae of Andrew Zinn.	

1. Introduction

Hawkhead Consulting was appointed by WSP Africa Pty (Ltd) to conduct a Terrestrial Biodiversity, Plant Species and Mammal Species Specialist Assessment for the proposed Port Durnford Mine, near Mtunzini in KwaZulu-Natal, South Africa. WSP was appointed by Tronox KZN Sands (Pty) Ltd (Tronox) to undertake the environmental impact assessment (EIA) for the proposed Port Durnford mineral sands mine.

1.1. Project Background

Tronox holds a prospecting right (PR) under the Department of Mineral Resources and Energy (DMRE) Reference: KZN 30/5/1/1/2/296 PR in respect of ilmenite, rutile and zirkon on the farms [Sub 1 and Remainder of Lot 102 uMlalazi No. 13860, Sub 1,2 and Remainder of Lot 131 uMlalazi No. 14098, Sub 1 and Remainder of Lot 103 uMlalazi No. 13880, Sub 2,3 and Remainder of Lot 104 uMlalazi No. 13853 and Sub 1 and Remainder of Lot Hibbert No. 15714] measuring 843.72 hectares in extent, within the uMlalazi and uMhlathuze Municipality, KwaZulu-Natal Province (the Waterloo PR). This prospecting right was renewed by the DMRE pursuant to Section 18 of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA).

Historically, Tronox held the following two prospecting rights in terms of Section 17 of the MPRDA:

- DMRE Ref: KZN 30/5/1/1/2/10708 PR (formerly 771 PR) in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 3 945.95 hectares in extent in the uMlalazi and uMhlathuze Municipality, KwaZulu-Natal Province (the Port Durnford PR); and
- DMRE Ref: KZN 30/5/1/1/2/279 PR in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 258.27 hectares in extent in the uMlalazi and uMhlathuze Municipality, KwaZulu-Natal Province (the Penarrow PR)

Tronox is now applying to convert these Prospecting Rights into a consolidated Mining Right and seeks environmental authorisation to support this process.

The proposed mining operation (hereafter termed the proposed Project) will be undertaken in two phases: Phase 1, between 2025 and 2036 will entail the mining of 70 400 tpa; and Phase 2, which will commence operations between 2036/2037 at 3000 tph (26 280 000 tpa) and will continue until mine closure in 2074.

1.2. Scope and Purposes of this Report

This specialist study focused on terrestrial biodiversity, plant species (flora) and mammal species. It was conducted in line with the 'Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when Applying for Environmental Authorisation'. Relevant protocols include:

- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Terrestrial Biodiversity;
- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Terrestrial Plant Species; and

- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Animals.

The primary scope of work included:

- Collating and reviewing information and data on terrestrial biodiversity, flora and mammal species that occur, or potentially occur, on-site and in the surrounding landscape;
- Conducting a field programme to:
    - Verify the ecosystem and biodiversity character of the site and surrounding landscape;
    - Assess the character and composition of vegetation and flora species present on-site, and the presence and potential presence of flora species of conservation concern; and
    - Assess the presence and potential presence of mammal species present on-site, with specific focus on species of conservation concern;
- Assessing the suitability of the Proposed project and the potential negative impacts on biodiversity receptors that may result from proposed Project activities; and
- Recommending mitigation and management measures for inclusion in the proposed Project's Environmental Management Programme (EMP) and/or Biodiversity Management Plan (BMP).

In line with the above scope, the purpose of this report was to;

1) present a baseline description of terrestrial biodiversity (incl. flora and mammal species) occurring on-site, highlighting important and sensitive features, including the presence/potential presence of species of conservation concern;
2) present the findings of an impact assessment for the proposed Project activities;
3) recommend applicable mitigation and management measures for identified impacts; and,
4) provide an impact statement on the appropriateness of the proposed Project with respects to terrestrial biodiversity, flora species and mammal species.

This report should be read in conjunction with the other ecology / biodiversity-related reports for the proposed Project.

1.3. Project Location and Delimits of the Study Area

The proposed Project site, hereafter referred to as the 'study area', is approximately 4 733 ha in extent, and located along the east coast of KwaZulu-Natal, between the towns of Mtunzini in the west and Empangeni and Richard Bay in the east (Figure 1).

The study area is bordered by several towns and villages including *inter alia*; Mtunzini, Nyembe, Port Durnford, Sikhalasenkosi (previously Esikhawini), Gobandlovu, Khandisa and Ongoye, and is bisected by the N2 national freeway. The N2 is a major arterial transport route linking the port city of Durban to Richard Bay and Maputo in Mozambique. Figure 2 presents an aerial image showing the prevailing land cover of the study area and surrounding landscape, with an overlay of proposed Project infrastructure.

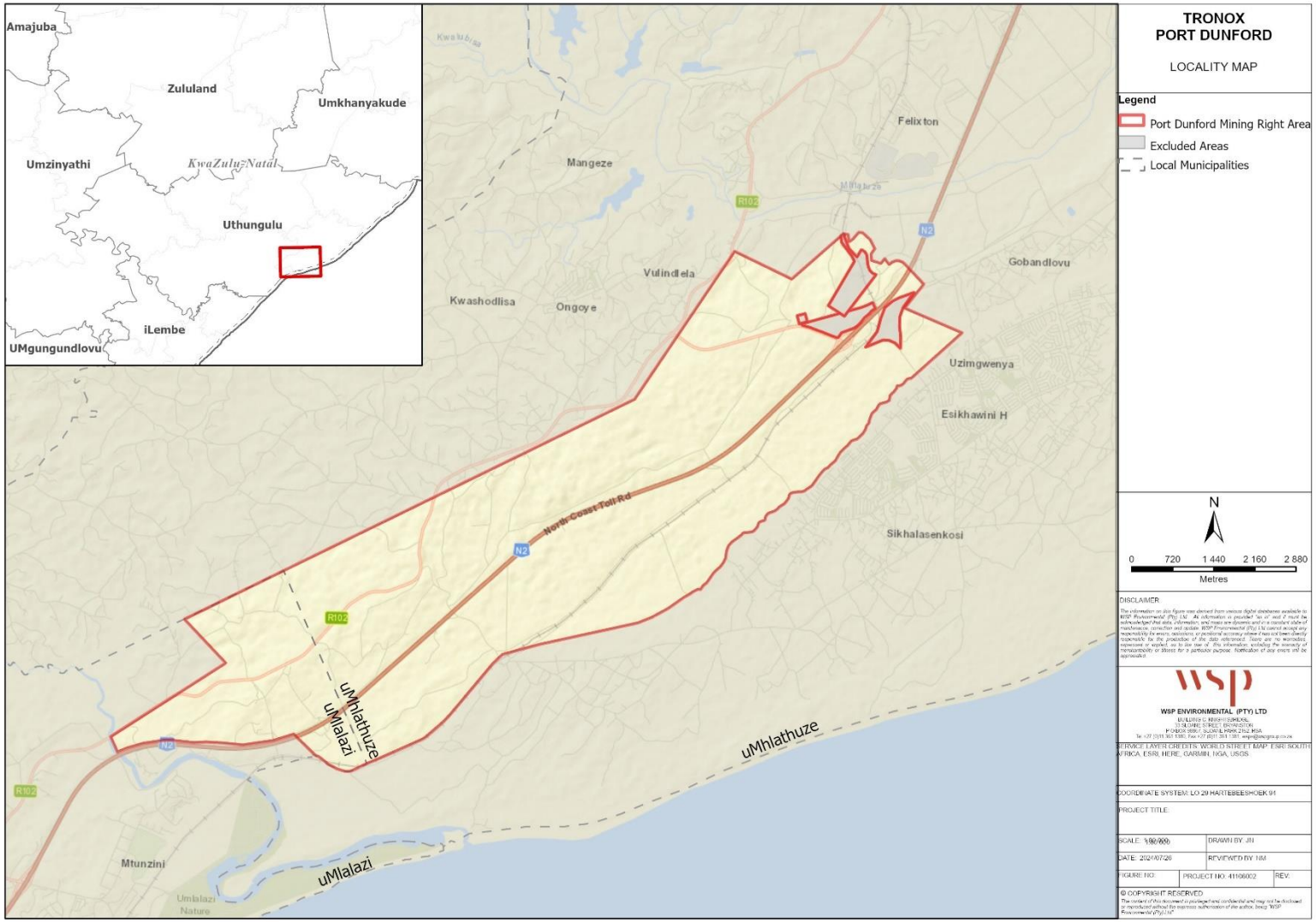

Figure 1: Regional location of the study area.

Figure 2: Proposed Project infrastructure on an aerial image of the study area showing on-site and surrounding land cover.

1.4. Results of the Environmental Screening Tool

With respects to the scope of this report, the National Web Based Screening Tool indicated the following sensitivities for the study area:

- The Terrestrial Biodiversity Theme is rated 'Very High Sensitivity' based on the following features:
    - Critical Biodiversity Area 1;
    - Critical Biodiversity Area 2;
    - Ecological Support Area;
    - National Forest Inventory.

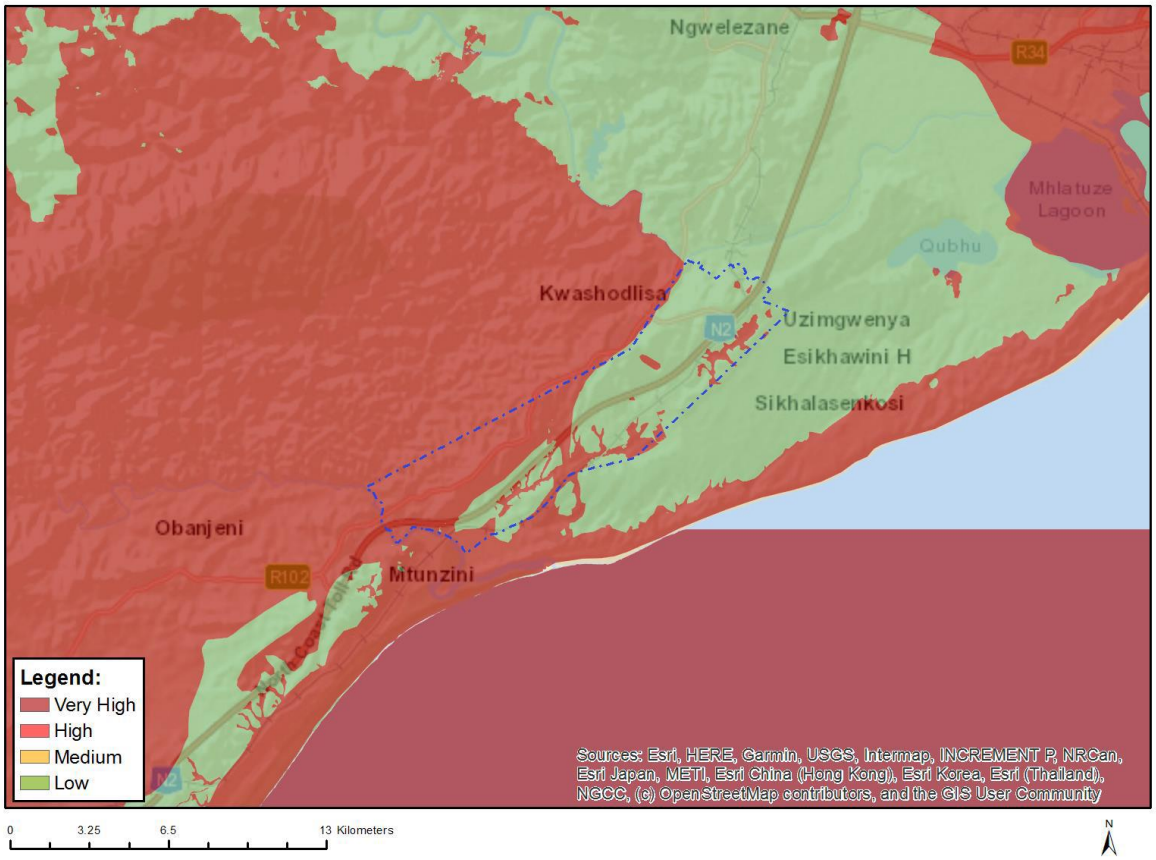

Figure 3: Relative Terrestrial Biodiversity Sensitivity for the proposed Project.

- The Plant Species Theme is rated as 'Medium Sensitivity', on account of the potential presence of several threatened flora species including:
    - Sensitive species 1252;
    - *Aspalathus gerrardii;*
    - *Tephrosia inandensis;*
    - *Thesium polygaloides;*
    - Sensitive species 89;
    - *Dahlgrenodendron natalense;*
    - *Fimbristylis aphylla;*
    - *Emplectanthus cordatus;*

- *Pachycarpus concolor* subsp. *arenicola;*
- *Nidorella tongensis;*
- *Senecio ngoyanus;*
- *Wolffiella denticulata;*
- *Salpinctium natalense;*
- *Cassipourea gummiflua* var. *verticillata;*
- Sensitive species 1083
- Sensitive species 814;
- Sensitive species 1185;
- *Oxygonum dregeanum* subsp. *streyi;*
- *Pavonia dregei;*
- Sensitive species 649;
- Sensitive species 1221;
- *Disperis woodii;*
- Sensitive species 191;
- *Zostera capensis*.

As per the National Web Based Screening Tool output, none of these plant species are rated High with respects to local sensitivity.

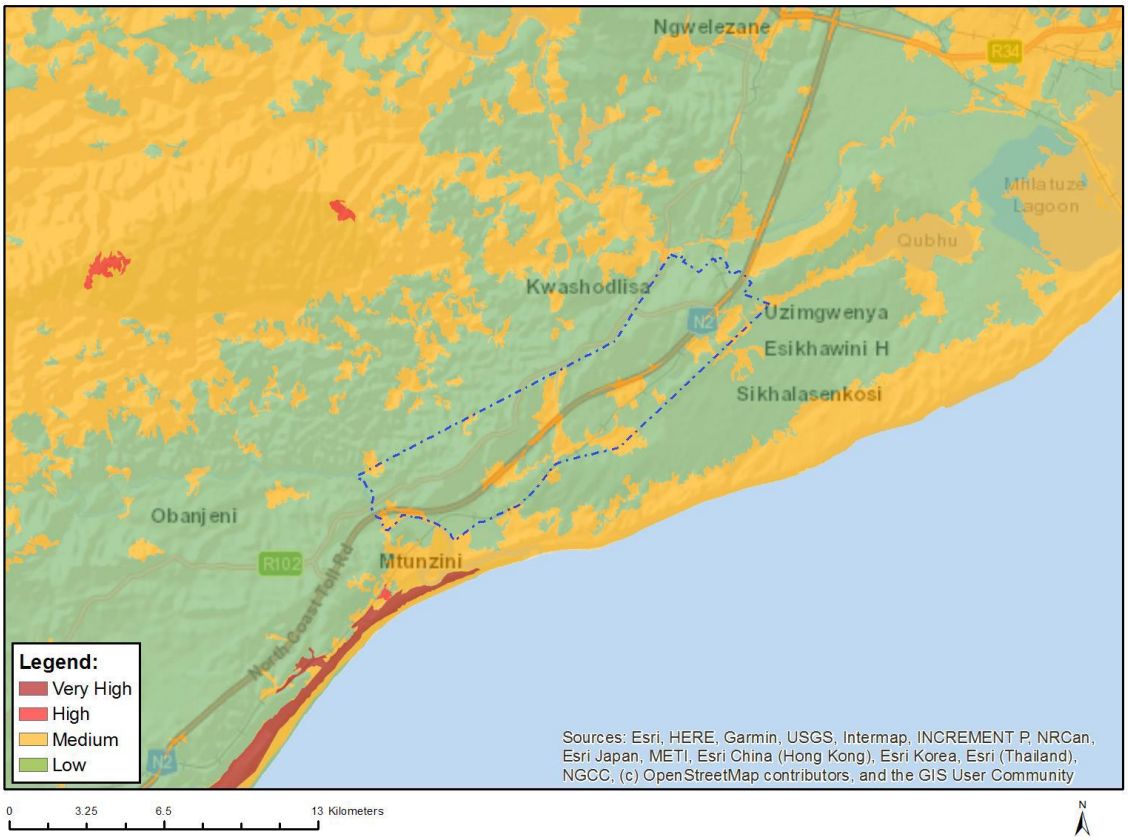

Figure 4: Relative Plant Species Sensitivity for the proposed Project.

- The Animal Species Theme is rated as 'High Sensitivity', on account of the potential presence of several fauna species, including (with respects to this specialist assessment) three mammal taxa, *viz*:
    - Samango Monkey (*Cercopithecus albogularis*);
    - Tree Hyrax (*Dendrohyrax arboreus*); and
    - Sensitive Species 8.

As per the National Web Based Screening Tool output, none of these mammal species are rated High, with respects to local sensitivity.

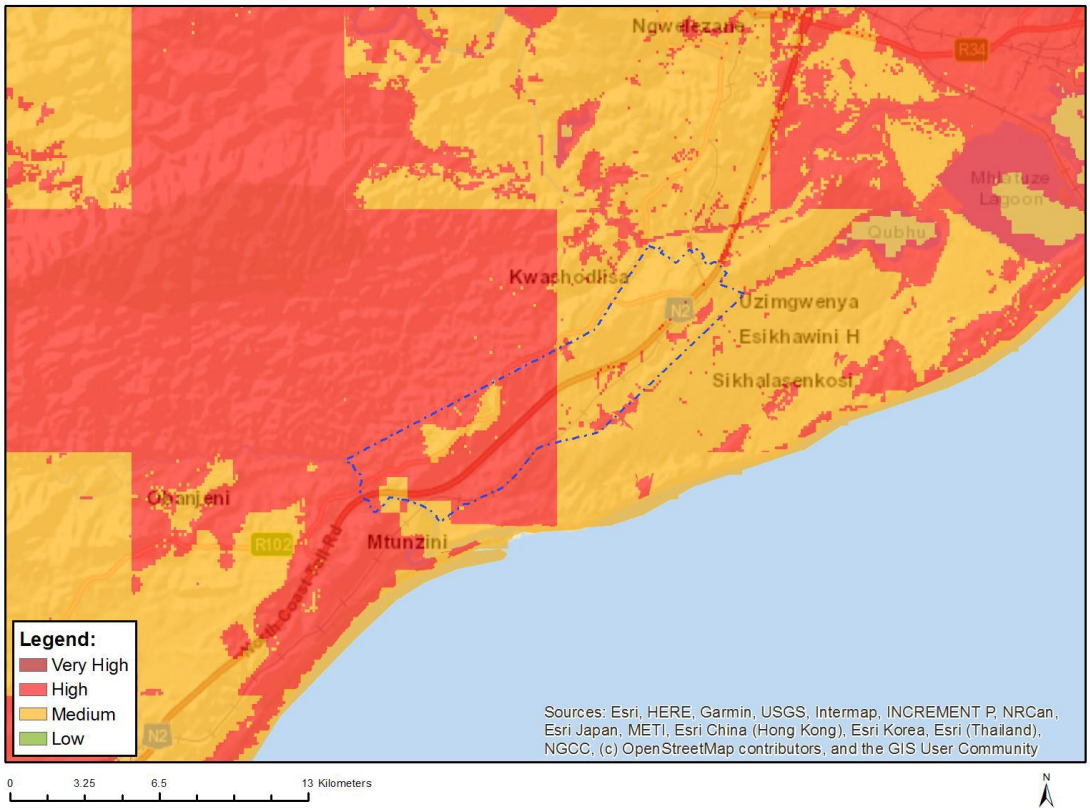

Figure 5: Relative Animal Species Sensitivity for the proposed Project.

Note: The names of specific taxa that are regarded as being susceptible to overexploitation have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number', *a*s per the species assessment guidelines (SANBI, 2020).

2. Relevant Legislation and Guidelines

2.1. Relevant Legislation and Guidelines

National and provincial legislation, associated guidelines and policies that are relevant to the environmental and biodiversity, and which were used to guide the various aspects of the specialist assessment are listed in Table 1.

Table 1: Relevant national and provincial environmental and biodiversity legislation, policies and guidelines.

Applicable Legislation and Guideline	Relevance to the Proposed Project
National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA)	Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management, and laid down in Chapter 5 of the NEMA. In terms of section 24(1), the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the NEMA with granting of the relevant environmental authorisation. In terms of section 24 F (1) of the NEMA no person may commence an activity listed or specified in terms of section 24(2)(a) or (b) unless the competent authority has granted an environmental authorisation for the activity. Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA (1998), when applying for environmental authorisation, the following are relevant to this study: • Protocol for the specialist assessment and report content requirements for environmental impacts on terrestrial biodiversity; • Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species; and • Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)	The NEMBA provides the framework under the NEMA for the: • Management and conservation of South Africa's biodiversity; • The protection of species and ecosystems that warrant protection; • The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; and • The establishment and functions of a South African National Biodiversity Institute. Amongst other components, the NEMBA includes: • Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (February 2007), with associated amendments (December 2007 and 3 June 2020) (ToPS); • Threatened or Protected Species Regulations (February 2007);

Applicable Legislation and Guideline	Relevance to the Proposed Project
	• National list of threatened terrestrial ecosystems for South Africa (2011), including the revised list, published on 18 November 2022; • National Biodiversity Offset Guideline (2023), which provides guidance on the need to develop biodiversity offsets. The purpose of ToPS lists and regulations are to regulate the permit system concerning restricted activities involving specimens of listed threatened or protected species. The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by identifying 'witness' sites' of exceptionally high conservation value and enabling and facilitating proactive management of these ecosystems. The NEMBA also provides a list of regulations and guidance concerning alien invasive species, including: • A guideline for Monitoring, Control and Eradication Plans (September 2015); • 2020 Alien and Invasive Species Regulations (September 2020); and • 2020 Alien and Invasive Species Lists (March 2021)
National Forest Act (Act No. 84 of 1998)	The list of protected tree species gazetted under Schedule A of National Forest Act (1998) is of particular relevance to this study. Amongst other activities, the clearing, cutting down, pruning, disturbance or use of trees listed under Schedule A is not permitted without a permit from the Department of Agriculture, Forestry and Fisheries.
Natal Province Conservation Ordinance (No. 15 of 1974)	Amongst other provisions, the Conservation Ordinance (No. 15 of 1974) provides lists of specially protected and protected fauna and flora. Of particular relevance are species listed under: • Schedule 2: Protected Game; • Schedule 3: Specially Protected Game; and • Schedule 12: Specially Protected Indigenous Plants.
Other Relevant Policies, Plans and Guidelines	Other relevant policies, plans and guidelines that were considered during this study include: • KwaZulu-Natal Biodiversity Sector Plan; • Guidelines for Biodiversity Impact Assessments in KZN, February 2013 (EKZNW, 2013); • Species Environmental Assessment Guideline (SANBI, 2020); • National Protected Area Expansion Strategy (2018); and • National Biodiversity Offset Guideline (2023), which provides guidance on the need to develop biodiversity offsets.

2.2. Study Methodology

2.2.1. Desktop Data Collation and Literature Review

The desktop literature review component aimed to collate and review existing ecosystem, botanical and mammal information related to the study area and the surrounding landscape. A key literature source that was reviewed for this study was the previous terrestrial biodiversity assessment report of the study area that was compiled by Coastal & Environmental Services in 2009. Several other data sources were also consulted, and collectively, these represent a robust and contemporary terrestrial biodiversity dataset. These are discussed below:

2.2.1.1. Regional Ecosystem and Vegetation Types

- General habitat descriptions relevant to the study area and the surrounding landscape were obtained from Mucina and Rutherford (2011), with the regional mapping of South Africa's vegetation types as per SANBI (2018). The KwaZulu-Natal provincial vegetation map was also reviewed;
- The conservation context of the study area at a provincial and national level was established based on:
    - The KwaZulu-Natal Biodiversity Sector Plan (KZN BSP) (2016);
    - The South African Red List of Ecosystems (2011 and 2022 revision); and
    - Vegetation type conservation targets, status and level of protection in KwaZulu-Natal in 2016, by Debbie Jewitt (2018).
- The presence of protected areas (PA) and conservation areas (CA) in the broader region was determined based on the South African Protected Areas Database website (SAPAD, 2021). This database contains a register of all protected areas (legally gazetted) and conservation areas (managed for biodiversity conservation, but not legally declared) in South Africa;
- The National Protected Areas Expansion Strategy (NPAES) (2018) was also reviewed to assess the study area's location with respect to identified Priority Focus Areas for protected area expansion; and
- The presence of Strategic Water Source Areas (SWSA) and National Freshwater Ecosystem Priority Areas (NFEPA) were determined with respects to the study area's location based on available online spatial datasets;
- The presence of indigenous forests was determined based on the National Forest Inventory; and
- Marnewick, *et al*. (2015) was reviewed to identify Important Bird Areas (IBA) in the landscape surrounding the study area.

2.2.1.2. Habitat Descriptions and Flora Species Richness

- The vegetation community / habitat descriptions presented in Coastal & Environmental Services (2009) were reviewed;
- The list of flora species previously recorded in the study area by Coastal & Environmental Services (2009) was used as the baseline botanical inventory. This was cross-referenced against both regional (national) and provincial lists of threatened and/or protected flora species to identify species of conservation concern (SCC) (refer to Section 2.2.6); and
- Additional floristic data was also obtained from SANBI's online Botanical Database of Southern Africa (BODATSA) for the broader region encompassing the study area, and

screened for flora SCC that may be present. This was further augmented with the sensitive flora species listed in the environmental screening report for the proposed Project.

2.2.1.3.Mammal Species

- Data on mammals previously recorded in the study area by Coastal & Environmental Services (2009) was used as the baseline mammal inventory; and
- This list was augmented by a list of mammal species that are known to occur in the broader region, as per the historic distribution ranges presented in Stuart and Stuart (2007), and based on mammal data obtained from MammalMAP platform (FitzPatrick Institute of African Ornithology, 2022) for the 2831DD Quarter Degree Squares (QDS) and from a biodiversity study conducted by Golder (2011) for the nearby Fairbreeze Mine.

2.2.2. Field Programme

The field programme comprised one wet-season field survey that was conducted from 14th to 18th November 2022. The period coincides with the early growing season for flora, and it was noted that sufficient rain had fallen prior to the field survey to promote new season vegetation growth. The sampling methodologies used during the field programme were based, in part, on those recommended in SANBI (2020), and included the following:

2.2.2.1.Vegetation and Flora Surveys

- Vegetation was sampled using meander transects at 29 sites in the study area, while general habitat notes and representative photographs were collected at 26 reference points;
- Survey sites were selected prior to visiting the field, based on a desktop evaluation of habitat types using aerial imagery and existing vegetation maps;
- Collected data included flora species identity and estimated cover/abundances using the Braun-Blanquet scale, general habitat structure, character and condition, presence of alien invasive species and any evidence of disturbances;
- Several reference works were used to identify flora species, including:
    - Van Wyk and Van Wyk (1997), Coates Palgrave (2002), Boon (2010) for woody taxa;
    - Van Oudtshoorn (1999) for grasses;
    - Pooley (2005) and Johnson *et al*., (2015) for herbaceous forbs/herb species; and
    - Crouch *et al*., (2011) for ferns;
- Flora nomenclature is based on species names presented in SANBI's Red List of South African Plants website; and
- Vegetation structural classification was based on Edwards (1983).

2.2.2.2.Mammal Surveys

Mammal sampling included both active and passive sampling methodologies:

- Active sampling of mammals included the use of baited motion-triggered camera traps (for large- and medium-sized mammals) and Sherman traps (for small mammals) placed at select sampling sites in the study area:
    - Camera traps were placed at six fauna sampling sites. Sites were selected based on consideration of a combination of factors including 1) habitat type, 2) coverage of the study area, 3) risk of theft/vandalism, 4) presence of game trails/paths, and 5) general accessibility to field workers. The camera traps were operational

continuously for the 24-hour cycle of each day of the survey. All devices were programmed to medium-sensitivity, with a one-minute delay between successive photographs to limit repeat triggers. Raw chicken pieces were used as bait, and traps were rebaited each day of the survey as required; and
    - A grid of five Sherman traps was laid at four of the sampling sites in the study area. A home-made bait consisting of a mixture of oats, peanuts, peanut-butter, syrup and polony was used for the Sherman traps. Sherman traps were inspected each morning of the survey and rebaited as required;
- Passive sampling aimed to record mammals of all sizes and included direct observations and indirect observations:
    - Direct observations (sightings) of all mammal species made while traversing through the study area were recorded. Special care was taken while driving and walking in the study area to scan tree canopies in order to observe arboreal mammal species; and
    - Indirect observations included the identification of mammal tracks, faeces (scats), burrows and mounds that were encountered while traversing the study area. Special care was taken to scan for evidence of mammal presence along forest paths.

2.2.3. Delineation and Mapping of Habitat Units

Mapping of habitat units in the study area was conducted based on a combination of observations and notes made in the field during the survey, a study of available composite aerial imagery, and vegetation delineations presented by SANBI (2019). It must be noted that owing to the size and spatially complexity of the study area and limited duration of the field survey, it was not possible to visit every natural/semi-natural habitat patch in the study area. Moreover, there is likely to be considerable overlap of the different forest units.

2.2.4. Alien Invasive Flora Species

Owing to their potential to spread into natural habitat and outcompete indigenous vegetation, special emphasis was placed on declared alien invasive flora species occurring in the study area. These were categorised according to the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - 2020 listing of declared alien and invasive species.

2.2.5. Flora Species of Medicinal Value

Many common and widespread flora species have medical or cultural utility to humans, and as such, have value to local communities. Flora of medicinal value recorded in the study area were therefore highlighted and their purported uses described, as per Van Wyk, *et al*., (2009).

2.2.6. Assessment of Species of Conservation Concern

2.2.6.1.Threatened, Near Threatened and/or Protected Species

Flora and mammal species of conservation concern (SCC) were defined as those listed as either threatened or Near Threatened on regional (i.e., South African / national) Red Lists. Also discussed under SCC are flora and mammal taxa that are listed as threatened, Protected, or Specially Protected, according to national and/or provincial legislation:

- Red List of South African Plants (SANBI) (redlist.sanbi.org);
- Red List of Mammals of South Africa, Lesotho and Swaziland (Child *et al.*, 2016);

- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- National Forest Act (Act No. 84 of 1998) list of protected trees (Schedule A); and
- Natal Conservation Ordinance (No. 15 of 1974), specifically Schedule 2, 3 and 12 concerning protected and specially protected game and flora species.

2.2.6.2.Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of flora and fauna SCC that are known to occur in the region, a 'probability of occurrence' of a particular species being present in the study area was determined by conducting habitat suitability assessments. The following parameters were used in these assessments:

- Habitat requirements: Most threatened species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of SCC.

Probability of occurrence is presented in the following categories:

- Recorded: Any SCC observed/documented in or close to the study area;
- Probable: the species is likely to occur in the study area due to suitable habitat and resources being present;
- Possible: The species may occur in the study area, or move through the study area (in the case of mobile species), due to potential habitat and/or resources; and
- Unlikely: the species will not likely occur in the study area due to lack of suitable habitat and resources, or significant differences in its Area of Occupancy (AOO) compared to its Extent of Occurrence (EOO).

2.2.7. Assessment of Site Ecological Importance

The ecological importance of habitat units was determined using the protocol for evaluating site ecological importance (SEI) published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near

Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes" (SANBI, 2020).

- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

For tables detailing the rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, refer to Appendix B. Table 2 presents a guideline for interpreting the SEI (SANBI, 2020).

Table 2: Guidelines for interpreting SEI in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.
Source: SANBI (2020).	

2.3. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions, uncertainties and gaps in knowledge are highlighted for this specialist study:

- The field programme was conducted over a five-day period in November 2022. The timing of the field programme coincided with the early wet-season. Sufficient rain had fallen during the preceding weeks to promote a productive vegetation community and this was conducive to assess flora condition and composition. It is also noted that mammal presence and activity are generally high during this period. The seasonal conditions during which the field work for this study was conducted are therefore not considered significantly limiting with respects to the findings presented in this report. Notwithstanding the above:

    - It is possible that certain flora taxa, including *inter alia* short-lived annuals, geophytes, cryptic species or dormant deciduous species, that are most readily visible or distinguishable when in leaf or flower earlier, or later during the wet/growing season, may have been overlooked during field visit;
    - It is possible that rare, cryptic, secretive or transient mammal species may not have been present and/or observed during the field survey. The absence or non-recording of a specific mammal species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species; and
- Given the difficulty of fully sampling and characterising the abundance and distribution of mammals in the study area during the short period of time allocated to field work, the baseline descriptions were qualitative.

3. Terrestrial Biodiversity, Flora and Mammal Baseline Description

3.1. Regional Biome and Vegetation Type Characteristics

The study area is located in the Indian Ocean Coastal Belt Biome, with embedded elements of the Forest Biome. The broader coastal region is termed the Maputaland-Pondoland-Albany Hotspot on account of its rich biodiversity attributes. According to the 2018 SANBI mapping of South Africa's regional vegetation types, the study area consists of five primary vegetation types. These are shown in Figure 6, and include:

- Northern Coastal Forest (Foz7);
- Swamp Forest (FOa2);
- Maputaland Coastal Belt (CB1);
- KwaZulu-Natal Coastal Belt (CB3); and
- Subtropical Alluvial Vegetation (AZa 7).

KwaZulu-Natal conservation authorities further parsed these regional vegetation types into finer-scale provincial vegetation/mapping units. Those mapped in or adjacent to the study area are listed below and shown in Figure 7:

- KwaZulu-Natal Coastal Forest: Maputaland Moist Coastal Lowlands Forest (62_4);
- KwaZulu-Natal Coastal Forest: Maputaland Moist Coastal Lowlands Forest (62_3);
- KwaZulu-Natal Coastal Forest: Southern Mesic Coastal Lowland Forest (62_5);
- Maputaland Coastal Belt (19);
- Swamp Forest: *Ficus trichopoda* Swamp Forest (66_2);
- KwaZulu-Natal Coastal Belt Grassland (29);
- Alluvial Wetlands: Subtropical Alluvial Vegetation (75_1);
- Alluvial Wetlands: Subtropical Alluvial Vegetation: Lowveld Floodplain Grassland: Tall Reed Wetland (75_4);
- Alluvial Wetlands: Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands (75_3); and
- Freshwater Wetlands: Subtropical Freshwater Wetlands (76_1).

It must be noted that Maputaland Coastal Belt and KwaZulu-Natal Coastal Belt Grassland are broad-scale mapping units, that cover all areas (incl. all transformed and modified sites) that are not delineated by one of the finer-scale mapping units. The provincial vegetation naming and numbering convention will be followed in this report.

Biome characteristics, as well as descriptions of the regional vegetation types (as per Mucina and Rutherford, 2011) and the Maputaland-Pondoland-Albany Hotspot, are presented in Sections 3.1.1 through to Section 3.1.3.

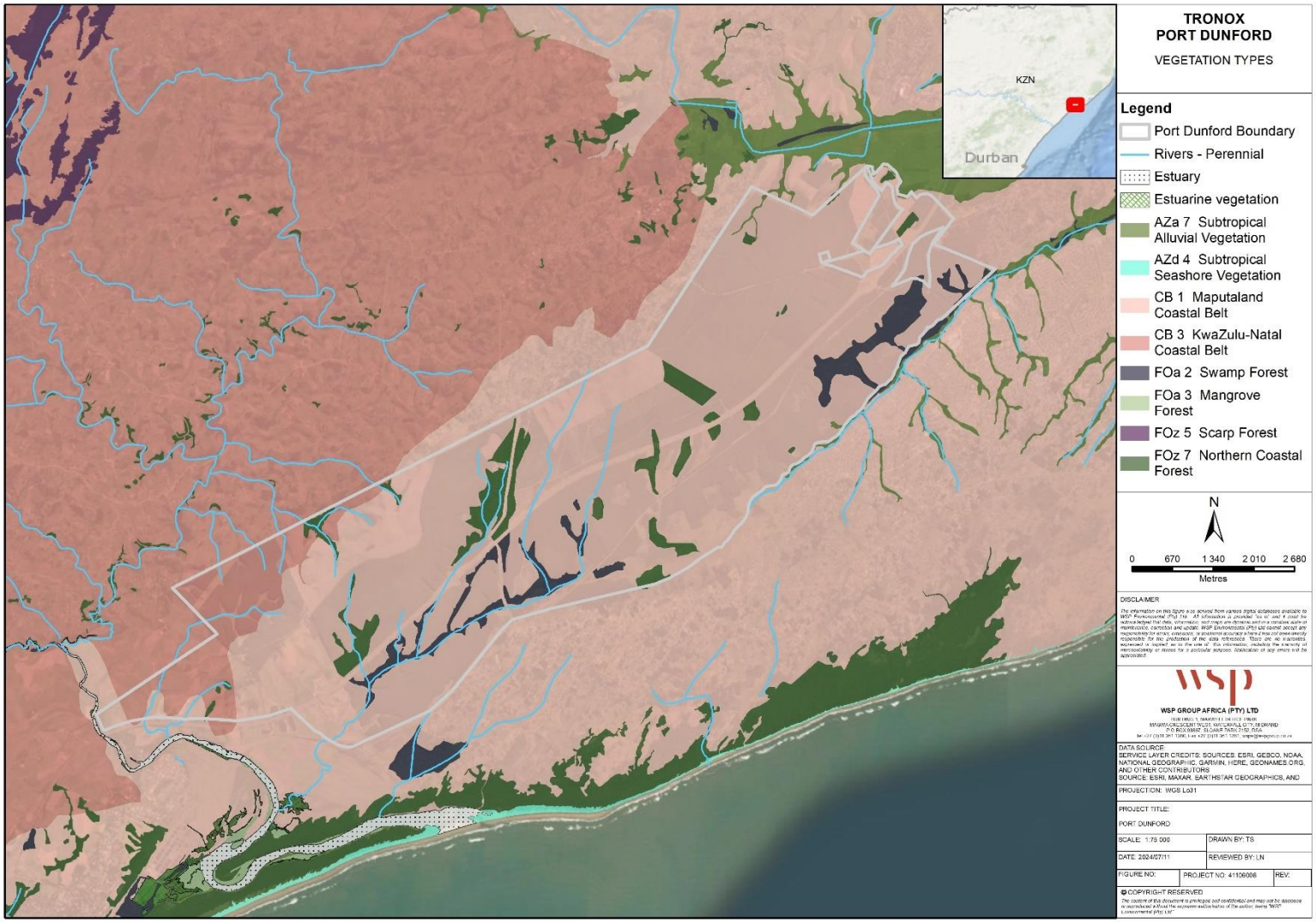

Figure 6: Regional vegetation types in the study area (SANBI, 2018)

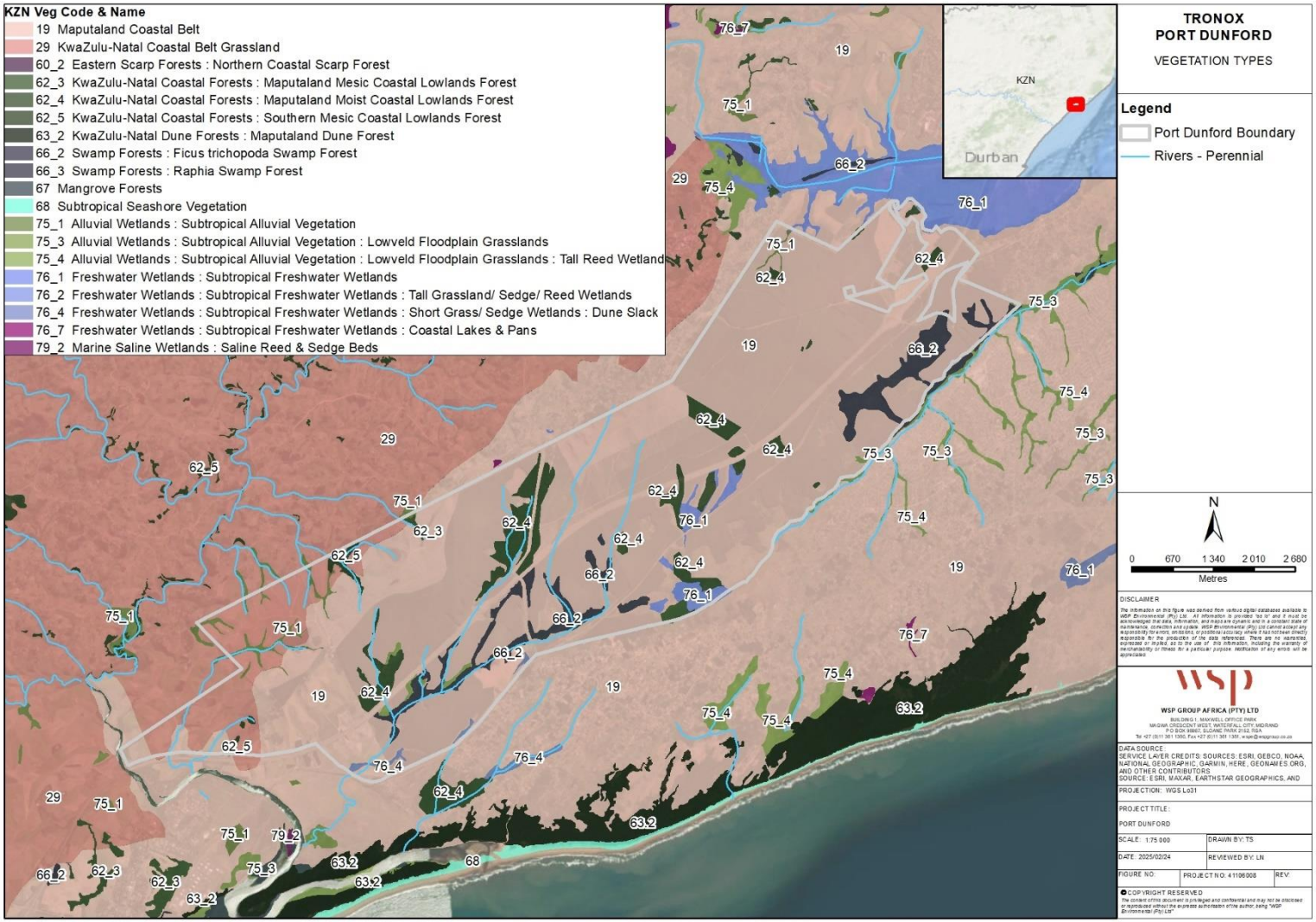

Figure 7: Vegetation types in the study area according to the KwaZulu-Natal provincial mapping.

3.1.1. Biome Descriptions

3.1.1.1.Indian Ocean Coastal Belt Biome

The Indian Ocean Coastal Belt biome extends along the South African coast from the Mozambique border southward to the Great Kei River in the south.

Landscapes are flat to alternating rolling hills, bisected by deeply incised river valleys. Vegetation is dominated by forests, with edaphically or hydrologically controlled areas of grassland, as well as savanna habitat also present (Mucina and Rutherford, 2011). Owing to agriculture, agroforestry and various coastal developments, large portions of this biome have been transformed. Areas comprising the Indian Ocean Coastal Belt biome are densely populated, with a band of almost continuous residential settlements located along the coastline (Mucina and Rutherford, 2011).

3.1.1.2.Forest Biome

Forests are defined by their distinctive vegetation structure, which is multi-layered and dominated by trees up to 30 m in height (Mucina and Rutherford, 2011). The combined woody strata form an overlapping or closed canopy and graminoids in the herbaceous layer are generally rare (Mucina and Rutherford, 2011).

In South Africa, all forests are evergreen. They occur in small (<100 ha) to very small (<10ha) scattered patches along the eastern and southern margins of the country (Mucina and Rutherford, 2011). Predicated on the modelling of favourable combinations of climate (rainfall) and substrate conditions, up to 7% of South Africa's land surface forms potential habitat for forests (Mucina and Rutherford, 2011). However, only 0.1% of the country is covered by extant forest. In conjunction with climate and substrate, local fire patterns are key determinants of the distribution of forests, particularly in hilly and mountainous landscapes (Mucina and Rutherford, 2011).

3.1.2. Regional Vegetation Types

3.1.2.1.Northern Coastal Forest

Northern Coastal Forest occurs along the Indian Ocean seaboards of KwaZulu-Natal and into the Eastern Cape (Mucina and Rutherford, 2011). Vegetation is characterised by tall- to medium height forests occurring on the rolling coastal plains and stabilised dunes. These forests are generally species rich, with the dominant species and general composition differing between forests located on coastal plains and those on stabilised dunes (Mucina and Rutherford, 2011).

Mucina and Rutherford (2011) list the following flora species as being important or characteristic taxa in the Northern Coastal Forest vegetation type, amongst others:

Tall Trees: *Albizia adianthifolia, Drypetes reticulata, Mimusops caffra, Psydrax obovata, Sideroxylon inerme, Trichilia emetica* and *Vepris lanceolata.*

Small Trees: *Brachylaena discolor, Buxus natalensis, Cavacoa aurea, Englerophytum natalense, Erythroxylum emarginatum, Eugenia capensis, Gymnosporia nemorosa, Kraussia floribunda, Peddiea africana, Searsia nebulosa, Strychnos henningsii, Callichilia orientalis, Dovyalis rhamnoides, Euclea natalensis* and *Teclea gerrardii.*

Climbers: *Senegalia kraussiana, Rhoicissus tomentosa, Dalbergia armata, Monanthotaxis caffra, Uvaria caffra* and *Gloriosa superba.*

***Shrubs**: Carissa bispinosa, Hyperacanthus amoenus, Putterlickia verrucosa, Chrysanthemoides monilifera, Isoglossa woodii, Dracaena aletriformis* and *Strelitzia nicolai.*

Graminoides: *Cyperus albostriatus* and *Oplismenus hirtellus.*

Herbs: *Achyranthes aspera, Asystasia gangetica, Laportea peduncularis* and *Microsorum scolopendria.*

3.1.2.2.Swamp Forest

Swamp Forests occur in small pockets along a narrow coastal belt from Maputaland in the north to Port Grosvenor in the south (Mucina and Rutherford, 2011). Vegetation is characterised by tall forests with two main vegetation strata; an upper canopy, which is dominated by *Ficus trichopoda, Barringtonia racemosa, Syzygium cordatum* and *Cassipourea gummiflua*; and an understorey, which is typically dominated by ferns such as *Microsorum punctatum* and *Nephrolepis biserrata* (Mucina and Rutherford, 2011).

Important or characteristic taxa in Swamp Forest according to Mucina and Rutherford (2011) include:

Tall Trees: *Macaranga capensis*, *Ficus trichopoda, Rauvolfia caffra, Schefflera umbellifera, Barringtonia racemosa, Shirakiopsis elliptica* and *Syzygium cordatum.*

Small Trees*. Allophylus dregeanus, Bridelia micrantha, Cassipourea gummiflua, Morella serrata, Phoenix reclinata* and *Sclerocroton integerrimum.*

Climbers: *Stenochlaena tenuifolia* and *Ipomoea indica.*

Tall Shrubs: *Burchellia bubalina, Psychotria capensis, Tarenna pavettoides* and *Hibiscus tiliaceus.*

Herbs: *Microsorum punctatum, Eulophia horsfallii* and *Nephrolepis biserrata.*

Graminoides: *Scleria angusta.*

3.1.2.3.Maputaland Coastal Belt

Maputaland Coastal Belt vegetation extends in a 35 km broad strip along the flat coastal plain of the Indian Ocean from KwaZulu-Natal and into Mozambique (Mucina and Rutherford, 2011). Vegetation comprises pockets of various forest-types and thickets, embedded within primary and secondary grasslands, timber plantations and sugar cane fields.

Important or characteristic taxa in Maputaland Coastal Belt vegetation according to Mucina and Rutherford (2011) include:

Trees and Tall Shrubs: *Syzygium cordatum, Vachellia natalitia, Annona senegalensis, Apodytes dimidiata, Bridelia micrantha, Canthium inerme, Chrysanthemoides monilifera, Euclea natalensis, Ficus burtt-davyi, Kraussia floribunda, Phoenix reclinata, Searsia natalensis, Sclerocroton integerrimum* and *Strychnos spinosa*.

Low Shrubs*: Agathisanthemum bojeri, Helichrysum kraussii* and *Tephrosia longipes.*

Climbers: *Abrus precatorius* and *Smilax anceps.*

Graminoides: *Diheteropogon amplectens, Eragrostis sclerantha, Ischaemum fasciculatum, Themeda triandra, Urelytrum agropyroides, Aristida stipitata, Cymbopogon pospischilii, Elionurus muticus, Eragrostis inamoena, Eragrostis lappula, Trachypogon spicatus* and *Tristachya leucothrix.*

Herbs: *Achyranthes aspera, Centella asiatica, Chamaecrista plumosa, Hermbstaedtia odorata, Oocephala centaureoides* and *Hilliardiella elaeagnoides.*

3.1.2.4.KwaZulu-Natal Coastal Belt

This vegetation type extends along the KwaZulu-Natal coast from Margate in the south to Mtunzini in the north (Mucina and Rutherford, 2011). The landscape is characterised by an undulating and bisected coastal plain that historically would have been dominated by various forest formations (Mucina and Rutherford, 2011). Currently, vegetation is characterised by patches of primary grassland embedded within a broader mosaic of sugarcane fields, timber plantations, urban development, secondary grassland and thicket (Mucina and Rutherford, 2011).

Important or characteristic taxa in KwaZulu-Natal Coastal Belt vegetation according to Mucina and Rutherford (2011) include:

Graminoides: *Aristida junciformis, Digitaria eriantha, Panicum maximum, Themeda triandra, Alloteropsis semialata, Cymbopogon caesius, Eragrostis curvula, Hyparrhenia filipendula* and *Melinis repens.*

Herbs: *Berkheya speciosa, Cyanotis speciosa, Senecio glaberrimus, Alepidea longifolia, Centella glabrata, Chamaecrista mimosoides, Crotalaria lanceolata, Indigofera hilaris, Hebenstretia comosa, Helichrysum cymosum, Gerbera ambigua, Pentanisia prunelloides* and *Stachys aethiopica.*

Trees and Tall Shrubs: *Bridelia micrantha, Phoenix reclinata, Syzygium cordatum Vachellia natalitia Albizia adianthifolia* and *Antidesma venosum*.

Low Shrubs*: Clutia pulchella, Gnidia kraussiana, Phyllanthus glaucophyllus* and *Tephrosia polystachya.*

Climbers: *Abrus laevigatus* and *Smilax anceps.*

3.1.2.5.Subtropical Alluvial Vegetation

This vegetation type is found through eastern South Africa and Swaziland. According to Mucina and Rutherford (2011) flat alluvial river terraces support a complex of macrophytic vegetation that includes marginal reedbeds, flooded grasslands, ephemeral herblands and riverine thickets.

Important or characteristic taxa in Subtropical Alluvial Vegetation according to Mucina and Rutherford (2011) include:

Graminoides: *Eragrostis trichophora, Panicum maximum, Setaria incrassata, Sporobolus ioclados, Chloris virgata, Enneapogon cenchroides* and *Urochloa mossambicensis.*

Herbs: *Commelina bengalensis, Abutilon austro-africanum, Acalypha indica, Achyranthes aspera, Boerhavia erecta, Cucumis zeyheri, Lobelia angolensis, Pupalia lappacea Crinum moorei* and *Portulaca quadrifida.*

Tall Trees. *Vachellia natalitia, Vachellia robusta, Combretum erythrophyllum, Phoenix reclinata, Salic mucronata, Ziziphus mucronata, Senegalia nebrownii, Senegalia nigrescens, Vachellia tortilis* and *Vachellia xanthophloea.*

Shrubs*: Commiphora glandulosa, Euclea divinorum, Gymnosporia senegalensis, Justicia flava* and *Ocimum canum.*

Reedbeds and Flooded Grasslands: *Phragmites australis, Phragmites mauritianus, Cyperus articulatus, Echinochloa pyramidalis, Cyperus corymbosus, Cyperus difformis, Cyperus distans, Cyperus sexangularis, Seteria sphacelatum* and *Sporobolus consimilis.*

3.1.3. Maputaland-Pondoland-Albany Hotspot

The Maputaland-Pondoland-Albany (MPA) Hotspot is recognised by its high degree of floristic endemism and diversity. The MPA Hotspot extends below the escarpment from the Eastern Cape through KwaZulu-Natal and into Mpumalanga Province, Swaziland and Mozambique (Conservation International, 2008).

The floristic richness of the MPA Hotspot is second only to the Cape Floristic Region in Africa. Approximately 8 100 plant species are present, of which, 1 900 are strict endemics (Conservation International, 2008). The region also has remarkable fauna diversity, with 540 birds, 200 mammals, over 200 reptiles and 72 amphibians recorded (Conservation International, 2008).

According to Conservation International (2008), an estimated 20% of the original extent of the MPA Hotspot has been transformed. Commercial and subsistence agriculture are the major agents of habitat transformation, along with commercial forestry, urbanisation and mining.

Large areas of the hotspot are also under communal land ownership, and as a result, portions that are not directly transformed, are nonetheless severely overgrazed and overharvested (Conservation International, 2008).

3.2. Regional Ecological Sensitivity and Conservation Setting

3.2.1. National and Provincial Ecosystems Statuses

Due to various anthropogenic land uses, such as agriculture, forestry plantations, urban sprawl, tourism-orientated costal developments, dams and mining, large areas of natural vegetation along the KwaZulu-Natal coast have been transformed in the past, and remaining areas of natural vegetation are under increasing threat (Mucina and Rutherford, 2011 & Jewitt, 2018). Indeed, Jewitt, (2018) highlights that vegetation along the KwaZulu-Natal coast is amongst the most threatened in the entire province. Accordingly, the NEMBA List of Threatened Ecosystems lists the Maputaland Costal Belt and KwaZulu-Natal Coastal Belt vegetation types as Endangered - mapping of remaining areas is shown in Figure 8, as per SANBI (2018).

At a provincial level, several vegetation types associated with the study area are considered threatened and of conservation importance, as per Jewitt, (2018). These are listed in Table 3, along with their provincial conservation status.

Table 3: Provincial conservation status of KwaZulu-Natal vegetation types.

Vegetation Type/Subtypes	Provincial Conservation Status	Approx. extent in Study Area (ha)
Maputaland Coastal Belt (19)	Endangered	3 845.12
KwaZulu-Natal Coastal Belt Grasslands (29)	Critically Endangered	344.71
Freshwater Wetlands: Subtropical Freshwater Wetlands (76_1)	Vulnerable	61.55
Freshwater Wetlands: Subtropical Freshwater Wetlands: short grass/sedge wetland: dune slack (76_4)	Vulnerable	12.68
Swamp Forest - *Ficus trichopoda* Swamp Forest (66_2)	Critically Endangered	226.24
KwaZulu-Natal Coastal Forest: Maputaland Moist Coastal Lowland Forest (62_4)	Endangered	217.48
KwaZulu-Natal Coastal Forest: Maputaland Mesic Coastal Lowland Forest (62_3)	Endangered	15.15
KwaZulu-Natal Coastal Forest: Southern Mesic Coastal Lowland Forest (62_5)	Critically Endangered	18.24
Alluvial Wetlands: Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands: Tall Reed Wetland (75_4)	Vulnerable	12.82
Alluvial Wetlands: Subtropical Alluvial Vegetation (7**5**_1)	Endangered	31.81
Alluvial Wetlands: Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands (75_3)	Critically Endangered	2.02
Source: Jewitt (2018)		

3.2.2. Critical Biodiversity Areas and Ecological Support Areas

The KwaZulu-Natal Biodiversity Sector Plan (KZN BSP) (2016) provides a spatial framework to identify areas of high biodiversity importance or irreplaceability in the province. Features such as vegetation types, habitats, ecological corridors, fauna and flora assemblages, and presence of SCC, are used to determine the biodiversity importance or irreplaceability of particular land parcels.

The study area is shown in relation to the delineations of the KZN BSP (2016) in Figure 8. It is noted that several patches of land in the study area are designated as Critical Biodiversity Area (CBA) Irreplaceable, while smaller patches are designated CBA Optimal. These patches are mostly aligned with forest habitat. It is noted that some CBA patches within the study area intersect with transformed land (e.g., commercial forestry and the Eskom powerline servitude). These areas have been excluded from the assessment of impacts.

At a broader-scale, small scattered patches of CBA Irreplaceable land are also present to the north of the study area, while the Mlalazi River and land to the south- and east of the study area are also designated CBA Irreplaceable, CBA Optimal or Ecological Support Areas (ESA) (Figure 9).

Outside of formally protected areas, land designated as CBA Irreplaceable and CBA Optimal are the highest priority for conservation planning, and are critical to meeting biodiversity conservation targets in KwaZulu-Natal. The presence of CBA Irreplaceable and CBA Optimal land in the study area

is therefore a concern with respects to terrestrial biodiversity management and negative impacts from the proposed Project.

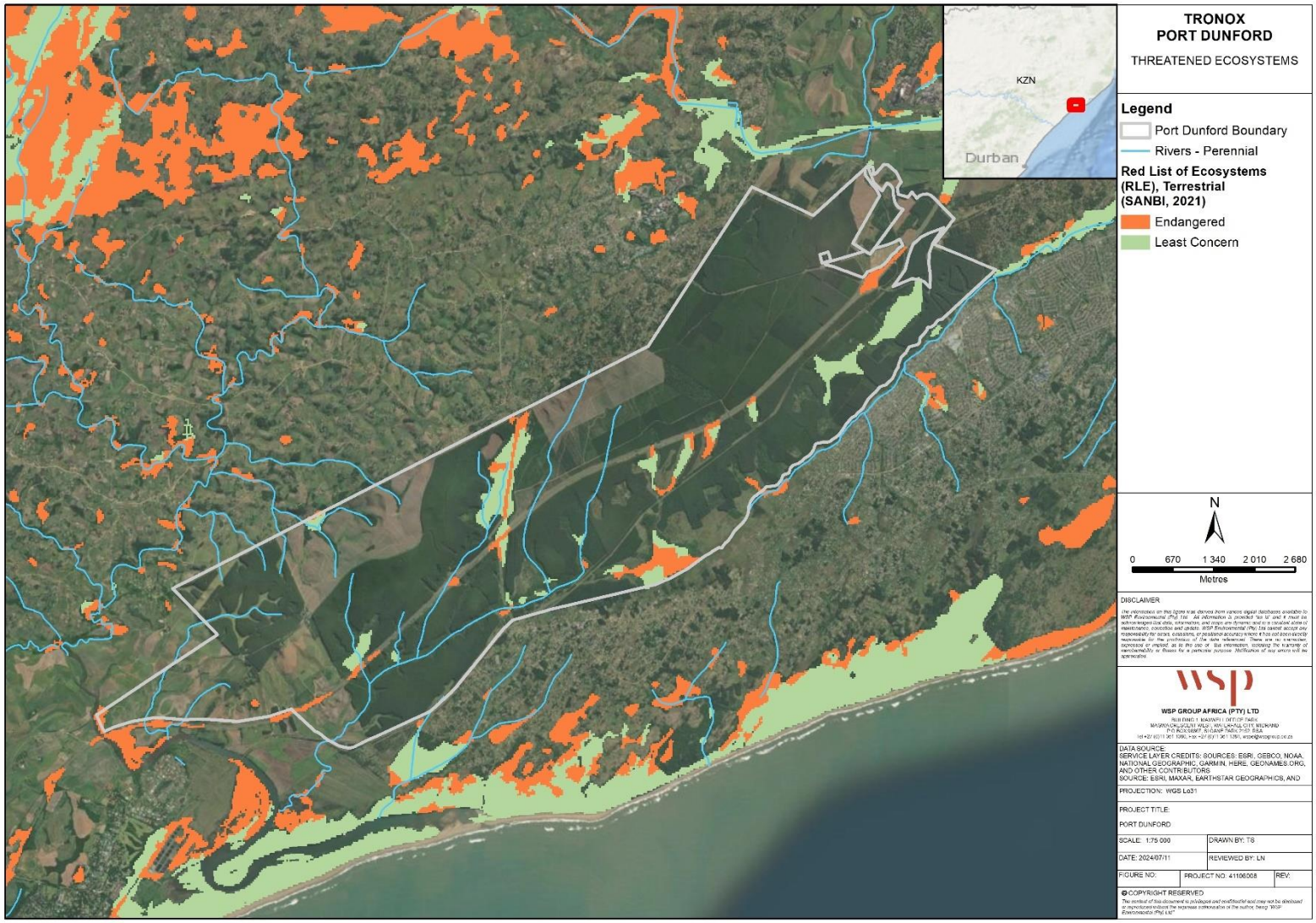

Figure 8: Study area and surrounding landscape in relation to the SANBI (2018) mapping of threatened ecosystems.

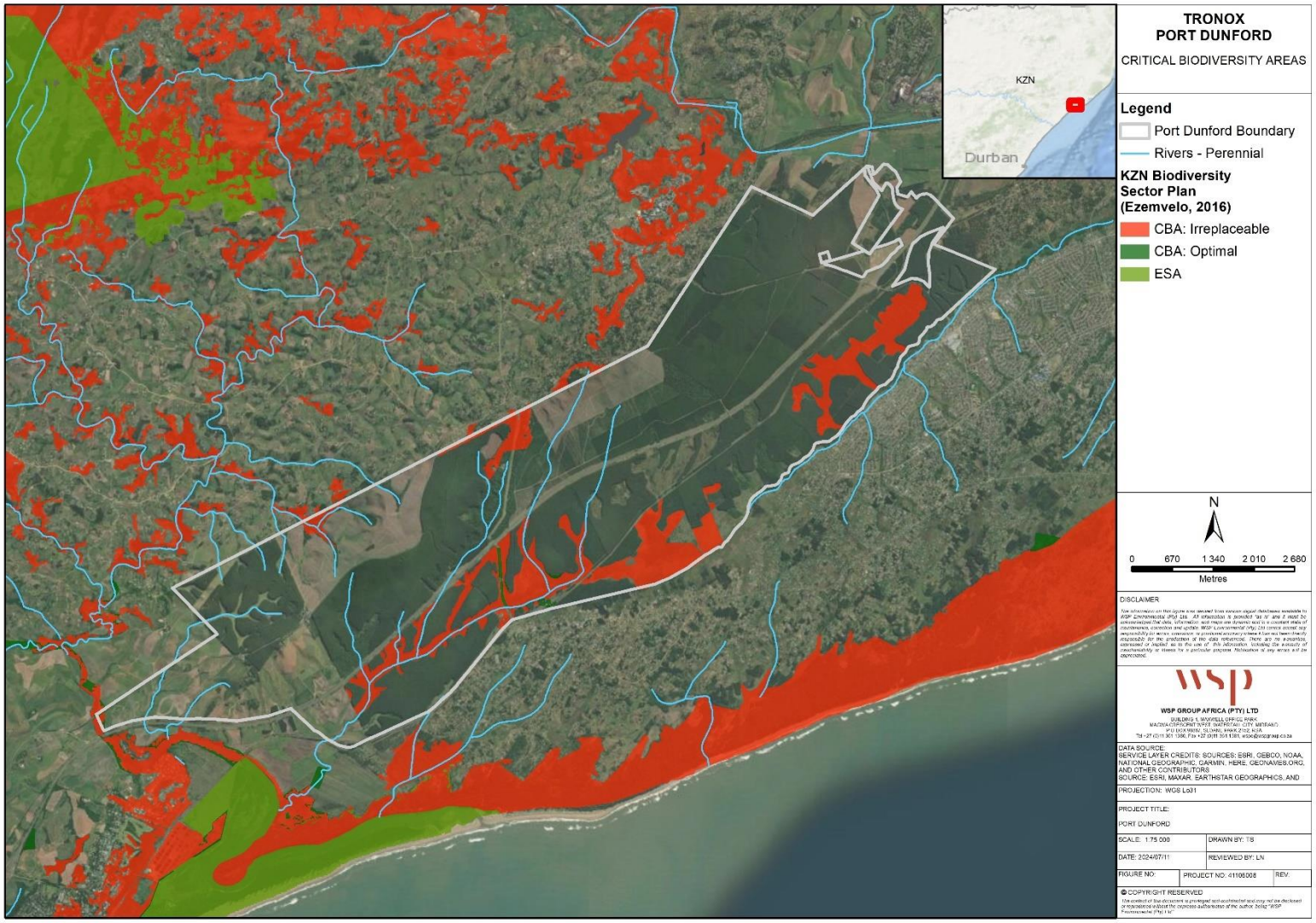

Figure 9: Critical Biodiversity Areas and Ecological Support Areas in and around the study area, as per the delineations of the KwaZulu-Natal Biodiversity Sector Plan (2016).

3.2.3. Strategic Water Source Areas

According to mapping of Strategic Water Source Area (SWSA) (2017), most of the study area is located in a SWSA termed the Zululand Coast and Richards Bay Surface Water and Ground Water Fed Estuary, with small areas to the south-west mapped as Zululand Coast Surface Water – refer to Figure 10.

3.2.4. Freshwater Ecosystem Priority Areas

Freshwater Ecosystem Priority Areas (FEPA) are rivers and wetlands required to meet biodiversity targets for freshwater ecosystems. Essentially, these areas were identified at a national level as priority areas for conserving freshwater ecosystems and supporting the sustainable use of water resources, as well as upstream catchment management areas (Driver, *et al*., 2012). According to Driver, *et al*., (2012), FEPA's should be maintained in a natural/near natural condition, and anthropogenic activities in Upstream Management Areas should be carefully managed to prevent degradation of downstream FEPA's

The study area is not located in a Freshwater Ecosystem Priority Area (FEPA). The nearest mapped FEPA is located to the north of the study area, as shown in Figure 11.

3.2.5. Indigenous Forests

According to the Indigenous Forest Patches spatial data (DWAF), small patches of recognised forests are present in the study area. These are designated as VI1: KwaZulu-Natal Coastal Forests and described as Zonal and Intrazonal Forests – refer to Figure 12.

3.2.6. Protected Areas and Priority Focus Areas for Protected Area Expansion

3.2.6.1.Protected Areas

Three protected areas are located in close proximity to the study area (SAPAD, 2022) (see Figure 13).

- The closest protected area is Umlalazi Nature Reserve, which borders the south-western boundary of the study area. Umlalazi is a long narrow reserve, of approximately 1 451.32 ha. It is known for various vegetation types such as *inter alia* Northern Coastal Forest (Foz7), Swamp Forest (Foa2), Subtropical Dune Thicket (AZs3), and Mangrove Forest (Foa3), lagoon, and estuary, and species such as the Palm-nut Vultures (*Gypohierrax angolensis*) and *Raphia australis* (Kosi Palm); and
- Ngoye Forest Reserve is located approximately 6.3 km to the north-west of the study area. This reserve is approximately 3 894.07 ha in extent and is surrounded by rural communities. It is characterised by well-developed Scarp Forest (Foz5) and patches of KwaZulu-Natal Coastal Belt Grassland (CB3). The smaller Ezigwayini and Dengwini Forest Reserves abut Ngoye to the north and south respectively (shown in Figure 13); and
- Richards Bay Game Reserve is 1 290 ha in extent and located approximately 8 km east of the study area (Figure 13). This reserve is characterised by Mangrove Forest (Foa3) and Subtropical Alluvial Vegetation (Aza7), such as wetlands, mudflats and estuarine habitats, which are fed by three local rivers, namely the Mtantatweni, Mhlatuze and an unnamed channel (Marnewick, *et al*., 2015).

It is also noted that the coastal- and marine zone to the south of the study area forms part of the uThukela Marine Protected Area (Figure 13).

3.2.6.2.Priority Focus Areas for Protected Area Expansion

Portions of the study area have also been identified as Priority Focus Areas for protected area expansion, as per the National Protected Areas Expansion Strategy (2018). The delineated Priority Focus Areas essential form three north-south corridors across the study area, linking the Ngoye Forest Reserve landscape in the north, with Umlalazi Nature Reserve and natural vegetation along the coast (shown in Figure 14).

3.2.7. Important Bird Areas

Important Bird Areas (IBAs) are sites/habitats around the world that are of global importance for bird conservation (Marnewick, *et al*., 2015). They have been identified by multi-stakeholder consultative processes, using defined criteria including the presence of threatened species, restricted-range and biome-restricted species, and large congregations of congregatory species (Marnewick, *et al*., 2015). Not only do IBA's provide essential habitat for birds, including breeding grounds, feeding areas, and stopover points for migrating birds, but they are also effective indicators of biodiversity hotspots, and therefore play a vital role in conserving general flora and fauna biodiversity (Marnewick, *et al*., 2015). All three protected areas discussed in Section 3.2.6.1 are IBA's:

- Umlalazi Nature Reserve is a recognised IBA based on the presence of several globally, regionally and biome-restricted species, including *inter alia*; Spotted Ground Thrush (*Geokichla guttata*), Southern Banded Snake Eagle (*Circaetus fasciolatus*), African Finfoot (*Podica senegalensis*), Mangrove Kingfisher (*Halcyon senegaloides*), Black-bellied Starling (*Lamprotornis corruscus*) and the Gorgeous Bushshrike (*Telophorus quadricolor*) (Marnewick, *et al*., 2015);
- Ngoye Forest Reserve is recognised IBA on account of several trigger species, but is best known for the presence of Green Barbet (*Stacolaena olivacea*), which in South Africa, is exclusively restricted to Ngoye Forest (Marnewick, *et al*., 2015); and
- Several regionally threatened water birds are recognised tigger species for the Richard Bays Game Reserve IBA, including Pink-backed Pelican (*Pelecanus rufescens*), Capsian Tern (*Sterna caspia*), Great-white Pelican (*Pelecanus onocrotalus*) and the Greater Flamingo (*Phoenicpterus roseus*) (Marnewick, *et al*., 2015).

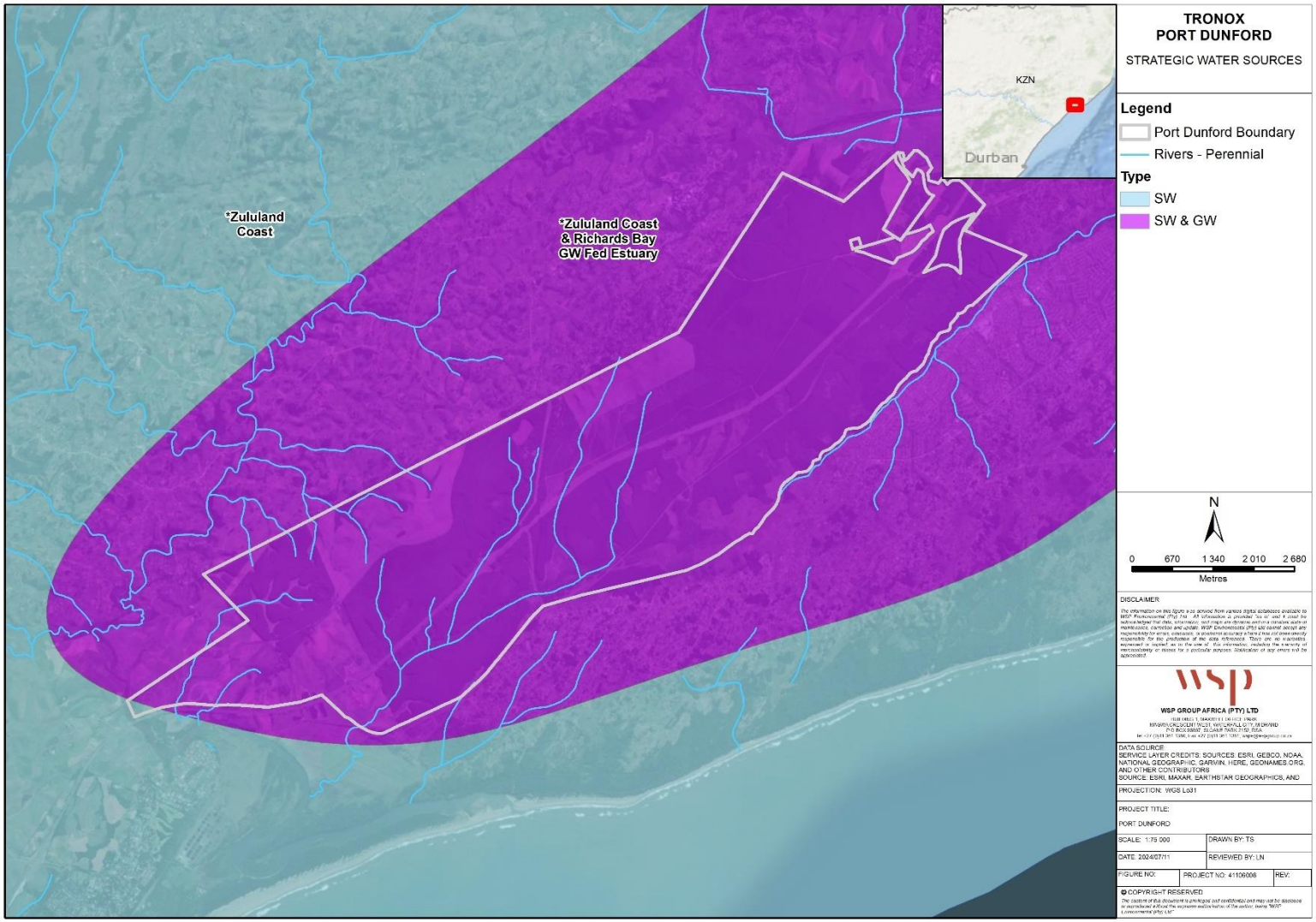

Figure 10:Study area in relation to Strategic Water Source Areas.

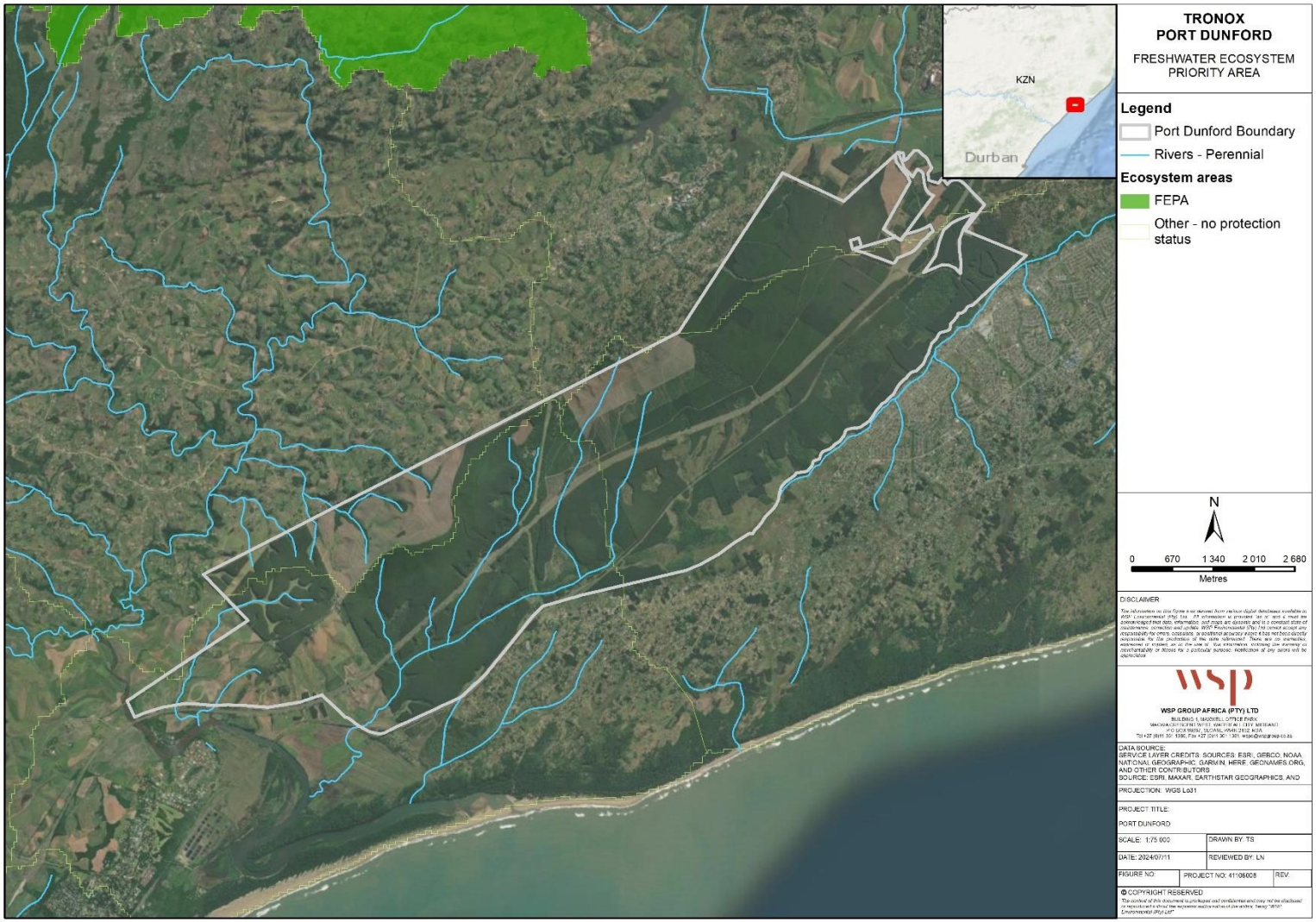

Figure 11: Study area in relation to Freshwater Ecosystem Priority Areas.

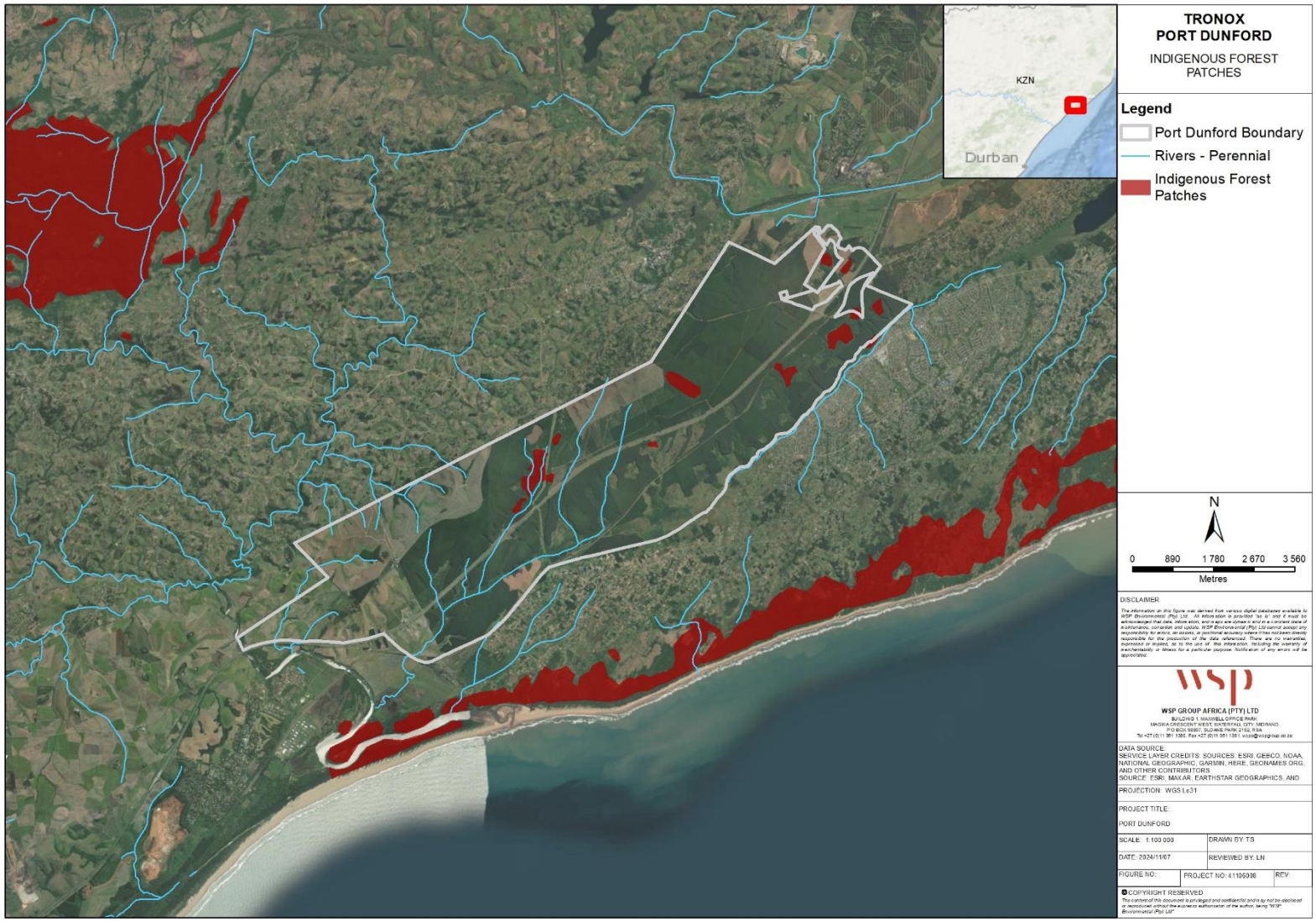

Figure 12: Study area in relation to mapped indigenous forest patches, as per the National Forest Inventory.

Figure 13:Location of Protected Areas in relation to the study area.

Figure 14: Study area and identified Priority Focus Areas, as per the National protected Area Expansion Strategy (2018).

3.3. Landscape Context and Existing Impacts on Terrestrial Biodiversity

The following notes and accompanying photographs summarise the key features, characteristics and existing anthropogenic impacts of the study area and surrounding landscape:

- The study area is located within a highly modified and fragmented landscape matrix:
    - Most of the land to the north and the south of the study area is characterised by rural residential areas, such as *inter alia*; Nyembe, Port Durnford, Sikhalasenkosi, Gobandlovu, Khandisa and Ongioye. These residential areas constitute transformed and developed land that is mostly devoid of natural vegetation (Figure 15) and characterised by built-infrastructure. Small areas of open undeveloped land are also present. These areas however, are typically highly disturbed and used for subsistence crop growing and livestock farming;
    - Most of the land to the west of the study area is also highly modified and consists of sugarcane farms and the residential suburbs of Mtunzini town. Areas of natural habitat are present, including those associated with Umlalazi Nature Reserve;
    - Land to the east of the study area is similarly developed and fragmented and includes agricultural farms, forestry plantations, residential areas and mining operations;
- Prominent linear developments in the landscape include the Eskom powerline servitude, R102 arterial road, the N2 Freeway and a railway line. These traverse through the centre of the study area on an east-west axis. Numerous other gravel roads and vehicle tracks are also present throughout the landscape and cause additional landscape and habitat fragmentation;
- Major local drainage systems include:
    - The Mlalazi River, which marks the western border of the study area, and flows southward before entering the ocean at a point 2 km south of the study area's southern boundary (Figure 16). The KwaGugushe River flows briefly across the north-west corner of the study area before joining the Mlalazi River;
    - The Amanzamnyama and Mzingwenya Rivers (Figure 17) which flow westward and eastward along the southern boundary of the study area, respectively; and
    - The Mhlatuze River, which is located to the north-east of the study area and flows in and south-easterly direction before it drains into the Indian Ocean;
- Areas that have been disturbed by anthropogenic activities are typically colonised by alien invasive flora species. In some instances, these taxa have established in areas of natural habitat (see Figure 18); and
- Large portions of the study area itself are under commercial forestry plantations and sugarcane farming – these are considered modified habitat types. The study area has a long history of both commercial forestry and sugarcane farming, with historical aerial imagery from 1957 showing extensive areas

Figure 15: Port Durnford village, located along the southern boundary of the study area.

Figure 16: The Mlalazi River along the western boundary of the study area is flanked by sugarcane fields.

Figure 17: Section of Swamp Forest along the Mzingwenya River that has been cleared of vegetation by adjacent community members - ostensibly for subsistence cropping.

Figure 18: Tributary of the Mlalazi River dominated by alien invasive vegetation, including Melia azedarach and Lantana camara.

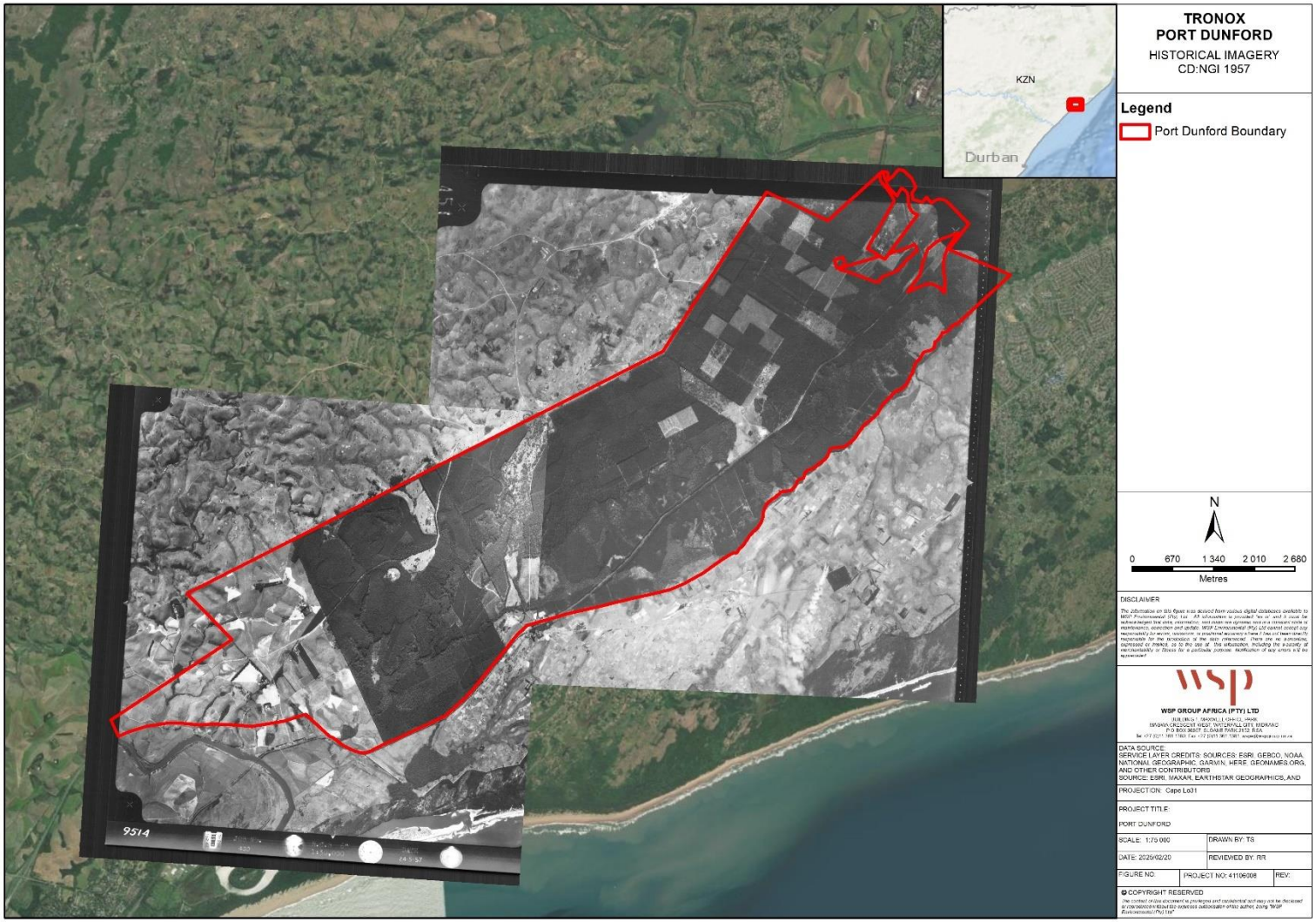

Figure 19: Historic aerial image of the study area from 1957.

3.4. Habitat Units

This section presents descriptions of the primary habitat units identified in the study area. Habitat Unit names are based, in part, on those identified in the study area by Coastal & Environmental Services (2008), but the associated descriptions have been compiled using data and observations collected during the 2022 wet season field survey. Habitat unit descriptions are predicated on a combination of flora composition, vegetation structure and disturbance characteristics. Two units are regarded as modified habitats and four units are regarded as natural habitats, *viz*:

Modified Habitats

- Timber Plantations; and
- Sugarcane Fields.

Natural Habitats

- Coastal Lowland Forest;
- Swamp Forest (incl. Undefined Forest Regions);
- Riparian Woodland; and
- Grassland with Trees and Bush-clumps.

Habitat unit descriptions and representative photographs are presented in Section 3.4.1 to Section 3.4.6. A habitat unit map of the study area is presented Figure 20. It must be noted that there is anticipated to be considerable overlap in the coverage of Coastal Lowland Forest and Swamp Forest as mapped entities.

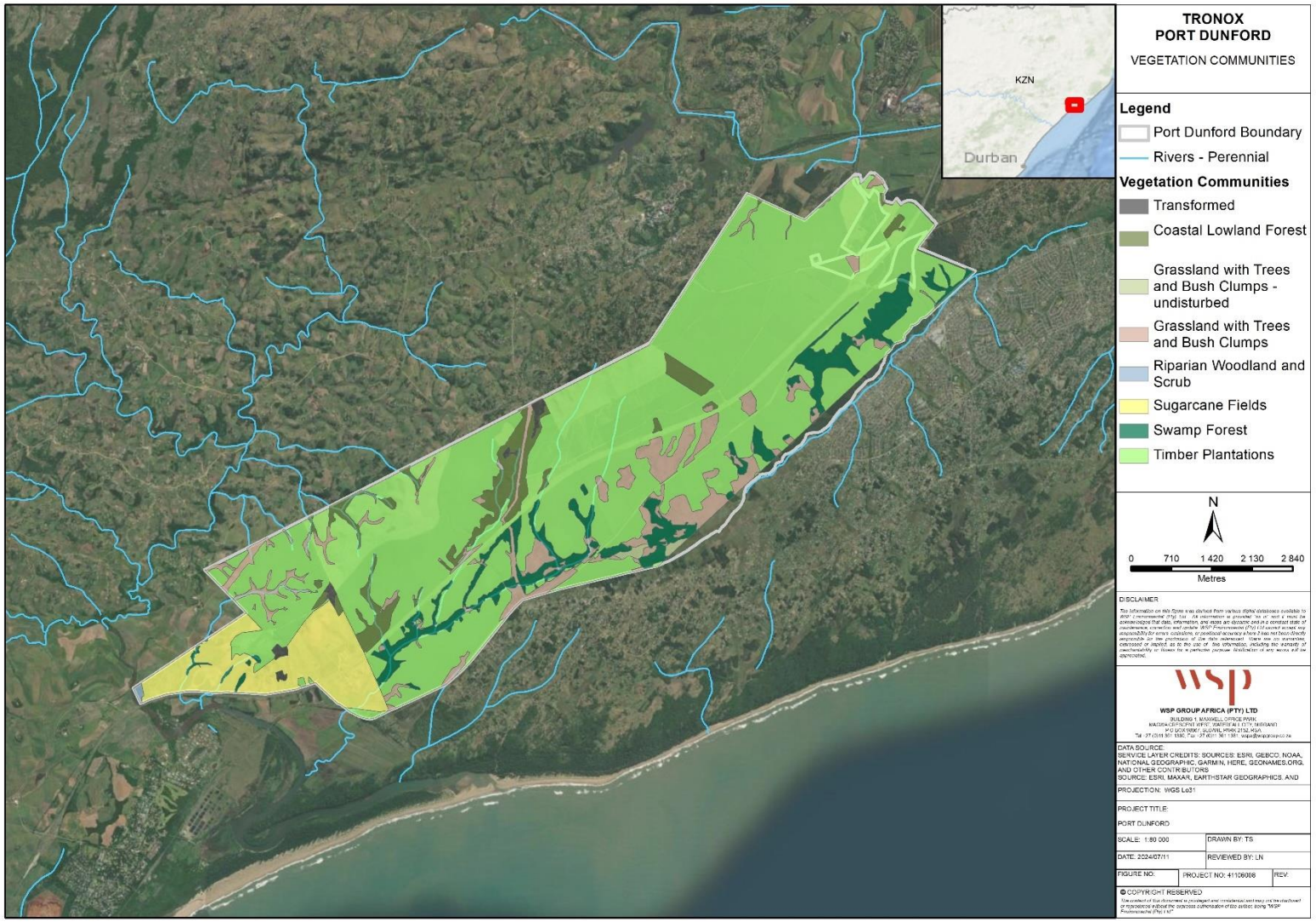

Figure 20: Habitat unit map of the study area.

3.4.1. Timber Plantations

Extensive timber plantations dominate large portions (approximately 3 366.9 ha) of the study area. These are formal agroforestry plantations that are actively managed by the timber industry (Mondi).

Plantation stands are characterised by tall, regularly-spaced alien *Eucalyptus* trees of varying ages and sizes (Figure 21) (a small area of *Pinus* trees was also noted). Herbaceous vegetation within plantation stands is either very sparse and limited to ruderal grasses, or in very shaded areas is entirely absent.

The land between plantation stands is typically open and characterised by short grassland, with occasional scattered woody species (Figure 22). These areas are often aligned with drainage lines and appear to be subject to high levels of cattle grazing by local communities, with the creeping lawn grass *Stenotaphrum secundatum* dominant (also refer to description in Section 3.4.6).

Sensitivity Aspects

Timber plantations are a modified habitat type. They are characterised by a mono-culture of non-indigenous timber tree species, and are subject on-going agroforestry activities and disturbances. The probability that any flora and mammal SCC are present in these areas is considered 'unlikely'.

Figure 21: Example of a Eucalyptus plantation in the study area. Note almost complete absence herbaceous vegetation.

Figure 22: Short grassland characterises drainage lines between Eucalyptus timber stands.

3.4.2. Sugarcane and Macadamia Fields

The western portion of the study area is characterised by sugarcane and converted Macadamia fields (approximately 371.3 ha). These areas are subject to ongoing disturbances related to active farming. These fields are completely denuded of indigenous vegetation and dominated by a monoculture of either sugarcane (*Saccharum officinarum*) or Macadamia plants – shown in Figure 23.

Small narrow patches of natural/seminatural habitat occur along drainage lines in this habitat unit. These however, are highly disturbed and encroached with several alien invasive flora species, such as *inter alia*; *Melia azedarach, Lantana camara* and *Chromolaena odorata*.

Sensitivity Aspects

Sugarcane and Macadamia fields are considered a modified habitat type. No flora and mammal SCC were recorded in areas of this habitat unit, and the probability of such species being present in considered 'unlikely'.

Figure 23: Sugarcane field in the study area.

3.4.3. Swamp Forest

Patches of Swamp Forest are generally associated with drainage features and poorly drained, water-logged soils in the study area. Spatially, they generally occur as linear forest patches, that are closely bordered by modified habitat, including Timber Plantations, vehicle tracks/access roads, Sugarcane Fields, human settlements and areas of Grassland and Wetland with Trees and Bush-clumps. In total, approximately 341.6 ha of the study area is covered by Swamp Forest, of which, approximately 6.3 ha is overlain by proposed Project infrastructure.

Coastal & Environmental Services (2009) recognised three main types of Swamp Forest in the study area based on woody species co-dominance, namely *Syzygium/Cassipourea* dominated Swamp Forest, which characterise upper drainage line areas, and *Ficus/Voacanga* dominated Swamp Forest and *Barringtonia* dominated Swamp Forest, which characterise mid- and lower drainage line areas, respectively. For mapping purposes, these have been grouped as 'Swamp Forest'.

In line with Edward's (1983) structural classification for vegetation, structurally Swamp Forests in the study area are classified as a 'tall- to high forest'. They are characterised by a distinct upper canopy layer and lower woody shrub and herbaceous layers (Figure 24 to Figure 26).

In terms of general composition, common woody species in the upper canopy include diagnostic Swamp Forest taxa, such as *Barringtonia racemosa, Cassipourea gummiflua* var. *verticillata, Ficus trichopoda, Macaranga capensis* and *Syzygium cordatum* subsp. *cordatum. Tabernaemontana ventricosa* is a dominant woody species in the lower shrub strata, along with other species such as, *inter alia*, *Asparagus falcatus, Phoenix reclinata, Psychotria capensis* subsp. *capensis, Shirakiopsis elliptica, Vitex* species and *Voacanga thouarsii.* In many areas of swamp forest, the herbaceous layer

is dominated by dense colonies of the large ferns *Nephrolepis biserrata* and *Stenochlaena tenuifolia,* while the climbers *Dalbergia armata, Smilax anceps* and *Urera trinervis* are also common.

The condition of Swamp Forest in the study area varies considerably. Some forest patches are undisturbed and in good condition, with little evidence of disturbance. Other forest patches are regenerating following historic or contemporary disturbances, such as commercial forestry, wildfire encroachment, logging, direct clearing (for subsistence agriculture), or alien invasive species colonisation.

It was noted for instance, that forest patches bordering areas comprising the Grassland and Wetland with Trees and Bush-clumps habitat unit are impacted by edge-effect disturbances caused by encroaching wildfires. Similarly, small areas of Swamp Forest along the Mzingwenya River, amongst other locations, have been cleared of vegetation by the adjacent community – ostensibly for subsistence farming purposes (refer to Figure 17). Remnant Swamp Forest along the drainage lines in the sugarcane fields in the west of the study area are also subject to high levels of ongoing disturbance from commercial farming activities and alien invasive species encroachment (shown in Figure 27). Areas of Swamp Forest that have been disturbed, as well as the forest margins/edges are typically characterised by a less well-developed, more open forest structure, and species such as *inter alia*; *Albizia adianthifolia, Bridelia micrantha*, *Macaranga capensis, Syzygium cordatum* subsp. *cordatum, Tabernaemontana ventricosa, Senecio tamoides* and *Trema orientalis*. Refer to Appendix C for a full list of flora species recorded in this habitat unit.

Sensitivity Aspects

Patches of Swamp Forest significantly increase landscape-scale habitat heterogeneity and provide important resource and refuge habitat for a diverse assemblage of terrestrial and aquatic flora and fauna. They also act as ecological corridors, increasing local habitat connectivity and facilitating flora and fauna dispersal. Swamp Forests also play an important part in numerous hydrological processes, such as water filtration and flood control.

In terms of flora SCC, *Cassipourea gummiflua var. verticillata* (Vulnerable) is a common woody species in Swamp Forest, as are both *Ficus trichopoda* and *Barringtonia racemosa,* which are diagnostic woody taxa in this habitat unit and listed as protected according to the National Forest Act (1998). Several other SCC have been recorded or are potentially present in Swamp Forest habitats in the study area, including *inter alia*, the endemic palm *Raphia australis* (Vulnerable). This species was recorded in the study area by Coastal & Environmental Services (2009) and was also observed in the landscape surrounding the study area during the 2022 field survey – refer to Section 3.5.2.

Figure 24: Typical Swamp Forest habitat in the study area.

Figure 25: Swamp Forest along the Mzingwenya River.

Figure 26: Densely wooded and very shaded area of Swamp Forest.

Figure 27: Narrow area of remnant Swamp Forest that is dominated by Barringtonia racemosa, but severely encroached and disturbed by adjacent sugarcane fields.

3.4.4. Coastal Lowland Forest

Areas of Coastal Lowland Forest are mostly confined to small habitat patches to the north of the N2 Freeway. Prior to the large-scale conversion of land to timber plantations and sugarcane fields, it is likely that large portions of the study area (outside of areas of Swamp Forest) would have been characterised by this habitat unit. Approximately 210.1 ha of the study area currently comprises coastal lowland forest, of which, approximately 113.6 ha is overlain by proposed Project infrastructure.

As per Edwards' (1983) structural classification, Coastal Lowland Forests are generally classified as being 'short- to high forests.' Like Swamp Forests, this unit is also characterised by distinct upper- and lower woody strata, and an herbaceous layer that ranges from well- to poorly developed, depending on light availability (Figure 28 and Figure 29).

Common tall, upper-canopy woody species recorded in this habitat unit include, *inter alia; Albizia adianthifolia, Cussonia spicata, Bridelia micrantha, Ficus natalensis* subsp. *natalensis, Harpephyllum caffrum* and *Macaranga capensis. S*pecies commonly recorded in the lower strata include *Allophylus*

dregeanus, Asparagus falcatus, Deinbollia oblongifolia, Dracaena aletriformis, Kraussia floribunda, Monanthotaxis caffra, Peddiea africana, Psychotria capensis subsp*. capensis, Phoenix reclinata, Peddiea africana* and *Tabernaemontana ventricosa.* Common climbers noted include *Dalbergia armata, Entada rheedii, Flagellaria guineensis, Senecio tamoides* and *Urera trinervis.*

Herbaceous species recorded include various herbs, graminoides and woody species and climber such as *Flagellaria guineensis, Oplismenus hirtellus, Olyra latifolia, Isoglossa woodii, Scadoxus puniceus, Setaria megaphylla, Rivina humilis*, Smilax anceps* and the fern *Stenochlaena tenuifolia.* Refer to Appendix C for a full list of flora species recorded in this habitat unit.

The condition of remaining patches of Coastal Lowland Forest in the study area shows varying levels of disturbance, with both patches of relatively undisturbed forest and patches of regenerating/disturbed forest observed. It is noted that edge effect- and localised internal disturbances have been caused by various anthropogenic activities, including former commercial forestry, but also bush-clearing, logging, alien invasive species colonisation and wildfires.

Sensitivity Aspects

Patches of Coastal Lowland Forest share many of the same ecological functioning properties as areas of Swamp Forest. I.e., they provide important resource, refuge and corridor habitat for diverse assemblages of flora and fauna, and contribute to landscape-scale habitat heterogeneity and connectivity.

In terms of SCC, *Barringtonia racemosa, Cassipourea gummiflua var. verticillata* and *Ficus trichopoda* were also recorded in this habitat unit, and based on habitat suitability, it is also likely that several other flora and fauna SCC are present – refer to Section 3.5.2 and Section 3.6.2.

Figure 28: Typical example of Coastal Lowland Forest

Figure 29: Coastal Lowland Forest with poorly developed herbaceous layer.

3.4.5. Riparian Woodland and Scrub

Riparian Woodland and Scrub is one of the smaller vegetation communities in the study area and characterises a small 3.4 ha of vegetation occurring along the Mlalazi River (see Figure 30 and Figure 31). As a result of the adjacent farming activities, this habitat unit is generally highly disturbed and many areas are colonised by alien flora species.

Vegetation structure is variable, and in line with Edwards (1983) structural classification, ranges from 'short-open to short-closed woodland' - depending on, *inter alia*, the degree of anthropogenic disturbance.

Common indigenous woody species recorded in this unit include fine-leaved taxa such as *Vachellia natalitia* and *Vachellia robusta,* and several broader-leaved taxa, including *inter alia; Barringtonia racemosa, Grewia lasiocarpa, Hippobromus pauciflorus, Phoenix reclinata, Searsia pyroides, Trema orientalis, Rauvolfia caffra* and *Trichilia emetica.* Localised monoculture stands of *Bambusa balcooa* – a tall alien bamboo species, are also present in this habitat unit. Common indigenous herbaceous species recorded in this unit include the grasses *Cynodon dactylon, Panicum maximum* and *Stenotaphrum secundatum,* and the tall reed *Phragmites australis.*

Apart from conspicuous stands of *Bambusa balcooa*, portions of this unit are also severely encroached by other listed alien invasive species, with several woody and herbaceous taxa abundant, including *Chromolaena odorata, Melia azedarach, Lantana camara, Parthenium hysterophorus, Solanum mauritianum* and *Ricinus communis.* Refer to Appendix C for a full list of flora species recorded in this habitat unit.

Sensitivity Aspects

The Riparian Woodland and Scrub habitat unit in the study area has been subject to high levels of anthropogenic disturbances. This notwithstanding, this habitat unit is functionally important, as it buffers the adjacent river/drainage systems and provides sheltering and movement corridors for flora and fauna.

One flora SCC was recorded in this unit, namely the protected tree *Barringtonia racemosa.* Considering the degree of disturbance, the probability of other SCC being present is generally considered possible – refer to Section 3.5.2.

Figure 30: Mlalazi River located along the western boundary of the study area is bordered by Sugar Cane Fields

Figure 31: Stand of Common Bamboo (Bambusa balcooa) – an aggressive, although not-listed, alien species.

3.4.6. Grassland with Trees and Bush-clumps

This broad and variable habitat unit characterises non-forested areas of natural/semi-natural habitat to the north and south of the N2 Freeway. It includes small areas (approximately 12.7 ha) of undisturbed moist grassland (wetlands), as well as large patches (totalling approximately 359.1 ha) of secondary grassland and shrub/woodlands that are either regenerating following the clearing of agroforestry trees (*Eucalyptus*) or indigenous forest, or that are maintained as open servitudes.

Wildfire and to a lesser extent livestock grazing appear to be frequent and the dominant ecological disturbances in certain patches of this habitat unit. It is likely that fire in particular, is important in maintaining patches in a subclimax grassland or woodland state. It is anticipated that the exclusion of fire will likely result in progressive bush-thickening, and over the long-term, the transition of open grassland patches toward a forest-type community.

As per Edwards (1983), vegetation structure of this unit is highly variable but can generally be defined as 'low- to short closed grassland' (see Figure 32 to Figure 34), within which are embedded patches of 'short- open to closed woodland' (Figure 35).

In terms of composition, open areas of this habitat unit are grass- and sedge dominated, with *Stenotaphrum secundatum* dominant in large regenerating areas (Figure 33), and various *Cyperus* species dominant in less disturbed moist areas. Other commonly recorded graminoid and herb species recorded include *Andropogon eucomus, Centella asiatica*, *Cynodon dactylon*, *Eleocharis limosa*, *Imperata cylindrica, Paspalum distichum, Phragmites australis* and *Sporobolus africanus.* Refer to Appendix C for a full list of flora species recorded in this habitat unit.

In large areas of this unit, the fern *Pteridium aquilinum* subsp. *capense* has formed dense, monospecific colonies (Figure 34), highlighting the high frequency of wildfire (*Pteridium aquilinum* subsp. *capense* proliferates and becomes a troublesome weed in grasslands that are burnt too frequently).

Woody species in the more open grass and sedge dominated areas of this habitat unit typically comprise scattered individual small (< 3 m) trees, with *Barringtonia racemosa, Ficus trichopoda, Maesa lanceolata, Morella serrata, Phoenix reclinata, Rauvolfia caffra* and *Syzygium cordatum*

subsp. *cordatum*, all noted. In the more wooded areas, taller (> 6m) stands dominated by the fast-growing *Syzygium cordatum* subsp. *cordatum* trees are characteristic (see Figure 35).

Sensitivity Aspects

Disturbance levels in this habitat unit vary considerably, with large areas essentially comprising secondary/regenerating vegetation. Indeed, in some areas remnant *Eucalyptus* tree stumps remain clearly visible. More permanently wet patches that were not previously under timber plantations however, are generally in good condition.

Although most of the open areas of this habitat unit are likely to burn frequently and therefore act as disturbance source areas, the more well-wooded patches are likely to act as supporting / buffering habitat for adjacent forest patches. The wetland areas provide important habitat for flora and fauna, and also play an important functional role in hydrological and various other ecological processes.

Both protected trees *Ficus trichopoda* and *Barringtonia racemosa* were recorded in this habitat unit during the field visit. In undisturbed moist grassland/wetland areas, it is noted that several other flora SCC may be present, including threatened taxa, such as *inter alia, Asclepias gordon-grayae* (Endangered), and *Disperis woodii, Habenaria woodii, Pachycarpus concolor* and *Kniphofia littoralis* which are all listed as Vulnerable on the national Red List – refer to Section 3.5.2.

Figure 32: Wetland area dominated by various Cyperaceae, with occasional scattered Syzygium cordatum subsp. cordatum and Barringtonia racemosa trees.

Figure 33: Former timber plantation, cleared of Eucalyptus trees and currently characterised by very short, moist grassland, dominated by the creeping grass Stenotaphrum secundatum.

Figure 34: Open area dominated by the colony-forming Pteridium aquilinum subsp. capense.

Figure 35: Woodland-type habitat, dominated by small to medium-sized Syzygium cordatum subsp. cordatum trees.

3.5. Floristic Analysis

3.5.1. General Floristics

Based on the combined floristic data collected during the 2022 field survey and by Coastal & Environmental Services (2009) during their field work, a combined total of 255 flora species, representing 92 families have been recorded in the study area. Refer to Appendix C for a list of flora species recorded in the study area.

The most represented family is the Poaceae with 25 species, followed by the Fabaceae with 25 species, the Asteraceae with 17 species, and the Rubiaceae with 14 species. The majority of identified species are indigenous taxa (76%), with the remaining 24% alien taxa. The presence of alien taxa is linked to longstanding anthropogenic disturbances, such as *inter alia*; commercial forestry activities, vegetation clearing, plant harvesting and cropping. Tree and woody shrubs are the most abundant growth form with 110 species, followed by 64 herbs species, 42 graminoid species, 27 climbers and 12 ferns.

3.5.2. Flora Species of Conservation Concern

In line with the internationally endorsed IUCN Red List Categories and Criteria, the Red List of South African Plants recognises three categories of threatened species, namely Critically Endangered (CR), Endangered (EN) and Vulnerable (VU), and five 'other categories of conservation concern' that are recognised as having high conservation importance, namely Near Threatened (NT), Critically Rare, Rare, Declining, and Data Deficient – Insufficient Information (DDD).

Also discussed as flora SCC are taxa listed on the NEMBA ToPS List (2007) as nationally threatened or protected, trees listed as protected under the National Forest Act (1998), and species listed as provincially protected/specially protected, as per the Natal Conservation Ordinance (No. 15 of 1974).

Based on reviewed botanical datasets and data collected in the study area during the field survey, up to 41 flora SCC potentially occur in the study area. These are listed in Table 4, along with their conservation statuses, habitat preferences and a 'probability of occurrence' (as informed by field records or habitat suitability assessments).

Note*: As per the species assessment guidelines, the name of specific taxa that are regarded as being susceptible to overexploitation, have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number'.*

Table 4 contains seven taxa listed as Endangered, 21 as Vulnerable, seven as Near Threatened and two as Rare on the South Africa Red List. Several taxa are also listed under the NEMBA ToPS List (2007), the National Forest Act (1998) and/or the Natal Conservation Ordinance (No. 15 of 1974).

In terms of SCC recorded in the study area:

- The small tree *Cassipourea gummiflua* var. *verticillata* (see Figure 36), which is listed as Vulnerable on the South Africa Red List, was recorded in the understorey of patches of Swamp Forest and Coastal Lowland Forest during the field survey. This species is listed in the National Web Based Screening Tool report for the study area;
- Two protected tree species, as listed under the National Forest Act (1998), namely *Barringtonia racemosa* (Figure 37) and *Ficus trichopoda* (Figure 38), were also recorded in

the study area. Both taxa are abundant in Swamp Forest habitat, where they are often co-dominant, but they were also recorded in some of the other habitat units;

- Although not recorded during the 2022 field survey, the endemic palm *Raphia australis* (Vulnerable) was recorded in study area by Coastal & Environmental Services (2009). This species favours Swamp Forest habitat;
- Sensitive species 191 was not recorded in the study area during the 2022 field survey. However, Coastal & Environmental Services (2009) indicate that they observed this species being harvested by local communities. This species is listed in the National Web Based Screening Tool report for the study area. Sensitive species 191 is also listed as Protected on the NEMBA ToPS List (2007) and Specially Protected according to the Natal Conservation Ordinance (No. 15 of 1974);
- Coastal & Environmental Services (2009) recorded *Curtisia dentata* (Near Threatened) in the study area. This species favours evergreen forests, but available records indicate that it is unlikely to occur naturally along the KwaZulu-Natal coast. It is therefore suspected that this may be a misidentification; and
- Flora species recorded in the study area, either during the 2022 field survey or by Coastal & Environmental Services (2009), that are listed as Specially Protected at a provincial level according to Schedule 12 of the Natal Conservation Ordinance (No. 15 of 1974) include *Dioscorea cotinifolia, a Crocosmia* species*, Freesia laxa, Millettia grandis, Scadoxus puniceus* (Figure 39) and a *Zantedeschia* species*.*

Refer to Appendix D for a map showing the location of the transects/points where some of the threatened and protected flora species were recorded.

Figure 36: Cassipourea gummiflua var. verticillata (*Vulnerable*).

Figure 37: Barringtonia racemosa (Protected, Nat.).

Figure 38: Ficus trichopoda (Protected, Nat.).

Figure 39: Scadoxus puniceus (Specially Protected, KZN).

Table 4: List of flora species listed as nationally threatened (Red List) and/or protected occurring or potentially occurring in the study area. Recorded species are shaded dark orange. Those species that were assessed to have a 'Possible' or 'Probable' presence in the study area (based on habitat suitability assessments) are shaded light orange and orange respectively. Those that were assessed 'Unlikely' to occur in the study area are not shaded.

Family	Scientific Name[#]	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Acanthaceae	*Salpinctium natalense*	Rare	-	-	-	Favours savanna habitats where it occurs in shaded areas under Acacia's (Victor & van Wyk, 2005).	Unlikely – no suitable habitat present.
Apocynaceae	*Asclepias gordon-grayae*	Endangered	-	-	-	Range restricted species (EOO 14 00km^2), that is known from five locations. Favours tall, unburnt coastal grassland in black peat soils in wetlands (Nicholas, *et al*., 2007)	Possible – suitable habitat present.
Apocynaceae	*Emplectanthus cordatus*	Vulnerable	-	-	-	Estimated EOO is 2263 km^2, and known from only four locations. Inhabits scarp and coastal forest (Mtshali & von Staden, 2015).	Probable – suitable habitat present.
Apocynaceae	*Pachycarpus concolor subsp. concolor*	Vulnerable	-	-	-	Occurs in grassland on stabilised dunes within 20 km of the coast. This species has a EOO of 6350 km^2 and is known from fewer than 10 locations (Von Staden, 2012a).	Unlikely – no suitable habitat available.
Apocynaceae	*Raphionacme lucens*	Near Threatened	-	-	-	Known from less than five locations. This species favours coastal grassland (Venter, 2009).	Possible – suitable habitat present.
Arecaceae	*Raphia australis*	Vulnerable	-	-	-	Known from two locations in South Africa (Scott-Shaw *et al*., 2016), with an AOO of 476.69 km^2 (SANBI, 2020). Occurs in swamp forest on seasonally inundated costal dunes (Scott-Shaw *et al*., 2016).	Recorded (Coastal & Environmental Services, 2008)
Asphodelaceae	*Aloe kraussii*	Endangered	-	-	-	Widespread (EOO 11 062 km^2), but rare species. Occurs on grassy slopes (Mtshali, 2019).	Unlikely - limited suitable habitat.

Family	Scientific Name#	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Asphodelaceae	*Kniphofia littoralis*	Near Threatened	-	-	-	Widespread species (EOO 23 000 km^2), but known from only 13 locations. Occurs in coastal grassland and wetland habitats (Scott-Shaw & Victor, 2005).	Possible – suitable habitat present.
Asteraceae	*Cineraria atriplicifolia*	Vulnerable	-	-	-	Range of this species is uncertain. Mostly known from Durban and Pietermaritzburg. EOO estimated at 2000-7400 km^2. Prefers grassland, thornveld and forest edges (Von Staden, 2008b)	Unlikely – uncertain whether this species occurs north of Durban.
Asteraceae	*Senecio ngoyanus*	Vulnerable	-	-	-	Occurs in coastal grassland and marshy depressions. EOO is estimated at 13 600 km^2 (Scott-Shaw & Von Staden, 2007).	Possible – suitable habitat present.
Astercaeae	*Nidorella tongensis*	Endangered	-	-	-	A rang-restricted species, with an EOO of 4030 km^2. Favours damp places among dunes overlooking the sea (Von Staden, 2020)	Unlikely – limited habitat present, but known from Mtunzini.
Curtisiaceae	*Curtisia dentata*	Near Threatened	-	Protected	-	Fairly widespread species, that occurs in evergreen forest from the coast to 1800m (Williams *et al*., 2008b).	Recorded (Coastal & Environmental Services, 2008), but record is uncertain.
Cyperaceae	*Fimbristylis aphylla*	Vulnerable	-	-	-	Known from five collection, with an EOO of 12 600 km^2. Favours permanent wetland habitats, usually near the sea (Archer *et al*., 2006).	Probable – suitable habitat present.

Family	Scientific Name[#]	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Fabaceae	*Aspalathus gerrardii*	Vulnerable	-	-	-	Favours damp marshy habitats in coastal grassland and forest margins. EOO estimated at 10 000 km^2 (Von Staden 2008a)	Probable – suitable habitat present.
Fabaceae	*Tephrosia inandensis*	Endangered	-	-	-	Grassland forest margins (Von Staden, 2007).	Possible – suitable habitat present.
Gesneriaceae	*Streptocarpus wendlandii*	Rare	-	-	-	Range-restricted species, that is not threatened. Occurs in scarp forest in Ngoye Forest (Truter *et al*., 2017).	Unlikely – no suitable habitat and known range does not overlap with study area.
Hyacinthaceae	*Merwilla plumbea*	Near Threatened	Vulnerable	-	-	Widespread species. Occurs in montane mistbelt and Ngongoni grassland where it favours rocky areas of steep slopes (Williams, *et al*., 2008a).	Unlikely – no suitable habitat
Iridaceae	*Dierama dubium*	Vulnerable	-	-	Specially Protected	Restricted range in central KZN, with an EOO of 3800km^2). Known from five to seven locations. Favours grassland habitats between 1200 and 1500 m (Von Staden, *et al*., 2006)	Unlikely – no suitable habitat available.
Iridaceae	*Dierama sertum*	Near Threatened	-	-	Specially Protected	Restricted range (EOO 1900km^2) and known from 10-15 locations. Favours grassland between coastal forest patches (Scott-Shaw, *et al*., 2007).	Probable – suitable habitat present.
Iridaceae	*Freesia laxa subsp. azurea*	Vulnerable	-	-	Specially Protected	Narrow distribution range (EOO 2 395 km^2) and known from fewer than 10 locations north of Richards Bay. Favours grassy dunes and margins of coastal forest (Von Staden, 2012b)	Unlikely – limited suitable habitat available.

Family	Scientific Name[#]	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Lauraceae	*Cryptocarya wyliei*	Near Threatened	-	-	-	EOO estimated at 19 600km^2, and known from 10 locations. Favours scarp forest, and margins of riverine, thicket and coastal bush (Von Staden & Abbott, 2007a).	Possible – suitable habitat present.
Lauraceae	*Dahlgrenodendron natalense*	Endangered	-	-	-	Population estimated at < 1000 trees. Favours stream habitats in scarp forest on Natal group and Msikaba Formation sandstones, but also granite (Von Staden & Abbott, 2007b).	Unlikely – limited suitable habitat available.
Lecythidaceae	*Barringtonia racemosa*	Least Concern	-	Protected	-	Occurs near water, including river areas, swamp forest and less saline mangrove swamps (Coates Palgrave (2002).	Recorded
Lemnaceae	*Wolffiella denticulata*	Vulnerable	-	-	-	Aquatic species, known from four locations. Occurs in swamp forest, where is floats on freshwater wetlands or slow-moving streams (Scott-Shaw & von Staden, 2007).	Probable – suitable habitat present.
Malvaceae	*Pavonia dregei*	Vulnerable	-	-	-	A range restricted species, with an EOO of 11 129 km^2. Coastal grassland along forest margins and often in disturbed sites (von Staden, 2007).	Probable – suitable habitat present
Moraceae	*Ficus trichopoda*	Least Concern	-	Protected	-	Fairly common species, that favours coastal and swamp forest (Coates Palgrave (2002).	Recorded
Orchidaceae	*Disperis woodii*	Vulnerable	-	-	Specially Protected	Widespread but rare species. EOO estimated at 76 783 km^2, and known from four locations. Favours damp grassland (Von Staden, 2018)	Possible – suitable habitat present.
Polygonaceae	*Oxygonum dregeanum subsp. streyi*	Endangered	-	-	-	Widespread species that has undergone population decline. Favours costal grasslands and palm veld (von Staden, 2015).	Possible – suitable habitat present.
Rhizophoraceae	*Cassipourea gummiflua var. verticillata*	Vulnerable	-	-	-	This species favours evergreen and swamp forest (Williams *et al*., 2008). The AOO of this species is 17.17 km^2 (SANBI, 2020).	Recorded

Family	Scientific Name#	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Santalaceae	*Thesium polygaloides*	Vulnerable	-	-	-	Range restricted (EOO 7183 km^2), known from seven locations. Favours swamps on coastal flats (Von Staden, 2016)	Probable – suitable habitat present.
Sapindaceae	*Atalaya natalensis*	Near Threatened	-	-	-	Known from 10-15 fragmented populations. Occurs in scarp forest on steep slopes or less shaded groves (Scott Shaw, *et al.*, 2006)	Unlikely – limited suitable habitat
Sapotaceae	*Sideroxylon inerme subsp. inerme*	Least Concern	-	Protected	-	Favours coastal woodland and forest (Coates Palgrave, 2002).	Probable – Suitable habitat present.
Zosteraceae	*Zostera capensis*	Least Concern	-	-	-	Occurs in intertidal zones of permanently open estuaries (Adams & van der Colff, 2016).	Unlikely – no suitable habitat present.
-	Sensitive species 191	Vulnerable	Protected	-	Specially Protected	Favours scarp and coastal forest, as well as Ngongoni and coastal grassland. The AOO of this species is estimated at 99.44 km^2.	Recorded (Coastal & Environmental Services, 2008)
-	Sensitive species 1083	Vulnerable	-	-	Specially Protected	Coastal river forests in loose rocky habitat, in partial shade.	Unlikely to Possible – limited habitat present.
-	Sensitive species 1185	Endangered	-	-	-	Species is known from 12 subpopulations, with a total population estimated at <2500 mature plants. Favours rocky cliffs, and steep earth embankments in forests below 600 m.	Unlikely – Limited suitable habitat present.
-	Sensitive species 649	Vulnerable	-	-	Specially Protected	Eight remaining subpopulations, with an EOO estimated at 6000 km^2. Occurs in coastal grassland between 10 and 200 m.	Possible – Suitable habitat present.

Family	Scientific Name[#]	National Red List	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
-	Sensitive species 89	Vulnerable	-	-	-	Occurs on steep slopes in evergreen forest, close to waterfalls and streams.	Probable – Suitable habitat present.
-	Sensitive species 1252	Vulnerable	-	-	Specially Protected	Widespread species in eastern South Africa. Occurs in *inter alia*, moist bushveld and coastal bush habitats.	Probable – Suitable habitat present.
-	Sensitive species 814	Vulnerable	-	-	Specially Protected	Favours coastal and riverine forest, where it occurs in damp places along watercourses.	Probable – Suitable habitat present.
-	Sensitive species 1221	Vulnerable	-	-	Specially Protected	Known from 10 locations with an AOO of <200 km^2. Occurs in marshy grassland areas below 600m.	Possible – suitable habitat present.

[#]The names of specific taxa that are regarded as being susceptible to overexploitation have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number', as per the species assessment guidelines (SANBI, 2020).

3.5.3. Declared Alien Invasive Species

Twenty-four flora species recorded in the study area during the field survey are listed as declared alien invasive species (AIS) under the NEMBA. These are listed, along with their common name and NEMBA category, in Table 5.

Figure 40 to Figure 43 shows photographs of select AIS taken in the study area. For an indication of AIS recorded in each habitat unit, refer to Appendix C.

Apart from *Eucalyptus grandis* which is actively grown in on-site timber plantations, declared AIS generally occurred at low densities in areas of natural habitat, and were mostly restricted to localised disturbed sites or areas of infrastructure. The notable exception being the small patches of natural habitat that are embedded within and adjacent to the sugarcane fields in the west of the study area.

At these locations, several AIS, including both woody and herbaceous species, are common and locally abundant. These include *Chromolaena odorata, Lantana camara, Melia azedarach, Parthenium hysterophorus, Ricinus communis, Solanum mauritianum, Verbena bonariensis* and *Xanthium strumarium.* These taxa are all highly invasive and capable of responding rapidly to disturbances.

Table 5: Declared alien invasive species recorded in the study area during the field visit.

Scientific Name	Common Name	NEMBA Category
Ageratum houstonianum	Invading Conyzoides	1b
Argemone mexicana	Mexican Poppy	1b
Caesalpinia decapetala	Mauritius Thorn	1b
Canna cf. indica	Indian Shot	1b
Catharanthus roseus	Madagascar Periwinkle	1b
Chromolaena odorata	Paraffin Weed	1b
Cirsium vulgare	Spear Thistle	1b
Eucalyptus species	Gum	1b or 3
Grevillea robusta	Australian Silky Oak	3
Lantana camara	Common Lantana	1b
Melia azedarach	Syringa	1b
Mirabilis jalapa	Four o'clock	1b
Parthenium hysterophorus	Famine Weed	1b
Passiflora edulis	Purple Granadilla	2
Passiflora suberosa	Devil's Pumpkin	1b
Pennisetum clandestinum	Kikuyu	1b
Pinus patula	Patula Pine	2
Psidium guajava	Guava	3
Ricinus communis	Castor-oil Plant	1b
Rivina humilis	Rivina	1b
Schinus terebinthifolius	Brazilian Pepper Tree	1b
Solanum mauritianum	Bugweed	1b
Verbena bonariensis	Wild Verbena	1b
Xanthium strumarium	Large Cocklebur	1b

Figure 40: Chromolaena odorata

Figure 41: Lantana camara

Figure 42: Ricinus communis

Figure 43: Solanum mauritianum

3.5.4. Flora of Medicinal Value

Fifteen flora species recorded during the field survey have medicinal/traditional value. These are listed in Table 6, along with their purported use, and include both indigenous and alien woody and herbaceous species.

Table 6: Flora species with medicinal value recorded in the study area during the field survey

Scientific Name	Medicinal use
Acokanthera oblongifolia	Dried leaves are used to treat headaches and snake bites
Albizia adianthifolia	The bark of this species is used to cleanse blood, and treat skin diseases. An infusion is also used to treat eye inflammation.
Bersama lucens	Used to relieve menstrual pain and to treat impotency and infertility.
Cassipourea gummiflua var. verticillata	The bark of this species is used for medicinal purposes including to treat sun burn and skin diseases.
*Catharanthus roseus**	Used as a remedy for diabetes and rheumatism
Centella asiatica	This species has been used to treat, *inter alia*, leprosy, wounds, caner, fever and syphilis.
Sensitive species 191	Used as an emetic to treat fits, flatulence, backaches and pains
Ekebergia capensis	Bark is used as an emetic and for the treatment of heartburn, and dysentery.

Scientific Name	Medicinal use
Harpephyllum caffrum	Bark decoctions are as blood purifiers and emetics.
*Psidium guajava**	Leaves are used as a remedy for diarrhoea and many other ailments, such as diabetes, fever and coughs.
Rauvolfia caffra	Bark is used to treat fever, insomnia and malaria,
*Ricinus communis**	Leaf infusions are used to treat stomach ache, wounds, sores and boils.
Scadoxus puniceus	Used to treat coughs and gastrointestinal afflictions.
Strychnos henningsii	Bark is mixed as a tonic and used to treat nausea and other stomach complaints
Syzygium cordatum subsp. cordatum	Used as a treatment for respiratory problems, tuberculosis, stomach issues and diarrhoea.
Trichilia emetica	Used to treat dysentery, kidney problems, indigestion and parasites.
Typha capensis	Rhizome decoction is used as a treatment for venereal disease, diarrhoeas, dysentery and to enhance male libido.
Source: Uses as described by Van Wyk *et al.* (2009).	
*denotes alien species.	

3.6. Mammal Assessment

3.6.1. Mammal Richness and Habitat Availability

Only three mammal species were recorded in the study area during the field survey, namely Vervet Monkey (*Chlorocebus pygerythrus*), Rusty-spotted Genet (*Genetta maculata*) and Slender Mongoose (*Herpestes sanguineus*) (Table 7). Vervet Monkey was the most frequently recorded species, and was observed at several locations throughout the study area. Slender Mongoose was documented based on one visual observation and one camera trap record. Rusty-spotted Genet was recorded on one camera trap – refer to Figure 44 and Figure 46. No small mammals were caught in the Sherman traps during the field survey.

The low mammal species richness recorded during the 2022 field survey is surprising considering the availability of suitable forest patches in the study area. In their study, Coastal & Environmental Services (2009) confirmed the presence of eleven mammal species in the study area (also listed in Table 7), while Golder (2011) documented 18 mammal species in the Fairbreeze MRA, which is located to the south-west of the study area. Moreover, according to the Virtual Museum's MammalMAP records, 28 terrestrial indigenous mammal species have previously been recorded in the 2831DD QDS (Fitzpatrick Institute of African Ornithology, 2022) - these, along with species that potentially occur in the study area based on a review of historic distribution ranges, are listed in Appendix E.

Although the majority of species listed by MammalMAP are small taxa, these data and those of Coastal & Environmental Services (2009) and Golder (2011) also indicate the presence of medium-sized taxa, such as the Bushbuck (*Tragelaphus scriptus*), Common Duiker (*Sylvicapra grimmia*) and Red Duiker (*Cephalophus natalensis*). It is noted that several of the MammalMAP records for the QDS are likely to originate from the nearby Umlalazi Nature Reserve, which is a formal protected area. This notwithstanding, considering the proximity of the reserve to the study area, these data highlight the potential importance of natural habitat patches within the study area as

corridors/stepping stone habitats for free-roaming mammals that are dispersing to- or from the reserve.

The low mammal richness recorded during the field survey is likely attributable to high-levels of subsistence hunting by members of local communities. Packs of hunting dogs were observed on several occasions throughout the study area, and hunting dogs were also photographed on camera traps at two separate locations (see Figure 47). Dog packs are particularly effective at hunting small- and medium-sized antelope, such as Common Duiker and Red Duiker and this may account for these taxa not being re-recorded during the 2022 field survey (subsistence hunting is discussed in more detail in Section 3.7.2.1 of this report).

Notwithstanding the perceived hunting pressures, it is noted that patches of natural vegetation in the study area do provide suitable habitat for a variety of mammal species that favour forest and/or grassland/wetland ecosystems, and that several mammal SCC may be present. These are discussed in more detail in Section 3.6.2.

Table 7: Mammals recorded in the study area during the 2022 field survey and based on Coastal & Environmental Services (2009) data.

Family	Scientific Name	Common Name	Field Record	
			Coastal & Environmental Services (2009)	2022 Field Survey
Bovidae	*Tragelaphus sylvaticus*	Southern Bushbuck	x	
Bovidae	*Cephalophus natalensis*	Natal Red Duiker	x	
Bovidae	*Sylvicapra grimmia*	Common Duiker	x	
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	x	x
Cercopithecidae	*Cercopithecus albogularis labiatus*	Samango Monkey	x	
Herpestidae	*Herpestes sanguineus*	Slender Mongoose		x
Leporidae	*Lepus saxatilis*	Scrub Hare	x	
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Mouse	x	
Mustelidae	*Aonyx capensis*	Cape Clawless Otter	x	
Soricidae	*Mysorex sclateri*	Sclater's Forest Shrew	x	
Vespertilionidae	*Neormicia nana*	Banana Bat	x	
Viverridae	*Genetta maculata*	Rusty-spotted Genet		x
-	-	Sensitive Species 8	x	

Figure 44: Vervet Monkey (Chlorocebus pygerythrus)

Figure 45: Rusty-spotted Genet (Genetta maculata)

Figure 46: Slender Mongoose (Herpestes sanguineus)

Figure 47: Domestic hunting dog, photographed in the study area.

3.6.2. Mammals of Conservation Concern

At least 19 mammal SCC listed at a national level have historic distribution ranges that overlap with the study area, and therefore are potentially present. These are listed in Table 8, along with their national conservation statuses, habitat preferences, and a 'probability of occurrence' - based on habitat suitability assessments and existing records. The provincial conservation status of nationally listed SCC that are registered in Table 8 is also provided.

The SCC listed in Table 8 include:

- Eighteen taxa that are considered threatened or Near Threatened on the South African Red List of Threatened Mammal Species (Child *et al*., 2016);
- Ten species that are listed on the NEMBA ToPS List (2007); and
- Six species that are listed at a national level, are also listed as either 'protected' or 'specially protected' at a provincial level, according to the Natal Nature Conservation Ordinance (No. 15 of 1974).

Five mammal species previously recorded in the study area by Coastal & Environmental Services (2009) are SCC, namely the Natal Red Duiker (*Cephalophus natalensis*), Sensitive species 8, Cape Clawless Otter (*Aonyx capensis*), Samango Monkey (*Cercopithecus albogularis erythrarchus*) and Sclater's Forest Shrew (*Mysorex sclateri*). Despite the time that has elapsed since the Coastal &

Environmental Services (2009) study, as a precaution these taxa are still considered possibly/probably present, although it is considered likely that their numbers have declined considerably in the study area due to primarily subsistence hunting, and possibly other anthropogenic activities/disturbances such as forest clearing. The environmental sensitivity screening report for the proposed Project highlights both Sensitive Species 8 and Samango Monkey, as well as the Southern Tree Hyrax (*Dendrohyrax arboreus*).

The six SCC that were recorded by Coastal & Environmental Services (2009) and/or listed by the environmental sensitivity screening report are discussed in more detail below:

3.6.2.1.Natal Red Duiker

Natal Red Duiker (Near Threatened) favours indigenous forest and thicket, including both coastal- and swamp forest (Ehlers-Smith, *et al*., 2016). This species has a widespread but disjunct distribution as a result of habitat loss, with an Area of Occupancy (AOO) estimated at 1 800 km^2. In small forest patches, Natal Red Duiker attain densities of 0.5-0.4 animals per hectare. Ehlers-Smith, *et al*., (2016) indicates that Natal Red Duiker is threatened by poaching. This species was recorded in the study area by Coastal & Environmental Services (2009), but it was not re-recorded during the 2022 field survey. Suitable habitat remains available in the study area, with the network of forest habitat to the south of the N2 Highway likely to be particularly important to this species. But subsistence hunting pressure may have caused local population declines.

3.6.2.2.Cape Clawless Otter

Cape Clawless Otter (Near Threatened) is an aquatic species, that is seldom found far from permanent water and riparian habitats (Okes, *et al*., 2016). This species can occur in marine environments, but access to freshwater is an important habitat requirement for both drinking and rinsing their fur (Okes, *et al*., 2016). Density estimates of this species vary, from one otter per 3-4 km of river to 1.5 otter per 1 km of river. This species is targeted by hunters for traditional medicine, bushmeat and for their pelt for clothes (Okes *et al*., 2016). Cape Clawless Otter was not recorded in the study area during the 2022 field survey, but it was recorded by Coastal & Environmental Services (2009). Abundant suitable habitat remains available associated with the main river systems (e.g., Mlalazi River) and it is therefore probable that this species is still present.

3.6.2.3.Sclater's Forest Shrews

Sclater's Forest Shrews (Vulnerable) occur near water in coastal and swamp forest, where they favour moist grassland and wetland habitats, but cannot exist in degraded or transformed habitat. The Extent of Occurrence (EOO) of Sclater's Forest Shrew is 15 972 km^2, but its estimated AOO is only 697 km^2 (Taylor *et al*., 2016). No data are available of population size. Habitat loss is the primary threat to this species (Taylor *et al*., 2016). Sclater's Forest Shrew was recorded in the study area by Coastal & Environmental Services (2009), but it was not re-recorded during the 2022 field survey. Suitable habitat nonetheless remains available in the study area and it is therefore probable that this species is still present.

3.6.2.4.Sensitive Species 8

Sensitive Species 8 (Vulnerable) is a medium-sized, rare and secretive mammal taxon. It is territorial and lives in small family groups in forests, thickets and dense bush along the coast, but is also known to occupy modified habitats (Venter *et al*., 2016). The AOO is calculated at between 2 858 and 1 415 km^2. The densities of this species along the KwaZulu-Natal coast range from 11 to 24 individuals per

km^2 (Venter *et al*., 2016). This species is subject to extensive bush-meat hunting throughout its range, which is causing localised extinctions (Venter *et al*., 2016). Sensitive Species 8 was recorded in the study area by Coastal & Environmental Services (2009), but it was not re-recorded during the 2022 field survey. Suitable habitat is present in the study area, with the network of forest habitat to the south of the N2 Highway likely to be particularly important to this species. It is expected however, that Sensitive Species 8 is heavily targeted by subsistence hunters, which may have negatively impacted the local population.

3.6.2.5.Samango Monkey

Note: This discussion focuses on *Cercopithecus albogularis erythrarchus,* which is the Samango Monkey subspecies that occurs on the KwaZulu-Natal north coast. Samango Monkey (Near Threatened) is a small primate, that is restricted to forest habitats. It is an arboreal species, favouring the canopy of evergreen forests (Linden *et al*., 2016). The AOO of this subspecies is estimated at 455 km^2 and its population size is calculated at between 91 065 and 12 294 individuals (Linden *et al*., 2016). Estimated population densities range from low (< 30 individuals/ km^2) in swamp forest to high (200 individuals/ km^2) in coastal forest (Linden *et al*., 2016). In the Cape Vidal region, Samango Monkey have homes ranges of 0.15 km^2 (Linden *et al*., 2016). Samango Monkey was recorded in the study area by Coastal & Environmental Services (2009), but it was not re-recorded during the 2022 field survey. This notwithstanding, suitable habitat remains available in the study area for Samango Monkey and it is possible that it is still present. It is noted however, that this species is heavily targeted for bushmeat and traditional medicine (Linden *et al*., 2016), and this may have negatively impacted the local population.

3.6.2.6.Southern Tree Hyrax

Southern Tree Hyrax (Endangered) is an arboreal, predominantly solitary species that is restricted to well-developed intact areas of forest, where it resides in tree cavities (Gaylard, *et al*., 2016). According to Gaylard and Kerley (2001), it is known to favour only a select number of tree species for denning, including *Searsia chirindensis, Apodytes dimidiata, Trichilia emetica* and *Teclea natalensis* which were recorded in the study area during the field survey. The AOO of the Southern Tree Hyrax is 5.80 km^2 (SANBI, 2020). This species is threatened by direct habitat loss, as well as alterations in forest structure resulting from selective logging and increased fire frequency and intensity (Gaylard, *et al*., 2016). It also considered a target of bush-meat hunting and traditional medicine (Gaylard, *et al*., 2016). Southern Tree Hyrax was not recorded in the study area during the 2022 field survey, nor was it previously recorded by Coastal & Environmental Services (2009). Suitable habitat is nonetheless available in the study area and it is possible that this species is present.

Table 8: Mammals species of conservation concern occurring and potentially occurring in the study area. Recorded species are shaded dark orange. Those species that were assessed to have a 'Possible' or 'Probable' presence in the study area (based on habitat suitability assessments) are shaded light orange and orange respectively. Those that were assessed 'Unlikely' to occur in the study area are not shaded.

Family	Species Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
Bovidae	*Cephalophus natalensis*	Natal Red Duiker	Near Threatened	-	Protected	Favours indigenous forest and thicket, including both coastal- and swamp forest (Ehlers-Smith, *et al*., 2016).	Recorded - Coastal & Environmental Services (2009), but current status uncertain due to likely high levels of subsistence hunting.
Bovidae	*Nesotragus moschatus zuluensis*	Suni	Endangered	Vulnerable	Protected	Found in closed-canopy woodland, dune forests and thickets. The AOO of the Suni is 29.91 km^2 (SANBI, 2020).	Possible – suitable habitat present, but likely subjected to high levels of subsistence hunting
Bovidae	*Redunca arundinum*	Southern Reedbuck	Least Concern	Protected	Protected	Favours open grassland areas in savanna, close to water.	Unlikely – suitable habitat present, but may be subject to subsistence hunting in study area.
Cercopithecidae	*Cercopithecus albogularis erythrarchus*	Samango Monkey	Near Threatened (Vulnerable)	-	Protected	Arboreal species, favouring the canopy of evergreen forests (Linden *et al*., 2016).	Recorded - Coastal & Environmental Services (2009).
Chrysochloridae	*Calcochloris obtusirostris*	Yellow Golden Mole	Near Threatened	-	-	Fossorial species, favouring alluvium and coastal sands in forest and woodland habitats.	Unlikely – species is largely restricted to far northern KZN and Mozambique.
Felidae	*Leptailurus serval*	Serval	Near Threatened	Protected	-	Favours grassland and savanna habitats, but can penetrate forest areas along rivers. Also found in agricultural landscapes (Child *et al*., 2016).	Probable – suitable habitat present, and previously recorded in the region.
Felidae	*Panthera pardus*	Leopard	Vulnerable	Vulnerable	Specially Protected	Range of habitats, but generally prefers woodland and grassed savanna. Also known to occur in coastal scrub.	Unlikely – limited suitable habitat present. Large predator that is sensitive to anthropogenic disturbance and persecution.
Macroscelididae	*Petrodromus tetradactylus*	Four-toed Sengi	Near Threatened	Endangered	-	Favours a range of habitats, including forest, dense woodland and thickets (Child *et al.,* 2016).	Possible – suitable habitat present, but this species has not been recorded in the

Family	Species Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
							region (see distribution map in Child *et al.,* 2016).
Muridae	*Dasymys incomptus*	African Marsh Rat	Near Threatened	-	-	Known from a variety of habitats, including forest, swampland and grassland but favour wetland habitats (Child *et al.,* 2016).	Possible – suitable habitat present.
Muridae	*Otomys auratus*	Vlei Rat	Near Threatened	-	-	Known from a range of habitats, including mesic grassland and wetlands where it favours dense vegetation close to water (Child *et al.,* 2016).	Possible – suitable habitat present.
Mustelidae	*Aonyx capensis*	Cape Clawless Otter	Near Threatened	Protected	-	Aquatic species, that is seldom found far from permanent water and riparian habitats (Okes, *et al.*, 2016).	Recorded - Coastal & Environmental Services (2009).
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	Protected	-	Favour a range of habitats including savanna and forests.	Probable – suitable habitat present.
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	Near Threatened	-	-	Documented in savanna and grassland habitats, but is expected to have a wide habitat tolerance including forests and pine plantations (Child *et al.,* 2016).	Probable – suitable habitat present.
Procaviidae	*Dendrohyrax arboreus*	Southern Tree Hyrax	Endangered	Vulnerable	-	Favours well-developed intact areas of forest (Gaylard and Kerley, 2001). The AOO of the Southern Tree Hyrax is 5.80 km^2 (SANBI, 2020)	Possible – suitable habitat present.
Sciuridae	*Paraxerus palliates subsp. ornatus*	Red Squirrel (Ngoye)	Vulnerable	Endangered	-	Found in moist evergreen forest, riverine forest and thicket (Child *et al.,* 2016).	Unlikely – suitable habitat present, but closest known subpopulation is restricted to Ngoye Forest.
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	Near Threatened	-	-	Habitats specialist with an estimated AOO of 0.72 km^2 (SANBI, 2020). Favours riverine	Probable – suitable habitat present.

Family	Species Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Habitat Preferences	Probability of Occurrence
						and aquatic vegetation along riverbanks and in wetlands.	
Soricidae	*Myosorex sclateri*	Sclater's Forest Shrew	Vulnerable	-	-	Occurs near water in coastal and swamp forest. Also noted to occur in grassland and wetland habitats (Taylor *et al*., 2016). Has an estimated AOO of 0.75 km^2 (SANBI, 2020).	Recorded - Coastal & Environmental Services (2009).
Vespertilionidae	*Kerivoula argentata*	Damara Woolly Bat	Near Threatened	-	-	Known from evergreen and riverine forests, as well as mesic and dry woodland. Thought to favour riparian corridors.	Possible – suitable habitat present.
Vespertilionidae	*Scotoecus albofuscus*	Thomas' House Bat	Near Threatened	-	-	Low-lying humid savanna and dune forest along the coast.	Probable – suitable habitat present.
-	Sensitive Species 8	-	Vulnerable	Vulnerable	Protected	Occurs in range of forests, thickets and dense bush along the coast. They are also known to occupy modified habitats (Child *et al*., 2016), with a total AOO estimated at 41.74 km^2 (SANBI, 2020).	Recorded - Coastal & Environmental Services (2009), but current status uncertain due to likely high levels of subsistence hunting.
Source: Unless otherwise indicated, habitat preferences are as per the species accounts in Child *et al.,* (2016) or Stuart & Stuart (2007).							

3.7. Key Ecological Attributes and Processes

3.7.1. Habitat Corridors, Resources and Refugia

The study area is highly fragmented. Large portions have been transformed by anthropogenic activities – principally commercial forestry and sugarcane farming. Various forms of linear infrastructure, including roads (from major arterial roads to informal plantation access tracks), railway lines and powerlines servitudes have also exacerbated habitat fragmentation – see Figure 48. This modified habitat template is essentially mirrored across the broader landscape surrounding the study area, albeit with rural urban development replacing commercial forestry as a co-dominant landcover form.

Natural habitat that is present in the study area typically takes the form of either linear patches of forest or grassland habitats that are associated with drainage features (or water-logged soils), or small isolated forest patches that are embedded within the larger modified habitat matrix, which is dominated by Timber Plantations.

Areas of natural habitat significantly increase landscape-scale habitat heterogeneity. They provide important resource and refuge habitat for terrestrial biodiversity and form a network of dispersal and movement corridors or stepping-stone habitats that promote broader-scale habitat connectivity. These attributes are likely to contribute to ecosystem processes and functioning across the landscape, which may play an important role in maintaining the biodiversity of adjacent natural areas and formal protected areas, such as Umlalazi Nature Reserve, which is located approximately 600 m to the south-west of the study area, and Richards Bay Game Reserve, located 8 km to the east of the study area.

Figure 48: Photograph showing the common land uses (agroforestry) and linear infrastructure (roads and railway lines) that fragment large portions of the study area.

3.7.2. Ecological Processes and Drivers of Change

The following notes summarise the key processes and drivers of change that are present in the landscape and their possible influence on the character of the terrestrial flora and mammal communities in study area.

3.7.2.1.Subsistence Hunting

Reviewed literature indicates that several small antelope species, such as Common Duiker and Red Duiker, potentially occur in the study area. Surprisingly however, despite the presence of suitable habitat, none were recorded during the field survey, nor was any evidence (e.g., tracks or scat) of their presence observed.

This, coupled with the frequent sighting of hunting dogs (see Figure 49), suggests that high-levels of subsistence hunting likely occur in the study area, and has probably had, and will continue to have, a negative impact on local mammal communities. Subsistence bushmeat hunting with the use of wire snares and hunting dogs by members of local communities is therefore regarded as an important influence and driver of change in the study area.

Figure 49: Hunting dog photographed on a camera trap in the study area.

3.7.2.2.Plant Over-Harvesting and Logging

Several flora species that have been recorded, or are known to occur, in the study area are harvested for their use as medicinal plants (refer to Table 6 in Section 3.5.4). If poorly regulated, this practice can lead to overharvesting, which can result in local extirpations of the targeted flora species.

Moreover, it is noted that selective logging of certain indigenous tree species alters forest structure/composition, which will affect habitat suitability for sensitive species, such as the South Tree Hyrax, which favours only specific tree species for denning (read Gaylard and Kerley, 2001). Plant harvesting and logging are therefore considered potentially important drivers of change in the study area, that are capable of impacting flora species composition and vegetation structure.

3.7.2.3.Fire and Livestock Grazing

Fire is frequently used in grassland and savanna ecosystems as a management tool to, *inter alia*, remove moribund vegetation and enhance grass production and palatability for grazing livestock and as a means to control bush encroachment.

Evidence of frequent anthropogenic burning, probably to enhance the grazing resource, was noted in the Grassland with Trees and Bush-clumps habitat unit. Indeed, it is likely that portions of this unit are prevented from succeeding into a more climax woodland/forest-type community by the regular application of fire. Herds of cattle were also frequently observed grazing in the study area during the field survey (Figure 50), and their grazing pressure is also likely to retain many grassed areas in a short, lawn-like form.

Fire (vegetation burning), coupled with attendant livestock grazing, are therefore considered important ecological processes and drivers of change in the study area.

Figure 50: Cattle grazing was observed to be a common and widespread land use in the study area.

3.7.2.4.Alien Invasive Species Colonisation

Several NEMBA listed AIS were recorded in the study area. These include aggressive colonisers that are capable of rapidly spreading into undisturbed areas of natural forest habitat. If not actively controlled, these taxa are capable of outcompeting and replacing indigenous vegetation. The fast-growing and aggressive climbers *Chromolaena odorata* and *Lantana camara* are particularly problematic in forest ecosystems, where unlike other invasive taxa, that are adept at assailing and smothering woody vegetation.

This can have several negative consequences on the integrity and functioning of natural habitats, which may have severe negative consequences for both local flora and fauna diversity. The spread of alien invasive vegetation is therefore considered a significant driver of change in the study area and surrounding landscape.

3.7.2.5.Commercial Forestry

Large portions of the study area are under commercial forestry (Timber Plantations). These areas are managed for the long-term production of timber, and are characterised by a monoculture of fast-growing alien trees. They are typically intensively managed over several years, with repeated cycles of planting and harvesting.

Forestry operations not only impact the immediate plantation footprints, but adjacent areas of natural habitat and associated biodiversity are often impacted through manifold direct- and indirect edge-effect disturbances caused by *inter alia* planting, tree maintenance and logging activities, as well as from the presence- and use of the extensive access road networks by vehicles and pedestrians. Ongoing commercial forestry is therefore considered a significant driver of change in the study area and surrounding landscape.

3.8. Analysis of Site Ecological Importance

Table 9 provides comment on the site ecological importance (SEI) of habitat units, that were used to guide the rating of habitat patches in the study area, as per the SANBI (2020) protocol (refer to Section 2.2.7 and Appendix B).

Figure 51 presents a corresponding map of the SEI of habitat units. According to EKZNW (2013), for activities that are likely to result long-term severe impacts, a forest buffer of 200 m is recommended and is shown in Figure 51 around forest patches with a 'Very High' SEI. A reduced buffer of ˜100 m can be considered around forest patches with a 'High' SEI (also shown in Figure 51).

Table 9: Rating of Site Ecological importance for each habitat unit.

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Timber Plantations	VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	VERY LOW: Several major current negative ecological impacts.	VERY LOW	VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality.	VERY LOW
Sugarcane Fields	VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	VERY LOW: Several major current negative ecological impacts.	VERY LOW	VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality.	VERY LOW
Swamp Forest	VERY HIGH: Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species (=*Cassipourea gummiflua* var. *verticillata, Raphia australis* & Sensitive species 191). Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN	VERY HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type, High / good habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. Mostly minor current negative ecological impacts.	VERY HIGH	VERY LOW: Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed	VERY HIGH

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Swamp Forest (regenerating patches)	ecosystem type (=*Ficus trichopoda* Swamp Forest, CR).	MEDIUM: Some small patches affected by major impacts (e.g., vegetation clearing, established population of alien invasive flora).	HIGH	MEDIUM: Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality	HIGH
Coastal Lowland Forest	VERY HIGH: Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species (=*Cassipourea gummiflua* var. *verticillata, Raphia australis* & Sensitive species 191). Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type (=Southern Mesic Coastal Lowland Forest, CR & Maputaland Moist Coastal Forest, EN).	VERY HIGH/HIGH: Very large (>100 ha)/Large (>5 ha but <100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type. BUT Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts.	VERY HIGH	VERY LOW: Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.	VERY HIGH
Coastal Lowland Forest (small and/or regenerating patches)	HIGH: Confirmed or highly likely occurrence of CR, EN, VU species. Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN	MEDIUM: Some small patches affected by major impacts (e.g., vegetation clearing, established population of alien invasive flora).	MEDIUM	LOW: Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50%	HIGH

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
	ecosystem type (=Maputaland Coastal Belt, EN)			of the original species composition and functionality of the receptor functionality.	
Riparian Woodland	HIGH: Confirmed or highly likely occurrence of CR, EN, VU species. Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type (=Maputaland Coastal Belt, EN)	MEDIUM: (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type. Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches; Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential	MEDIUM	LOW: Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50% of the original species composition and functionality of the receptor functionality.	HIGH
Grassland with Trees and Bush-clumps (regenerating)	LOW: No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species; and <50% of receptor contains natural habitat with limited potential to support SCC	LOW: Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. and	LOW	MEDIUM: Habitat that can recover slowly (~ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality	LOW

Habitat Unit	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
		Several minor and major current negative ecological impacts.			
Grassland with Trees and Bush-clumps (undisturbed)	HIGH: Confirmed or highly likely occurrence of CR, EN, VU species. Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type (=Maputaland Coastal Belt, EN)	MEDIUM: Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types. Good habitat connectivity with potentially functional ecological corridors. and Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential	MEDIUM	LOW: Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality	HIGH

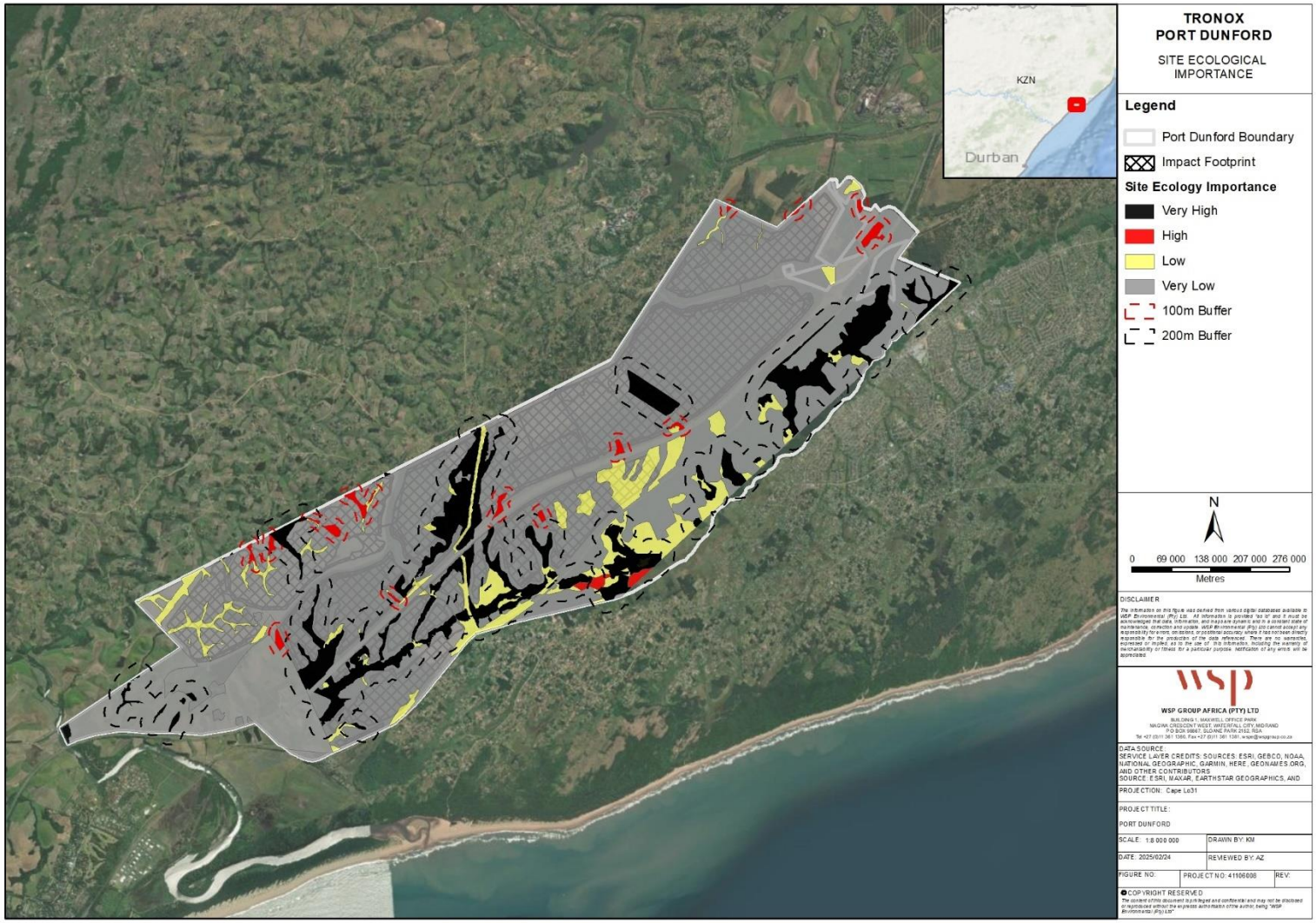

Figure 51: Site Ecological Importance of habitat units in the study area. Forest patches are shown with a 200 m buffer, as prescribed by EKZNW (2013) for activities that cause long term severe impacts.

4. Impact Assessment – Flora and Mammals

4.1. Impact Methodology

A methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014, as amended (GN No. 326) (the "EIA Regulations") was used to assess identified impacts on terrestrial biodiversity, specifically flora and mammals.

As required by the EIA Regulations (2014) as amended, the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact;
- Significance of the Impact;
- Consequence of the Impact;
- Extent of the Impact;
- Duration of the Impact;
- Probability if the Impact;
- Degree to which the Impact:
    - can be reversed;
    - may cause irreplaceable loss of resources; and
    - can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering *inter alia* magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Impacts are assessed in terms of the following criteria:

a) The nature; a description of what causes the effect, what will be affected and how it will be affected.

Table 10: Nature or type of impact.

Nature of Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g., new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g., noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g., employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

b) The physical extent

Table 11: Physical extent rating of impact

Score	Description
1	The impact will be limited to the site;
2	The impact will be limited to the local area;
3	The impact will be limited to the region;
4	The impact will be national; or
5	The impact will be international;

c) The duration, wherein it is indicated whether the lifetime of the impact will be:

Table 12: Duration rating of impact

Score	Description
1	Of a very short duration (0 to 1 years)
2	Of a short duration (2 to 5 years)
3	Medium term (5–15 years)
4	Long term (> 15 years)
5	Permanent (this is considered permanent if the impact will be experienced post mine closure)

d) Reversibility: An impact is either reversible or irreversible. How long before impacts on receptors cease to be evident.

Table 13: Reversibility of impact

Score	Description
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

e) The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned.

Table 14: Magnitude rating of impact

Score	Description
0	Small and will have no effect on the environment
1	Minor and will not result in an impact on processes.
2	Low and will cause a slight impact on processes.
3	Moderate and will result in processes continuing but in a modified way.
4	High (processes are altered to the extent that they temporarily cease).
5	Very High and results in complete destruction of patterns and permanent cessation of processes.

f) The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

Table 15: Probability rating of impact

Score	Description
1	Very improbable (probably will not happen)
2	Improbable (some possibility, but low likelihood).
3	Probable (distinct possibility).
4	Highly probable (most likely).
5	Definite (impact will occur regardless of any prevention measures).

g) The significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;

- The status, which is described as either 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; and
- The degree to which the impact can be mitigated.

The significance is determined by combining the above criteria in the following formula:

$$\text{Significance} = (\text{Extent} + \text{Duration} + \text{Reversibility} + \text{Magnitude}) \times \text{Probability}$$

[S= (E+D+R+M) ×P]

Where the symbols are as follows:

Symbol	Criteria
S	Significance Weighting
E	Extent
D	Duration
M	Magnitude
P	Probability

The significance weightings for each potential impact are as follows:

Overall Score	Significance Rating (Negative)	Significance Rating (positive)	Description
< 30 points	Low	Low	Where this impact would not have a direct influence on the decision to develop in the area
31 - 60 points	Medium	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	High	High	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

As there are two phases of mining development, the assessment will be undertaken for the following stages of the proposed Project:

- Site Establishment / Construction
- Phase 1 Operations;
- Phase 2 Operations; and
- Decommissioning and Closure.

A discussion on assessed impacts for each stage of the proposed Project is provided in the sections below, with a summary table presented in Table 22. The general character or nature of an identified impact is described in detail where it is first discussed in the text. Thereafter, only the relevance of the impact to the specific Project phase or activity is discussed.

4.2. Site Establishment / Construction

This section deals with site establishment and construction activities associated with Phase 1 and the development of the Primary Wet Plant (for Phase 2). Rating of identified impacts for this phase are presented in Table 16.

4.2.1. Direct Loss and Disturbance of Natural Habitat

Habitat loss and disturbance refers to the direct removal or degradation of natural habitat/vegetation. In terrestrial ecosystems, this primarily occurs through vegetation clearing and bulk earth works during site establishment and construction. The immediate impact is the removal of vegetation within the development footprints. If remaining habitat patches are insufficient in size and heterogeneity to sustain ecological processes, a breakdown of ecosystem integrity and functioning at broader ecological scales can occur, leading to further losses of biodiversity.

Proposed site establishment/construction Phase 1 activities will include vegetation clearing and earth works within the development footprints for, *inter alia*, the mine footprint, ROM stockpile, built infrastructure (e.g., offices and ablutions), internal haul roads, and to widen the existing gravel access roads.

- **Mining Footprint:** The Phase 1 mining footprint is relatively small, and covers Timber Plantations. Accordingly, no natural habitat will be directly impacted by the Phase 1 mining footprint.
- **Mine Infrastructure**:
    - **Built Infrastructure**: The Phase 1 built infrastructure will include *inter alia*, offices, ablutions, parking bays, workshop and laydown areas, fuel and lubricant storage facilities, ROM stockpiles and waste facilities. The development footprint for these is relatively small (approx. 8.2 ha), and located on land that comprises Timber Plantations; and
    - **Linear Infrastructure:** Proposed linear infrastructure includes access- and haul roads. The haul road will access the site through Timber Plantation, while it is proposed that the access road will utilise an existing road, which may need to be widened, which may impact patches of Lowland Coastal Forest. There is scope however, to ensure that any widening of the existing road impacts areas of Timber Plantation, rather than Lowland Coastal Forest (shown in Figure 52).

Habitat loss and disturbance associated with Phase 1 site establishment/construction activities is rated “low” (Score 22) significance before mitigation. After mitigation, which includes *inter alia*, restricting new disturbances to areas of Timber Plantation, and clearing only the minimum area required for Project purposes, results in an impact of “Low” significance (Score 10).

Figure 52: Any widening of the access road to the Phase 1 site should be sited in the Timber Plantations as indicated by the red line, and not areas of forest on the opposite side of the existing road.

Proposed Phase 2 site establishment/construction activities will include vegetation clearing and earth works within the planned footprint of the Primary Wet Plant (PWP). It is noted however, that the entire PWP footprint (approx. 42 ha) is characterised by Timber Plantations – see Figure 53. This is a modified habitat unit, and the associated site establishment / construction activities are not considered a major concern with respects to direct natural habitat loss and disturbance. This impact was therefore not considered further.

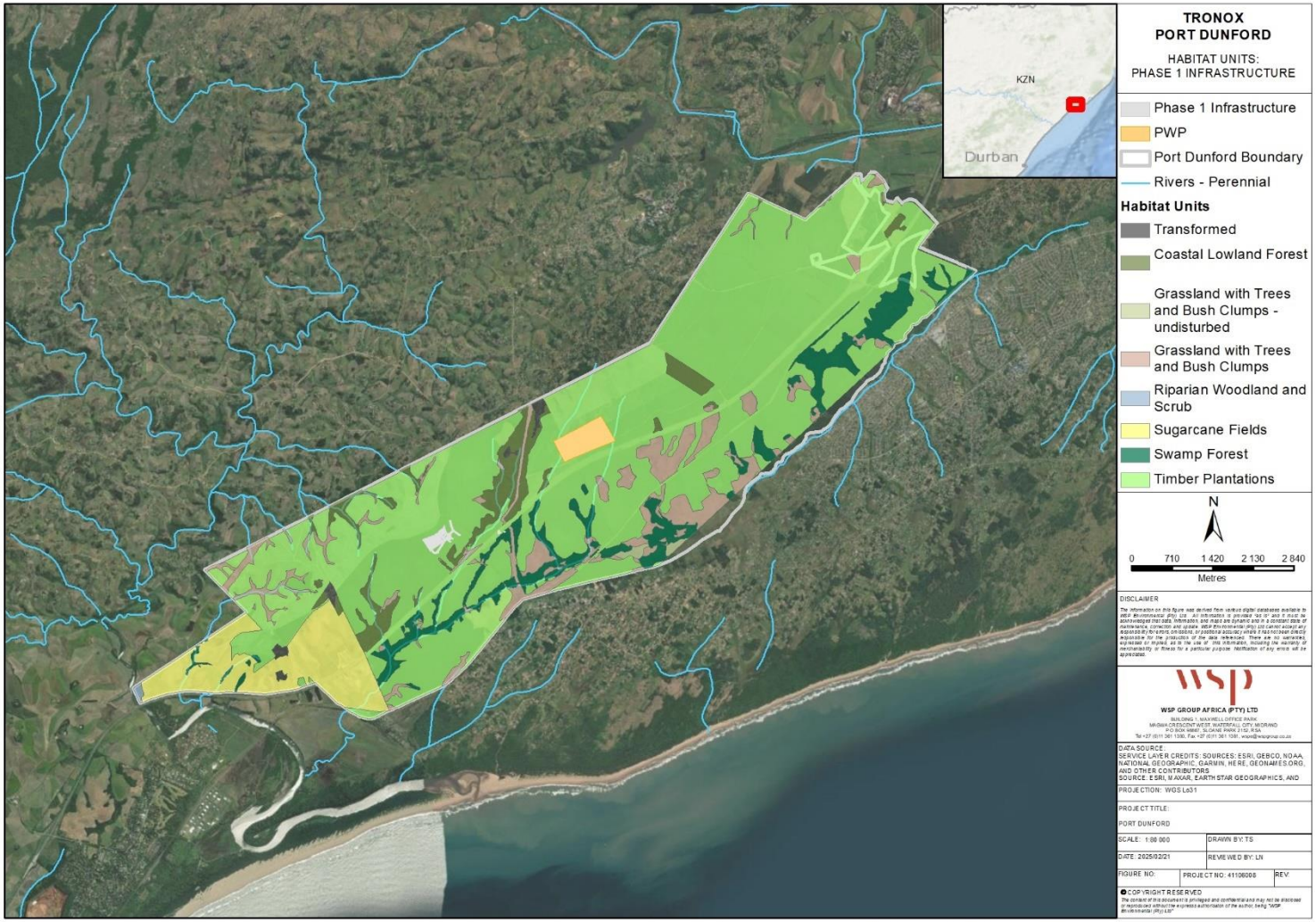

Figure 53: Site establishment and construction footprints for proposed Phase 1 and PMP Project components.

4.2.2. Fragmentation of Natural Habitat

Habitat fragmentation occurs when habitat loss results in the breakup of natural habitat into smaller, discontinuous and often isolated habitat patches. It can also occur when new linear infrastructure (e.g., fences and roads) is constructed that act as a physical barrier across the landscape. Habitat fragmentation and the impeding of ecological corridors can negatively impact various important landscape-scale ecosystem processes, such *as inter alia*, mammal breeding- and natal dispersal, and flora pollination and propagule (seed) dispersal.

The proposed development footprint for Phase 1 and most of the surrounding land are characterised by Timber Plantations, which, compared to built-infrastructure, is a more permeable land cover matrix for certain ecological processes (fauna movement/dispersal for example). Activities conducted during this phase, such as the development of haul roads and construction of built infrastructure, may have some fragmentation effects at a local-scale. Before mitigation, the impact was assessed as "Low" (Score 24). By widening haul roads into existing timber plantations thereby avoiding natural habitats, amongst other measures, the impact was further reduced to "Low" (Score 11).

The proposed PWP footprint and surrounding land are similarly characterised by Timber Plantations. Site establishment/construction activities for the PWP may therefore have similar fragmentation effects at a local-scale as those discussed for Phase 1 activities. Before mitigation, impact significance is rated “Medium” (Score 24). With the application of mitigation measures impact significance can be reduced to “Low” (Score 11).

4.2.3. Establishment and Spread of Alien Invasive Species

Habitat disturbances caused by vegetation clearing and earth works during site establishment/construction is likely to facilitate the establishment and spread of AIS. Once established, AIS can spread, suppress and replace indigenous vegetation. This may compromise ecosystem integrity resulting in a loss of biodiversity. Twenty-four NEMBA listed AIS were recorded in the study area, including *inter alia*; *Chromolaena odorata* and *Lantana camara,* which are potentially highly problematic species in forest habitats*.* Vegetation clearing and earth works during Phase 2 site establishment/construction may therefore facilitate the establishment and spread of AIS.

For Phase 1 site establishment and construction activities, this impact, which is rated “medium” significance (Score 48) before mitigation, but can be effectively mitigated through concurrent AIS control. With correct, proactive management, the after-mitigation significance of AIS establishment and spread is rated of ‘low” significance (Score 18).

For the PWP site establishment and construction activities, before mitigation, AIS colonisation is rated an impact of “Low” significance (Score 26) significance. This impact can be further managed through the development and implementation of an AIS Control and Eradication Plan for the study area. With a plan in place and actively implemented, the after-mitigation impact significance is “Low” (Score 10).

4.2.4. Sedimentation of Drainage Features

The stripping of vegetation, coupled with earth works, may lead to the mobilisation and transportation of sand/soil into nearby drainage features in the study area. High levels of

sedimentation could have a smothering effect and impact the integrity and functioning of downstream riparian habitat (e.g., Swamp Forest).

Phase 1 site establishment and construction activities may cause increased soil erosion, which may cause additional sedimentation in the two small drainage lines located approximately 200 m to the south of the development footprints, as well as riparian habitat to the south of the N2 Highway. Correct soil- and storm-water management, amongst other measures, can effectively reduce the potential for erosion and the transportation of sediment into drainage features. This impact is rated "Low" (Score 20) before mitigation and "Low" (Score 8) after mitigation.

During PWP Site Establishment / Construction, increased sedimentation may occur in the small drainage lines that traverse through the proposed PWP footprint, where they may be conveyed to riparian habitat located approximately 1 km south of the PWP footprint. This impact is rated an impact of "Low" significance (Score 20) significance before mitigation. Correct soil- and storm-water management, amongst other management measures during this phase can effectively mitigate this impact, resulting in a "Low" (Score 8) significance after mitigation.

4.2.5. Loss of Flora Species of Conservation Concern

The proposed Phase 1 development footprints are mostly characterised by Timber Plantations. Proposed linear infrastructure may impact patches of natural habitat, which may impact flora SCC that occur within, or adjacent to the development footprints. There is however, scope to avoid impacting natural habitat (discussed under Phase 1: Direct habitat loss and disturbance), which along with other management measures can act as effective mitigation. Before mitigation, impact significance is rated "Medium" (Score 34). With the application of mitigation measures impact significance can be reduced to "Low" (Score 17).

The proposed PWP footprint and surrounding land are characterised by Timber Plantations. No natural habitat is present, and the probability that flora SCC occur within, or adjacent to the development footprint, is negligible. This impact was therefore not considered further for the PWP Site Establishment / Construction.

4.2.6. Loss of Mammal Species of Conservation Concern

Both the proposed Phase 1 footprints and the PWP footprint (and most surrounding land) are characterised by commercial Timber Plantations, with little- to no natural habitat is present. The probability that mammal SCC occur within or adjacent to the main development footprint is considered low. This notwithstanding, it is possible that across the broader study area, mammal SCC may be killed, injured and/or disturbed by, *inter alia,* vehicle/machinery collisions, hunting/snaring in adjacent natural habitat by mine workers, and increased sensory disturbances from dust or noise generation.

Several management measures can be implemented to effectively mitigate this impact including *inter alia;* active on-site supervision by a trained environmental control officer (ECO), enforcement of on-site speed limits, active dust and noise suppression, species-specific management plans, and through the education and enforcement of rules with respects to the workforce and potential human-wildlife interactions.

With effective mitigation during Phase 1 site establishment and construction activities, the killing, injuring and disturbance of mammals can be reduced from an impact of “Medium” (Score 34) to one of “Low” significance (Score 17).

Similarly, with effective mitigation during PWP site establishment and construction activities, the killing, injuring and disturbance of mammals can be reduced from an impact of “Medium” (Score 34) to one of “Low” significance (Score 17).

4.2.7. Loss of Ecosystem Services to Local Communities

The proposed Phase 1 development footprints and most surrounding land are characterised by commercial Timber Plantations. No natural habitat is present, and it is considered unlikely that the site renders any direct ecosystem goods and services to local communities. This impact was therefore not considered further for the Phase 1 site establishment and construction activities.

The proposed PWP footprint and surrounding land are also characterised by commercial Timber Plantations, with no natural habitat is present. This impact was therefore not considered further for the PWP Site Establishment / Construction activities.

Table 16: Rating of identified impacts for Site Establishment /Construction

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
PWP: Vegetation clearing and earth works	Fragmentation of natural habitat	Terrestrial Flora and Mammals	PWP - Site Establishment / Construction	2	5	2	2	3	24	Low	2	4	2	1	3	11	Low
PWP: Vegetation clearing and earth works	Establishment and spread of alien invasive species	Flora/ Habitat	PWP - Site Establishment / Construction	3	5	2	2	3	26	Low	2	4	1	1	3	10	Low
PWP: Vegetation clearing and earth works	Sedimentation of drainage features	Flora/ Habitat	PWP - Site Establishment / Construction	3	2	2	2	3	20	Low	2	1	2	1	3	8	Low
PWP: Vehicle/machinery collisions, Hunting/snaring by construction workers, Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Mammal SCC	PWP - Site Establishment / Construction	5	5	2	2	5	34	Moderate	5	5	2	1	5	17	Low
Phase 1: Vegetation clearing and earth works	Direct loss and disturbance of natural habitat (no buffer around infrastructure)	Flora/ Habitat	Phase 1 - Site Establishment / Construction	2	4	2	2	3	22	Low	2	4	1	1	3	10	Low
Phase 1: Vegetation clearing and earth works	Direct loss and disturbance of natural habitat (with buffer around infrastructure)	Flora/ Habitat	Phase 1 - Site Establishment / Construction	1	4	2	2	3	20	Low	1	4	1	1	3	9	Low
Phase 1: Vegetation clearing and earth works	Fragmentation of natural habitat	Terrestrial Flora and Mammals	Phase 1 - Site Establishment / Construction	2	5	2	2	3	24	Low	2	4	2	1	3	11	Low
Phase 1: Vegetation clearing and earth works	Establishment and spread of alien invasive species	Flora/ Habitat	Phase 1 - Site Establishment / Construction	2	5	2	4	3	48	Moderate	1	4	1	2	3	18	Low
Phase 1: Vegetation clearing and earth works	Loss of flora species of conservation concern	Flora SCC	Phase 1 - Site Establishment / Construction	5	5	2	3	5	51	Moderate	3	4	1	2	3	22	Low
Phase 1: Vegetation clearing and earth works	Sedimentation of drainage features	Natural Habitat	Phase 1 - Site Establishment / Construction	3	2	2	2	3	20	Low	2	1	2	1	3	8	Low

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Phase 1 - Vehicle/machinery collisions, Hunting/snaring by construction workers, Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Mammal SCC	Phase 1 - Site Establishment / Construction	5	5	2	2	5	34	Moderate	5	5	2	1	5	17	Low

4.3. Phase 1 – Operations

Impact scoring for the Phase 1 Operations is presented in **Error! Reference source not found.** 17.

4.3.1. Establishment and Spread of Alien Invasive Species

On-site disturbances associated with Phase 1 operational activities are likely to facilitate the establishment and spread of AIS.

This impact, which is rated "Medium" significance (Score 52) before mitigation, but can be effectively mitigated through concurrent AIS control. With correct, proactive management, the after-mitigation significance of AIS establishment and spread is rated of "Low" significance (Score 27).

4.3.2. Sedimentation of Drainage Features

Mining activities during Phase 1 Operations may cause increased soil erosion and the sedimentation of drainage features to the south of the mining and infrastructure footprints and the N2 Highway. Correct soil- and storm-water management, amongst other measures, can effectively reduce the potential for erosion and the transportation of sediment into drainage features. This impact is rated "Low" (Score 30) before mitigation and "Low" (Score 7) after mitigation.

4.3.3. Loss of Mammal Species of Conservation Concern

The proposed Phase 1 Operational footprints and most surrounding land are characterised by commercial Timber Plantations, with little- to no natural habitat is present. The probability that mammal SCC occur within or adjacent to the main development footprint is considered low. This notwithstanding, it is possible that across the broader study area, mammal SCC may be killed, injured and/or disturbed by, *inter alia,* vehicle/machinery collisions, hunting/snaring in adjacent natural habitat by mine workers, and increased sensory disturbances from dust or noise generation.

As briefly outlined in Section 4.2.6, several management measures can be implemented to mitigate this impact from a "Medium" (Score 34) significance to one of "Low" significance (Score 17).

Table 17: Rating of identified impacts for Phase 1 Operations.

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Vegetation clearing and earth works	Establishment and spread of alien invasive species	Flora/ Habitat	Phase 1 - Operations	3	5	2	4	3	52	Moderate	1	4	1	3	3	27	Low
Vegetation clearing and earth works	Sedimentation of drainage features	Flora/ Habitat	Phase 1 - Operations	3	2	2	2	3	20	Low	1	1	2	1	3	7	Low
Vehicle/machinery collisions, Hunting/snaring by construction workers, Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Mammal SCC	Phase 1 - Operations	5	5	2	2	5	34	Moderate	5	5	2	1	5	17	Low

4.4. Phase 2 - Operations

Impact scoring for the Phase 2 Operations is presented in Table 21.

4.4.1. Direct Loss and Disturbance of Natural Habitat

Phase 2 operational activities will result in large-scale vegetation clearing and earth works across a large proportion of the study area. A general discussion on proposed mining and infrastructure is presented below and shown in Figure 54**Error! Reference source not found.**.

- **Mining Footprint**: A large proportion of the Phase 2 mining footprint (LOM) covers large areas of Timber Plantations. However, patches of natural habitat will be negatively impacted, including large patches of Coastal Lowland Forest in the east and centre of the study area, as well as smaller patches of natural habitat in the west of the study area. The impacted forest patches in the centre and west of the study area are designated CBA.

- **Mine Infrastructure**
    - **Residue Storage Facility (RSF)**: In the centre and east of the study area, the RSF will be located on land that has been transformed by the Phase 2 mining footprint. However, in the east of the study area, RSF will impact patches of natural habitat comprising Coastal Lowland Forest, and Grassland with Trees and Bushclumps;
    - **Sandtails**: Sand tails to the north of the N2 Highway will impact much of the land that is impacted by Phase 2 mining activities, including the large patch of Coastal Lowland Forest in the centre of the study area. In addition, a network of Grassland with Trees and Bushclumps in the west of the study area will be impacted. To the south of the N2 Highway, sand tails will potentially impact patches of Swamp Forest, as well as Grassland with Trees and Bushclumps;
    - **Primary Wet Plant (PWP) and the Pollution Control Dam (PCD)**: The PWP and the PCD are located in Timber Plantations to the north of the N2 Highway, and will not directly impact natural habitat;
    - **Top Soil Stockpiles**: The two small topsoil stockpiles located to the south of the N2 Highway are positioned in Timber Plantations, and will therefore directly impact areas of natural habitat. The topsoil stockpile located to the north of the N2 Highway will impact a portion of the large patch of Coastal Lowland Forest in the centre of the study area;
    - **Road Network**: Most of the proposed new haul roads are routed across Timber Plantations. However, these proposed roads do also traverse areas of natural habitat, including forest patches immediately north and south of the N2 Highway, along the northern boundary of the study area. To the south of the N2 Highway, there is also a proposed access road into the southern portion of the study area that is aligned with an existing gravel road. This existing road traverses through forest patches, and it is therefore possible that any further developments to this road, such as road widening, may disturb adjacent natural habitat;
    - **Powerline Servitudes and Water Pipelines:** Powerline servitudes and water pipelines have the potential to negatively impact patches of natural habitat through direct habitat loss and the attendant effects of habitat fragmentation.

The proposed development footprints cover large areas of Timber Plantations, as well as smaller patches of natural habitat. A summary of the approximate extent of direct habitat loss for each habitat unit presented in Table 18**Error! Reference source not found.**. In total, approximately 226.7 ha of natural habitat and 1783.9 ha of modified habitat will be impacted during this phase of the proposed Project. The loss and disturbance of Timber Plantations is not considered an impact of concern as this is a modified habitat type. However, the loss and disturbance of natural habitat is a concern.

Table 19 shows the approximate extent of loss of areas delineated at a provincial level as threatened vegetation subtypes. Corrected for habitat transformation, approximately 25.5 ha designated CBA under the KZN BSP (2016) will be impacted by proposed Project activities.

Table 18: Summary of the approximate extent of direct habitat loss during Phase 2 Operations.

Habitat Class	Habitat Units	Estimated Extent of Loss (ha) during Phase 2 Operations.
Natural Habitat	Swamp Forest	6.3
	Coastal Lowland Forest	113.6
	Riparian Woodland and Scrub	0.0
	Grassland with Tree and Bush-clumps	106.8
Modified Habitat	Timber Plantations	1774.8
	Sugarcane Fields	0.0
	Transformed Sites (e.g., residential areas, etc.)	9.1

Table 19: Approximate extent of provincial vegetation subtypes impacted by proposed Project infrastructure.

Provincial Vegetation Subtypes	Approx. extent in Study Area (ha)	Approx. extent impacted by infrastructure (ha)
Freshwater Wetlands: Subtropical Freshwater Wetlands (76_1)	61.55	10.56
Freshwater Wetlands: Subtropical Freshwater Wetlands: short grass/sedge wetland: dune slack (76_4)	12.68	0.19
Swamp Forest - *Ficus trichopoda* Swamp Forest (66_2)	226.24	4.11
KwaZulu-Natal Coastal Forest: Maputaland Moist Coastal Lowland Forest (62_4)	217.48	118.50
KwaZulu-Natal Coastal Forest: Southern Mesic Coastal Lowland Forest (62_5)	18.24	4.46
Alluvial Wetlands: Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands: Tall Reed Wetland (75_4)	12.82	2.16
Alluvial Wetlands: Subtropical Alluvial Vegetation (75_1)	31.81	20.61

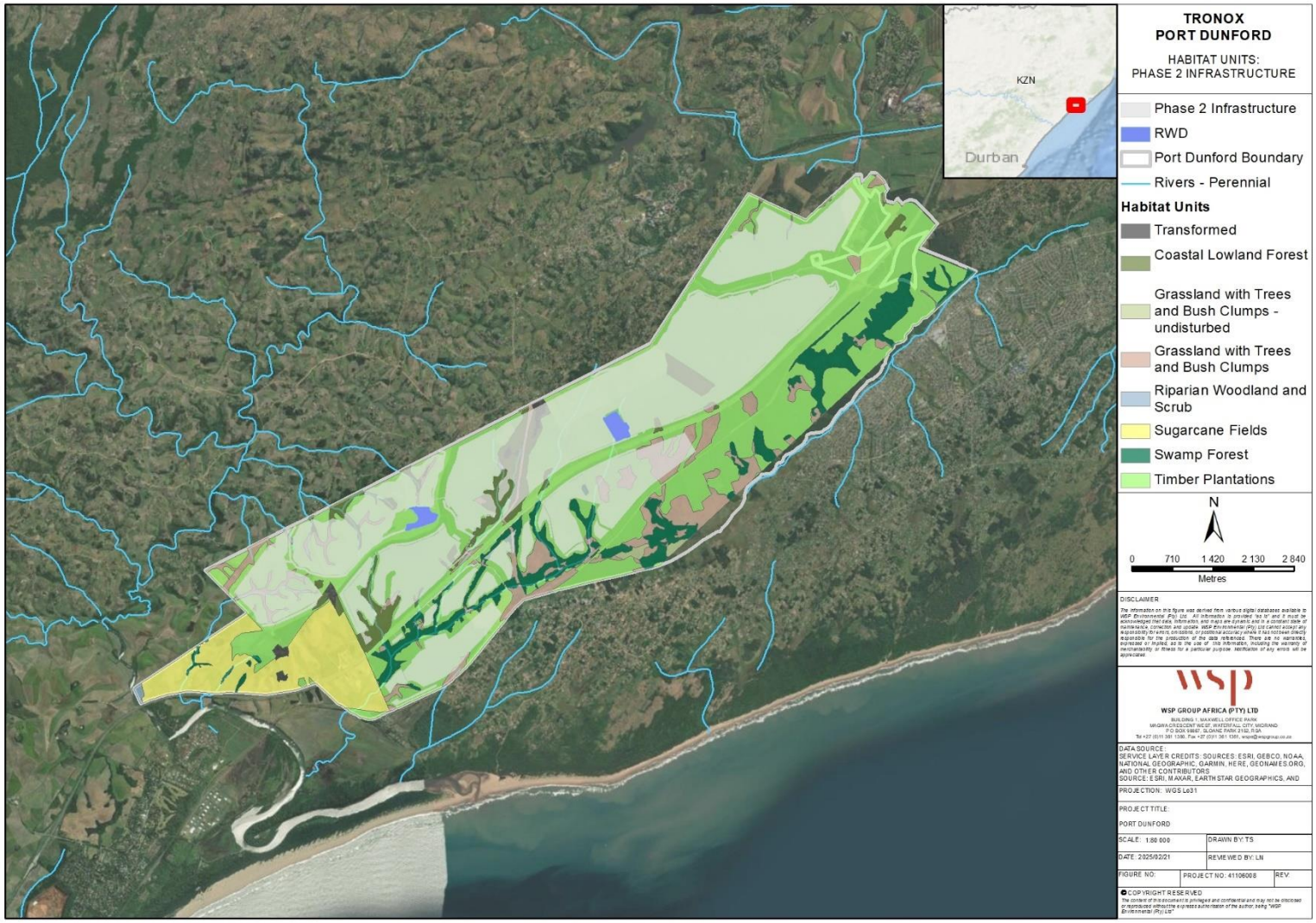

Figure 54: Phase 2 Operations mining and infrastructure overlay

For the purposes of this impact assessment, impact significance for the loss/disturbance of forest habitats and the Grassland with Trees and Bush-clumps habitat unit, are rated separately:

Swamp Forest & Coastal Lowland Forest: The loss and disturbance of indigenous forest patches in a landscape that is already highly transformed and fragmented is likely to negatively impact landscape-scale ecological functioning and the viability of local flora and mammal populations. This impact is rated separately for the main forest portions that fall within the proposed mining/infrastructure footprints and that will thus be directly cleared (lost), and those forest patches that are located adjacent to proposed mining/infrastructure footprints and that are thus may be indirectly disturbed.

Table 20 presents an inventory and impact significance scoring of the main forest portions and patches that will be cleared and/or potentially disturbed, during Phase 2 Operations. Historic aerial imagery from 1957, coupled with more recent available aerial imagery (2005 to present), was studied to track past impacts and disturbances to these forest portions. These were considered during the scoring od potential impacts. Refer to Figure 55 for a corresponding map of numbered forest portions/patches.

- Direct loss of forest portions within the mining/infrastructure footprints: The loss of the forest portions that are located within the mining/infrastructure footprints impact is rated "High" significance before mitigation, with scores ranging from 85 to 80 depending on the condition (SEI) of the affected portions. Without further amendments to the proposed mining and infrastructure layout, this impact is unavoidable and mitigation is difficult. For directly impacted forest portions that form part of larger forest patches, it is recommended that wherever feasible, a buffer is maintained around the remainder of the affected forest patch to limit additional indirect disturbances. A 200 m buffer is recommended around remaining forest patches with Very High SEI scores, while reduced buffer of ˜100 m can be considered around forest patches with High SEI scores. Other recommended mitigation includes minimizing the footprints cleared of vegetation to only what is absolutely necessary for operations and restoring all disturbed forest areas post-mining. Even with these mitigation efforts, the impact significance of the direct loss of forest habitat will remain "High" (score: 70) for forests with Very High SEI scores and "Medium" (score: 52) for forests with High SEI scores.
- Potential disturbances to main forest patches adjacent to the mining/infrastructure footprints: The disturbance of the main forest patches that are located outside, but adjacent to, mining/infrastructure footprints impact is rated "Medium" significance (Score: 39) before mitigation. As above, to reduce impact significance, a 200m buffer zone is recommended around forest patches with Very High SEI scores, and if required, a reduced buffer of ˜100 m can be considered around forest patches with High SEI scores. With these and other mitigation measures in place, the impact is expected to be "Low" (score: 18). If the recommended buffers cannot be implemented, but other mitigation measures are, the impact will be "Medium" (score: 33).;

Grassland with Trees and Bush-clumps: Several patches of this habitat unit, totalling about 106.8 ha, will be impacted by the establishment of proposed Project facilities. Large patches will be impacted by Sandtails in the south of the study area (between the railway line and the N2 highway),

while smaller patches will be impacted by RSF 9 in the north of the study area, and Sandtails in the west of the study area. Despite this, this habitat unit is fairly well-represented across the broader study area, with 265 ha remaining outside proposed Project footprints. The loss of this habitat unit is rated “Medium” significance (Score 60) before mitigation. With the implementation of various mitigation measures, including active rehabilitation, this impact can be reduced to an impact of “Low” significance (Score 24).

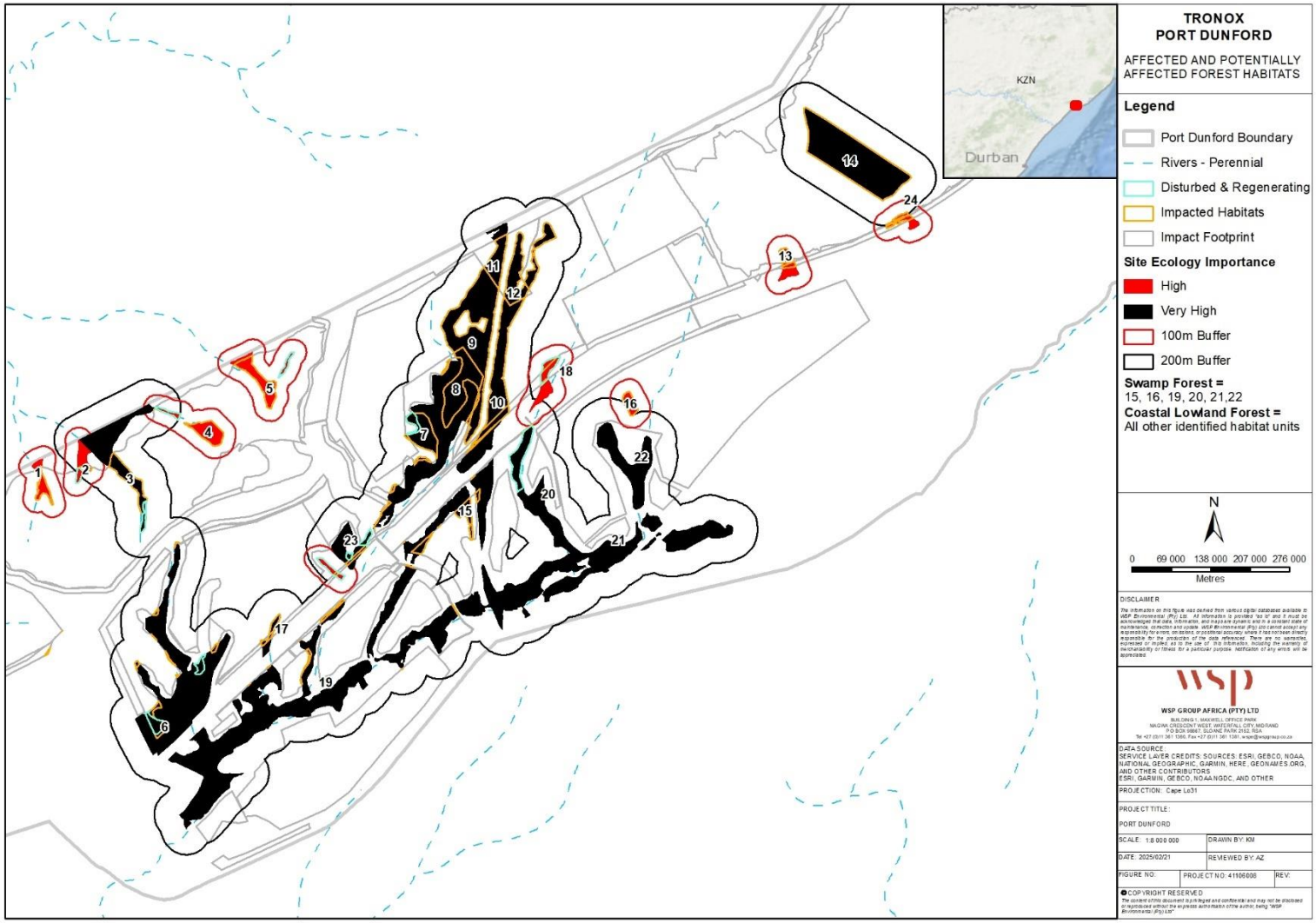

Figure 55: Map showing the numbered forest portions and patches that will, or are likely to be, directly affected by proposed Project activities.

Table 20: Summary of impacts on the main forest portions and patches that will be directly impacted by proposed Project mining and infrastructure during Phase 2 Operations.

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
Main forest portions that are located within proposed Project ming and infrastructure footprints and that will be directly impacted.									
Western Cluster	Portion 1	1.5	RSF 9	Alluvial Wetlands; Subtropical Alluvial Vegetation	-	Small, isolated portion of Coastal Lowland Forest that is regenerating following disturbance. Isolated and surrounded by commercial forestry (i.e., Timber Plantations), except in the north, where it is bordered by rural community farmland. Aerial imagery from 1957 indicates this portion was under commercial forestry. Imagery from 2005 indicates that, at this time, this portion comprised regenerating forest vegetation.	High	High	Medium
	Portion 2	0.87	RSF 9	Southern Mesic Coastal Lowland Forest	-	Small portion of Coastal Lowland Forest, that forms part of a larger forest patch. Most of the larger forest patch to the north of this portion is mapped as CBA Irreplaceable. Imagery from 1957 indicates that this portion was previously disturbed by commercial forestry. More recent imagery from 2005 onwards, indicates that this portion comprised regenerating forest vegetation.	High	High	Medium
	Portion 3	4.4	RSF 9	Southern Mesic Coastal Lowland Forest	CBA Irreplaceable (˜ 2.15 ha)	Linear portion of Coastal Lowland Forest, that forms part of a larger forest patch. Most of the larger forest patch is mapped as CBA Irreplaceable. Imagery from 1957 indicates that at this time, this portion was not disturbed by commercial forestry. Imagery from 2005 onwards indicates that some disturbances had occurred in the south of this portion, and with vegetation thereafter regenerating.	Very High	High	High
	Portion 4	3.92	RSF 9	Maputaland Coastal Belt	-	Small, linear and fragmented portion of Coastal Lowland. Isolated and surrounded by commercial forestry. Aerial imagery from 1957 suggests that this portion was disturbed and encroached by commercial forestry activities. Later aerial imagery (2005 to present) shows continued regeneration in the north of this forest portion.	High	High	Medium

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
	Portion 5	4.44	RSF 9	Maputaland Moist Coastal Lowland Forest	-	Small, linear and fragmented portion of Coastal Lowland Forest. Isolated and surrounded by commercial forestry, except in the north, where it is bordered by rural community farmland. Imagery from 1957 indicates the eastern branch of this forest portion was cleared of woody vegetation at this time, but the western branch of this forest portion was not disturbed. Imagery from 2005 to the present, indicates no additional disturbances to the western branch of this forest portion, and continued regeneration of the eastern branch.	High	High	Medium
	Portion 17	0.85	LOM Sand Tails Haul Roads	Maputaland Coastal Belt	-	Small, narrow and isolated portion of Coastal Lowland Forest. Surrounded by commercial forestry (i.e., Timber Plantations), except in the south where it borders on the N2 Highway. Aerial imagery indicates that this portion was impacted by commercial forestry in 1957, but later imagery indicating no additional disturbances.	Very high	High	Medium
Central Cluster	Portion 6	2.13	LOM	Maputaland Moist Coastal Lowland Forest	-	Small portion of a Coastal Lowland Forest, that forms part of a larger forest patch, and links to forest patches south of the N2 Highway. Aerial imagery from 1957 indicates that this portion and parts of the larger forest patch were disturbed by commercial forestry, amongst other activities. Imagery from 2013 indicates that most of this portion was disturbed at this time, and has since regenerated. The larger forest patch however, has remained undisturbed except for a small patch of disturbance.	Very High	High	Medium
	Portion 7	5.1	LOM	Maputaland Moist Coastal Lowland Forest	-	Small portion of Coastal Lowland Forest. Forms part of a larger forest patch that extends southward from the study area's northern boundary, linking to forest patches south of the N2 Highway. Most of the northern extent of this larger forest patch is mapped as CBA Irreplaceable. Aerial imagery from 1957 indicates this portion may have been disturbed by	Very High	High	High

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
						commercial forestry at this time. Imagery from 2005 onwards indicates that this forest portion has regenerated well, although there was additional disturbance associated with commercial forestry activities in the north-west corner of this portion in 2020. However, the remainder of this portions remains undisturbed.			
	Portion 8	8.56	LOM	Maputaland Moist Coastal Lowland Forest	-	Medium-sized Coastal Lowland Forest portion, that forms part of a larger forest patch that extends south from the study area's northern boundary, connecting with forest patches south of the N2 Highway. Minimal and localised disturbance is evident in this forest portion in aerial imagery from 1957. Imagery from 2005 onwards indicates that it has regenerated well, with no additional disturbances noted.	Very High	High	High
	Portion 9	21.57	LOM Sand tails	Maputaland Moist Coastal Lowland Forest	CBA Irreplaceable (~7.4 ha)	Large portion of Coastal Lowland Forest, and forms part of a larger forest patch that extends south from the study area's northern boundary, connecting with forest patches south of the N2 Highway. Land to the west comprises commercial forestry, while that to the east comprises the Eskom powerline servitude. Approximately 7.4 ha of this portion is designated CBA Irreplaceable. Aerial imagery from 1957 shows localised disturbance in the north and centre of this forest portion. However, imagery from 2005 to the present indicates that, outside of forestry residential dwellings, forest habitat has remained undisturbed.	Very High	High	High
	Portion 10	13.63	LOM Sand tails Haul Roads	Maputaland Moist Coastal Lowland Forest	CBA Irreplaceable (~1.43 ha)	Large, linear portion of Coastal Lowland Forest. The portion is bordered by commercial forestry to the east and the Eskom powerline servitude to the west. This forest portion is part of a larger, fragmented network that extends south from the study area's northern boundary, connecting with forest patches south of the N2 Highway. A 1.43 ha strip in the north of this forest portion is designated CBA Irreplaceable.	Very High	High	High

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
						Aerial imagery from 1957 shows minimal disturbance in the southern section of this portion, with localized disturbances in the north. By 2005, imagery suggests that the area, excluding residential and development locations, has remained undisturbed.			
	Portion 11	3.75	LOM Sand tails	Maputaland Moist Coastal Lowland Forest	CBA Irreplaceable (~3.3 ha)	Small patch of Coastal Lowland Forest, that forms part of a larger, albeit fragmented, network of forest habitat that extends from the northern boundary of the study area to south of the N2 Highway. Approximately 3.3 ha has of this particular forest portion is designated CBA Irreplaceable. Aerial imagery indicates that this forest portion was mostly cleared of vegetation in 1957. But, by 2005, imagery suggests that the portion, excluding residential and development locations, has remained undisturbed.	Very High	High	High
	Portion 12	4.49	Sand tails Topsoil Stockpile	Maputaland Moist Coastal Lowland Forest	-	Small, narrow portion of Coastal Lowland Forest, that also forms part of a larger, albeit fragmented, network of forest habitat that extends from the northern boundary of the study area to south of the N2 Highway. Approximately 3.9 ha has of this particular forest portion is designated CBA Irreplaceable. It is bordered to the west by the large Eskom powerline servitude and to the east by forestry residences. Aerial imagery from 1957 indicated that this forest portion was disturbed during this period, but later aerial imagery (2005 to present) indicates that this portion has regenerated well, and has remained undisturbed.	Very High	High	High
	Portion 18	1.5 ha	LOM Haul Road	Maputaland Coastal Belt	-	Small of Coastal Lowland Forest patch that is bordered to the south by the N2 highway and the remaining sides by commercial forestry. Aerial imagery from 1957 indicates that this portion was impacted commercial forestry. Later aerial imagery indicates that this portion was further disturbed and is regenerating.	High	High	Medium

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
	Portion 23	0.5	Haul Road	Maputaland Coastal Belt	-	Small, fragmented portion that is bordered to the south by the N2 highway and the remaining sides by commercial forestry. Aerial imagery from 1957 indicates that these areas were disturbed by commercial forestry. Imagery from 2005 indicates that western section of this forest portion, as well as small localised areas of the remainder of this portion were disturbed. These have subsequently regenerated, with the remainder showing not additional disturbance.	Very High	High	Medium
Eastern Cluster	Portion 13	0.97	LOM RSF C	Maputaland Moist Coastal Lowland Forest	-	Small portion of Coastal Lowland Forest. This patch is fairly isolated, and it is bordered to the north, east and west by commercial forestry, and to the south by the N2 Highway. Natural habitat is however, present adjacent to this portion to the south of the N2 Highway. Aerial imagery from 1957 suggests that this portion was not converted to commercial forestry at this time, and later aerial imagery (2005 to present) indicates that apart from a small localised site of disturbance immediately adjacent to the N2 Highway, the rest of the portion has remained undisturbed.	High	High	Medium
	Portion 14	26.48	LOM RSF C	Maputaland Moist Coastal Lowland Forest	-	Large, isolated Coastal Lowland Forest portion, bordered on all sides by commercial forestry. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957, but it was subject to localised disturbances. Aerial imagery (2005 to present) indicates that this portion has regenerated and has remained undisturbed.	Very High	High	High
	Portion 24	0.9	RSF Haul Road	Maputaland Moist Coastal Lowland Forest	-	Small, isolated portion of Coastal Lowland Forest. Surrounded by commercial forestry, except to the south, where the N2 Highway is located. In 1957 aerial imagery, this portion does not appear to be impacted by commercial forestry. More recent aerial imagery indicates that small areas of this portion have been	High	High	Medium

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
						disturbed by ongoing commercial forestry, and are regenerating.			
	Portion 15	>2.4	Sand Tails	*Ficus trichopoda* Swamp Forest	CBA Irreplaceable	Small portion of Swamp Forest, that forms part of a larger network of forest habitat (Patch 19) that is designated CBA Irreplaceable. This portion is bordered by the Eskom powerline servitude and commercial forestry. Aerial imagery from 1957 indicates this portion was likely under commercial forestry. More recent imagery shows signs of edge effects disturbances in the south and north-east. However, the remainder of this portion has remained undisturbed.	Very High	High	High
	Portion 16	1.4	Sand Tails	*Ficus trichopoda* Swamp Forest	-	Small, isolated portion of Swamp Forest. Bordered on all sides by commercial forestry. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957. However, later aerial imagery indicates that this small portion was disturbed by adjacent forestry activities and is regenerating.	High	High	Medium
Large main forest patches located adjacent to proposed Project infrastructure that will be indirectly (or directly) impacted.									
Southern Cluster	Patch 19	-	Adjacent to Sandtails, with small areas of direct Sandtails impacts	*Ficus trichopoda* Swamp Forest	CBA Irreplaceable	Large network of Swamp Forest habitat, that is associated with the Amanzamnyama River and is designated CBA Irreplaceable. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957. More recent aerial imagery indicates small, localised areas of disturbance. However, most of this forest patch remains undisturbed.	Very High	Medium	Low
	Patch 20	-	Adjacent to Sandtails.	*Ficus trichopoda* Swamp Forest	CBA Irreplaceable	Swamp Forest that forms part of a large network of Swamp Forest associated with the Amanzamnyama River Swamp Forest and is tributaries. Entire area is designated CBA Irreplaceable. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957. Later aerial imagery indicates that north and central areas of this portion	Very High	Medium	Low

Forest Cluster	Impacted Habitat Portion Ref.	Approx. Size (ha) of Directly Impacted Portion	Project Infra. Impacting Portion	Provincial Vegetation Type	Critical Biodiversity Areas	Description of Forest Portion	Portion Specific Condition (SEI)	Significance of Loss / Disturbance	
								Before Mitigation	After Mitigation
						were disturbed and are regenerating. Overall, however this forest remains undisturbed.			
	21	-	Adjacent to Sandtails.	*Ficus trichopoda* Swamp Forest	CBA Irreplaceable	Large area of Swamp Forest that forms part of a large network of Swamp Forest associated with the Amanzamnyama River Swamp Forest and is tributaries. Designated CBA Irreplaceable. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957. Later aerial imagery indicates that small, localised areas have been disturbed, but overall, this forest remains undisturbed.	Very High	Medium	Low
	22	-	Adjacent to Sandtails.	*Ficus trichopoda* Swamp Forest	CBA Irreplaceable	Swamp Forest that forms part of a large network of Swamp Forest associated with the Amanzamnyama River Swamp Forest and is tributaries. Designated CBA Irreplaceable. Aerial imagery from 1957 indicates that this patch was not under commercial forestry in 1957. Later aerial imagery indicates that the north-western branch of the patch was disturbed (possibly by fire), but overall, this forest has recovered well with no additional disturbances noted.	Very High	Medium	Low

4.4.2. Fragmentation of Natural Habitat

The study area and the surrounding landscape are currently highly fragmented. The loss of natural habitat patches through vegetation clearing and earth works, coupled with the development of mine infrastructure, will increase fragmentation and reduce overall landscape connectivity. This may negatively impact ecological processes within the study area and at a broader landscape-scale. Potential fragmentation effects caused by Phase 2 Operational activities are therefore a concern with respects to the proposed Project. It is noted that mining will occur in phases, with ongoing rehabilitation of mined areas taking place throughout the proposed Project's life cycle. This approach will aid in minimising the effects of habitat fragmentation. Furthermore, the proposed rehabilitation of RSF includes planting indigenous woody trees, that once established, may provide a suitable habitat matrix that contributes to general ecological connectivity across the landscape.

Before mitigation, impact significance is rated “High” (Score 70). Additional measures can be taken to reduce impact significance, including *inter alia*, retaining buffers around forest patches, managing habitat between infrastructure footprints, such as along the Amanzamnyama River, as ecological corridors, clearing only the minimum area of land required for Project purposes, and rehabilitating disturbances footprints. After mitigation impact significance is rated “Medium” (Score 48).

4.4.3. Establishment and Spread of Alien Invasive Species

Ongoing vegetation clearing and earth works during Phase 2 Operations will facilitate the establishment and spread of alien invasive species.

Before mitigation, this impact is rated of “Medium” significance (Score 56). This impact can however, be effectively managed through the continuing implementation of regular alien invasive species control, coupled with the active rehabilitation of disturbed areas. With these measures in place, the after-mitigation significance of alien invasive species establishment and spread is rated “Low” (Score 27).

4.4.4. Sedimentation of Drainage Features

Mining activities may cause increased soil erosion and the sedimentation of drainage features in the study area. High levels of sediment may result in smothering, which could negatively affect the integrity and functioning of downstream riparian habitats (e.g., Swamp Forest). Correct soil- and storm-water management amongst other measures, such as installing and regularly inspecting and maintaining storm water infrastructure, can effectively mitigate this impact, which is rated “Medium” (Score 52) before mitigation and “Low” (Score 20) after mitigation.

4.4.5. Habitat Disturbance from Breach of the Reside Storage Facilities

Breaches of the Residue Storage Facilities (RSF) is a low probability event, but one that may result in high levels of material being transported into drainage features, leading to sedimentation and smothering of habitat. This could negatively affect the integrity and functioning of downstream riparian habitats (e.g., Swamp Forest).

Apart from engineering designs, additional measures, such as regular inspections and maintenance, and long-term rehabilitation, can effectively mitigate this impact, which is rated “Medium” (Score 30) before mitigation and “Low” (Score 10) after mitigation

4.4.6. Loss of Flora Species of Conservation Concern

Several flora SCC occur, or potentially occur, in natural habitat patches in the study area. Vegetation clearing and earth works during construction may result in the direct loss of these taxa and potentially other flora SCC occurring within the proposed development footprints.

South of the N2 Highway, proposed Sandtail facilities encroach into areas of Swamp Forest, which may result in the clearing or disturbance of Red List species, such as *inter alia*, *Cassipourea gummiflua* var. *verticillata* and *Raphia* australis, and the nationally listed protected tree species *Ficus trichopoda* and *Barringtonia racemosa*. These species are generally common in Swamp Forest habitat. North of the N2 Highway, several portions of Coastal Lowland Forest will be cleared for proposed mining and the establishment of infrastructure such as the RSFs, Sandtails and the haul roads. Several flora SCC occur/potentially occur in these forest patches, including *inter alia*, the SCC listed above, as well as Sensitive species 191.

With respects to *Cassipourea gummiflua* var. *verticillata*, *Raphia australis*, *Ficus trichopoda* and *Barringtonia racemosa*, it is noted that only a small proportion (approx. 6.3 ha) of Swamp Forest in the study area will be affected by proposed mining and infrastructure development activities. The remaining patches of Swamp Forest are located outside the Project's proposed footprints and therefore SCC occurring in these areas will not be impacted by proposed mining activities. This notwithstanding, flora SCC occurring in patches of Coastal Lowland Forest that fall within the mining/infrastructure footprints will be directly impacted by proposed Project activities. The avoidance, as far as possible, of patches of forest habitat is therefore recommended to prevent any impacts on flora SCC. However, in instances where forest clearing is unavoidable, additional conservation measures should be implemented to reduce impact significance, including the development and implementation of a Flora SCC Management Plan that includes, *inter alia* surveys, search and rescue operations (for flora taxa that can be relocated), and the development of a propagation/nursery programme that is aimed at germinating[1] and growing SCC for later out-planting during rehabilitation. Before mitigation, impact significance is rated "High" (Score 68). After mitigation this impact is rated to be of "Low" significance (Score 22).

4.4.7. Loss of Mammal Species of Conservation Concern

Several factors associated with Phase 2 operational activities may negatively impact the viability of local mammal SCC populations, including:

- The direct loss and disturbance of forest habitat in the study area will reduce the availability of key habitat patches for on-site mammal SCC. Proposed Project activities that will result in habitat loss include the clearing of natural habitat for mining and the development of infrastructure including RSFs, Sandtails and haul roads;
- The broader-scale transformation/development of the study area (including Timber Plantation areas), may negatively affect the ability of mammal SCC to move/disperse across habitat patches in the landscape;
- Ongoing mining activities in the study area may cause a high-level of sensory disturbance, forcing mammal SCC to abandon natural habitat patches; and

[1] Both *Cassipourea gummiflua* var. *verticillata* and *Raphia australis* for example, are known to propagate relatively easily from fertile seed (see Nichols, 2005).

- Mammal SCC may be directly killed or injured in vehicle collisions and through hunting/snaring, both of which may increase in the study area as a result of the proposed Project.

Five mammal SCC have previously been recorded in the study area, including Natal Red Duiker, Sensitive Species 8, Cape Clawless Otter, Samango Monkey, and Sclater's Forest Shrew. The above listed mammal SCC were not re-recorded during the 2022 field survey. As a precaution however, it is considered possible/probable that they are still present, and that suitable habitat in the study area forms part of their recognised AOO. Discussion and assessment of the potential impact of proposed Project activities on the five mammal SCC that have previously been recorded in the study area is presented below, with impact scoring in Table 21:

- Natal Red Duiker: Forest habitat in the study area comprises about 0.31% of the AOO of Natal Red Duiker, and proposed Project activities are thus only likely to directly impact approximately about 0.07% of the AOO of this species. Of the 552 ha of forest habitat currently present in the study area, approximately 431.8 ha will not be directly impacted by mining/infrastructure development and thus will remain potentially suitable habitat for Natal Red Duiker. It is noted however, that Natal Red Duiker is a forest specialist that is sensitive to high-levels of anthropogenic activity, and is particularly targeted for bush-meat. It is thus possible that any Natal Red Duiker present in the study area may be negatively affected by indirect Project impacts, such as increased incidences of subsistence hunting, vehicle collisions and sensory disturbances. Before mitigation, impacts on Natal Red Duiker is rated "High" (Score 68) significance. Certain measures can be implemented to mitigate impacts to this species, including *inter alia*, implementing a mammal SCC monitoring programme, avoiding impacts to remaining forest patches – particularly the network of forest habitat to the south of the N2 Highway which should be maintained as an ecological corridor, strictly preventing hunting/snaring by on-site workers, enforcing speed limits and reducing sensory disturbances. With mitigation, residual impact significance is "Medium" (Score 42).
- Sensitive Species 8: Forest habitat in the study area comprises about 0.39% of the AOO of Sensitive Species 8, and proposed Project activities are thus only likely to directly impact approximately 0.08% of the AOO. Of the 552 ha of forest habitat currently present in the study area, approximately 431.8 ha will not be directly impacted by mining/infrastructure development, and thus will remain potentially suitable habitat for Sensitive Species 8. However, it is noted that Sensitive species 8 is a shy, sensitive species and like the Natal Red Duiker, is particularly targeted for bush-meat. It is thus likely that any Sensitive species 8 present in the study area will be negatively affected by indirect Project impacts. Before mitigation, impacts on Sensitive species 8 is rated "High" (Score 68) significance. Certain measures can be implemented to mitigate impacts to this species, including *inter alia*, implementing a mammal SCC monitoring programme, avoiding impacts to remaining forest patches – particularly the network of forest habitat to the south of the N2 Highway which should be maintained as an ecological corridor, strictly preventing hunting/snaring by on-site workers, enforcing speed limits and reducing sensory disturbances. With mitigation, residual impact significance is "Medium" (Score 42);

- Samango Monkey: Forest habitat in the study area comprises about 1.21% of the AOO of the Samango Monkey, and proposed Project activities may thus directly impact approximately 0.26% of the AOO of this species. Of the 552 ha of forest habitat currently present in the study area, approximately 431.8 ha will not be directly impacted by mining/infrastructure development and thus will remain potentially suitable habitat for Samango Monkey. This species however, is sensitive to forest disturbances, and is a poor re-coloniser of former habitat patches. It is also heavily hunted for bushmeat and traditional medicine. Any Samango Monkey present in the study area are thus likely to be negatively affected by direct and indirect Project impacts. Before mitigation, impacts on Samango monkey are rated "High" (Score 68) significance. Measures can be implemented to mitigate impacts to this species, including *inter alia*, implementing a mammal SCC monitoring programme, avoiding impacts to remaining forest patches, and strictly preventing hunting/snaring by on-site workers. With mitigation, residual impact significance is "Medium" (Score 42).
- Sclater's Forest Shrew: This species is known from a fairly broad range of habitats (i.e., forest, moist grassland & wetlands), and thus 926.9 ha of the study area comprises potential suitable habitat – this is about 1.32% of the AOO of the species. Proposed Project activities may thus directly impact approximately 0.32% of the AOO of this species. Of the potentially suitable habitat currently present in the study area, approximately 700.2 ha will not be directly impacted by mining/infrastructure development and thus will remain potentially suitable habitat for this species. Sclater's Forest Shrew is sensitive to general forms of habitat degradation, and thus may be affected by direct Project impacts. Before mitigation, impacts on Sclater's Forest Shrew are rated "High" (Score 51) significance. Measures can be implemented to mitigate impacts to this species, including limiting the extent of habitat loss and disturbance, and implementing active alien invasive species control. With mitigation, residual impact significance is "Low" (Score 28) significance; and
  Cape Clawless Otter: This species has a widespread distribution and occurs in all major drainage systems across its range. In the study area, this species will be associated with the main water courses, such as the Mlalazi River. Cape Clawless Otter are sensitive to disturbances to aquatic habitats, and thus may be affected by Project impacts that negatively affect drainage systems. Before mitigation, impacts on Sclater's Forest Shrew are rated "Medium" (Score 32) significance. Measures can be implemented to mitigate impacts to this species, including limiting the extent of habitat loss and disturbance in riparian habitats. With mitigation, residual impact significance is "Low" (Score 14) significance.

4.4.8. Loss of Ecosystem Services to Local Communities

The study area provides various ecosystem services to local communities and these may be impacted by the proposed Project. Key ecosystem services related to terrestrial flora and mammals that are likely to be directly impacted include, *inter alia*:

- Access to grazing land for livestock;
- Loss of access to biological resources, such as firewood, building material, wild foods, medicinal plants; and
- Loss of hunting opportunities for bushmeat and/or traditional medicine.

It is understood that fencing of mining areas and infrastructure will be progressive, and the entire study area will not be fenced as a whole. This notwithstanding, it is likely that access to ecosystem

services will be restricted due to proposed Project infrastructure and activities. Before mitigation, the loss of ecosystem services is rated an impact of “Medium” significance (Score 60). With the implementation of mitigation, this impact can be reduced to a “Low” significance (Score 22).

Table 21: Rating of identified impacts for Phase 2 Operations

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 1	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 2	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 3	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 4	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 5	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 6	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 7	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 8	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 9	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 10	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 11	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 12	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 13	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 14	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 15	Phase 2 Operations	5	5	2	5	5	85	High	4	4	1	5	5	70	High
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 16	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 17	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 18	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 23	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Forest habitat - Portion 24	Phase 2 Operations	4	5	2	5	5	80	High	3	4	1	4	5	52	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat - without buffer	Forest habitat adjacent to mining/infrastructure footprint (e.g., Patches 19 - 22)	Phase 2 Operations	3	5	2	3	3	39	Moderate	2	4	2	3	3	33	Moderate
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat - with buffer	Forest habitat adjacent to mining/infrastructure footprint (e.g., Patches 19 - 22)	Phase 2 Operations	3	5	2	3	3	39	Moderate	1	4	1	2	3	18	Low
Vegetation clearing and earth works	Direct loss and disturbance of natural habitat	Grassland with Trees and Bushclumps	Phase 2 Operations	2	5	2	5	3	60	Moderate	2	3	1	3	3	27	Low
Vegetation clearing and earth works	Fragmentation of natural habitat	Terrestrial Flora and Mammals	Phase 2 Operations	5	2	2	5	5	70	High	3	4	2	4	3	48	Moderate

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Vegetation clearing and earth works	Establishment and spread of alien invasive species	Flora/ Habitat	Phase 2 Operations	4	5	2	4	3	56	Moderate	1	4	1	3	3	27	Low
Vegetation clearing and earth works	Sedimentation of drainage features	Flora/ Habitat	Phase 2 Operations	3	5	2	4	3	52	Moderate	2	3	2	2	3	20	Low
Breach of Residue Storage Facility	Habitat disturbance from breach of the Reside Storage Facilities	Flora/ Habitat	Phase 2 Operations	5	5	2	2	3	30	Moderate	2	3	2	1	3	10	Low
Vegetation clearing and earth works	Loss of flora species of conservation concern	Flora SCC	Phase 2 Operations	5	5	2	4	5	68	High	3	4	1	2	3	22	Low
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Natal Red Duiker	Phase 2 Operations	5	5	2	4	5	68	High	3	4	2	3	5	42	Moderate
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Sensitive species 8	Phase 2 Operations	5	5	2	4	5	68	High	3	4	2	3	5	42	Moderate
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Samango Monkey	Phase 2 Operations	5	5	2	4	5	68	High	3	4	2	3	5	42	Moderate
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Scalter's Forest Shrew	Phase 2 Operations	5	5	2	3	5	51	Moderate	3	4	2	2	5	28	Low
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Loss of mammal species of conservation concern	Cape Clawless Otter	Phase 2 Operations	4	5	2	2	5	32	Moderate	3	4	2	1	5	14	Low
Vegetation clearing and earth works, Restrictions and loss of access to on-site natural resources	Loss of ecosystem services to local communities	Ecosystem services	Phase 2 Operations	3	5	2	4	5	60	Moderate	2	4	2	2	3	22	Low

4.5. Decommissioning and Closure Phase

Impact scoring for the Decommissioning and Closure is presented in Table 22.

4.5.1. Establishment and Spread of Alien Invasive Species

Progressive rehabilitation of mined areas will take place during mining, and this will reduce the potential for large-scale alien invasive species establishment and colonisation during decommissioning and closure.

This notwithstanding, decommissioning and closure related activities, such as the dismantling and removal of Project infrastructure and capping for the RSF's, will potentially result in additional disturbances to vegetation and soils, which may facilitate the establishment and spread of alien invasive species. As such, this impact will remain a concern during the decommissioning and closure phase, and prior to mitigation has an impact rating of "Medium" significance (Score 56). With the continued roll-out of AIS control, coupled with the progressive rehabilitation of disturbed sites and correct land and habitat management, impact significance can be reduced to "Low" (Score 24).

4.5.2. Sedimentation of Drainage Features

Progressive rehabilitation will also reduce the potential for large-scale soil erosion and sedimentation of drainage features during decommissioning and closure. However, decommissioning and closure activities may cause some increased erosion and sedimentation of drainage features in the study area. Similarly, increased sedimentation may result due to erosion from poorly rehabilitated areas or features, such as the sand tailings and RSF. This could negatively affect the integrity and functioning of downstream riparian habitats (e.g., Swamp Forest). Correct soil- and storm-water management amongst other measures, such as rehabilitation, can effectively mitigate this impact, which is rated "Medium" (Score 48) before mitigation and "Low" (Score 18) after mitigation.

4.6. Cumulative Impacts

Several projects in the region surrounding the study area have been approved, or are in the process of obtaining environmental authorisation. These were considered with respects to assessing cumulative impacts, and include:

- Tronox Fairbreeze Mine;
- Tronox Hillendale Mine (currently in closure phase);
- Richards Bay Minerals – Zulti South Project; and
- Adjacent mining leases for heavy mineral sands located to the south-west, south and west of the study area.

Key cumulative impacts associated with the proposed Project are discussed below and impact scoring is presented in Table 23:

4.6.1. Cumulative Loss, Disturbance and Fragmentation of Natural Habitat

The study area, as well as the broader landscape, are highly fragmented and transformed, with natural habitat typically confined to small patches. Many of these patches comprise indigenous vegetation types that are classified as threatened at both a national and provincial level, and accordingly, designated as CBA Irreplaceable and CBA Optimal under the KZN BSP (2016). These natural habitat patches not only play an important role in preserving remnant areas of threatened

vegetation types, but collectively, they also support landscape-scale ecological processes (e.g., source-sink patch dynamics) that contribute to conserving local flora and fauna populations.

The cumulative loss, disturbance and fragmentation of natural habitat patches from the proposed Project and other local development projects will result in the loss of threatened habitat, but it will also reduce the number and viability of, and linkages between, remaining habitat patches that are crucial to maintaining the broader-scale ecological processes that support local biodiversity.

Prior to any form of mitigation, the cumulative impact of habitat loss, disturbance and fragmentation is rated "High" (Score 85). The Project contribution to cumulative impacts can be minimised by strictly implementing the required mitigation measures, and addressing any significant residual impacts via additional conservation actions. The cumulative impact of habitat loss, disturbance and fragmentation, can be thus reduced to 'Medium' (Score 42) significance.

4.6.2. Cumulative Loss of Flora Species of Conservation Concern

Several flora SCC occur, or potentially occur, in areas of natural habitat study area as well as across the broader landscape. Species such as *Cassipourea gummiflua* var. *verticillata* and Sensitive species 191 are threatened across their range due to habitat loss and overexploitation for medicinal purposes.

The potential loss of these taxa in the study area due to proposed Project activities, coupled with losses across the broader landscape associated with ongoing habitat loss and overexploitation is a cumulative impact of concern, that is rated "High" (Score 68) significance before mitigation. With effective mitigation, which includes several conservation measures outlined in Section 5, the proposed Project's contribution to the cumulative impact can be minimised resulting in a "Low" significance (Score 24).

4.6.3. Cumulative Loss of Mammal Species of Conservation Concern

As discussed in Section 4.6.1, the cumulative loss, disturbance and fragmentation of natural habitat patches, particularly forest habitats, from the proposed Project and other local development projects is likely to disrupt landscape-scale habitat patch dynamics. This may permanently impact the viability and persistence of local mammal SCC populations.

The proposed Project's impact on forest habitat will be mostly concentrated to the north of the N2 Highway, where direct losses are anticipated within existing forest patches. Forest patches south of the N2 Highway will be subject to less direct habitat loss and will be crucial habitats for the conservation of local populations of mammal SCC occurring in the study area. It is noted however, that other impacts and forms of disturbance associated with anthropogenic activity, such as increased vehicle traffic, noise, and subsistence hunting, may increase in these habitats as a result of the proposed Project.

Maintaining the integrity and connectivity of the forest patches in the south of the study area is thus crucial to reducing potential negative impacts on mammal SCC. This can be done by *inter alia*, limiting anthropogenic activity, reducing any forms of additional habitat disturbances and fragmentation, and actively maintaining these habitats as ecological corridors in order to promote broader ecological connectivity across the landscape.

Impact on mammals SCC resulting from the cumulative loss, disturbance and fragmentation of natural habitat at broad ecological scales is difficult to fully mitigate. Before mitigation, impact significance is rated “High” (Score 68) while after mitigation it is rated “Medium” (Score 42).

Table 22: Rating of identified impacts for Decommissioning and Closure

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Decommissioning and Closure																	
Vegetation clearing and earth works during dismantling of infrastructure and rehabilitation	Establishment and spread of alien invasive species	Natural Flora and Mammal Habitat	Decommissioning and Closure	4	5	2	4	3	56	Moderate	1	3	1	3	3	24	Low
Vegetation clearing and earth works	Sedimentation of drainage features	Natural Flora and Mammal Habitat	Decommissioning and Closure	3	4	2	4	3	48	Moderate	1	3	2	2	3	18	Low

Table 23: Rating of identified impacts for Cumulative Impacts

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Magnitude	Duration	Physical Extent	Probability	Reversibility	Significance	Significance without Mitigation	Magnitude	Duration	Physical extent	Probability	Reversibility	Significance	Significance with Mitigation
Cumulative Impacts																	
Vegetation clearing and earth works	Cumulative loss, disturbance and fragmentation of natural habitat	Terrestrial Biodiversity	Cumulative	5	5	2	5	5	85	High	3	4	2	3	5	42	Moderate
Vegetation clearing and earth works	Cumulative loss of flora species of conservation concern	Flora SCC	Cumulative	5	5	2	4	5	68	High	3	4	2	2	3	24	Low
Vegetation clearing and earth works, Vehicle/machinery collisions, Hunting/snaring by construction workers Increased sensory disturbance from dust or noise generation	Cumulative loss of mammal species of conservation concern	Mammal SCC	Cumulative	5	5	2	4	5	68	High	3	4	2	3	5	42	Moderate

5. Recommended Mitigation and Monitoring Measures

5.1. Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed in the preceding section.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following main Project stages:

- Planning and Design;
- Site Establishment / Construction
- Phase 1 Operations;
- Phase 2 Operations; and
- Decommissioning and Closure.

Mitigation type: The type of mitigation measure. This includes the following:

- Avoidance;
- Minimisation;
- Rehabilitation or restoration;
- Offsetting; and
- No-go.

For each impact mitigation / management action, the following information is provided:

- Activity generating impact;
- Key Performance Indicators (KPIs's)
- Frequency of management: The time period when the impact management actions must be implemented; and
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions;
- Means of monitoring.

Table 24**Error! Reference source not found.Error! Reference source not found.** presents a summary of the proposed impact mitigation actions during the various stages of the proposed Project.

Table 24: Mitigation measures for terrestrial biodiversity, flora and mammals.

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
PLANNING AND DESIGN								
1.1	Terrestrial Flora and Mammals	Direct loss and disturbance of natural habitat	• As far as possible, the proposed Project layout of mining and infrastructure footprints should be amended to avoid impacting patches of forest habitat, with buffers of 200 m recommended around forest patches with 'Very High' SEI scores. A reduced buffer of ˜100 m can be considered around forest patches with 'High' SEI scores; • As far as possible, proposed Project infrastructure should only be located on land that is already modified (i.e., Sugarcane Fields and Timber Plantations); • Where the proposed mining/infrastructure development results in unavoidable impacts to provincial Critical Biodiversity Areas (CBAs) and threatened vegetation types, additional conservation actions, such as, but not limited to, biodiversity offsetting, will be required. Additional conservation actions must be developed in consultation with Ezemvelo KZN Wildlife to ensure its effectiveness and alignment with local conservation priorities (refer to the offsetting report for the proposed Project). • To inform the development of the biodiversity offset strategy and additional conservation actions, additional surveys should be undertaken in the patches of forest that are located within the finalised Project footprints and that will be lost during mining. Key data that should be collected includes: o Identity and number of flora SCC (i.e., Red List and Protected species) that will be impacted during clearing, and that will need to be managed through additional conservation actions; o The final extent (ha) and composition of natural habitat that requires offsetting; • Wherever possible, linear infrastructure, such as access roads, powerlines and pipelines, should be aligned with existing linear features in the study area.	Vegetation clearing and earth works	Minimal loss of existing indigenous forest habitat. Increased natural habitat connectivity over the long-term.	Project Manager	During project planning	Mine plan
1.2	Flora SCC	Loss of flora of conservation concern	• Portions of natural habitat that are located within planned mining / infrastructure footprints and that cannot be avoided, should be surveyed by a botanist to identify and count potentially affected flora SCC (i.e., Red List and Protected species); • The survey results should inform the development of a Flora SCC Management Plan. As necessary, the plan should make provision for both *in-situ* and *ex-situ* conservation initiatives, such as *inter alia*: o The identification of potential habitat patches as 'set-asides/no-go areas'; o Procedure to apply for and obtain clearing and/or rescue and relocation permits for flora SCC from the relevant authorities; o A rescue and relocation procedure for taxa that are able to be relocated. Amongst other components, the procedure should: ▪ Identify suitable relocation sites of comparable habitat; ▪ Advise on plant rescuing and out-planting methods, and	Vegetation clearing and earth works	No or minimal loss of flora SCC in the study area	Project Manager	Prior to any vegetation clearing and earth works in natural habitat	Flora SCC Management Plan

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
			▪ Advise on post out-planting care and maintenance, and monitoring protocols. ○ For species that are not suitable for rescue and relocation (e.g., large trees), a propagation/nursery programme should be developed. The programme should include: ▪ The development of an on-site plant nursery; ▪ Seed collection and germination methods; ▪ General plant care methods; and ○ Propagated SCC plants should be used in rehabilitation/restoration efforts to replace the loss of SCC sustained during vegetation clearing.					
1.3	Mammal SCC	Loss of mammal species of conservation concern	• A monitoring programme for forest-dwelling mammal SCC should be developed for the study area; • The aims of the monitoring programme should be to assess the presence of mammal SCC, estimate their population size, and determine their range-use/distribution; and • The findings of the monitoring should then be used to inform the development of species-specific management plans for mammal SCC occurring in the study area.	Vegetation clearing and earth works And Direct mortality, injuring and disturbance of mammals (e.g., vehicle collisions, hunting/snaring)	No loss of mammal SCC in the study area	Project Manager	Prior to any vegetation clearing and earth works in natural habitat	Monitoring programme by ecologist / specialist.
SITE ESTABLISHMENT AND CONSTRUCTION								
2.1	Terrestrial Flora and Mammals	Direct loss and disturbance of natural habitat	• Vegetation clearing should be restricted to approved Project development footprints only, with no clearing or any forms of disturbance permitted outside of these areas; • Wherever possible, disturbances associated with the widening of the access or haul roads should be restricted to areas of Timber Plantation rather than areas of natural habitat; • Development footprints should be clearly demarcated in the field prior to prevent unnecessary clearing outside of these footprints; • All materials and equipment should be stored in approved laydown areas, with no storage permitted outside of these areas; • No mine vehicles should travel beyond the marked clearing footprints and designated access roads; and • Active restoration/rehabilitation of disturbed footprints should commence as soon as practically possible, and should continue on an ongoing basis throughout the life of mine.	Vegetation clearing and earth works	No unauthorised loss of natural habitat	Project Manager	During Site Establishment and Construction	Regular on-site inspections and reporting by appointed ECO
2.2	Terrestrial Flora and Mammals	Fragmentation of natural habitat	Refer to all mitigation actions listed under *Direct loss and disturbance of natural habitat.*					
2.3	Natural habitat	Establishment and spread of alien invasive species	• Control of alien invasive species should be conducted throughout Site Establishment and Construction, as per the AIS Control and Eradication Plan.	Vegetation clearing and earth works	Minimal AIS establishment in areas disturbed by construction activities	Project Manager	During Site Establishment and Construction	Annual monitoring and reporting by appointed ECO

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
2.4	Natural habitat	Sedimentation of drainage features	• Correctly designed storm water infrastructure, including berms and sediment traps should be constructed on-site to correctly channel surface water to reduce potential soil erosion and prevent excessive sediment entering drainage features; • Regular inspections of storm water infrastructure should be conducted to ensure operational efficiency; • Active restoration/rehabilitation of disturbed footprints and erosion-prone facilities should commence as soon as practically possible, and should continue on an ongoing basis throughout the life of mine.	Vegetation clearing and earth works	Minimal incidents of erosion and sedimentation of drainage features.	Project Manager	During Site Establishment and Construction	Regular on-site inspections and reporting by appointed ECO
2.5	Mammal SCC	Loss of mammal species of conservation concern	• The provisions of species-specific management plans for mammal SCC that were developed during Planning and Design should be implemented in the study area. • An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. • As appropriate, barriers should be erected around construction trenches and excavations to prevent mammals being trapped in these features. • Any mammals trapped in construction areas, should be safely and correctly relocated to an adjacent area of natural habitat. • A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions. • The handling, poisoning, trapping and killing of all mammal species on-site by mine workers and contractors must be strictly prohibited. • The rules and regulations concerning all wildlife should be communicated to mine workers and contractors through on-site signage and awareness training (induction). • An incidence register should be maintained throughout all phases of the Project detailing any wildlife mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements. • Dust suppression using, *inter alia*, water bowsers should be implemented at all site where dust generation is likely to occur. • All vehicle and machinery should be fitted with noise reduction equipment.	Vegetation clearing and earth works And Direct mortality, injuring and disturbance of mammals (e.g., vehicle collisions, hunting/snaring)	No loss of mammal SCC in the study area	Project Manager	During Site Establishment and Construction	Monitoring programme by ecologist / specialist.
PHASE 1 OPERATIONS								

3.1	Natural habitat	Establishment and spread of alien invasive species	• An AIS Control and Eradication Plan relevant to the entire study area and all phases should be developed for the proposed Project. The plan must include, at a minimum:
			  • Identification of AIS management units;
			  • Prioritisation of sites and species requiring control;
			  • Targets and indicators of success;
			  • Scheduling of AIS control roll-out.
			  • Species-specific control methods, using a combined approach of both chemical and mechanical control methods; and
				Vegetation clearing and earth works	Minimal AIS establishment in areas disturbed by construction activities	Mine Manager	During Phase 1 Operations – wet season	Annual monitoring and reporting by appointed ECO

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
			• Provision for follow-up treatments, as informed by regular AIS monitoring.					
3.2	Natural habitat	Sedimentation of drainage features	• Correctly designed storm water infrastructure, including berms and sediment traps should be constructed on-site to correctly channel surface water to reduce potential soil erosion and prevent excessive sediment entering drainage features. • Regular inspections of storm water infrastructure should be conducted to ensure operational efficiency. • Ongoing rehabilitation of disturbed footprints and erosion-prone sites should commence as soon as practically possible, and should continue on an ongoing basis throughout this phase.	Vegetation clearing and earth works	Minimal incidents of erosion and sedimentation of drainage features.	Mine Manager	During Phase 1 Operations	Regular on-site inspections and reporting by appointed ECO
3.3	Mammal SCC	Loss of mammal species of conservation concern	• The provisions of species-specific management plans for mammal SCC that were developed during Planning and Design should be implemented in the study area. • An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. • As appropriate, barriers should be erected around construction trenches and excavations to prevent mammals being trapped in these features. • Any mammals trapped in construction areas, should be safely and correctly relocated to an adjacent area of natural habitat. • A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions. • The handling, poisoning, trapping and killing of all mammal species on-site by mine workers and contractors must be strictly prohibited. • The rules and regulations concerning all wildlife should be communicated to mine workers and contractors through on-site signage and awareness training (induction). • An incidence register should be maintained throughout all phases of the Project detailing any wildlife mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements. • Dust suppression using, *inter alia*, water bowsers should be implemented at all site where dust generation is likely to occur. • All vehicle and machinery should be fitted with noise reduction equipment.	Direct mortality, injuring and disturbance of mammals (e.g., vehicle collisions, hunting/snaring)	No loss of mammal SCC in the study area	Mine Manager	During Phase 1 Operations	Monitoring programme by ecologist / specialist.
PHASE 2 OPERATIONS								
4.1	Terrestrial Flora and Mammals	Direct loss and disturbance of natural habitat	• Vegetation clearing should be restricted to approved Project development footprints only, with no clearing or any forms of disturbance permitted outside of these areas; • Development footprints should be clearly demarcated in the field prior to vegetation clearing and earthworks to prevent unnecessary clearing outside of these footprints; • During operations, buffer areas around forest habitat that comprise existing Timber Plantations, should be retained to provide a screen against additional edge-effect disturbances;	Vegetation clearing and earth works	No unauthorised loss of natural habitat	Mine Manager	During Phase 2 Operations	Regular on-site inspections and reporting by appointed ECO

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring

			• All materials and equipment should be stored in approved laydown areas, with no storage permitted outside of these areas;
			• No construction vehicles should travel beyond the marked clearing footprints and designated access roads; and
			• Active restoration/rehabilitation of disturbed footprints should commence as soon as practically possible, and should continue on an ongoing basis throughout the life of mine.
			• A Forest Rehabilitation Plan should be developed to restore areas of forest that were cleared/disturbed during mining.
			  ○ The plan should be developed by specialist rehabilitation ecologists, with expertise and experience in swamp and coastal forest restoration,
			  ○ The plan should include a monitoring component to assess rehabilitation performance and allow for adaptive management.				

4.2	Terrestrial Flora and Mammals	Fragmentation of natural habitat	Refer to all mitigation actions listed under *Direct loss and disturbance of natural habitat,* and • Areas of natural- and modified habitat located between development footprints should be managed/maintained as potential movement/dispersal corridors and should not be obstructed by temporary or permanent infrastructure (e.g. fences). • Natural habitat patches along and adjacent to the Amanzamnyama and Mzingwenya Rivers in the south of the study area should be managed and maintained as an important ecological corridor. These areas should be kept free from additional vegetation disturbances and alien invasive species encroachment.	Vegetation clearing and earth works	No unauthorised loss of natural habitat & maintenance of habitat corridors.	Mine Manager	During Phase 2 Operations	Regular on-site inspections and reporting by appointed ECO
4.3	Natural habitat	Establishment and spread of alien invasive species	• Control of alien invasive species should be conducted throughout Phase 2 Operations, as per the AIS Control and Eradication Plan. As required, the plan should be updated to account for any operational/environmental changes.	Vegetation clearing and earth works	Minimal AIS establishment in areas disturbed by construction activities	Mine Manager	During Phase 2 Operations – wet season	Annual monitoring and reporting by appointed ECO
4.5	Natural habitat	Sedimentation of drainage features	• Correctly designed storm water infrastructure, including berms and sediment traps should be constructed on-site to correctly channel surface water to reduce potential soil erosion and prevent excessive sediment entering drainage features. • Regular inspections of storm water infrastructure should be conducted to ensure operational efficiency. • Active restoration/rehabilitation of disturbed footprints and erosion-prone facilities (e.g. sand tailings) should commence as soon as practically possible, and should continue on an ongoing basis throughout the life of mine.	Vegetation clearing and earth works	Minimal incidents of erosion and sedimentation of drainage features.	Mine Manager	During Phase 2 Operations	Regular on-site inspections and reporting by appointed ECO
4.6	Natural habitat	Habitat disturbance caused by breach of the Reside Storage Facilities	• RSF should be regularly inspected and maintained to reduce the risk of accidental breaches.	Breach of the Reside Storage Facilities	No habitat disturbance caused by breaches of the Reside	Mine Manager	During Phase 2 Operations	Regular on-site inspections by facility engineer

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
					Storage Facilities			
4.7	Flora SCC	Loss of flora of conservation concern	• Any flora SCC located within proposed development footprints should be managed in accordance with the Flora SCC Management Plan that was developed during the Planning and Design. This may include rescue and relocation under the correct permit.	Vegetation clearing and earth works	No net-loss of flora SCC in the study area	Mine Manager	During Phase 2 Operations	Flora SCC Management Plan
4.8	Mammal SCC	Loss of mammal species of conservation concern	Refer to all mitigation actions listed under *Direct loss and disturbance of natural habitat* and *Fragmentation of natural habitat;* and • The provisions of species-specific management plans for mammal SCC that were developed during Planning and Design should be implemented in the study area. • An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. • As appropriate, barriers should be erected around construction trenches and excavations to prevent mammals being trapped in these features. • Any mammals trapped in construction areas, should be safely and correctly relocated to an adjacent area of natural habitat. • A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions. • The handling, poisoning, trapping and killing of all mammal species on-site by mine workers and contractors must be strictly prohibited. • The rules and regulations concerning all wildlife should be communicated to mine workers and contractors through on-site signage and awareness training (induction). • An incidence register should be maintained throughout all phases of the Project detailing any wildlife mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements. • Dust suppression using, *inter alia*, water bowsers should be implemented at all site where dust generation is likely to occur. • All vehicle and machinery should be fitted with noise reduction equipment.	Vegetation clearing and earth works And Direct mortality, injuring and disturbance of mammals (e.g., vehicle collisions, hunting/snaring)	No loss of mammal SCC in the study area	Mine Manager	During Phase 2 Operations	Monitoring programme by ecologist / specialist.

4.9	Ecosystem services	Loss of ecosystem services to local communities	• Conduct ongoing consultation process with local community members who depend on local ecosystem services in order to:
			  • Highlight the principles of, and need for, the sustainable use and harvesting of natural resources.
			  • Identify priority ecosystem services that are threatened by proposed Project activities.
			  • Identify possible management options to compensate for the loss of priority ecosystem services.
				Vegetation clearing and earth works.
				And
				
				Possible restriction of access to various parts of the study area.
					Continued provision and sustainable use of natural resources	Mine Manager	During Phase 2 Operations	Stakeholder engagement

DECOMMISSIONING AND CLOSURE PHASE								
5.1	Natural habitat	Establishment and spread of	• Control of alien invasive species should be conducted throughout the Decommissioning and Closure Phase, as per the AIS Control and	Vegetation clearing and earth works	Minimal AIS establishment	Mine Manager	During Decommissioning	Annual monitoring

Ref. No.	Aspect	Impact	Mitigation Actions	Management				
				Activity Generating Impact	KPI's	Responsible Person	Frequency of Management	Means of Monitoring
		alien invasive species	Eradication Plan. As required, the plan should be updated to account for any operational/environmental changes.		in areas disturbed by construction activities		and Closure – wet season	and reporting by appointed ECO
5.2	Natural habitat	Rehabilitation	• Disturbed/mined footprints that are not designated to return to commercial forestry, should be actively rehabilitated toward a natural forest state, as per the Forest Rehabilitation Plan. • Post-rehabilitation, it is recommended that the buffer areas around forest habitat should be planted with *Eucalyptus* trees (or indigenous tree species) to limit the potential for wildfires to encroach into and disturbed forest patches. • It is further recommended that in areas that are designated to return to commercial forestry, a network of corridors is delineated along drainage lines, and actively rehabilitated toward a natural forest state, in order to serve as ecological corridors and promote landscape connectivity.	Rehabilitation	Restoration of natural habitats and improved habitat connectivity in the study area	Mine Manager	During Decommissioning and Closure	Rehabilitation and Closure Plan

5.2. Monitoring Measures

The following section presents the proposed monitoring actions for monitoring and reporting on the implementation of the impact mitigation actions presented in the preceding Section 5.

The content of this section is largely based on the monitoring requirements outlined in Appendix 4 of the EIA Regulations, 2014.

For each monitoring action, the following information is provided:

- Category: The category within which the potential impact and/or risk occurs;
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning/closure of the proposed Project;
- Method for monitoring: The method for monitoring the implementation of the recommended mitigation measures;
- Time period: The time period over which the monitoring actions must be implemented
- Frequency of monitoring: The frequency of monitoring the implementation of the recommended mitigation measures;
- Mechanism for monitoring compliance: The mechanism for monitoring compliance with the impact management actions; and
- Responsible persons: The persons who will be responsible for the implementation of the monitoring actions.

As with the impact management actions, the proposed monitoring actions have been arranged according to the following project phases:

- Site Establishment / Construction;
- Phase 1 Operations;
- Phase 2 Operations; and
- Decommissioning and Closure.

Table 25 presents a summary of the proposed monitoring actions for the different phases.

Table 25: Monitoring Measures

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
1. SITE ESTABLISHMENT/CONSTRUCTION						

1.1	Alien invasive species	• Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:
		  ○ All sites disturbed during site establishment and construction;
		  ○ Areas of natural habitat adjacent to disturbed sites.
		• Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.
			Wet/growing season	Annual	Annual monitoring report	Project manager

1.2	Mammal SCC	• A monitoring programme for forest-dwelling mammal SCC should be developed for the study area; • The aims of the monitoring programme should be used to assess the presence of mammal SCC, estimate their population size, and determine their range-use/distribution; and • The findings of the monitoring should then be used to inform the development of	Ongoing	Annual & Ongoing	Annual monitoring report	Project manager

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
		species-specific management plans for the Mining Rights Area.				
2. PHASE 1 - OPERATIONS						

2.1	Alien invasive species	• Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:
		  ○ All sites disturbed by site establishment and construction activities and operational activities, and
		  ○ Areas of natural habitat adjacent to disturbed sites.
		• Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.
			Wet/growing season	Annual & Ongoing	Annual monitoring reports	Environmental manager

3. PHASE 2 - OPERATIONS						
3.1	Alien invasive species	• Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:	Wet/growing season	Annual & Ongoing	Annual monitoring reports	Environmental manager

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
		○ All sites disturbed by site establishment and construction activities and operational activities, and ○ Areas of natural habitat adjacent to disturbed sites. • Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.				
3.2	Rehabilitation	• Monitoring of rehabilitated forest patches should be conducted during Phase 2 Operations, as per the methods and frequency prescribed in the approved Forest Rehabilitation Plan. Aspects that should be considered include, *inter alia* flora species composition, vegetation structure, soil properties and fauna species composition	Wet/growing season	As prescribed in the approved Forest Rehabilitation Plan	Monitoring reports	Environmental manager
4. DECOMISSIONING AND CLOSURE						
4.1	Alien invasive species	• Alien invasive species monitoring should be conducted on an annual basis during decommissioning, and for a period of five	Wet/growing season	Annually during decommissioning &	Annual monitoring reports	Environmental manager

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
		years following closure. Monitoring should focus on all sites disturbed during mining, including rehabilitated sites. • Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.		for a period of five years after closure.		
4.2	Rehabilitation	• Monitoring of rehabilitated forest patches should be conducted during Decommissioning and Closure, as per the methods and frequency prescribed in the approved Forest Rehabilitation Plan.	Wet/growing season	As prescribed in the approved Forest Rehabilitation Plan	Monitoring reports	Environmental manager

6. Environmental Impact Statement

6.1. Summary of Main Findings

Most of the study area, which encompasses all of the port Durnford Mining Rights Area, and surrounding landscape are transformed and fragmented. Extensive commercial Timber Plantations and to a lesser extent Sugarcane Fields characterise large areas, while linear infrastructure including arterial roads, informal forestry tracks, and railway- and powerlines have contributed to habitat loss and fragmentation.

Beyond the study area, rural residential areas, amongst other land uses, dominate most of the surrounding landscape. The study area is thus already highly modified and fragmented, and also embedded within a highly modified and fragmented landscape.

Remaining areas of natural habitat in the study area are therefore critically important to retaining local ecosystem processes and biodiversity. At a national level, the prevailing Maputaland Costal Belt and KwaZulu-Natal Coastal Belt vegetation types are listed as Endangered. Similarly, at a provincial level, several of the KwaZulu-Natal delineated vegetation types that mapped for the study area are threatened, with provincial conservation statuses ranging from Vulnerable to Critically Endangered.

Natural habitat in the study area consists of small patches or narrow corridors of indigenous forest (i.e., Swamp Forest and Coastal Lowland Forest), with remaining areas characterised by a mosaic of Grassland with Scattered Trees and Bush-clumps.

From a functional perspective, the remaining patches of natural habitat in the study area provide important resource and refuge habitat for local flora and mammal species. They also act as important dispersal and movement corridors or stepping stone habitats across the local landscape, and thus likely play a vital role in maintaining various ecological processes and terrestrial biodiversity at the landscape-scale.

Based on data collected during the 2022 field survey and during the initial baseline study conducted by Coastal & Environmental Services (2009), several flora and mammal SCC occur, or are likely to occur (based on habitat suitability assessments) in natural habitat patches in the study area.

These biodiversity attributes are recognised under the KZN BSP (2016), which delineates many of the natural habitat patches (mostly associated with Swamp Forest in the south of the study area) as CBA Irreplaceable, with smaller areas designated CBA Optimal. The continued functioning and integrity of CBA's is crucial to meeting provincial biodiversity conservation targets.

Pursuant to these factors, the findings of this specialist study indicate that the environmental screening tool report's ratings of 'Very High' sensitivity for the Terrestrial Biodiversity theme and 'High' sensitivity for the Animal Species theme are supported/confirmed for patches of natural habitat in the study area. Similarly, the findings of this study also indicate that the Plant Species sensitivity rating for patches of natural habitat in the study area are 'High', rather than the 'Medium' as indicated by the environmental screening tool.

In line with the mitigation hierarchy, since 2022 the proposed Project's mine plan has undergone a series of amendments based on recommendations from the various ecologists and biodiversity specialists, in order to avoid and minimise negative impacts of sensitive biodiversity features.

The currently proposed Project plan will have several negative impacts on terrestrial vegetation, flora and mammals. Key amongst these, is the direct loss, disturbance and fragmentation of natural habitat that will result from vegetation clearing, earth works and mining. These activities are also likely to be accompanied by other associated impacts, such as *inter alia*, alien invasive species establishment and spread, sedimentation of drainage features, loss of flora and mammal species of conservation concern, and the loss of ecosystem services to local community members.

Several mitigation and management measures have been recommended in this report to further avoid, minimise and rehabilitate the identified and assessed impacts. Residual impacts associated with habitat loss nonetheless remain, and these will need to be addressed through additional conservation actions, including, but not limited to, biodiversity offsetting - refer to the Biodiversity Offsetting report for the proposed Project. Additional conservation actions should be developed in collaboration with conservation planners at Ezemvelo KZN Wildlife.

6.2. Specialist Opinion

In accordance with the outcomes of the impact assessment (Section 4) and taking cognisance of the baseline conditions as presented in Section 3, as well as the impact avoidance, mitigation and management measures outlined herein (Section 5), and subject to the development of an approved offsetting strategy in the event that the forest habitat loss is unavoidable, the proposed Project can be considered for authorisation.

7. References

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8. Specialist Declaration

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Port Durnford Mine Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

Andrew Zinn

Appendix A: Curriculum Vitae – Andrew Zinn

Hawkhead Consulting

Curriculum Vitae of Andrew Zinn (Pr.Sci.Nat.)

Details

Andrew David Zinn
Terrestrial Ecologist
B.Sc. (Hons.), M.Sc., Pr.Sci.Nat.

Email: andrew@hawkhead.com
Mobile: +27 83 361 0373
Address: 58 Central Rd, Linden Ext., Johannesburg, 2195
South Africa
Date of birth: 14 July 1982
Nationality: South African

Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and 15 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

Education and Qualifications

- University of the Witwatersrand, M.Sc. Resource Conservation Biology (2013).
- University of KwaZulu-Natal, BSc. Hons. Ecology and Conservation Biology (2005).
- University of KwaZulu-Natal, BSc. Zoology and Grassland Science (2004).
- Bryanston High School, Johannesburg. Matric Exemption. (2000).

Affiliations

- Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).
- Member of the South African Wildlife Management Association.
- Member of the South African Association of Botanists.

Work Experience

1. **Independent Ecologist**

Hawkhead Consulting, South Africa
September 2020 – Present

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- Biodiversity study design and implementation;
- Biodiversity baseline and impact assessment reporting;
- Mitigation measure design and application;
- Vegetation surveys and vegetation community mapping;
- Fauna surveys for mammals, birds, reptiles and amphibians;
- Development of biodiversity management plans;
- Development of rehabilitation and revegetation plans; and
- Alien invasive species control and eradication plans.

2. Ecologist

Golder Associates Africa, South Africa
June 2011 – September 2020

Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa. Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's (IFC) Performance Standard 6 (PS6)

3. Independent Ecologist

Subcontracted to KPMG, United Arab Emirates
March – April 2011

Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

4. Environmental Consultant

WSP Environment and Energy, South Africa
August 2008 – March 2011

Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes, conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

5. Research Technician

Yale University, Kruger National Park, South Africa
October 2007 – May 2008

Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.
- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

Appendix B: Rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, as per (SANBI, 2020).

The ecological sensitivity of habitats in the study area was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystems types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

Table 1: Conservation Importance (CI) criteria.

Conservation Importance (CI)	Fulfilling Criteria
Very High	• Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10km^2; • Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type; and • Globally significant populations of congregatory species (>10% of global population).
High	• Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of > 10km^2, IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining; • Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type; • Presence of Rare species; • Globally significant populations of congregatory species (>1% but < 10% of global population).
Medium	• Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals; • Any area of natural habitat of threatened ecosystem type with status of VU; • Presence of range-restricted species; and • >50% of receptor contains natural habitat to support SCC.
Low	• No confirmed or highly likely populations of SCC; • No confirmed or highly likely populations of range-restricted species; and • <50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	• No confirmed and highly unlikely populations of SCC; • No confirmed and highly unlikely populations of range-restricted species; and • No natural habitat remaining.

Table 2: Functional Integrity (FI) criteria.

Functional Integrity (FI)	Fulfilling Criteria
Very High	• Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type; • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches; • No or minimal current negative ecological impacts with no signs of major disturbance (e.g., ploughing)
High	• Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types; • Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches; and • Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential.
Medium	• Medium (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type or >20 ha for VU ecosystem type; • Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches; • Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	• Small (> 1 ha but <5ha) area; • Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential; and • Several minor and major current negative ecological impacts.
Very Low	• Very small (<1 ha) area; • No habitat connectivity except for flying species or flora with wind-dispersed seeds; • Several major current negative ecological impacts.

BI = CI + FI

Biodiversity Importance (BI) Rating Matrix

Biodiversity Importance (BI)		**Conservation Importance**				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Functional Integrity	**Very High**	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

Table 3: Receptor Resilience criteria (RR)

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (˜less than 5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (˜ 5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

SEI = BI + RR

Site Ecological Importance (SEI) Rating Matrix

Site Ecological Importance		Biodiversity Importance				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Receptor Resilience	**Very Low**	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Table 4: Guidelines for interpreting SEI in the context of the proposed development activities.

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

Appendix C: List of Flora Species Recorded in the Study Area During the 2022 Field Survey and by Coastal & Environmental Services (2009).

Family	Species Name	Growth Form	Origin	Conservation Status				Habitat Units (2022 Field Survey)					Coastal & Enviro. Services (2009)
				National Red List Status	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Coastal Lowland Forest	Swamp Forest	Riparian Woodland & Scrub	Grassland with Trees and Bush-clumps	Transformed Sites (incl. road sides & developed areas)	
Acanthaceae	*Asystasia gangetica*	Herb	Indigenous	LC							X		+
Acanthaceae	*Isoglossa woodii*	Shrub	Indigenous	LC				X	X	X			+
Aceraceae	*Raphia australis*	Tree	Indigenous	VU									#
Achariaceae	*Xylotheca kraussiana*	Tree	Indigenous	LC									#
Amaranthaceae	*Achyranthes aspera* var. *aspera**	Herb	Alien	NE				X	X	X		X	+
Amaryllidaceae	*Scadoxus puniceus*	Herb	Indigenous	LC			Specially Protected	X	X				+
Anacardiaceae	*Harpephyllum caffrum*	Tree	Indigenous	LC				X	X	X			+
Anacardiaceae	*Protorhus longifolia*	Tree	Indigenous	LC					X				+
Anacardiaceae	*Schinus terebinthifolius**	Tree	Alien (NEMBA 1b)	NE						X	X		
Anacardiaceae	*Searsia chirindensis*	Tree	Indigenous	LC						X			+
Anacardiaceae	*Searsia dentata*	Tree	Indigenous	LC				X					
Anacardiaceae	*Searsia pyroides*	Tree	Indigenous	LC						X			
Annonaceae	*Monanthotaxis caffra*	Tree	Indigenous	LC				X	X				+
Apiaceae	*Centella asiatica**	Herb	Alien	NE							X		+
Apiaceae	*Hydrocotyle americana**	Herb	Alien	NE							X		
Apocynaceae	*Carissa macrocarpa*	Shrub	Indigenous	LC							X		
Apocynaceae	*Catharanthus roseus**	Herb	Alien (NEMBA 1b)	NE								X	
Apocynaceae	*Gomphocarpus physocarpus*	Herb	Indigenous	LC							X	X	+
Apocynaceae	*Landolphia kirkii*	Climber	Indigenous	LC					X				
Apocynaceae	*Oncinotis tenuiloba*	Shrub	Indigenous	LC									#
Apocynaceae	*Rauvolfia caffra*	Tree	Indigenous	LC				X	X	X	X		+

Family	Species Name	Growth Form	Origin	Conservation Status				Habitat Units (2022 Field Survey)					Coastal & Enviro. Services (2009)
				National Red List Status	NEMBA ToPS List (2007)	National Forest Act (1998)	KZN Provincial Status	Coastal Lowland Forest	Swamp Forest	Riparian Woodland & Scrub	Grassland with Trees and Bush-clumps	Transformed Sites (incl. road sides & developed areas)	
Apocynaceae	*Riocreuxia torulosa*	Climber	Indigenous	LC									#
Apocynaceae	*Secamone alpini*	Shrub	Indigenous	LC									#
Apocynaceae	*Tabernaemontana ventricosa*	Tree	Indigenous	LC				X	X	X	X		+
Apocynaceae	*Voacanga thouarsii*	Tree	Indigenous	LC					X				+
Aquifoliaceae	*Ilex mitis*	Tree	Indigenous	LC									#
Araceae	*Zantedeschia* sp.	Herb	Indigenous	-			Specially Protected	X					+
Araliaceae	*Cussonia arenicola*	Tree	Indigenous	LC				X	X				
Araliaceae	*Cussonia spicata*	Tree	Indigenous	LC				X		X			+
Araliaceae	*Schefflera umbellifera*	Tree	Indigenous	LC				X			X		#
Arecaceae	*Hyphaene coriacea*	Tree	Indigenous	LC				X		X			+
Arecaceae	*Phoenix reclinata*	Tree	Indigenous	LC				X	X	X	X		+
Asparagaceae	*Asparagus falcatus*	Shrub	Indigenous	LC				X	X	X	X		+
Asparagaceae	*Behnia reticulata*	Climber	Indigenous	LC									#
Aspleniaceae	*Asplenium prionitis*	Fern	Indigenous	LC				X	X				+
Aspleniaceae	*Diplazium esculentum**	Fern	Alien	NE							X		
Asteraceae	*Ageratum houstonianum**	Herb	Alien (NEMBA 1b)	NE								X	+
Asteraceae	*Ambrosia artemisiifolia**	Herb	Alien	NE								X	+
Asteraceae	*Bidens pilosa**	Herb	Alien	NE						X		X	+
Asteraceae	*Chromolaena odorata**	Herb	Alien (NEMBA 1b)	NE					X	X			+
Asteraceae	*Cirsium vulgare**	Herb	Alien (NEMBA 1b)	NE								X	
Asteraceae	*Conyza canadensis**	Herb	Alien	NE								X	+

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Asteraceae	*Helichrysum foetidum*	Herb	Indigenous	LC									#
Asteraceae	*Helichrysum kraussii*	Herb	Indigenous	LC								X	+
Asteraceae	*Lactuca indica*	Herb	Alien	NE									#
Asteraceae	*Laggera crispata*	Herb	Indigenous	LC									#
Asteraceae	*Parthenium hysterophorus**	Herb	Alien (NEMBA 1b)	NE						X		X	
Asteraceae	*Senecio polyanthemoides*	Herb	Indigenous	LC							X		
Asteraceae	*Senecio pterophorus*	Herb	Indigenous	LC									#
Asteraceae	*Senecio* sp.	Herb	Indigenous	-									#
Asteraceae	*Senecio tamoides*	Climber	Indigenous	LC				X	X		X		+
Asteraceae	*Tagetes minuta**	Herb	Alien	NE								X	+
Asteraceae	*Xanthium strumarium**	Herb	Alien (NEMBA 1b)	NE						X			
Blechnaceae	*Stenochlaena tenuifolia*	Fern	Indigenous	LC				X	X				+
Cactaceae	*Rhipsalis baccifera* subsp. *mauritiana*	Herb	Indigenous	LC									#
Cannaceae	*Canna* cf. *indica**	Herb	Alien (NEMBA 1b)	NE					X	X			
Celastraceae	*Gymnosporia senegalensis*	Shrub	Indigenous	LC						X		X	
Combretaceae	*Combretum* cf. *kraussii*	Tree	Indigenous	LC					X				
Combretaceae	*Combretum erythrophyllum*	Tree	Indigenous	LC						X			
Commelinaceae	*Aneilema aequinoctiale*	Herb	Indigenous	LC				X	X				+
Commelinaceae	*Commelina africana*	Herb	Indigenous	LC				X					#
Commelinaceae	*Commelina benghalensis*	Herb	Indigenous	LC				X			X		+
Convolvulaceae	*Ipomoea ficifolia*	Herb	Indigenous	LC									#
Convolvulaceae	*Ipomoea* sp.	Herb	Indigenous	-									#

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Cucurbitaceae	*Momordica foetida*	Climber	Indigenous	LC									#
Curtisiae	*Curtisia dentata*	Tree	Indigenous	NT		Protected							#
Cyperaceae	*Bulbostylis* cf. *hispidula*	Graminoid	Indigenous	LC							X		
Cyperaceae	*Carpha glomerata*	Graminoid	Indigenous	LC							X		
Cyperaceae	*Cyperus albostriatus*	Graminoid	Indigenous	LC				X					
Cyperaceae	*Cyperus compressus*	Graminoid	Indigenous	LC							X		
Cyperaceae	*Cyperus distans*	Graminoid	Indigenous	LC							X		+
Cyperaceae	*Cyperus prolifer*	Graminoid	Indigenous	LC							X		+
Cyperaceae	*Eleocharis limosa*	Graminoid	Indigenous	LC							X		
Cyperaceae	*Isolepis prolifera*	Graminoid	Indigenous	LC							X		+
Cyperaceae	*Mariscus* sp.	Graminoid	Indigenous	-							X		+
Cyperaceae	*Pycreus polystachyus*	Graminoid	Indigenous	LC							X		+
Cyperaceae	*Rhynchospora corymbosa*	Graminoid	Indigenous	LC									+
Cyperaceae	*Schoenoxiphium* sp.	Graminoid	Indigenous	-									#
Cyperaceae	*Scirpus sp.*	Graminoid	Indigenous	-									#
Cyperaceae	*Scleria angusta*	Graminoid	Indigenous	LC									#
Dennstaedtiaceae	*Pteridium aquilinum* subsp. *capense*	Fern	Indigenous	LC					X		X		+
Dioscoreaceae	*Dioscorea cotinifolia*	Climber	Indigenous	LC			Specially Protected						#
Dioscoreaceae	*Dioscorea* sp.	Climber	Indigenous	LC			Specially Protected						#
Ebenaceae	*Diospyros villosa*	Shrub	Indigenous	LC					X				
Ebenaceae	*Euclea natalensis*	Tree	Indigenous	LC				X		X			
Euphorbiaceae	*Dalechampia capensis*	Shrub	Indigenous	LC									#
Euphorbiaceae	*Euphorbia heterophylla**	Herb	Alien	NE								X	
Euphorbiaceae	*Euphorbia tirucalli*	Tree	Indigenous	LC						X			

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Euphorbiaceae	*Macaranga capensis*	Tree	Indigenous	LC				X	X				+
Euphorbiaceae	*Ricinus communis**	Herb	Alien (NEMBA 2)	NE					X	X			+
Euphorbiaceae	*Sclerocroton integerrimus*	Tree	Indigenous	LC				X	X		X		+
Euphorbiaceae	*Shirakiopsis elliptica*	Tree	Indigenous	LC				X	X				+
Fabaceae	*Acacia mearnsii**	Tree	Alien (NEMBA 2)	NE									#
Fabaceae	*Albizia adianthifolia*	Tree	Indigenous	LC				X	X		X		+
Fabaceae	*Albizia cf. chinensis**	Tree	Alien	NE							X		
Fabaceae	*Caesalpinia decapetala**	Herb	Alien (NEMBA 1b)	NE						X			
Fabaceae	*Canavalia bonariensis*	Climber	Indigenous	LC					X				+
Fabaceae	*Chamaecrista mimosoides*	Herb	Indigenous	LC							X		#
Fabaceae	*Crotalaria natalensis*	Herb	Indigenous	LC						X			+
Fabaceae	*Dalbergia armata*	Climber	Indigenous	LC				X	X				+
Fabaceae	*Dalbergia obovata*	Climber	Indigenous	LC					X				+
Fabaceae	*Desmodium incanum**	Herb	Alien	NE				X	X		X		+
Fabaceae	*Dichrostachys cinerea*	Tree	Indigenous	LC							X		
Fabaceae	*Entada rheedii*	Climber	Indigenous	LC				X					+
Fabaceae	*Erythrina caffra*	Tree	Indigenous	LC					X	X			+
Fabaceae	Fabaceae creeper 1	Climber	-	-									#
Fabaceae	Fabaceae creeper 2	Climber	-	-									#
Fabaceae	Fabaceae creeper 3	Climber	-	-									#
Fabaceae	*Mimosa cf. pudica**	Herb	Alien	NE					X		X		+

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Fabaceae	*Millettia grandis*	Tree	Indigenous	LC			Specially Protected	X			X		#
Fabaceae	*Rhynchosia caribaea*	Climber	Indigenous	LC									#
Fabaceae	*Senegalia schweinfurthii*	Climber	Indigenous	LC									#
Fabaceae	*Senna occidentalis**	Shrub	Alien	NE						X			+
Fabaceae	*Sesbania punicea**	Shrub	Alien (NEMBA Category 1b)	NE									#
Fabaceae	*Tephrosia* sp.	Herb	Indigenous	-									#
Fabaceae	*Vachellia natalitia*	Tree	Indigenous	LC						X			
Fabaceae	*Vachellia robusta*	Tree	Indigenous	LC						X			
Fabaceae	*Vachellia xanthophloea*	Tree	Indigenous	LC						X			
Flagellariaceae	*Flagellaria guineensis*	Graminoid	Indigenous	LC				X	X				+
Icacinaceae	*Apodytes dimidiata* subsp. *dimidiata*	Shrub	Indigenous	LC							X		+
Iridaceae	*Crocosmia* sp. (no flowers)	Herb	Indigenous	-			Specially Protected				X		+
Iridaceae	*Dietes* sp. (no flowers)	Herb	Indigenous	LC				X					
Iridaceae	*Freesia laxa*	Herb	Indigenous	LC			Specially Protected		X				
Juncaceae	*Juncus capensis*	Graminoid	Indigenous	LC									#
Lamiaceae	*Plectranthus* sp.	Shrub	Indigenous										#
Lamiaceae	*Vitex* cf. *ferruginea*	Tree	Indigenous	LC					X				
Lamiaceae	*Vitex obovata*	Tree	Indigenous	LC					X				
Lecythidaceae	*Barringtonia racemosa*	Tree	Indigenous	LC		Protected		X	X	X	X		+
Loganiaceae	*Strychnos henningsii*	Tree	Indigenous	LC				X					

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Lycopodiaceae	*Lycopodiella cernua*	Fern	Indigenous	LC									#
Lygodiaceae	*Lygodium microphyllum*	Fern	Indigenous	LC									#
Malpighiaceae	*Acridocarpus natalitius*	Shrub	Indigenous	LC									#
Malvaceae	*Hibiscus cannabinus*	Herb	Indigenous	LC									#
Malvaceae	*Hibiscus* sp.	Herb	Indigenous	-									+
Malvaceae	*Hibiscus trionum**	Herb	Alien	NE						X			#
Malvaceae	*Pavonia sp.*	Herb	Indigenous	-									#
Malvaceae	*Taliparititi tiliaceum* var. *tiliaceum*	Tree	Indigenous	LC									#
Meliaceae	*Ekebergia capensis*	Tree	Indigenous	LC					X		X		
Meliaceae	*Melia azedarach**	Tree	Alien (NEMBA 1b)	NE				X	X	X			+
Meliaceae	*Trichilia emetica*	Tree	Indigenous	LC				X		X	X		
Melianthaceae	*Bersama lucens*	Tree	Indigenous	LC							X		
Memeylaceae	*Memecylon natalense*	Tree	Indigenous	LC				X					
Menispermaceae	*Cissampelos torulosa*	Climber	Indigenous	LC					X				+
Monimiaceae	*Xymalos monospora*	Tree	Indigenous	LC				X					
Moraceae	*Ficus capreifolia*	Tree	Indigenous	LC						X			
Moraceae	*Ficus natalensis* subsp. *natalensis*	Tree	Indigenous	LC				X	X		X		+
Moraceae	*Ficus sur*	Tree	Indigenous	LC				X	X		X		+
Moraceae	*Ficus trichopoda*	Tree	Indigenous	LC		Protected			X		X		+
Moraceae	*Ficus verruculosa*	Tree	Indigenous	LC							X		
Musaceae	*Ensete ventricosum*	Tree	Indigenous	LC								X	
Myricaceae	*Morella serrata*	Tree	Indigenous	LC							X		
Myrsinaceae	*Maesa lanceolata*	Tree	Indigenous	LC					X		X		

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Myrtaceae	*Eucalyptus spp**	Tree	Alien (NEMBA 1b or 2)	NE						X	X	X	+
Myrtaceae	*Psidium guajava**	Tree	Alien (NEMBA 3)	NE						X			+
Myrtaceae	*Syzygium cordatum* subsp. *cordatum*	Tree	Indigenous	LC				X	X		X		+
Nephrolepidaceae	*Nephrolepis biserrata*	Fern	Indigenous	LC				X	X		X		+
Nyctaginaceae	*Mirabilis jalapa**	Herb	Alien (NEMBA 1b)	NE				X					
Nymphaeaceae	*Nymphaea nouchali*	Herb	Indigenous	LC			Specially Protected				X		+
Orchidaceae	*Ansellia africana*	Herb	Indigenous	LC			Specially Protected	X					
Orchidaceae	Orchid sp. (no flowers)	Herb	Indigenous	LC			Specially Protected				X		+
Oxalidaceae	*Oxalis* sp.	Herb	-	-									#
Papaveraceae	*Argemone mexicana**	Herb	Alien (NEMBA 1b)	NE								X	
Passifloraceae	*Adenia gummifera*	Climber	Indigenous	LC				X					
Passifloraceae	*Passiflora edulis**	Climber	Alien (NEMBA 2)	NE						X			
Passifloraceae	*Passiflora suberosa**	Climber	Alien (NEMBA 1b)	NE					X				+
Phyllanthaceae	*Antidesma venosum*	Tree	Indigenous	LC				X			X		+
Phyllanthaceae	*Bridelia micrantha*	Tree	Indigenous	LC				X	X		X		+
Phytolaccaceae	*Ravinia humilis**	Herb	Alien (NEMBA 1b)	NE				X					+
Pinaceae	*Pinus patula*	Tree	Alien (NEMBA 2)	NE				X					+
Plantaginaceae	*Plantago lanceolata*	Herb	Indigenous	LC								X	
Plantaginaceae	*Veronica anagallis-aquatica*	Herb	Indigenous	LC									#
Poaceae	*Andropogon eucomus*	Graminoid	Indigenous	LC							X		+

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Poaceae	*Bambusa balcooa**	Graminoid	Alien	NE						X			
Poaceae	*Chloris gayana*	Graminoid	Indigenous	LC								X	
Poaceae	*Chloris pycnothrix*	Graminoid	Indigenous	LC								X	
Poaceae	*Cynodon dactylon*	Graminoid	Indigenous	LC						X	X		+
Poaceae	*Dactyloctenium australe*	Graminoid	Indigenous	LC								X	+
Poaceae	*Digitaria sanguinalis**	Graminoid	Alien	NE					X		X		+
Poaceae	*Eragrostis curvula*	Graminoid	Indigenous	LC								X	+
Poaceae	*Eragrostis* sp.	Graminoid	Indigenous	LC							X		
Poaceae	*Imperata cylindrica*	Graminoid	Indigenous	LC							X		+
Poaceae	*Leersia hexandra*	Graminoid	Indigenous	LC									#
Poaceae	*Olyra latifolia*	Graminoid	Indigenous	LC				X	X				+
Poaceae	*Oplismenus hirtellus*	Graminoid	Indigenous	LC				X	X				+
Poaceae	*Panicum laticomum*	Graminoid	Indigenous	LC									#
Poaceae	*Panicum maximum*	Graminoid	Indigenous	LC					X	X			+
Poaceae	*Paspalum dilatatum**	Graminoid	Alien	NE								X	+
Poaceae	*Paspalum distichum*	Graminoid	Indigenous	LC							X		+
Poaceae	*Paspalum urvillei**	Graminoid	Alien	NE					X				+
Poaceae	*Pennisetum clandestinum**	Graminoid	Alien (NEMBA 1b)	NE						X			
Poaceae	*Phragmites australis*	Graminoid	Indigenous	LC					X	X	X		+
Poaceae	*Setaria megaphylla*	Graminoid	Indigenous	LC				X	X	X			+
Poaceae	*Setaria sphacelata*	Graminoid	Indigenous	LC									#
Poaceae	*Sporobolus africana*	Graminoid	Indigenous	LC							X		+
Poaceae	*Sporobolus pyramidalis*	Graminoid	Indigenous	LC						X			

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Poaceae	*Stenotaphrum secundatum*	Graminoid	Indigenous	LC					X	X	X		+
Polypodiaceae	*Microsorum cf. punctatum*	Fern	Indigenous	LC				X					
Polypodiaceae	*Microsorum scolopendria*	Fern	Indigenous	LC				X	X				+
Proteaceae	*Grevillea robusta**	Tree	Alien (NEMBA 3)	NE								X	
Ptaeroxylaceae	*Ptaeroxylon obliquum*	Tree	Indigenous	LC									#
Pteridaceae	*Cheilanthes viridis var. macrophylla*	Fern	Indigenous	LC							X		+
Pteridaceae	*Pityrogramma calomelanos* var. *aureoflava**	Fern	Alien	NE									#
Rhamnaceae	*Brachylaena discolor*	Tree	Indigenous	LC				X			X		
Rhamnaceae	*Scutia myrtina*	Climber	Indigenous	LC				X	X		X		+
Rhamnaceae	*Ziziphus mucronata*	Tree	Indigenous	LC						X			
Rhizophoraceae	*Cassipourea gummiflua* var. *verticillata*	Tree	Indigenous	VU				X	X				+
Rosaceae	*Rubus sp.*	Climber	Alien	-									#
Rubiaceae	*Burchellia bubalina*	Tree	Indigenous	LC									#
Rubiaceae	*Canthium ciliatum*	Tree	Indigenous	LC							X		
Rubiaceae	*Canthium inerme*	Tree	Indigenous	LC					X		X		+
Rubiaceae	*Empogona lanceolata*	Tree	Indigenous	LC				X					
Rubiaceae	*Keetia gueinzii*	Climber	Indigenous	LC				X	X				+
Rubiaceae	*Kraussia floribunda*	Tree	Indigenous	LC				X					
Rubiaceae	*Oldenlandia affinis*	Herb	Indigenous	LC									#
Rubiaceae	*Pavetta edentula*	Tree	Indigenous	LC									#
Rubiaceae	*Pentanisia sp.*	Herb	Indigenous	-									#

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Rubiaceae	*Psychotria capensis* subsp. *capensis*	Tree	Indigenous	LC				X	X				+
Rubiaceae	*Psydrax obovata*	Tree	Indigenous	LC				X					
Rubiaceae	*Richardia brasiliensis**	Herb	Alien	NE								X	+
Rubiaceae	*Rothmannia globosa*	Tree	Indigenous	LC				X	X				+
Rubiaceae	*Tarenna pavettoides* subsp. *pavettoides*	Tree	Indigenous	LC									#
Ruscaceae	*Dracaena aletriformis*	Tree	Indigenous	LC				X	X				+
Ruscaceae	*Dracaena mannii*	Tree	Indigenous	LC									#
Rutaceae	*Clausena anisata*	Tree	Indigenous	LC						X			
Rutaceae	*Teclea natalensis*	Shrub	Indigenous	LC				X					
Rutaceae	*Toddaliopsis bremekampii*	Tree	Indigenous	LC				X					
Salicaceae	*Scolopia mundii*	Tree	Indigenous	LC				X					+
Sapindaceae	*Allophylus dregeanus*	Tree	Indigenous	LC				X	X	X			
Sapindaceae	*Allophylus natalensis*	Tree	Indigenous	LC									#
Sapindaceae	*Deinbollia oblongifolia*	Tree	Indigenous	LC				X					+
Sapindaceae	*Hippobromus pauciflorus*	Shrub	Indigenous	LC						X			
Sapotaceae	*Englerophytum natalense*	Tree	Indigenous	LC					X				
Sapotaceae	*Mimusops obovata*	Tree	Indigenous	LC				X	X		X		
Smilacaeae	*Smilax anceps*	Climber	Indigenous	LC				X	X		X		+
Solanaceae	*Solanum capsicoides**	Herb	Alien	NE				X					
Solanaceae	*Solanum elaeagnifolium**	Herb	Alien (NEMBA 1b)	NE									#

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Solanaceae	*Solanum mauritianum**	Tree	Alien (NEMBA 1b)	NE				X	X	X		X	+
Solanaceae	*Solanum panduriforme*	Herb	Indigenous	LC							X		
Stilbaceae	*Halleria lucida*	Tree	Indigenous	LC				X	X	X	X		+
Strelitziaceae	*Strelitzia nicolai*	Tree	Indigenous	LC				X	X	X			+
Thelypteridaceae	*Ampelopteris prolifer*	Fern	Indigenous	LC									#
Thymelaeaceae	*Peddiea africana*	Tree	Indigenous	LC				X		X	X		+
Tiliaceae	*Grewia lasiocarpa*	Shrub	Indigenous	LC				X		X			
Tiliaceae	*Grewia occidentalis*	Shrub	Indigenous	LC				X		X			
Typhaceae	*Typha capensis*	Graminoid	Indigenous	LC						X	X		+
Ulmaceae	*Celtis africana*	Tree	Indigenous	LC				X					+
Ulmaceae	*Celtis* cf. *gomphophylla*	Tree	Indigenous	LC				X					
Ulmaceae	*Trema orientalis*	Tree	Indigenous	LC				X	X	X	X		+
Urticaceae	*Urera trinervis*	Climber	Indigenous	LC				X	X				+
Verbenaceae	*Lantana camara**	Climber	Alien (NEMBA 1b)	NE						X			+
Verbenaceae	*Verbena aristigera**	Herb	Alien	NE								X	+
Verbenaceae	*Verbena bonariensis**	Herb	Alien (NEMBA 1b)	NE						X			
Vitaceae	*Rhoicissus revoilii*	Climber	Indigenous	LC									#
Xyridaceae	*Xyris capensis*	Herb	Indigenous	LC							X		+
-	Sensitive species 191	Shrub	Indigenous	VU	Protected		Specially Protected						#

Red List Categories
NE = Not Evaluated
LC = Least Concern
NT = Near Threatened
VU = Vulnerable

**Indicates alien species*
+ Species recorded during both the 2022 field survey and by Coastal & Environmental Services (2009).
 # Species only recorded by Coastal & Environmental Services (2009), and not during the 2022 field survey.

Appendix D: Location of transects or points where Red List and/or Protected flora species were recorded in the study area.

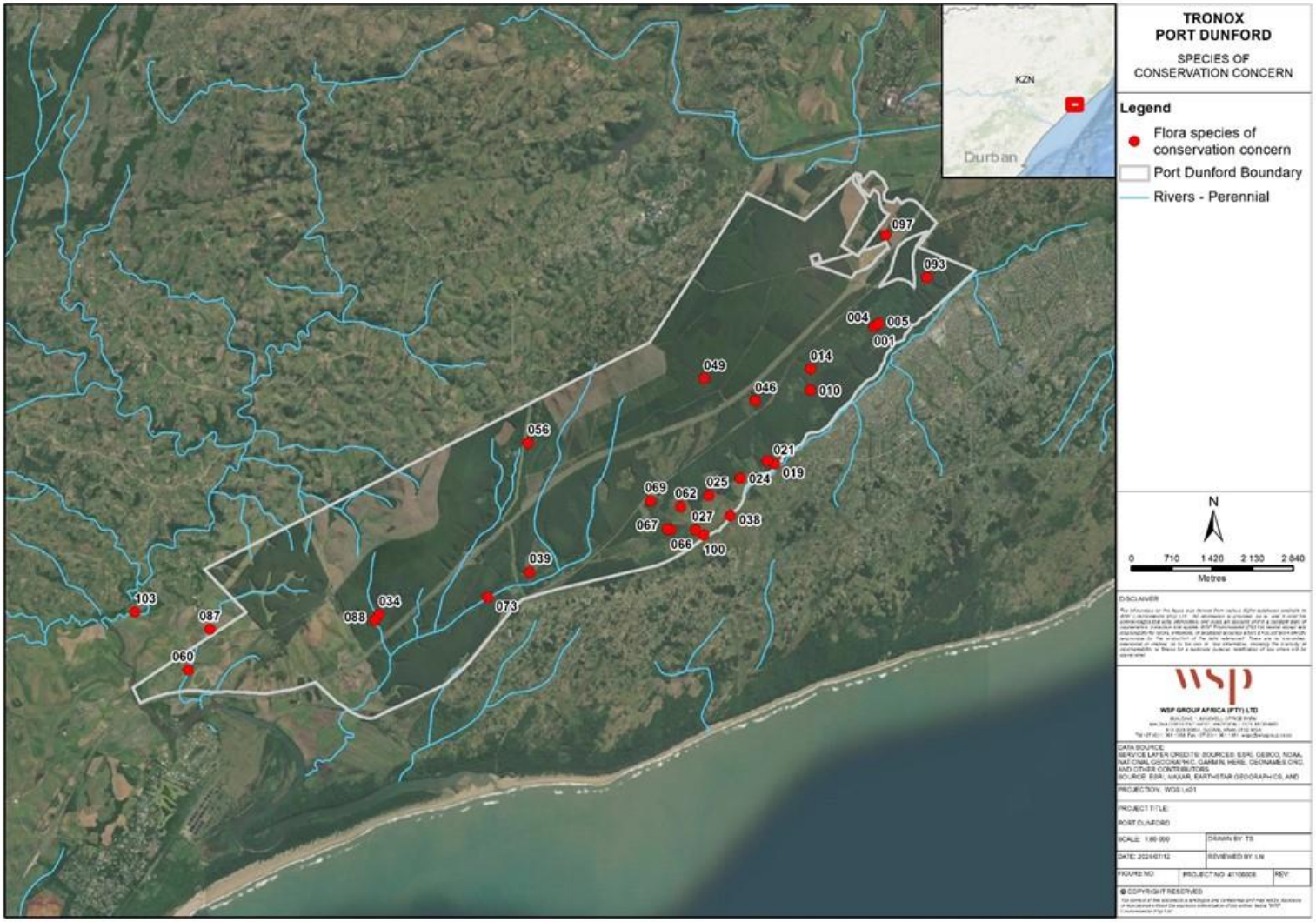

Figure 1: Location of transects or points where Red List and protected flora species were recorded in the study area.

Transect location	*Barringtonia racemosa* (Protected, Nat)	*Ficus trichopoda* (Protected, Nat)	*Cassipourea gummiflua* var. *verticillata (VU)*	*Scadoxus puniceus* (Specially Protected, KZN)	*Zantedeschia sp.* (Specially Protected, KZN)	*Crocosmia sp.* (Specially Protected, KZN)
001	x		x			
004	x					
005				x		
010		x				
014		x				
019	x					
021			x	x		
024		x				
025		x				
027	x	x				
034	x		x			
038	x					
039		x				
046		x				
049		x				
056					x	
060	x	x				x
062		x				
066		x				
067	x	x				
069		x				
073	x	x				
087	x					
088	x					
093			x			
097				x		
100	x	x				
103	x	x				

Appendix E: List of Mammal Species Recorded or Potentially Occurring in the Study Area.

Species in **bold** text have been recorded in the 2831DD QDS, according to the Virtual Museum's MammalMAP records.

Family	Scientific Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Recorded in the study area	
						Coastal & Environ. Services (2009)	Field Survey 2022
Bathyergidae	*Cryptomys hottentotus*	Common Mole-rat	Least Concern				
Bovidae	***Cephalophus natalensis***	**Natal Red Duiker**	**Near Threatened**		**Protected**	**x**	
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*	Common Waterbuck	Least Concern		Protected		
Bovidae	*Nesotragus moschatus zuluensis*	Suni	Endangered	Vulnerable	Protected		
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern		Protected		
Bovidae	*Redunca arundinum*	Southern Reedbuck	Least Concern	Protected			
Bovidae	***Sylvicapra grimmia***	**Common Duiker**	**Least Concern**			**x**	
Bovidae	*Tragelaphus angasii*	Nyala	Least Concern				
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern		Protected		
Bovidae	***Tragelaphus sylvaticus***	**Southern Bushbuck**	**Least Concern**		**Protected**	**x**	
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern				
Cercopithecidae	***Chlorocebus pygerythrus***	**Vervet Monkey**	**Least Concern**			**x**	**x**
Cercopithecidae	*Cercopithecus albogularis labiatus*	Samango Monkey	Vulnerable		Protected	x	
Cercopithecidae	***Papio ursinus***	**Chacma Baboon**	**Least Concern**				
Chrysochloridae	***Amblysomus hottentotus***	**Hottentot's Golden Mole**	**Least Concern**				
Chrysochloridae	*Calcochloris obtusirostris*	Yellow Golden Mole	Near Threatened				
Chrysochloridae	*Chrysospalax villosus*	Rough-haired Golden Mole	Vulnerable	Critically Endangered			
Emballonuridae	*Taphozous mauritianus*	Mauritian Tomb Bat	Least Concern				
Equidae	***Equus quagga***	**Plains Zebra**	**Least Concern**				
Felidae	*Felis silvestris*	African Wildcat	Least Concern				
Felidae	***Leptailurus serval***	**Serval**	**Near Threatened**	**Protected**			
Felidae	*Panthera pardus*	Leopard	Vulnerable	Vulnerable	Protected		
Galagidae	***Otolemur crassicaudatus***	**Thick-tailed Bushbaby**	**Least Concern**		**Protected**		
Myoxidae	*Graphiurus murinus*	Woodland Dormouse	Least Concern				

Family	Scientific Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Recorded in the study area	
						Coastal & Environ. Services (2009)	Field Survey 2022
Herpestidae	*Atilax paludinosus*	Water Mongoose	Least Concern				
Herpestidae	*Herpestes ichneumon*	Large Grey Mongoose	Least Concern				
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern				x
Herpestidae	*Ichneumia albicauda*	White-tailed Mongoose	Least Concern				
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern				
Hipposideridae	*Hipposideros caffer*	Sundevall's Leaf-nosed Bat	Least Concern				
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern				
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern				
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern			x	
Leporidae	*Pronolagus crassicaudatus*	Natal Red Rock Rabbit	Least Concern				
Macroscelididae	*Petrodromus tetradactylus*	Four-toed Sengi	Near Threatened	Endangered			
Molossidae	***Chaerephon pumilus***	**Little Free-tailed Bat**	**Least Concern**				
Molossidae	*Mops condylurus*	Angolan Free-tailed Bat	Least Concern				
Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	Least Concern				
Muridae	***Aethomys ineptus***	**Tete Veld Rat**	**Least Concern**				
Muridae	*Aethomys chrysophilus*	Red Veld Rat	Least Concern				
Muridae	*Dasymys incomtus*	African Marsh Rat	Near Threatened				
Muridae	***Gerbilliscus brantsii***	**Highveld Gerbil**	**Least Concern**				
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern				
Muridae	*Grammomys cometes*	Mozambique Woodland Mouse	Least Concern				
Muridae	*Grammomys dolichurus*	Woodland Mouse	Least Concern				
Muridae	*Lemniscomys rosalia*	Single-striped Mouse	Least Concern				
Muridae	*Mastomys natalensis*	Natal Multimammate Mouse	Least Concern				
Muridae	*Micaelamys namaquensis*	Namaqua Rock Mouse	Least Concern				
Muridae	*Mus minutoides*	Pygmy Mouse	Least Concern				

Family	Scientific Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Recorded in the study area	
						Coastal & Environ. Services (2009)	Field Survey 2022
Muridae	*Otomys angoniensis*	Angoni Vlei Rat	Least Concern				
Muridae	*Otomys irroratus*	Vlei Rat (Fynbos type)	Least Concern				
Muridae	*Otomys auratus*	Laminate Vlei Rat	Near Threatened				
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Mouse	Least Concern			x	
Muridae	***Thallomys paedulcus***	**Tree Rat**	**Least Concern**				
Mustelidae	*Aonyx capensis*	Cape Clawless Otter	Near Threatened	Protected		x	
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern				
Mustelidae	***Mellivora capensis***	**Honey Badger**	**Least Concern**	**Protected**			
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	Near Threatened				
Nesomyidae	*Dendromus melanotis*	Grey Climbing Mouse	Least Concern				
Nesomyidae	*Dendromus mesomelas*	Brant's Climbing Mouse	Least Concern				
Nesomyidae	*Dendromus mystacalis*	Chestnut Climbing Mouse	Least Concern				
Muridae	*Saccostomus campestris*	Pouched Mouse	Least Concern				
Muridae	*Steatomys pratensis*	Fat Mouse	Least Concern				
Nycteridae	*Nycteris hispida*	Hairy Slit-faced Bat	Least Concern				
Nycteridae	***Nycteris thebaica***	**Egyptian Slit-faced Bat**	**Least Concern**				
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern		Protected		
Pteropodidae	***Epomophorus wahlbergi***	**Wahlberg's Epauletted Fruit Bat**	**Least Concern**				
Pteropodidae	***Rousettus aegyptiacus***	**Egyptian Fruit Bat**	**Least Concern**				
Pteropodidae	***Eidolon helvum***	**African Straw-coloured Fruit Bat**	**Least Concern**				
Procaviidae	*Dendrohyrax arboreus*	Southern Tree Hyrax	Endangered	Vulnerable			
Rhinolophidae	*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	Least Concern				
Rhinolophidae	*Rhinolophus darlingi*	Darling's Horseshoe Bat	Least Concern				
Rhinolophidae	***Rhinolophus simulator***	**Bushveld Horseshoe Bat**	**Least Concern**				
Rhinolophidae	*Rhinolophus swinnyi*	Swinny's Horseshoe Bat	Vulnerable				

Family	Scientific Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Recorded in the study area	
						Coastal & Environ. Services (2009)	Field Survey 2022
Sciuridae	*Paraxerus palliatus ornatus*	Ngoye Red Squirrel	Vulnerable	Endangered			
Soricidae	***Crocidura cyanea***	**Reddish-grey Musk Shrew**	**Least Concern**				
Soricidae	***Crocidura flavescens***	**Greater Red Musk Shrew**	**Least Concern**				
Soricidae	*Crocidura fuscomurina*	Tiny Musk Shrew	Least Concern				
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern				
Soricidae	***Crocidura mariquensis***	**Swamp Musk Shrew**	**Near Threatened**				
Soricidae	*Myosorex sclateri*	Sclater's Forest Shrew	Vulnerable			x	
Soricidae	*Myosorex varius*	Forest Shrew	Least Concern				
Soricidae	***Myosorex cafer***	**Dark-footed Mouse Shrew**	**Vulnerable**				
Soricidae	*Suncus lixus*	Greater Dwarf Shrew	Least Concern				
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern		Protected		
Suidae	***Potamochoerus larvatus***	**Bushpig**	**Least Concern**				
Thryonomyidae	*Thryonomys swinderianus*	Greater Cane Rat	Least Concern				
Vespertilionidae	*Glauconycteris variegata*	Butterfly Bat	Least Concern				
Vespertilionidae	*Kerivoula argentata*	Damara Woolly Bat	Near Threatened				
Vespertilionidae	*Kerivoula lanosa*	Lesser Woolly Bat	Least Concern				
Vespertilionidae	*Miniopterus natalensis*	Natal Long-fingered Bat	Least Concern				
Vespertilionidae	*Myotis tricolor*	Temminck's Hairy Bat	Least Concern				
Vespertilionidae	*Neoromicia capensis*	Cape Serotine Bat	Least Concern				
Vespertilionidae	***Neoromicia nana***	**Banana Bat**	**Least Concern**			x	
Vespertilionidae	*Neoromicia zuluensis*	Aloe Bat	Least Concern				
Vespertilionidae	*Nycticeinops schlieffeni*	Schlieffen's Bat	Least Concern				
Vespertilionidae	***Pipistrellus hesperidus***	**African Pipistrelle**	**Least Concern**				
Vespertilionidae	*Scotoecus albofuscus*	Thomas' House Bat	Near Threatened				
Vespertilionidae	*Scotophilus dinganii*	Yellow House Bat	Least Concern				
Vespertilionidae	*Scotophilus viridis*	Lesser Yellow House Bat	Least Concern				

Family	Scientific Name	Common Name	Red List Status (2016)	NEMBA ToPS Status (2007)	KZN Provincial Status	Recorded in the study area	
						Coastal & Environ. Services (2009)	Field Survey 2022
Viverridae	***Genetta maculata***	**Rusty Spotted Genet**	**Least Concern**				x
-	**-**	**Sensitive Species 8**	**Vulnerable**	**Vulnerable**	**Protected**	**x**	
Source: Master list based on distribution maps presented in Stuart and Stuart (1997). Species in **bold** text are MammalMap records for the 2831DD QDS.							